Computer Algorithms and Image Processing

Title: SBIR Phase II: Neuromorphic Color Sensor for Object and Place Recognition

Award Number: 0091594
Program Manager: Sara B. Nerlove

Start Date: May 1, 2001
Expires: October 31, 2004
Total Amount: $500,000
Investigator: Anthony M. Lewis, tlewis@iguana-robotics.com
Company: Iguana Robotics
P.O. Box 625
Urbana, IL 61803
Phone: (217)265-6458

Abstract:

This Small Business Innovation Research (SBIR) Phase II Project proposes the construction of a miniature object recognition and color segmentation system on a chip. This chip will be tuned to recognize various predefined targets in natural environments. The chip will use an object recognition model, color histogramming, originally derived from research in cognitive neuroscience. Taking advantage of recent advances in Neuromorphic Engineering, the company will implement the basic sensing and computational elements directly in silicon using mixed analog/digital processing. In contrast, implementing the same model or algorithm with conventional microprocessor technology would require that the basic computations be simulated as an intermediate step. The removal of this intermediate step will result in an intelligent sensor with dramatically lower cost, smaller volume, and reduced power usage-achievements not possible using competing microprocessor-based technology.

The applications for this technology include intelligent toys and prosthetic devices. A toy might be made to recognize and the Reference be able to respond to the presence of another toy or specially designed environment. More advanced and elaborated versions of the chip might be used as an aid to the blind by assisting them in finding standardized (i.e. specially colored) objects. For example, a blind person might be assisted in localizing a coffee mug, distinguishing between two similar items of clothing differing only in color, or finding a standardized 'EXIT' sign in a building. The broader impact of this technology is that it will help bridge the gap between the natural, unstructured environment and computing technology.

Title: SBIR Phase II: Grid Computing for Energy Exploration and Development

Award Number: 0522194
Program Manager: Errol B. Arkilic

Start Date: August 15, 2005
Expires: July 31, 2007
Total Amount: $500,000
Investigator: Dimitri Bevc, dimitri@3dgeo.com
Company: 3DGeo Development Inc
4633 Old Ironsides Dr # 401
Santa Clara CA, 95054
Phone: (408)450-7840

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will develop a grid-enabled environment where large multidimensional seismic data sets can be rapidly accessed, visualized, and interpreted by geographically dispersed users with heterogeneous local resources. The proposed work will transform the Phase I prototype into production-ready commercial quality software, and demonstrate it on 3-D seismic data. The key technical innovations of the Phase II project are (1) a multi-resolution data visualizer, (2) a data-staging tool, and (3) a multi-channel collaboration tool to support collaborative visualization and data analysis on the grid. The proposed technology will allow multiple users to share and interact with multidimensional grid-dispersed data sets, while viewing independent multiple renderings with resolutions and bandwidths commensurate to their local display and network capabilities. The proposed technology will be enabled by implementing several grid services, and a virtual file system, that make grid deployed data sets appear local to the user. This implementation comprises the bulk of the technical tasks, and leverages the middleware. The immediate outcome of the Phase II project will be a version of Internet Seismic Processing production software (INSP) with specialized features for remote visualization, data staging, and collaborative analysis of seismic images on the grid.

The ultimate objective of the Phase II project is a commercial grid-enabled software product providing scientific data, services, computing power, and visualization on demand, not only to the oil and gas industry but to a much wider range of application areas, such as geographic information systems, education, medical imaging, and battlefield management. The product will push the limits of what can be done, and fully contribute to a new business paradigm, made possible by the advent of the grid, allowing businesses to concentrate on their core competencies and rely on other entities for grid-enabled context technologies, without deterring from their primary objectives. The outcome of Phase II will be a commercial implementation and utilization of the grid, and the toolkit, which up until now, has been used mostly in academic and research applications. This technology will first be commercialized in a strategically important economic sector; namely, for the exploration of new energy resources. Specific to U.S. energy needs, this unique application of high end information technology to an area of economic and national importance will ultimately open up new exploration venues in extremely complicated geological conditions, leading to new discoveries, and decreasing US dependence on imported oil

Title: SBIR Phase II: IBARS - An Image Barcode Acquisition and Recognition System for Mobile Commerce

Award Number: 0522144
Program Manager: Errol B. Arkilic

Start Date: September 15, 2005
Expires: August 31, 2007
Total Amount: $499,550
Investigator: Huiping Li, Huiping.Li@appliedmediaanalysis.com
Company: Applied Media Analysis, Inc.
7814 Rockburn Dr
Ellicott City MD, 21043
Phone: (410)493-9043

Abstract:

This Small Business Innovation Research (SBIR) Phase II research project develops the concept of using hand-held, mobile devices to link the physical world to information networks using advanced pattern and symbol recognition technology that will be deployed on the mobile device. The proposed mobile symbol recognition technology will enable many opportunities for mobile e-commerce by recognizing bar codes, text on documents and user-customizable icons that are used to carry and convey information. To address these opportunities, technical challenges associated with limited processing power and memory resources, lower-quality optics in cameras, varying available network bandwidth, and the diversified development platforms they represent must be overcome. The advances proposed include the ability to unwarp images to account for distortions due to perspective imaging and lenses, removing imaging artifacts such as non-uniform lighting and highlights, deblurring images caused by fixed focus and motion, and improving the image contrast all within the resource constraints of the mobile devices. Recognition algorithms in the system must be able to automatically identify and decode various barcodes symbologies, handle multiple languages and fonts for Optical Character Recognition (OCR), and be trainable for user customizable icons. Special consideration must be given to cross platform development so algorithms can be efficiently and robustly embedded in different development platforms.

The ability to perform image processing and pattern recognition algorithms on diversified handheld devices will provide advances in fields such as computer vision, mobile computing, and software engineering. This concept is powerful in that it requires no new infrastructure, since it uses popular mobile devices, and existing symbols such as barcode tags, text, and user-customizable icons. The downloadable symbol recognition component will enable many applications. Other than service providers and OEMs, merchants, advertisers, information providers and other service providers are likely partners and customers for our technology. Finally, the technology can be used to help disadvantaged groups (handicapped or visually impaired, for example) get access to product information (prescription drug instructions, for example) or transact commerce activity conveniently, using a device they may already have, or that is easily acquired. These include applications in medical care delivery, military applications, sign recognition for the visually challenged, and others

Title: SBIR Phase II: A Foundation for Emergency Egress Simulation

Award Number: 0521897
Program Manager: Errol B. Arkilic

Start Date: September 1, 2005
Expires: August 31, 2007
Total Amount: $499,374
Investigator: Daniel Swenson, swenson@thunderheadeng.com
Company: Thunderhead Engineering Consultants, Inc
1006 Poyntz Ave
Manhattan KS, 66502
Phone: (785)770-8511

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will develop new capability to model emergency egress from buildings. The primary focus of the research is evacuation due to fires, but the software will be designed such that exposure and response to biological and chemical agents can also be simulated. The project will couple egress analysis to time-varying fire conditions (e.g. smoke density, heat, and CO) calculated using a Computational Fluid Dynamics fire simulator. This will enable simulation of emergency situations in which, for example, some exit paths become blocked. In addition to incorporating current human response models, the software will allow researchers to specify more complex individual behavior based on the results of recent studies of observed human behavior during emergencies. Thus, the project will not only result in a commercial product of immediate use to the fire safety industry, but will also provide a framework in which to incorporate future knowledge into a problem of fundamental importance to an urban society.

This research will lead to a product that will facilitate broad use of fire emergency egress analysis and will introduce a new technology (coupling egress analysis with CFD fire modeling) into the present fire safety design and regulation process. In 2003 fire claimed 3,925 American lives and caused direct losses of $12.3 billion, with a total economic cost of $165 billion. Any technology that reduces even a fraction of this cost will be significant. The integration of egress analysis with fire simulation provides new capability to more accurately simulate emergency building evacuation. The engineering time required for the analyses will be significantly reduced by a common user interface and geometry database that will enable the broader application of this technology throughout the fire safety industry. Societal impacts include increased public safety, advancement in fire research, and reduced building costs. Coupling egress analysis and fire simulation will lead to new discoveries and recommendations based on post accident analysis. The software will enable researchers to add their own models of human behavior to the analysis

Title: SBIR Phase II: Variable Azimuth Wave-Equation Imaging (VAWEM)

Award Number: 0450588
Program Manager: Juan E. Figueroa

Start Date: March 15, 2005
Expires: February 28, 2007
Total Amount: $512,000
Investigator: Dimitri Bevc, dimitri@3dgeo.com
Company: 3DGeo Development Inc
4633 Old Ironsides Dr # 401
Santa Clara CA, 95054
Phone: (408)450-7840

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will implement and demonstrate the feasibility of a new technology that enables enhance seismic resolution and imaging of deep water complex geologic structures by using variable azimuth wave-equation migration (VAWEM). VAWEM will provide much greater resolution and accuracy than what can be accomplished today for towed marine streamer data, and at significantly less computational cost. The software will be optimized for deployment on Linux clusters, and testing will be conducted to determine the optimal geophysical parameters for obtaining the best possible images. The project involves significant computer engineering to obtain the maximum efficiency required to image terabyte size data sets and significant geophysical work to demonstrate the validity of the approach. This advanced imaging methodology will improve success rate and cost effectiveness for new field discoveries and increase recovery efficiency for the development of existing fields. This technology is a fundamental revolutionary advance, and is a necessary building block in any seismic processing system that images 3-D prestack data using wave-equation methods for imaging deep water, under-salt complex geological structures which are the focus of modern oil and gas exploration.

Societal and economic benefits from the proposed VAWEM technology will accrue directly to the nation by lowering energy costs and reducing dependence on foreign energy sources. Energy is at the core of the U.S. and world economies; therefore, the political, societal, and economic benefits of the proposed technology go well beyond the substantial direct economic benefit that this technology will bring to the proposing company and its customers. Commercial potential of the proposed technology is directly applicable to the fastest growing and strategically most important area of U.S. exploration, namely the deepwater subsalt oil and gas province of the Gulf of Mexico federal waters. It is estimated that most of the Gulf's untapped resources (45 Billion barrels of oil and 207 trillion cubic feet of natural gas) are trapped in deepwater subsalt reservoirs, and in ultra deep (over 15,000 ft) gas deposits. Since exploratory wells in these areas typically cost more than $30 million, tapping these reserves will require advanced imaging technology such as VAWEM to reduce risk and make exploration feasible. Reduction USA's dependence on Persian Gulf sources and the strategic benefits of maintaining strong U.S.A. leadership in oil technology transcend purely financial considerations

Title: SBIR Phase II: Algorithms and Hardware for Real-Time H.264 Encoder

Award Number: 0450514
Program Manager: Juan E. Figueroa

Start Date: February 1, 2007
Expires: January 31, 2007
Total Amount: $500,000
Investigator: Sassan Pejhan, sassanp@vbrick.com
Company: Vbrick Systems, Inc
12 Beaumont Rd
Wallingford CT, 6492
Phone: (203)303-0225

Abstract:

This Small Business Innovation Research (SBIR) Phase II project aims to develop novel algorithms and hardware accelerators, as well as a prototype, for a real-time, high-resolution, H.264-based network video appliance. H.264 is the latest video compression standard, jointly developed by the ITU-T and ISO/IEC (MPEG). It is also designed for transmission over packet-based networks and to achieve significantly superior compression efficiency compared to previous standards and proprietary solutions. This compression efficiency, however, is achieved at the cost of severely increasing the complexity of the encoder. Real-time, high-resolution H.264 encoders are not feasible with current personal computers or DSP-based approaches. The new algorithms and designs for hardware acceleration will be targeted at video compression techniques that were introduced by the H.264 standard for the first time. They are anticipated to improve encoder performance by at least one order of magnitude compared to current implementations

If successful a real-time, network appliance with the compression efficiency of H.264 will have broad applications, particularly in the areas of distance learning, remote training, security and surveillance. The innovations resulting from this should enable implementers to significantly improve the real-time performance of H.264. Limited bandwidth and the resulting poor quality video have so far been an impediment to realizing the full benefits of digital video. A real-time, high-resolution network appliance with the compression efficiency of H.264 will bring digital video in the mainstream by delivering high quality video to the endpoints of the network. This will drive both business and consumer uses. It will provide the visual communication crucial to making distance learning and remote training a superior experience and compelling from an economic viewpoint - and therefore mitigate geography as a barrier to participation in scientific and engineering activities. Students can partake in classes offered at remote campuses while rural K-12 schools can partner with museums in major cities to provide their students with a richer education.

Title: SBIR Phase II: A Decision Support System for the Railroad Blocking Problem

Award Number: 0450504
Program Manager: Juan E. Figueroa

Start Date: December 1, 2004
Expires: November 30, 2006
Total Amount: $532,000
Investigator: Ravindra Ahuja, ravi@InnovativeScheduling.com
Company: Innovative Scheduling Systems, Inc.
4548 SW 97th Terrace
Gainesville FL, 32608
Phone: (352)336-1257

Abstract:

This Small Business Innovation Research Program (SBIR) Phase II project entails developing a decision support system for the railroad-blocking problem, one of freight railroad transportation's most significant optimization problems. The mathematical complexity of railroad transportation problems has precluded the development of optimization algorithms for solving them preventing railroads from benefiting from the advances taking place in the field of optimization; they still rely on manual decision-making processes for most of their planning and scheduling needs. During Phase I, the company developed prototype software for the railroad blocking problem and tested it on the data provided by three major US railroads: CSX Transportation, BNSF Railway, and Norfolk Southern Corporation. In this Phase II project the company will develop a prototype for a commercial decision support system for the railroad-blocking problem by combining state-of-the-art operations research techniques with latest information technology tools. This project will enhance core optimization engines and algorithms using cutting-edge ideas in network optimization, heuristic optimization, data structures, and software engineering. Database connectivity will also be provided. This Phase II project will extend algorithms for the railroad-blocking problem to similar problems arising in postal/package delivery service design and developing prototype software.

Currently, railroads takes months of team effort to determine a blocking plan and undertake this exercise once in several years with intermittent periods of minor adjustments to account for seasonal variations in the traffic pattern. The proposed decision support system would allow a railroad to determine a blocking plan in a matter of a few hours and produce solutions far superior than those obtained manually. The proposed solution will enable a large freight railroad to optimize its blocking plans frequently and reduce cost by at least $10 million annually and hundreds of millions of dollars for railroads companies in the USA and Canada over a few years. The research will establish the efficacy of network optimization and heuristic methodology in solving railroad planning and scheduling problems. The success of this product will lead to a greater acceptance of optimization models and optimization-based software in the railroad industry.

Title: SBIR Phase II: New Algorithms for Pan-Tilt-Zoom (PTZ) Camera Based Object Tracking

Award Number: 0450171
Program Manager: Juan E. Figueroa

Start Date: March 1, 2005
Expires: February 28, 2007
Total Amount: $500,000
Investigator: Laura Drake, ladrake@ieee.org
Company: JunTech, Inc.
2314 E. Stratford Ct.
Shorewood WI, 53211
Phone: (414)332-8349

Abstract:

This Small Business Innovation Research (SBIR) Phase II project aims to develop a new class of moving object tracking algorithms and software prototype for Pan-Tilt-Zoom (PTZ) cameras in video surveillance systems. In most of today's video surveillance systems, human operators using PTZ cameras perform real-time object tracking manually. This is often stressful and inefficient (an operator can only control one PTZ camera at a time) and causes inconsistent results. The proposed project will develop a new class of algorithms to direct PTZ cameras to track multiple moving objects of interest automatically. Using an optimal filter with new object state and observation models does this. The project outcome will be smart software modules that can be integrated into standard video surveillance systems to improve their capabilities.

Video surveillance systems are important tools in the fight against crime and terrorism. Most of the systems on the market today are relatively standard DVR's (digital video recorders) with few smart features. The proposed innovation (automatic object tracking) is a smart feature that can significantly improve a standard system's capabilities by allowing it to get better and more useful images. Since this feature is demanded by many end-users, it is highly attractive to equipment vendors and integrators. Furthermore, by introducing new models for object tracking , the proposed innovation also advances the state-of-the-art in image processing and computer vision research.

Title: SBIR Phase II: Computerized Tool for Baggage Screening

Award Number: 0422071
Program Manager: Juan E. Figueroa

Start Date: August 1, 2004
Expires: July 31, 2006
Total Amount: $498,882
Investigator: Edward Sommer, ejsommer@nrt-inc.com
Company: National Recovery Technologies, Inc. (NRT)
566 Mainstream Drive
Nashville, TN 37228
Phone: (615)734-6400

Abstract:

This Small Business Innovation Research Program Phase II research project will develop a technology for improving security checkpoint effectiveness and increasing throughput while reducing labor costs for airports and other sensitive installations by integrating information technology systems incorporating new x-ray image inspection technology, new electronics communications technology, materials handling automation, and database-centric computerization. Current processing rates through a typical security checkpoint are relatively slow and laborious and costs are high. Today's checkpoints take little advantage of computerization thereby limiting their effectiveness. It is planned that the prototype system will be integrated into a TSA approved test site and tested and evaluated by an independent third party Modernization of checkpoint security will improve protection of many other segments of society. In today's world it is vital that our nation's citizenry, transportation systems, institutions, sensitive installations, and economy have the best protection possible. Security has become much more restrictive and time consuming.

If successful this project will develop a product that will be able to increase the security at check bags handling facilities while reducing the time to conduct the checks. The streamlining and improving of security at federal buildings, government installations, maritime ports, shippers, mailrooms, and other sensitive locations can increase confidence in our day-to-day lives and help improve the nation's economic security.

Title: SBIR Phase II: Next Generation Binary Decision Diagrams (BDD)-Based Logic Optimization System

Award Number: 0421993
Program Manager: Errol B. Arkilic

Start Date: August 1, 2004
Expires: July 31, 2006
Total Amount: $500,000
Investigator: Qian Ren, qren@logic-mill.com
Company: LogicMill Technology
41 The Hollow
Amherst, MA 01002
Phone: (413)587-2030
Abstract

This Small Business Innovation Research Phase II project targets the synthesis of very large-scale integrated circuits (ICs) and systems on chip (SoC) in very short CPU time. The expected short CPU time comes from relying on binary decision diagram (BDDs) that replaced the traditional algebraic representations used pervasively in present-day tools. This Phase II SBIR project is devoted to developing further the capabilities of swift and integrating it with a number of commercial tools. The development plan includes new capabilities, such as improving area by adding new logic transformations and improving the speed of processing by implementing novel decomposition algorithms.

This project will significantly advance the theory of modern logic optimization and promote its understanding in industry and academia. It would also promote the inclusion of faster logic synthesis tools in existing Electronic Design Automation (EDA) systems. It would benefit the national EDA industry, and help the US to maintain its competitive advantage against its foreign competitors in this strategically important market.

Title: SBIR Phase II: Adaptive Personalization and Context Management for Location-Based Mobile Devices (AdaptTribe)

Award Number: 0349778
Program Manager: Juan E. Figueroa

Start Date: January 15, 2004
Expires: December 31, 2005
Total Amount: $467,609
Investigator: Daniel Greening, greening@bigtribe.com
Company: BigTribe Corporation
330 Townsend St Ste 209
San Francisco, CA 94107
Phone: (415)995-7150

Abstract:

This Small Business Innovation Research Phase II research project develops personalized user-interfaces for location-based services. This adaptive proximity-based personalization algorithm recommends nearby venues based on predicted user interest and distance. It will further develop a highly distributed algorithm that allows handsets to perform part of the calculation, dramatically reducing computation costs that central servers would otherwise bear. This context-based user-interface allows users to chain operations, concentrating activities by proximity, and avoiding retyping. This project will expand the user- interface advancements to include personalizing categories, and a user-interface approach that mixes categories with individual venues. In addition it will explore algorithms that mix different types of venues on the same screen. Identity federation will help retailers and portals more readily deal with intermediary services. Self-service retail interfaces can allow traditional "brick-and-mortar" retailers to cost-effectively provide "click-and-mortar" services to consumers. A SOAP-based web-service will allow portals to filter data and configure look-and-feel more precisely. However, the proposedtag mechanism will likely be good enough for most portals, as the output format can be configured easily through CSS, and filtering can be performed through the company's self-service portal interface

The end result of this project is a product that can be incorporated in enterprise logistics applications that help field personnel find, reserve, use and store resources while being able to improve the speed that consumers navigate user-interfaces, even when location is irrelevant. The in-handset personalization may ensure better privacy and security, even in non-location based applications. The product will use proximity to maximize value: building business-consumer relationships, enhancing social harmony and strengthening communities, as a result.

Title: SBIR Phase II: Artificial Intelligence Software for Student Assessment in Chemistry Education

Award Number: 0349630
Program Manager: Sara B. Nerlove

Start Date: February 1, 2004
Expires: January 31, 2006
Total Amount: $500,000
Investigator: Benny Johnson, johnson@quantumsimulations.com
Company: Quantum Simulations Incorporated
5275 Sardis Road
Murrysville, PA 15668
Phone: (724)733-8603

Abstract:

This Small Business Innovation Research Phase II project builds Phase I work on development of meaningful interactive tutoring and assessment capabilities for chemistry education software. Despite clearly articulated teacher and student demand for improvement, this area has been repeatedly identified as that where existing offerings are weakest. Quantum Simulations proposes a new and different approach, adapting and incorporating new concepts from artificial intelligence (AI). More than just assigning a grade, meaningful opportunities will be created for students to learn directly from the assessment itself. The proposed technology will benefit all students; however, it is specifically targeted to help those who have the greatest need--such as students of average or marginal performance and students from historically underserved groups-- by lowering barriers to accessing high-quality science instructional software. Quantum Simulations has partnered with members of the Department of Education's STAR Schools program to further these goals.

Quantum Simulations' customers include textbook publishers, software providers, hardware vendors and distance learning companies. A prominent textbook publisher, Holt, Rinehart and Winston, has entered into a long-term contract and has partnered with Quantum Simulations to commercialize this Phase II technology, resulting in rapid dissemination to an established end user base.

Title: SBIR Phase II: Technology for Integrated Computation and Communication

Award Number: 0349414
Program Manager: Juan E. Figueroa

Start Date: February 15, 2004
Expires: January 31, 2006
Total Amount: $500,000
Investigator: Chitoor Srinivasan, srinivas@cs.rutgers.edu
Company: EDSS., Inc.
Port Saint Lucie, FL 34952
Phone: (772)335-3677

Abstract:

This Small Business Innovation Research Program Phase II research project proposes to develop a prototype product for an innovative parallel program development and execution technology, which can run parallel programs asynchronously in multiprocessors and supercomputers up to 100 times faster than what is currently possible, without using Message Passing Interfaces (MPI). For more than thirty years it had been assumed that the only way to efficiently compile and execute parallel programs was through MPI. Even though it had been recognized that parallel programs would run faster if executed asynchronously on the basis of data availability, technology needed to do that efficiently was not available, until Technology for Integrated Computation and Communication (TICC) came along. This tuning technology eliminates the need for dynamic checking of temporal coordination, and makes it possible to execute control signal exchange protocols in parallel with computations. More than 40 million messages may be exchanged per second. This eliminates communication bottleneck and allows asynchronous execution of parallel programs based on data availability without using MPI. TICC defines the semantics of causal statements and provides a very efficient implementation for them. TICC brings the following additional facilities: (1) Component based parallel program development environment, (2) Dynamic debugging of parallel programs (3) Dynamic monitoring and changing of messages and message traffic, (4) Dynamic repair and failure recovery, (5) Dynamic reconfiguration, and (5) Dynamic evolution parallel software systems. These have the consequent benefit of reducing parallel program development and maintenance costs, making them more easily and widely available.

This, together with decreasing costs of multiprocessors, has the potential to usher in a new era of desktop supercomputing by 2007, with profound impact on science, technology, industry, education, theories of computation and communication, and society in general.

Title: SBIR Phase II: Time-Lapse P- and S-Wave Monitoring of Fluid Flow

Award Number: 0321747
Program Manager: Errol B. Arkilic

Start Date: November 1, 2003
Expires: October 31, 2005
Total Amount: $500,000
Investigator: David Lumley, david.lumley@4thwaveimaging.com
Company: Fourth Wave Imaging Corporation
16A Journey, Suite 200
Aliso Viejo, CA 92656
Phone: (949)916-9787

Abstract:

This Small Business Innovative Research (SBIR) Phase II project concerns the use of time-lapse seismic P-wave and S-wave data simultaneously to obtain seismic monitoring images of fluid-flow saturation and pore pressure in subsurface reservoirs. Time-lapse seismic using P-waves alone may not always produce reliable discrimination between fluid-flow saturation changes and pore pressure changes since this information is contained in the large-reflection- angle portion of the P-wave seismic data, which can easily be contaminated by noise and can be subject to data acquisition aperture limitations. Using S-waves in addition to P-waves in the time-lapse analysis can provide more accurate inversion results, thereby improving the reliability and robustness of fluid-flow saturation and pressure estimates. The critical commercialization research and development issues in this project are: (1) mode-equalization image processing and pre-conditioning of the P-wave and S-wave data sets to make them suitable for simultaneous quantitative inversion and analysis; (2) computation of optimal seismic attributes and robust pressure-saturation inversion of these attributes; (3) testing and bulletproofing these techniques on a real field data set to overcome the inevitable practical data issues; and (4) developing the tools in an interactive GUI-based software package to provide a workflow that facilitates integrated numerical computation and human interpretation.

Commercial applications of proposed research will include accurate mapping of bypassed oil, monitoring of costly injected fluids in hydrocarbon reservoirs and global-warming CO2 sequestration projects. It will have applications in the monitoring of ground water reserves, contaminant plumes and environmental clean-up activities. Medical imaging is another potential market target use of elastic waves as they could yield superior results over acoustic waves alone. Commercial and societal benefits include extending the life of existing oil and gas fields, thus reducing the need for exploration in environmentally sensitive areas and improving the nation's energy security.

Title: SBIR Phase II: Development and Commercialization of a Real-Time Visualization Tool for the Energy Industry

Award Number: 0320525
Program Manager: Errol B. Arkilic

Start Date: November 1, 2003
Expires: October 31, 2005
Total Amount: $500,000
Investigator: Mark Laufenberg, lauf@powerworld.com
Company: PowerWorld Corporation
1816 South Oak Street
Champaign, IL 61820
Phone: (217)384-6330

Abstract:

This Small Business Innovation Research (SBIR) Phase II project aims to develop a new software tool for viewing real-time electrical data for the energy industry. The purpose of this project is to allow an advanced visualization environment to be used with real-time power system data as input. Existing product will be decoupled from off-line power flow cases and generalize the visualization links so that any real-time database can be linked to the visualization objects. The end result will be a software product that will allow any user with secure access to view real-time power system data from any Windows PC with a TCP/IP connection to the Internet.

The market for this product will be all electrical utilities, independent system operators, and regional transmission organizations in the world since they all must have an energy management system (EMS) installed in their control center. EMS systems have the ability to display real-time power system data obtained from meters installed throughout the electrical grid and sent in real-time to the control center. However this data has been essentially trapped in the control center with no way for company employees in other locations to visualize in real time what is happening on the system. Typically a report on real-time system information necessitates a telephone call to an EMS operator. When implemented this system should generate savings for the power companies which in turn will be passed on to the consumer.

Title: SBIR Phase II: Robust, Intelligent and Practical Face Recognition Based on Optical Joint Transform Correlation and Neural Networks

Award Number: 9983308
Program Manager: Juan E. Figueroa

Start Date: June 1, 2000
Expires: May 31, 2002
Total Amount: $399,967
Investigator: Andrew Kostrzewski, akostrzewski@poc.com
Company: Physical Optics Corporation
20600 Gramercy Place, Bldg 100
Torrance, CA 90501
Phone: (310)320-3088

Abstract:

This Small Business Innovation Research Phase II project will enable Physical Optics Corporation (POC) to build a highly robust and adaptive face recognition system called the Opto-electronic Intelligent Face Recognition System (OIFRS). This system will uniquely combine an artificial neural network and an optical joint transform correlator (JTC) to increase invariance to distortion, shift, scale, and facial expression. In Phase I, we conducted a concept feasibility study and demonstration, developing an optical face recognition system. In Phase II, POC will implement a parallel optical JTC to increase processing speed, accommodate a large number of training patterns, and enhance scalability. POC will design, develop, and implement an innovative, adaptive, nonlinear, self-aligned pseudo-phase-conjugate joint Fourier-Fresnel transform correlator, which will make recognition highly invariant to longitudinal translation and tilt of the input face, and to head position.

The proposed innovative OIFRS technology will lead not only to a new robust face recognition system but also to a variety of other security systems with high dual use application potential. OIFRS versatility will benefit not only the national security concerns of DOE, DoD, and other agencies that require highly secure access control, but also commercial access control, and credit card verification.

Title: SBIR Phase II: Knowledge Modeling and Computational Intelligence

Award Number: 9983287
Program Manager: Juan E. Figueroa

Start Date: April 15, 2000
Expires: September 30, 2003
Total Amount: $815,888
Investigator: Richard Saeks, rsaeks@accurate-automation.com
Company: Accurate Automation Corporation
7001 Shallowford Road
Chattanooga, TN 37421
Phone: (423)894-4646

Abstract:

This Small Business Innovation Research Phase II project proposes to design, implement and flight test an adaptive critic based flight control system using both the nonlinear and linear quadratic adaptive critic algorithms developed in Phase I; implement a hardware-in-loop test system for the adaptive critic flight control system; and flight test the adaptive critic flight conotrol system in Accurate Automation's LoFLYTE neurocontrol testbed aircraft.

Title: SBIR Phase II: Statistical Absorption Tomography for Turbulent Flows

Award Number: 0077512
Program Manager: Jean C. Bonney

Start Date: August 15, 2000
Expires : July 31, 2002
Total Amount: $395,322
Investigator: Yudaya Sivathanu, sivathan@enurga.com
Company: En'Urga Inc
1291-A Cumberland Ave
West Lafayette, IN 47906
Phone: (317)463-7288

Abstract:

This Small Business Innovation Research Phase II project involves the development of a commercial optical patternator, based on Statistical Absorption Tomography. The mathematical deconvolution procedure that forms the basis for optical patternation of turbulent flows was developed and evaluated during the Phase I research. Local absorptances, resolved to less than $1/10^{th}$ of the integral length scale were obtained in a turbulent spray, using the deconvolution algorithm, in conjunction with an optical patternator, suited for constant temperature, axisymmetric flows. During the Phase II, three research issues that affect the commercialization of the optical patternator will be addressed. The three issues that will be addressed during the Phase II research are: (1) obtaining local transmittances in turbulent flows with temperature gradients, (2) obtaining spatially resolved mass flux in turbulent sprays, and (3) obtaining patternation factors for turbulent flows issuing from non-axisymmetric nozzles.

Two broad areas of commercial applications for the optical patternator are for obtaining pattern factors in commercial nozzles and for monitoring smoke stack emissions. The immediate market for the patternator is as an on-line quality control instrument for spray nozzle manufacturers. The estimated annual market size is approximately 150 million dollars

Title: SBIR Phase II: New Oxide Coatings for Protection of Alloys in a High-Temperature Oxidizing Environment

Award Number: 0078234
Program Manager: Sara B. Nerlove

Start Date: July 1, 2000
Expires: June 30, 2003
Total Amount $500,000
Investigator: Dimitri Bevc, dimitri@3dgeo.com
Company: 3DGeo Development, Incorporated
4633 Old Ironsides Dr.
Santa Clara, CA 95054
Phone: (408)450-7840

Abstract:

This Small Business Innovation Research Phase II project from 3DGeo Development Incorporated will develop a software package which utilizes primary and converted-wave energy to accurately and efficiently image gas and oil reservoirs, and to determine rock properties for reservoir evaluation and management. In the recently completed Phase I project, 3DGeo demonstrated the feasibility of imaging with converted waves by analyzing the nature and occurrence of converted waves in synthetic seismic data. Full wavefield modeling and ray tracing in realistic models was used to simulate both towed-cable and ocean-bottom-cable marine data. Both acquisition geometries show important converted-wave events that will be used in Phase II to accurately image reservoirs and estimate rock properties. In addition to the mode converted energy, this project will incorporate two other significant propagation phenomena that commonly occur in geological settings which give rise to converted waves, namely: (1) multiply reflected events [multiples], and (2) transmitted and reflected energy propagating along multiple paths in the subsurface [multi-valued traveltimes]. These two phenomena, coupled with the mode conversions, which are the main focus of this research effort, comprise the greatest challenge to seismic prospecting for oil and gas.

This Phase II project develops a comprehensive and synergistic subsalt imaging solution that exploits the full potential of the seismic wavefield for reservoir imaging and rock property estimation in complex areas. Commercial potential of the proposed technology is directly applicable to subsalt oil and gas exploration in complex areas such as the Gulf of Mexico. US companies will spend $50 billion drilling deep subsalt prospects over the next 5 years, and this project could have a direct and significant impact by developing an accurate and economical reservoir monitoring and imaging technology.

Title: SBIR Phase II: Optical Diffusion Tomography in Frequency Domain by the Elliptic Systems Method

Award Number: 9983523
Program Manager: Jean C. Bonney

Start Date: August 15, 2000
Expires: July 31, 2002
Total Amount: $750,000

Investigator: Jonathon Benson, jlbenson@vnet.net
Company: Medical Optical Imaging Inc
8701 Mallard Creek Road
Charlotte, NC 28262
Phone: (704)548-1090

Abstract:

This Small Business Innovation Research Phase II project builds upon the concepts developed in the Phase I grant to develop a clinical prototype of an optical mammography device that could be used for breast cancer screening or diagnosis. The major technical obstacles to the development of an optical mammography device have been the need for imaging algorithms that are fast and accurate in the presence of scattered light, and for developing measurement techniques that can collect enough photons in a safe and timely way to develop an accurate image. Phase I demonstrated the technical feasibility of a new approach to the algorithms and hardware.

The software objectives of this project involve testing an approach to compute inclusion absorption coefficients, modifying the software to directly locate inclusions without transformation and developing a 3-D and GUI interface. Hardware objectives include developing a clinical prototype that would be safe and appropriate for imaging human subjects and calibrating and testing the hardware/software device on experimental data.

Title: SBIR Phase II: Advanced DSP Toolkit For Java

Award Number: 0078563
Program Manager: Juan E. Figueroa

Start Date: September 1, 2000
Expires: October 31, 2002
Total Amount: $376,481
Investigator: Andrew Watkins, andrew@mpi-softtech.com
Company: MPI Software Technology, Inc.
110 12th Street North
Birmingham, AL 35203
Phone: (205)314-3471

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will contribute mathematical services in signal and image processing for distributed Java computing. A major component of internetworked information is digital images and audio signals. Current vector, signal, and image processing standards are evaluated to achieve advanced signal processing for Java. Phase I emphasized the design, algorithms, and Java relevance. VSIP (vector signal and image processing) constitutes a viable option for commercialization in the distributed Java environment. This Phase II effort seeks to bridge the gap between the theoretical and the commercial for VSIP in Java, while identifying operational modes and service requirements for this non-traditional programming environment.

If successful, a huge community of Java programmers in academia, industry, and government could be enabled, as well as all the service recipients whose applications exploit such as library. Standardization for platform independence is a critical issue for Internet applications. An advanced commercially DSP toolkit would provide for a greater level of portability for signal-processing-intensive Internet applications. This would provide for better support for processing audio/visual information in valuable application settings. Embedded Java applications will make use of the toolkit to provide advanced signal analysis capabilities with mobility, portability, and high quality.

Title: SBIR Phase II: 3D Volumetric Image Display

Award Number: 0078583
Program Manager: Juan E. Figueroa

Start Date: September 1, 2000
Expires: August 31, 2003
Total Amount: $423,999
Investigator: Che-Chih Tsao, actrescorp@aol.com
Company: ACT Research Corporation
16 Walnut Street, Apt. 43
Arlington, MA 02476
Phone: (781)646-3587

Abstract:

This Small Business Innovation Research Phase II project is to develop a new computer peripheral: a Volumetric Image Display system that displays 3D images in a real space. Many viewers can walk around the display and see the 3D images from omni-directions without special glasses. The overall business objectives corresponding to this project are to develop and implement the technologies required for building the VID product, to demonstrate the market viability, and to complete the financial preparation for Phase III. In order to speed up commercialization, a Basic Model product will be completed in year 1. It will feature a flexible configuration and good specifications to address the initial need in various fields. Marketing will then begin in year 2 to test market and seek business alliances, using the Basic Model as a demonstration platform as well as an evaluation product. A low-volume manufacturing procedure will be established to support initial sales. In year 2, techniques that further improve product color and gray scale will be developed and demonstrated.

We already have a Phase III funding commitment. Based on the demonstrated market viability and technical readiness, a new business plan will be prepared to raise additional funding commitments to complete the finance preparation for Phase III. The marketing goals also include obtaining at least one development contract from a major corporation, as part of the Phase III finance. Market analysis indicates great commercial potential in four major segments: medical, computer aided design and engineering, visual data analysis, and computer gaming.

Title: SBIR Phase II: Advanced Question Answering

Award Number: 0215672
Program Manager: Juan E. Figueroa

Start Date: August 15, 2002
Expires: July 31, 2004
Total Amount: $500,000
Investigator: Mihai Surdeanu, mihai@languagecomputer.com
Company: Language Computer Corporation
6222 Misty Trail
Dallas, TX 75248
Phone: (972)490-5420

Abstract:

This Small Business Innovation Research (SBIR) Phase II project is developing an advanced questions answering (QA) system with the use of innovative natural language processing (NLP). The specific areas addressed by this project are: (1) a true open-domain, high precision QA system optimized for commercial deployment; (2) distributed processing that provides an unprecedented QU system response time; and (3) system management and reporting tools for real-time customer feedback.

The final product will provide accurate and short answers to questions asked in plain English. The need for this capability is widespread in companies, government agencies, and among individuals. The users may be casual questioners who ask simple factual questions, consumers who look for specific product features and prices, research analysis that collect market, finance, or business information, or professional information analysts such as law enforcement officials searching for very specific information requiring considerable expertise.

Title: SBIR Phase II: Minimal Sensor Signal Processing for Turbine Engine Health Monitoring

Award Number: 0216021
Program Manager: Juan E. Figueroa

Start Date: September 15, 2002
Expires: August 31, 2004
Total Amount: $500,000
Investigator: Carole A. Teolis, carole@technosci.com
Company: Techno-Sciences, Inc.
10001 Derekwood Lane
Lanham, MD 20706
Phone: (301)577-6000

Abstract:

This Small Business Innovative Research (SBIR) Phase II project will develop full waveform models and minimal sensor algorithms for the General Dynamics - Advanced Technology Systems (GDATS) eddy current sensor (ECS). These algorithms will enable the practical real-time high performance health monitoring for turbine engines. Current processing techniques could require four or more sensors; however, these approaches do not make use of all the information made available by the ESC. Using the full ECS signature, it is possible, in theory, to estimate integral vibration frequency, phase and amplitude using only a single sensor. The reduction of the number of sensors required in each engine stage could potentially save millions of dollars over the life of the engine.

There are no systems commercially available today for continuous health monitoring of gas turbine engines. Once in use, this system will allow pilots to react immediately to critical engine health problems thus avoiding potentially catastrophic engine failures and loss of lives. The minimal sensor algorithms for continuous health monitoring have a large market spanning the aviation industry, as well as the rapidly expanding power industry.

Title: STTR Phase II: Automation of the Crosscut Operation in a Wood Processing Mill

Award Number: 0321635
Program Manager: Juan E. Figueroa

Start Date: August 1, 2003
Expires: July 31, 2005
Total Amount: $500,000
Investigator: Alexander Mullin, smullin@barr-mullin.com
Company: Barr-Mullin Inc.
2506 Yonkers Rd.
Raleigh, NC 27604-2241
Phone: (919)832-2848

Abstract:

This Small Business Technology Transfer (STTR) Phase II project is to design and develop a fully automated system for crosscutting planks of lumber into parts with specific length and surface characteristic requirements. This system consists of a scanning device with four heads to scan the four surfaces of each incoming plank, a mathematical programming model and a software system to determine an optimal cutting pattern for each plank, and all necessary mechanisms to interface with (and to coordinate the operation of) various components of the manufacturing line. These components include the transport devices such as conveyor belts, the positioning devices, the saw mechanism, and the subsequent cut-piece sorter. Installation of an automated system would result in both higher speed and higher yields. The project will also extend the scope of this mathematical model, in combination with the models for the gang-rip saw operation, to create a combined system for ripping and crosscutting.

