





# UNT College of **ENGINEERING**

Senior Design Day 2019



Department of  
**COMPUTER SCIENCE  
AND ENGINEERING**



# COMPUTER ENGINEERING

# Securing IoT Team HED

## Team Members:

- Chima Akano
- Justin K. Paul
- Jorge Moreno
- Hector Tamez

## External Sponsors/Mentors:

- N/A

## Internal Sponsors/Mentors:

- Dr. Pradhumna Shrestha
- Dr. Robin Pottathuparambil
- Thomas Kanaby

## Abstract:

IoT devices are growing and have become an important part of embedded systems to handle data for interconnected communication networks. This brings up the importance of securing our IoT devices and maintaining the integrity of the data these devices manage.

The purpose of this project is to identify malicious attacks on a WSN (wireless sensor network) that will consist of four nodes (four raspberry pi's) and a central node (HUB) to gather sensor data. We will then observe how the malicious attacks have infiltrated weak areas of our IoT network and apply countermeasures to resolve the attacks thus keeping our nodes and their data safe. Our proposed solution is to research solutions to secure our IoT network from attacks, and to produce countermeasures to future attacks.



# Team Impulse

## Team Members:

- Gabriel Costa
- Michael Kahn
- Rebecca Molnar
- Alejandro Siller

## External Sponsors/Mentors:

- Dave Perkowski & Cristian Almendariz - All Axis Machining

## Internal Sponsors/Mentors:

- Dr. Pradhumna Shrestha

## Abstract:

All Axis Machining uses a handful of CNC machines for the production and testing of all of the parts their clients order. While this layout allows for the machining of uniform parts with a high accuracy, each of the machines needs to be monitored constantly by on site personnel.

Team Impulse will be working in conjunction with All Axis Machining to implement a central unit that will receive machine status and job progress reports from each of the CNC machines in All Axis Machining's shop. The central unit will then display this information in a custom designed GUI in All Axis Machining's central office. All Axis Machining's employees can then remotely command the CNC machines through the same central unit.

While this information will be accessible at all times from a pre installed TV in All Axis Machining's central office, management will be able to view this information from their personal mobile devices or computers by accessing All Axis Machining's wireless network. The project will facilitate monitoring and managing the machine shop.



# Smart Door

## M.T.E.K

### Team Members:

- Michael Thomas
- Eric Nwokocho
- Kennard Boykin
- Trevor Hendricks

### External Sponsors/Mentors:

- Our project was 100% sponsored internally

### Internal Sponsors/Mentors:

- UNT Computer Science and Engineering Department
- Dr. Pradhuma Shrestha
- Thomas Kanabay

### Abstract:

Our project is a facial recognition device that allows a homeowner or known member of the household to unlock the front door without using a physical key. The device is attached to the front door of a home and works by a user going up to the device, looking into the camera, and then being allowed or denied access to the house.

Implementing this device automates and increases the level of security of the house and ease access as well. The facial recognition is implemented using a Convolutional Neural Network, where a sample value (in this case, a picture received from the camera on the device), is compared to a dataset of correct images for accuracy. This dataset of images for any one person (any one member of the house) is pre-trained for accuracy against a wider array of different faces, so that a specific face is distinguishable from others.

The device will also allow the predetermined head-of-household to allow non-home-members inside the house remotely, through means of a manual override via text message.



# Smart Home for Assisted Living

## Team Lannister

### Team Members:

- Mitchell Clarke
- Anmol Singh
- Prajwal Waiva
- Girard Roston

### External Sponsors/Mentors:

### Internal Sponsors/Mentors:

- Dr. Pradhumna Shrestha
- Thomas Kanabay

### Abstract:

Smart home technology is still fairly new, but it is becoming much more common in modern homes. Families are integrating this technology into their homes to provide better security and an improved quality of life. This technology has not yet branched out past common households yet, but it's the next step for this growing technological innovation.

Team Lannister's smart home for assisted living centers takes smart home and IoT technology and integrates it into assisted living centers to improve the quality of life of each patient and simplify the jobs of every employee.

