Accident Prevention and Detection System

Krushang Vakil[1], Raj Mehta[1], Jatin Soni[1], Bhuvan Bagwe[1],Sayan Bera[1], Archana Chaudhary[2]
[1] U. G. Student, Department of Electronics and Telecommunication, D.J.Sanghvi College of Engineering, Vile Parle (W), Mumbai- 400056
[2] Assistant Professor, Electronics and Telecommunication Department D.J.Sanghvi College of Engineering, Vile Parle (W), Mumbai-400056
E-mail: [1]vakilkrushang@gmail.com, [1]mehtaraj0402@gmail.com, [1]bhuvanbagwe@gmail.com, [1] 285sayanbera@gmail.com, [2]archana.chaudhary@djsce.ac.in

***Abstract*—"Drowsiness and sleepiness are significant factors that contribute to accidents in various settings, including transportation, healthcare, and manufacturing. The use of accident prevention and detection systems has become increasingly important in mitigating the risks associated with these states. This project presents an accident prevention and detection system that effectively reduces the number of accidents in a given environment with a high level of accuracy. The system utilizes various sensors and algorithms to detect potential hazards and alert users of potential dangers, including drowsiness and sleepiness. It was built using Python and tested in a simulated environment. Future improvements to the system could include expanding the types of sensors used and incorporating real-time monitoring for faster response times. Transportation has become an integral part of our daily routine, simplifying many of our tasks. However, in recent years, road accidents caused by driver drowsiness, distractions, and exceeding speed limits have led to catastrophic consequences. Such incidents may result from factors such as drowsiness, dozing, or alcohol consumption, which can cause loss of focus and impede driving. To address this issue, this study introduces a prototype system that utilizes a Raspberry Pi, Pi Camera, and various sensors to monitor the driver's eye movements, detect yawning, and identify alcohol consumption. The Internet of Things and machine learning technologies are leveraged to enable the system to transmit data on the driver's behaviour and driving patterns to the cloud for immediate action in case of emergencies. By alerting drivers through a sound system, the device has helped prevent distractions before they occur, potentially saving lives. Cloud services and machine learning techniques are used to identify fatigued drivers through the collection and analysis of data stored in the cloud. Experimental testing of the system has demonstrated its efficiency and effectiveness in preventing accidents and providing safety assistance to drivers.**

Keywords—Alcohol consumptiom, Accident, Prevention, Dlip, Euclidean formula

I. INTRODUCTION

Driving while sleepy or under the influence of alcohol is the primary cause of traffic accidents and the resulting financial losses. Road crashes cost most countries approximately 3.14% of their GDP and lead to around 1.35 million deaths every year. In India, despite accounting for only 1% of the world's vehicle population, the country experiences 6% of global road accidents, with around 151,000 deaths resulting from road accidents. The national highway traffic safety administration is one of the main agencies that conducts research on road and driver safety. According to a study that looked at the critical reasons for road accidents, 94% of car accidents are caused by drivers, and drowsy or drunk driving accounts for 25 to 30% of accidents. Although improved automobile structures have helped reduce accidents, drivers' attitudes while driving are not evaluated properly. There are three main approaches to evaluating driver attention: visual-based, driving behaviour-based, and physiological techniques involving the analysis of vital signals such as brain activity, heart rate, and pulse rate. However, the use of electronic devices that are attached to drivers' bodies can be inconvenient. The driving behaviour- based approach evaluates drivers' behaviour over time by observing variations in speed, steering wheel angle, acceleration, lateral position, and braking. Liang et al. demonstrated a real-time approach to detecting driver distraction using eye movements and driving performance, and both support vector machines (SVM) and logistic regression models (LRM) were trained and tested to recognize driver distraction. The visual-based approach analyzes drivers' facial images, such as eye blinks, yawning, and head movements. Hammond et al. proposed a drowsiness detection system that assesses eye status in the near-infrared spectrum. Moriyama et al. predicted eye status by using templates to match with eye lids, and the number of eye blinks can also detect drowsiness. Visual-based approaches are preferred because they do not interfere with the driver.