The software system developed under this research grant will have an impact on the efficiency of the crosscut operation, by increasing both its speed and its yield. This in turn could lead to substantial reductions in the manufacturing cost as well as to significant savings in the overall consumption of wood, which is a scarce national resource. This project supports the educational development of one graduate student at NC State University.

Title: SBIR Phase II: Robotic Systems for Network Interrogation of Smart Civil Structures

Award Number: 0110217
Program Manager: Juan E. Figueroa

Start Date: September 1, 2001
Expires: August 31, 2004
Total Amount: $499,906
Investigator: Steven W. Arms, swarms@microstrain.com
Company: MicroStrain Inc
310 Hurricane Lane
Williston, VT 05495
Phone: (802)862-6629

Abstract:

This Small Business Innovation Research (SBIR) Phase II, project is aimed at the continued development and field testing of an autonomous robotic structural inspection system capable of remote powering and data collection from a network of embedded sensing nodes with remote data access via the internet. The system will utilize existing microminiature, multichannel, wireless, programmable Addressable Sensing Modules (ASM's) to sample data from a variety of sensors. These inductively powered nodes do not require batteries or interconnecting wires, which greatly enhances reliability and reduces installation cost. Networks of sensing nodes can be embedded, interrogated, and remotely accessed in applications where visual inspection by people is not practical due to: physical space constraints, remote geographic locations, high inspection costs, and high risks involved for those performing the inspections.

The sensors can indicate the need for repair, replacement, or reinforcement, which will reduce the risk of catastrophic failure and will be useful after natural disasters, such as earthquakes, hurricanes, tornadoes, and floods.

Title: SBIR Phase II: Imaging Subsurface Fluid Flow with Time-Lapse Seismic Data

Award Number: 0091452
Program Manager: Sara B. Nerlove

Start Date: March 1, 2001
Expires: February 28, 2003
Total Amount: $493,450
Investigator: David E. Lumley, david.lumley@4thwaveimaging.com
Company: Fourth Wave Imaging
16A Journey, Suite 200
Aliso Viejo, CA 92656
Phone: (949)916-9787

Abstract:

This Small Business Innovation Research (SBIR) Phase II project concerns the development and implementation of seismic imaging and inversion methods and parallel computer algorithms to estimate subsurface fluid-flow properties from time-lapse seismic data. In recent years, there has been exponential growth in time-lapse seismology project activity. These projects have yielded seismic difference anomalies that result from monitoring time-variant changes in the earth's subsurface related to fluid flow. However, such anomalies are often qualitative and ambiguous--what causes the anomalies, and what do they mean? The proposed Phase II research will develop the capability of making quantitative estimates of the 3D distribution of subsurface fluid pressure and fluid saturation changes that cause the seismic anomalies, using wave-equation seismic imaging and inversion techniques, coupled with rock physics analysis. The research consists of three parts: optimized parallel software and computational design, amplitude preserved seismic imaging and impedance inversion, and robust rock physics inversion to estimate pressure and saturation. The software and services generated by this Phase II research will be invaluable to help guide new wells and optimize reservoir management decisions in the 70+ oilfields world-wide that are being actively monitored with time-lapse seismic data.

Near-term commercial applications of the proposed research include petroleum industry mapping and monitoring of commercial oil reserves, monitoring of costly injected fluids (water, steam, CO2, miscible gas), and imaging pressure compartmentalization and the leaking or sealing properties of faults and fractures. Non-petroleum applications may include monitoring groundwater reserves, near-surface monitoring of contaminant plumes and environmental clean-up projects. Potential far-market applications may include sub-sea acoustic imaging, synthetic aperture radar satellite imaging, and medical imaging.

Title: SBIR Phase II: Internet Based Remote Seismic Depth Imaging

Award Number: 0091447
Program Manager: Sara B. Nerlove

Start Date: February 1, 2001
Expires: January 31, 2004
Total Amount: $500,000
Investigator: Dimitri Bevc, dimitri@3dgeo.com
Company: 3DGeo Development, Inc
465 Fairchild Drive, Suite 226
Mountain View, CA 94043-2251
Phone: (415)969-3886

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will develop a seismic processing system that enables the delivery of leading-edge seismic services over the Internet and Intranets. Internet-based seismic processing (INSP) enables exploration companies to directly control their critical seismic imaging projects, without the need of purchasing and maintaining expensive hardware and software. INSP is a complete processing system that includes a client-based Java GUI, and server-based processing and database modules. The computationally intensive modules run on shared-memory parallel computers and Linux clusters. Phase I implemented the essential functionalities for a useful product, demonstrated concept feasibility, and laid the groundwork for the Phase II project. Phase II will add functionality to the product, and implement all security and data management aspects necessary for Internet deployment.

INSP ushers in a paradigm shift for the upstream oil and gas industry. Commercial potential is significant because INSP makes digital information and compute-intensive technology accessible to a large client base that wishes to outsource its non-core competencies to an application service provider, while maintaining control of projects. INSP greatly increases interaction between the client and contractor, thereby increasing the quality of the final seismic image, and reducing exploration and development cost.

Title: SBIR Phase II: Design of a True Three Dimensional (3-D) Information Display System

Award Number: 0110266
Program Manager: Juan E. Figueroa

Start Date: December 1, 2001
Expires: November 30, 2003
Total Amount: $491,525
Investigator: Soma Chakrabarti, schakrabarti@biocomp-systems.com
Company: BioComp
2429 Via Linda Drive
Lawrence, KS 66047
Phone: (785)841-6835

Abstract:

This Small Business Innovation Research (SBIR) Phase II project proposes the development of a low-cost desktop true three dimensional (3-D) information display system suitable for commercialization during Phase III. The proposed video monitor will provide highly realistic static and dynamic 3-D images by presenting information over a volumetric space, rather than a conventional planar space. As a result, the displayed information neither suffers from the loss of actual depth information as in a conventional monitor, nor requires the use of specially designed eyeglasses needed for stereovision systems. Fullcolor true 3-D views will be generated by projecting plane-by-plane image slices onto a projection screen that moves backward and forward in synchronization with the information generated on a CRT screen. By accessing these planes-of-view 30 times per second, flicker-free true 3-D views are generated over a volumetric space that are viewable from multiple angles. The anticipated low cost of this practical system should make it affordable for personal use since it will be designed primarily with commercially available system components, aided by novel digital imaging techniques and software approaches.

Thus, the proposed system is expected to find many diverse applications ranging from scientific and industrial visualization to entertainment. Some of the initial applications include biomedical image processing, scientific visualization, protein structure determination, general-purpose 3-D computer graphics, radar imaging, battlefield management, and aircraft design.

Title: SBIR Phase II: An Intelligent Three-Dimensional (3D) Mosaic Tool for Multiple 3D Images Integration

Award Number: 0091359
Program Manager: Juan E. Figueroa

Start Date: April 1, 2001
Expires: March 31, 2004
Total Amount: $500,000
Investigator: Ping Zhuang, geng@genextech.com
Company: Genex Technologies, Incorp
10605 Concord Street, Suite 500
Kensington, MD 20895-2504
Phone: (301)962-6565

Abstract:

This Small Business Innovative Research (SBIR) program investigates a novel software tool for integrating multiple 3D images. Three-dimensional (3D) modeling of physical objects and environment is an essential part of the challenges for many multimedia tasks. However, most physical objects self occlude, and no single view 3D image suffices to describe the entire surface of a 3D object. Multiple 3D images of the same object or scene from various viewpoints have to be taken and integrated in order to obtain a complete 3D model of the 3D object or scene. This process is called the "3D mosaic". The primary objective of this SBIR effort is to develop a fully automatic and intelligent software tool that is able to mosaic (i.e., align and merge) multiple 3D images of the same object taken from different viewpoints, without a priori knowledge of camera positions. The main innovations of this proposed effort are threefold: (1) an intelligent alignment method that is able to register multiple un-calibrated 3D images without needing any priori knowledge of camera location and orientation; (2) a seamless merge method to "stitch" together the aligned 3D images using the fuzzy logic principle; and (3) an intelligent 3D image compression algorithm that preserves 3D image geometric features while achieving high compression ratio.

The 3D Mosaic technique to be developed under this SBIR program has enormous commercial applications including industrial design and prototyping, reverse engineering, manufacturing part inspection, part replacement and repair, animation, entertainment, 3D modeling for WWW documents, archiving, virtual reality environment, education, virtual museum, commercial on-line catalogues, etc. It will become an important part of future 3D TV technology.

Title: SBIR Phase II: A Programming Environment to Enable Engineers to Program Distributed Measurement and Control Networks

Award Number: 0216240
Program Manager: Juan E. Figueroa

Start Date: October 1, 2002
Expires: September 30, 2004
Total Amount: $499,170
Investigator: Thomas D. Sharp, tsharp@sdltd.com
Company: Sheet Dynamics, Ltd.
1776 Mentor Avenue, Suite 170
Cincinnati, OH 45212-3571
Phone: (513)631-0579

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will develop a high level graphical programming environment for distributed measurement and control networks used in industry. Using this environment, an industrial control engineer will be able to describe the desired behavior of his/her system at a high level of abstraction (e.g. 'control motor speed', 'monitor bearing', 'monitor pump') and then "click a button" for the executable distributed application to be generated. In addition, the engineer will be able to monitor the behavior of the executing system at the graphical level to help identify problems. This system will automatically partition the graphical description into components targeted at specific processors on the network based upon the resources required by the algorithm. This functionality will greatly benefit the industrial control engineer, who will be able to focus on algorithm and application development rather than details of hardware and networking realizations.

As the commercial potential of distributed approaches are becoming more prevalent in industrial applications, the potential of this software system will grow at a fast rate. For example, 15 network controllers instead of one now manage a Proctor & Gamble diaper manufacturing line. Currently the market for distributed measurement and control is fragmented, with over 60 proprietary process network standards in use. The advent of the IEEE 1451 smart transducer standard creates a huge market opportunity by providing a portable application model that enables development tools, such as those being developed in this project, to be used with the multitude of existing commercial process busses.

Title: SBIR Phase II: An Aspect-Oriented Solution for Unit Test Generation

Award Number: 0238697
Program Manager: Juan E. Figueroa

Start Date: February 15, 2003
Expires: January 31, 2005
Total Amount: $498,243
Investigator: Paul Anderson, Paul@grammatech.com
Company: GrammaTech
317 North Aurora Street
Ithaca, NY 14850-2073
Phone: (607)273-7340

Abstract:

This Small Business Innovation Research Phase II project aims to make it much easier to create unit-level regression tests for Java programs. Their benefits are clear, but existing techniques for creating them are flawed because they are difficult to apply to existing code, and tool support requires modification of the target code. The innovation is to instrument a gold-standard version of the module of interest so that when a client application executes, all events that cross the boundary to the module are intercepted and logged to a file. Later, after the unit has been modified or extended, and without any further need for the client application, the events can be reconstructed and fed to the unit. The results are checked for consistency with the log, and discrepancies flagged as faults. This makes it much easier for a user to create a test suite for a module. The approach is made feasible by using Aspect-Oriented Programming, and object mocking. The research challenges are: how to devise techniques for tolerating permitted changes in the target module, and how to reduce the chances of a single failure triggering a profusion of cascading failures. The use of advanced static analysis techniques, including dependence analysis, is the key to solving these problems.

If successful, this system will help software development organizations reduce the cost of development and maintenance of their software assets while at the same time increasing its quality. It will help increase assurance of safety-critical software, such as in medical equipment, or flight-control systems, thus reducing the risk of damage to property and loss of life.

Title: SBIR Phase II: Video Mining for Customer Behavior in Retail Enterprises

Award Number: 0548734
Program Manager: Errol Arkilic

Start Date: May 26, 2006
Expires: May 31, 2008
Total Amount: $500,000
Investigator: Satish Mummareddy, smummareddy@videomining.com
Company: VideoMining Corporation
403 South Allen St Suite 101
State College, PA 16801
Phone: (814)867-8977

Abstract:

This Small Business Innovation Research (SBIR) Phase II project aims at developing video mining techniques for automatically generating statistics about in-store shopping behavior to help retail enterprises. These statistics can provide valuable insights for supporting critical decisions in store layout design, merchandising, marketing, and customer service. Further, since it is automated, video mining can become a tool for monitoring the impact of all customer-facing elements in a store. The Phase II research will continue in cooperation with the proposing company's partners and customers, while addressing the remaining challenges for video mining. The proposed tasks include robust person detection, tracking people across multiple cameras, modeling and recognizing complex shopping behavior involving shopping groups and sales associates. The approach will be to use a variety of computer vision and statistical learning techniques under the constraints of a typical retail environment.

Retail enterprises today operate in a hyper-competitive environment characterized by blurring categories, eroding market shares and fickle, but more demanding customers. These challenges have prompted retailers to adopt customer-centered strategies focused on uncovering and matching the needs of customers to gain (retain) market share. These strategies rely heavily on obtaining deeper insights into shopper behavior. Current methods (human observation and manual video indexing) for analyzing shopper behavior are limited in their scope while being expensive and time-consuming. On the contrary, the shopper insights gained from the proposed video mining platform will enable more informed decision-making leading to improvements in retail productivity and business process optimization. The proposing company has plans to immediately incorporate the outcome of the SBIR research into its retail product line.

Title: SBIR Phase II: THz Imaging Focal Plane Array

Award Number: 0548853
Program Manager: Errol Arkilic

Start Date: March 6, 2006
Expires: February 29, 2008
Total Amount: $464,344
Investigator: Oliver Edwards, oliver@zyberwear.com
Company: Zyberwear
2114 Victor Rd
Ocoee, FL 34761
Phone: (407)295 5955

Abstract:

This Small Business Innovation Research (SBIR) Phase II project is to develop a high-resolution focal plane array for terahertz imagery. THz radiation is a largely unexplored region of the spectrum, but holds great promise for its ability to pass through clothing, packaging and baggage walls (security applications) and for its ability to excite resonant molecular motions according to the composition and conformation of complex molecules such as explosives, illegal drugs and pharmaceuticals (imaging spectroscopy). Present uncooled detector technology is marginal in its ability to sense THz radiation and in video frame rate.

The anticipated results of this work are to demonstrate: (1) a 20 to 40 times improvement in noise-limited radiation detection at operation up to 250 Hz frame rate; (2) a new technique for very low cost manufacture of all-wavelength focal plane arrays; and (3) a high-performance THz focal plane array.

Title: SBIR Phase II: Fast Remote X-ray Screening

Award Number: 0620369
Program Manager: Errol Arkilic

Start Date: September 7, 2006
Expires: August 31, 2008
Total Amount: $500,000
Investigator: Edward Sommer, ejsommer@nrt-inc.com
Company: National Recovery Tech Inc
566 Mainstream Dr. Suite 300
Nashville, TN 37228
Phone: (615)734-6400

Abstract:

This SBIR Phase II project will provide development of a new homeland security technology for improving security for crowded venues by integrating a new networked security screening technology and new electronics communications with materials handling automation and computerized process control. New approaches and technologies are needed to provide effective security screening for places having high passenger and high pedestrian traffic. A primary need is to be able to screen persons and their carried items at significantly higher processing rates from those achieved using conventional security checkpoints while maintaining a smooth flow of people through the system. The Phase I project demonstrated technical feasibility. Phase II will complete development of the new high flow security screening system and design, construct, and test a near commercial scale prototype system. It is planned that the prototype system will be tested and evaluated by a TSA-approved, independent third party. Upon successful testing the system will be ready for deployment.

The U.S. transportation industry needs fast effective improvements in its security systems. Improved security technologies for use in transit systems can be applied to many other segments of society as well. In today's world it is vital that our nation's citizenry, transportation systems, institutions, and economy have the best protection possible from those who seek to weaken and destroy our society. The proposed technology will provide smooth flow of people and items through a fast and effective security inspection station with greater than an order of magnitude increase in processing rates compared to current technologies. The new technology will provide a significantly higher level of protection to persons in busy and crowded areas against attacks by terrorists using weapons or explosives than is currently available. Similarly, security at federal buildings, government installations, maritime ports, shippers, mailrooms, and other sensitive locations can be improved by the proposed technology that will allow for a faster and less impeded flow of persons and packages through the security inspection process.

Title: SBIR Phase II: T-Splines for Surface Intersection

Award Number: 0620461
Program Manager: Errol Arkilic

Start Date: August 4, 2006
Expires: July 31, 2008
Total Amount: $499,111
Investigator: David Cardon, tspline@byu.edu
Company: T-Spline Company
331 North 1100 East
Orem, UT 84097
Phone: (801)592-0263

Abstract:

This SBIR Phase II project addresses what is considered to be a significant unsolved problem in the Computer-Aided Design (CAD) industry; the fact that many CAD models contain numerous small, unwanted holes or gaps. These gaps occur most often along the seams where two surfaces in a CAD model meet, such as where a wing meets the fuselage of an airplane, and result from fundamental mathematical limitations. Software for analyzing a CAD model for physical properties such as aerodynamics, deflection, or stress cannot work unless those holes are repaired; a time consuming process that causes a significant bottleneck in the CAD workflow. Under Phase I funding, a solution to this gap problem was devised that uses a new surface formulation called T-Splines. Tasks to be performed in Phase II include extending the algorithms to work in arbitrary cases, designing and implementing algorithms for converting trimmed-NURBS models into gap-free T-Splines, adding fillets to the surface intersection, and incorporating the core software into two existing CAD packages using the idea of a "plugin."

The gap problem has vexed the CAD industry for over 25 years. The solution to the gap problem conceived in previous efforts involves a new technology called T-Splines, which some researchers in the CAD community believe represents a significant advance in the field of surface modeling theory. This project will help the T-Splines technology to mature and will hasten its adoption into the CAD industry.

Title: SBIR Phase II: CLEAR-View - A Cost Effective Thermal Imaging Sensor

Award Number: 0724500
Program Manager: Errol Arkilic

Start Date: September 15, 2007
Expires: August 31, 2009
Total Amount: $499,991
Investigator: Kamil Agi, kagi@ka-wireless.com
Company: K&A Wireless, LLC
2617 Juan Tabo Blbd NE Ste A
Albuquerque, NM 87112
Phone: (505)338-2380

Abstract:

This Small Business Innovative Research (SBIR) Phase II project aims to develop and produce a novel suite of algorithms to enhance the performance of thermal imagers, offering real-time solutions in the automotive, surveillance and other segments of the thermal imaging market. The proposed algorithm is integrated with noise-infested, uncooled microbolometer infrared cameras, elevating their performance and offering manufacturing-cost reductions while adding new features and capabilities. At the heart of the approach is a Scene-Based NonUniformity Correction (SBNUC) algorithm, which works to correct the fixed-pattern noise resulting from nonuniform detector-to-detector responses in the focal-pane array. The novel SBNUC approach relies on exploiting the presence of minute amounts of scene/camera motion in a video sequence, naturally present in almost all applications, to algebraically extract the nonuniformity-noise parameters in a dynamic fashion, without the need for a mechanical shutter, as done conventionally. This approach improves the camera's reliability.

If successfully commercialized, the largest market is in the automotive sector, where the lower cost and improved performance of the device can potentially lead to tens of millions of dollars from new installs of collision-avoidance systems in cars and trucks. The enhanced features and lower costs offered by this technology also offer the potential of expanding the use of thermal imaging in other applications. In the firefighting market segment, equipping every firefighter with a thermal imager will reduce the number of fatalities due to smoke inhalation, heat, and response efficiency. In security applications, more information will be delivered at a higher level of quality.

Database Management

Title: SBIR Phase II: Organized Search Results with Document Clustering

Award Number: 0131966
Program Manager: Juan E. Figueroa

Start Date: February 1, 2002
Expires: January 31, 2004
Total Amount: $499,905
Investigator: Raul Valdes-Perez, valdes@cs.cmu.edu
Company: Vivisimo, Inc.
2435 Beechwood Blvd.
Pittsburgh, PA, PA 15217-2722
Phone: (412)422-2496

Abstract:

This Small Business Innovation Research Phase II project will produce advances in document clustering technology. The company's proprietary software transforms a long list of raw search results into organized hierarchical folders that are browsed in Windows Explorer style. This software brings into easy view relevant information that otherwise would remain buried in the search results. It also enables effortless knowledge discovery: at a glance, a user learns the main subtopics corresponding to the query. The company has the first document clustering technology good enough for mass use, in terms of speed, quality of the clustering, and ease of interaction.

The resultant software product will augment the capabilities of web, enterprise, and database search engines. The market will include search engine vendors, system integrators and large organizations in business, academe, and government.

Title: SBIR Phase II: The Visual Database: Portable, Extensive Markup Language (XML)-Based Middleware For Media Representation, Interaction and Exchange

Award Number: 0450513
Program Manager: Juan E. Figueroa

Start Date: January 1, 2005
Expires: December 31, 2006
Total Amount: $470,500
Investigator: William Schroeder, will.schroeder@kitware.com
Company: Kitware Inc
28 Corporate Dr # 204
Clifton Park NY, 12065
Phone: (518)371-3971

Abstract:

This Small Business Innovative Research (SBIR) Phase II project will create a portable representational and interaction metaphor for digital media embedded in a 3D context. Popular document technologies remain text oriented-that is, content is organized into pages and viewed in reading order. The company is creating a novel information exchange paradigm that is generally applicable to information that is best understood in an interactive 3D environment. Applications of this technology include embedded routes on maps, electronic medical records, biological atlases, digital tours of 3D environments such as buildings, and mechanical assembly/disassembly diagrams. Analogous to a PDF file, but designed for a 3D interaction environment, the proposed solution defines an open, portable schema that can be efficiently represented using the portable Extensible Markup Language XML. In Phase II the company will specialize the editor for geospatial application, atlas creation, and assembly planning; addressing such technical challenges as large data and user interaction.

If successful the technology will enhance the ability of researchers, teachers, businesses, and consumers to record, describe and exchange complex 3D content. This innovation has the potential to improve the productivity of individuals and firms that create and communicate with such information; and to enhance the effectiveness of researchers and teachers to convey abstract concepts to others. This project defines a novel metaphor for working with information that goes beyond traditional organizational metaphors such as books and web pages. The proposed product supports complex 3D information; and takes advantage of recent developments in 3D graphics and visualization technology. The representational schema is simple enough to be supported by small portable devices such as PDA's, and sophisticated enough to support complex human/computer interaction in a 3D visualization environment.

Title: STTR Phase II: Location-Based PDA Bird Field Guide

Award Number: 0422158
Program Manager: Juan E. Figueroa

Start Date: August 1, 2004
Expires: July 31, 2006
Total Amount: $499,386
Investigator: Giles Timms, giles@pulluin.com
Company: South Dakota Health Technology Innovations, Inc.
109 Austin St.
Vermillion, SD 57069
Phone: (605)624-9792

Abstract:

This Small Business Technology Transfer (STTR) Phase II project will develop and test an electronic field guide for North America that will facilitate bird identification in the field combining images, audio, geographic information, and descriptive data. The system will include 1000 birds of North America, uniquely presented audio content, expanded GIS features, support for Windows CE devices, and the wireless transfer of data. The highlights of this software are the mobility offered by the PDA, database searches to aid species identification, access to multimedia and GIS data in the field. The proposed software will provide significant benefits to the education and research communities by allowing multiple PDA users to upload their observations to CLOs (Cornell Lab of Ornithology) eBird server (www.ebird.org) via desktop software or wireless Internet connection.

The availability of PDA-based software for use by students will facilitate student learning and enable students to play a key role in data collection for national and international research projects. The availability of this software to birders and amateur naturalist will promote citizen participation in science and conservation. The data collection and GPS features of the system will help researchers to accurately record scientifically useful data. The portable data collection and data transfer features will facilitate the gathering of data and timely reporting of that data to researchers

Title: SBIR Phase II: Automatic Information Awareness

Award Number: 0349724
Program Manager: Sara B. Nerlove

Start Date: January 15, 2004
Expires: December 31, 2005
Total Amount: $499,560
Investigator: Yves Schabes, schabes@teragram.com
Company: Teragram Corporation
236 Huntington Ave
Boston, MA 02115
Phone: (617)369-0100

Abstract:

This Small Business Innovation Research (SBIR) Phase II project proposes to study and implement a large-scale information awareness system which will fuse, present and provide an alert as to the existence of newly available information from large bodies of documents based on each user's profile. The amount of information available electronically has been growing at such a rate that it is not only impossible for people to identify the nature of the information content as it is made available, but it is even more out of the question for people to absorb the actual information content. Thus, awareness of and synthesis of the content of information has now become the real challenge. This project will enable users to specify their interests and to detect new information trends matching each individual user's interests, based on the relevance and importance of newly available information. By extracting information from unstructured texts, categorizing it, and fusing it, each user will be presented with a unique view of the content.

Teragram profiler technology allows users to specify information needs for the future. It will provide an alert mechanism based on user specified interests contained in user profiles, measurement and formulation of information speed, volume, decay; and fusion of information found in multiple documents. Such techniques will enable the next generations of information retrieval systems in which information will be tailored to the users' interests thus enabling easy access to relevant information found in large repositories.

Title: SBIR Phase II: Discovery Analyst: A Data Mining System for Image Databases

Award Number: 0349736
Program Manager: Juan E. Figueroa

Start Date: February 1, 2004
Expires: January 31, 2006
Total Amount: $500,000
Investigator: Stuart Blundell, sblundell@vls-inc.com
Company: Visual Learning Systems, Inc.
1280 S. 3rd Street West
Missoula, MT 59801
Phone: (406)829-1384

Abstract:

This Small Business Innovation Research Program Phase II project will develop a highly innovative data mining software tool that is capable of mining imagery and spatial information stored in a database management system (DBMS). Billions of dollars have been spent in converting the world's vast supply of paper maps into digital, geographically referenced, data for geographic information systems (GIS) applications because location matters in almost every instance of decision-making for both government agencies and private sector businesses. The proliferation of relational, spatial, and now visual data from high-resolution satellites, all stored in a common DBMS architecture, offers organizations the opportunity for knowledge discovery in databases; however, the technical challenges of maintaining, navigating, and mining these data are formidable. Current workflow approaches are disjointed and exclusive of image data. The product resulting from this project will allow all of the data to be queried and mined in a holistic workflow approach yielding potential useful discoveries through its primary innovations not presently available in data mining software; 1) Seamless integration of data mining and feature extraction workflows, 2) Mining content of high-resolution earth imagery stored in spatial databases, 3) Cleanup of GIS databases, and 4) Advanced query generation and data mining technology. Market research confirms that companies are investing in data mining software and high- resolution commercial satellite imagery.

The proposed product will have commercial applications in both traditional GIS application areas (forestry, defense, civil government, agriculture) and emerging vertical markets for GIS applications (banking and financial, telecommunications, security, manufacturing, retail and healthcare. There is a powerful demand for the knowledge acquisition vital to all location-based government decision-making processes. This significantly impacts the quality of management in our national security, resource handling, and the quality of our environment.

Title: SBIR Phase II: HIVbase, Data Integration Software to Support the Study of Chronic Viruses

Award Number: 0349669
Program Manager: Errol B. Arkilic

Start Date: March 1, 2004
Expires: February 28, 2006
Total Amount: $499,812
Investigator: Susanna Lamers, susanna@genejohnson.net
Company: Gene Johnson, Inc.
4 Milton St.
St. Augustine, FL 32084
Phone: (985)493-3487

Abstract:

This Small Business Innovation Research Phase II project will provide HIV researchers with progressive approaches to manage and analyze genetic data. There is a crisis developing in biology, in that completely unstructured information does not enhance understanding. Today's HIV investigators possess massive amounts of research information in user-hostile formats, error- filled spreadsheets, outdated databases, and directories containing thousands of individual files. These researchers need advanced protocols for extracting value from their disorganized information. Phase I feasibility study proved that the proposed solution provides a quality link between collection and the analysis of data that has never before been available to HIV researchers. This link helps HIV researchers do their job and ultimately promotes understanding for the most deadly and costly epidemic of our time. This project aims to solving researchers problems through the development of software that combines the power of unique data storage and integration with novel applications for data mining, analysis, and data retrieval. The goal is to provide researchers with a combination of modern querying, database, and analysis approaches.

The initial target market for the proposed product is made of HIV researchers and their associated facilities. This market is large, growing in multiple directions, and in need of this product. HIV infects an estimated 40 million people and is being funded at record levels from both government and private organizations. The major significance of the proposed product is in its ability to assist accelerate the efforts of the many scientists, epidemiologists and pharmacologists to make important discoveries relating to this on-going and tragic epidemic

Title: SBIR Phase II: Web-Based International Trade Knowledge Discovery System (TradingCube)

Award Number: 0349464
Program Manager: Juan E. Figueroa

Start Date: February 15, 2004
Expires: January 31, 2006
Total Amount: $499,895
Investigator: Carlos Sanchez, csanchez@tradingcube.com
Company: TradingCube Inc.
819 Florida Avenue
Pittsburgh, PA 15228
Phone: (412)624-2690

Abstract:

This Small Business Innovation Research Program Phase II project will focus on applied research for the development and implementation of a commercial Web-Based International Trade Knowledge Discovery System. It will address the significant need for organizations supporting international trade and for small and medium-sized business to have improved access to information and dynamic analyses of world markets in a single source. This product will provide subscribers with dynamic analyses of world markets for baskets of goods allowing them to extract actionable information to make strategic and tactical decisions while enabling the functionality of a novel combination of tools including knowledge discovery, data management technologies, web technologies, international trade economics and strategic analysis. This project will focus on: (1) Implementing a prototype based on the results of the Phase I feasibility study within a web portal framework, (2) Developing a library of international trade analyses, interactive maps and graphics, (3) Developing a meta-business directory and implement an international trade search engine, and (4) Developing personalization features and snapshot reports.

The proposed product will contribute to applications of knowledge discovery in the international trade domain, data warehousing, information hierarchies, and clustering-indexing techniques to support analytical queries. In addition it advances research in the application of Scalable Vector Graphics (SVG). SVG is a language for describing two-dimensional dynamic and interactive graphics in XML. The product addresses one of the fundamental areas on which trade promotion can have a significant impact --access to actionable information that will help businesses maximize export potential. In the process it will contribute to economic growth, education and participation of small businesses and underrepresented groups in international trade. The development process and product will involve researchers and students from several disciplines. The potential market includes any commercial, private or public organization with the need to find and evaluate international trade opportunities.

Title: SBIR Phase II: Bootstrap Tilting Inference and Large Data Sets

Award Number: 0078706
Program Manager: Juan E. Figueroa

Start Date: December 1, 2000
Expires: November 30, 2003
Total Amount: $487,103
Investigator: Tim Hesterberg, TimH@insightful.com
Company: Insightful Corporation
1700 Westlake Avenue N Ste 500
Seattle, WA 98109
Phone: (206)283-8802

Abstract:

This Small Business Innovation Research Phase II project is for development of fast bootstrap confidence intervals and hypothesis tests, and ways to make bootstrapping feasible for large data sets. Classical inference (intervals and tests) methods are known to be inaccurate when theoretical assumptions are violated, the usual case in practice. For example, skewness causes the usual t-test to be in error. The new methods are an order of magnitude (power of sqrt(n), where n is the sample size) more accurate in general than classical inferences. Bootstrap methods are a promising alternative to classical inferences, and can handle complex statistics including modern robust statistics, but are slow and have been little used in practice.

The methods proposed are typically 17--37 times faster than other bootstrap methods. The methods are fast enough to be seamlessly incorporated into standard software, alongside or instead of classical inferences. This provides statistical practitioners a realistic alternative to easy but inaccurate classical inferences and non-robust methods. The competitive advantage to the firm that does this first is a major opportunity. Furthermore, the large sample methods would be attractive in the thriving data mining market.

Title: SBIR Phase II: Automating Workflow In Agriculture - Integrated Pest Monitoring System for On-Time and Online Decision Making

Award Number: 0132164
Program Manager: Juan E. Figueroa

Start Date: February 15, 2002
Expires: January 31, 2004
Total Amount: $499,700
Investigator: Agenor Mafra-Neto, president@iscatech.com
Company: ISCA Tech
1660 Chicago Ave., Suite M-2
Riverside, CA 92507-2052
Phone: (909)686-5008

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will proceed with the development of a fully automated and integrated pest management (IPM) system. The goal of IPM is to minimize reliance on pesticides by emphasizing the moment-to-moment knowledge of the field situation to dynamically make decisions and deliver timely, targeted actions. Current IPM programs use data collection technologies from early 1900s, thus lacking speed and integration necessary to generate reports required by decision-makers who need to act quickly. With the Phase II development of a robust centralized Internet hub housing expert systems for automated data analysis, reporting (with GIS) and quick distribution of information, the benefits to agriculture will be unsurpassed.

The company targets its suite of field data management and decision-making tools the pest management market.

Title: SBIR Phase II: A New Digital Video Surveillance System

Award Number: 0131228
Program Manager: Juan E. Figueroa

Start Date: March 15, 2002
Expires: February 29, 2004
Total Amount: $500,000
Investigator: Jun Zhang, junzhang@csd.uwm.edu
Company: JunTech, Inc.
2027 E. Newton Ave.
Shorewood, WI 53211
Phone: (414)332-8349

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will develop a digital video surveillance system prototype. Over the past few years, video surveillance systems have been moving from analog to digital. The success of a digital video surveillance system depends on three key enabling technologies: compression, search and retrieval and network transmission. Existing commercial systems generally use standard video compression techniques, which often result in higher memory and bandwidth requirements and jerky object motion. In current video search and retrieval, the existing systems offer only search-by-time and no search-by-content. In network transmission, today's systems use relatively simple techniques that tend to make remote monitoring slow and sluggish. The company is using a highly efficient compression algorithm that exploits the special characteristics of surveillance video and is based on a segmentation technique. This technique, when applied to video search and retrieval, leads to search-by-content, which is more efficient and effective in practical applications. Finally the proposed system will employ fast network transport protocols and scalability techniques to make remote monitoring faster, uninterrupted by network traffic surges, and to allow display on a range of user devices.

This digital video surveillance system can be used to maintain the security of banks, airports, government buildings, corporate sites, homes, and small businesses. It can also be used to monitor the performance and operating conditions of machines and equipment.

Title: SBIR Phase II: A Machine Learning Approach to Approximate Record Matching

Award Number: 0216213
Program Manager: Juan E. Figueroa

Start Date: July 15, 2002
Expires: June 30, 2004
Total Amount: $499,764
Investigator: Andrew Borthwick, Andrew.Borthwick@choicemaker.com
Company: ChoiceMaker Technologies
41 East 11th St., 11th Floor
New York, NY 10003
Phone: (212)905-6031

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will enhance the company's approximate record-matching software, the Maximum Entropy De-Duper, MEDD(TM) by: 1) Enhancing MEDD's performance using advanced standardization tools to convert data, such as names and addresses, into standard formats; 2) Expanding MEDD's market by matching business names not only person names; 3) Internationalizing MEDD to support Canadian French or Mexican Spanish; 4) Benchmarking MEDD against the competition and developing a methodology to objectively compare matching systems; 5) Reducing MEDD's reliance on training data to ease deployment; producing the best possible "untrained" models that will adapt and improve through client use; 6) Applying the latest advances in machine learning technology to the record-matching problem to increase competitive advantage; and 7) Speeding MEDD word blocking with a fast, innovative memory-resident data-store.

MEDD's market includes all business and government entities that store mission-critical information in large databases. The project will yield societal benefits for public health, anti-terrorist efforts, epidemiological research, the U.S. Census, and the data quality of records relating to racial and ethnic minorities.

Title: SBIR Phase II: Universal Nanoparticle Taggants

Award Number: 0548756
Program Manager: Errol Arkilic

Start Date: February 16, 2006
Expires: February 29, 2008
Total Amount: $511,495
Investigator: Robert Haushalter, bob@parallel-synthesis.com
Company: Parallel Synthesis Technologies, Inc
3054 Lawerence Expy
Santa Clara, CA 95051
Phone: (408)749-8308

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will provide a system that is capable of easily labeling documents, with millions of unique optical signatures that provide a means of distinguishing these documents from other similar objects. Since there are no suitable commercial alternatives, both a scanning spectrometer and hyperspectral imaging system will be constructed and evaluated. The compatibility of developed materials with current screening technology, and the large number of distinct resolvable optical codes available, provides a level of authentication that will be difficult to replicate or decrypt.

Since there is a strong and continuing need to authenticate and verify documents, objects or people, the benefits of this technology will be broad-based and will influence authentication, sorting and identification of many items such as documents, pharmaceuticals or biological samples. The commercially available multiplexing level (number of distinguishable optical signatures) for optical encoding technology is currently limited to 100, so there is immediate need for a technology to provide a means of optically distinguishing very large numbers of similar objects.

Data Storage

Title: SBIR Phase II: Holographic Disk Data Storage on a New Photochromic Glass

Award Number: 0091591
Program Manager: Juan E. Figueroa

Start Date: March 1, 2001
Expires: February 29, 2004
Total Amount: $499,999
Investigator: Ralph DeMasi, newspan@nsotech.com
Company: New Span Opto-Tech Inc
9380 SW 72nd Street, B-180
Miami, FL 33173-3243
Phone: (305)275-6998

Abstract:

This Small Business Innovation Research (SBIR) Phase II project studies holographic data storage in a new ion-exchanged photochromic glass disk. It is well known that holographic data storage can significantly increase data storage capacity and reduce access time. However, the technology maturity of holographic data storage is believed to be impeded by: the lack of good holographic material that can be erased and recorded optically with almost unlimited rewriting cycles, with large index modulation for large capacity multiplexed data recording, and with long lifetime and immunity to destructive readout for archival applications. As demonstrated in Phase I the new ion-exchanged photochromic glass can satisfy all above requirements. In addition, it does not require developing or fixing after hologram recording making it an attractive candidate to replace other holographic materials in holographic storage applications. The Phase II research will first explore techniques to increase the recording volume thickness. The holographic performance parameters will again be determined after the thickness improvement. A compact holographic storage system will then be designed and constructed to show the effectiveness of disk type storage application. High capacity storage will be demonstrated. Commercial development will be explored with some major storage companies.

Using the new ion-exchanged glass can significantly improve the holographic data storage technology for commercial and military applications such as computer data storage, on-line storage, library archival applications, image storage and processing for medical applications and military target identification, and fast access to large intelligent databases.

Title: SBIR Phase II: Novel Coded High Density Optical Disk Data Storage

Award Number: 0450531
Program Manager: Juan E. Figueroa

Start Date: September 1, 2005
Expires: August 31, 2007
Total Amount: $485,058
Investigator: Jianwen Yang, jjyang@nsotech.com
Company: New Span Optotechnology Inc
9380 SW 72nd St Ste B180
Miami FL, 33173
Phone: (305)275-6998

Abstract:

This Small Business Innovation Research (SBIR) Phase II research project aims to develop a high-density optical disk storage prototype based on a new coding concept that will result in the prototype development of a compact packaged high-density optical disk storage system that is back compatible with current optical disk. Using such coding concept can significantly increase the disk data storage density and data access rate based on a modification of existing optical disk recording/readout hardware architecture. The new high density disk drive allows back compatibility with the current DVD disk and has advantage of easier market acceptance for product roll out than other developing storage technologies such as holographic and near field storages. The near term objective is to achieve 50 GB/disk capacity and more than 100 GB/disk is the next foreseeable product goal.

If successful, the outcome of this project will enhance the availability of high-density low cost storage for many social applications, increasing US based data storage technologies, and increasing US jobs. It will have extensive commercial and military applications such as computer data storage, on-line storage, library archival applications, image storage, and processing for medical applications, and military target identification and fast access to large intelligent databases. Educational impacts include advancing library archive storage for educational uses and benefiting university research in astronomy, meteorology and others that require huge data storage.

Title: SBIR Phase II: Group Coding for Reliable High Performance Network-Centric Storage

Award Number: 0239034
Program Manager: Juan E. Figueroa

Start Date: February 15, 2003
Expires: January 31, 2005
Total Amount: $500,000
Investigator: Qutaibah M. Malluhi, qmm@datareliability.com
Company: Data Reliability Inc.
3895 Metro Drive
Jackson, MS 39209
Phone: (601)944-0048

Abstract:

This SBIR Phase II project takes advantage of a powerful new coding technique called Group Coding (GC) pioneered in Phase I by Data Reliability Inc. (DRI), and an innovative storage system architecture called NetSTOR, to build a prototype for a highly available, reliable, high performance, application-friendly, and scalable network-based storage engine. The engine is multi-platform software that cost-effectively aggregates distributed islands of independent storage resources into a single virtual shared pool of storage. GC typically offers 6 to 27 times enhancement for encoding and 3.5 to 6.5 times enhancement for decoding. The NetSTOR approach is superior to commonly used data replication because it offers optimal redundancy leading to better resource (storage and bandwidth) utilization. NetSTOR is capable of aggregating the capabilities of multiple parallel storage nodes to get improved response times in both WAN and LAN environments. NetSTOR dramatically enhances the overall system throughput and exhibits perfect linear throughput scalability.

