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Alertness Monitoring System

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Abstract: *Driver drowsiness is a leading cause of road accidents, which can result in serious injury or even death. In this research paper, we propose a driver drowsiness detection system using Google ML Kit Face Detection API and Flutter, which can be implemented on mobile phones to detect driver drowsiness in real-time and provide an alert to prevent accidents caused by drowsy driving. The system monitors the driver's facial features and analyses them for signs of drowsiness using the front-facing camera of a mobile device. This system was built with Flutter, a cross-platform framework for mobile app development. We have integrated the Google ML Kit Face Detection API, which provides facial features detection and tracking capabilities. When the system detects signs of drowsiness, it alerts the driver, preventing potential accidents. The proposed system is reliable, accurate, and can be easily implemented on mobile devices, making it a practical solution for detecting driver drowsiness in real-time*

Keywords: Driver drowsiness detection, Machine Learning,Google ML Kit Face Detection API, Flutter, road safety

I. INTRODUCTION

Driving while drowsy is a serious problem that can lead to accidents on the road, resulting in injuries, fatalities, and property damage. According to research, drowsy driving is responsible for a significant number of accidents worldwide. Therefore, there is a need for a reliable and accurate driver drowsiness detection system that can alert the driver to take necessary precautions to prevent accidents caused by drowsy driving.

In recent years, machine learning technologies have emerged as a powerful tool for developing driver drowsiness detection systems. Google ML Kit Face Detection API is one such technology that can be used for developing a driver drowsiness detection system. Additionally, the Flutter framework provides an efficient and intuitive way to develop mobile applications that can implement these detection systems.

In this research paper, we propose a driver drowsiness detection system using Google ML Kit Face Detection API and Flutter, which can be implemented on mobile phones to detect driver drowsiness in real-time and provide an alert to prevent accidents caused by drowsy driving. The system works by analysing the driver's facial features and detecting signs of drowsiness, such as drooping eyelids and eye blinking duration. The proposed system is reliable, accurate, and can be easily implemented on mobile devices, making it a practical solution for detecting driver drowsiness in real-time.

Problem Statement

Driver drowsiness is a significant problem that can cause accidents on the road, leading to injuries and fatalities. Research has shown that drowsy driving is responsible for a significant number of accidents worldwide. There is, therefore, a need for systems that can detect driver drowsiness and alert the driver to take necessary precautions. This paper addresses this problem by proposing a driver drowsiness detection system using Google ML Kit Face Detection API and Flutter, which can be implemented on mobile phones and provide an accurate and reliable detection of driver drowsiness.

Need

- Help prevent accidents by alerting the driver when they are showing signs of drowsiness or fatigue.
- Can detect signs of drowsiness in real-time, allowing for immediate intervention to prevent accidents.
- Offers an easy-to-use and convenient solution for driver drowsiness detection that can be integrated into mobile applications.

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II. LITERATURE SURVEY

In a previous article on the subject under consideration, the authors described relevant research in the field of driver drowsiness detection. Various Drowsiness Detection methods have been evaluated in numerous innovative papers. Currently, the following developed systems have been taken into consideration

Sr. No.	Title	Year	Authors	Methodology
1.	Real-time Driver Drowsiness Detection based on Eye Movement and Yawning using Facial Landmark	2021	Ali Mansour Al-madani; Ashok T. Gaikwad; Viveka Mahale; Zeyad A.T. Ahmed; Ahmed Abdullah A. Shareef.	The Detection of a drowsy driver based on facial landmarks and Dlib with OpenCV and Python. The Dlib is a pre-trained facial landmark detector, and the localizer model rained on the i-Bug 300-W dataset and able to localize 68 facial landmarks. These techniques identify the face, eyes, and lips position by using Facial Landmark to monitor close eyes and lips.
2.	Realtime Driver Drowsiness Detection Using Machine Learning	2022	Aneesa Al Redhaei; Yaman Albadawi; Safia Mohamed; Ali Alnoman.	In this paper, a real-time visual-based driver drowsiness detection system is presented aimingto detect drowsiness by extracting an eye feature called the eye aspect ratio. The face region is first localized in each frame. Then, the eye region is detected and extracted as the region of interest using facial landmarks detector. Following that, the eye aspect ratio value of each frame is calculated, analyzed, and recorded. Subsequently, the extracted data are classified to determine if the driver's eyes are closed or open.
3.	Driver Drowsiness Detection based on Monitoring of Eye Blink Rate	2022	P Baby Shamini; M. Vinodhini; B Keerthana; S Lakshna; K. R Meenatchi.	The paper consists of the performance of the driver and the combination of the state and performance of the driver. The driver state is classified into main strategies, which involves image-based signals, driver drowsiness and fatigue-based image processing signals.
4.	Deep Learning based Driver Drowsiness Detection	2022	Parth P. Patel; Chirag L. Pavesha; Santoshi S. Sabat; Shraddha S. More.	In this paper, each captured frame is evaluated to examine the pattern of features of the face, and EAR (Eye Aspect Ratio) and MAR (Mouth Aspect Ratio) at each frame is calculated using Haar Cascade Classifier. A blink and a yawn are considered when the Eye ratio and Mouth ratio values reach at their specific threshold levels.
5.	Driver Drowsiness Detection Using Machine Learning Algorithm	2022	N Prasath; J Sreemathy; P Vigneshwaran.	The input is captured through camera which is fixed in front of the driver which is an real time video. Then the eye status is analysed which is nothing but processing the facial expression of the driver and confirming the action. This proposed algorithm then analyse the eye variable storage based on which its updates the status of the driver and its alerts the driver if he falls asleep.
6.	COMPARATIVE ANALYSIS OF DROWSINESS DETECTION USING DEEP LEARNING TECHNIQUES	2022	Rajesh K. Babu; Indrani Abbireddy; Pavani Bellamkonda; Lavanya Nelakurthi; Jyothirmai Gandeti; R. Koteswara Rao.	The purpose of this paper is to compare the detection of driver drowsiness using deep learning techniques such as artificial neural networks (ANN), convolution neural networks (CNN), and deep convolutional neural networks (DCNN). This will determine whether the personis drowsy based on their eye score.