II. OBJECTIVE

The objective of an accident prevention and detection system is to reduce the occurrence of accidents in vehicles by identifying potential hazards, providing early warning signals, and alerting individuals or systems to take preventive measures.Accidents can have significant consequences, including loss of life, serious injury, and financial damage. Therefore, preventing and detecting accidents is critical for maintaining a safe environment and protecting human life and property.

The following are some specific objectives of an accident prevention and detection system:

1. Identify potential hazards: The system should be able to identify potential hazards in various environments and provide a warning before an accident occurs. This could include identifying unsafe work practices, hazardous materials, or dangerous equipment.
2. Provide early warning signals: The system should provide early warning signals to alert individuals or systems to take preventive measures. This could include alarms, notifications, or other types of alerts.

 ISBN: 978-93-5768-409-5

3. Improve safety protocols: The system should provide feedback to improve safety protocols and procedures. This could include identifying areas for improvement, providing recommendations for training or equipment upgrades, or other suggestions.

Overall, the objective of an accident prevention and detection system is to create a safe and secure environmentthat minimizes the risk of accidents and protects the healthand safety of person By identifying potential hazards, providing early warning signals, and improving safety protocols, such a system can significantly reduce the occurrence and severity of accidents on roads.

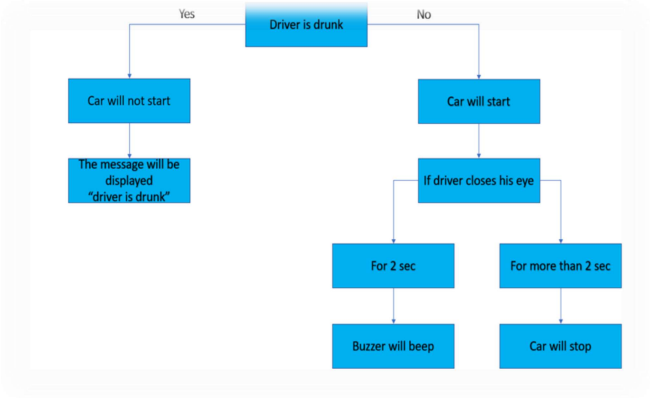

Fig.1 Block Diagram of Accident Detection System

III. DESCRIPTION

OpenCV in Python:

OpenCV(Open Source Computer Vision) is a popular open-source computer vision and machine learning software library. It provides a wide rangeof tools and algorithms that can be used for image and video processing tasks, such as object detection, tracking, and recognition. Open CV has a Python interface that makes it easy to use and integrate with other Python libraries. Here are some key features of Open CV in Python:

1. Easy installation: OpenCV can be installed in Python using pip, the Python package manager, making it easy to get started with the library.
2. Rich set of image processing functions: OpenCV provides a rich set of functions for image processing tasks, such as filtering, thresholding, edge detection, and morphological operations.
3. Video processing: OpenCV provides a number of functions for processing video streams, such as capturing frames from a camera, writing frames to a video file, and performing object detection and tracking in real-time.
4. Machine learning: Open CV includes machine learning algorithms for tasks such as object detection, face recognition, and image classification.
5. Integration with other libraries: OpenCV can be easily integrated with other Python libraries such as NumPy, SciPy, and Matplotlib, allowing for more advanced imageprocessing and data visualization.
6. Cross-platform support: OpenCV in Python is crossplatform and can run on various operating systems,including Windows, macOS, and Linux.
7. Large community: OpenCV has a large community of developers who contribute to the library by providingsupport, bug fixes, and new features.