The NetSTOR engine serves as an enabling core storage technology. Applications can build on and benefit from the unique feature of this core. Many applications will exploit the competitive advantages of NetSTOR including storage virtualization, electronic software distribution, multimedia network-based services, modeling and simulation applications, data grids, document storage and delivery, distributed information retrieval, medical imaging, video on demand and terrain visualization. The GC technique pioneered by this project provides a new way of looking at and understanding existing array codes. This understanding will lead to the discovery of new codes and could result in significant scientific advances in coding theory. The impact of Phase II is not limited to the technological and commercial merits. For this project, DRI is partnering with Jackson State University (JSU); the Reference, the project will offer JSU students a tremendous educational experience. Since Jackson State University is an HBCU (Historically Black College and University), the project will set a precedent for continuous collaboration and will increase the participation of underrepresented and minority groups in science and technology.

Title: SBIR Phase II: Variable-Focal-Length Liquid Crystal Objective Lens

Award Number: 0091550
Program Manager: Juan E. Figueroa

Start Date: February 15, 2001
Expires: January 31, 2003
Total Amount: $499,389
Investigator: Jackie Lin, jackie.lin@reveo.com
Company: Reveo Inc
3 Westchester Plaza
Elmsford, NY 10523-1609
Phone: (914)345-9556

Abstract:

This Small Business Innovation Research (SBIR) Phase II project is designed to develop and commercialize our electrically controllable, dynamic-focusing liquid crystal microlens/microlens array device for 3D optical media readout and writing. The device will be the world's first compact, electrically controllable, dynamic focusing liquid crystal (LC) microlens reading/writing device for 3D data storage, and has the potential to revolutionize optical data storage and retrieval. The device will dramatically increase both the reading and writing speed of conventional CD/DVD systems and multi-layer DVDs and will be the enabling component in the next generation of truly 3D data storage technologies. In Phase I, the feasibility of the technology was demonstrated and tested various dynamic liquid crystal lens structures to gain an understanding of the issues of design, fabrication, and optical properties of LC microlenses. Building on this success, Phase II is dedicated to the optimization of the LC microlens structures and the development of a fast-switching dynamic focusing LC microlens with large variable focal length range and numerical aperture. Finally, a microlens array to develop parallel reading/writing devices will be designed and built. A prototype 3D reading device will be demonstrated. In Phase III, Reveo will commercialize the new technology.

Optical storage offers higher capacities, removable platters, and more durable media than magnetic disk storage, but it is limited by slow access speeds and higher costs of drives and media. The first product to be developed from the microlens technology will be an electrically controllable, dynamic-focusing liquid crystal microlens device for integration into the data reading system of current DVD players and other optical storage drivers. The device will maximize retrieval efficiency of current optical storage media so customers can immediately enjoy the benefits of 3D data storage technology.

Title: SBIR Phase II: Zero-Remanence Tamper-Responsive Cryptokey Memory

Award Number: 0724306
Program Manager: William Haines

Start Date: September 1, 2007
Expires: August 31, 2009
Total Amount: $499,809
Investigator: James Deak, jdeak@nve.com
Company: NVE Corporation
11409 Valley View Rd
Eden Prairie, MN 55344
Phone: (952)996-1636

Abstract:

This Small Business Innovative Research (SBIR) Phase II research project is to develop a more secure encryption key for non-volatile memory. Secure ICs often utilize encryption to protect non-volatile memory contents. A clever engineer can recover the key after decapsulating and probing the semiconductor die. NVE intends to produce an innovative non-volatile spintronic cryptographic key memory that will self-erase without data remanence in the event of tampering and without applied power. The main research objectives of this work involve development of a fully integrated 256-bit embedded tamper resistant magnetic random access memory.

The technology proposed in this Phase II SBIR program is intended to provide a defense against theft of intellectual property and to protect sensitive data stored in an integrated circuit. Identity theft has become a very large issue for society in general and particularly in the more computerized societies. This is more than a problem of economics, as US military systems have also been reversed engineered by both friendly and unfriendly nations to gain access to US weapons capability. The technology proposed under the Phase II program addresses the need to provide a tighter level of security for data stored on integrated circuit (IC) and IC assemblies. Commercially, this provides an extra layer of protection on IC-based assemblies such as smart cards, cash machines etc. In addition, the proposed program would render a system inoperable in the event of physical tamper. This may be a very useful tool in stemming the tide of fraudulent usage, compromises, and reverse engineering of IC-based instruments as well as certain types of identify theft.

Engineering Analysis & Modeling

Title: SBIR Phase II: Digital Machine Shop - An Immersive Two-Handed Precision 3D Modeling Environment

Award Number: 0110214
Program Manager: Juan E. Figueroa

Start Date: October 1, 2001
Expires: September 30, 2003
Total Amount: $500,000
Investigator: Paul K. Mlyniec, paul@dartforms.com
Company: Digital ArtForms
15466 Los Gatos Blvd., #214
Los Gatos, CA 95032-2551
Phone: (408)356-6169

Abstract:

This Small Business Innovation Research (SBIR) Phase II project, The Digital Machine Shop, is a practical immersive precision modeling system. With the aid of Digital Jigs, Digital Blades, and other innovative techniques, the user sculpts and assembles precision objects in a natural fashion with his or her own two hands. Real users from many backgrounds have validated the approach, showing these new paradigms to be easy to learn and easy to use. They have achieved comfort and productivity in a fraction of the time required by conventional modeling products because natural dexterity and real-world strategies apply. The apparent absence of Repetitive Stress Injury (RSI) in the Digital Machine Shop's two-handed interface promises to be a bonus of immeasurable value. The ease of use of the Digital Machine Shop will serve to tap the talent, creativity, and expertise of a large segment of society that has been discouraged by the complexity and tedium of conventional interfaces. Those comfortable with digital methods will benefit from enhanced productivity and creativity.

The Digital Machine Shop embodies enabling technologies whose impact far exceeds the scope of this project. It is through the example of practical innovation that the industry will adopt new and improved methods. The potential commercial applications include: architectural design, visual simulation modeling, game modeling, industrial design, automotive design, education, fine arts, and medicine.

Title: SBIR Phase II: Applications of Morse Theory in Reverse Engineering

Award Number: 0521838
Program Manager: Errol B. Arkilic

Start Date: July 15, 2005
Expires: June 30, 2007
Total Amount: $500,000
Investigator: Michael Facello, facello@geomagic.com
Company: Raindrop Geomagic Inc
617 Davis Dr.
Durham NC, 27713
Phone: (919)474-0133

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will investigate applications of Combinatorial Morse Theory in Reverse Engineering, a field that focuses on converting physical objects into a digital representation suitable for CAD, CAM, and CAE. The biggest challenge in this field is to automate the conversion process while producing a model that meets all the requirements of downstream applications. These requirements include both an accurate representation of features and a high degree of smoothness. Combinatorial Morse Theory relies on a single mathematical approach: the definition of a continuous function on a polygonal model and the decomposition of the surface based on the gradient flow of that function. One advantage of this over earlier approaches to the conversion problem is its flexibility obtained by adapting to and combining different analysis criteria. Morse theory is the key to computing patch layouts that naturally adapt to and follow the shape of the surface, a property that is difficult to achieve but necessary to automatically construct high-quality NURBS surfaces of scanned or triangulated CAD models.

The proposed algorithms will allow users to easily create accurate representations of scanned physical parts, thereby providing an efficient closed-loop between physical and digital at any phase of a product life cycle. This project will make strong research contributions in computer science and mechanical engineering by dealing with the practical applications of Morse Theory, automatic feature detection and patch layout. It will also make strong advances in the amount of information that can be extracted from a polygonal model. Commercial applications include design and analysis of complex shapes such as turbine blades, transmission housings, and engine blocks, creating digital inventory of legacy parts, historical preservation, mass customization and biometric shape reconstruction. These applications will allow manufacturing companies to be more competitive globally because it enables product differentiations and existing processes to be carried out efficiently, cost-effectively, and automatically. The societal impact of this technology includes the improvement of work environments due to reduction of dust, noise, and work-related injuries associated with traditional processes, prevention of loss of lives and equipment by enabling sampling based inspections as well as improvement of the quality life through customized medical devices, and apparel that conform perfectly to the wearer

Title: SBIR Phase II: An Integrated Software Tool for Modeling and Model-Based Control of Semiconductor Manufacturing Equipment

Award Number: 0450482
Program Manager: Juan E. Figueroa

Start Date: June 1, 2005
Expires: May 31, 2007
Total Amount: $500,000
Investigator: Jon Ebert, jle@scsolutions.com
Company: SC Solutions Inc
1261 Oakmead Pkwy
Sunnyvale CA, 94085
Phone: (408)617-4550

Abstract:

This Small Business Innovation Research (SBIR) Phase II project aims to develop a commercial prototype of a novel software tool for integrated model-based control design for Rapid Thermal Processing (RTP) systems. Semiconductor process engineers and RTP equipment design engineers will use the tool. Currently, the design and development of advanced process controllers is a relatively slow and complicated process. There is no high-level tool that allows the process engineer to design, tune and deploy advanced controllers and develop low-order, fast physical models to be used for control. Based on customer feedback and its own experience the company has found a strong need for an integrated modeling and control tool that can be customized for a specific process. Phase I results proved the feasibility of such a tool by closed-loop simulations of a generic RTP chamber using a proof-of-concept version of the proposed tool. This Phase II will further develop and implement relevant model-order reduction algorithms, implement the algorithm for speeding up the Monte Carlo ray tracing calculations, develop the user interface, and integrate the tool components. The company will work closely with its industrial partner in testing the prototype tool in the design of next-generation RTP equipment.

If successful the proposed software package will result in a tool that will substantially reduce the development time of RTP equipment and processes. The tool also provides components for development of advanced techniques in virtual sensing and fault detection. RTP is the company's initial focus, but will leverage the modular nature of the product to extend its capabilities to other semiconductor equipment (e.g., CMP, CVD, etch, etc.) and even equipment used in other industries. Moreover, devices for MEMS and new nanoscale electronics technologies (e.g. spintronic and molecular computing) are expected to be commercialized using CMOS-like manufacturing processes. Hence, by creating a new way of designing and developing equipment and processes efficiently, this tool will have an impact far beyond RTP. The software will serve as a teaching and training tool that can be used in universities and government laboratories of NIST, DoD, DoE, etc

Title: SBIR Phase II: Rapid Application Development Architecture for Product, Process, and Cost Configuration Across Manufacturing Verticals

Award Number: 0450308
Program Manager: Juan E. Figueroa

Start Date: January 1, 2005
Expires: December 31, 2006
Total Amount: $499,999
Investigator: Nainesh Rathod, nainesh.rathod@imaginestics.com
Company: ImaginesticsLLC
1220 Potter Dr Ste 124
West Lafayette IN, 47906
Phone: (765)464-1700

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will develop prototype architecture of an engineering advisory system and validate its application. Although the cost of product design could be only about 5% of the total product cost, decisions made during the design stage can contribute as much as 70-80% to the final product cost. Inappropriate design decisions made without sufficient manufacturing knowledge, or information, increases iterations in the product development lifecycle, causing significant costs to both the original equipment manufactures (OEMs) and the lower tier manufacturers. A survey by Purdue University indicated that 90% of the engineers/designers had very little process knowledge, thus indicating that there is a serious design-manufacturing knowledge gap. The aims and responsibilities of the Phase II project are to bridge the design-manufacturing knowledge gap through the development of an engineering advisory system to be used in early design. The system would be analogous to a spell-checking tool, advising engineers/designers on manufacturability and cost. The system will perform Dynamic Design for Manufacturability (DFM) analysis, evaluate part geometry in order to provide advice on the manufacturing aspects of the part, especially tooling and process related parameters in part design, help in estimating relative manufacturing costs for a part by mapping the geometric and non-geometric parameters of the part to a cost-based manufacturing process model, integrate 3D Shape Search Engine (licensed from Purdue University) with Part/Tooling/Cost Advisor & Knowledge Reuse Agent, seamlessly integrate with commercial Computer-Aided-Design (CAD) system using sophisticated geometric reasoning algorithms and a hybrid B-rep-voxel approach, and extract manufacturing feature-based geometric information.

If successful this product will enable engineers/designers make informed decisions early in product design about processes and part/tooling for manufacturability while serving as an on-demand manufacturing "what-if" educational tool for engineers/designers. It will reduce non-value added design features so optimal and economical processes can be considered, thus lowering tooling costs while minimizing the risk in the quotation process for both OEMs and tooling firms. The outcome of this research also have an educational impact in engineering schools by introducing students to manufacturing processes and design for manufacturability concepts. The company will provide the engineering advisory system to universities to use in their engineering curriculum. The outcome of the proposed research can improve product design, lower cost and positively impact the local economy by linking local suppliers in early design directly through an engineering advisory system.

Title: SBIR Phase II: Creating Functionally Decomposed Surface Models from Measured Data

Award Number: 0450230
Program Manager: Ian M. Bennett

Start Date: February 15, 2005
Expires: January 31, 2007
Total Amount: $489,179
Investigator: Tamas Varady, varady@geomagic.com
Company: Raindrop Geomagic Inc
617 Davis Dr
Durham NC, 27713
Phone: (919)474-0133

Abstract:

This Small Business Innovation Research Phase II project deals with the problems of reconstructing complex free-form shapes from measured data. Raindrop Magic's primary interest is to produce well-structured, high-quality CAD models. Several techniques exist to reach this goal; unfortunately, automatic surfacing systems provide only rough approximations and do not capture the original design intent, while manual segmentation methods are not very stable and require tedious work. Using functional decomposition, objects are built up as a collection of large, independent primary surfaces being connected by smaller, dependent feature surfaces, such as fillets or swept surfaces. In Phase I, semi-automatic methods were elaborated to create good segmenting curve nets. Exploiting the specific properties of different feature types, the research team proposed algorithms to compute optimal surface representations for each. In Phase II, the team envisions transforming and extending their theoretical results into robust and efficient computational algorithms. Five subsystems are proposed: Surface-Indicators, Constrained-Fitting, Curve-Tracing, Fairing, and Feature-Fitting. New core technologies are developed for creating different geometric entities, which are eventually integrated to obtain high-quality surface models. This technology should significantly shorten lead-time in related industrial design and manufacturing processes and produce aesthetic objects, having a positive impact on the whole society.

The proffered technology has broader impacts in two key market sectors: reverse engineering and advanced surfacing. At the research front, the proposed project deepens the understanding of computer-aided geometric modeling working with scan data, a field that has not received much attention from the large CAD companies, but is an active area of research. It combines the knowledge of both discrete and continuous mathematics and takes advantage of the strength of both approaches. On the technology front, it introduces a new paradigm that will significantly improve the current commercial systems of reverse engineering with better engineering features and advanced surfacing through simpler operations. The main applications will be product design, including automotive, aerospace, consumer products, and medical devices. The improved product will help the US manufacturing industry to be more competitive in the world market, providing a way to introduce design on demand and engineering on demand services. The proposed project will help US companies to increase customer-focused production and reduce the time between product iterations.

Title: SBIR Phase II: Parallel Processing of Time-Lapse Seismic Data Via the Internet

Award Number: 0216413
Program Manager: Sara B. Nerlove

Start Date October 1, 2002
Expires September 30, 2005
Total Amount $602,687
Investigator(s): Stephen Cole, steve.cole@4thwaveimaging.com
Company: Fourth Wave Imaging Corporation
16A Journey, Suite 200
Aliso Viejo, CA 92656
Phone: (949)916-9787

Abstract:

This Small Business Innovation Research (SBIR) Phase II project concerns the processing and analysis of time-lapse seismic data on parallel computers, using the Internet to control the processing flow and visualize the results. In recent years, there has been exponential growth in time-lapse seismic project activity. Time-lapse seismic analysis facilitates the management of oil and gas reservoirs by imaging fluid movement in the reservoir over time. The results are used to guide reservoir management decisions-such as where to place a new well or where to inject water, gas, or steam to stimulate hydrocarbon movement-and help maximize the life of both new and existing fields while minimizing recovery costs. The computer algorithms needed to process time-lapse seismic data are complex and require advanced computational hardware-typically multiprocessor Unix workstations or clusters of personal computers-that many potential customers do not have. The proposed innovation will allow customers to process their data on a centralized PC cluster, using the Internet to control the processing and to visualize the results remotely. The proposed innovation will improve the links between the components of the time-lapse seismic workflow, leading to greater understanding and more widespread commercial acceptance of the technology. Potential applications of the research proposed by Fourth Wave Imaging include petroleum industry mapping of by passed oil, monitoring of costly injected fluids, and imaging flow compartmentalization and the hydraulic properties of faults and fractures. Non-petroleum applications include monitoring groundwater reserves, subsurface monitoring of contaminant plumes and environmental clean-up projects. The web-based parallel software system developed for this project could be applied to other computer-intensive fields such as earthquake seismology and medical and satellite imaging. Tools from this web-based software platform such as those for modeling rock physics and seismic data may also be useful for educational purposes.

Title: STTR Phase II: Integrated Software and Systems for Large-Scale Nonlinear Optimization

Award Number: 0422132
Program Manager: Juan E. Figueroa

Start Date: July 15, 2004
Expires: June 30, 2006
Total Amount: $499,929
Investigator: Richard Waltz, waltz@ziena.com
Company: Ziena Optimization Inc.
2615 Hartzell Street
Evanston, IL 60201
Phone: (847)869-3269

Abstract:

This Small Business Innovation Research Program Phase II research project will address the design and creation of integrated nonlinear optimization software that combines complementary approaches to nonlinear optimization to achieve robust performance over a wide range of application requirements. The work will concentrate on the area of smooth nonlinearly constrained optimization, which arises directly in numerous applications and as a sub-problem in mixed-integer nonlinear programming and global optimization. The work will employ both mathematical convergence analyses and extensive testing on problems of practical interest. Results of the research will take nonlinear optimization software to a new level, based on an adaptive and versatile collection of algorithms in contrast to the single-algorithm approaches employed by current optimization packages. Nonlinear optimization models arise in diverse areas of science such as medical imaging, oceanography, crystallography, and climate modeling, and in almost all areas of engineering, chip feature placement for semiconductor manufacturers to energy management for electric and gas utilities.

Nonlinear optimization is also rapidly becoming a key tool in decision analysis in such areas as finance and revenue management. By enabling optimization packages to be more fexible and more reliable, this research will lead to stronger support for current nonlinear optimization applications while making new, more ambitious applications possible.

Title: SBIR Phase II: Integrated Fire Modeling Software

Award Number: 0349759
Program Manager: Juan E. Figueroa

Start Date: February 15, 2004
Expires: January 31, 2006
Total Amount: $498,900
Investigator: Brian Hardeman, hardeman@thunderheadeng.com
Company: Thunderhead Engineering Consultants, Inc.
1006 Poyntz Ave.
Manhattan, KS 66502
Phone: (785)770-8511

Abstract:

This Small Business Innovation Research project will develop an integrated fire modeling software package for use in building design and accident analysis. This will increase public safety by providing widespread access to state-of-the-art fire simulation. Modeling fires using a rigorous scientific approach makes it possible to predict the course of an evolving fire and its impact on the building occupants, contents, and structure. The software will help designers implement new fire safety codes and standards that allow the use of Performance-Based design as an alternative to Rule-Based design. Performance-based design and post-accident analysis offer the potential to reduce injury, loss of life, property damage, and the overall cost of constructing and maintaining buildings through advanced technology. This project will accelerate the introduction of new fire simulation technology into the fire safety industry. In the United States, the total cost of fires is over $100 billion annually, with a loss of more than 4,000 lives. Driven by the availability of the Fire Dynamics Simulator (FDS) from NIST and new performance-based fire safety standards, the fire safety industry is responding to these costs by adopting greater use of fire simulation. As a result, there is an emerging market for fire simulation software that is powerful, yet easy to use.

The potential market includes fire safety engineers (design), companies involved in accident review and litigation, Authorities Having Jurisdiction (regulation), and fire service personnel (suppression and investigation).

Title: SBIR Phase II: Relational Bayesian Modeling for Electronic Commerce

Award Number: 0349497
Program Manager: Juan E. Figueroa

Start Date: January 15, 2004
Expires: December 31, 2005
Total Amount: $450,056
Investigator: Bruce D'Ambrosio, dambrosi@cleverset.com
Company: CleverSet, Inc.
673 NW Jackson Ave.
Corvallis, OR 97330
Phone: (541)738-1010

Abstract:

This Small Business Innovation Research Phase II project will focus on scale-up and validation of the company's relational model discovery technology, with specific application focus on web-visitor behavior modeling. In Phase I research the company developed a modeling paradigm based a synthetic variable language for relational Bayesian modeling. Its synthetic variable language is the first comprehensive effort to develop a principled way to represent, discover, and perform probabilistic inference with mixed intra-table, cross-table, and multi-table relational features. This capability provides the basis for construction of comprehensive, integrated models of relational data. Models constructed capture the rich detail of web visitor behavior and can be used to make inferences about web visitor intent (e.g., whether or not a purchase in planned) in real- time. These results are not obtainable by any other modeling technology. The technical objectives for the Phase II project are to: (1) develop a complete language to establish solutions to outstanding issues in our synthetic variable capability, (2) engineer the infrastructure needed for commercial deployment, (3) construct deployable models of web visitor behavior to identify opportunities for intervention, and (4) conduct field-trials of model-based interventions to establish the business value of our approach. A paradox of modern society is that we possess so little knowledge relative to the amount of data we collect and store. E-commerce provides a paradigmatic example of this paradox. E-Commerce platforms collect unprecedented amounts of information about customer interactions, yet today's E-commerce applications do not provide the service expected by customers or the performance demanded by online retailers. Online retailers are demanding increasingly sophisticated marketing and merchandising technologies.

The proposed product will empower online merchants and service providers by enabling efficient and integrated understanding of online consumer behavior and will bring in a new class of customer centric (instead of page-centric) web-based interactions that will contribute to the evolution of the World Wide Web as a communication medium. The company's technology also applies to offline scientific analysis as a method for hypothesis generation in complex relational data as in the E-commerce domain. This technology enables scientists to make better use of the data at their disposal.

Title: SBIR Phase II: A Toolbox for Optimal Design

Award Number: 0321420
Program Manager: Errol B. Arkilic

Start Date: November 1, 2003
Expires: October 31, 2005
Total Amount: $500,000
Investigator: Victor Pereyra, victor@ca.wai.com
Company: Weidlinger Associates Incorporated, NYC
375 Hudson Street
New York City, NY 10014
Phone: (212)367-3080

Abstract:

This Small Business Innovation Research (SBIR) Phase II project combines large-scale simulation of wave propagation phenomena with optimization. Simulation in itself is seldom a final objective. Rather, simulation is usually a step in an iterative process to solve the real problem, that could be the determination of material properties from indirect measurements, imaging, parameter estimation or optimal design, to name a few. All these problems share the need to couple a large simulation package with an optimization one. This project will formalize this concept and proceed to create a set of tools to facilitate this coupling in the area of transient wave propagation phenomena, with special applications to piezoelectric transducer design, oil exploration and production, and optimal and protective structural design. These applications are chosen to exemplify the usage of the toolbox and emphasize its generality. It will couple a wave propagation finite element system and a system for 3D forward and inverse geological modeling, with a number of optimization programs.

The target market for the proposed solution is small to medium sized companies in need of a set of affordable design tools that will cover a number of different classes of application areas which have been previously available only to large firms. The results of this project will have a broad impact on a large number of small and medium size industries that rely on Computer Aided Design and Engineering to develop their products, accelerating and making more efficient the process between product conception, production and market introduction, key in a highly competitive world.

Title: SBIR Phase II: Scalable, Parallel Automatic Mesh Generation

Award Number: 0321529
Program Manager: Errol B. Arkilic

Start Date: November 1, 2003
Expires: October 31, 2005
Total Amount: $496,549
Investigator: Mark Beall, mbeall@simmetrix.com
Company: Simmetrix, Inc.
10 Halfmoon Executive Park Drive
Clifton Park, NY 12065
Phone: (518)348-1639

Abstract:

This Small Business Innovation Research Phase II project proposes to develop technologies to automatically generate large meshes appropriate for finite element and similar analyses directly from CAD model representations. This will be done using scalable, parallel algorithms that will enable the generation of meshes on distributed parallel computers including workstation clusters. The result of this project will be software that is capable of generating meshes with hundreds of millions of elements in an efficient manner. The generated meshes will already be partitioned to be compatible with the needs of parallel analysis codes. The commercial applications of this research are in those industries that need to perform large-scale simulations of complex problems over general domains.

The procedures to be developed will allow simulation based design technologies to be applied to applications that demand massive simulations. By enabling these large-scale simulations for industrial problems, this technology will enable the more widespread and effective use of numerical simulation in the design of manufactured products in all industries (automotive and aerospace being two major industries with an immediate need for this technology). The software developed in this project will be available for licensing to all CAD/CAE software developers to enhance the capabilities of their products.

Title: SBIR Phase II: Meshless Petrov-Galerkin Geo-Environ Technology For Wide Scale Field Uses

Award Number: 0321651
Program Manager: Juan E. Figueroa

Start Date: February 15, 2004
Expires: January 31, 2006
Total Amount: $379,038
Investigator: Sumant Gupta, cfest@cfest.com
Company: Consultants for Environmental System Technologies
2 Corporate Park, Suite 202
Irvine, CA 92606
Phone: (949)724-1696

Abstract:

This Small Business Innovative Research (SBIR) Phase II proposes to develop a Meshless Petrov-Galerkin Geo-Environ Technology For Wide Scale Field Uses. Groundwater supplies are increasingly threatened by organic, inorganic, and radioactive contaminants that are introduced to the environment by improper disposal or accidental releases. Estimates of remediation costs at U.S. government sites alone totals into the billions of dollars. Computational mechanics and aerospace advances in meshless Petrov-Galerkin provide easy means for stable accurate simulations of large groundwater reservoirs without grid generation. The proposed software package Meshless Groundwater Model-Petrov Galerkin (MGM-PG) will be designed for advanced hydrologists as well as for groundwater basin managers, purveyors, and field hydrologists. Current software advancements will be interfaced for easy conceptual model development for various applications. MGM-PG potential market includes: (i) groundwater reservoir quantity and quality management; (ii) cleanup of contaminated sites; (iii) storage of wet year surplus surface water underground and its uses for extended draught periods (ASR projects); (iv) safe disposal of treated effluents by rapid infiltration and extraction projects (RIX projects); (v) conjunctive uses of surface and subsurface water; (vi) landfill sites; and (vii) cleanup of large contaminated Federal Facilities.

This technology has applicability to thousands of EPA National Priority List for expedited clean up of contaminated sites and also for groundwater management projects that are implemented at a cost of billions of dollars by federal agencies, State, counties, petroleum facilities, and chemical industries. Worldwide only 4-5 geo-environ codes have been developed for wide variety of societal needs. MGM-PG will be a new technological advancement and will promote training of new graduate students in meshless advances rather than old methods.

Title: SBIR Phase II: Modeling and Model-Based Control for Chemical Mechanical Planarization

Award Number: 9983309
Program Manager: Winslow L. Sargeant

Start Date: July 1, 2000
Expires: June 30, 2003
Total Amount: $750,000
Investigator: Abbas Emami-Naeini, emami@scsolutions.com
Company: SC Solutions, Inc.
1261 Oakmead Pkwy
Sunnyvale, CA 94085
Phone: (408)617-4550

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will develop physical modeling and model-based sensing and control techniques for chemical mechanical planarization (CMP) systems. CMP is rapidly emerging as a global planarization technology for microelectronics fabrication. Phase I found feasible modeling and real-time control techniques using actual experimental data from a commercial CMP system. Three-dimensional (3D) results of contact mechanical models correlate closely with experimental results for removal rate distribution across a wafer. Reduced input-output models relating the within wafer nonuniformity (WIWNU) to the pressure ratio and pad conditioning, obtained from detailed 3D models, were used as a basis for real-time and run-to-run control. Phase II will extend these models and control methods and develop a model-based embedded controller for within-wafer and within-die uniformity control. Phase II will culminate in tests of advanced process modeling and control software and an embedded controller for CMP systems.

Commercial applications in the semiconductor industry are expected to result in improved and repeatable performance, increased throughput, and improved yields. An embedded controller product promises significant improvements in uniformity and throughput by allowing real-time control of uniformity for various CMP applications. Process modeling software and control software have potential for significant improvements in the 'trial and error' approach currently employed in CMP.

Title: SBIR Phase II: Large Eddy Simulations (LES) of Gas-Particle Flows

Award Number: 9983395
Program Manager: Juan E. Figueroa

Start Date: June 1, 2000
Expires: May 31, 2003
Total Amount: $499,904
Investigator: Shivshankar Sundaram, jls@cfdrc.com
Company: CFD Research Corporation
215 Wynn Drive, 5th Floor
Huntsville, AL 35805
Phone: (256)726-4800

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will further develop, validate and demonstrate Large Eddy Simulations (LES) for the prediction of gas-particle flow phenomena. The Phase I study has clearly demonstrated the feasibility of using a commercial CFD code to perform Gas-Particle Large Eddy Simulations in flows with simple geometry. Good predictions of particulate dispersion, deposition and agglomeration in isotropic and channel turbulent flows have been obtained. The Phase II study will refine the models and techniques developed in Phase I and extend them to simulate more complex flows, in practical geometries. The Phase II work will be focused on the following main areas: unstructured and mixed element (adaptive cartesian) grids (driven by the need for fast and accurate simulations; adaptation and implementation of advanced sub-grid scale models and particle transport in these alternative grid topologies; implementation of enhanced particle sub-grid scale models for (a) fluid sub-grid scale (SGS) velocity (b) deposition and (c) agglomeration; extensive and systematic validation in channel, free shear and mixing layer flows; technology demonstration using a practical contaminant transport simulation. A team of experienced investigators and strongly interested end-users of this capability (Aerodyne Research, PLG, Dura Pharmaceuticals) has been assembled. The end-product of the Phase II effort will be an Integrated Large Eddy Simulation System for gas-particle flows (featuring advanced gridding, solver and visualization software). Gas-particle processes cannot usually be well-understood without a detailed consideration of the complex and usually highly nonlinear interaction between the flow and the motion of the particles. The developed Integrated Large Eddy Simulation System will foster a better fundamental understanding of dilute particulate turbulent flows in complex geometries. It will enable improved engineering design in a variety of fields such as air pollution control and chemical/bio-terrorism programs to chemical/pharmaceutical/semiconductor processing.

The product developed at the end of Phase II will put a sophisticated physics simulator heretofor only avaialbe with academicians and that too in simple flow situations, in the hands of a trained industrial engineer enabling him to better understand and improve the processes of concern.

Title: SBIR Phase II: An Advanced Computational Simulation Tool for Metalorganic Vapor Phase Epitaxy of Compound III-V Layers in Industrial Reactors

Award Number: 9983415
Program Manager: Juan E. Figueroa

Start Date: June 1, 2000
Expires: May 31, 2003
Total Amount: $522,495
Investigator: Samuel Lowry, sal@cfdrc.com
Company: CFD Research Corporation
215 Wynn Drive, 5th Floor
Huntsville, AL 35805
Phone: (256)726-4800

Abstract:

This Small Business Innovation Research Phase II project will produce a commercial simulation tool to design and optimize Metalorganic Vapor Phase Epitaxy (MOVPE) systems for the fabrication of III-V materials. The Phase I study has demonstrated the proof-of-concept of using advanced models to optimize MOVPE equipment and processes. Specifically the effects of radiative heat transfer, gas flow field, gas phase/surface chemistry and electromagnetic induction heating on the deposition rate/uniformity were quantified using the models. Following preliminary validation, the models were tested for both two and three-dimensional commercial reactor geometries. The proposed Phase II project will focus on the necessary model refinements and development identified during the Phase I study. Specifically, improvements are sought in the areas of modeling chemistry of ternary and quaternary III-V materials, establishing the relationship between strain and growth rate, and development of mechanisms, which can model deposition accurately both in the kinetic as well as the mass-transport regime. Comprehensive databases for optical, thermodynamic/transport properties, and reaction mechanisms will be implemented to ensure the commercial success of the proposed simulation tool. Model developments will be followed by extensive validation studies on commercial MOCVD reactors, to be conducted in collaboration with Aixtron AG, one of the leading MOVPE equipment manufacturers. Validations will also be performed on reactor geometries and cases available from the open literature as well as research groups currently working in collaboration with CFDRC. Phase III work will focus on commercialization aspects such as improvements in software frontends, improved data handling and development of virtual reactor prototypes for commercial use.

The availability of the proposed simulation tool will facilitate the design, optimization and scale-up (to large wafer sizes) of reactors/processes for MOVPE. This will result in lower equipment and fabrication costs and improved uniformity/quality of the grown materials. Thus, the simulation tool will be an enabling technology in eliminating a major road block in the commercialization of III-V MOVPE technology. This will also have a positive impact on the growth of the optoelectronic device and telecommunication industries.

Title: SBIR Phase II: Design-Based Developments for Pump Cavitation Control

Award Number: 0078582
Program Manager: Cheryl F. Albus

Start Date: January 1, 2001
Expires: December 31, 2002
Total Amount: $399,883
Investigator: Daniel Baun, dob@conceptnrec.com
Company: Concepts ETI Inc
217 Billings Farms Road
White River Junction, VT 05001
Phone: (802)296-2321

Abstract:

This Small Business Innovation Research Phase II project is to provide the means to reliably calculate turbopump stiffness and damping matrices based on dynamic force measurements collected using a magnetic bearing rig. During Phase I exploratory development of a high suction specific speed (NSS) = 65,000 rocket engine turbopump pump stage was carried out and laid the foundation for this project. A complementary Phase I project for NASA focused on an NSS = 85,000 stage. Earlier Air Force funding concentrated on demonstrating magnetic bearings as a useful lab instrument. More recent breakthroughs include a novel fix for auto-oscillation and establishing the structure of an innovative dynamic force matrix measurement methodology. The primary challenge in this work is to isolate those forces on the rotor (with and without cavitation) due to the interaction of the impeller with the stator using innovative test and signal processing techniques. By testing a series of impellers, a database of rotordynamic coefficients will be established based on component dynamic force data. An additional objective is to evaluate the capability of CFD for replicating those physical force measurements. The goal is to create scientifically based design methods for lighter high-performance turbopumps.

Smaller, lighter, and higher speed rocket engine turbopumps are required to meet lower space launch cost requirements. Successful accomplishment of this fundamentally based approach for measuring component specific rotor dynamic forces and a method for using experimental results on a broader basis in the design process can lead to a breakthrough technology. It will enable turbopump designers to overcome current thresholds due to hydraulic induced rotor dynamic instabilities. In addition to reducing equipment size and cost, reliability will improve. The technology is also applicable to industrial turbomachinery including industrial pumps, aircraft engine fuel pumps, and compressors.

Title: SBIR Phase II: Simulation of Rapid Thermal Processing in a Distributed Computing Environment

Award Number: 0078608
Program Manager: Juan E. Figueroa

Start Date: December 1, 2000
Expires: November 30, 2002
Total Amount: $399,576
Investigator: Jiwen Liu, liu@esi-al.com
Company: Engineering Sciences Inc
1900 Golf Road, Suite D
Huntsville, AL 35802
Phone: (256)883-6233

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will continue to develop and demonstrate a computational tool for detailed simulation of Rapid thermal processing (RTP) in a distributed computing environment by taking advantages of the findings in Phase I. RTP has become a key technology in the fabrication of advanced semiconductor devices. As wafers get larger and chip dimensions smaller, the understanding of the highly coupled physics such as radiative heat transfer, transient fluid flow and heat transfer as well as chemical reactions through numerical modeling using high-performance computing is the key to the design, optimization, and control of RTP reactors. In Phase II, A 3D surface radiation model based on the modified discrete transfer method (MDTM) will be developed to treat radiative transfer in the lamphouse and process chamber as a whole process. The detailed pattern effects will be taken into account by rigorously solving time-domain Maxwell's equations through a finite volume approach. The rarefied gas dynamics in low pressure RTP will be modeled by adding Burnett terms into the Navier-Stokes equations. The governing equations that contain various multi-disciplinary physical models will be solved by a 3D unstructured finite volume method. To address computationally intensive 3D simulation needs, an efficient parallel strategy will be implemented in the solution procedure. Data communication among parallel processors will be conducted by the Message Passing Interface (MPI) library. To accelerate the overall solution convergence and improve the parallel performance, the algebraic multi-grid (AMG) method will be used to solve the discretized equations in each processor.

It is expected that the proposed simulation tool can be used to systematically investigate the underlying physics occurring in RTP systems, and to help in the design, optimization, and control of RTP reactors. The proposed simulation tool will significantly benefit the semiconductor manufacturing equipment industries that require a detailed understanding of multimode and highly coupled transport phenomena. The potential applications include the design, optimization, and control of RTP reactors and many other manufacturing and materials processing systems.

Title: SBIR Phase II: Mesh Generation for High-Order Finite Element Methods

Award Number: 0132742
Program Manager: Juan E. Figueroa

Start Date: February 1, 2002
Expires: January 31, 2004
Total Amount: $497,925
Investigator: Robert M. O'Bara, obara@simmetrix.com
Company: Simmetrix, Inc.
10 Halfmoon Executive Park Drive
Clifton Park, NY 12065-5630
Phone: (518)348-1639

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will develop technologies to generate meshes over general three-dimensional domains that are appropriate for high-order finite element analysis. A current stumbling block to the wide adoption of high-order finite element techniques is the lack of automatic means to generate appropriate curved meshes. This project will develop a new and innovative procedure for the effective generation of these types of meshes.

The commercial application of this research is the integration of CAD technologies with advanced automated simulation techniques to be used within engineering design processes. These tools will reduce the time and costs associated with performing engineering analysis during design and increase the accuracy of the predictions obtained.

Title: SBIR Phase II: A Fast Parallel Grid-Free Method for Simulating Turbulent Incompressible Flow In/Around Time-Varying Geometries

Award Number: 0216671
Program Manager: Juan E. Figueroa

Start Date: September 15, 2002
Expires: August 31, 2004
Total Amount: $500,000
Investigator: Adrin Gharakhani, adrin@applied-scientific.com
Company: Applied Scientific Research
1800 E. Garry Ave., Suite 214
Santa Ana, CA 92705-5803
Phone: (949)752-7545

Abstract:

This Small Business Innovation Research (SBIR) Phase II project builds on algorithms developed for simulating turbulent incompressible flows in and around time-varying geometries. The Phase II project proposes to develop and commercialize a state-of-the-art computational fluid dynamics (CFD) package utilizing the algorithms developed. The computational engine is based upon an advanced parallel, adaptive fast multipole (FMM) implementation of a 3-D Lagrangian vortex-boundary element method. Turbulence is accounted for via Large Eddy Simulation (LES) using a dynamic Smagorinsky sub-grid scale model. The method is (1) grid-free in the fluid domain, (2) virtually free of numerical diffusion, (3) inherently solution-adaptive, and (4) capable of modeling inhomogeneous unsteady wall-bounded turbulent flow. During Phase II additional innovative algorithms will be developed for FMM to substantially increase it computational speed as well as accuracy. Additionally, an LES model for unsteady inhomogeneous flows will be implemented and tested rigorously using problems of potential interest to industry.

The software is ideal for simulation and analysis of complex laminar-through-turbulent flow phenomena involving massive flow separation, unsteady vortex shedding, transient jets in cross-stream, and wake-body interaction. Examples of interest to industry are flow over bluff bodies such as ground vehicles or buildings, in data storage units with rotating and moving parts; in internal combustion engines; and in and around rotating machinery such as pumps and fans.