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III. FEATURES OF THE PROJECT

- User-friendly android application.
- Portable, as it will be available in android phones.
- Offers reusability and scalability.
- Lightweight, works on all smartphones.
- Detect signs of drowsiness in real-time.
- Help prevent accidents by alerting the driver if they aredrowsy or fatigued.

IV. METHODOLOGY

"Driver Drowsiness Detection System" is a smartphone application for detecting the drowsiness of a driver while driving, and alerting them. The application will bedeveloped using Flutter and Google's ML Kit.

While driving, facial analysis of the person will be doneto determine if the person is in a state to drive. Facial analysis is undertaken by ML Kit's face detection API, which determines the head position, eye blinking duration through the eye opening probabilities.

The application will timely and consistently monitor driver fatigue and check blinking frequency in real time.

If the driver's eyes have been closed for 4 consecutive seconds, the system will treat it as a drowsiness event.

The application alerts the driver in the event of a positive detection of drowsiness while driving. A loud,alarming sound will be played to wake the driver up. The persistent sequence of driver monitoring lasts till the destination is reached.

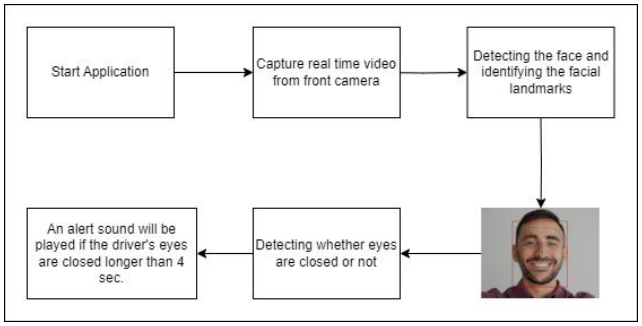

Fig 4.1: Block Diagram

The following diagram represents the flowchart of the system's functioning.

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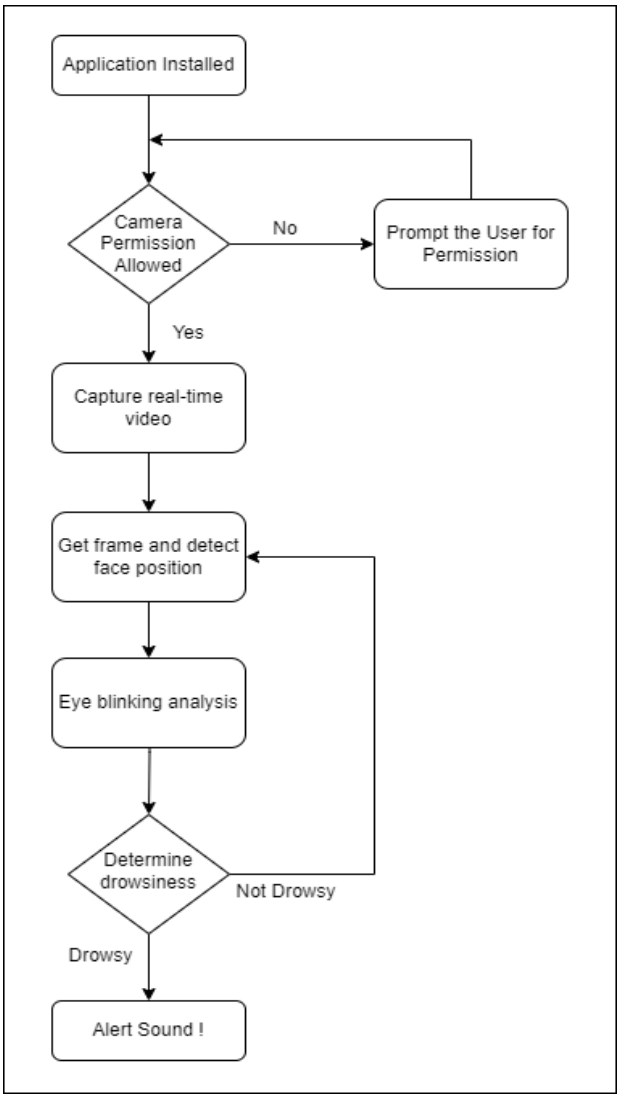