IV. EUCLIDEAN FORMULA

The Euclidean formula, also known as the Pythagorean theorem, is used to measure the angle of vision for both eyes and is a common test used by most optometrists to diagnose refractive errors. The formula can help detect astigmatism, hyperopia, myopia and other vision problems. By measuring objects from different distances and angles, the optometrist can accurately determine the state of a patient's eyes. The formula is used by measuring the curvature of the eyes, which is a key factor in determining refractive errors.

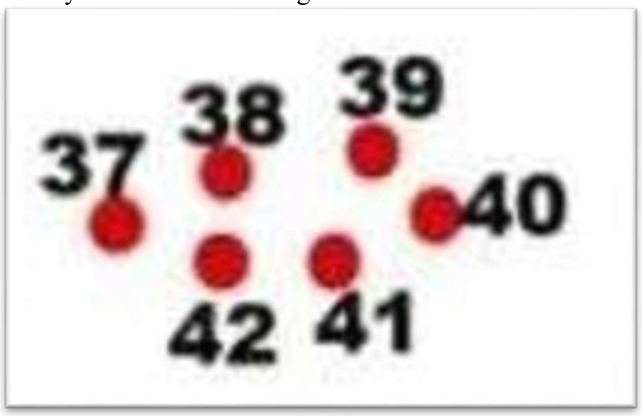

Fig.2 Diagram for Euclidean Formula

The EAR is a measure of the eye's openness, and it is calculated using the following formula:

EAR = (||p2-p6|| + ||p3-p5||) / 2(||p1-p4||) where p1, p2, p3, p4, p5, and p6 are the coordinates of six landmarks on the eye.To calculate the Euclidean distance between two points.We use the following formula:

||p1-p2|| = sqrt((p1x-p2x)^2 + (p1y-p2y)^2)

where p1x, p1y, p2x, and p2y are the x and y coordinates of the two points.To calculate the EAR using the Euclidean distance formula.

We substitute the formula for Euclidean distance into the EAR formula as follows:

EAR= (sqrt((p2x-p6x)^2 + (p2y-p6y)^2) + sqrt((p3xp5x)^2 +(p3y-p5y)^2)) / (2 * sqrt((p1x-p4x)^2 + (p1yp4y)^2))

So, to calculate the EAR using the Euclidean distance formula, we need to first obtain the coordinates of the six eye landmarks using dlib's facial landmark detection algorithm. We can then plug these coordinates into the above formula to calculate the EAR.

V.DESCRIPTION

The Dlib library is a popular open-source C++ library for machine learning, computer vision, and image processing tasks. It was developed by Davis King and first released in 2002. The library is widely used in both academic research and industry for a variety of applications, such as face detection, object tracking, image segmentation, and clustering. Here are some key features of the Dlib library:

Machine learning algorithms

The Dlib library provides a number of machine learning algorithms, such as support vector machines (SVMs), k-nearest neighbors (KNN), and deep neural networks (DNN).

 ISBN: 978-93-5768-409-5

These algorithms can be used for classification, regression, clustering, and dimensionality reduction tasks.

Image processing algorithms

The Dlib library provides a number of image processing algorithms, such as convolutional neural networks (CNNs), histogram of oriented gradients (HOG), and Canny edge detection. These algorithms can be used for image classification, object detection, and feature extraction tasks.
Facial landmark detection: The Dlib library provides a powerful facial landmark detection algorithm that can detect the location of 68 key facial landmarks, such as the corners of the eyes, mouth, and nose. This algorithm is widely used in facial recognition and facial expression analysis applications.

Cross-platform support

The Dlib library is designed to be cross-platform and can run on Windows, Linux, and macOS operating systems. It also provides interfaces for Python, Java, and MATLAB programming languages.

Efficient performance

The Dlib library is known for its efficient performance and scalability. It can handle large datasets and complex models with ease, and it can take advantage of multi-core CPUs and GPUs to accelerate computation.
Overall, the Dlib library is a powerful and versatile tool for machine learning, computer vision, and image processing tasks, and it is widely used in both research and industry for a variety of applications.

