MOUNTAIN-PLAINS CONSORTIUM

RESEARCH BRIEF | MPC 16-313 (project 460 | September 2016

Remote Sensing of Multimodal Transportation Systems

the ISSUE

Rapid condition monitoring and performance evaluations of the vast and vulnerable transportation infrastructure has been elusive. The framework and models developed in this research will enable the next generation of transportation professionals to develop and deploy affordable and scalable solutions using evolving remote sensing technologies.

the RESEARCH

Hyperspectral remote sensing is an emerging field with many potential applications in the observation, management, and maintenance of the global transportation infrastructure. This report develops an affordable framework to capture and classify hyperspectral images for transportation systems planning, analysis, and performance assessments. Every hyperspectral image frame contains information in wavelengths that extend well beyond those that the humans are capable of seeing or perceiving. The rapid size and cost reduction of both unmanned aircraft systems and hyperspectral image sensors enables solution scaling by conducting multiple parallel missions to achieve broad area coverage at affordable prices. The authors showcase the general utility of the hyperspectral remote sensing framework for roadway congestion forecasting, railway condition monitoring, and pipeline risk management. To offer additional insights, the authors demonstrate a specific utility of the framework for the rapid detection of hazardous spills.

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North Dakota State University
South Dakota State University
University of Colorado Denver
University of Denver
University of Utah
Utah State University
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Project Title

Remote Sensing of Multimodal Transportation Systems

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the **FINDINGS**

Simulations of the rapid hyperspectral image classification method of the remote sensing framework demonstrated that an agile and real-time detection system is possible with small unmanned aircrafts. Such a capability will enable many new applications in transportation planning and performance evaluations. A detailed application scenario for the rapid detection of hazardous spills reveals the potential for significant improvements in cost and effectiveness over existing approaches.

the **IMPACT**

Practitioners who utilize the framework and associated models to implement affordable remote sensing platforms will benefit from greater situational awareness to make informed decisions in transportation systems development, operations, and maintenance. Small and agile unmanned aircraft systems with hyperspectral imaging can see beyond the human ability. This new capability will reduce the cost of deploying hundreds of millions of dollars of traditional non-destructive evaluation equipment to achieve similar benefits. Finally, educators have expressed the desire to incorporate the products of this research into new curricula focused on Intelligent Transportation Systems.

For more information on this project, download the entire report at http://www.ugpti.org/resources/reports/details.php?id=853

For more information or additional copies, visit the Web site at www.mountain-plains.org, call (701) 231-7938 or write to Mountain-Plains Consortium, Upper Great Plains Transportation Institute, North Dakota State University, Dept. 2880, PO Box 6050, Fargo, ND 58108-6050.