Title: SBIR Phase II: Analytic Simulation Method for Oil/Gas Field Management and Optimization

Award Number: 0236569
Program Manager: Juan E. Figueroa

Start Date: January 15, 2003
Expires: December 31, 2004
Total Amount: $500,000
Investigator: Randy D. Hazlett, rdhazlett@integrity.com
Company: Potential Research Solutions
1818 Shelmire Drive
Dallas, TX 75224
Phone: (214)941-3907

Abstract:

This Small Business Innovation Research (SBIR) Phase II project provides the foundational R&D for new oil and gas reservoir management tools to optimize hydrocarbon recovery. It proposes extension of state-of-the-art analytic solution methods for potential flow in porous media from 2-D to 3-D. It incorporates 3-D analytic fluid flow simulation technology into large-scale optimization routines where reservoir recovery performance is required, such as in the optimum placement of new wells or the optimum operation of existing wells. Unlike previous analytic solution methods, complex heterogeneous reservoir architecture can be managed without a loss of accuracy. This project will provide a new class of reservoir management tools capable of rapidly and accurately screening what-if scenarios for field development. Phase II will: i) generalize analytic solution boundary element methodology to three dimensions, ii) build a prototype, 3-D, well optimization tool, iii) develop analytic stream-function technology for optimization of improved recovery operations, and iv) extend algorithms to additional geometric shapes for enhanced flexibility.

Powerful analytic solution technology has been developed that allows robust solution of fluid flow problems with complex, heterogeneous rock properties. This general analytic solution methodology is an industry first, providing the ability to generate a brand new line of desktop hydrocarbon reservoir management tools. In particular, the results of this project will provide software and services to optimally locate new wells within existing hydrocarbon reservoirs. While reservoir simulation and well planning software both exist in the marketplace, no current commercial product offers the ability to rigorously compute well productivity within a feedback loop of a powerful gradient search optimization method to automatically select the best drilling location for new wells. This technology also addresses the optimum performance of existing wells in improved recovery operations. Using analytic stream-function optimization, well configurations in mature fields can be optimized for maximum productivity and ultimate recovery, thus minimizing unrecoverable natural resources.

Title: SBIR Phase II: Visualizing Arbitrary Basis Functions for Advanced Engineering Analysis and Simulation

Award Number: 0238964
Program Manager: Juan E. Figueroa

Start Date: March 1, 2003
Expires: February 28, 2005
Total Amount: $500,000
Investigator: William J. Schroeder, will.schroeder@kitware.com
Company: Kitware Inc
469 Clifton Corporate Parkway
Clifton Park, NY 12065
Phone: (518)371-3971

Abstract:

This Small Business Innovative Research Phase II project will create general-purpose software tools for visualizing the results of advanced numerical simulation. Simulation techniques, which make up a large part of the multi-billion dollar CAD/CAM/CAE market, are widely used to design and build the majority of products manufactured today. Visualization plays an important role in this process by transforming simulation results into images which designers, engineers, and scientists can use to understand and communicate about their products. Recent advances in numerical simulation provide an opportunity for methods based on higher-order basis functions. These functions better model curved geometry and are more accurate than conventional techniques employing linear approximation functions. The use of this technology is limited by a lack of general-purpose visualization software tools for higher-order methods. Providing these tools will accelerate the adoption of this technology into the marketplace resulting in software that will produce superior product designs, in shorter time, and at lower cost. An adaptive tessellation process that converts higher-order basis into linear graphics primitives and preserves the visual accuracy of the solution, while maintaining interactive graphics performance, is proposed.

This technology will be licensed and add-on adaptors will be offered that will enable vendors to easily and efficiently interface their systems to this technology.

Title: SBIR Phase II: Computational Tool for Plasma Equipment Design Using a Non-Statistical Boltzmann Solver

Award Number: 0091572
Program Manager: Cheryl F. Albus

Start Date: March 15, 2001
Expires: February 29, 2004
Total Amt: $499,884
Investigator: Vladimir Kolobov, jls@cfdrc.com
Company: CFD Research Corporation
215 Wynn Drive, 5th Floor
Huntsville, AL 35805
Phone: (256)726-4800

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will further develop, validate and demonstrate a Computer-Aided Design (CAD) tool for plasma equipment/processes using a non-statistical Boltzmann solver for the analysis of charged particle kinetics. Phase I implemented a new Boltzmann module and clearly demonstrated the feasibility of coupling a Bolzmann solver to the company's plasma simulator for efficient kinetic description of low-pressure plasma reactors used in semiconductor manufacturing. The Phase II project will focus on: (1) the development of elliptic representation of the velocity distribution function (VDF) valid for arbitrary anisotropy of the VDF; (2) full integration of the Boltzmann solver with a commercial software; (3) kinetic simulations for industrial plasma systems; and (4) interfacing the Boltzmann module with plasma simulation codes developed by different research groups. Using an elliptic representation will extend the applicability of the Boltzmann solver to problems with arbitrary VDF anisotropy such as electron beams, ion kinetics, etc. The goal of Phase II will be to validate the new CAD tool for wide variety of plasma technologies and expand the software usage to new industries.

The total commercial markets of plasma etch and Chemical Vapor Deposition (CVD) equipment is currently in excess of $2 billion per annum with strong projections for growth. Commercial application of the proposed software tool will allow optimization of the performance of all hardware equipment of this market and to "smartly" design new equipment. It is projected to "save" millions of dollars of equipment and process development costs to Plasma Equipment Manufacturers and to semiconductor chip producing companies.

Title: SBIR Phase II: Battery Design by Using an Electronic Interface (ENTERFACE)

Award Number: 0109141
Program Manager: Cheryl F. Albus

Start Date: June 15, 2001
Expires: May 31, 2004
Total Amount: $500,001
Investigator: Robert M. Spotnitz, rspotnitz@batdesign.com
Company: Battery Design Co.
2277 Delucchi Drive
Pleasanton, CA 94588
Phone: (925)858-0699

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will develop prototype software for designing batteries based on user requirements. A user will specify an objective (such as maximize runtime) and use conditions (such as the electrical current), and the software determines, based on first principles (trade mark) models, the optimal design. The Phase I project successfully yielded, based on optimization of capacity, significant improvements in runtime for devices such as personal digital assistants (PDAs). The Phase II project will develop a user-friendly, prototype system that can handle multiple battery chemistries, simulate abuse testing, and predict battery life. The software serves as an intermediary between battery developers and users by capturing expertise from both groups, allowing them to accrue benefits of simulation. Aligning development cycles of batteries to devices leads to better products (with concomitant market penetration, share growth, and lower costs). The software protects confidential information of all parties, creating opportunities for broader partnerships.

The commercial benefits will come from the development of the software, which provides a ready outlet for academic research and a rational basis for product specifications. It is anticipated that if this project is successful it will open up the battery industry to innovation and will help to create new partnerships.

Title: SBIR Phase II: Characterization of Three Dimensional Discontinuity Properties from Digital Images of Rock Masses

Award Number: 0239119
Program Manager: Juan E. Figueroa

Start Date: March 15, 2003
Expires: February 28, 2005
Total Amount: $499,566
Investigator: Jeffrey Handy, jeff@spliteng.com
Company: Split Engineering LLC
110 S. Church Avenue
Tucson, AZ 85701
Phone: (520)327-3773

Abstract:

This Small Business Innovation Research Phase II project will further the investigation of two innovative technologies for characterizing fractures in rock masses. The first technology involves image-processing algorithms for the extraction of 3D fracture properties from fracture traces in digital images. The second technology involves the use of laser-scanners to extract the 3D properties of exposed fracture surfaces. The two technologies complement each other well and there are situations where the characterization of fracturing is best analyzed with one or the other or both technologies. The first objective of the Phase II research is to continue to improve the two technologies, and to integrate all the various algorithms into a single user-friendly software tool. The second objective is to thoroughly evaluate sources of error in both technologies through synthetic and field studies, and to develop a set of recommended field procedures and equipment for various applications to optimize the techniques and minimize errors. The third objective is to develop relationships with potential customers for the software and also groups interested in collaborating on software development and validation. Once a beta version of the software is developed, this software will be provided to some customers for validation and assessment.

Within the broad scope of the rock engineering market, four distinct market segments have been identified for this innovation. Each market segment has a separate end-use application: mining, geotechnical, petroleum, and environment. Market research and letters of support from various market participants have demonstrated that a market need exists for automation of tasks currently performed manually by rock engineering professionals.

Title: SBIR Phase II: Information Theoretic Learning and Application to Fetal ECG

Award Number: 0239060
Program Manager: Juan E. Figueroa

Start Date: February 15, 2003
Expires: January 31, 2005
Total Amount: $499,578
Investigator: Neil R. Euliano, neil@nd.com
Company: NeuroDimension Inc
1800 North Main St., Suite D-4
Gainesville, FL 32609
Phone: (352)377-5144

Abstract:

This Small Business Innovation Phase II Project will develop information theoretic methods to separate fetal electrocardiogram (FECG) signals from the noisy electrical environment of the maternal abdomen based on statistical properties of the mixtures (blind source separation). The separation is done using a recently introduced algorithm (Mermaid) that is computationally and data efficient. Phase I research showed that Mermaid is a marked improvement over prior methods of FECG separation. The project will develop the technology for a comprehensive fetal and maternal monitor including fetal heart rate, FECG, and maternal Electrohysterogram (EHG, which measures contraction information) in a very compact device. The project includes clinical studies designed to provide the information necessary to create and validate NeuroDimension's system and also to illustrate its effectiveness.

Potential markets include hospital-based fetal monitoring, home/physician's office fetal monitoring and stress tests, and use as a research tool. The monitor not only will be less expensive than current monitors, but also will provide additional information that can dramatically improve patient care and reduce costs by avoiding unnecessary procedures.

Title: SBIR Phase II: Advanced Formal Techniques for Dependable Reactive Systems

Award Number: 0091499
Program Manager: Juan E. Figueroa

Start Date: March 15, 2001
Expires: February 28, 2003
Total Amount: $499890
Investigator: Steven T. Sims, sims@reactive-systems.com
Company: Reactive Systems, Inc.
114 Bleeker St
Port Jefferson, NY 11777
Phone: (516)473-2931

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will develop the automated tool support that will enable engineers to deploy powerful and mathematically rigorous, yet easy-to-use and cost-effective, techniques to model, analyze and implement correct and reliable reactive software systems. Such systems are intended to maintain an ongoing interaction with their environment in order to provide appropriate responses to stimuli the environment generates. Examples include the embedded software found in medical, automotive, aeronautical, consumer-electronic, e-commerce, and telecommunications applications. Many of these are safety- or business-critical. Providing an enabling technology for the cost-effective development of correctly functioning reactive systems would thus be of great social and economic benefit to the nation.

The main tangible outcome of the proposed effort and the flagship product will be the React tool environment. React will allow reactive-system designers to create mathematical models of their systems; validate models via simulation and automatic verification; and automatically generate implementations or test suites from models. The key innovation of the proposed technology is its reliance on powerful formal techniques, developed by RSI for modeling systems and validating properties of these models in a fully automatic fashion.

Title: SBIR Phase II: A Newton-Krylov Based Solver for Modeling Finite Rate Chemistry in Reacting Flows

Award Number: 0216590
Program Manager: Juan E. Figueroa

Start Date: September 1, 2002
Expires: August 31, 2004
Total Amount: $500,000
Investigator: Michael J. Bockelie, bockelie@reaction-eng.com
Company: Reaction Engineering Intl
77 West 200 South
Salt Lake City, UT 84101
Phone: (801)364-6925

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will develop computational fluid dynamic (CFD) modeling technology that uses state-of-the-art techniques for modeling finite rate chemistry in chemically reacting turbulent flows with recently developed numerical methods for solving systems of non-linear equations. In Phase I an improved CFD solver was developed that used reduced chemical kinetic mechanisms to model finite rate chemistry effect and solved the resulting stiff system of partial differential equations with a matrix-free Newton-Krylov method. In Phase II two Newton-Krylov based CFD tools will be developed, one to model combustion from turbulent, diffusion flames and the second to model turbulent, pre-mixed flames.

The commercial potential for this work is the electric power industry, designers and builders of commercial chemical plants, and designers of chemical process heaters and other industrial furnace applications.

Title: SBIR Phase II: Problem Solving Environment for Reduced Kinetic Mechanisms

Award Number: 0091593
Program Manager: Juan E. Figueroa

Start Date: April 1, 2001
Expires: March 31, 2004
Total Amount: $500,000
Investigator: Christopher J. Montgomery, montgomery@reaction-eng.com
Company: Reaction Engineering Intl
77 West 200 South
Salt Lake City, UT 84101
Phone: (801)364-6925

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will develop a computational Problem Solving Environment (PSE) for the creation, optimization, testing, and application of reduced chemical kinetic mechanisms. Inclusion of detailed chemistry into 3D simulations with turbulence-chemistry interaction will be computationally intractable for the foreseeable future. Practical simulation of reacting flows requires reduced mechanisms tailored to the application and conditions of interest. The PSE created in Phase I allows the user to rapidly create reduced mechanisms, set up multi-parameter test problems for comparison to detailed chemistry, and interrogate and visualize the results more thoroughly than was previously possible. Human effort for reduced mechanism validation is reduced from days to hours. Rigorous testing is necessary to make reduced mechanisms a reliable commercial product. In Phase II the PSE will be extended to automatically optimize reduced mechanisms to the users' specification, and produce reduced mechanism modules for a variety of applications that seamlessly integrate into a variety of Computational Fluid Dynamics codes.

These technologies will have commercial value due to the ever-increasing need to include more detailed chemistry into the design and analysis software used by scientists and engineers. The problem-solving environment provides the engineer with the ability to rapidly create reduced mechanisms, set up multiple test problems covering a multidimensional parameter space for comparison to detailed chemistry, and efficiently interrogate and visualize the results.

Title: SBIR Phase II: Inversion of Geophysical Measurements for Fracture Geometry

Award Number: 0110276
Program Manager: Sara B. Nerlove

Start Date: July 1, 2001
Expires: June 30, 2003
Total Amount: $492,251
Investigator: Stephen R. Brown, sbrown@ner.com
Company: New England Research Inc
76 Olcott Dr
White River Junction, VT 05001-2313
Phone: (802)296-2401

Abstract:

This Small Business Innovation Research (SBIR) Phase II project considers an innovative method for detecting and quantifying natural fracture systems in rock. The geometry of the fracture system controls the permeability of many oil and gas reservoirs and aquifers. Both oil and gas and environmental applications require new tools and techniques to quantify the fracture geometry, thus allowing prediction of permeability. During the Phase I research, an inverse method was developed for fracture geometry from diverse geophysical measurements. This was accomplished by combining forward models relating fracture geometry to various anisotropic, stress-dependent properties including permeability, electrical conductivity, and seismic velocity with a maximum entropy regularization criterion. It was demonstrated that a relatively small number of geophysical measurements could be used to invert for a statistical description of the fracture geometry with some predictive power. Following this proof of principle, in Phase II, this method will now be turned into an interactive tool for studying and understanding fracture system behavior for oil and gas and environmental applications.

To accomplish this, the forward models will be referenced, the inversion algorithm will be tuned for this specific problem, and the algorithms will be validated using case studies. This new capability will likely provide many improvements to exploration, development, and reservoir performance activities by defining realistic input parameters for reservoir fluid flow simulators. It is in our national interest to develop new innovative and cost effective exploration and reservoir simulation technologies which will extend the useful lifetime of oil and gas reservoirs, thus extending the period of time that competitively priced oil and natural gas can be produced in this country.

Title: SBIR Phase II: Next Generation Component Software for Simulation-Based Econometric Estimation

Award Number: 0132076
Program Manager: Sara B. Nerlove

Start Date: March 15, 2002
Expires: February 29, 2004
Total Amount: $499,604
Investigator: Jiahui Wang, jwang@insightful.com
Company: Insightful Corporation
Seattle, WA 98109-3044
Phone: (206)283-8802

Abstract:

This SBIR Phase II research project proposes to develop user-friendly component software for classical econometric estimation and inference based on simulation methods, such as maximum simulated likelihood, method of simulated moments, and efficient method of moments. In the last decade different simulation-based methods have been developed to tackle complex economic/statistical models, which cannot be estimated by conventional methods such as Maximum Likelihood Estimation (MLE) and Generalized Method of Moments (GMM). Although these simulation-based estimators have desirable theoretical properties, they have been utilized in academic research and have not become useful tools for practitioners because of the lack of user-friendly software. Building upon the Phase I research and development, Insightful (formerly MathSoft) plans to study two classes of models: mixed logit models for discrete choice analysis which represent cross sectional and panel data problems, and models for term structure of interest rates which represent discrete time and continuous time structural models. Extensive Monte Carlo experiments will be used to explore finite sample properties of various aspects of simulation, estimation and forecasting, with an aim of improving and stabilizing the current algorithms. The user-friendly component software will be developed using both object oriented S-Plus language and the state-of-art JavaBean technology, and it will provide intuitive graphical user interface.

The S-Plus functions of the technology proffered by Insightful for econometric estimation and inference will serve the purpose of quickly gaining a broad user base, while the JavaBeans can be used to develop custom applications. The software will help economists and practitioners in other fields such as the financial industry, social sciences, and biotechnology to conduct flexible and extensible model estimation and inference.

Title: STTR Phase II: Parallel Lattice Kinetic Software for High Mach Number Fluid Dynamics

Award Number: 0620490
Program Manager: Ian Bennett

Start Date: August 25, 2006
Expires: August 31, 2008
Total Amount: $500,000
Investigator: Hudong Chen, hudong@exa.com
Company: Exa Corp.
3 Burlington Woods Drive
Burlington, MA 01803
Phone: (781)676-8587

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will produce a novel parallel dynamic rule-based software tool for simulating high Mach number flows of interest for the ground transportation, aerospace and power generation markets. This work couples a multi-disciplinary interplay between algorithm design, modern cluster/grid computer architecture, parallel processing, and software engineering, and employs Lattice-Boltzmann Methods (LBM) with automatically generated grids with up to 100 million computational cells.

This new technology will enable virtual design within the ground transportation industry. Secondly, the ability of the parallel lattice kinetic software to address high Mach/Knudsen number problems should open important markets in aerospace, power generation, automotive, and other industries. Additionally, this new technology should establish markets for computer aided engineering (CAE), by numerical simulation of vehicles and powertrain components whose complexity have forced design/optimization using either physical experimentation or semi-empirical rules. The research will help to demonstrate the linkage between fundamental research and industrial applications, and emphasize the importance of non-equilibrium statistical physics methods as a core component in the commercial simulators.

Title: STTR Phase II: Modular Feedforward Adaptive Noise Control

Award Number: 0620496
Program Manager: Errol Arkilic

Start Date: August 23, 2006
Expires: August 31, 2008
Total Amount: $499,827
Investigator: Robert Collier, robert.d.collier@dartmouth.edu
Company: Sound Innovations
55 Railroad Row
White River Junction, VT 05001
Phone: (802)280-3020

Abstract:

This Small Business Technology Transfer (STTR) Phase II project seeks to develop an inexpensive, multi-purpose active noise reduction (ANR) module and associated software evaluation tools with broad commercial application to many occupational environments. This project will develop signal processing algorithms that improve the computational efficiency for ANR. The current Phase II objectives include: (1) developing a multi-purpose ANR module and associated ANR software modules capable of single- and multi-channel ANR for two markets: "quiet zone" ANR in commercial vehicle cabins and active noise abatement products for the noise consulting industry; (2) developing a corresponding suite of software tools to be used by noise consultants for turnkey retrofits of noisy environments with active noise abatement products, and (3) conducting full-scale in-situ evaluation of the ANR module, software, and tool suite in demonstration projects with the support of commercialization partners. The expected technical outcomes of Phase II include: (1) a manufacture-ready ANR hardware module with associated modular ANR software, (2) a suite of ANR evaluation tools for the noise consulting industry, validated through in-situ testing and (3) experimental results of the modular ANR concept from several full-scale demonstration projects.

The strong pull for new noise control technologies is the result of increasingly strict government and community regulations, industry standards, the growing body of scientific evidence of on noise-induced hearing loss (NIHL), and the multimillion dollar cost of occupational hearing disability compensation. The current business model is based on partnerships in which the proprietary 'Plug-and-Play' ANR module represents a branded embedded component for products manufactured and marketed by other industrial organizations and for installations by acoustical consultants.

Title: SBIR Phase II: A Decision Support System for the Train Schedule Design Problem

Award Number: 0548666
Program Manager: Sally Nerlove

Start Date: December 29, 2005
Expires: December 31, 2007
Total Amount: $512,000
Investigator: Ravindra Ahuja, ravi@InnovativeScheduling.com
Company: Innovative Scheduling
4548 SW 97th Terrace
Gainesville, FL 32608
Phone: (352)336-1257

Abstract:

This Small Business Innovation Research (SBIR) Phase II project entails developing a decision support system for the train schedule design problem, one of the freight railroad transportation's most significant optimization problems. Train scheduling is an important part of a railroad's operating plan that enables efficient movement of railcars. Designing such an operating plan is a very large-scale and very complex multi-objective optimization problem that, to date, has defied solution. Consequently, operating plan development at railroads is a lengthy, manual, and cumbersome process that may involve five to ten persons for a period of three to six months. Using cutting-edge operations research techniques, Innovative Scheduling, is developing a software product that can obtain a new operating plan within two weeks using two-three employees and can save a typical Class I US railroad over $50M annually. The train schedule design problem determines: how many trains to run; the origin, destination, and route of each train; the train arrival and departure times for each station at which it stops; the weekly operating schedule for each train; and the assignment of blocks of cars to trains. The train schedule must satisfy numerous practical constraints and business rules and achieve the minimum cost of transportation. This problem is a very large-scale multi-objective integer-programming problem containing trillions of decision variables. The proposed research will develop decomposition-based customized algorithms using state-of-the-art network optimization and heuristic techniques so that this problem can be solved within two hours of computer time on a workstation. These algorithms will be packaged into a web-based decision support system with attractive and friendly graphical and geographical interfaces, which will allow sufficient user control. The proposed research and development requires significant advances in modeling, algorithmic, and implementation technologies and will provide much needed software to schedule freight trains worldwide. This research will further be extended to develop a decision support system for passenger train scheduling. BNSF Railway, a Class I US Railroad, which is a Development Partner in this project and is providing supplementary funds, data and manpower.

The train scheduling decision support system is likely to be used by all freight railroads in their operating plan development process. A computerized method for train scheduling will make a railroad more responsive to traffic changes and enable it to change its schedule frequently. Optimal and timely train schedule will introduce greater efficiency in the system and significantly lower costs. Further, optimal train schedules require significantly less train miles, crew hours, locomotive hours, and railcar hours to transport the same set of shipments, thereby increasing our nation's energy efficiency and reducing pollution. The success of this product will lead to a greater acceptance of models and operations research techniques in railroad planning and scheduling. Railroads are then anticipated to embrace operations research models and introduce decision support systems in a variety of business processes including tactical operations and commercial strategy. The railroad industry will then be in a position to achieve a new level of productivity, resulting in lower freight charges for end users, and making America's products more competitive on the world market.

Title: SBIR Phase II: Web-Based Manufacturing Performance Management with Multi-Objective, Multi-model Optimization using Meta-Modeling

Award Number: 0548731
Program Manager: Ian Bennett

Start Date: January 13, 2006
Expires: December 31, 2007
Total Amount: $512,000
Investigator: Thomas Knight, tknight@invistics.com
Company: Invistics Corporation
5445 Triangle Parkway Suite 300
Norcross, GA 30092
Phone: (770)559-6386

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will further develop a new Flow Path Management System (FPMS) representing an innovation in manufacturing software that: (1) Extends existing Enterprise Resource Planning (ERP), Supply Chain Management (SCM), and Manufacturing Execution Systems (MES) software by incorporating 'Lean Manufacturing' principles into a set of innovative simulation-based optimization algorithms; (2) Provides millions of dollars in inventory savings to existing and targeted manufacturing customers; and, (3) Is more available to virtual enterprises and smaller manufacturing companies than existing systems in that it can be delivered via the World Wide Web. The focus of this research project is the development of a meta-model-based simulation software for the analysis, prediction and optimization of manufacturing and supply chain processes. This software applies Kriging spatial optimization models - a proven interpolation-based response technique employed successfully in geo-statistics to solve complex and computationally intense manufacturing and supply chain problems.

The technology will be commercialized as a new module within the company's existing software suite, called the Flow Path Management System, and sold through three distribution channels: (1) on-site intranet installations at large companies; (2) delivery as a web service via the Internet to smaller companies; and, (3) licensing the algorithms to larger ERP/SCM/MES customers for incorporation in their software suites.

Title: SBIR Phase II: Multi-Environment Probability Density Function (PDF) Method for Modeling Turbulent Combustion Using Detailed Chemistry

Award Number: 0548752
Program Manager: Rosemarie Wesson

Start Date: February 10, 2006
Expires: January 31, 2008
Total Amount: $500,000
Investigator: Qing Tang, tang@reaction-eng.com
Company: Reaction Engineering Intl
77 W 200 S STE 210
Salt Lake, UT 84101
Phone: (801)364-6925

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will extend the applicability of the multi-environment probability density function (MEPDF) method to model turbulent combustion problems with realistic chemical kinetics within comprehensive Computational Fluid Dynamic (CFD) simulations of practical combustion equipment. The project aims to further advance the MEPDF method by extending it to simulate industrially relevant single-phase and two-phase combustion systems, such as chemical process furnaces fired with lean pre-mixed gas burners; oil fired utility boilers and industrial furnaces; and coal gasification equipment.

The proposed activities for extending the MEPDF method to simulate practical combustion systems using complex chemical kinetics would result in a tool that will enhance the scientific and engineering knowledge base for these processes. The advanced simulation tools produced from this project would provide a means for companies in the power generation, chemical process, mineral process, and incineration industries to improve product designs and services, which in-turn would benefit the environment, global competitiveness and national/homeland security.

Title: SBIR Phase II: Development of ModelGlove - A Virtual Clay Modeling System Using Force/Position Sensor

Award Number: 0620509
Program Manager: Errol Arkilic

Start Date: August 23, 2006
Expires: August 31, 2008
Total Amount: $500,000
Investigator: Kevin Chugh, chugh@tactustech.com
Company: Tactus
4250 Ridge LEA Suite 39
Amherst, NY 14226
Phone: (716)898-5923

Abstract:

This Small Business Innovation Research (SBIR) Phase II project aims to develop a Virtual Clay system comprised of a patent-pending sensor-enabled glove (called the ModelGlove), and a physics-based simulation engine which presents the user with a virtual 3D representation of modeling clay. The glove enables a designer to mold and shape the virtual clay with his or her fingers and hand, just as he or she would with physical clay. Clay modeling was pioneered by General Motors in 1914, and remains a popular technique. Since the early 80's, the computer aided design (CAD) market has grown dramatically, and 3D CAD has become the most technically-advanced tool for designing complex shapes. However, very little work has been done to merge the physical clay and CAD environments. Virtual Clay aims to fuse these environments, blurring the line between art and engineering and giving designers a unified modeling tool at all stages of development.

By advancing the state of the art in design and opening new worlds of design to mechanical engineers designing and modeling products, broad impacts are anticipated. The Virtual Clay system represents a significant advancement in wearable computing, where the user directly manipulates a virtual object with his or her hand. Further, a physics-based simulation of clay in a design environment promises to open new areas of exploration in the CAD world. By giving control to the user of not only the design, but the simulation environment itself (the user can control how soft or hard the clay is, for example), a whole new way of thinking about how simulation and CAD can evolve. Further, artists and engineers will benefit from being able to watch and decipher every manipulation that an expert modeler has completed on the virtual clay. Bringing a physical medium to a digital environment will thus open up numerous possibilities in design, assessment and analysis, testing, and collaboration.

Title: SBIR Phase II: Strategic Model for Manufacturing Organizations (DSMMO)

Award Number: 0646275
Program Manager: Ian Bennett

Start Date: February 15, 2007
Expires: January 31, 2009
Total Amount: $500,000
Investigator: Lia DiBello, lia@wtri.com
Company: Workplace Technologies Research Inc.
1425 Russ Blvd.
San Diego, CA 92101
Phone: (619)232-8054

Abstract:

This Small Business Innovation Research (SBIR) Phase II research project proposes a dynamic modeling technology that helps decision makers visualize and calculate the top and bottom line financial impact of changes made at the strategic, tactical, and operational levels of a business. The proposed research will make intellectual contributions regarding how technologies extend complex cognitive capabilities in high-performance business settings. The resulting tool promises to address two well-known problems faced by business executives: decision-making rigidity and the inability to think simultaneously on strategic and tactical levels.

The broader impacts of the proposed technology have already been indicated by the increased use and measurable success of these models in client engagements. However, the models in their current form, are not widely or easily accessed although demand for them is high. This tool will have important pedagogic value to university programs because it will enable students to think through the multi-level issues in organizations. The models themselves may also add to the understanding of how the different levels and functions in an organization interact.

Enterprise Systems

Title: SBIR Phase II: Workflows to Enable Agile Virtual Enterprises (WEAVE)

Award Number: 0110278
Program Manager: Juan E. Figueroa

Start Date: July 1, 2001
Expires: June 30, 2004
Total Amount: $499,881
Investigator: Robert Pokorny, pokorny@xsb.com
Company: XSB, Inc.
25 East Loop Road
Stony Brook, NY 11790-3383
Phone: (631)444-6800

Abstract:

This Small Business Innovative Research (SBIR) Phase II project, Workflows to Enable Agile Virtual Enterprises (WEAVE), is envisioned as an on-line service to manage workflow for virtual enterprises. Phase I feasibility was undertaken in the context of virtual enterprises that arise in supply chain management. Phase II will do full-scale implementation of WEAVE to efficiently establish and manage supply chains in an e-commerce environment. Traditional supply chains are built with a small number of long-term suppliers because of the high cost of finding and establishing new supply sources. The Web and a variety of legacy data sources provide abundant information about possible supply sources. But this information is often dynamic and unstructured requiring manual effort to discover. XSB, Inc has developed technology to infer supplier capabilities, giving manufacturers an instant view of 'who makes what' across their own supply chain as well as thousands of potential suppliers across the web.

WEAVE will implement this technology to locate sources of supply. This ability to locate sources for parts will be integrated with a system to plan and manage purchasing strategies for a user's complete bill-of-materials. Using WEAVE small-to-medium manufacturers can quickly create supply chains that is relevant for their enterprise. In the long-term WEAVE will serve as the infrastructure for establishing a peer-to-peer supply network.

Title: SBIR Phase II: Advanced Planning and Scheduling Tools for Extended Enterprise Systems

Award Number: 0450552
Program Manager: Juan E. Figueroa

Start Date: April 1, 2005
Expires: March 31, 2007
Total Amount: $394,965
Investigator: Guining Li, guining@yahoo.com
Company: LS Optimal, Inc.
1445 Starr Grass Dr.
Madison WI, 53719
Phone: (608)833-1189

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will build upon the successful development of the Phase I project that developed models and algorithms for planning and job scheduling systems. The software tool described in this proposal will allow organizations to schedule their operations in real-time to generate the optimal plan to maximizing their operational targets. During Phase I, the team created new planning and scheduling algorithms and successful empirical studies using recent innovative research in the areas of large-scale optimization and the newly developed methodology of Nested Partitions. In Phase II the team plan to further develop the concept to create successful implementations in several manufacturing firms. The technology to be developed in Phase II will greatly enhance the capability of the current planning and scheduling software tools. This innovation brings the state-of-the-art decision and optimization methodology to the Advanced Planning and Scheduling software market. In addition, planning systems developed with the proposed methodology will add new levels of flexibility for companies to more quickly adapt to changing material, operational, and market conditions.

This SBIR project will make new planning and scheduling tools broadly accessible to virtually any manufacturing firm. The proposed scheduling and planning tools will enable them to communicate, collaborate, and integrate their planning and scheduling functionalities to obtain optimal results throughout their enterprise and their entire supply chain. It is expected that coordinated use of these tools will eventually create an integrated cyber-infrastructure for American manufacturing firms and create more efficient supply chains that will enable these firms to be more competitive in the global marketplace. Moreover, if successful, the development of this proposed tool will lead to fruitful attempts to develop and commercialize an advanced planning and scheduling software tools that can be used for many other sectors of the economy

Title: SBIR Phase II: Lean Physics: Streamlining the Supply Chain Using Factory Physics

Award Number: 0349659
Program Manager: Juan E. Figueroa

Start Date: January 15, 2004
Expires: December 31, 2005
Total Amount: $500,000
Investigator: Keith DiAngelis, diangelis@factoryphysics.com
Company: Factory Physics, Inc.
5107 Laurel Valley Court
College Station, TX 77845
Phone: (979)690-7105

Abstract:

This SBIR Phase II project involves the creation of an innovative Methodology and software Toolkit that can substantially improve the supply chain of virtually any manufacturing firm. The proposed Support Tools offers a comprehensive system that combines the best of the "software only" and the "best-practices" approaches with a framework to create a new paradigm for production system improvement. Algorithms based on this framework will provide important diagnostic and analysis tools that show how and where major improvements to the supply chain should be made. Execution algorithms that "bolt onto" existing supply chain management systems will provide the means to improve productivity, reduce inventory, and increase customer responsiveness without having to replace existing implementations. The toolkit can also be delivered over the Internet, providing a cost effective alternative to smaller companies.

Commercial versions of this innovation could enable widespread adoption of a new and more effective paradigm of manufacturing logistics. With the loss of 2.3 million jobs in the last three years, the issue of manufacturing productivity is critical as is the need for supply chain tools which integrate production software systems with operational initiatives to improve productivity and cost competitiveness. Widespread adoption of this methodology and tools could have a profound influence on the competitiveness of U.S. industry.

Title: SBIR Phase II: Evolving Object Neural Networks

Award Number: 0349604
Program Manager: Errol B. Arkilic

Start Date: February 1, 2004
Expires: January 31, 2006
Total Amount: $499,642
Investigator: David Fogel, dfogel@natural-selection.com
Company: Natural Selection, Inc.
3333 N. Torrey Pines Ct.
La Jolla, CA 92037
Phone: (858)455-6449

Abstract:

This Small Business Innovation Research Phase II research project will investigate the problem of generating evolutionary object neural networks for controlling characters in classes of entertainment software, with consideration given to genres of massively multiplayer online games. The objective of the research is to identify and develop general self-adaptive routines and software tools that can be incorporated in a software developer's kit (SDK) that is suitable for licensing to third-party developers. A series of experiments conducted within a statistical framework will identify first- and second-order effects of parameter choices for the evolutionary control of game characters, which will be incorporated into the SDK. R&D will be aimed at generating the most rapid evolutionary learning for game characters while having the smallest code "footprint." Additional research will facilitate automatic play testing and optimization of artificial intelligence in games. The scientific and technical understanding of hybridizing evolutionary computation and neural networks will be enhanced by the careful study of the nonlinear effects of parameter choices in the studied settings.

If successful this product will ease the transition of video games from development to products. The development of an SDK that will help reduce the time and cost of segments of video game production by 50-80%. The software developed may serve as educational classroom aids in university courses. Furthermore, the strong correlation between video games and military simulations suggests important contributions to dynamic planning in combat simulations, as well as extensions to optimizing courses of action in business operations, such as supply-chain management.

Title: SBIR Phase II: Uncertainty Analysis of Manufacturing Process Models

Award Number: 0348771
Program Manager: Juan E. Figueroa

Start Date: May 1, 2004
Expires: April 30, 2006
Total Amount: $499,235
Investigator: Ellen Meeks, emeeks@reactiondesign.com
Company: Reaction Design, Inc
6440 Lusk Boulevard
San Diego, CA 92121
Phone: (858)550-1920

Abstract:

This Small Business Innovation Research (SBIR) Phase II project proposes to create a robust software system for performing uncertainty analysis of process simulations for manufacturing. For simulations that are large or that contain many parameters, even the best Monte Carlo, or importance-based sampling methods for uncertainty analysis can be prohibitively expensive. Consequently, systematic uncertainty analyses are rarely implemented for complex systems. This proposal presents a plan to produce a commercially viable package of a new method for quantifying simulation uncertainty, based on polynomial chaos expansions. The method can determine the probability density functions of black-box model responses and can identify quantitatively which of the parameters contribute most to uncertainties in responses for multivariate inputs and outputs. The unique sampling approach enabled by the use of polynomial chaos expansions allows more accurate resolution of probability distribution functions at a very small fraction of the cost to achieve similar results with more traditional uncertainty-analysis methods.

While illustrative examples from the chemical manufacturing industries will be used to demonstrate the software functionality, the methodology has broad application to such fields as circuit design, risk management, allocation of experimental resources, chemical plant design and operation of production systems. Due to the ability to handle arbitrary or black-box simulations, the methods can be applied as easily to economic market analysis, or global climate modeling, as to chemical process design.

Title: SBIR Phase II: Supply Chain Management via the World Wide Web

Award Number: 0216212
Program Manager: Cheryl F. Albus

Start Date: July 1, 2002
Expires: June 30, 2004
Total Amount: $500,000
Investigator: Thomas Knight, knight@saklogistics.com
Company: SAK Logistics
5335 Triangle Parkway
Norcross, GA 30092
Phone: (770)559-6386

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will further develop a new Flow Path Management System (FPMS) representing an innovation in Enterprise Resource Planning (ERP) and Supply Chain Management (SCM) that is more effective than existing supply-chain management software paradigms, incorporates "lean manufacturing" principles, and is more available to smaller manufacturing companies than existing systems in that it can be delivered via the World Wide Web. The software has the potential to reduce inventory by 20% or more in companies with complicated manufacturing operations and/or supply chains. In addition, the software can recommend supply chain planning policies that increase throughput, decrease cycle times, and improve customer service.

The commercialization strategy is to use distribution channels: (1) on-site Intranet installations at large companies (2) delivery as a web service via the Internet for smaller companies, and (3) licensing the algorithms to larger ERP/SCM vendors for incorporation in their software suites.

Title: SBIR Phase II: Optimal Replenishment Algorithms for Service Parts Logistics Systems

Award Number: 0239030
Program Manager: Juan E. Figueroa

Start Date: February 1, 2003
Expires: January 31, 2005
Total Amount: $498,419
Investigator: Vipul Agrawal, agrawal@mcasolutions.com
Company: MCA Solutions LLC
230 South Broad Street, St 601
Philadelphia, PA 19102-4107
Phone: (215)717-2180

Abstract:

This Small Business Innovation Research Phase II Project will develop prototype software to provide optimal real time purchase and repair replenishment, and allocation of service spare parts used to provide after-sales support to mission-critical products. It will design, develop and test advanced optimization algorithms to ensure that the right part is ordered from the right source in the right quantity at the right time and then allocated to the right location. In Phase III these engines will be incorporated in MCA Solutions planned commercial enterprise software product Replenishment and Allocation Optimizer (RAO) and complement MCA Solutions current product Service Parts Optimizer (SPO).

The use of this tool will result in higher availability of service parts; increase products uptime and lower expense in service parts inventory. The target industries for this solution will be Defense, Aerospace, and manufacturers of Automotive, Computer, Telecommunications and Hi-Tech equipment. RAO will be the first commercial software product to support near real time optimization of inventory management in service supply chains. The requirement allocation optimizer software market is underdeveloped. The size of this opportunity is significant. Over 1,100 companies in the United States generate sales higher than $250 M/year in the original equipment manufacturer segment. Combined sales in this sector are $3.3 trillion with total inventory investment in service parts of about $250 Billion. Service parts inventory accounts for about 5 to 10% of product sales for an OEM. The technology has the potential to reduce these investments by 20% to 40, which in turn may pass some of the reductions to the customers.

Title: SBIR Phase II: Supply Chain Optimization and Product Explorer

Award Number: 0620233
Program Manager: Errol Arkilic

Start Date: August 1, 2006
Expires: July 31, 2008
Total Amount: $499,995
Investigator: Nainesh Rathod, nainesh.rathod@imaginestics.com
Company: Imaginestics
1220 Potter Dr. Suite 124
West Lafayette, IN 47906
Phone: (765)464-1700

Abstract:

This Small Business Innovation Research Phase II project will achieve higher retrieval accuracy for shape-based search for both the web and the enterprise. The proposed work in Phase II is to achieve higher retrieval accuracy supported by three key components: 1) pose determination for 3D models: bridging the space gap between 2D and 3D shapes by finding three intuitive and robust orthogonal orientations for 3D models; 2) 2D orthogonal view generation: representing a three orthogonal views along the pose orientations; 3) similarity measurement between 2D shapes: finding 2D and 3D shapes based on the user's query. A framework will be developed by focusing on three important modules: 1) 2D constraint detection and use of implied constraints with initial application in 2D and 3D views; (2) Enhanced multiple level-of-details in 3D representations, and (3) Human assisted system classification of large datasets.

