TIP Project Brief – 080014/9H9009

Civil Infrastructure
Infrastructure Defect Recognition, Visualization, and Failure Prediction System utilizing Ultra Wide Band Pulsed Radar Profilometry

Develop a novel, deep-penetrating scanning system based on ultrawideband radar for inspecting buried infrastructure such as pipelines, tunnels, and culverts that can detect fractures, quantify corrosion and determine the presence of voids in the surrounding soil to ¿see¿ beyond the structure to prevent accidents. The technology provides analysis which cannot be detected by current pipe inspection techniques.

Sponsor: ELXSI
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- Project Performance Period: 2/1/2009 - 4/30/2013
- Total project (est.): $6,747 K
- Requested TIP funds: $3,119 K

The United States has over one million miles of buried pipes carrying water to cities, towns and homes. The consequences of pipeline failure range from disease-causing water pollution to sometimes fatal highway accidents due to sinkholes created by soil erosion around leaky pipes. Current practice is to inspect buried pipes with closed-circuit video cameras mounted on pipe-crawling robots, but the cameras can see only surface damage, not corrosion hidden by pipe liners or dangerous voids in the soil around the pipes. A joint research venture led by Elxsi Corporation (Orlando, Fla.) and including UltraScan, LLC. (Ruston, La.) and Louisiana Tech University (Ruston, La.) plans to develop an entirely novel approach to the problem using a technology called ultrawideband (UWB) pulsed radar that only became available in the past few years. The project, FutureScan, incorporates leading-edge simulation, electronics, robotics, signal processing and three dimensional (3-D) rendering technologies in a package that could be mounted on existing pipe-inspection robots. Using extremely narrow electromagnetic pulses and special signal-processing algorithms derived from mine and bomb detection technology, the technique can "see" through solid, non-ferrous objects with extremely high spatial resolution and measure both surface and internal structural integrity. 3-D visualization software will be used to render the results in a convenient format to allow for ease of assessment by civil engineers and rehabilitation experts. In addition to soil voids, the proposed system will be able to measure the current wall thickness of the pipe, the dimensions and depth of circumferential cracks and defects in the pipe wall, the integrity of internal reinforcement rods and the amount of deformation of the pipe. The proposed system should be compatible with many of the estimated 17,000 pipeline inspection robots in use today, allowing for rapid and economical deployment. TIP support is needed for this project because it involves several challenging technology development components, particularly the signal-processing software.

For project information:
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Active Project Members
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