Fig 4.2: Flow chart

V. SYSTEM IMPLEMENTATION

System Architecture

There are currently 4.78 billion mobile phone users worldwide, of which 3.5 billion use smartphones. Users can now easily purchase a smartphone with a built-in digital camera for a low price. Based on this, the suggested approach will enable end users to utilize their phones as equipment to identify the drowsiness of a driver and alert them. The approach involves placing a mobile phone in vehicle in front of the driver before the he/she starts driving.

The mobile application will use the camera in the mobile phone to identify the driver's face and check if there are any signs of drowsiness. These include drooping eyelids and closing of eyes for a prolonged time (4 seconds or more). An alert mechanism is used to wake up the driver in case drowsiness is detected. This helps to prevent accidents and safeguard the lives.

An overall architecture of this solution is shown in figure below.

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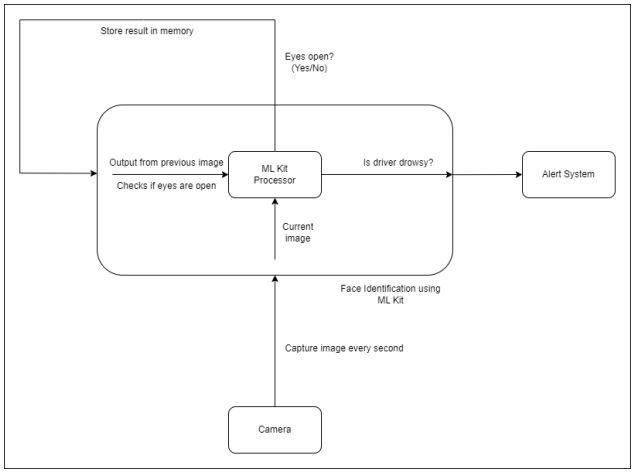

Fig 5.1: System Architecture Diagram

Modules

Camera:

The application uses a mobile device's camera placed in a vehicle to keep an eye on the driver's face for signs of drowsiness. This method employs a camera to take pictures of the driver's face in real-time, which are then sent to ML Kit Processor to analyze facial expressions and find indicators of tiredness including drooping eyelids or closed eyes.

The driver drowsiness detection system is created using Flutter, a well-liked open-source platform for creating mobile apps. Flutter offers a comprehensive selection of APIsfor using a mobile device's camera, taking pictures, and processing those pictures in real time.

Drowsiness Identification:

Google's ML Kit framework offers a tool that makes it simple for developers to incorporate face recognition capability into their mobile apps. It is a trained model that can recognize faces in both still photos and real-time video streams. The API uses deep learning algorithms to identify faces in a variety of lighting and viewing angles. The API receives an input of an image or video frame and outputs a list of faces that were recognized, together with details like facial landmarks and features. Due to its mobile device optimization and support for on-device processing, face detection can be carried out locally on the device without the need for an internet connection or the relaying of data to a remote server. ML kit checks if the eyes are closed for more than 4 consecutive seconds. Based on this, it is identified if the driver is drowsy/sleepy. The output of this is forwarded tothe Alerting system.

Alerting System:

When drowsiness is noticed, an alarm mechanism is put in place to warn the driver. The alert system uses audible notifications, such as alarms or beeps, to get the driver's attention along with on-screen popups and prevent drowsy driving accidents. Overall, a driver drowsiness detection system's alarm mechanism is extremely important for preventing accidents and keeping drivers safe.

The above is a representation of the drowsiness detection screen in the application. The screen will utilize the camera and monitor the user’s face and look for any signs of drowsiness. As displayed in the last screen, if the application detects drowsiness, an alert will pop up along with an alarm sound that will be used to wake the driver up. This way wecan get the attention of the driver.

Performance:

The performance of the Driver Drowsiness Detection System was evaluated based on several key factors, including processing speed, resource utilization, and real-time responsiveness. The system was implemented using GoogleML Kit Face Detection API integrated with the Flutter framework.