Traditional options of finding part suppliers using catalogs, trade shows and prior business relationship limit the choice of suppliers. Current text-based search to find suppliers face challenges, such as context and language sensitivity, and is inadequate in overcoming the technological challenges posed by variations in how product or part information is specified across a global supply chain. The current effort proposes to use shape, which is the lowest common denominator, to link the OEMs and suppliers. This technology can also aid the current trend among companies in aerospace, automotive, medical equipments and other industries towards 3Ddata standards for fast retrieval, as it can provide a significant leap in terms of accuracy, speed and relevance in the search and retrieval of information. If successful, this technology can contribute significantly to research in areas where shape is important, such as bio-technology and pharmaceutical sectors, where rapid identification of molecules and their docking features help reduce time and cost involved in drug development. For the medical industry due to increased usage of CT scans and 3D imaging technologies, 3D shape search can be used for local feature identification in colonoscopy or other exploratory procedures, brain angiography, reconstruction, projection of malformation or location of polyps and ensure better and rapid diagnosis of disease. Development of methods for automatically parsing human sketches and determining constraints will enable many other research activities and broadly help in a more natural human machine interaction.

Title: SBIR Phase II: Reducing Lead Time and Inventory by Using Optimized Product Configurations

Award Number: 0620269
Program Manager: Errol Arkilic

Start Date: July 25, 2006
Expires: July 31, 2008
Total Amount: $499,818
Investigator: Roy Marsten, rmarsten@emcien.com
Company: Emcien
75 Fifth Street, NW
Atlanta, GA 30308
Phone: (770)621-5877

Abstract:

This Small Business Innovation Research (SBIR) Phase II project addresses the impact of product variety on the customer order fulfillment process. It aims to help the manufacturers of highly configurable products with many possible "variants" or "configurations" to maximize product availability and order fill rates. Prior research by Emcien has created a methodology for representing product variants, modeling customer demand, and computing an optimal set of product configurations to maximize margins. These stockers are optimal in the sense of satisfying the most demand while maximizing profitability, but they assume unlimited product inventory. In previous research, Emcien built a prototype simulation model to determine how well these optimal stockers would perform in practice. The prototype simulation model was used successfully by two of Emcien's clients. The Phase II project will turn this prototype into production quality software that will become a part of Emcien's suite of products that address product variety.

More manufacturers are moving in the direction of "mass customization", which means allowing each customer to choose the features and options they want. Mass production of a uniform product, or one with a small number of variants, is evolving into flexible production as more and more choices are offered to the customer. But customers not only want to customize their product, they also want to get it quickly. Pure build-to-order systems can result in unacceptably long customer lead times, especially when demand has seasonal ups and downs. This forces manufacturers to build partially finished or fully finished units for inventory, in order to smooth production and reduce customer lead time. This requires a delicate balance between the extra revenue and the extra costs of offering more variety. Emcien's mission is to help manufacturers profit from product variety as a competitive advantage, rather than being overwhelmed by the extra costs of supporting too much variety.

Title: SBIR Phase II: Parts Forecasting for Configurable Products

Award Number: 0723832
Program Manager: Errol Arkilic

Start Date: September 15, 2007
Expires: August 31, 2009
Total Amount: $499,905
Investigator: Roy Marsten, rmarsten@emcien.com
Company: Emcien
75 Fifth Street, NW
Atlanta, GA 30308
Phone: (770)621-5877

Abstract:

This Small Business Innovative Research (SBIR) Phase II project will develop a new methodology for parts forecasting for discrete manufacturing. Emcien is developing a software suite to enable a product manager to better manage a configurable manufactured product. This suite includes a method for forecasting the demand for a configurable product at the full configuration level of detail. This means forecasting unique configurations, each with an expected volume. The method depends on extracting customer buying patterns from the sales history for the product. The mathematical algorithms for extracting and representing these patterns, and forecasting using these patterns are the main contributions of the research. The set of parts needed to build a configurable product generally depends on combinations of options, so it is not possible to plan parts requirements from an aggregate forecast. By using a configuration level forecast, it is possible to expand each unique configuration into component parts, and then use the associated volumes to produce a complete parts forecast.

American manufacturers are specializing in complex, configurable, high-end products, as mass produced commodity products move offshore. Allowing customers to customize a product results in significant numbers of alternative product configurations. This variety increases costs in many ways. One important way is the increased difficulty of planning parts requirements. The current practice of basing parts planning on a few popular variants leads to excess inventory of some parts and shortages of others. Excess inventory incurs both holding and obsolescence costs. Shortages can interrupt production and cause both lost sales and quality problems. Emcien has developed a methodology that, among many other benefits, can improve the accuracy of parts planning.

High Speed Networking

Title: SBIR Phase II: Reconfigurable and Scalable Fiber-Optic Ultra-High-Speed Multi-Media Networks

Award Number: 0091601
Program Manager: Juan E. Figueroa

Start Date: May 1, 2001
Expires: April 30, 2004
Total Amount: $500,000
Investigator: Behzad Moslehi, bm@ifos.com
Company: Intelligent Fiber Optic Systems
650 Vaqueros Avenue, A
Sunnyvale, CA 94085-3543
Phone: (408)328-8610

Abstract:

This Small Business Innovation Research (SBIR) Phase II project addresses the next generation data networks, which will require terabit information handling capability. Future networks must be reconfigurable, highly secure and easily upgraded in both bit rate and number of nodes. The company will apply its extensive fiber optic expertise and its proprietary wavelength-division multiplexed (WDM) technology to the development of a reconfigurable high-speed fiber-optic backbone structure that supports the transmission of multiple data protocols between multiple network stations. The approach is based on the company's all-fiber, static and dynamic WDM network access designs which offer high efficiency, compactness and low cost. In Phase I a three-node, two-wavelength system was constructed with static access modules to demonstrate the feasibility of simultaneously transmitting different protocols such as ATM and Ethernet. Phase I formed a basis for Phase II engineering development where the researcher will employ dynamic access modules and expand the network to 8 nodes and 4 wavelengths to demonstrate network reconfigurability and scalability.

The market for fiber-optic networks is growing at a rate of over 20% per year and is expected to exceed $18 billion in 2001. Multi-protocol fiber backbones have applications in commercial platforms, such as enterprise networks, ships, airliners, automobiles, and integrated manufacturing equipment. Each optical fiber can replace hundreds of wires resulting in substantial drop in costs, component weight, and an increase in performance. The project will integrate well with the Internet-II, and SuperNet programs for the government-wide Next Generation Internet (NGI).

Title: SBIR Phase II: Hardware Support for 10 Gbps Intrusion Detection

Award Number: 0521902
Program Manager: Errol B. Arkilic

Start Date: July 1, 2005
Expires: June 30, 2007
Total Amount: $498,205
Investigator: Livio Ricciulli, livio@metanetworks.org
Company: Metanetworks, Inc
647 N Santa Cruz Ave E
Los Gatos CA, 95030
Phone: (408)879-9133

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will dramatically advance performance breakthroughs achieved by utilizing a Multiple Instruction Single Data (MISD) processing model applied to high-speed Intrusion Detection and Prevention System (IDPS) hardware. A multiple-chip implementation of the MISD processing model will further demonstrate the scalability and cost-effectiveness of the technology by increasing IDPS processing capacity to levels while reducing costs for the existing system. Current line speed stateful computations are limited by the cost and scalability of currently available content addressable memories. Ideas derived from memory caching architectures will be adapted to build a novel memory subsystem specifically designed to cost-effectively support critical, stateful, 10 Gbps security applications such as TCP stream reassembly and protocol normalization. Finally, the development of open-source interfaces will extend the use of these innovations to a large community of users who will certainly contribute to the advancement of IDPS technology through inter-organizational collaborative efforts.

Next-generation applications require high-speed network connectivity. For example, supercomputer clustering, medical image delivery, data storage networking, video conferencing, and tele-presence applications all need 10 Gigabit and higher speeds. Unfortunately, public and private communication infrastructures are today being destabilized by security compromises. Network viruses, worms and other attacks can propagate very quickly over the Internet and private networks, disabling commerce and resulting in significant productivity loss. The ability to detect and prevent these attacks from traveling through high speed links is a crucial requirement for fostering their adoption across organizational boundaries. Without proper intrusion detection and prevention, high speed links will introduce severe attacks in information systems and limit the commercial viability and far-reaching benefits of high bandwidth, next-generation applications. This Phase II project will dramatically improve the cost-effectiveness, openness and scalability of high-speed IDPS technology. This will facilitate a broader use of inter-organizational, high-speed connectivity and impact social, economic and educational progress

Title: SBIR Phase II: Scalable and Reliable Storage Infrastructure for Network Storage Environments

Award Number: 0450528
Program Manager: Juan E. Figueroa

Start Date: February 1, 2007
Expires: January 31, 2007
Total Amount: $500,000
Investigator: M.Firas Malouhi, firas@datareliability.com
Company: Data Reliability Inc.
3895 Metro Drive
Jackson MS, 39209
Phone: (601)944-0048

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will build a scalable and reliable storage system for network storage environments. This outcome of this project is a revolutionary system that employs a combination of unique ideas to address the main challenges encountered in today's demanding storage environments namely scalability, availability, performance, and manageability. The ideas of this proposed solution are applied as a disk-based solution for the time-consuming network backup/restore problem. With the rapid growth of data-driven network services, traditional storage solutions are not able to keep pace with the rapidly expanding storage requirements. Unlike traditional solutions the proposed solution employs a new architecture that allows for independent and practically unlimited scalability of capacity, file access performance, and namespace access performance. The proposed product utilizes a unique, very fast coding technique called PND to ensure fast, reliable, and highly available access to data. It offers the opportunity of applying a more effective block-level edge caching technique, which enhances the performance and achieves better utilization of the valuable cache memory. It takes advantage of Data Reliability, Inc.'s innovative RAISTM storage engine to cost-effectively aggregate distributed islands of independent storage resources into a single virtual shared pool of storage. Project Phase I has clearly demonstrated the above advantages.

Many applications will exploit the competitive advantages of the proposed product including Web server farms; multimedia network services, content management, document storage and delivery, digital imaging, and file transfer services. In addition, the expected solution's ideas can be expanded to build general-purpose file servers that are not subject to performance bottlenecks and capacity limitations. Therefore, these ideas will have an important impact on building next generation NAS devices. The PND technique, pioneered by this project, provides a new class of codes that are expected to result in scientific advances in coding theory. In addition, the PND technique will contribute to enhanced performance and architectures of disk arrays. Applications of PND coding in areas other than data storage include mobile communications, reliable multicasting, audio/video streaming, and digital fountain systems. The company is partnering with Jackson State University (JSU) and will offer JSU students a tremendous educational experience. Since Jackson State University is an HBCU (Historically Black College and University) in the underrepresented state of Mississippi, the project will foster continuous collaboration and will increase the participation of underrepresented and minority groups in science and technology

Title: SBIR Phase II: Commoca Internet Protocol Phone - Making Communications Personal

Award Number: 0450436
Program Manager: Juan E. Figueroa

Start Date: January 1, 2005
Expires: December 31, 2006
Total Amount: $500,000
Investigator: Carlos Velez-Rivera, carlosvelez@comoca.com
Company: Commoca, Inc.
Calle Mendez Vigo 68E
Mayaguez PR, 680
Phone: (787)640-0439

Abstract:

This Small Business Innovation Research (SBIR) Phase II project aims to develop a suite of server based infrastructure software and applications to empower service providers with the ability to deploy, monitor, customize content, debug, and upgrade their VoIP (Voice over Internet Protocol) terminals remotely. The proposed Transactional Applications Delivery System (TADS) will allow service providers to define new revenue generating applications and corporate IT departments and third-party IT solution providers to develop vertically integrated, productivity enhancing data-voice applications. The proposed system will also provide a cost-effective means for service providers to move high-end VoIP terminals into the home consumer market, through, for example, multi-year service contracts in exchange for subsidized phones (the new revenue generating opportunities will allow service providers to do this). By addressing these needs, TADS will allow tighter integration between telephony features and IT based systems, taking better advantage of unified messaging (voice mail, e-mail, video mail, instant messaging, etc), collaboration, conferencing, presence, etc. It will also allow end-users access to ubiquitous features across different networks and different locations.

This project will define, develop, and deploy a complex software platform that will significantly accelerate the time to market of revenue generating and productivity enhancing advanced VoIP applications and services. In addition, the development of the proposed TADS technology will lead to new knowledge in the areas of human computer interaction, data mining, IP information appliances, and networking. The results to be obtained from this project will have a significant impact on the structure of the VoIP consumer market and the way converged voice-data applications are developed and deployed in the enterprise market

Title: SBIR Phase II: Automated Personalized Rich Media Broadcast Generation

Award Number: 0349740
Program Manager: Juan E. Figueroa

Start Date: March 1, 2004
Expires: February 28, 2006
Total Amount: $494,723
Investigator: Robert Rubinoff, robert.rubinoff@streamsage.com
Company: StreamSage, Inc.
1202 Delafield Pl., NW
Washington, DC 20011
Phone: (202)722-2440

Abstract:

This Small Business Innovation Research Phase II research project will create a prototype system that will cut through the overload of audio/video (rich media) content by generating personalized broadcasts from a library of rich media documents. Building upon existing expertise in dealing with rich media, the proposed research will apply and refine the techniques discovered in phase I to organize relevant material using both the context of the documents and the topics of the selected material. The prototype will also apply the phase I results to identify and fill in the critical gaps between segments of material extracted from the source documents with bridging text that will provide necessary context and structure, allowing the system to present the relevant material as a single coherent broadcast. This research will result in new techniques that allow separately obtained passages of audio/video (or even text) to be joined together coherently. It will also provide techniques for organizing information based on both contextual and topical cues. These techniques will be applicable in any context in which information in natural language form is being extracted from a source collection. Furthermore, the research results will provide cost efficiencies for a number of specific important vertical markets (e.g. finance, broadcast news monitoring, etc.).

The resulting software products will dramatically reduce the costs of the currently manually intensive information extraction process employed by firms in these markets. More generally, the software products that are derived from the company's current technology platform will also increase individuals' ability to find and absorb relevant information from diverse information sources, many of which are entirely intractable today. This ability is important in a wide range of communities such as academic institutions, intelligence agencies, homeland security agencies, financial institutions, and news broadcasters.

Title: SBIR Phase II: Advanced Proxies for Shared Wireless Internet Access

Award Number: 0348440
Program Manager: Juan E. Figueroa

Start Date: January 15, 2004
Expires: December 31, 2005
Total Amount: $500,000
Investigator: Norman Abramson, nabramson@hokupaa.com
Company: Hokupaa Technologies, Inc.
521 Lake Street
San Francisco, CA 94118
Phone: (415)666-3223

Abstract:

This Small Business Innovation Research Program Phase II project will develop advanced forms of transparent network proxies for both satellite and terrestrial broadband wireless communications to the Internet. Shared wireless access links to the Internet often exhibit what has been called a traffic / cost anomaly. While almost 90% of the traffic in the network can flow from the Internet to the user, almost 90% of the cost of the access links can be attributed to the channel transmitting packets from the user to the Internet. Wireless Internet access from the user to the Internet is often implemented by means of some variation of a random access ALOHA channel. The interaction of ALOHA channels with TCP and other high level protocols used in the Internet can limit the effectiveness of both TCP and ALOHA for such access. The goal of this NSF SBIR research program is to understand this awkward interaction of standards in the high cost random access channel and to develop a strategy of migration to a more sensible access architecture based upon transparent proxies.

The societal and commercial impact of this project will be to increase the capacity of broadband wireless Internet multiple access channels thereby decreasing the cost per user of the channel. This decrease in the cost per user when shared with customers can increase the market for broadband wireless access to the Internet while increasing the profitability for wireless Internet Service Providers. These fast proxies will make wireless Internet access affordable for under-served and un-served end users in rural areas in the United States and in much of the rest of the world. Additionally the technical innovations of this research will serve to advance the current level of understanding of how TCP/IP protocols interact with other protocols in wireless data networks.

Title: STTR Phase II: Autonomous Undersea Systems Network (AUSNET)

Award Number: 0132084
Program Manager: Juan E. Figueroa

Start Date: February 15, 2002
Expires: January 31, 2004
Total Amount: $500,000
Investigator: Charles J. Benton, cbenton@simworks.com
Company: Technology Systems, Inc.
P.O. Box 717
Wiscasset, ME 04578-0717
Phone: (207)882-7589

Abstract:

This STTR Phase II project will result in the creation of an advanced network capability to enable ad-hoc networks to operate in a low bandwidth undersea environment. The specific application of the resultant capability will be to support Autonomous Undersea Systems Networks (AUSNET), which are fleets of unmanned robotic vehicles that can provide survey, search, and monitoring functions for customer bases including the oil industry, environmental monitoring, undersea communications infrastructure, search and rescue, and military applications. The capability will build upon the emerging standard Dynamic Source Routing (DSR) protocols to create a network that is entirely self-configuring, bandwidth conserving, and tailored to the unique requirements of cooperative undersea robotic operations. The two technical thrusts of the effort include AUSNET low-level protocol development, and higher level Application Programmer Interface specification and development. The cooperative Autonomous Undersea Vehicle (AUV) market is emerging and substantial. There are currently 17 companies selling undersea communications devices, each of which is a candidate licensee for AUSNET technology. Near term application of Phase II results is anticipated in Naval applications. Even greater application is to be found in support of offshore undersea operations addressing requirements of the oil industry, communications (undersea cable) installation and maintenance, environmental survey and monitoring, search and rescue operations, and exploration/scientific research.

Title: SBIR Phase II: Programmable, Scalable Wireless Information Infrastructure

Award Number: 0110460
Program Manager: Sara B. Nerlove

Start Date: October 1, 2001
Expires: September 30, 2004
Total Amount: $499,937
Investigator: John Chapin, jchapin@vanu.com
Company: Vanu, Inc.
One Porter Square, Suite 18
Cambridge, MA 02140-1496
Phone: (617)864-1711

Abstract:

This Small Business Innovation Research (SBIR) Phase II project has two primary objectives: to continue the research and development of clustered software radio technology begun in the Phase I project, and to use that technology to extend current waveform implementations to a fully functional base station. A high impact application of clustered software radio is for cellular telephone base stations, changing them from fixed hardware devices into flexible software devices that can support multiple commercial standards and also public safety needs. This Phase II project will develop a clustered software radio base station that interoperates with commercial GSM mobile units and switching centers. The goal is a base station sufficiently functional to be deployed in a field trial, which is the necessary next step in commercializing the technology. The project will include innovative technology development in timing control, wideband synthesis, and intra-cluster data transport.

In the telecommunications industry, many foresee that base stations for third-generation wireless systems will be software radios or software-defined radios. The development of clustered software radio technology by Vanu, Inc. for this market will improve interoperability, improve service to underserved rural areas, enable more efficient use of the radio frequency (RF) spectrum, provide substantial public safety benefits, and increase the pace of technological innovation in the wireless communication marketplace. Moreover, the firm's computing architecture has broad application to signal processing problems outside the wireless industry.

Human/Computer Interface

Title: SBIR Phase II: Enabling Sharable Infrastructure for the Human/Computer Interface

Award Number: 0238965
Program Manager: Juan E. Figueroa

Start Date: March 1, 2003
Expires: February 28, 2005
Total Amount: $500,000
Investigator: William B. Seales, seales@uky.edu
Company: Lumenware LLC
4241 Watertrace Drive
Lexington, KY 40515-0001
Phone: (859)885-4651

Abstract:

This Small Business Innovation Research Phase II project addresses the challenge of seamless interoperability among computer systems and user interface components such as displays and keyboards. Such components today are tightly coupled with the computer, which restricts the utility of both especially in mobile systems, where users invariably have to choose between usable displays and reasonable portability. The system being separates I/O devices from computing devices enabling a different mode of use of computers where a user can carry around much smaller computing devices and use shared larger I/O devices as available. The design and implementation of these enhancements will be guided by feedback from users of prototypes deployed in the field. In the long run, the widespread adoption of this approach has the potential to revolutionize the way humans interact with computers, by allowing computing devices to shrink out of sight, while freeing interfaces from the constraints of portability.

The technology has immediate commercial applications in health care and mobile computing as well, these markets will be explored through future strategic partnerships.

Title: SBIR Phase II: The Delivery of Content-Rich Traffic Information to Improve Driver Decision Making

Award Number: 0522320
Program Manager: Errol B. Arkilic

Start Date: October 1, 2005
Expires: September 30, 2007
Total Amount: $500,000
Investigator: Randall Cayford, rcayford@intellione.com
Company: IntelliOne Technologies Corporation
1776 Peachtree Rd NW
Atlanta GA, 30309
Phone: (404)969-3755

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will develop user interfaces, routing algorithms, and driver notification systems necessary to deliver content-rich traffic information to travelers en route. Large volumes of traffic data, of varying types over large areas, is being gathered by public and private agencies. To be useful to a driver while traveling, this data must be reduced to small amounts of information and delivered in a way that allows easy comprehension with minimal distraction. Key driver behaviors benefiting from traffic information are pre-trip departure time changes, pre-trip and en-route route changes, and en-route anxiety reduction through drivers knowing the estimated arrival time. These behaviors depend on collecting and analyzing the planned route under changing traffic conditions and comparing that route with possible better alternatives. This research will develop user interfaces to collect origin, destination, and route information from drivers, pre-trip via the web and en-route via cell phone. Algorithms to determine alternate routes will be developed through analysis of field collected route data. Notification methods that present the salient information with minimal distraction will be developed and tested. The research will result in the development of better traffic information services that truly support the decisions drivers make as they travel.

The results of this research have potentially broad impacts on society. Traffic congestion is a growing problem in U.S. cities. In some areas, it has become a limiting factor on economic growth. Emphasis has shifted in recent years from providing additional capacity to better utilization of the existing infrastructure. Broad dissemination of traffic information in a form suitable for making optimal routing and trip decisions allows efficiency improvements based on the decentralized decisions of many drivers. Trip modifications based on traffic information can save drivers an estimated $3.9 billion in lost productivity, 225 million hours of travel time, and 340 million gallons of fuel, per year. It is believed that such savings could support a viable commercial marketplace for personalized traffic information. Similar savings are possible for commercial travel through improvements in delivery routing, on-time delivery, and more efficient dispatching. Congestion management by public agencies strives for efficient use of the public infrastructure by shifting motorists onto less congested roads and would benefit from better interfaces between the traffic data collected and the individual drivers on the roads. The examination of route choice will advance the scientific understanding of how drivers choose their routes and how they alter those routes under changing external conditions.

Title: SBIR Phase II: Automatic Classification of Magnetocardiograms

Award Number: 0349580
Program Manager: Errol B. Arkilic

Start Date: February 15, 2004
Expires: January 31, 2006
Total Amount: $486,749
Investigator: Karsten Sternickel, karsten@cardiomag.com
Company: CardioMag Imaging, Inc
450 Duane Ave
Schenectady, NY 12304
Phone: (518)381-1000

Abstract:

This SBIR Phase II research project will incorporate machine-learning techniques into agneto-cardiography (MCG) that measures minute magnetic fields emitted by the heart's electrophysiological activity, based on SQUID technology and operable in typical (magnetically unshielded) hospital rooms, for early non-invasive diagnosis of heart disease. The overall objective of this project is to identify and localize, using MCG, cardiac ischemia, the leading cause of death in the US. The focus will be on excellent predictability, ease of tuning, and user transparency of machine learning tools. Upon successful completion of this project MCG has the potential to become the new gold standard for the detection of cardiac ischemia in patients presenting with suspicion of acute coronary syndrome. Worldwide, the lack of inexpensive and non-invasive cardiac diagnostic techniques causes unnecessary delays in the recognition of acute coronary heart disease and its treatment. The feasibility of MCG to diagnose heart disease has been demonstrated. Machine learning tools provide quantitative methods for the automated diagnosis of heart disease.

After successful completion of this project, physicians and nurses in leading U.S. hospitals can be trained in automated MCG diagnosis. It will also usher the use of machine learning tools for medical diagnosis in general.

Title: SBIR Phase II: A Computerized Test Battery to Evaluate Workplace Stresses

Award Number: 0078467
Program Manager: Sara B. Nerlove

Start Date: December 1, 2000
Expires: November 30, 2002
Total Amount: $379,144
Investigator: Robert Kennedy, 6kennedy@bellsouth.net
Company: RSK Assessments Incorporated
1040 Woodcock Road, Ste 227
Orlando, FL 32803

Abstract:

This Small Business Innovation Research Phase II project from RSK Assessments, Inc. will expand and improve upon the test battery implemented for Phase I, including cross validation, examination of other behavioral scoring approaches (signal detection theory, Bayesian methods), other agents (viz., sleep loss) as well as the interplay of these methods on special purpose hardware and new software. Phase I examined the feasibility of conducting human performance-based fitness-for-duty (FFD) testing as an alternative to chemically-based testing. The testing method was brief and inexpensive, and the tests were stable and reliable. Using a multiple cut-off analysis varying proportion of tests passed, they yielded 98+% specificity (minimal false positives) with 80% sensitivity for high dosages of alcohol (and 60% for low). The new battery tightens security, running within self-contained kiosks and providing data encryption and access via smart card usage. Improved managerial control will be implemented within the test system, including test control and scheduling, data analysis methods, and reporting. Additional means of quantifying behavioral decrements will be obtained from sleep deprivation research, analyses of past alcohol research, and an "alpha" test site. Data from these sources will yield a better assessment model and refine calculations for tradeoff between test length, specificity, and sensitivity.

RSK Assessments proffers a tool for testing human performance that could facilitate higher productivity in industrial plants, a means of testing employees while in the field, and reduction in worker on-the-job injuries.

Title: SBIR Phase II: Scanning Automultiscopic 3-D Visualization System

Award Number: 0216231
Program Manager: Juan E. Figueroa

Start Date: September 15, 2002
Expires: August 31, 2004
Total Amount: $499,998
Investigator: Tin M. Aye, tinmaye@aol.com
Company: Physical Optics Corp.
20600 Gramercy Place, Bldg 100
Torrance, CA 90501-1821
Phone: (310)320-3088

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will develop a scanning automultiscopic 3-D visualization system. Current 3-D systems have very limited field-of-view or require intrusive headgear with head tracking to emulate look-around, and introduce inconsistencies between binocular convergence and eye accommodation. This project will develop a new class of 3-D displays based on proprietary liquid crystal scanner panels that time-sequentially project a large number of perspective images over a wide field-of-view into the view space in front of the display. The device will be a fully functioning full color, high resolution 3-D display system with large screen, large look-around field-of-view with many-perspective-image scanning at a flicker-free rate, using a high speed video projection system.

The proposed 3-D system will be used for visualization of multidimensional scientific and medical data, for 3-D design and simulation, training and education of government and civilian personnel in a collaborative 3-D virtual environment, and for telepresence and teleoperation

Title: SBIR Phase II: Auto-Tracking Using Trailing Templates and Skeletal Guides

Award Number: 0091510
Program Manager: Sara B. Nerlove

Start Date: May 1, 2001
Expires: April 30, 2003
Total Amount: $500,000
Investigator: Paul S. Mostert, pmostert@mostertgroup.com
Company: Mostert Group
3298 Roxburg Drive
Lexington, KY 40503-3432
Phone: (606)223-1490

Abstract:

This Small Business Innovation Research (SBIR) Phase II project continues research and development aimed at demonstrating the feasibility for automatic video tracking of the motion of animals and humans in unconstrained environments. The Phase I study succeeded by designing low-level intelligence into predictive search algorithms that were able to confine their search for the correct position in a succeeding image to specific, small regions predicted by the system. The objective is to create a software system, easily operable by an unsophisticated user that can quickly and accurately track multiple points or regions of a moving animal or human through a sequence of video images. This tracking can be done despite background clutter and intermittent occlusion, and without attaching any distinguishing markers to the subject. In Phase I, a user interface was designed that allowed the user to choose a 'skeletal template' to be tracked with a pointing device (a mouse) by selecting vertices of closed polygons and connected rotation points. By sensing the direction and speed of motion of the system, the model-based tracking algorithm told the search mechanism where it should look in the next image to match a 'trailing template' derived from previous locations and orientations of the template. In Phase II, more sophisticated modeling and prediction algorithms, including supervised learning of constructed models, and a pyramided coarse-to-fine scale-space, constructed at video load time, will be brought to bear that will increase speed and efficiency of the tracking algorithm and improve the robustness of the model-based approach. At the same time, the user interface will be redefined to improve the 'look and feel' and give it a more intuitive structure.

Applications for this software have a ready market demand. Present commercial tracking technology of biological motion requires the placement of intrusive control targets at critical positions on the subject. The commercial need for tracking and characterizing general biological motion will be exploited, including tools for animal behavior analysis, and predicting and improving motion efficiency in athletes. In addition, this technology has applications in diagnostics and medicine/health applications, surveillance, and other uses ranging from NASA's space research, to ergonomic design, to the fingering of musical instruments.

Title: SBIR Phase II: Handwriting Based Interface for Mathematical Notation

Award Number: 0296216
Program Manager: Sara B. Nerlove

Start Date: December 19, 2001
Expires: December 31, 2002
Total Amount: $398,707
Investigator: Peter Garst, pgarst@mathsoft.com
Company: MathSoft Eng & Educ, Inc.
101 Main Street, 16th Floor
Cambridge, MA 02142-1519

Abstract:

This Small Business Innovation Research Phase II project will develop a prototype handwriting based input system for mathematical notation which demonstrates the ease of use, recognition accuracy and editing power required to make computer input of mathematical equations easier than writing them on a pad of paper. This will solve the persistent problem of tedious and difficult input methods for text formatters, technical assistants and other systems, which require input of mathematical notation. The proposed work includes collection of handwritten mathematical data, investigation of a usable interface and editing system, and research into a fast and accurate recognizer for handwritten notation. The market for natural and efficient input of mathematical notation is potentially very large, spread across a range of innovative products for students and professionals in many technical, business and educational fields. Potential applications include easy electronic communication of mathematical notation; far more productive word processors for technical notation; handheld calculators which accept symbolic problems as easily as numeric ones; and others.

Title: SBIR Phase II: Exploring Computer Biological Concepts in an Interactive 3-D Learning Environment over the Internet

Award Number: 0239238
Program Manager: Sara B. Nerlove

Start Date: February 15, 2003
Expires: January 31, 2005
Total Amount: $500,000
Investigator: Douglas B. Seifert, dbseifert@comcast.net
Company: Syandus, Inc.
836 Robert Dean Drive
Downingtown, PA 19335-4469

Abstract:

This Small Business Innovation Research Phase II project will create a 3D, interactive learning system to communicate complex scientific concepts from biological and medical science, which are difficult to grasp via long narrative scripts. The detailed technical specifications formulated in Phase I will be developed into a software solution distinctive from what is available today. This learning tool allows the user to inquire about objects in a visualization context, where specific aspects of these objects can be manipulated. Syandus has adapted sophisticated real-time 3D rendering technology common to video games as follows: 1) by creating the ability to interact with time driven, 3D process models of complex scientific phenomena; and 2) by associating textual information with these visualized objects and processes. At a user's mouse click, objects intelligently reveal what they are about in deeply layered text, illustrations and linked files. This interface can aggregate all kinds of information, such as all of a pharmaceutical company's technical information on a disease. Finally, Syandus is building the software to be delivered across the Internet through a standard browser interface or launched from a CDROM and automatically updated via a narrowband Internet connection. The differentiation among pharmaceutical products is ever increasingly grounded in rapidly evolving complex science, thus making essential a mechanism for aggregating and communicating scientific information that relates how drugs work to disease states. Focusing on the pharmaceutical industry as the firm's first target market, Syandus proposes to create a tool to help physicians understand the breakthrough medicines to treat complex disease states that adversely impact people's lives.

The firm's custom projects will result in enduring resources for medical students, professionals and healthcare consumers. As the technology matures, the firm will pursue higher education markets. Through Internet connectivity, the product can reach wide audiences across the globe.

Title: SBIR Phase II: Smart Instrument Controls with Feel Display

Award Number: 0091589
Program Manager: Sara B. Nerlove

Start Date: June 1, 2001
Expires: November 30, 2004
Total Amount: $499,995
Investigator: George V. Anastas, janastas@immersion.com
Company: Immersion Corporation
801 Fox Lane
San Jose, CA 95131-1601
Phone: (408)467-1900

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will build on Phase I results to take advantage of an exciting opportunity to revolutionize the way people interact with the machines they encounter in everyday life. Visual displays have progressed remarkably in past decades. Aircraft cockpits that used to have hundreds of gauges and dials now have just a few color displays that provide rich visual information that changes depending on the situation. Yet physical interfaces--knobs, buttons, sliders, etc.--remain as primitive as ever. Regardless of context, these interfaces always feel the same and can serve only a limited number of functions. Phase I results demonstrated the potential human factors benefits of Smart Instrument Controls with programmable feels-- operator performance improved, especially when visual attention was critical, such as during a driving simulation task. These systems also could simplify interfaces by reducing the number of separate controls. One control could operate several functions, each function having a distinctly separate "feel". Phase II will continue human factors studies and expand to include research into novel sensor and actuator technologies for Smart Instrument Controls in order to develop a technology that simplifies elaborate system interfaces while improving or maintaining operator performance.

Immersion Corporation proffers a man-machine interface technology that enhances an operator's experience and in many cases can improve performance by leveraging the underutilized sense of touch. These benefits have attracted companies.

Title: SBIR Phase II: Numerical Techniques for Human Oriented Interaction

Award Number: 0239344
Program Manager: Juan E. Figueroa

Start Date: February 1, 2003
Expires: January 31, 2005
Total Amount: $499,979
Investigator: Christopher J. Ullrich, ullrich@immersion.com
Company: Immersion Corporation
801 Fox Lane
San Jose, CA 95131-1601
Phone: (408)467-1900

Abstract:

This Small Business Innovation Research (SBIR) Phase II project is focused on research and development of whole hand interaction with computer aided design (CAD) models. This project incorporates advanced numerical constraint optimization techniques, tessellated and algebraic collision detection algorithms, and CyberGlove-based input devices to interactively manipulate the kinematics of large commercial CAD models. Immersion will develop techniques for enforcing graphical non-penetration of virtual avatars with CAD models. Grasping and manipulation-state machines will permit users to naturally grasp and manipulate CAD parts. Force feedback will be calculated and displayed to users with CyberForce hardware devices. A client-server infrastructure for offloading the computationally intense algorithms from desktop workstations will be developed. All CAD related development would occur in CATIA V5 from Dassault Systeme SA.

The technology has potential for a broad impact on virtual prototyping of consumer products and processes. Enabling real-time interaction with a virtual design will facilitate higher quality products with reduced development costs. Virtual prototyping of manufacturing processes will reduce laborer stress and injury by allowing detailed analysis of human factors before a factory work-cell is developed. Immersion will realize commercial returns from this project through a combination of increased hardware sales, product revenue, intellectual property licensing, and contract opportunities.

Title: SBIR Phase II: Artificial Intelligence and Character Animation

Award Number: 0548723
Program Manager: Errol Arkilic

Start Date: February 7, 2006
Expires: January 31, 2008
Total Amount: $499,996
Investigator: Michal Hlavac, michal@ingeeni.com
Company: Ingeeni Studios
271 Windsor Street
Cambridge, MA 02139
Phone: (617)818-7547

Abstract:

This Small Business Innovation Research (SBIR) Phase II project is to build and launch simple and intuitive software tools that allow for the creation of interactive 3D graphics within Macromedia Flash (a 2D vector graphics package). Combined with the existing technology, this collection of technologies will provide the first version of the revolutionary Artificial Intelligence Platform for the creation and delivering of interactive animated characters with emotional intelligence. The systems provide the characters with autonomous behavior selection (what should I do?), emotion (how do I feel?) and learning (have I seen this before?). Such a unique blend of technologies opens opportunities for the study of the theories of the human mind and creates an entirely new class of interactive media.

The broader impacts of this work are scientific, educational, and economic. The technologies advance discovery and understanding of the workings of the human mind by giving a rapid prototyping environment for computational theories of the mind. Scientists and non-scientists alike can create AI networks and see the resulting characters "twitch" on screen in real time. This work promotes teaching, training and learning as Ingeeni will work with UC Irvine and MIT Media Lab to develop curriculums for Synthetic Characters classes that use the platform. Massive adoption of Ingeeni's technologies is the company's main goal, and it is developing libraries of detailed step-by-step tutorials freely available online.

Title: SBIR Phase II: Development of a Tunable Filter for Mini Hyperspectral Imager

Award Number: 0724494
Program Manager: Juan E. Figueroa

Start Date: September 15, 2007
Expires: August 31, 2009
Total Amount: $499,421
Investigator: Dennis Zander, dennis.zander@infotonics.org
Company: SpectralSight
5450 Campus Drive
Canandaigua, NY 14424
Phone: (585)919-3029

Abstract:

This Small Business Innovative Research (SBIR) Phase II research project will address the need to see beyond ordinary human vision, which is critical to improvements in health care delivery, development of precision agriculture methods, guarantee of front-line responder safety and protection, and processing a safe food supply. Hyperspectral imaging, with its ability to capture hundreds of continuous spectra, delivers a valuable tool that provides enhanced visualization and analysis. Current systems tend to be space- or air-borne, large bulky modules that do not lend themselves to portable or hand-held solutions. This mini hyperspectral imager has at its core a novel MEMS monolithic, Fabry-Perot tunable filter and optical system and will be portable and handy, similar in size to a zoom camera in a cell phone.

This research and development effort will develop a family of innovative miniature hyperspectral imaging systems that potentially can have a significant impact. These systems can alert our modern war fighter and emergency first responders by seeing beyond our vision and identifying terrorist threats. It can safeguard our nation's water and food supplies by utilizing affordable hyperspectral systems to identify e-coli and other bacterial contaminations before they are consumed.

Title: SBIR Phase II: Robust Speech-to-Text Messaging

Award Number: 0724271
Program Manager: Ian Bennett

Start Date: September 1, 2007
Expires: August 31, 2009
Total Amount: $500,000
Investigator: Ashwin Rao, ashwin@travellingwave.com
Company: TravellingWave
1200 Mercer St Suite 412
Seattle, WA 98109
Phone: (425)273-6933

Abstract:

This Small Business Innovation Research (SBIR) Phase II research project proposes to develop techniques for the hands-free input of text to mobile devices. Specifically, this project extends the results of the Phase I effort to produce a speech-recognition system for mobile devices and personal appliances that is robust in the presence of background noise. To increase the speech recognition accuracy, four techniques are employed: 1) Spellation where the users have to speak and partially spell the words as they dictate, 2) VoiceTap which requires that, for each character, the user says that character and the following character in the alphabet, 3) Voice Predict where the user has to say the word and input the first character of the word using the keyboard or VoiceTap, and 4) multi-modal speech to text, where the user speaks and uses the keyboard simultaneously. The research effort will focus on developing modules that allow speech to be dictated using a combination of whole words and spelled words.

The outcome of the proposed research has significant commercial potential. Because the front end or client-side can be ported to a variety of operating systems and processors, the flexibility of this technology should enable wide licensing of the technology to telecommunication device manufacturers. The mobile wireless industry is very large and growing industry, and multi-modal input technology is important to mobile customers who demand more efficient and accurate methods for communication. Improvements in accuracy could be very significant and would potentially have widespread applicability.

Information Management and Retrieval

Title: SBIR Phase II: Semi-Automatically Constructing Wrappers to Access Internet-Based Information Sources

Award Number: 0090978
Program Manager: Juan E. Figueroa

Start Date: April 1, 2001
Expires: March 31, 2004
Total Amount: $490,210
Investigator: Steven Minton, minton@fetch.com
Company: Fetch Technologies
4676 Admiralty Way
Marina del Rey, CA 90292
Phone: (310)448-8275

Abstract:

This Small Business Innovation Research (SBIR) Phase II project focuses on developing technology for semi-automatically creating wrappers that extract data from semi-structured web pages. The key innovation is a bootstrapping method for wrapper generation, so that experience in wrapping previous sites can be automatically re-used to minimize the effort required to wrap new sites. The proposed technology will make it practical to create thousands of highly accurate wrappers almost completely automatically, creating new opportunities for web-based information integration.

The proposed technology will enable Fetch Technologies to scale our current wrapper generation technology far beyond what his now practical. Thousands of Internet services create value for their users by aggregating and integrating information from Internet sources. The proposed technology will make these types of services radically simpler to implement. Applications include portal sites, comparison-shopping services, auction sites, finance integration, and competitive intelligence-gathering services.