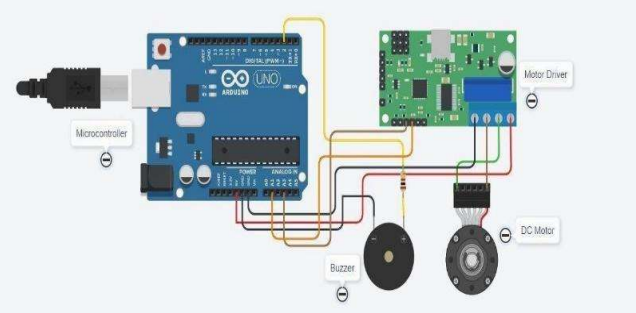

Fig.3 Circuit Diagram

VI.IMPACT

The accident prevention and detection system presented in this project has the potential to make a significant impact on society by reducing the number of accidents caused by drowsiness and sleepiness. These accidents can cause serious injuries, fatalities, and property damage, leading to significant economic and social costs. By detecting potential hazards and alerting users of potential dangers, the system can help prevent accidents from occurring in various settings, including transportation, healthcare, and manufacturing. In particular, the transportation sector can benefit greatly from this system, as it can help reduce the number of accidents caused by driver drowsiness, distractions, and exceeding speed limits. This can lead to a safer and more efficient transportation system, reducing the number of injuries and fatalities, and decreasing the economic costs associated with accidents. Moreover, the use of cloud services and machine learning techniques can enable the system to collect and analyze data on driving patterns and behaviour, providing insights into driver fatigue and other risk factors. This can help improvedriver training and education programs, leading to safer driving practices and a more responsible driving culture. Overall, the implementation of this accident prevention anddetection system can have a positive impact on society by improving safety, reducing the number of accidents, and minimizing the associated economic and social costs.
Applications of proposed system:

The accident prevention and detection system presented in this project can be applied in various settings to enhance safety and prevent accidents caused by drowsiness and sleepiness. Some of the potential applications of this system include:
Transportation

The system can be installed in vehicles to monitor driver behavior and detect potential hazards, such as drowsiness and distractions. It can also alert drivers of potential dangers, helping prevent accidents and promoting safe driving practices

Healthcare

The system can be used in healthcare settings to monitor the sleep patterns and behavior of patients, helping prevent accidents and promoting better sleep hygiene.

Manufacturing

The system can be installed in manufacturing plants to monitor worker behavior and detect potential hazards, such as drowsiness and distractions. It can also alert workers of potential dangers, helping prevent accidents and promoting safe working practices.

Mining

The system can be applied in mining environments to monitor workers' behavior and detect potential hazards, such as drowsiness and fatigue. It can also alert workers of potential dangers, helping prevent accidents and promoting safe working practices.

 ISBN: 978-93-5768-409-5

Aviation

The system can be used in the aviation industry to monitor pilots' behavior and detect potential hazards, such as drowsiness and distractions. It can also alert pilots of potential dangers, helping prevent accidents and promoting safe flying practices.

In summary, the application of this accident prevention and detection system is not limited to any specific industry or environment. It can be utilized in various settings to enhance safety and prevent accidents caused by drowsiness and sleepiness.

VII.RESULT AND CONCLUSIONS

After completing all necessary procedures, our project on "Accident Prevention, Detection System" was successfully implemented. The project's final output is presented below. In the 21st century, as science and technology continue to advance, there is increased emphasis on vehicle safety. The number of road accidents is also on the rise with the growing number of vehicles, making it our responsibility to address the issue. Most accidents occur due to drunk driving, drowsiness while driving.This project's implementation can help reduce accidents caused by these reasons. The system is automated, cost-effective, and energy-efficient, making it easy to install in vehicles. A non-intrusive system has been developed for monitoring driver drowsiness and detecting alcohol consumption, with no disturbance to the driver. The system employs self-determined algorithms to collect information on the driver's head and eye positions, and triggers an automatic alert if the eyes remain closed for an extended period. In extreme cases, the engine is shut down. The system leverages image processing techniques to achieve highly accurate and reliable drowsiness detection. Additionally, a buzzer immediately alerts the driver if someone with alcohol consumption enters the vehicle. By addressing these major factors contributing to fatal crashes, an embedded kit for drowsiness detection has been developed and is designed to be installed in vehicles.