This system will include a temperature sensor, door sensors for the main doors and medicine cabinet, and a motion sensor inside each room. A smart watch with a fall detection system will also be worn by the resident, along with a Polar T34 heart rate monitor to monitor irregular resident movement and their heart rate.

Data will be sent to and stored in an online database that nurses can access for each patient, and SMS alerts will be sent out if any irregular readings occur.

- Adafruit.com for supplying all of the sensors and microcontrollers used in this project
- Dr. Pradhumna Shrestha for mentoring us and giving us guidance throughout the semester
- Thomas Kanabay for working with us during the parts ordering and design processes



# MetroBand

## Team EyeD

### Team Members:

- David Adeyemi
- Gersom Adu
- William Lewis
- Luke Parks

### External Sponsors/Mentors:

### Internal Sponsors/Mentors:

- Dr. Pradhumna Shrestha

### Abstract:

MetroBand is a smart watch poised to revolutionize the music performance, performing arts, and synchronized sports industries.

The main components of the MetroBand watch are:

- Metronome
- Instrument Tuner
- Metronome wireless synchronization across multiple watches (SmartConnect)
- Normal smart watch functionality (date and time, alarms and timers)

The SmartConnect metronome network will enable effortless collaboration and will synchronize multiple performers who are wearing the MetroBand smart watch.







# Project Status Report 3 Team: 1A4

## Team Members:

- Rad Wadud
- Adesunkanmi Afolabi
- Nasser Alquaihi
- Spencer Igwe
- Laura Kent

## External Sponsors/Mentors:

- N/A

## Internal Sponsors/Mentors:

- University of North Texas
- Dr. Pradhumna Shrestha

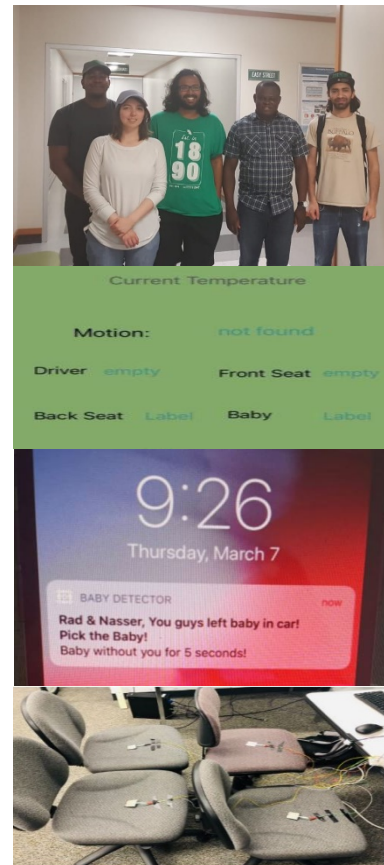
## Abstract:

Our project serves to act as a presence detector within a car. The driver is notified when a living being is left behind in the vehicle.

This is feasible through multiple connected sensors which send information to a microcontroller board in the event the received information has met certain conditions that suggest a presence. The board communicates to the app over a wireless internet connection to notify the user via cell phone app.

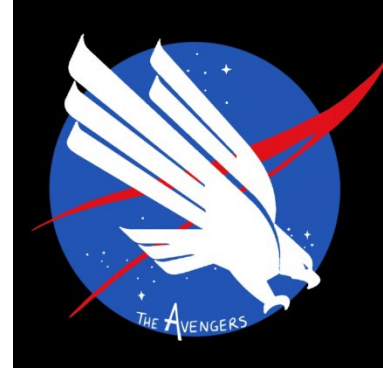
The app continues notifying the user over a certain period until the user selects to acknowledge the notification.

This can be “Accept” or “Reject” decision. On the chance that the event is a false- alarm, the user is able to select a Reject response to confirm that there is actually no presence. If a being is left alone in the car, the driver choose “Accept” and pick the baby.



We thank the Project Manager, our professor, Dr. Pradhumna Shrestha who conceptualized the project and piloted us through from beginning to the end.

And Thomas Kanabay who supported us for needed parts on short notices.