Title: SBIR Phase II: Building a Large-Scale, Effective, Self-Maintainable and Customizable News Metasearch System

Award Number: 0522271
Program Manager: Errol B. Arkilic

Start Date: September 1, 2005
Expires: August 31, 2007
Total Amount: $500,000
Investigator: King-Lup Liu, kliu2002@yahoo.com
Company: WebScalers L.L.C.
121 Conque Drive
Lafayette LA, 70506
Phone: (337)984-3968

Abstract:

The Small Business Innovation Research (SBIR) Phase II project develops a metasearch capability engineered for news searching. Searching is the second most popular activity on the Internet behind emailing and it already has a multibillion dollar advertising market. News searching accounts for a major percentage of all searches. News items are available from a large number of online sources but the current technologies for news search are not scalable to effectively cover all of these sources in a timely manner. This project is to develop a new technology to tackle this problem via constructing a large-scale, highly effective, self-maintainable and customizable news metasearch engine. High effectiveness is achieved by automatically selecting the most appropriate search engines to access for each user query and by effectively identifying the correct meanings of the terms in each query. By employing highly automated techniques to incorporate search engines, this system can automatically adapt to changes that are made to the connected search engines and users can customize by adding their favorite news search engines.

Highly automated solutions employed herein reduce labor costs for development and maintenance, which translate to lower advertising costs and make online advertising more affordable for "small players", including small, local media Websites, individuals and small companies. This project advances large-scale information integration, large-scale distributed information retrieval, information extraction, automatic system self-maintenance, and customization on demand. The proposed technology empowers ordinary users in their search for more relevant and more up-to-date news items from a large number of news sources. It also empowers them to customize the search system to suit their information needs

Title: SBIR Phase II: Assessing Status and Trends of Threatened Species from Uncertain Monitoring Data: Methodology and Software

Award Number: 0514541
Program Manager: Errol B. Arkilic

Start Date: September 1, 2005
Expires: August 31, 2007
Total Amount: $499,785
Investigator: H Akcakaya, resit@ramas.com
Company: Applied Biomathematics Inc
100 N Country Rd
Setauket NY, 11733
Phone: (631)751-4350

Abstract:

This Small Business Innovation Research (SBIR) Phase II project aims to develop and implement as software methods for entering, processing, and analyzing species distribution monitoring data, which is one of the most basic forms of biological information that comes from surveys, censuses, and other routine assessments. These methods will use basic monitoring data to (1) assess the status and trends of the monitored species at the population-level, and (2) estimate the input parameters for the more advanced quantitative models, thereby increasing the use of these models, which include population viability analysis models, habitat models and other GIS-based methods, and quantitative risk criteria, such those used by the World Conservation Union (IUCN) and the NatureServe. One of the major innovations of the proposed software will be its treatment of uncertainty. Ecological data are often scarce and uncertain, including spatial and temporal variation, measurement and sampling errors, and demographic variance. The methods to be implemented in the proposed software will account for this uncertainty and incorporate it into the assessment of status and other outputs produced.

Broader impacts of the project will include standardization of the monitoring process for a broad spectrum of species, significantly reducing the cost of processing and analyzing monitoring data and increasing the use of advanced quantitative models in relation to environmental issues. This will, in turn, increase the use of scientific information in environmental decision-making and policy formulation. The methods developed in this project will also allow incorporating data uncertainties in an objective, transparent, and credible way, thereby providing scientifically credible and sound summary of the status and trends of the species monitored. The proposed methods will be implemented as software. Expected commercial applications include software sales and contracts for specific applications of the software.

Title: SBIR Phase II: A Hydro Optical Analysis System (HOPAS) for Environmental Monitoring of Water Quality

Award Number: 0349581
Program Manager: Errol B. Arkilic

Start Date: January 15, 2004
Expires: December 31, 2005
Total Amount: $491,760
Investigator: Francis O'Brien, fjobrien@cox.net
Company: System Science Applications, Inc.
121 Via Pasqual
Redondo Beach, CA 90277
Phone: (310)375-9803

Abstract:

This Small Business Innovation Research (SBIR) Phase II research proposes to complete the development of an environmental information system - the Hydro-Optical Analysis System (HOPAS). HOPAS combines an advanced radiative transfer model with a powerful nonlinear programming algorithm to enable transforms of optical water measurements into information on the composition and concentration of materials that effect water quality. For the first time, measurements of the light field from satellites, aircraft, moorings, and ships can be rapidly inverted to obtain accurate estimates of phytoplankton, suspended mineral particles, and dissolved materials. HOPAS will enable scientists, environmental engineers, and aquatic resource managers to use easily obtained in situ or remotely sensed optical data to understand and manage aquatic ecosystems.

HOPAS will alleviate the need for expensive, labor-intensive laboratory analysis of water samples for use in addressing water quality issues, including microbial growth in drinking water supplies, surface pollutants from farms, industries, vessels, and domestic sources, algal blooms, fisheries and mariculture, and protection of coral reefs and sea grass beds.

Title: SBIR Phase II: Authentication of Mobile Video Recordings (MVRs) Based on Real-Time Hybrid Digital Watermarking

Award Number: 0349602
Program Manager: Juan E. Figueroa

Start Date: January 15, 2004
Expires: December 31, 2005
Total Amount: $500,000
Investigator: Zhenyu Wu, zhenyu.wu@ieee.org
Company: MY EZ Communications LLC
580 Lake Drive
Princeton, NJ 08540
Phone: (609)713-3465

Abstract:

This Small Business Innovation Research (SBIR)Program Phase II project is aimed at the refinement and commercialization of the authentication technology developed during Phase I that enables the deployment of digital Mobile Video Recordings (MVR) system. A very large fleet of patrol vehicles operated by the law enforcement community that record events involving contact with civilians collects MVR data daily. Due to staggering costs associated with operating current analog, non-indexing system, there is an overwhelming needs for a computerized digital MVR technology. However, its deployment is hindered by legal acceptance, because digital medium can be easily altered. Authentication plays a critical enabling role by providing an effective means to safeguard the integrity of MVR content. To capitalize upon this emerging trend of digital MVR, the company proposes as a commercialization strategy to market the innovative technology in a package in an authenticated acquisition system, consisting of a digital video camera and a software suite for on-the-fly video watermarking, off-line MPEG compression and watermark verification. This compact and low-cost acquisition system leverages on existing in-car laptop for processing and storage, and is specifically designed to meet stringent operational requirements set forth by next generation MVR system. It integrates seamlessly with existing IT infrastructure and computerized MVR management systems. MVR has provided an effective way of protecting law enforcement agencies, their officers and the public they serve.

The MVR authentication provides an enabling technology for the acceptance and deployment of cost-saving computerized MVR technology for the law enforcement community nationwide. It allows for safe elimination of the labor-intensive process associated with safeguarding the integrity of MVR content, because watermarking is done on the fly and there is no time window at which MVR data are ever unprotected. With the deployment of digital MVR system equipped with watermark authentication technology, the costs associated with operating the system will be greatly reduced allowing for the savings to be redeployed to other law enforcement endeavors. Within the next three years a comprehensive national digital facial database will be created to support Homeland Security. As an integral component of the in-car laptop, this technology will serve as the front line in capturing the data for submission to the national database.

Title: SBIR Phase II: Animated Real-Time Road Traffic Visualization for Broadcast and the Internet

Award Number: 0349460
Program Manager: Juan E. Figueroa

Start Date: January 15, 2004
Expires: December 31, 2005
Total Amount: $510,000
Investigator: Andre Gueziec, andre@trianglesoftware.com
Company: Triangle Software
1265 W. Knickerbocker Dr
Sunnyvale, CA 94087
Phone: (408)893-8798

Abstract:

This Small Business Innovation Research (SBIR) Phase II project aims at 2D/3D visualization of real-time traffic/traveler data (incidents, speed/density, public events) and computer traffic simulations. The rapid production of data-driven, information-rich animations has previously proved very difficult. With the notable exception of weather forecast animations, requiring highly expensive complex multi-computer systems, quality animations are routinely produced weeks ahead of time for television documentaries. Traffic/traveler data represents particular challenges such as the fact that data changes very frequently and becomes stale in minutes. Much of this data is in textual form, as reported on-scene by police or emergency crews. Reliability and utility to the traveler are concerns. Consequently, the four major weather broadcast companies have scarcely addressed the traffic market. This project will develop traveler data processing algorithms for predicting travel time, mining large databases of traffic information, and intelligent text- processing. It will also develop traffic micro-simulations, automating data-driven animation, and exploiting programmable graphics hardware for broadcast-quality real-time informative animations.

The expected results of this project are: (1) algorithms providing useful information to travelers/commuters from raw real-time police reports and sensor data; and (2) a product animating real-time traffic/traveler information for TV broadcast and the Internet, exploiting gradual improvements of raw data, as departments of transportation equip highways with speed/density sensors, and enforcement agencies open their servers. The Federal Highway Administration reports that the cost of traffic congestion in 1999 came to $78 billion nationwide, including 4.5 billion hours of lost time and 6.8 billion gallons of fuel wasted. Most transportation experts estimate that the ability to quickly provide accurate traffic information as proposed in this project has many benefits: (1) for drivers to plan alternative routes, keep on their schedules, and to reduce stress; (2) for overall congestion and better road maintenance; (3) for safety and road-rage mitigation; and (4) for improved pollution control

Title: SBIR Phase II: Speculative Compilation for Energy Efficiency

Award Number: 0348966
Program Manager: Errol B. Arkilic

Start Date: February 15, 2004
Expires: January 31, 2006
Total Amount: $500,000
Investigator: Csaba Moritz, andras@bluerisc.com
Company: BlueRISC Labs
28 Dana Street
Amherst, MA 01002
Phone: (413)545-2442

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will develop energy-aware compiler techniques to reduce power and energy consumption in microprocessors, without affecting performance. Over the past few years, energy consumption by computers has emerged as a major area of intellectual and commercial activity. A key principle behind this approach is to use speculative information available at compile time to reduce power and energy consumption. The key qualifier is speculative: the information does not have to be provably correct. Speculative information that turns out to be correct will enhance energy reduction; if it is incorrect, the worst that will happen is that a penalty (in terms of energy) will have to be paid. The use of such speculative compile-time information opens up a largely unexplored dimension in compilers and computer architectures, to target energy efficiency.

The outcome of the proposed effort will not merely be a set of products, but also a vastly increased understanding of the means by which compile-time information can be exploited for energy savings. It is expected that this development effort will have a considerable impact on the theoretical underpinnings of compilers and compiler-architecture interaction, as well as a significant commercial impact. With the increasing prevalence of battery-powered computing devices such as PDAs, mobile telephones, and notebooks, power-aware computing is becoming increasingly important commercially.

Title: SBIR Phase II: MPI-2: A Systematic Study, Design, and Commercialization of the Extended Message Passing Interface for NOWs and Parallel Computers

Award Number: 9983413
Program Manager: Juan E. Figueroa

Start Date: June 15, 2000
Expires May 31, 2003
Total Amount: $516,645
Investigator: Rossen Dimitrov, rossen@mpi-softtech.com
Company: MPI Software Technology, Inc.
110 12th Street North
Birmingham, AL 35203
Phone: (205)314-3471

Abstract:

This Small Business Innovation Research Phase II project builds on MPI Software Technology, Inc.'s (MSTI's) extensive MPI-1 implementation experience with our MPI-2 design developed in Phase I in order to continue research and advanced prototyping of a quality implementation of the MPI-2 standard for clusters of workstations . In Phase II, we build upon prototypes created in Phase I, while continuing our investigations into scalable dynamic process startup, advanced and poly-algorithmic approaches to one-sided communications, collective operations, and parallel I/O. Our research and development outcomes will enable the high-performance computing community to unlock the potential of the latest workstation and networking technology, providing access to architectural enhancements of systems and software, and more complex computational environments. Rationale for undertaking this effort is that the scientific community needs enhancements to its most important parallel processing environment, MPI, and that workstation cluster targets comprise the fastest growing component of parallel processing environments. Inventing MPI-2 capability for HPC represents widely enabling technology for scientists and engineers to produce new science, while incorporating computer-science challenges of its own, both of a research and advanced development nature. Significant software, protocol, and algorithmic challenges must be tackled in order to create a useful MPI-2 environment. MPI-2's dynamic process management would support several classes of new scientific applications, and computation strategies. These include computational servers, growing/shrinking parallel applications, and multi-disciplinary codes. Support for the one-sided model would enable classes of applications that need fine grain communication support, including certain sparse matrix algorithms, as well as quantum chemistry codes that utilize global array-type algorithms (e.g., Focker-Planck computations).

Support for effective intercommunicator collective operations would simplify and enable applications that work with dataflow models, including composite parallel simulation and visualization techniques. Support for MPI-2's I/O techniques would support myriad out-of-core and database-type applications, including growing interest in financial modeling with MPI, but also the traditional scientific problems in areas of climate and weather modeling, and others with large, out-of-core datasets needed in conjunction with parallel computing.

Title: SBIR Phase II: Computer-Assisted Document Interpretation

Award Number: 0078525
Program Manager: Juan E. Figueroa

Start Date: September 1, 2000
Expires: February 29, 2004
Total Amount: $750,000
Investigator: Dan Sokol, dsokol@cohesia.com
Company: Renaissance Engineering Inc
130 West Second, Suite 1414
Dayton, OH 45402
Phone: (937)224-1414

Abstract:

This Small Business Innovation Research (SBIR) Phase II project addresses the outdated methods by which companies use material and process specifications. Specifications are a fact of life for any organization involved in complex manufacturing (e.g., aerospace, automotive, materials). Specifications are comprehensive and voluminous documents, covering hundreds of different key characteristics. The constant reading, checking, and analyzing of specifications is extremely labor-intensive, quality-impacting, and time-consuming. During Phase I research, the feasibility of the concept was successfully determined, and a conceptual design solution for tools was created which provides computer-assistance in the interpretation of specification requirements. The conceptual solution is based on the theories of Information Extraction and the analysis of specification content within the context of a meta-specification created as a result of prior NSF-sponsored research. This meta-specification provides an ontology for capturing the semantic knowledge contained in the text of specifications. The Phase II objectives are to build a working prototype of the solution as the foundation for potential full-scale commercialization. The tools created as a result of this prototype will be used to convert existing text-based specifications into the computer-sensible ontology. The Phase II solution is not attempting to totally automate the interpretation process. Instead, the focus is on innovative approaches for providing computer assistance in the semantic analysis of a limited domain of documents.

The organizations which have their processing, inspecting, and testing controlled by specifications are extremely interested in using tools that access specifications in an intelligent, computerized format. These organizations include the United States Government as well as suppliers and prime contractors in American industry. This effort could 'jump-start' an entire industry related to providing tools for the computer-assisted analysis of specification requirements.

Title: SBIR Phase II: Information Extraction from Synthetic Procedures

Award Number: 0110478
Program Manager: Sara B. Nerlove

Start Date: August 1, 2001
Expires: July 31, 2004
Total Amount: $499,923
Investigator: Paul van Eikeren, paul.van.eikeren@intellichem.com
Company: IntelliChem
20310 Empire Avenue, Suite A-102
Bend, OR 97701
Phone: (541)382-7043

Abstract:

This Small Business Innovation Research (SBIR) Phase II project is directed at developing a collection of software tools for use in selective extraction of information from the running text of synthetic recipes. Synthetic procedures are batch recipes used in the creation and discovery of new chemical entities for drug discovery. The ultimate aim of the project is to automate information extraction and place the information in a computer-understandable data structure that fully captures the data and semantics of the synthetic recipe. The Phase I program successfully demonstrated feasibility of the approach by constructing a prototype system and using it to solve a range of representative synthetic-recipe-related information extraction problems. In Phase II, the objectives are to (1) refine and extend the features of the prototype system; (2) implement machine learning capability for extraction rule induction, (3) construct focused demonstration applications, and (4) test, evaluate and validate the software system in conjunction with pharmaceutical-company research-collaborators. The ultimate goal of the program is to develop a commercial software toolkit that enables chemists to easily construct systems for information extraction from synthetic recipes.

Recipes for more than 19 million unique compounds are contained in the public literature, and there are a comparable number in the archives of pharmaceutical companies. The vast majority of these procedures are maintained as unstructured running text. Intellichem, Inc. proffers tools for extraction of synthetic recipe information into computer-understandable data structures that will benefit the following: database construction and updating, summarization, chemical process discovery, knowledge reuse, improved productivity of the chemist, and chemistry-related
e-commerce.

Title: SBIR Phase II: Xtractica - A System for Extracting Coherent Data from Documents

Award Number: 0238863
Program Manager: Juan E. Figueroa

Start Date: January 15, 2003
Expires: December 31, 2004
Total Amount: $499,942
Investigator: Tatyana Vidrevich, tatyana@xsb.com
Company: XSB, Inc.
25 East Loop Road
Stony Brook, NY 11790-3383
Phone: (631)444-6800

Abstract:

This Small Business Innovation Research Phase II project will implement a software system that allows domain experts to specify programs that transform unstructured or partially structured data from a variety of document sources, such as World Wide Web sites, PDF files, and text into structured, coherent, and readily usable information. The system will consist of a set of tightly integrated syntactic and semantics-driven data extraction technologies that are managed from a graphical user interface. The goal will be to retrieve information that was created for human understandability, and work with it to create knowledge that can support automated decision-making and transactions. The system will empower users, who are knowledgeable about their application domains but are not necessarily trained as computing technologists, to rapidly structure data into knowledge. The Phase II implementation effort will build upon the results from the Phase I feasibility study to produce a fully functional system.

Phase III will make the system commercially available to clients with diverse business interests including content aggregation, e-procurement, ERP, and supply chain management vendors.

Title: SBIR Phase II: Ultrafast Block Retrieval for Optical Storage

Award Number: 0216379
Program Manager: Juan E. Figueroa

Start Date: August 15, 2002
Expires: July 31, 2004
Total Amount: $498,950
Investigator: Bunsen Fan, fan@reveo.com
Company: Reveo Inc
3 Westchester Plaza
Elmsford, NY 10523-1609
Phone: (914)345-9556

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will develop and commercialize an ultra fast block data retrieval method for the company's patented chiral film-based optical data storage system. The technology will combine ultrahigh storage capacity with ultra fast retrieval speed. The current retrieval rates of CD-ROM, DVD-ROM and MO technology is inherently limited for applications such as image retrieval for medical diagnosis or target recognition. The company's block retrieval technique is a new method for solving the bottleneck of data retrieval. Using imaging and pattern recognition techniques, data is retrieved in 2D blocks. This retrieval method will result in orders-of-magnitude increases in throughput and increases in storage density.

Since the need for high density, high-speed storage is continuing to escalate; there will be a ready market from storage system vendors who supply products to the myriad of industries whose business depends upon volumes of storage and quick retrieval.

Title: SBIR Phase II: Surface Enhanced Raman Scattering (SERS)-Based Nanoparticles as Covert Taggants for Anti-Counterfeiting Applications

Award Number: 0548687
Program Manager: Errol Arkilic

Start Date: February 7, 2006
Expires: January 31, 2008
Total Amount: $499,624
Investigator: Sharron Penn, sharron.penn@oxonica.com
Company: Nanoplex
665 Clyde Ave, Suite A
Mountain View, CA 94043
Phone: (650)603-5922

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will continue the development of an anti-counterfeiting solution for the brand security market, built around a series of covert, nanoscale taggants, called SERS nanotags. Three technical hurdles remain for the innovative tags to be accepted by customers: (1) ability for to develop cost-effective, commercial scale manufacture; (2) the demonstration of a handheld reader; and, (3) seamless integration into printed products.

Because of its mushrooming growth and profound economic impact, the FBI has called counterfeiting "the crime of the 21st century". Part of the problem is that current anticounterfeiting technologies offer extremely limited performance and are themselves easy to counterfeit. SERS nanotags embody all of the features of the, much needed, next generation of anti-counterfeiting technologies. Therefore, if successful, this technology will have an impact across many commercial and government sectors.

Title: SBIR Phase II: Unsupervised Extraction of Relational Data from the Web

Award Number: 0548699
Program Manager: Errol Arkilic

Start Date: January 23, 2006
Expires: January 31, 2008
Total Amount: $499,936
Investigator: Steven Minton, minton@fetch.com
Company: Fetch Technologies
2041 Rosercrans Ave Suite 245
El Segundo, CA 90245
Phone: (310)414-9849

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will enable software systems to make use of data on the Web that is embedded in HTML pages. The semantic web is intended to allow data to be shared and used by software applications. Unfortunately, in the present world, data on the Web is generally inaccessible to most applications because it is presented in a format intended to be usable by humans, as opposed to computers. The goal of this project is to create a relational view of data on the Web, so that applications can access Web data based on entities and their relations. The approach uses unsupervised machine learning to extract data from web sites for conversion into relational form. This project will result in a new generation of Web harvesting technology that has clear commercial value.

Web harvesting is an area of growing commercial interest for a variety of vertical markets, including Sales Intelligence, Market Intelligence, News Aggregation, and Background Search. However, web harvesting technology is limited today, since the collection of rich, detailed data must be done on a site-by-site basis. The approach described here, if successful, will enable a new generation of intelligent web harvesting technology that can scale to the entire Web. Ultimately, our approach will enable applications to query the entire Web as if it were a relational database. This has tremendous commercial value, and will enable many new types of web applications to be developed. In addition to the commercial value, the technical approach is novel and has significant merits on its own. If it is successful, the proposed method should generalize to other complex domains (such as scene understanding and natural language processing) where multiple heterogeneous types of structure must be analyzed to discover underlying meaning.

Title: SBIR Phase II: Improving Infection Control Through Radio Frequency Identifier (RFID)-Based Patient Tracking

Award Number: 0548737
Program Manager: Errol Arkilic

Start Date: January 23, 2006
Expires: January 31, 2008
Total Amount: $495,856
Investigator: Daniel Kokotov, dkokotov@vecna.com
Company: Vecna
5004 Lehigh Rd B
College Park, MD 20740
Phone: (301)864-7253

Abstract:

This Small Business Innovation Research (SBIR) Phase II Project will provide hospitals with a way to analyze and prevent hospital-associated infection outbreaks based on integrating a location tracking system with live hospital microbiology data, building on research done in Phase I. The goal is the design, implementation, deployment and clinical validation of two tools: (1) a visualization and analysis tool for investigating propagation dynamics of past and current infection outbreaks; and, (2) a simulation tool for evaluating response measures to potential outbreaks. The research will center on clinical acceptance and usability. The involvement of medical and infection control experts will ensure that the models of infection spread are accurate, the visualization and analysis tools are intuitive, and the simulation tools cover the important infections and scenarios.

Every year tens of thousands of lives, and billions of dollars, are lost to infections acquired in health care facilities. The envisioned product will give hospitals powerful tools for reducing these numbers, allowing them to better understand why infections happen and what counter-measures are effective. Hospital-associated infections' impact goes beyond the immediate sickness they cause, forcing treatment of the infection in addition to the underlying illness, and dissuading many from seeking necessary care because of the fear of acquiring infections.

Title: SBIR Phase II: Visualization Toolkit for 3D Photography

Award Number: 0724338
Program Manager: Errol Arkilic

Start Date: September 15, 2007
Expires: August 31, 2009
Total Amount: $500,000
Investigator: Siavash Zokai, zokai@brainstormllc.com
Company: Brainstorm Technology LLC
514 West 24th Street, 3rd Floor
New York, NY 10011
Phone: (516)668-1393

Abstract:

This Small Business Innovation Research (SBIR) Phase II project seeks to develop a comprehensive 3D photography toolkit for importing the geometry of existing large-scale urban structures into the computer. The goal of the project is to minimize the effort of building models of high geometric and photometric accuracy that are suitable for efficient rendering, manipulation, and analysis. The proposed Phase II work will build upon the feasibility study conducted in Phase I. The Phase I effort introduced a novel algorithm that successfully integrated multiview geometry with automated 3D registration to produce realistic visualizations of complex, reconstructed, real-world 3D models with minimal human interaction. The goal is to build approximate lightweight 3D models directly from a collection of photographs of the scene. The proposed workflow treats a photograph as tracing paper upon which 2D shapes are defined prior to extruding them into 3D models.

The commercial application of this Phase II project is the introduction of a comprehensive software toolkit for 3D photography. The ultimate goal is the reconstruction and visualization of detailed models of urban sites, i.e. digital cities. The creation of digital cities drives other areas of research as well: visualization of very large data sets, creation of model databases for GIS (Geographical Information Systems) and combination of reconstructed areas with existing digital maps. Other applications include video game development, entertainment, architecture, virtual tourism, fire/police/urban planning, urban design, disaster prevention, archaeology, and historical preservation.

Title: STTR Phase II: Nonintrusive Electrical Monitor (NEMO)

Award Number: 0646585
Program Manager: Errol Arkilic

Start Date: April 1, 2007
Expires: March 31, 2009
Total Amount: $500,000
Investigator: John Rodriguez, NEMOmetrics@aol.com
Company: NEMOmetrics
28 Constitution Road
Charlestown, MA 02129
Phone: (617)242-0050

Abstract:

This Small Business Technology Transfer (STTR) Phase II project will develop and qualify a Non-Intrusive Electrical Monitor product (NEMO) to provide inexpensive, accurate, in depth monitoring of electrical usage, permit expanded energy savings and provide additional information, like potential equipment faults and failures. NEMO increases the amounts and kinds of diagnostic information that can be gleaned from a single set of electrical measurements, thus lowering the cost of monitoring building energy management systems. By analyzing the transient signatures produced when different electrical equipment draws power, NEMO can identify which of multiple loads turn on and off and assess their condition. The objectives of the research are to determine: the reliability of NEMO algorithms in the presence of multiple loads, prioritize several possible diagnostic analyses for the commercial product, and maximize the automation of NEMO data analysis while minimizing the need for human scrutiny and intervention. Phase I demonstrated the value of NEMO systems in monitoring and diagnostics with air conditioning units. The Phase II research plan calls for continuing the development work and installation of a qualified prototype in commercial buildings.

Data analysis will reveal inefficiencies in building operation and effectiveness of the algorithms themselves. This project will develop a system for non-intrusive detection and identification of multiple electrical loads with major energy conservation and other benefits. Time of use data can be used to create new automated algorithms that minimize energy use and optimize heating, ventilation, and air conditioning system operation without affecting occupant comfort, while electrical health diagnostics can signal when a motor is nearing failure or a valve has jammed. A reduction in the cost of in-depth monitoring allows more commercial facilities to reap energy and maintenance savings from these algorithms and the NEMO product that contains them. Actual measurement rather than estimation of initial and ongoing electrical power consumption of electrical equipment within a commercial building enables verification of upgrade performance. It also facilitates design and operation of intelligent, energy efficient buildings and assists in attaining Leadership in Energy Efficient Design (LEEDTM) certification. By promoting energy efficiency in buildings, NEMO will enable customers to reduce their energy costs, reduce or eliminated unscheduled maintenance and increase profitability.

Teaching & Learning

Title: SBIR Phase II: Digital Starlab

Award Number: 0321598
Program Manager: Sara B. Nerlove

Start Date: August 1, 2003
Expires: July 31, 2005
Total Amount: $499,827
Investigator: Jane Sadler, jsadler@starlab.com
Company: Learning Technologies Inc.
40 Cameron Avenue
Somerville, MA 02144-2404
Phone: (617)628-1459

Abstract:

This SBIR Phase II project will develop a planetarium system based on a new computerized digital projector. Learning Technologies Inc. will make use of recent developments in new micro mirror devices and simulation software. The proposed planetarium system will be capable of projecting an accurate, simulated night sky with the capacity for a multitude of motions and displays and dynamically changing information displays of the earth, including plate tectonics, weather patterns, and biological distributions. The small size of the projector with supporting laptop computer and inflatable dome will allow the units to be shared within school systems and loaned out by museums and educational cooperatives. Standardization will encourage adept teachers and planetarium educators to distribute their programs and activities. Integrated help screens and tutorials will aid in supporting teachers who wish to learn how to master this equipment. The new system will build on the firm's portable planetarium systems, which are now used by an estimated 5% of the school age children in the U.S.

A small digital-projection planetarium system will expand the market for small planetariums to teachers interested in earth science and multidisciplinary topics, geology, volcanism, meteorology, oceanography, and biological population studies. In addition, the connections between science and the humanities can be illustrated by coupling the historical age of exploration with the science of celestial navigation. For schools with limited resources, the system's portability will facilitate shared use. Such a system will have a broad impact on the teaching of astronomy and earth science. It will use the latest astronomical and Geographic Information System (GIS) data, and it will aid in teaching the content of the national standards, especially earth science at the elementary and middle school level. Professionally produced interactive shows can be a new venue for astronomers and earth scientists to inform large numbers of students of their results and of the nature of the scientific enterprise.

Title: SBIR Phase II: Sketchpad for Young Learners of Mathematics - Dynamic Visualization Software in Grades 3-8

Award Number: 0521981
Program Manager: Ian M. Bennett

Start Date: July 1, 2005
Expires: June 30, 2007
Total Amount: $499,808
Investigator: Nicholas Jackiw, njackiw@keypress.com
Company: KCP Technologies
1150 65th Street
Emeryville CA, 94608
Phone: (510)595-7000

Abstract:

This Small Business Innovation Research (SBIR) Phase II project aims to overcome barriers to the effective use of The Geometer's Sketchpad software in elementary and middle school math classes, and to deliver on the software's potential for transforming education at these levels. This research-based educational technology tool and its "Dynamic Geometry" interaction paradigm are well known at the secondary and higher level for their ability to foster visualization and exploration in mathematics and to enhance student learning. This project responds to clear calls for the software's application and adaptation to younger grades coming from teachers, from curriculum development and research communities, and from standards bodies such as the National Council of Teachers of Mathematics (NCTM). The proposed research, led by the team that created and maintains Sketchpad, first identifies and prototypes modifications to the software to add scope and age-relevant functionality and to remove barriers to access for young learners; and second pioneers new classroom activities-structures, materials, and vehicles-for supporting and extending standards-based curricula in grades 3-8 through the agency of Dynamic Geometry technology. The intellectual merit of the proposed activity reflects (a) the degree to which the activity responds to perceived pedagogic need (as cited, e. g., in the NCTM Principles and Standards 2000) for Dynamic Geometry technology at the elementary and middle school level; (b) the opportunity to extend the broad base and literature of research that exists on Dynamic Geometry at the secondary level to significantly earlier grade levels (particularly with respect to effective Dynamic Geometry activity design and Dynamic Geometry impact on student affect and cognition in the early grades); and (c) the resources this proposal brings to the question of how best to integrate effective, standards-based curriculum (in this case, the Connected Mathematics Project, Everyday Mathematics, and Math Workshop curricular programs) with effective, standards-based technology. The project brings together research experience in both curricular and software design; project staff includes Sketchpad's authors and project consultants include the author teams of each of the named curricula.

The broader impact of this project reaching its objectives will be the creation and availability, in primary and middle grades, of age-appropriate Dynamic Geometry mathematics education technologies and supporting curriculum similar to those which define Sketchpad at the secondary level, where the software is considered the "most valuable software for students" (Becker, 1999) by mathematics teachers across the country; and of research-driven solutions to the challenge of supporting standards-based curricula effectively with educational technology.

Title: SBIR Phase II: Digital Microscopy with Collaborative Learning

Award Number: 0450650
Program Manager: Ian M. Bennett

Start Date: April 15, 2005
Expires: March 31, 2007
Total Amount: $500,000
Investigator: Timothy Hall, tim@prime-ent.com
Company: Digital Blue Incorporated
4885 Olde Towne Pkwy Suite 101
Marietta GA, 30062
Phone: (770)579-0501

Abstract:

This SBIR Phase II project seeks to provide a model for integrating digital microscopy and web-based on-line collaborative learning in order to improve science education. In Phase I, Digital Blue developed a collaborative worksite, www.planetmicro.com and enrolled +400 students. In Phase II Digital Blue proposes to further this inquiry by building, in conjunction with the Concord Consortium, a state-of-the-art website where students use common digital microscopes and engage in a true collaborative educational experience. Digital Blue will undertake this work by scaffolding the website to improve interaction between members; improving the work flow in which users "tag" their digital images thus optimizing search engine productivity; developing common curriculum modules; developing an online professional development utility to empower teachers to use this technology in their coursework; and adding thousands of members to foster an innovative and successful collaborative community.

Digital Blue proffers an innovative product and service for the education market, namely Planetmicro.net, a collaborative workspace that is fully integrated with a proprietary digital microscope. The site would be the first collaborative workspace that interacts seamlessly with affordable digital laboratory equipment in each classroom. Other collaborative learning environments offer common methods and processes but fail to integrate uniform tools, creating a gap between the hands-on activity of the lab and the virtual activity. In contrast, Planetmicro.net would make it easy to integrate collaborative learning with traditional science pedagogy

Title: SBIR Phase II: Customizable Question Answering System for Homeland Security and Commercial Applications

Award Number: 0450599
Program Manager: Ian M. Bennett

Start Date: September 15, 2005
Expires: August 31, 2007
Total Amount: $499,717
Investigator: Munirathnam Srikanth, srikanth@languagecomputer.com
Company: Language Computer Corporation
1701 North Collins Blvd.
Richardson TX, 75080
Phone: (972)231-0052

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will result in a novel question-answering technology. The features of this technology are as follows: (1) Automatic filtering of questions. During Phase I, Language Computer Corporation (LCC) developed a system that decomposes high-level questions into low-level, fact-seeking questions. Some of these questions, however, turn out to be nonsensical. In Phase II, the firm proposes to submit all of the decomposed questions to a knowledge-based system, which will eliminate questions that are inconsistent with tacit knowledge. All of the questions that survive filtering will be passed back for processing by the question-answering system. (2) Aligning domain ontologies with a large reference ontology. During Phase I, LCC developed a tool that generates domain ontologies from raw text. During Phase II, the firm will extend this tool so that the domain ontologies are automatically aligned with an overarching domain-independent ontology. This alignment will permit deeper expansion of query concepts, because it will allow domain-independent concepts to be augmented with domain-dependent content. (3) Formal evaluation of semantic relations. The foundation of the question-answering system is semantic relations extracted from queries and documents. These relations will be evaluated to assess the relative contribution of each one to question answering. The result of this evaluation will establish which aspects of semantics are most useful to question- answering.

This project will have a direct impact in the following areas: (1) The system can be deployed in commercial and government settings where the accuracy, coverage, reliability, and usability of the retrieved information are crucial. Ideal applications for the technology include homeland defense, CRM, education, medicine, and the law. (2) The system bridges the gap between domain-independent and domain-specific content. Domain ontologies are constructed automatically, and these ontologies are automatically aligned with a large reference ontology, so that queries can be simultaneously expanded into the terms appropriate to many different domains.

Title: SBIR Phase II: A Model for Virtual Dialogues with Master Teachers

Award Number: 0450567
Program Manager: Ian M. Bennett

Start Date: March 15, 2005
Expires: February 28, 2007
Total Amount: $500,000
Investigator: William Harless, wgharless@idrama.com
Company: Interactive Drama Inc.
7900 Wisconsin Avenue, Suite 200
Bethesda MD, 20814
Phone: (301)654-0676

Abstract:

This Small Business Innovation Research (SBIR) Phase II project describes software that combines speech recognition, digital video, and personal computer technologies to allow PC users to have "face-to-face" dialogues with video characters that are real people. This software, called Conversim (Registered Trademark), incorporates an independent speaker recognition engine so that any English-speaking user can spontaneously say the words and phrases known to the system and be understood. All Conversim (RT) programs include a non-directive, intelligent prompting algorithm. Each time the virtual character responds to the user, the system dynamically selects statements and questions that are specifically relevant to the character's last response and then displays three choices in a rhythmic scroll. Between questions, the character's active image remains on the monitor as if waiting for the next question. The Conversim (RT) dialogue model is unique since it enables the user to have a virtual conversation with a real person whose intellect, personality, and personae are intact and available. This very personal model opens the door to numerous innovative applications in education. Scientific research has shown that most users enjoy the virtual dialogue experience; many have significant, often accelerated, learning gains; and almost all feel as though they have met the person with whom they have been "talking." These findings strongly indicate the method merits further research in conventional educational settings.

This model represents a new paradigm in education, one that allows the student to learn through a one-on-one interview of the master teacher. The paradigm involves non-directive, independent learning by conducting face-to-face dialogues with master teachers in cyberspace, who are always present, always available, and always willing to converse with people who wish to engage them. Multimedia presentations can be used in concert with the dialogue to clarify concepts and complex topics. Also, the power of the computer for tracking and innovative, dynamic evaluation strategies are inherent in this model. The broad objective is to make this model and this new paradigm available in all educational institutions that would benefit from its use. It has potential to provide a means for students everywhere to gain access to and learn by engaging in dialogue with some of the best minds in the country; to be used to educate a broad range of students, from high school to the post-graduate level; to help students whose education is restricted by geographic location or economics; to enhance learning for all students by making them active participants in the learning process; and to provide high-quality education while significantly reducing per student costs.

Title: SBIR Phase II: Use of a Visual Programming Environment to Promote Bioinformatics Education

Award Number: 0450526
Program Manager: Ian M. Bennett

Start Date: August 1, 2005
Expires: July 31, 2007
Total Amount: $500,000
Investigator: Maciek Sasinowski, maciek@incogen.com
Company: Incogen Inc
263 McLaws Cir Ste 200
Williamsburg VA, 23185
Phone: (757)221-0550

Abstract:

This Small Business Innovation Research (SBIR) Phase II project seeks to provide a tool to improve bioinformatics education. This tool, VIBE-Ed, is a software product designed to augment bioinformatics at the college and university level by creating an interactive, integrated, and comprehensive approach to bioinformatics education using visual programming. During the Phase I project, INCOGEN demonstrated that its existing research tool, VIBE, provides an excellent foundation for an educational tool given its inherent technological attributes. VIBE employs visual programming for bioinformatics, and in this respect, VIBE-Ed will provide a novel approach to bioinformatics classroom instruction. The Phase I work demonstrated the effectiveness of visual programming in the learning process. In addition to visual programming, the architecture of VIBE supports the inclusion of extensive information about the bioinformatics tools contained therein, making VIBE-Ed well suited to host the large and complex amount of resources and documentation required by an educational tool. Finally, VIBE was created to be extensible, allowing it to be naturally extended into VIBE-Ed. As the bioinformatics community discovers and validates new analysis tools, these can easily be incorporated into VIBE-Ed, along with the educational features to support them.

Bioinformatics education is a growing field, driven by the great need for trained bioinformaticists in biological and biomedical research. Recent years have witnessed notable increases in the number of bioinformatics courses and degree programs at colleges and universities worldwide. Textbooks and lectures alone do not expose bioinformatics students to hands-on data analysis and, by themselves, they are insufficient for bioinformatics education. Despite the growing trend in bioinformatics education and the need for educationally focused tools, there is a significant lack of commercially available software tools specifically designed for bioinformatics education. Currently, bioinformatics instructors fill this gap by using either complicated and expensive research tools or collections of web-based tools. Bioinformatics research software is often cost prohibitive for an educational application, and the software itself is geared toward experts in the field rather than toward students. Web-based tools are often free of charge, but they are also frequently dispersed throughout the web, requiring excessive time and sometimes also requiring programming skill to combine the use of several tools. Many of the tools are not accompanied by instruction or related conceptual information, making them less suitable for education. VIBE-Ed successfully addresses these concerns and promises to have immediate impact on bioinformatics education and, ultimately, in knowledge discovery on life science research

Title: SBIR Phase II: Cheminformatics Teaching Tools for the Cheminformatics Virtual Classroom

Award Number: 0450457
Program Manager: Ian M. Bennett

Start Date: March 1, 2005
Expires: February 28, 2007
Total Amount: $519,956
Investigator: Norah MacCuish, norah.maccuish@mesaac.com
Company: Mesa Analytics & Computing, LLC
212 Corona St.
Santa Fe NM, 87501
Phone: (505)983-3449

Abstract:

This Small Business Innovation Research (SBIR) Phase II project addresses the development of virtual classroom software tools for cheminformatics training in academia and industry. Mesa Analytics & Computing, LLC provides a commercial, integrated suite of the leading-edge cheminformatics software tools for the pharmaceutical and biotech industry. However, these tools, incorporating the most recent research in cheminformatics by Mesa, and integrated with other leading cheminformatics vendors` software (OpenEye, eduSoft, ChemAxon, and AccuSoft), are for use in large-scale research and industrial applications, where the users already have experience in cheminformatics software, most often obtained through on-the-job training. The research goals of this project are to develop an easy to use, comprehensive, and competitively priced cheminformatics virtual classroom. This project will further the advanced research and development of software tools for interactive distance learning in cheminformatics topics, such as finding compound substructure commonalities, generation and use of structural and property compound descriptors, similarity searching, cluster analysis, compound library design, 3D drug design, compound databases, and Quantitative Structure Activity Relationship (QSAR). The project will produce a beta version of the cheminformatics virtual classroom ready for testing and marketing to the academic and industry markets.

