Maintenance

Preliminary Investigation of Thermal Infrared Camera-based Obstacle Detection for Snow Plows and Tow Trucks

Evaluate the effectiveness of commercially available thermal infrared camera-based obstacle detection in improving safety and efficiency in snowplow operations.

WHAT IS THE NEED?

The Caltrans Division of Maintenance needs to operate tow trucks and snowplows in extreme weather conditions and low visibility to ensure that bridges and roads remain open. As an example, emergency tow trucks are operated in case of collisions e.g., on Bay Area bridges where dense fog is very common. The sensitive nature of such operations necessitates Caltrans' timely response.

However, under low visibility, timely response can be very challenging to both the traveling public and the Caltrans' crew. This is especially true in the case of collisions under low visibility when pedestrians are more likely to be present on highways. For example, vehicle occupants may exit their vehicle after a collision while waiting for the emergency tow truck. They are often unaware of traffic exposure hazards and may wear low-visibility clothing. Driver assistance and obstacle avoidance technologies have advanced during the past decade. These driver assistance technologies may help improve the safety of such maintenance operations.

WHAT ARE WE DOING?

This Preliminary Investigation (PI) will review the leading infrared (IR) camera-based obstacle avoidance and driver assistance technologies. This will include assessment of IR camera technologies (hardware) as well as the software that uses the images produced to automatically detect obstacles and inform the driver of their existence.

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The PI will summarize the state of suitable technologies and the commercially available hardware/software solutions for obstacle detection in low visibility conditions with an emphasis on infrared imaging technologies. The PI will be used by the Division of Maintenance regarding adoption of latest technologies to improve safety in operations taking place under low visibility conditions. The assessment will include:

- A comparative assessment of various technologies for obstacle detection in low visibility conditions: a) camera, b) RADAR, c) Light detection and ranging and d) IR camera based on existing studies. The research team expect the outcome of the first task to support further investigation of the IR imaging technologies as the more promising choice.
- A list of available IR products for Advanced Driver Assistance Systems (ADAS).
- A comparative assessment of various commercially available IR-based ADAS systems. This assessment will be based on information from the vendors, e.g., marketing materials, web sites, and specification sheets or documents. The assessment will not include procurement or testing of the products. The resulting document will be used to inform the Division of Maintenance regarding availability of IR camera based ADAS systems for obstacle detection. The assessment will consider the ability of the existing IR-based ADAS systems in detecting pedestrians and other active vehicles (engine running) at night and in dense fog.

WHAT IS OUR GOAL?

The goal is to review existing applications of IR cameras for advanced driver assistance and their pros and cons under low visibility conditions, such as dense fog, for potential incorporation into Caltrans operations.

WHAT IS THE BENEFIT?

The PI will include a conclusive discussion on whether IR-based ADAS systems have potential to improve safety in operations taking place in poor visibility conditions. It will also include a list of ADAS products that use IR cameras for obstacle detection, including a tabulation of the important specifications for each product.

WHAT IS THE PROGRESS TO DATE?

AHMCT researchers provided a draft preliminary investigation report at the end of quarter one. Task Manager reviewed the document and communicated comments and edits to AHMCT throughout the month of October. A final report was then provided to the task manager for review. Feedback and comments for AHMCT were provided and a revised report was submitted by AHMCT in December for final approval. For more information, contact the task manager.
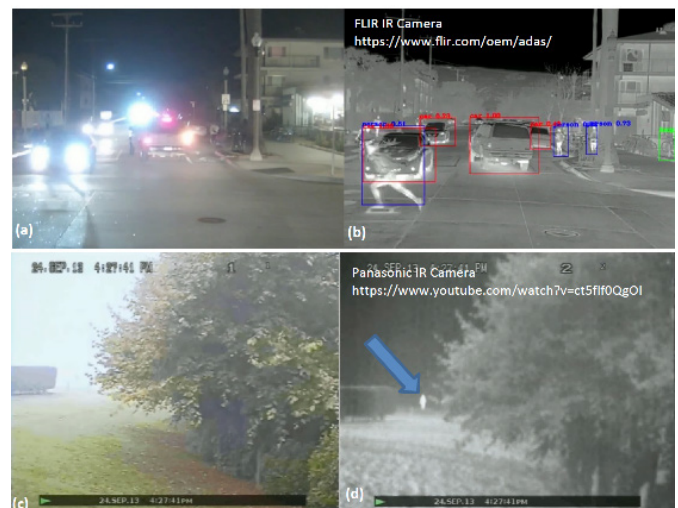
IMAGE

Image 1: Pedestrians may be almost invisible through a regular camera due to (a): bad lighting and (c): dense fog. As shown in (b) and (d), the IR camera seems to be more robust to poor visibility conditions.