An Unmanned Aerial System of Visible Light, Infrared and Hyperspectral Cameras with Novel Signal Processing and Data Analytics

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Main Objective

This project was awarded to Missouri S&T in order to develop a robust semi/fully-autonomous Unmanned Aerial System (UAS) with multiple sensors for the evaluation of ground conditions and pipeline risks, explore signal and image processing techniques, and evaluate field performance of the integrated UAS for pipeline safety inspection.

Figure 1. . Integrated UAVs

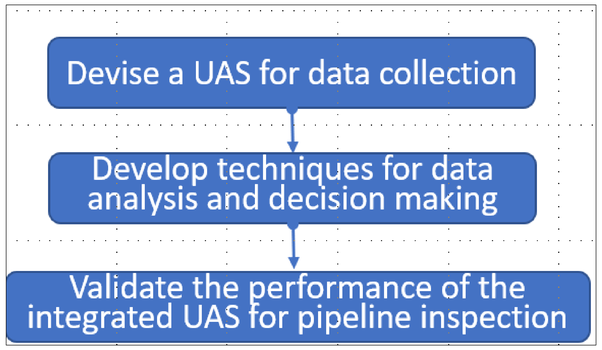

Figure 2. Flowchart of the project

Project Scope

Analytical, numerical and experimental studies will be conducted to:

- Design and prototype the UAS for the collection of cohesive types of images from visible light, infrared, and hyperspectral cameras.
- To validate 1D spectral analysis at each pixel, 2D image classification of changes and spatial analysis of a hyperspectral images with its fusion with other images to increase the probability of detection.

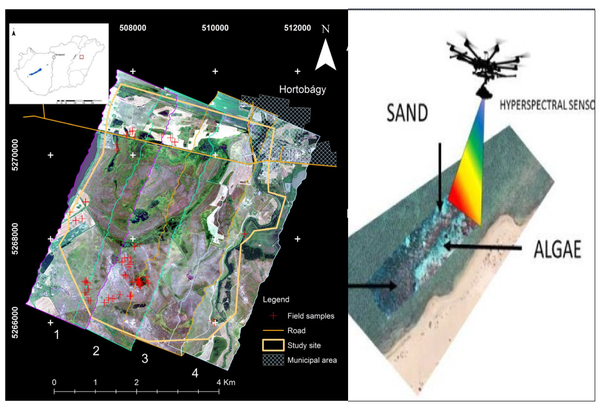

Figure 3. Hyperspectral images

Figure 4. Thermal Images

Expected Results

Once developed, the UAS enables a routine and maintenance inspection of pipelines for data collection, processing, and applications towards condition and risk assessment for pipeline operators. The UAS with multiple sensors will acquire both hyperspectral and thermal images of a representative pipeline in laboratory and field tests. The hyperspectral images can be used to extract the light reflectance of each pixel to analyze the potential leakage of the pipeline while the thermal images to estimate both the location and volume of the leakage area. The two imaging techniques can verify each other and be integrated through signal processing and data fusion to increase the probability of detection. Artificial intelligence tools will be attempted to assess the pipeline from the obtained videos.

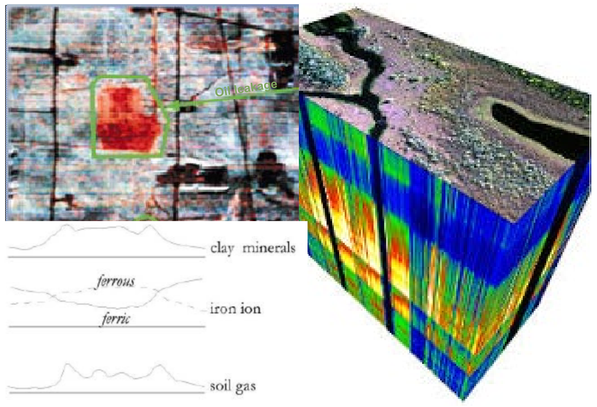

Figure 5. Hyperspectral image of ground surface

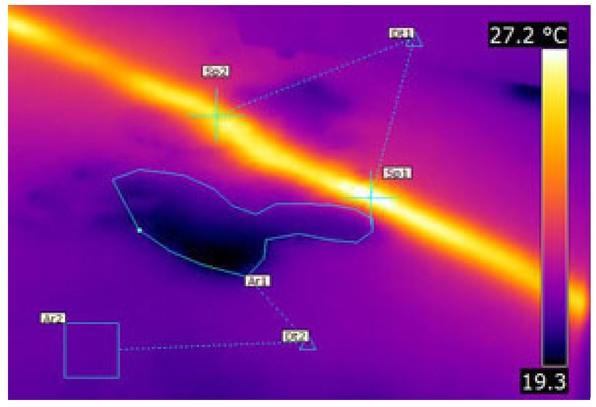

Figure 6. Thermal Image of a pipeline with hot water

Acknowledgments

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https://images.app.goo.gl/Yfgxhoa2pXH3LKNDA

Public Project Page

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