There are a growing number of university departments worldwide offering courses and degrees in cheminformatics, across a range of life science disciplines. However, there is no comprehensive cheminformatics virtual classroom product. Software products used in the pharmaceutical and biotech industry are expensive, difficult to install, and of limited utility for introductory training. Converting Mesa`s tools and other vendors` software into a coherent set of Web-based training tools for concept learning, with the help of six diverse academic testing sites, will provide the necessary training tools for academia and industry. Web delivered training software is a cost effective means to provide distance learning for rural and urban academic institutions and industry sites here and abroad. The virtual classroom will help to lower the cost of on-the-job training for early phase drug discovery research efforts found in the pharmaceutical and biotech industries. The long term goal is to increase the quality and quantity of new researchers, with the potential benefit of increasing the number of drug leads, thereby improving the chances of finding more effective drugs for a wider range of serious diseases, and possibly lowering the cost to consumers.

Title: SBIR Phase II: Enabling Pedagogical Choice and Cost-Efficiency in the Development of Web-based Curricula

Award Number: 0450380
Program Manager: Ian M. Bennett

Start Date: September 1, 2005
Expires: August 31, 2007
Total Amount: $500,000
Investigator: Linda Chaput, lchaput@thinkfive.com
Company: Agile Mind Inc
1100 South Main St
Grapevine TX, 76051
Phone: (650)906-8721

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will build a first-release Web-based system for content authoring and delivery that supports multiple approaches to pedagogical practice and provides efficient, easy to use methodologies with which course designers can employ system capabilities. Specifically, this project will continue the work started and demonstrated to be feasible in Phase I to create online authoring and complementary course management systems, which have features and benefits that are immediately available to innovative instructional designers. The goal is to enable the development of technology-mediated instruction through cost-effective means for producing new content and to do so with a focus on supporting instructional design innovation without compromising the capabilities of the technology. The goal is an innovation that will empower content providers to use principled learning theories and pedagogical practices for creating new online curricula that support technology-mediated instruction. The project will produce a new type of authoring and delivery system in which the functionality available to create course structure; manage multimedia content development; translate course specification into reliable production delivery; and access course-related activities for learners and their teachers or mentors, including dynamic learning interactions and real-time behavior tracking and reporting reflects the authors' preferred learning theories and pedagogies.

This project seeks to provide a set of enabling tools that support the development of technology-mediated instruction through cost-effective means for producing content, focused on supporting instructional design innovation without compromising the capabilities of the technology. The commercial applications of the research result are sales and licenses of the created systems, both with and without content, to content developers, publishers, and also middle and high schools, districts, and other local entities for use by individuals and groups who desire to create and to publish content and assessments for communities of practice and who are impeded by cost and time constraints. The resulting systems will address a major problem in education: the consolidation of content development and dissemination in the hands of a small number of publishing conglomerates and the consequent lack of quality and diversity of choice that have been a result of that consolidation. With an extensible authoring system, the company would be positioned to tap into a large market with a business model that supports both new business development and the legacy assets of publishers and eLearning providers, and to create major new opportunities for many other types of content providers.

Tite: SBIR Phase II: Modular Online Simulations for Math and Science with Integrated Assessment of Complex, Standards-Aligned Learning Objectives

Award Number: 0422116
Program Manager: Sara B. Nerlove

Start Date: July 15, 2004
Expires: June 30, 2006
Total Amount: $499,246
Investigator: Paul Cholmsky, pcholmsky@explorelearning.com
Company: ExploreLearning, Inc.
P.O. Box 2185
Charlottesville, VA 22902
Phone: (434)293-7043

Abstract:

This SBIR Phase II project will produce a commercial version of PathfinderPlus, an online system that integrates assessment of complex, standards-based instructional objectives within interactive simulations and makes the resultant data available in a timely and efficient manner to students, teachers and administrators. In order to effectively implement curriculum standards-based educational reforms (e.g., as mandated by the No Child Left Behind Act), teachers need guidance in linking students' day-to-day learning to these standards and in adapting subsequent instruction based on students' progress against the standards. Existing educational technology products, however, are explicitly correlated only to the macro-level terminal objectives in each state's curriculum standards. As a result, these products do not provide diagnostic information regarding component knowledge and skills, and they thereby fail to support teachers in understanding more precisely where students are having difficulties within a given terminal objective. PathfinderPlus provides a comprehensive online library of highly interactive learning objects that track student' actions as they use them. The system analyzes the generated data to create assessment probes which yield results that are indexed against a hierarchy of component knowledge and skills related to each state's terminal objectives. This analysis provides students, teachers and other educational stakeholders with a roadmap to success in meeting their state's curriculum standards. In terms of broader impacts, the successful production of a fully functional, commercial PathfinderPlus product will break significant technical ground in the field of large online repositories of interactive learning objects. The deployment of ExploreLearning's XML specification HILO ML (Highly-Interactive Learning Object Markup Language) separates the pedagogical logic of a learning object's adaptive behavior from its technical instantiation. This separation enables the efficient development of the volume of scripts required by a system that covers entire courses (e.g., Algebra). The use of a four-tiered architecture to link fine-grained pedagogical events (i.e., pedagogically-meaningful interactions between students and the online simulations) to macro-level terminal objectives provides a flexible, modular foundation for the system.

In terms of impacts on K-12 education, PathfinderPlus will foster alignment with standards-based curricula, support teachers in integrating technology effectively and efficiently into their classrooms, and provide a new approach for measuring the impact of educational technology on student learning. In addition, the system's use of interactive simulations as the medium for assessment enables a broader range of more complex, higher-order instructional objectives to be assessed (e.g., problem solving strategies and skills), as compared to traditional probes used in computer-based applications such as multiple-choice questions.

Title: SBIR Phase II: Personal-Knowledge-Management eLearning System

Award Number: 0423443
Program Manager: Sara B. Nerlove

Start Date: August 1, 2004
Expires: July 31, 2006
Total Amount: $491,956
Investigator: Robert London, blondon@taxonomize.com
Company: Taxonomize
10980 Northsky Square
Cupertino, CA 95014
Phone: (408)725-1658

Abstract:

This Small Business Innovation Research (SBIR) Phase II project improves access to knowledge by auto-organizing unstructured data to respond to specific individuals, groups, and their activities. Taxonomize Resource Aid (TRA) uses syntactic, semiotic, semantic and statistical techniques to generate and update resource taxonomies, which are multi-level indices into the information corpus (documents, web sites, etc.) specific to users' activities. These active taxonomies are practice-relevant and personalized, and they provide applications of enhanced search, auto-produced portals, personalized content management, and knowledge discovery. For example, TRA's coordinated knowledge directories produce discovery of trends in time-based documents (such as discussion groups); extraction of information from unstructured data (such as distributed themes); and notifications from monitoring multiple information sources for patterns of confluences (e.g., news relevant to collaborating partners) or discrepancies (e.g., knowledge missing in one area that can be filled from another). Phase II development will take the successful prototype that was tested in educational settings, and create a commercial product (initially as a SOAP/WSDL web service) that will be licensed to firms selling software solutions in the areas of e-learning, search, and knowledge management. Taxonomize Resource Aid (TRA) will provide knowledge tailored for individuals, groups, and activities, and thus will provide people who have been limited by accessibility, resources, or background ready access to resources of knowledge, instruction, and collaboration. The TRA prototype has already been shown to provide significant benefits to some university students who were learning how to do primary research. Those who have difficulty with the culture, language, or technology gain the greatest benefits from TRA, because it gives them accelerated access to knowledge that is automatically selected for relevance to their activities, based on Taxonomize's powerful auto-categorization capabilities. TRA can help in any field where people need to organize, manage, access and use large amounts of information and resources.

TRA can help improve education, healthcare, defense, and government organizations process information quickly, especially when dealing with immediate and critical situations. It can also help disadvantaged people find necessary resources, and keep updated with changes that would otherwise be infeasible to monitor. TRA improves knowledge accessibility, flexibility and adaptability and affordability of general learning capabilities, and so may benefit formal and informal learning in every area

Title: SBIR Phase II: Interactive Earth: Tools for Earth Systems Science

Award Number: 0349784
Program Manager: Sara B. Nerlove

Start Date: February 15, 2004
Expires: January 31, 2006
Total Amount: $531,998
Investigator: Kirk Bergstrom, worldlnk@well.com
Company: WorldLink Media, Inc.
San Francisco, CA 94115
Phone: (141)593-1695

Abstract:

This SBIR Phase II project proposes to research and develop ways to increase accessibility and utilization of Earth systems science data and visualizations for secondary school teachers and students. The commercial product will consist of a DVDROM, curriculum, and web site. Building on WorldLink Media, Inc.'s previously published CD product, Interactive Earth, the firm will develop an integrated tool set for data display and image interpretation that will enable students to inquire, hypothesize, analyze, discover, and communicate with peers-replicating the work of real scientists. Much more than a static software program, the Interactive Earth DVD-ROM will be part of a "learning platform" that includes an in-depth curriculum package, access to a rich archive of global data via the web, and professional development opportunities. Partnerships with NASA's Earth Observatory web site and the World Resources Institute's EarthTrends project will enable classroom access to extensive global data sets and visualizations. TERC, a research and education organization, will develop a curriculum that aligns with the National Science Education Standards. This SBIR project recognizes the vital interplay between a curriculum developer (TERC), data providers (NASA and World Resources Institute), and a media designer and tool-builder (WorldLink) in creating exemplary learning materials. Earth science is of national strategic importance as a field of research and innovation.

The potential contribution to our schools and students is not just in Earth systems science, but in the broader applicability of the skills developed by students to related domains of science, math, geography, and other fields. These thinking skills include inquiry, visual literacy, understanding systems and models, and the ability to apply knowledge and problem solving to a range of real-world issues.

Title: SBIR Phase II: Affordable Handwriting Capture Device for Augmenting Communications Within Groups

Award Number: 9983371
Program Manager: Sara Nerlove

Start Date: May 15, 2000
Expires: April 30, 2002
Total Amount: $396,006
Investigator: Kurt Goszyk, kurt@cyberscan.com
Company: CyberScan Technologies
82 Walker Lane
Newtown, PA 18940
Phone: (215)860-8082

Abstract:

This Small Business Innovation Research Phase II project provides an affordable means of electronically enhancing the nation's installed chalk, white, and drawing board base of 2.5 million units. By adapting conventional writing surfaces rather than replacing them with expensive electronic white boards or graphics tablets, academic institutions, corporations, and governments could save approximately $10 billion in new equipment and installation costs. CyberScan Technologies proposes to develop a retrofittable, low cost, area adaptive product that can optically capture notes, drawings or sketches to a computer or to the Internet. CyberScan will refine the feasibility of digitizing hand strokes in real time that it demonstrated in Phase I using a small optical sensor and an optically transmitting pen or chalk holder. CyberScan's objective is to convert written information on standard school chalk board surfaces of nine feet by four feet into electronic data suitable for display on a PC SVGA display screen and posting on Internet Web pages.

Potential commercial applications of the research include: CAD/CAM digitizers, low cost and portable electronic white board alternatives, video conferencing input devices, medical patient charting, and academic, corporate, military, and government interactive presentation devices. Because of the serious interest of three potential marketing partners in the electronic white board field, rapid commercialization of products beyond Phase II is extremely likely.

Title: SBIR Phase II: Web-Based Touch Display for Accessible Science Education

Award Number: 9983472
Program Manager: Sara B. Nerlove

Start Date: June 1, 2000
Expires: December 31, 2003
Total Amount: $500,623
Investigator: George Anastas, janastas@immersion.com
Company: Immersion Corporation
801 Fox Lane
San Jose, CA 95131
Phone: (408)467-1900

Abstract:

This Small Business Innovation Research Phase II project from Immersion Corporation takes advantage of an opportunity to turn an emerging mainstream computer technology into a universal accessibility tool. During Phase I, researchers at Immersion Corporation and at Oregon State developed enabling software technologies for Web-based force feedback and put them to use by designing a physics computer laboratory module. The module allowed students to actually FEEL forces while holding a simulated charged particle in an electric field, take data points, and then feel a plotted curve using prototypes of a force feedback mouse. Such mice have received excellent reviews from mainstream users who enjoy the ease-of-use and excitement of feeling GUI objects and computer feel effects and have met with enthusiasm from blind users, who require the best touch interfaces at the lowest cost. Phase II will expand the enabling technology, curriculum, and evaluation work begun in Phase I, and it will add interaction with accessibility software developers. Enormous potential exists for accessibility research to push the cutting edge of force feedback technology and for accessibility applications to take advantage of mass market economies of scale, creating a true universal accessibility success story. Over 110 million computer mice are sold each year. Web-based applications will substantially drive the adoption of force-feedback mice.

The proposed Internet force feedback innovations will accelerate market penetration. Development of educational applications will boost the market for accessible science education. The technology could also give a competitive advantage to screen reader companies.

Title: SBIR Phase II: Three Dimensional Video Motion Detection for Science and Mathematics Learning

Award Number: 0078672
Program Manager: Sara B. Nerlove

Start Date: September 1, 2000
Expires: August 31, 2002
Total Amount: $399,937
Investigator: Nathan Kimball, nathan@albertiswindow.com
Company: Alberti's Window, LLC
304 Pleasant Street
Watertown, MA 02472
Phone: (617)923-8450

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will complete the research and development to product of a low-cost tool for exploratory science and math learning, a three-dimensional motion detector. This device uses a passive optical detection scheme with two ordinary home video cameras as sensors. For at least 15 years, systems that capture and display motion in real-time have been used for studying the meaning of graphs and to investigate physical phenomena, and their educational effectiveness has been researched and documented. To date, all low-cost systems have been constrained to one dimension, and generally use ultrasonic echo location. This project will make 3D-motion detection affordable and competitive with one-dimensional systems when used with schools' existing video equipment. It offers great learning potential by allowing students to build a bridge from their universal 3D-world experience into mathematical space. The Phase II project proceeds along three fronts: refinement of the signal processing hardware, coding of the 'host' software for capture, display, and analysis of the 3D data, and the development and testing of educational activities. The software and activities are targeted for high school mathematics and physics.

This small business proffers a hands-on exploratory system to allow students multiple views and ways of understanding the complex study of motion. Several of the largest national distributors of educational electronic laboratory equipment have demonstrated interest in selling and promoting the motion detector.

Title: SBIR Phase II: Digital Cadaver - An Immersive Environment for the Direct Reconstruction of Anatomical Data Sets

Award Number: 0078774
Program Manager: Sara B. Nerlove

Start Date: August 1, 2000
Expires: July 31, 2002
Total Amount: $399,713
Investigator: Thomas McCracken, tmccracken@visiblep.com
Company: Visible Productions LLC
201 Linden Avenue, Suite 301
Fort Collins, CO 80524
Phone: (970)407-7240

Abstract:

This Small Business Innovation Research Phase II project will continue research and development of the Digital Cadaver Environment -- software that makes available to students multiple views of virtual cadavers with improved visual quality of the computed image, an increase in the size and attributes of the data sets used for rendering images, support for automatic configuration of imaging parameter using heuristics, and support for interpolation of missing sections of a user stain document. Marking a unique approach to the application of computer technology to the undergraduate anatomy and physiology curriculum, this environment supports an interactive work model where students engage in the cycle of observation, interpretation, and action that characterizes the historic "dissect & sketch" paradigm. The Digital Cadaver environment allows students to produce an individual and unique record of their investigations. The Phase I demonstrated the feasibility of implementing the core functionality of the environment as a Java application and produced a beta version of the software. Phase II of the research will focus on research extending this development in four areas: 1) Tools for collaboration between students will be created, and an intuitive project management system implemented for managing collections of images and documents; 2) Imagery from Visible Productions will be introduced into the environment to overcome defects in the Visible Human (VH) data sets; these images may also serve as links to other content, such as animations, photographs, or other images and documents that serve to augment the current environment; 3) tools will be expanded to include volume rendering of images in all viewing planes (i.e., sagittal, coronal, and axial) and arbitrary slicing of any image set; the data sets available to the student will be expanded to include selected cryosections of the female VH data set and selected MRI (magnetic resonance imagery) and CT (computerized tomography) imagery from the male and female; and 4) on the server, a more sophisticated illumination model will be implemented for added realism, user selectable image display properties will be included (i.e., setting some tissue layers to transparent), and higher resolution images will be used; improved support for higher resolution images will complete the Digital Cadaver Immersive Environment.

Title: SBIR Phase II: Real-Time Image Processing Based Motion Detection for Science and Mathematics Learning

Award Number: 0321625
Program Manager: Sara B. Nerlove

Start Date: July 1, 2003
Expires: June 30, 2005
Total Amount: $499,957
Investigator: Paul Antonucci, paul@albertiswindow.com
Company: Alberti's Window, LLC
304 Pleasant Street
Watertown, MA 02472
Phone: (617)923-8450

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will create a software-based, real-time, single camera, direct-to-computer, two-dimensional motion analysis system for education using image-processing technology. Image processing has not previously been used in educational motion detection. Compared to the commonly used methods--real-time one-dimensional graphing and frame-by-frame analysis of stored video—this innovation has many advantages, such as the simultaneous real-time display of video and graphs, multidimensional operation, ability to operate over any distance scale, display of the shape and orientation of objects, and the automatic generation of stroboscope-like images. This innovation creates the opportunity to surpass in learning effectiveness and ease-of-use the technologies now used widely in high school and college physics for the study of motion. In addition, it will potentially reach a much larger group--mathematics classrooms from middle school through college. The system will operate with ordinary classroom computers and ordinary digital video cameras.

Used in conjunction with inquiry-based curricula, Alberti's' Windows' system will be primarily used in physics and mathematics education classes. Improving the teaching of physics and mathematics is basic to science literacy and is essential to creating a technologically capable workforce. Ultimately, the following potential markets can also be explored: CAD/CAM, physiological/medical testing, sports, industrial monitoring and control, videogames, and security.

Title: SBIR Phase II: Understanding 'Construction/Deconstruction' and the Role of Resistance in Accelerated Learning

Award Number: 0091356
Program Manager: Sara B. Nerlove

Start Date: April 1, 2001
Expires: March 31, 2004
Total Amount: $499,959
Investigator: Lia A. DiBello, lia@wtri.com
Company: Workplace Technologies Research Inc.
1425 Russ Blvd.
San Diego, CA 92101
Phone: (619)232-8054

Abstract:

This Small Business Innovation Research (SBIR) Phase II project addresses the need to improve the success rate at which new technologies can be introduced into the workplace. A methodology and service, ATTAIN(TM), has been conceived to accelerate the integration of technology by rapidly and aggressively identifying critical processes and practices in the organization and shifting them in value-added ways at the level of worker cognition and operational specifics. This method has been shown to be highly successful, but is labor intensive, expensive, and requires highly skilled practitioners. Furthermore, the method upon which ATTAIN is based is not sufficiently targeted. That is, more often than not, businesses have only 3-4 workplace processes or practices that need to be changed in order to increase the company's competitiveness. The original method does not single these out as more important than other elements of the workplace. To date, increasing the effective incorporation of new technology by changing workplace practice and worker cognition through specialized simulation training has been successful. A significant remaining challenge lies in increasing the effective incorporation of new technology by identifying the most appropriate target for the technology implementation or change has been very successful. The work of Phase II will involve integrating the current methods with those of another company. Their method has been shown to identify the "vital few" practices that mitigate a company's overall competitive survival and which are the most appropriate targets for change. Phase II has two goals. First, a hybrid method that is quicker and more targeted will be developed. Second, a practitioner training approach and supporting materials that make it possible for professionals without extensive experience to deliver the method in a high quality manner will be developed.

Training and licensing practitioners in a hybrid method of workplace learning will contribute significantly to the problem of efficient and successful technology integration and implementation of new technologies.

Title: SBIR Phase II: Development of a Scanning Electron Microscope (SEM) Simulator for Use in Education

Award Number: 0321679
Program Manager: Sara B. Nerlove

Start Date: June 1, 2003
Expires: May 31, 2005
Total Amount: $499,820
Investigator: Gary S. Casuccio, gcasuccio@rjlg.com
Company: RJ Lee Group Inc
350 Hochberg Road
Monroeville, PA 15146-1516
Phone: (412)325-1776

Abstract:

This SBIR Phase II project will result in a low cost PC based interactive scanning electron microscope (iSEM) simulator incorporated into modules to enhance existing science curricula. Although the Scanning Electron Microscope (SEM) is an essential scientific tool and has major impact on our nation's industrial competitiveness, its utilization in education has been modest. Only a handful of high schools in the U.S. have access to instrumentation of this nature, and availability at colleges and universities at the undergraduate level is limited. The premise of this project is that the essence of microscopy instruments can be captured in a software-based simulator running on a personal computer such that entire classrooms can become virtual laboratories, with each student exploring a lesson using microscope-simulator software coupled with appropriate imagery and lesson material. The researchers will use the FERA (Focus, Explore, Reflect, and Apply) Learning Cycle model to develop iSEM enhancement modules and supporting materials to extend current curricula such as the National Science Resources Center's Science and Technology for Children (STC) and the Lawrence Hall of Science series of Full Option Science System (FOSS) and will include a component of professional development.

The iSEM will not only enable schools to perform more sophisticated scientific experiments and help schools meet the standards mandate, it will also help prepare students for joining tomorrow's workforce in this evolving age of nanotechnology. The educational component of the project that will be developed is inquiry-based, encourages explorations and is inexpensive enough that schools and students can afford to purchase it.

Title: SBIR Phase II: Connecting Science and Mathematics Through Data

Award Number: 0216656
Program Manager: Sara B. Nerlove

Start Date: September 1, 2002
Expires: August 31, 2004
Total Amount: $496,761
Investigator: Timothy E. Erickson, tim@eeps.com
Company: eeps
5269 Miles Avenue
Oakland, CA 94618-1044
Phone: (510)653-3377

Abstract:

This Small Business Innovation Research (SBIR) Phase II project creates new technology and materials that emphasize data analysis in science education. Data analysis makes scientific concepts and processes concrete and gives students another way - besides memorization or analytical understanding - to learn quantitative science, often bypassing the need for advanced symbolic mathematics. This project will emphasize physics classes in high school and beyond, where labs are often cookbook demonstrations of phenomena and the data analysis mere verification. The first phase of this research, with the help of new technology, provided evidence that, with the help of new technology, those students' understanding and competence could be improved beyond their previous capabilities. This project enhances that technology-Fathom Dynamic Statistics Software (KCP Technologies 2000) - to make it more useful in the science classroom, and it develops curriculum materials that use this software. Specifically, the firm will produce complete manuscripts for two supplemental books in physics appropriate for the high school, AP, or college introductory course: a lab manual and a book of problem sets. In addition, Epistemological Engineering will begin to explore and prototype additional materials in physics, materials for other sciences, and staff development offerings.

The proposed research will lead to significant enhancements to Fathom software and open the door to creating curriculum materials in science education using tools previously available only to math educators. Epistemological Engineering proffers technology that will contribute to strengthening science education in this country by teaching students to thoughtfully approach the world with a zest for measurement and prediction.

Title: SBIR Phase II: Web-Based Urn Sampler and Statistical Authoring Environment

Award Number: 0091412
Program Manager: Sara B. Nerlove

Start Date: April 1, 2001
Expires: March 31, 2003
Total Amount: $500,000
Investigator: Peter C. Bruce, pbruce@cytel.com
Company: Cytel Software Corporation
675 Massachusetts Avenue
Cambridge, MA 02139-3309
Phone: (617)661-2011

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will create web-based courseware featuring software (the "Urn Sampler") built around the simulation/resampling method in statistics, which focuses on the process of formulating a statistical test. This courseware will also feature a statistics text (Statistics: Making Sense of Data by Stout, Marden and Travers), self-assessment tools, a "Virtual Professor" help system, a "Virtual Statistics Consulting Lab," and entry-level spreadsheet-based statistical software. The target market is students in introductory statistics courses, who will purchase the product just as they now purchase texts. The courseware aims to leverage the latest and most standard web technologies that are anticipated to be in place at the conclusion of the project's development phase.

The plan combines the power of a web-based structure with the new resampling techniques to create a unique learning environment for statistics students. The Urn Sampler will be an open and flexible lab tool that will let teachers create exercises to supplement class lectures and other course materials. It will make it easy to teach the new compute-intensive resampling methods that have proven successful in teaching statistical inference. It addresses a diverse audience, including undergraduate and graduate students taking a required course in quantitative reasoning or statistics, students taking an undergraduate major or minor in statistics, graduate students studying statistics, and continuing education students. Additional product sales will come through purchases of parts of the web product by students whose instructors have adopted a text other than the Stout, et al. text.

Title: SBIR Phase II: Interactive Tools for Active Learning (ITAL)

Award Number: 0110363
Program Manager: Sara B. Nerlove

Start Date: September 1, 2001
Expires: August 31, 2003
Total Amount: $499,855
Investigator: Yakov E. Cherner, ycherner@ATeLearning.com
Company: Ate Learning
87 Stanley Road
Swampscott, MA 01907-1454
Phone: (978)282-1119

Abstract:

This Small Business Innovation Research (SBIR) Phase II project, ITAL-2 (Interactive Tools for Active Learning) will develop a comprehensive e-Learning solution for conventional academic Science, Mathematics, and Educational Technology (SMET) education and for corporate training. The project product, 'Active Learning Suites' (ALS), is a highly interactive online learning content delivery and management system. It includes an Active Shell, Simulations and Virtual Experiments, interactive lessons, a Problem Solving Tutor, a scriptable Instructor's Agent, an Assessment system, Authoring tools, and more. ALS uses real-life objects and situations, such as those related to home, telecommunications and sports, as the context for science investigations. Immersion in these contexts that are populated with appropriate sets of objects enables learners to discover the connections between the scientific theory and its practical applications in technology. Authoring tools helps instructors to easily assemble a single e-learning environment from heterogeneous educational resources and the WWW. ALS can facilitate both problem-based learning and more conventional learning strategies. It can be used on a campus or in a school equipped with either stand-alone computers or a local network, at home (self-learning), in a corporate setting, or via distance learning over the Intranet and Internet.

Active Learning Suites (ALS) offer a wide variety of lessons that can be designed to address many different audiences: (1) two-year college students enrolled in science, technology and engineering programs; (2) non-science majors; (3) high school students taking science and technology courses; and (4) instructors and technicians of telecommunications companies. The approach of immersing students or technicians in practical problems has great potential for facilitating understanding of science.

Title: SBIR Phase II: Advanced Software for Interactive Chemistry Tutoring

Award Number: 0132003
Program Manager: Sara B. Nerlove

Start Date: February 15, 2002
Expires: January 31, 2004
Total Amount: $500,000
Investigator: Benny G. Johnson, johnson@quantumsimulations.com
Company: Quantum Simulations Inc
5275 Sardis Road
Murrysville, PA 15668
Phone: (724)733-8603

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will produce a set of completed and commercially viable intelligent tutoring systems for chemistry education, building upon a rule-based, model-tracing, cognitive modeling tutor prototype for chemical equation balancing. Teachers, students, parents and administrators state that existing chemistry education software does not satisfy their need for truly interactive and on-demand computer instruction. Current approaches are rigid and linear, offering only a limited number of fixed and statically scripted problems. They do not deal with the individual student's own work in any meaningful or intelligent way. By simulating reasoning using chemical principles rather than compiling a database of problems and answers, artificial intelligence methods can provide a route to overcoming these serious fundamental limitations. Although the technology proffered by Quantum Simulations, Inc. is technology that will assist all students, those students of average or marginal performance will benefit the most.

Creating tutoring systems that can function as guides and not just as graders of student work is an important step in realizing the full value of computers in education. The proposed work takes a significant step in this direction. Moreover, the technology has been designed in a general way such that it can be applied to other educational topics beyond chemistry and can work together in a synergistic, value-added fashion with other tools and curricula in a multi-resource learning environment. Quantum Simulations, Inc., customers are driven by strong end user needs and include textbook publishers, software provides, and distance learning companies.

Title: SBIR/STTR Phase II: Census Microdata in the Classroom

Award Number: 0131833
Program Manager: Sara B. Nerlove

Start Date: March 1, 2002
Expires: February 29, 2004
Total Amount: $499,831
Investigator: William F. Finzer, bfinzer@keypress.com
Company: KCP Tech
1150 65th Street
Emeryville, CA 94608
Phone: (510)595-7000

Abstract:

This SBIR Phase II project proposes to research ways to increase accessibility and utilization of microdata from censuses of the U.S. and other countries in secondary school and college courses in mathematics. A seamless, XML-driven interface to a web server at the Minnesota Population Center will make it possible for teachers and students to specify, request, and import this microdata into Fathom Dynamic Statistics software. Enhancements to Fathom software will increase its already considerable ease and power for working with census microdata; curriculum materials in mathematics will provide teachers with effective ways to begin working with this highly motivating data--both to teach existing content and to teach data literacy. Phase I research suggested strong similarities between census microdata and school census microdata data that is gathered by K-12 schools about student demographics and performance, course offerings, and classroom practice. Accordingly, Phase II leverages this overlap to produce greatly needed interfaces for easily accessing school census microdata, survey tools for producing it, and extensions to Fathom for analyzing it. KCP Technologies' census microdata project exploits the merging web connectivity in American schools, thus symbiotically fitting a larger pattern of evolution of school technologies.

The project offers a product that supports analysis of complex data through an easy-to-use interface, which will contribute to data analysis and learning from data analysis. U.S. education is very much in need of the kinds of software and curriculum resources to be produced under this project.

Title: SBIR Phase II: Education on Demand for Technique Training

Award Number: 0239180
Program Manager: Sara B. Nerlove

Start Date: March 15, 2003
Expires: February 28, 2005
Total Amount: $499,716
Investigator: Cesar Bandera, bandera@ieee.org
Company: Creneaux
145 Avenue of the Americas
New York, NY 10013-1548
Phone: (212)337-3203

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will develop and evaluate a delivery platform for interactive rich media and effective simulation-based e-learning. The platform will interface with learning content authoring and management systems that are scaleable to commercial operation without further development. Interoperability is achieved through verified compliance with the Advanced Distributed Learning Initiatives Shareable Content Object Reference Model, and the ability of the platform to directly admit and reuse e-learning assets in all pervasive formats. Rich media is represented in an object-oriented fashion that retains the identity of each media asset in order to: (1) facilitate courseware maintenance and reuse; (2) allow referenced server bandwidth and storage utilization, and system scalability; (3) enable data rights management of individual assets and diverse revenue models; (4) render content as an interactive multimedia engagement that promotes attention retention and the reinforcement of learner skills without the need for special hardware; (5) tailor content to diverse client platforms, distribution channel configurations, and the individual demographics, curriculum certification, and physical handicap of the learner; and (6) enable client-side rendering of high-definition content not possible to deliver pre-rendered over conventional Internet access.

The proposed system enables learners to receive courseware of higher audiovisual quality, greater interactivity, more referenced personalization, and with greater learner retention than that possible with current streaming technologies. Interoperability with existing learning content management systems, and scalability to large and diverse audiences strengthen commercialization potential. Enabling technologies that rely on rich-media delivery, such as collaborative visualization and distributed interactive simulation, are also supported by the proposed object-oriented rich media representation.

Title: STTR Phase II: Lifelike Virtual Tutors to Support Authentic Learning

Award Number: 0620486
Program Manager: Ian Bennett

Start Date: August 24, 2006
Expires: August 31, 2008
Total Amount: $497,843
Investigator: Edward Sims, eds@vcom3d.com
Company: VCOM3D, Inc.
3452 Lake Lynda Dr. Suite 260
Orlando, FL 32817
Phone: (407)737-7310

Abstract:

This Small Business Technology Transfer (STTR) Phase II project will develop proof-of-concept, Web- or CD-delivered Virtual Reality (VR) simulations that incorporate lifelike virtual tutors, capable of demonstrating and performing science experiments and communicating in written or spoken English or sign language, for Grades 5-8 curricula.

This project provides an opportunity to broaden participation of under-represented groups in authentic learning experiences, through the use of lifelike virtual tutor avatars. Originally conceived as a means to explain concepts visually and with sign language to deaf students with low English skills, these virtual tutors will benefit a broader range of learners who are otherwise isolated by language or reading barriers, or by lack of access to laboratory equipment.

Title: SBIR Phase II: Cognitive Agility Assessment Tool

Award Number: 0548631
Program Manager: Sally Nerlove

Start Date: January 6, 2006
Expires: March 31, 2008
Total Amount: $532,000
Investigator: Lia DiBello, lia@wtri.com
Company: Workplace Technologies Research Inc.
1425 Russ Blvd.
San Diego, CA 92101
Phone: (619)232-8054

Abstract:

This Small Business Innovation Research (SBIR) Phase II project focuses on the development of an assessment tool that will enable users to profile a decision-maker's cognitive agility and expertise in high-level business situations. It is appropriate for evaluating decision makers in organizations and students who aspire to leadership roles. This version of the product can also be self-administered. It is based on results from recent basic research conducted by Workplace Technologies Research Inc. (WTRI) that revealed the cognitive mechanisms involved in the thinking of highly accomplished experts in business. It uses knowledge elicitation technology that WTRI has developed over several years to support research on the identification of intuitive expertise (in the sense of Dreyfus 1997). The proposal outlines a plan to develop an on-line Internet based version that is self-scoring and tested among well-known experts. The product will be field-tested for its ability to predict general vs. industry specific expertise. The expected outcome is an easy to use tool for professional evaluators, professors, students or individuals, which will assist in staff development and education. The profiles generated by the product will identify hidden strengths, areas of weakness, and suggestions for further development. The long-term goal is distribution by recruiters, coaches, universities and consultancies.

In the current climate of rapid workplace change, decision-makers need to continually evaluate their ability to adapt to changes and re-invent their organization's value and competitive future. Few assessment tools address the cognitive underpinnings of the skill set involved. Rather, they evaluate personal traits or sub-skills that have some correlation with leadership, broadly defined. Using an empirically verified model of expertise in business strategy development and performance prediction, the research team at WTRI has built an assessment tool that locates an individual with regard to this model; much like chess players are evaluated against a notion of a Chess Grand Master. When applied to individual client situations, this tool has been shown to have powerful predictive capability and thus has successfully informed staff development efforts. Its distinctive feature is assessment of the ability to analyze disparate sources information in order to make strategy level decisions and supporting tactical plans. Making the tool more widely available and usable by non-scientists could importantly contribute to efforts to increase the performance of both organizations and decision makers. Organizations, distributors and several institutions of higher learning have expressed interest in this technology, which they consider to be addressing an area of unmet need.

Title: SBIR Phase II: Visualization of Massive Multivariate Adaptive Mesh Refinement (AMR) Data

Award Number: 0548729
Program Manager: Sally Nerlove

Start Date: January 23, 2006
Expires: February 29, 2008
Total Amount: $430,385
Investigator: Lisa Avila, lisa.avila@kitware.com
Company: Kitware Inc
28 Corporate Dr #204
Clifton Park, NY 12065
Phone: (518)371-3971

Abstract:

This Small Business Innovation Research (SBIR) Phase II project addresses the lack of visualization technology for hierarchical structured grids created through an advanced simulation process known as Adaptive Mesh Refinement (AMR). Although the AMR structure makes possible simulations that are too computationally expensive using a uniform grid approach, it leaves the scientist with a lack of visualization tools to properly render the resulting volumetric data. With the successful completion of this Phase II effort, Kitware will meet this need by developing visualization tools that are focused on efficiently and effectively rendering the large, multivariate, time-varying data produced using the AMR technique. The primary technical accomplishment of the Phase II effort will be the development of a high performance volume rendering strategy for AMR data that runs across a variety of platforms from a standard desktop system to a large cluster of high-end workstations. Advanced transfer function techniques will aid scientific discovery by allowing scientists to visualize relationships in their data. Packaging these visualization tools into a user-friendly application will make this complex technology accessible to researchers. In addition, Kitware will adapt this technology to the clinical medical visualization market, where large, multivariate, hierarchical data will become commonplace in the near future.

The state-of-the-art AMR visualization technology developed during this Phase II project will be donated to the scientific community as part of two open-source packages. This technology will be available to software developers through the Visualization Toolkit (VTK), a C++ class library of visualization, graphics, and image processing algorithms. This technology will also be incorporated into the end-user scientific visualization application ParaView, which can run on a desktop computer or across a high performance cluster. Through the use of extreme programming principles, these open source packages are developed, tested, and released daily, allowing Kitware to deliver the latest technology for immediate use by the scientific community. In return, this provides Kitware with continual feedback from users and developers that will help the firm to improve not only the open source software, also the firm's commercial products that are built on top of this code base. Kitware intends to leverage the Research Opportunities for Undergraduates (REU) and Research Opportunities for Teachers (RET) programs to build a team of students and teachers who will generate educational material from the software including lesson plans, presentation materials, animations, and suggested projects. This material will be distributed to educators at the high school and undergraduate levels.

Title: SBIR Phase II: Advancing an Interactive Learning Platform by Integrating Multiplayer Game Technology

Award Number: 0548732
Program Manager: Sally Nerlove

Start Date: January 23, 2006
Expires: January 31, 2008
Total Amount: $500,000
Investigator: Douglas Seifert, douglas.seifert@syandus.com
Company: Syandus, Inc.
760 Constitution Drive
Exton, PA 19341
Phone: (610)321-2500

Abstract:

This Small Business Innovation Research (SBIR)Phase II project advances Syandus's interactive learning platform by integrating multiplayer game technology. Syandus's current interactive delivery platform allows pharmaceutical firms and content experts to communicate complex concepts to physicians and patients through interactive presentations, discussion groups or self-directed learning. The addition of network-enabled collaboration afforded by this proposed project creates the opportunity for interaction between users and content experts without the constraints of geography. The integration of multiplayer game technology into Syandus's platform requires the innovative application of this technology to serve a new purpose. This proposal will support modification of the existing platform to function in a collaborative setting, building a collaborative engine to synchronize application data between users, integration of a third party multiplayer networking solution and development of a prototype application to test collaborative functionality. Syandus has completed projects with several of the top 20 pharmaceutical companies for the delivery of innovative medical education products based on the existing platform. In the first business application derived from this proposed concept, physicians will be able to remotely connect with nationwide content experts to interactively learn the latest best practices and medical science in a more compelling way than currently available.

The pharmaceutical industry strives to communicate medical science innovation and new treatment methods through an information cascade from international and national level thought leaders, to regional physician thought leaders, to practicing physicians and their patients. The anticipated results from the proposed concept will be a learning tool for pharmaceutical companies that allow groups of physicians nationwide to have an interactive dialog about a disease state and appropriate treatment. Longer term, in the educational realm, Syandus's technology could be used to develop more sophisticated collaborative learning environments that allow students, regardless of geographical location, to assemble in a virtual biological world or system (such as a cell or organ) and work together as individuals or in groups to solve problems and optimize processes. A highly rewarding learning experience can be created through the free exchange of information and ideas enabled by a collaborative network coupled with compelling visuals, rich interactivity and the underlying intelligence of mathematical models. Transforming Syandus's existing platform with multi user capability adds rich human interaction into the remote learning process, brings scientific models to life, and allows greater dissemination of knowledge.

Title: SBIR Phase II: Developing a Cost-Effective Method for Creating Cognitive Models for Cognitive Tutors

Award Number: 0548754
Program Manager: Sally Nerlove

Start Date: January 9, 2006
Expires: December 31, 2007
Total Amount: $509,999
Investigator: Stephen Gilbert, stephen@clearsighted.net
Company: Clearsighted
Suilte 4210
Ames, IA 50010
Phone: (515)233-5137

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will make the creation of effective intelligent tutoring systems (ITSs) easier, and it will enable the dissemination of that technology to a broader audience than currently realized. ITSs have proven to be highly effective in delivering computer-based instruction, but they have historically been expensive and difficult to build, requiring specialized skill in artificial intelligence and production systems programming. Building upon Clearsighted's Phase I accomplishments, the firm will: (1) finish a fully-functional software development kit (SDK) that will allow non-cognitive scientists to create the cognitive model that powers an ITS; (2) develop technology that will enable an ITS to communicate to the vast majority of third-party software; (3) develop techniques that will allow an ITS to work with an institution's existing on-line learning system; and (4) evaluate the research team's work with respect to both time-savings in building ITSs and customers' return on investment. Two main results are anticipated: (1) a two- to three-fold decrease in the amount of time it takes to author an ITS; and (2) an estimated savings to customers of 30% per hour of the cost of traditional training time.