VII.FUTURE SCOPE

Accident prevention and detection systems are becoming increasingly important in the automotive industry as car manufacturers strive to improve safety for drivers, passengers, and pedestrians. The future scope of accident prevention and detection systems in cars is vast, with new technologies and advancements being developed to prevent accidents caused by human error, improve driving conditions, and enhance the overall driving experience. One of the key areas of development in accident prevention and detection systems in cars is the use of sensors and cameras to detect potential hazards and avoid collisions. For example, some cars are now equipped with lane departure warning systems that use cameras to monitor the vehicle's position in its lane and alert the driver if they start to drift out of the lane. Some cars are also equipped with adaptive cruise control, which uses radar or liar sensors to detect the distance between the car and the vehicle in front, automatically adjusting the speed to maintain a safe distance.

REFERENCES

[1] Ashish Tawari, Student Member,Sujitha Martinand Mohan Manubhai Trivedi,'Continuous Head Movement Estimator forContinuous Head Movement Estimator for Driver Assistance: Issues, Algorithms and On-Road Evaluations 'IEEE transactions on intelligent transportation systems'.

[2] R. Panahi and I. Gholampour, "Accurate detection and recognition of dirty vehicle plate numbers for high- speed applications," IEEE Transactions on Intelligent Transportation Systems, vol. 18, no. 4, pp. 876–900, 2014.

[3] S. Kubota, Y. Okamoto, and H. Oda, "Safety Driving Support System Using RFID for Prevention of Pedestrianinvolved Accidents," in Proc. 6th International Conference on ITS Telecommunications, China, 2006.

[4] M. Desima, P. Ramli, D. Ramdani, and S. Rahman,"Alarm system to detect the location of IoT-based public vehicle accidents," in Proc. International Conference on Computing, Engineering, and Design (ICCED).

[5] K. Manogna, J. Chandra, and V. Ratnam,"Implementation of IoT based vehicle theft detection and accident monitoring system using Arduino," International Journal of Engineering & Technology.

[6] G. Sharma, "Performance analysis of vehicle number plate recognition system using template matching techniques," Journal of Information Technology & Software Engineering, vol. 8, no. 2, 2018.

[7] Prashanth K P, Kishen Padiyar, Naveen Kumar P H, K Santhosh Kumar, "Road Accident Avoiding System using Drunken Sensing Technique".

[8] Apeksha S. Chavan1, , Swapnil P.Kadam, Naval K. Mayekar, Kavita V.Jha, Poonam R. Bhagwat, "Design of Accident Prevention System UsingQRD 1114 and CNY 70 Sensors," May 2013.

[9] Dipali D. Pansare , "Accurate detection and recognition of dirty vehicle plate numbers for high- speed applications," IEEE Transactions on Intelligent Transportation Systems, vol. 18, no. 4, pp. 767–779, 2016.

[10] Dr. Sheifali Gupta & Er. Garima, "Road Accident Prevention System Using Driver's Drowsiness Detection by Combining Eye Closure and Yawning," July 2014.

[11] Kajal Nandaniya, Viraj Choksi, Ashish Patel, M B Potdar. , "Automatic Accident Alert and Safety System using Embedded GSM Interface", International Journal of Computer Applications (0975 – 8887), Volume 85 –No 6, January 2014.

[12] E Krishna Priya, P Manju, Mythra, "IoT Based Vehicle Tracking and Accident Detection System", International Journal of Innovative Research in Computer and CommunicationEngineering.

 ISBN: 978-93-5768-409-5