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Project Title: Caltrans UAS and Driver Safety: Driver Distraction in the Presence of UAS

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DRISI provides solutions and knowledge that improves California's transportation system.

Caltrans UAS and Driver Safety: Driver Distraction in the Presence of UAS

Continue the examination and testing of UAS and driver safety through the use of an eye-tracking system along with a driver simulator.

WHAT WAS THE NEED?

This research project aimed at comparing driver distractions caused by Unmanned Aerial Systems (UAS) to those arising from work zone-based road closures, where equipment like Under-Bridge Inspection Trucks (UBIT) are used. The primary goal was to evaluate the circumstances that lead to heightened driver distraction and to identify the most reliable and safe inspection tool for roadway/bridge engineering and construction purposes.

Distraction of drivers causes approximately 25% of all car accidents in the US, with young drivers accounting for more than double of such cases. A visual distraction draws drivers' visual attention away from the road by prompting them to take their eyes off it. This commonly happens when drivers look at advertisement billboards, a map for navigation, their phone, or the car audio system user interface. Visual distractions may be dangerous even for short periods of time. Previous research studies have demonstrated that that visual attention and eye movement of the drivers are correlated with each other. Therefore, to monitor and quantify visual attention of the drivers, researchers have leveraged tracking eyeball positions and movements due to high accuracy and relative simplicity of this method.

WHAT WAS OUR GOAL?

In this study, the research team designed a driving simulator experiment to assess driver distraction caused by roadside projects involving UASs and UBITs. The primary goal was to determine which scenario caused more distraction for drivers under various conditions, such as different UAS sizes, traffic densities, and traffic speeds. The research aims to increase driver safety by minimizing distractions to drivers.

WHAT DID WE DO?

The research design strategy implemented two main research tools: a driving simulator and an eye tracker. Driving simulators are machines that allow operators to recreate driving scenarios in a realistic manner. The driving simulator enabled the research tttaskeam to study the impact of distractors such as flying UAS in the line of sight of drivers. The driving simulator allowed the researchers to study a variety of performance metrics in a realistic yet safe environment, without exposing the experiment subject to potential driving accidents or injuries due to getting distracted by the UAS. Eye trackers are wearable devices similar to a pair of glasses that can track a subject's eye movement, what they look at, and for how long. Total fixation duration (TFD) will be used as a performance metric to compare the visual distraction between the levels of independent variables.

The project will follow the tasks outlined in below.

- Literature Review on Driver Distraction
- Experimental Design with multiple variables
- Scenario development for the DriveSafety RS-250 simulator
- Data collection from human subjects using the driving simulator
- Data Analysis from the participant eye tracker data
- Final Report

WHAT WAS THE OUTCOME?

This study's findings indicate that UAS is a safer option than UBIT, but both may be acceptable.

The analysis revealed the key parameters that significantly influence drivers' distraction levels, offering valuable insights into safer operational conditions for UAS and UBIT in the context of traffic safety. The following conclusions were made:

- Comparison of UAS and UBIT:
  - The comparison between UAS and UBIT revealed that UAS operations are safer than UBIT operations, causing substantially less driver distraction.
  - UBIT operations were generally more distracting, with participants looking more at the UBIT.
- In all cases, the mean TFD was well below the two-second threshold suggested in the literature as the maximum safe distraction duration.
  - This indicates that although UBIT is more distracting than UAS, both types of distractions can be considered within acceptable limits.
  - The average TFD was 0.9 seconds for UAS and 1.4 seconds for UBIT.
- UBIT Scenario: Different traffic density and speed levels did not affect drivers' distractions in a statistically significantly different manner. Drivers consistently glanced at the UBIT regardless of conditions.
- UAS Scenarios:
  - The size of the UAS, whether small or large, did not affect drivers' distractions in a statistically significantly different manner.
  - However, different traffic density and speed levels affected drivers' distractions in a statistically significantly different manner.

WHAT IS THE BENEFIT?

When considering methods of bridge inspection, Caltrans and other maintenance teams may consider the conclusion that UAS operations are safer than UBIT operations to minimize driver distraction and enhance driver safety.

The research serves as guidance for best practices for safety and risk mitigation for the use of UAS near roadways and highways. It also serves as a model for UAS programs throughout the State, nationally, and internationally. Caltrans Aeronautics managers now have a further resource for asset management decisions and support tool selection. Additionally, this research addresses UAS and road safety concerns.

LEARN MORE

https://dot.ca.gov/-/media/dot-media/programs/research-innovation-system-information/documents/final-reports/task-4097-final-report-v2-sdsu-a11y.pdf

IMAGES

Image 1: DriveSafety RS-250 Simulator

Image 2: Pupil Labs Eye Tracker used with the Driving Simulator