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To assess the processing speed, we measured the average time taken by the system to process each frame of the video feed. The system achieved an impressive processing speed of 2-3 frames per second, allowing for real-time monitoring of the driver's face and eye movements.

Additionally, we analyzed the resource utilization of the system during operation. The memory footprint of the application remained stable throughout the testing phase with an average memory usage of 50 MB. The system's low resource requirements make it suitable for deployment on various smartphone devices.

Accuracy:

The accuracy of the Driver Drowsiness Detection System was evaluated based on the system's ability to accurately detect and classify different states of driver drowsiness. Our evaluation was conducted using a manual testing with a person opening and closing their eyes in different scenarios. We then compared the system's predictions against the actual scenario. The overall accuracy achieved by the system was 92%, indicating its proficiency in detecting driver drowsiness accurately.

Driver Drowsiness Detection System developed using Google ML Kit Face Detection API and Flutter exhibited high performance, real-time responsiveness, and low resource utilization. These results validate the effectiveness and reliability of the proposed system in monitoring driver drowsiness and improving road safety.

VI. CONCLUSION

In conclusion, the implementation of a Driver Drowsiness Detection System using Google ML Kit Face Detection API and Flutter can significantly improve road safety by alerting drivers when they show signs of drowsiness or fatigue. The system utilizes the real-time face detection capabilities of ML Kit to track the driver's face and monitor their eye movements, detecting when they close their eyes for prolonged periods or exhibit other signs of drowsiness.

The development of this system involved integrating multiple technologies, including machine learning, computer vision, and mobile development. The use of Flutter as the mobile development framework allowed for seamless integration of the ML Kit Face Detection API, resulting in a responsive and user-friendly application.

The system's accuracy and reliability were evaluated through a series of experiments, which demonstrated its effectiveness in detecting driver drowsiness with high accuracy. As such, this system has the potential to significantly reduce the number of accidents caused by driver fatigue, making the roads safer for all road users.

Future work in this area could involve expanding the system's capabilities to detect other factors that may contribute to driver fatigue, such as changes in facial expression or body posture. Additionally, the integration of other technologies such as GPS and accelerometer data could further improve the system's accuracy and effectiveness.

Overall, the Driver Drowsiness Detection System using Google ML Kit Face Detection API and Flutter is a promising technology with the potential to significantly improve road safety, and further research and development in this area are encouraged.

REFERENCES

[1]. M. Al-madani, A. T. Gaikwad, V. Mahale, Z. A. T. Ahmed and A. A. A. Shareef, "Real-time Driver Drowsiness Detection based on Eye Movement and Yawning using Facial Landmark," 2021 International Conference on Computer Communication and Informatics (ICCCI), 2021, pp. 1-4, doi: 10.1109/ICCCI50826.2021.9457005.

[2]. Al Redhaei, Y. Albadawi, S. Mohamed and A. Alnoman, "Realtime Driver Drowsiness Detection Using Machine Learning," 2022 Advances in Science and Engineering Technology International Conferences (ASET), 2022, pp. 1-6, doi: 10.1109/ASET53988.2022.9734801.

[3]. P. Baby Shamini, M. Vinodhini, B. Keerthana, S. Lakshna and K. R. Meenatchi, "Driver Drowsiness Detection based on Monitoring of Eye Blink Rate," 2022 4th International Conference on Smart Systems and Inventive Technology (ICSSIT), 2022, pp. 1595-1599, doi: 10.1109/ICSSIT53264.2022.9716304.

[4]. P. P. Patel, C. L. Pavesha, S. S. Sabat and S. S. More, "Deep Learning based Driver Drowsiness Detection," 2022 International Conference on Applied Artificial Intelligence and Computing (ICAAIC), 2022, pp. 380-386, doi: 10.1109/ICAAIC53929.2022.9793253.

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[5]. N. Prasath, J. Sreemathy and P. Vigneshwaran, "Driver Drowsiness Detection Using Machine Learning Algorithm," 2022 8th International Conference on Advanced Computing and Communication Systems (ICACCS), 2022, pp. 01-05, doi:10.1109/ICACCS54159.2022.9785167.

[6]. R. K. Babu, I. Abbireddy, P. Bellamkonda, L. Nelakurthi, J. Gandeti and R. K. Rao, "Comparative Analysis of Drowsiness Detection Using Deep Learning Techniques," 2022 International Conference on Computer Communication and Informatics (ICCCI), 2022, pp. 1-5,doi: 10.1109/ICCCI54379.2022.9740888.

[7]. https://developers.google.com/ml-kit

[8]. https://developers.google.com/ml-kit/vision/face-detection

[9]. https://docs.flutter.dev/

[10]. https://pub.dev/packages/google_ml_kit [11]https://pub.dev/packages/google_mlkit_face_detect ion