# Spacecraft Lighting Network System Team Avengers

## Team Members:

- Jose Guzman
- James Gonzalez
- Gordon Fields
- Samantha Akos

## External Sponsors/Mentors:

- George Salazar- Nasa Mentor

## Internal Sponsors/Mentors:

- Dr. Robin Pottathuparambil – Faculty Advisor

## Abstract:

The innovative use of network lighting systems has created a solution that prevents radiation from damaging current lighting systems in spacecrafts. In space, Crew members have been using switches and knobs to control the power and light intensities onboard the spacecraft. These components are comprised of parts that are susceptible to radiation and can lead to damage of the lighting system. This proposal is concerned with the design of a Spacecraft Lighting Network System that will use a touchscreen to control lighting intensities and will provide feedback on the lighting system as a whole. Along with an updated approach, fault tolerant features will be in place in case of failure within certain subsystems. These subsystems include the router and switch, the individual slave Pi's, the sensors, and the GUI of the system. The system will also provide a health status of the lights and its life expectancy. With these innovations, our design aims to improve the current lighting systems by removing the conventional use of switches and knobs.



We extend our gratitude to last year's team, 2B! | 2B. We have built on their efforts and contribution to create our own vision on how to accomplish our project's goals. We would also like to thank Dr. Robin Pottathuparambil for his guidance and helpful suggestions when we hit a roadblock. Furthermore, we would like to thank Thomas Kanabay for providing us with parts and equipment he had on hand.



# Sleep Apnea Monitoring System

## Team CMBZ

### Team Members:

- Chris Covey
- Neil Mistry
- Kahale Barnes
- Damian Zubia

### External Sponsors/Mentors:

- Dr. Edwin Simon

### Internal Sponsors/Mentors:

- Dr. Robin Pottathuparambil
- Thomas Kanabay

### Abstract:

Approximately 25 million adults in the United States of America alone suffer from obstructive sleep apnea, according to the National Healthy Sleep Awareness Project. Obstructive sleep apnea is a disorder that causes the patient to repeatedly stop and start breathing during sleep. Current diagnosis standards involve an in-lab sleep study that monitors multiple variables such as respiratory movement, airflow, body movement, heartrate, oxygen saturation, and snoring sound. The diagnosis standard is incredibly time consuming and labor intensive. It also puts the patient in an unfamiliar environment, which can have an effect on the patient's ability to sleep for proper diagnosis. Our goal is to find a way to create a moderately low-cost portable solution so that a patient can administer a sleep study in the comfort of their own home. Our project is to create a patch with unified sensors that collects these pieces of data: Respiratory movement, airflow, body movement, heartrate, oxygen saturation, and snoring sound. Once the data is collected, it will be wirelessly pushed to a network that will then pass it to the cloud for post processing. This data will be collected, stored, and encrypted and will meet the current HIPPA guidelines for patient privacy. On completion, the system will have the ability to be used as the gold standard for the diagnosis of OSA and meet the standards for FDA approval.



Client & Subject Matter Expert: Dr. Edwin Simon

Faculty Advisors: Dr. Robin Pottathuparambil and Thomas Kanabay

Previous team members from Team Snooze



# Vehicle Interchangeable Electronic Controller Networks System (VIEC)

## Team ERAM

### Team Members:

- Edward Escamilla
- Maria Pavloschi
- Ryan Moye
- Alexander Villalobos Quintanilla

### External Sponsors/Mentors:

- George Salazar
- TSGC Design Challenge

### Internal Sponsors/Mentors:

- Dr. Robin Pottathuparambil
- Thomas Kannabay
- Office of the Dean

### Abstract:

As humans push the limits of exploration and the time duration spent in deep space, providing spare spacecraft components becomes more and more critical. While it is too expensive to ship unique spare components to space, nor is it feasible to send the spare components in the initial launch, there are other options.

Therefore, our goal is to create a system that permits interchangeability of vehicle controllers based on where the controller interfaces with the vehicle.

Our method of developing the system of interchangeable controllers is to configure the controllers via interaction with a network server providing information for each controller's unique behavior. This is accomplished by downloading the appropriate files from the server and implementing the appropriate actions to minimize overall costs.



