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**Office of Research and Implementation**

**FFY 2022 Request for Proposals**

Research Problem Statement Title:

**Flood Detection and Prediction System**

Problem Statement:

Floods are the most common natural event; they often lead to loss of lives and properties. Flash floods particularly are deadly because of the short time horizon during which drivers are not given ample time to avoid. Flash floods are hard to predict the occurrence due to lack of a comprehensive model that incorporates general and local weather information, local road geometrics, nearby creeks, and topographical information.

Oklahoma state rainfall is variable on a year-to-year basis. It also varies by season. Wintertime precipitation tends to be widespread, stratiform in nature [1]. Summertime precipitation is almost convective in nature, as it is produced by thunderstorms, while Autumn and spring offer both convective and stratiform precipitation. Oklahoma State has different types of storm cells that can vary in its duration and rain rate. Oklahoma storms vary in severity. On April 17th, 2013 [2] Medicine Park, Meers, Chickasha, and Newcastle counties had significant flash flooding from a single supercell that led to four to seven inches of rain falling in only two hours.

Proposed Research:

This project mainly proposes to 1) evaluate a set of systems used for flood detection for their , suitability, accuracy, and rapid detection; 2) construct a station on a potential ODOT site as a platform to integrate these systems for evaluation in actual sitting; 3) develop a prediction model that uses additional data (National Weather System, road geometry, and local topography); 4) develop a warning system to alert drivers of impeding flood.

Suggested Tasks (to include but not limited to):

1. Evaluate commercially available sensors and systems used for flood detection.
2. Acquire sensors and equipment with consultation with ODOT sponsor.
3. Design and construct a flooding emulating testbed made of wood to evaluate sensors and systems for accurate detection.
4. Finalize the flooding station design to prepare for deployment.
5. Consult with ODOT to select a site for a station deployment.
6. Install one monitoring station at ODOT and a selected field location.
7. Interface with the NWS for real-time weather data acquisition.
8. Examine the topographical map and characterize the conditions under which the site was historically flooded.
9. Evaluate and relate NWS localized data to those collected by the site.
10. Investigate various machine learning algorithms to implement prediction model based on sensory weather data locally collected by the station and weather data regionally collected by NWS. The prediction model would integrate both sets of data to improve its accuracy.
11. Duplicate the design of the station at multiple locations.
12. Integrate the developed flooding monitoring system website with the current ODOT road weather information system (RWIS) website.
13. Integrate an automated email notification system to ODOT superintendents and TOC.
14. Integrate advanced warning stations with the flooding detection system. ODOT to provide the advanced warning stations.

Implementation:

- Maintenance Division

Benefits:

* Evaluate various commercial sensors for flooding detection
* Develop flooding prediction models.
* Develop warning system to alert motorists.

Deliverables:

All projects require the submission of the following reports:

* Monthly Progress Reports
* Multi-Year Projects require a Year-end Annual Report
* Copies of the project Draft Final Report in Microsoft Word and ADA accessible Adobe Acrobat pdf electronic formats
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The Year-end Annual Report, Draft Final Report, Final Report and Color Article should be submitted to satisfy all federal and state requirements pertaining to the accessibility of documents including but not limited to:

* Oklahoma State Statute 62 § 41.5e and the Americans with Disability Act (ADA) of 1990, 42 USC 12.01 et seq.

The PI must also participate in the following project meetings:

* New project initiation meeting
* Semi-annual project meeting
* Close-out project meeting
* Continuing project meeting
* Estimated completion time twenty-four months.

Existing Research found in separate attached file.