DRISI
Caltrans Division of Research, Innovation and System Information

Research Notes

Maintenance

MAY 2022

Project Title:
Traffic Disruption-Free Bridge Inspection Initiative with Robotic Systems

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Traffic Disruption-Free Bridge Inspection Initiative with Robotic Systems

Inspecting and preserving infrastructure through robotic exploration.

WHAT IS THE NEED?

Currently, bridges and tunnels are visually inspected and manually maintained under traffic control with the aid of heavy lifting and access equipment. If access to the work area must be made from bridge decks, the indirect cost associated with road closure multiplies.

In such a case, travelers are frustrated with traffic congestion, and both the travelers and inspectors are subjected to a safety concern on high volume highways.

WHAT ARE WE DOING?

The Missouri Department of Transportation (MoDOT) is the lead state for the pooled fund study TPF-5(395) to engage closely with several state Departments of Transportation (DOTs) in the bridge inspection technology development at the INSPIRE University Transportation Center (UTC).

The INSPIRE UTC (https://inspire-utc.mst.edu) at Missouri University of Science and Technology was awarded in December of 2016 by the U.S. DOT. The UTC center was created for the development and technology transfer aimed at infrastructure inspection and preservation solutions. The center is focused on the development of advanced technologies to aid in bridge inspection and maintenance.

WHAT IS OUR GOAL?

The goals of this pooled-fund initiative are to engage closely with several DOTs in the early stage of technology development at the INSPIRE UTC, and leverage the center resources to develop case studies, protocols, and guidelines that can be adopted by state DOTs for bridge inspection without adversely impacting traffic.

The national study will use structural crawlers and unmanned aerial vehicles (UAVs) as a mobile platform for in-depth inspection of elevated bridges.

WHAT IS THE BENEFIT?

The study will demonstrate the benefit of automated bridge inspection and preservation of bridges with sensors, nondestructive evaluation devices, multi-modal robots, and data analytics. The study will provide cost-effective, consistent, and reliable solutions in bridge condition assessment and maintenance. It will provide training to a diverse transportation workforce so they can master the advanced technologies.

WHAT IS THE PROGRESS TO DATE?

In last quarter, the following activities took place:

The drawings of all bridges to be tested in Missouri, Texas, and Wisconsin have been collected for prototype inspection. The second prototype of Bridge Inspection Robot Deployment Systems (BIRDS II) was tested on automatic girder detection and flight control along the girder centerline. Six types of drones were tested to provide sufficient training and experience for an inspection team. Active thermal imaging was conducted on four full-scale reinforced concrete slabs to understand the heat transfer process and defect detectability.

Next step:

We will continue to collect drawings of the bridges selected to test before we plan for field testing in Summer 2022.

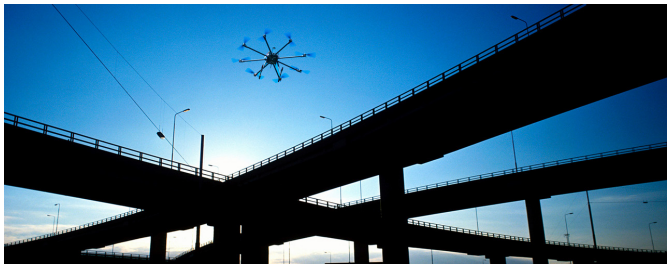
The operation checklist of unmanned aerial vehicles will be developed and completed to facilitate field tests at bridge sites.

Field operation guidelines of drones will be developed.

Field tests will begin on Missouri bridges in summer of 2022.

Both horizontal and vertical imaging from infrared and hyperspectral cameras will be summarized in the quality assurance/control guidelines.

IMAGE



Picture 1: Unmanned aerial vehicle inspecting infrastructure