The success of ITSs is well documented (e.g., Koedinger, Anderson, Hadley, & Mark, 1997; Corbett, 2001; Morgan & Ritter, 2002). However, ITSs have not been broadly deployed, due to the high level of expertise needed and the cost to create. Furthermore, lack of viable options to interface the cognitive model of an ITS with already existing software impairs wider dissemination of that technology. By increasing technological understanding of how to reduce the amount of the expertise needed to create an ITS and how to accomplish interfacing ITSs with existing software, the result of this supported work will be a wider distribution of ITSs. Clearsighted is well poised to become a market leader in on-line technical training by leveraging this technology. Clearsighted has partnered with Carnegie Learning, the ITS leader in K-12 education to assist in these goals, and it has the additional expertise needed to perform the required work. By transitioning ITS technology from its currently very small market to a wider audience that includes not only education, but also corporate and industrial applications, the costs to the many companies and institutions that do on-line training will greatly decrease, and the productivity of their workers will increase.

Title: SBIR Phase II: Incorporation of Knowledge Base into Statistical Machine Translation

Award Number: 0548763
Program Manager: Sally Nerlove

Start Date: January 11, 2006
Expires: December 31, 2007
Total Amount: $500,000
Investigator: Yookyung Kim, kim@sehda.com
Company: Sehda
455 Fairchild Dr. Suite 123
Mountain View, CA 94043
Phone: (650)864-9900

Abstract:

This Small Business Innovation Research (SBIR) Phase II project embodies an innovative approach to machine translation. The proposed model aims to overcome two important bottlenecks in the development of a high quality statistical machine translation (SMT) system: (1) inability to handle structural problems and (2) dependence on huge amounts of parallel texts. The inability of statistics to sufficiently handle grammatical problems such as word order becomes more evident when the language pair is very different in structure and morphology, such as with English and Korean. The dependence on a huge amount of parallel texts is a great challenge especially to speech translation. Based on successful tests in the Phase I project, this project proposes a method to learn linguistic knowledge crucial to handling word order and non-local dependencies automatically from input and incorporate it into SMT along with simple transformations, maximizing the strength of both knowledge-based approaches and statistical approaches, and minimizing the need for ever-increasing amounts of bilingual data. The proposed approach aims to build a syntactic-phrase-based statistical machine translation engine that not only is more accurate than the existing word-based ones, but also can decrease the need for large data sources.

The primary impact of the proposed project is the potential for achieving automatic translation quality as high as the quality of the best knowledge-based machine translation engines; but with a minimum of handcrafting of knowledge and therefore at a much lower cost in terms of development time and human resources. While the research is specifically concerned with MT between English and Korean, the resulting translation models would potentially be usable for translation between any pair of languages. The result of the research will be used to develop a speech translation device, in particular to overcome language barriers in communication with patients in hospitals. It will provide a key technology that will accelerate development of speech translation applications in order to reduce costs of healthcare providers and to enhance the quality of healthcare. Additionally, the proposed method of learning linguistic features will have an impact on many different applications including speech recognition, search engines, genre and topic detection, and document search and query. Finally, the proposed research will have beneficial impacts nationally and globally by helping to solve the 'automatic translation' problem, an area of paramount importance to the economic welfare and security of the United States and the rest of the world.

Title: SBIR Phase II: Creating New Learning Opportunities: Platform-Independent, Wireless, Task-Oriented Communities

Award Number: 0620327
Program Manager: Ian Bennett

Start Date: August 3, 2006
Expires: July 31, 2008
Total Amount: $499,958
Investigator: Michael Curtis, curtis@goknow.com
Company: GoKnow
2084 South State St
Ann Arbor, MI 48104
Phone: (734)929-6602

Abstract:

This Small Business Innovation Research (SBIR) Phase II project aimes to design and develop a challenging and critically important layer of communications' software that enables K-12 educational software developers to incorporate explicit support for collaborative learning activities into their existing applications quickly and at low-cost. The Elmer Software Development Kit (SDK) will enable students to collaborate using a broad range of handheld (or even desktop/laptop) computer platforms (Windows CE & XP, Linux, Mac OS X) since classrooms, as they are already beginning to experience, will be using non-homogenous computers side-by-side. The Intellectual Merit of this proposed effort stems from the need to construct new algorithms to automatically detect other devices, to reformat communications' messages to enable cross-platform (and cross-operating system) communication on a range of platforms. The outcome of this effort should be a software development kit that engenders the incorporation of collaborative learning strategies.

K-12 education is the cornerstone of America's democracy. As No Child Left Behind (NCLB) act acknowledges, America has some serious work to do in reinventing how we educate our children in order for America to continue to provide its people with the standard of living that is the American Promise. Technology is today's generation's tool of choice outside of school; we need to make technology an integral tool inside of school, too. Advocating for technology is the easy part - making the technology accessible, useful, and enjoyable remains the challenge. Our SBIR project goes directly to the core of helping K-12 realize the vision of technology positively impacting teaching and learning. In particular, the proposed research will enable educational software developers to create, quickly and at low cost, collaboration-enabled applications that teachers demand and that students find enjoyable and productive.

Title: SBIR Phase II: Providing Tools for Richer eLearning Assessment

Award Number: 0620380
Program Manager: Ian Bennett

Start Date: August 3, 2006
Expires: July 31, 2008
Total Amount: $500,000
Investigator: Linda Chaput, lchaput@thinkfive.com
Company: Agile Mind
1100 South Main St
Grapevine, TX 76051
Phone: (817)424-2863

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will study effective models for carrying out assessments employing challenging puzzle-like questions that incorporate distractor analyses in which meaning is assigned to complex responses. Such distractor analyses apply where there is the possibility that the test taker can give alternative correct, partially correct, and incorrect answers. Metadata and distractor analyses will be combined to provide in-depth reports on student test performance. This new rule-based solution to distractor analysis meets a significant challenge in being able to include engaging problems in assessments of student progress in quantitative courses, such as Algebra and Geometry. The research will further develop question authoring and test construction tools.

As a consequence of this work, educators using these new technologies will be able to move beyond online testing based solely on multiple-choice, single-answer questions that are known to be unmotivating for many students. The goals are twofold: to provide varied, interesting, and even gamelike learning interactions that incorporate motivational and pedagogically valuable feedback; and to do so in a form in which empirical evidence can be used to improve the assessment corpus - both the metadata and the rules used for defining distractor analysis, especially where the items are novel question types.

Title: SBIR Phase II: Understanding the Nature of Science

Award Number: 0620590
Program Manager: Ian Bennett

Start Date: September 15, 2006
Expires: August 31, 2008
Total Amount: $499,930
Investigator: Timothy Erickson, tim@eeps.com
Company: BigTime Science
5269 Miles Ave
Oakland, CA 94618
Phone: (510)653-3377

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will deliver simulations over the web for secondary and post-secondary science instruction which focus explicitly on students coming to understand the "nature of science." The nature of science implies that both the underlying logic of scientific discovery and the way that science is organized around the acquisition and dissemination of data and ideas. This is the big picture in science learning -- establishing the relationship between experiments and hypotheses; the idea that theories are models and not reality, and that the test of a theory is its predictive power. The research focuses on the careful design and testing of both the simulations and the lessons in which they are embedded, to ensure that they are as effective as possible.

Tomorrow's citizens need to know how science works. This project will help erase dangerous misconceptions about the origins and extent of scientific knowledge, and give students tools to evaluate scientific (and quasi-scientific) claims more effectively. This project also probes unusual models for both delivery of instruction and commercialization in the education world: it will use the Internet not to deliver content but to mediate a simulation and promote inter-group communication, usually within a single classroom rather than more widely; and will do so using subscriptions - a way that is cost-effective to the teacher in the short term.

Title: STTR Phase II: Intelligent Instruction Systems using Augmented Reality

Award Number: 0646587
Program Manager: Ian Bennett

Start Date: March 15, 2007
Expires: February 28, 2009
Total Amount: $499,022
Investigator: Jayfus Doswell, juxtopia@hotmail.com
Company: Juxtopia
6581 Hickman Terrace
Alexandria, VA 22315
Phone: (703)989-1199

Abstract:

This Small Business Innovation Research (SBIR) Phase II research project investigates the creation of intelligent instruction systems that exploit adaptive software mechanisms (i.e. intelligent software agents) and augmented virtual reality (AVR) techniques. Since it is common that production-line employees are required to wear goggles, intelligent agents could transfer their instructions via goggle-like wearable computers (i.e. AVR) that overlay the actual visual field with text and computer graphics. The proposed techniques will facilitate the real-time assessment of employees undergoing training and will allow the software agents to automatically and proactively reinforce weaker areas based on these assessments. An overall assessment model of all employees can characterize the entire workforce for a particular facility. For example, this overall assessment can be used to enhance resource management triggered by absenteeism or other factors, allowing planners to use such assessments for optimizing manufacturing processes by refactoring traditional, perhaps obsolete, production processes.

The broader impacts of the technology result from the use of intelligent agents to manage and direct the cross-training of employees in typical work environments where absenteeism and workforce turnover are important issues. Additionally, this technology, through workforce training broadly impacts the workforce to become more adaptive and agile with the resulting positive impact on overall product quality and productivity.

Universal Access

Title: SBIR Phase II: Intelligent World Wide Web (WWW) Access for the Visually Impaired

Award Number: 0091590
Program Manager: Sara B. Nerlove

Start Date: July 1, 2001
Expires: December 31, 2003
Total Amount: $455,568
Investigator: Marcus J. Huber, marcush@marcush.net
Company: IRS
4976 Lassen Drive
Oceanside, CA 92056-5440
Phone: (760)806-1497

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will develop screen reading software (used by the visually disabled to access computers) that responds to changes in task context. The proposed software will allow screen readers to automatically generate task-specific scripts--sophisticated macros that determine the behavior of the screen reader in response to the current state of an application--based on an analysis of the user's actions while performing a specific task. The end result of this project will be a functioning prototype screen reader (based on Henter-Joyce's JAWS (Job Access With Speech) screen reader) with the ability to observe the user's actions, identify the user's goal based on those actions (referred to as plan recognition), and then either create a script that automates the task of achieving that same goal in the future or remind the user that such a script already exists. Throughout the course of the project, feedback will be sought from members of the visually impaired community through user trials, focus groups, and formal experimentation. While investigators will work exclusively with the JAWS screen reader during Phase II, many of the algorithms developed during this project will be applicable to other screen readers. The software developed will be licensed to others to improve the performance of existing and new screen readers.

The enhanced screen reading software will provide a number of significant benefits. First and foremost, the visually impaired will have significantly improved access to computers for both personal and job-related activities. They will be able to use computers for tasks that were previously impossible or impractical, and they will be able to perform their current activities faster and more effectively. Second, employers will be more open to employing the visually impaired because of the reduced cost in time and effort of job training and the increased level of productivity; visually impaired employees will be able to do more jobs, will be able to learn jobs faster, and will be able to do their jobs better than before.

Title: SBIR Phase II: Accessible Electronic Mathematical Content

Award Number: 0522308
Program Manager: Ian M. Bennett

Start Date: August 1, 2005
Expires: July 31, 2007
Total Amount: $499,959
Investigator: Neil Soiffer, neils@dessci.com
Company: Design Science, Inc.
140 Pine Ave
Long Beach CA, 90802
Phone: (562)432-2920

Abstract:

This Small Business Innovation Research (SBIR) Phase II project makes mathematical expressions in common electronic formats seamlessly accessible to people with print disabilities. Print disabilities include blindness, low vision, dyslexia and other learning disabilities. While others have explored aspects of accessibility in stand-alone applications, none have integrated access to mathematical content for those with print disabilities into users' existing screen readers or other assistive technology. The advantage of this project's approach to math accessibility is that it allows documents containing math to be read with standard browsers and document viewers. The electronic formats supported by this project are web pages that encode math using MathML, Microsoft Word documents, and PDF. Accessibility is achieved by providing software add-ons to Internet Explorer, Word, and Adobe Reader, and modifications to the industry leading authoring and publishing workflow tools to embed MathML into these formats. The project brings together work on various aspects of making mathematical content accessible. It pushes forward the state-of-the-art in audio rendering of mathematical expressions, navigation of mathematical expressions with audio feedback, and audio rendering synchronized with highlighting of the sub expression being spoken. The project provides a platform that allows other NSF-funded research projects to convert MathML to Braille math codes and other formats.

Accessibility of electronic content is a requirement of the Rehabilitation Act Amendments of 1998, Section 508. Many states have adopted similar requirements for state-funded entities. The Individuals with Disabilities Education Act (IDEA) mandates accessibility of school materials. Accessibility laws apply to all forms of content, not just textual content. Current solutions for math accessibility are so costly and time consuming that access to materials in a timely manner is not always provided to those that need the access despite legal mandates. The results of this project will present a fast and inexpensive route for publishers of textbooks with mathematical content to satisfy these laws. It will also provide a simple and painless way for people who author documents with math in them to make the document accessible to people with print disabilities. The availability of books and other material coupled with accessible authoring of mathematical content has the potential to dramatically enhance the way students with print disabilities are taught and learn mathematics, science, engineering and other technical fields

Title: SBIR Phase II: Commercial Combustion Synthesis of Homogeneous Lots of Carbon Nanotubes

Award Number: 0522093
Program Manager: Rosemarie D. Wesson

Start Date: July 1, 2005
Expires: June 30, 2007
Total Amount: $499,482
Investigator: Henning Richter, hrichter@nano-c.com
Company: NANO-C, Inc
33 Southwest Park
Westwood MA, 02090
Phone: (781)407-9417

Abstract:

This Small Business Innovation Research (SBIR) Phase II project is designed to achieve a pilot-plant demonstration of the technical and commercial feasibility of cost- and energy-efficient large-scale conversion of natural gas to single-walled carbon nanotubes (SWCNT). The research will include: (1) exothermic and selective synthesis of SWCNT by premixed combustion of natural gas after introduction of catalyst precursors with the cold gas mixture; (2) continuous collection of material by means of a bag-house filter; and, (3) detailed understanding of the correlations between operating conditions (pressure, type of catalyst, fuel-oxygen ratio, dilution with inert gas, cold gas velocity) and characteristics of the carbon nanotubes (single-, double-, or multi-walled, diameter, length, conductivity).

Results of this project are expected to have a significant impact on the development of the US nanotechnology sector and to strengthen its international competitiveness. Projected sales price of not more than $50/g will lead to a pronounced increase of the number of economically viable SWCNT applications.

Title: SBIR Phase II: Tactile Graphic Array

Award Number: 0450169
Program Manager: Ian M. Bennett

Start Date: February 1, 2007
Expires: January 31, 2007
Total Amount: $500,000
Investigator: Oleg Tretiakoff, oleg@catechnology.net
Company: C. A. Technology, Inc.
9500 S. Ocean Drive
Jensen Beach FL, 34957

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will conduct research leading to the development of working prototypes of new low cost and compact Tactile Graphic Displays and Braille Displays. The dominant technology today, displays driven by piezo-electric actuators, has two major deficiencies. It is very expensive, about $12 to $16 per tactile dot, and the actuator shape, a 50 to 70 mm long reed, significantly increases the volume of feasible displays, essentially limiting their use to single line Braille displays for desktop or portable devices. During the Phase I of the project, C.A.Technology performed extensive research on the design of a new Shape Memory Alloy single dot actuator and has demonstrated the feasibility of tactile displays based on this technology. This actuator uses a short and very thin Titanium-Nickel alloy wire, which will bring the cost per dot down to about $3 to $4, and will considerably reduce the display volume, allowing its use in hand-held devices. The Phase II effort will include the following: 1) detailed design, construction and user testing of the new tactile arrays; 2) development of software to interface these displays with various portable and hand-held devices, such as C.A.Technology's own Portable Print Reading Device; and 3) preliminary design of manufacturing tools and facilities.

In the mid-seventies, the appearance of the first electronic Braille displays changed the lives of blind individuals. Today, many have immediate and selective tactile access to textual information through refreshable electronic Braille displays. However, the high cost of these devices still severely limits their diffusion. By reducing their cost, their size and their weight, this new technology will increase the market penetration of Braille displays, making them accessible to many more blind and deaf-blind individuals and significantly improve their employment opportunities. Access to graphic symbols widely used for example in mathematics, chemistry and access to plain graphics is still only possible through slow, bulky and very costly graphic embossers. If a picture is "worth a thousand words", then a compact, low cost refreshable graphic tactile display proffers a significant new opportunity for the lives of blind students, blind engineers, blind physicists and blind people involved in almost any intellectual activity. In addition, it will also be important to those with low vision.

Title: SBIR Phase II: Assistive Reading Device for Persons with Disabilities

Award Number: 0321686
Program Manager: Om P. Sahai

Start Date: November 1, 2003
Expires: October 31, 2005
Total Amount: $495,114
Investigator: Irene Schipper, schipper@pageflip.com
Company: Pageflip, Inc
111 Woodmere Blvd South
Woodmere, NY 11598
Phone: (516)374-1607

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will develop an assistive reading device for persons with disabilities. The device, an electromechanical page turner, will serve to automate the mechanical tasks associated with page turning, an important ancillary process of reading. With the touch of a button/pedal, the page turner will automatically grab the next page of a book, turn it, and keep the book opened flat during the entire process. In the prior Phase I work, a novel turnstile design was introduced, and data was collected on bending stiffness, static and dynamic coefficients of friction, and the mechanical characteristics of paper. The Phase II project will integrate the Phase I results into an engineering effort to optimize the design and improve the performance and reliability of the page turner.

The commercial application of this project will be in the area of assistive technologies for people with disabilities, the elderly, musicians, and avid readers.

Title: SBIR Phase II: Creating Accessible Science Museums for Blind and Visually Impaired Visitors with User-Activated Audio Beacons

Award Number: 0421973
Program Manager: Sara B. Nerlove

Start Date: July 15, 2004
Expires: June 30, 2006
Total Amount: $499,710
Investigator: Steven Landau, sl@touchgraphics.com
Company: Touch Graphics
330 West 38 Street
New York, NY 10018
Phone: (646)515-3492

Abstract:

This Small Business Innovative Research (SBIR) Phase II project will demonstrate the effectiveness of a new system for guiding visitors in science museums and other public spaces. Touch Graphics will design, implement, and evaluate an apparatus that will allow any museum visitor to dial in to, and then interact with, a computerized attendant, using the visitor's own cell phone or one lent to him/her. A special feature will allow blind and visually impaired users to navigate independently by following sounds from environmental audio beacons that they will control by pressing keys on their phones. Once a visitor arrives at the requested exhibit component, his or her phone will serve as an audio explainer and control interface. While the development of this concept has been motivated by the desire to accommodate the needs of visually impaired museum-goers; in Phase II, the small business will configure the system as a mainstream audio guide product that includes optional accessibility features. The small business will create an experimental installation of the envisioned system in a large science museum in New York City, where it will undergo two rounds of human subject testing. As part of this installation, an interactive touch model of rockets that are part of the museum's collection will be designed, fabricated and tested to study the effectiveness of users' cell phones as an accessible control interface for individual exhibit components. The project will also be complemented by a parallel study in which user-activated audio beacon technology is deployed in a different context; a phone-based navigation tool will be implemented and tested as a travel aid for blind and visually impaired bus riders in Austin, Texas who need to find public access information.

This user-activitated audio-beacon technology has the potential to improve access to important public resources, particularly science museums for individuals who have been excluded due to disabilities. It seeks to provide opportunities for the blind and visually impaired to experience the enrichment and entertainment offered at hundreds of facilities around the country. These institutions offer opportunities for informal science education that can inspire people to pursue careers in science and technology, and the Nation as a whole stands to benefit when more qualified young people are encouraged to enter these crucial fields. Improved science literacy for all citizens, young or old, is an important goal that this project seeks to promote.

Title: SBIR Phase II: Accessible Scalable Vector Graphic Authoring and Editing Applications

Award Number: 0422218
Program Manager: Sara B. Nerlove

Start Date: August 15, 2004
Expires: July 31, 2006
Total Amount: $493,942
Investigator: Vladimir Bulatov, bulatov@viewplustech.com
Company: ViewPlus Technologies, Inc.
1853 SW Airport Ave.
Corvallis, OR 97333
Phone: (541)754-4002

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will support development and testing of Windows applications for creating and making available highly accessible SVG files. Scalable Vector Graphics (SVG) is a graphics markup language supporting features critical to accessibility by individuals with print disabilities. One application permits authors easily to create and/or edit mainstream graphical information as SVG files fully usable by individuals with print disabilities. Full accessibility requires only that authors supply names of important graphics objects, a task easily done with the SVG Editor. Most individuals with print disabilities can comprehend graphical information better by moving the mouse over text or graphics objects displayed in the ViewPlus SVG Reader, whereupon they hear the text or names of graphics objects spoken aloud. Blind users and those unable to use a normal mouse can also comprehend such information by creating a tactile copy on a ViewPlus Tiger embosser which can then be read with their fingers after placing it on a ViewPlus Touchpad. Sighted users can obtain an embossed color image with the new Color Embosser. Availability of an appropriate embosser and Touchpad means that even individuals with severe print disabilities can access mainstream graphical information without assistance by another human being. Computer users with severe print disabilities currently have good access to words but very poor access to graphical information. Lack of good access to graphs, charts, and diagrams severely affects quality of life and educational and professional opportunities, particularly in the STEM fields, i.e., science, technology, engineering, and mathematics.

Graphical information today is "made accessible" largely by written or verbal description. There is currently no practical way to make most graphical information available in a form usable by individuals who are severely dyslexic or for blind people, who may or may not read Braille. These new SVG applications will provide a user-friendly technology that fills that need. Graphical information can simply be created and displayed on the web or in electronic documents as SVG files that are usable by everybody. The hardware technologies needed by blind or severely dyslexic people should cost no more than a present-day Braille embosser, so it should be affordable for libraries and institutions to provide this capability thus to serve these clientele. The largest user base for the SVG Reader will probably be individuals with less severe print disabilities who can improve their comprehension by supplementing visual with audio information.

Title: SBIR Phase II: The Accessible Semantic Web

Award Number: 0349718
Program Manager: Sara B. Nerlove

Start Date: March 1, 2004
Expires: February 28, 2006
Total Amount: $532,208
Investigator: Edward Sims, eds@vcom3d.com
Company: VCOM3D, Inc.
3452 Lake Lynda Drive
Orlando, FL 32817
Phone: (407)737-7310

Abstract:

This Small Busees Innovation Research Phase II Project proposes to develop an Accessibility Markup Language (AML) that annotates digital representations of English text with linguistic information needed for proper translation into other modalities, as required by persons with physical or cognitive disabilities. As an exemplar of the technology, VCom3D will develop, demonstrate, and evaluate the application of AML to making Web content accessible in American Sign Language (ASL). This development will entail the implementation of an Encoder to create AML from English text, and a Decoder to generate grammatical ASL from AML. Multinational corporations and institutions have recognized the economic and social need to make information and instruction accessible to persons around the world for whom English is, at best, a second language. To address this issue, international organizations, including the World Wide Web Consortium (W3C) are defining methodologies for using Controlled Languages, systems of annotation and, in the future, the Semantic Web to increase accessibility in other languages. These same emerging technologies and infrastructure can provide an unprecedented opportunity to make information available to underserved Americans with sensory, cognitive, and cultural differences. This project will demonstrate the application of emerging information technology to make information accessible to Deaf persons, and will provide resources for further research into ASL linguistics.

The initial commercial product based on this technology will be a translation and authoring tool that substantially automates the creation of grammatical, animated ASL from English text. This product will be used to increase access by Deaf and Hard of Hearing children and adults to digital information and to promote inclusive education and employment in accordance with the New Freedom Initiative, recent amendments to Section 508 of the Rehabilitation Act of 1973, the Americans with Disabilities Act (ADA), and Section 255 of the Telecommunications Act.

Title: SBIR Phase II: Mobility Agents for Persons with Cognitive Disabilities

Award Number: 0349663
Program Manager: Sara B. Nerlove

Start Date: March 1, 2004
Expires: February 28, 2006
Total Amount: $500,000
Investigator: Alexander Repenning, alexander@agentsheets.com
Company: Agentsheets, Inc.
6560 Gunpark Drive, Suite D
Boulder, CO 80301
Phone: (303)530-1773

Abstract:

This Smal Business Innovation Research (SBIR) Phase II project will develop Mobility Agents that help persons with cognitive disabilities use public transportation systems. The realization of an operational system that wirelessly connects users to real-time bus information through Mobility Agents depends on the fact that public transportation systems are increasingly equipped with GPS (Global Positioning System) systems connected to control centers through dedicated wireless networks. Controllers use this infrastructure to schedule and optimize operations and avoid organizational problems such as bunching. Agentsheets proposes to use this existing infrastructure to compute highly personalized information and deliver it on PDAs or cell phones to persons with cognitive disabilities. Wireless devices with location aware Mobility Agent services that help travelers use public transportation systems, permit caregivers to customize these agents, and monitor the progress of travelers by means of utilizing The Pragmatic Web, a framework for highly customizable Web information; and Deductive Tracking, a combination of sensor fusion and minimalist common sense AI that creates more reliable tracking information. Agentsheets will explore design and implementation issues for agent-based real-time user interfaces on handheld devices; build the system, and test it in a real-world setting using the Boulder bus system as a public transportation test bed.

The Mobility Agents technology turns general GPS-based information into personalized, practical information. Customization mechanisms range from simple preferences to rule definition, and are relevant to the fields of End-User Development/Programming, Visual Languages, and Human Computer Interaction. Deductive Tracking contributes to Sensor Fusion and Artificial Intelligence. Parts of a Phase I 3D engine, used in the real-time transportation visualization, have been made available to other research organizations and are already in use. This technology proffers assistance to persons with cognitive disabilities. The elderly and other groups will also benefit from the same technological developments. This technology creates new service organizations. It reduces the need for human escorts, increases the autonomy of persons with cognitive disabilities, and decreases the need for federal support.

Title: SBIR Phase II: Affordable Braille Display Using Novel Microactuators

Award Number: 0078660
Program Manager: Sara B. Nerlove

Start Date: August 15, 2000
Expires: July 31, 2003
Total Amount: $762,000
Investigator: Frederick Lisy, lisy@orbitalresearch.com
Company: Orbital Research Inc
4415 Euclid Ave.
Cleveland, OH 44103
Phone: (216)649-0399

Abstract:

This Small Business Innovation Research Phase II project from Orbital Research Inc. will design and test an affordable, multiline refreshable Braille display system (RBDS) able to display computer screen information either from the hard drive or the Internet. The proposed RBDS will combine state-of-the-art microelectromechanical (MEMS) actuators with cutting edge electronic assembly technology to assure ease in manufacturing and robustness. Additionally, Orbital Research will implement a modular architecture that allows for unprecedented versatility through tailoring the Braille surface for various applications requested by the end users. Traditionally, MEMS actuators are very small, cost efficient and low power. However, traditional packaging of the MEMS devices results in a much larger and much more expensive component. In Phase I of this project, Orbital Research as produced a MEMS actuator capable of producing Braille dots. In this phase, Orbital Research will integrate a flexible assembly process to overcome the traditional complexities associated with packaging MEMS actuators. Orbital Research will take full advantage of the features offered by cutting edge manufacturing processes such as MEMS, IC processing, flip-chip and surface mount technologies to assure the final proposed RBDS is light weight and small in size, cost affordable, robust, modula, enables tactile acuity, and is "user friendly." The refreshable Braille Display system proffered by Orbital Research will enhance access to electronic information on the job or at home. It will also provide for enhanced educational and employment opportunities for visually impaired individuals in line with the requirements of the Americans with Disabilities Act.

This device will create employment and research opportunities for the visually impaired, especially for those whose interests extend to mathematics, scientific, and technical fields that require frequent access to reference works in order to perform their tasks efficiently.

Title: SBIR Phase II: Mathematics Multimedia for Children with Hearing Loss

Award Number: 0079350
Program Manager: Sara B. Nerlove

Start Date: July 1, 2000
Expires: December 31, 2002
Total Amount: $400,000
Investigator: Marjorie Cappo, Marge@learn.motion.com
Company: Learning in Motion, Inc.
500 Seabright Avenue, Ste 105
Santa Cruz, CA 95062
Phone: (408)457-5600

Abstract:

This Small Business Innovation Research (SBIR) Phase II project addresses the need for customized learning tools in mathematics education for primary students with physical disabilities, in particular, those with significant hearing loss. The Phase II study focuses on modifying and testing sections of existing multimedia so that they will be appropriate as instructional tools for PreK-K children with significant hearing loss. The need is critical: 2 out of every 1,000 young children in the U.S. have hearing loss severe enough to adversely affect learning. In addition, resources for these individuals are normally allocated to the development of language acquisition; thus, the development of mathematical computation and reasoning often is not addressed until a significant learning window has lapsed. The National Action Plan for Mathematics Education Reform for the Deaf recommends that more resources address mathematics instruction for children with significant hearing loss. Learning in Motion intends to modify a research-based, field-tested multimedia program for early learners of mathematics. This program was the direct result of Phases I and II of a NSF SBIR project. The multimedia program includes three-dimensional graphics and characters, completed game logic, and four interactive game areas that are suitable for modification. The study's main objectives: (1) design, program, and test modifications to existing software games for students with hearing loss, (2) conduct and use subjective observations from teachers and researchers to further refine the modifications, and (3) initiate a testing plan for the complete modified program.

Ultimate results include: salable multimedia for the under-represented group of students with significant hearing loss and publishable design guidelines for others electing to produce specialized software. Learning in Motion seeks to provide a completely modified mathematics multimedia program for hearing-loss children. Design guidelines informed by the WGBH guidelines will also be produced, encouraging commercial collaboration with other publishers looking to produce similar programs.

Title: SBIR Phase II: Visible Light Audio Information Transfer System

Award Number: 0079323
Program Manager: Sara B. Nerlove

Start Date: August 1, 2000
Expires: July 31, 2004
Total Amount: $400,000
Investigator: Roderick Hinman, rod@talking-lights.com
Company: Talking Lights Co
28 Constitution Road
Boston, MA 02129
Phone: (617)242-0050

Abstract:

This Small Business Innovation Research Phase II project will develop an inexpensive Visible Light Audio Information Transfer System (VLAITS) that transmits information to small Personal Audio Receivers (PAR) for blind, hard of hearing, non-physically impaired and non-English speaking users. VLAITS uses already-installed visible lighting fixtures like fluorescent lights to provide modulated light as a carrier medium for data. The PAR receives this modulated light and presents audio to the user. VLAITS is remarkably inexpensive because it requires no additional equipment or special wiring other than typically used in existing lighting fixtures. There is no perceptible visual flicker in light because of data coding schemes. Phase I demonstrated VLAITS, qualified commercial visible light as an information carrier, and demonstrated wayfinding and aural assistance with blind and hard of hearing users. This project seeks to design and refine a commercial VLAITS system and validate system functions and capabilities with blind and hard of hearing users. Included are miniaturization and reduction of production cost of the computer-controlled light ballast transmitter and computer-controlled portable receiver. The receiver will also be designed to be compatible with currently installed infrared systems.

This project proffers a solution for the communication of information to people, particularly to those with disabilities, that leverages existing infrastructure in an innovative and cost effective way. Commercial products will be modified light ballasts, personal audio receivers and design of assistive networks.

Title: SBIR Phase II: Software Tools for Authoring American Sign Language

Award Number: 0238882
Program Manager: Sara B. Nerlove

Start Date: February 15, 2003
Expires: January 31, 2005
Total Amount: $499,247
Investigator: Daniel R. Roush, dannyr@vcom3d.com
Company: VCOM3D, Inc.
3452 Lake Lynda Drive
Orlando, FL 32817
Phone: (407)737-7310

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will develop a fully functioning prototype software tool that will allow educators, interpreters, and linguists skilled in American Sign Language (ASL), but not in computer 3-D animation, to create fully grammatical synthesized ASL. This technology will provide language access for Deaf individuals to Internet web pages and CD-ROM based media. This project builds upon the Principle Investigator's commercial Sign Smith products, which were developed, in part, under an earlier NSF SBIR grant. The current technology allows users to generate unique sentences composed of signs that are in citation, or non-inflected form and to add facial expressions. The resulting sign and sentence structure approximates English grammar and the reference represents a transliteration, also known as Signed English. Although Signed English does provide some access to digital media, the absence of many elements of ASL grammar limits the use of the technology by the larger segment of the Deaf population who require grammatical ASL for access. These tools will enable the user to dynamically compose and inflect ASL signs from parameterized components using several spatial frames of reference. These sign types include pronouns, indicating and locative verbs, and classifier predicates.

The final commercial product will be a new integrated tool within the Principle Investigator's commercial Sign Smith Studio Authoring Tool. This tool will allow educators and multimedia developers to create engaging, grammatically correct, ASL animations for language access to digital information on Web Pages and in CD-ROM titles. The software interface not only allows authors to spatially inflect signs, but also it can be used to create signs as well. This capability opens opportunities for quickly building libraries of technical and scientific terms to be used in educational and scientific curricula. It also affords the potential to create libraries of foreign sign languages, the reference making it possible for the product to enter international markets. Content can be viewed using a proprietary licensed software Player. This product will increase access of Deaf and Hard of Hearing children and adults to digitally based information and promote inclusive education and employment approaches which accords with the language and intent of the New Freedom Initiative, recent amendments to Section 508 of the Rehabilitation Act of 1973, the Americans with Disabilities Act, and Section 255 of the Telecommunications Act. Not only does this technology have a viable commercial market, it also has broad societal benefits for Deaf and Hard of Hearing individuals in America and beyond.

Title: SBIR Phase II: The Use of Gestural Interface and Robotics Technology to Facilitate Language Development

Award Number: 0239183
Program Manager: Sara B. Nerlove

Start Date: February 1, 2003
Expires: January 31, 2005
Total Amount: $499,620
Investigator: Corinna E. Lathan, lathan@alum.mit.edu
Company: AnthroTronix, Inc.
387 Technology Drive
College Park, MD 20742
Phone: (301)405-0156

Abstract:

This Small Business Innovation Research (SBIR) Phase II project seeks to enhance functionality and clinically evaluate an interactive robotic system to facilitate receptive and expressive language development of children with disabilities. Developed by Anthrotronix, Inc., a rehabilitation engineering, consulting, and product development company, this child-friendly robot is controlled by various interfaces adapted to individual needs, regardless of physical limitations. The child controls the robot via gestures and voice activation. Gestures may include reaching for a button, operating a joystick, or activating wearable sensors through body movement. The child can play and record sound and movement commands and interact with the robot in the context of programmed games. The robot allows the child to interact with its environment. The controlling software can be updated so that the robot continues to hold the child's interest and imagination over time. This robotic technology is designed to provide reinforcements and motivation for learning and therapy. Objectives are to (1) finalize the design and manufacture of the robotic systems hardware and software and (2) evaluate the systems ability to provide interventional activities, motivation, and positive reinforcement in speech/language therapy.

Over 10% of all children have one or more disabilities. The number of children with speech and language impairments is higher than that for any other disability. A total of 1,050,975 students between the ages of 6 and 17 have a primary speech and language impairment and another 441,410 students have a secondary diagnosis of speech and language impairment. Anthrotronix is addressing the market need for therapists to have effective tools that support an approach that integrates speech/language development with children's educational development and social development, such as communication and interpersonal skills. There is a clear opportunity for products that enable therapists to provide increased motivation and education of children with disabilities while performing therapeutic functions.

Title: SBIR Phase II: An Information Handling System for Low Vision

Award Number: 0132058
Program Manager: Sara B. Nerlove

Start Date: March 15, 2002
Expires: February 29, 2004
Total Amount: $498,629
Investigator: James C. Bliss, jim@jbliss.com
Company: JBliss
100 W. El Camino Real
Mountain View, CA 94040
Phone: (650)940-4115

Abstract:

This Small Business Innovation Research Phase II project will develop software and hardware products that assist people with low vision to efficiently read and process information from many sources. These products will combine optical character recognition (OCR), speech synthesis and recognition technologies, together with customizable displays based on the latest vision research to accommodate a variety of visual impairments. These products will incorporate a 'Pick and Click' user interface, developed in Phase I, which does not require viewing the screen, yet presents visual displays useful to a low vision person, and is intuitive to fully sighted teachers experienced with graphical user interfaces (GUIs). Included in the products will be functions particular to the low vision market, such as reading text optimally, enlarging pictures, and using a video camera for magnification while handwriting and viewing 3D objects. In addition, 'Pick and Click' interfaces to the most common computer applications programs, such as word processing, e-mail, Internet browser, spreadsheet, and financial accounting will be included. Low vision users will benefit from a low cost interface that provides a clean and less cluttered presentation of information on the screen. JBliss Imaging's proffered new technology has potential to improve access to and capability of manipulating information for the low vision population.

The technology also has potential to serve individuals with other disabilities, such as dyslexia and other forms of challenges to learning and reading abilities. Commercial applications are in schools, libraries, businesses, and homes.

Title: SBIR Phase II: Design of a New and Improved Print Reading Machine for the Blind

Award Number: 0296066
Program Manager: Sara B. Nerlove

Start Date: March 1, 2001
Expires: July 31, 2000
Total Amount: $400,000
Investigator: Deane Blazie, deane@blazie.com
Company: C. A. Technology, Inc.
9500 S. Ocean Drive
Jensen Beach, FL 34957-2337

Abstract:

This Small Business Innovation Research Phase II project from Blazie Engineering, Inc. will conduct research leading to the development of three working prototypes of a new print reading machine for the blind. As of early 1996, the only existing device in the world that can produce a tactile image of print from a small hand held camera, the Optacon, is no longer being produced by its manufacturer. In Phase I, the researchers demonstrated the feasibility of incorporating new technology in a new print reading machine which make it easier to use, quicker to learn, less expensive, and attractive to a larger market. A new tactile screen was designed which should significantly reduce costs and provide a clearer tactile image. A new camera design coupled with built in synthetic speech would make the device easier to learn and use and, with the proper accessories, the device would appeal to a larger market. The Phase II effort includes the following: detailed design, construction and user testing of the new tactile array; research and design of a new camera to produce a better tactile image; built-in speech synthesis and capability for training programs; development of software to allow tactile imaging of a PC screen; and design of hardware that allows for future expansion (including multi-purpose interface for additional cameras/scanners, hardware features to allow built in training features, and communications ports and universal serial bus for future expansion to market).

The Optacon print reader enables blind individuals to have access to the study of mathematics and science. If this research is successful an improved, lower-cost commercial product incorporating new technology will result which make such access not only possible but also more attractive to a wider population. This new print reader for the blind will increase their employment opportunities and self-sufficiency to perform household management tasks as well as their ability to interface with print materials.

Title: SBIR Phase II: Folding Power Wheelchair with Modular Battery System

Award Number: 0548759
Program Manager: F.C. Thomas Allnutt

Start Date: February 16, 2006
Expires: February 29, 2008
Total Amount: 488,309
Investigator: Bart Kylstra, kylstra@gmail.com
Company: Daedalus
20 Scot Alley
San Francisco, CA 94107
Phone: (415)385-4508

Abstract:

This Small Business Innovative Research (SBIR) Phase II project aims to develop a lightweight modular wheelchair that can be easily lifted and handled by either the user or a companion. This wheelchair can be loaded into any vehicle, thus dramatically improving the mobility of the user. The research project focuses on designing the frame, drivetrain, motor and battery system to allow more of synergistic effect and lightweight to aid the user in his/her mobility.

The commercial and societal benefits from this project will result in not only greater mobility but also drastic increase in the quality of life for the user, improved family mobility.

Title: SBIR Phase II: Individualized Guidance for the Blind (IGB)

Award Number: 0620511
Program Manager: Ian Bennett

Start Date: September 13, 2006
Expires: August 31, 2008
Total Amount: $467,488
Investigator: Gary Livshin, glivshin@talking-lights.com
Company: Talking Lights Co
28 Constitution Rd
Boston, MA 02129
Phone: (617)242-0050

Abstract:

This Small Business Innovation Research (SBIR) Phase II project will develop an Individualized Guidance for the Blind system which is an accurate, affordable, easy-to-use indoor/outdoor assistive navigation system to aid people who are blind in wayfinding and traveling. In a separate effort, a wayfinding system for the blind using GPS for outdoor location is now being designed and built. For indoor use, however, this system requires a complex inertial guidance system for location and guidance. In this project, inexpensive optical locators will be used to improve indoor wayfinding and supply GPS-like location indoors.

Software developed will allow Individualized Guidance for the Blind locators to provide GPS-like locator information indoors and permit the input of location to the personal data assistants (PDA), updating of location and elimination of errors. As a commerical product, application areas will include hospitals, care facilities, museums, malls, schools, retail stores, trade shows, transportation facilities and otherplaces where blind and people with limited vision require navigation assistance.