ENGINEERING INNOVATIVE DESIGN COMPETITION

ENGINNOVATE

[DrosiTech Guardian]

Group : “Your Safety Starts Here”

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PROBLEM STATEMENT

The problem of driver fatigue has been a major and ongoing factor in traffic accidents in the field of transportation safety [1]. The most common existing technology measures for drowsiness detection such as Vehicle-based measures (VBM), in which a camera is located on

the front of the vehicle to detect the lane position, which helps to detect the drowsy state, often rely on external factors such as road markings, lighting, and weather conditions [2].

The existing drowsiness detection technologies often rely on indirect measures of driver drowsiness which will affect the accuracy of the measurement. These measures can be influenced by many factors other than drowsiness, such as traffic, driver distraction, or road conditions. Furthermore, the price for commercially available drowsiness detection technologies is high. Over the years, the number of cars on the road has been increased. As the volume of vehicles increases, the potential for road safety concerns, particularly the risk of accidents caused by driver drowsiness will be increased, so it is essential to implement driver drowsiness detection in real-time using live stream data. Therefore, designing a drowsiness level detection through eye and mouth monitoring is essential. These techniques play a crucial role in enhancing driver safety by promptly identifying signs of fatigue and providing time alerts, contributing to the overall improvement of road safety standards.

In contemporary times, the automotive industry has made significant strides in integrating safety technologies of automatic emergency contact features but not all vehicles currently on the road are equipped with these life-saving functionalities. This deficiency poses a potential hindrance to swift emergency response and assistance for a substantial portion of the vehicle population. Our project also seeks to address this prevalent issue by incorporating a solution that can be universally applied across diverse vehicle models. By doing so, we aim to enhance the safety net by ensuring the benefits of automatic emergency contact features extend to a more extensive array of vehicles. Through this initiative, we aspire to contribute to a safer and more connected automotive landscape, prioritizing the well-being of all road users.

Figure 1: Drowsy driving.

PROPOSED SOLUTION

Softwares:

- MediaPipe
- Python

The method used in this project follows the generic model of machine vision, comprised of 7 main elements which are scene constraints, image acquisition, pre-processing, segmentation, feature extraction, classification, and actuation as shown in the Figure 2.

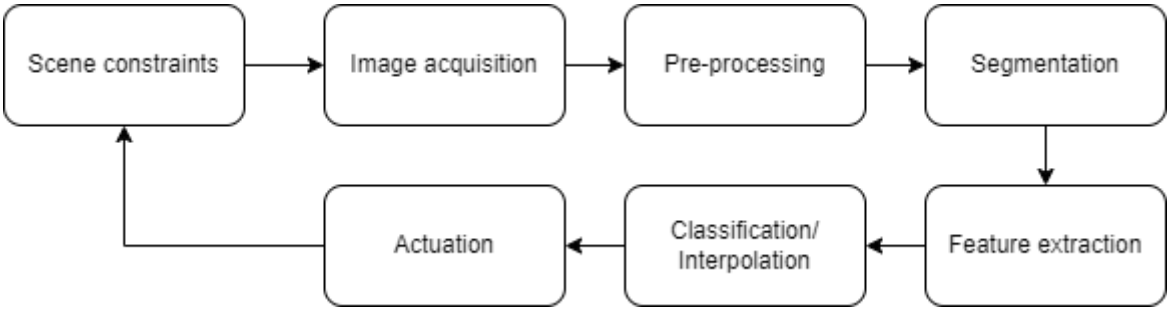

Figure 2: Generic model of machine vision

In this project, we make use of the MediaPipe Facemesh framework to extract facial features where the features of interest are the eyes and mouth. MediaPipe is utilized to aid in detecting eye and mouth motion, capturing the actual coordinates of the eyes and mouth.

After obtaining the facial landmark coordinates from MediaPipe Facemesh, the Python library which is TensorFlow can implement the neural network training and classification. The Binary Classification Neural Network is used to precisely detect the drowsy states of the driver. The raw landmark coordinates from Mediapipe are extracted and passed to Python. The Eye Aspect Ratio (EAR) and Mouth Aspect Ratio formulas are implemented in Python using the coordinates. They can used to detect drowsiness levels by detecting the opening level of the eyes and the yawning levels.

If the drowsiness detection model predicts the driver is sleepy for an extended period, a buzzer alarm will be triggered in the vehicle to awaken the driver. This prompt feedback loop aims to keep the driver alert and prevent unintended sleep while driving. In the case where an accident unfortunately occurs, likely due to driver fatigue, the system will automatically send the vehicle's GPS location to PLUS toll authorities. This will enable first responders to quickly pinpoint the accident site for dispatch. If the automatic emergency contact feature is not attended immediately by the driver in a short timeframe (Meaning that the accident happened is severe where the driver is unconscious), higher emergency response authority of emergency hotline 999 will be triggered for dispatch with the exact location of the accident.

EXPECTED OUTCOME AND CONCLUSION

In a nutshell, the developed machine vision system is able to detect the drowsiness level of a driver by using the Eye Aspect Ratio (EAR) and Mouth Aspect Ratio (MAR). Additionally,

the system can automatically send the vehicle's GPS location to emergency response authority in the case where an accident unfortunately occurs due to driver fatigue. In this project, the primary goal is avoiding accidents due to driver fatigue through driver alertness monitoring while the automated emergency location transmission capabilities add an extra layer of protection to activate help promptly in an accident. This comprehensive approach utilizes technology to reduce both the likelihood and potential impact of fatigue-related vehicular accidents.

REFERENCES

[1] "Drowsy Driving 2022 Facts & Statistics | Bankrate." Accessed: Jan. 16, 2024. [Online]. Available: https://www.bankrate.com/insurance/car/drowsy-driving-statistics/

[2] D. Han and J. So, "Energy-Efficient Resource Allocation Based on Deep Q-Network in V2V Communications," *Sensors*, vol. 23, no. 3, p. 1295, Jan. 2023, doi: 10.3390/s23031295.