# Silicon Wafer Sorting Machine

## Team JPJG

### Team Members:

- Philip Hunsberger
- Jack Durham
- James Artacho
- Garrett Gilcrease

### External Sponsors/Mentors:

- Willie Scales

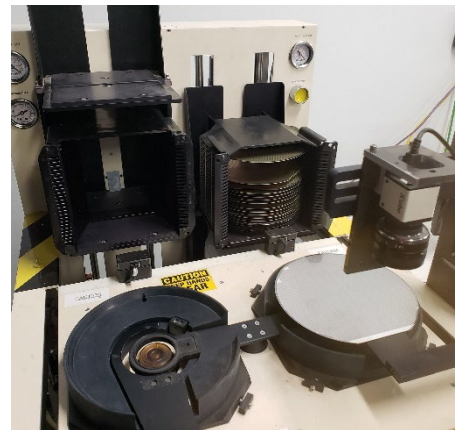
### Internal Sponsors/Mentors:

- Dr. Robin Pottathuparambil
- Thomas Kanabay

### Abstract:

This project's goal is to refurbish a silicon wafer sorting machine by adding an Optical Character Recognition system that is capable of fully autonomously sorting up to 50 unsorted silicon wafers at a time. We are sponsored by a local Senior Field Engineer working with ATE Technologies, Inc., Willie Scales.

This machine is capable of moving, straightening, scanning, organizing, and storing wafers with minimal user input and interaction. It utilizes laser sensors, vacuum and air pressure manipulators, and electronic drill and motor pieces to complete its task, along with a sorting algorithm and user interface designed and implemented by our team at UNT.



We would like to thank both Dr. Robin and Mr. Scales, along with the entire Computer Science and Engineering department for their help in obtaining this unique opportunity to work hands-on with the coding and embedded systems skillsets we have developed during our studies at UNT. Go Mean Green!

# MULTI-SENSOR CROWD FLOW VISUALIZER

Team LyLAT

## Team Members:

- Aaron Kennemer
- Luke Hillard
- Luke Peltier
- Tony Phonglom

## External Sponsors/Mentors:

- xRez Lab

## Internal Sponsors/Mentors:

- Ruth West
- Thomas Kanabay
- Dr. Robin Pottathuparambil

## Abstract:

When a robotic/automated system “sees”, it does not perceive the same way as the human visual system does. This mismatch in human expectations of what a digital system perceives causes challenges in the integration of robotics/automated systems in human context; this problem originates from Bill Smart at Oregon State University. One such situation is in tracking the flow of individuals and groups in a crowd. This project, in collaboration with xRez Lab, seeks to create an innovative system that uses many sensors to track the flow of a crowd and with this tracking data visualize it in a form truer to how the system “sees” the crowd. The system itself with the visualization will help improve upon current crowd tracking methods and will use pre-existing vision recognition algorithms to verify their accuracy. The novel use of Virtual Reality being the medium of the visualization will help immerse those who put on a headset and help give insight on what the system “sees”. The non-VR related part of the system itself will help in the design of surveillance, crowd counting, and dynamic emergency escape systems.



Acknowledgements: Cindy Grimm, Bill Smart, and xRez Lab @ UNT

# Smart Canopy Lighting System

## Team W.A.C.C



### Team Members:

- Jeff Anderson
- Ben Cruse
- Eli Cruse
- Jared Westmoreland

### External Sponsors/Mentors:

- Intelativ

### Internal Sponsors/Mentors:

- Dr. Robin Pottathuparambil
- Thomas Kanabay

### Abstract:

The goal of this project is to make an Internet of Things (IoT) based Smart Canopy Lighting utilizing Wi-Fi instead of ethernet based communication thus lowering the cost of the product. This should capture data from the canopy light through the following sensors attached to the light: lux, temperature, camera, and NoIR camera. Then send the captured data through a central hub to be viewed from the outside world. The user should also be able to send commands from outside the network to perform tasks such as: turning the light on/off, adjusting light intensity, view a live stream of each light, and download recorded videos from each light. Videos should be stored within the cloud and on a local backup drive. Each Smart Canopy Light will utilize the lux sensor and change light intensity thus saving on energy costs.

