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Driver Observation and Automatic Braking System Using Arduino

Pratik Mahadik[1,*], Jagdish Baraskar[1], Pritam Pawar[1], Adesh Telange[1], Nayana Jadhav[2]

Abstract

Autonomous braking systems and driver observation are two important developments in car safety technology that are intended to reduce accidents brought on by tired drivers. An eye blink sensor has been incorporated in the device. The sensors recognize an eye blink automatically once the driver starts the engine. This gadget displays the sensor's output so that it may be compared to the Arduino. The eye blink sensor gets a signal from the transmission module, causing the buzzer to automatically vibrate, the LED to illuminate, and the car to automatically stop when the value hits the predetermined level. Driver Observation and automatic braking system are technologies designed to make driving safer by addressing the issue of driver fatigue. These systems identify when a motorist is becoming sleepy using a variety of sensors and gadgets; for example, wearable devices like eye blink sensor and sensors to watch for signs like eye closure, blinking patterns. These systems notify the driver to take a break or wake up by means of sounds, vibrations, or visual alerts when they notice indications of drowsiness. Due to drivers' fatigue while operating a vehicle, there has been a marked rise in traffic accidents, many of which are fatal. When a driver falls asleep, he loses control and causes an accident. This occurs when a driver is unable to maintain control of their car while traveling at a fast speed on the road. A model that can stop these kinds of mishaps can be produced by this project. This immediate feedback helps prevent accidents that could happen if a driver falls asleep at the wheel. Together, these technologies greatly reduce the risk of accidents caused by driver fatigue, making roads safer for everyone. This aims to create a framework to keep the car safe and secure through critical activity. They ensure drivers stay alert and help prevent crashes by taking over certain driving tasks when necessary. This project can produce a model that can stop these kinds of mishaps. We presented a very straightforward and affordable solution that addresses this problem in order to stop this.

Keywords: Eye blink sensor, ultrasonic sensor, relays, Arduino, DC motor

***Author for Correspondence**
Pratik Mahadik
E-mail: pratikjmahadik23@gmail.com

[1]B.E Scholar. Department of Electrical Engineering, Vishwaniketan's Institute of Management Entrepreneurship Engineering Technology (ViMEET), Mumbai University, Khalapur, Maharashtra, India
[2]Professor, Department of Electrical Engineering, Vishwaniketan's Institute of Management Entrepreneurship Engineering Technology (ViMEET), Mumbai University, Khalapur, Maharashtra, India

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INTRODUCTION

Driver Observation and automatic braking system are significant advancements in automotive safety technology designed to prevent accidents caused by driver fatigue. An eye blink sensor has been incorporated in the device. The sensors recognize an eye blink automatically once the driver starts the engine. The sensor's output is presented on this device for comparison with the Arduino. The eye blink sensor gets a signal from the transmission module, causing the automobile to automatically stop, illuminate the LED, and sound a buzzer when the value exceeds the predetermined level. The objective and reason behind the project the purpose

of this project is to create a system that will improve road safety by reducing the number of accidents brought on by tired drivers [1].

Techniques for Detection: To make driving safer, use a variety of sensors and technology to keep an eye on driver behavior and physiological indicators of fatigue. In this project, the car will turn off its DC motor and start beeping alert when the driver closes his eyes or goes to sleep for 2 min. We may prevent accidents and dangers by employing this system, which is more vital to human life. To alert the driver, an alarm mounted on the back of the car sounds. The alarm keeps going for at least 10 sec in order to wake the driver and prepare him to steady the car. As a result, we can prevent the big mishaps [2–4].

PROBLEM STATEMENT

An important factor in many traffic accidents that result in numerous injuries and fatalities every year is driver weariness. Despite awareness of this issue, current preventive measures are insufficient for real-time detection and intervention. The primary challenge lies in accurately and reliably identifying signs of driver drowsiness and fatigue, which can vary greatly among individuals and across different driving conditions. Existing technologies often fail to provide timely and effective alerts, resulting in a lack of prompt corrective actions. Moreover, there is a need to seamlessly integrate anti-sleep alarm systems with existing vehicle control technologies, such as Adaptive Cruise Control (ACC), Lane Keeping Assist (LKA), and Automatic Emergency Braking (AEB). This integration is crucial to create a comprehensive safety system that not only alerts the driver but also assists in vehicle control to prevent potential accidents. Ensuring user comfort and acceptance is another significant challenge. The system must be designed to minimize annoyance and discomfort, encouraging widespread use and compliance among drivers.

OBJECTIVE

The objective of Driver Observation and automatic braking system is to keep drivers safe by detecting when they are getting sleepy and alerting them immediately. It works with the car's existing safety features to help control the vehicle if the driver does not respond. The system is designed to be easy to use, reliable, and affordable, aiming to reduce accidents caused by drowsy driving and make roads safer for everyone. This effort will contribute to the reduction of collisions or mishaps. Our primary goal with this research is to increase safety. To that end, we are sensing the driver's eye blinks, assessing their status, and controlling the car appropriately. To inform the driver and other nearby cars, buzzers and LEDs are employed. Here, the distance between the objects is being measured via ultrasonic sensors. Our predetermined cutoff value is. the objective is to enhance driver safety by providing timely alerts and assistance, ultimately reducing the risks associated with drowsy driving and improving road safety for all road users.

METHODOLOGY

The methodology involves detecting driver fatigue through various sensors, processing the data in real-time, and providing timely alerts to the driver. Vehicle control systems assist in maintaining safe driving conditions by adjusting speed, steering, and braking as needed. The integration, testing, and continuous adaptation of these systems ensure they effectively enhance road safety by mitigating the risks associated with driver fatigue.

Hardware Components

Eye blink sensor

It works by sensing the movement of the eyelids as they open and close. This output is forwarded to the Arduino board [5]. The buzzer receives a signal from the Arduino to produce sound. Eyeblink Sensor is shown in Figure 1.

Ultrasonic Sensor

An ultrasonic sensor, as shown in Figure 2, is a tool for measuring object distances using sound waves. This gadget is electronic. These sensors emit high-frequency sound waves and employ the principles of ultrasonography to detect objects around the vehicle. These waves return to the sensor after striking an item. Ultrasonic sensors are flexible instruments for measuring distance using sound waves, which makes them useful in a variety of industries for automation, safety, and efficiency. The sensor calculates the distance between itself, and the object, based on the time it takes for the wave to return. These sensors can apply the brakes in conjunction with other systems [6].

Figure 1. Eyeblink sensor.

Figure 2. Ultrasonic sensor.

Arduino

Arduino is a small computer that you can use to make all kinds of electronic projects (Figure 3). It has a little chip inside called a microcontroller, which is like a tiny brain that can be programmed to do different things. Think of Arduino as the brain of your project. It can control lights, motors, sensors, and other electronic parts based on the instructions you give it. You write simple instructions, called code, on your computer and upload it to the Arduino using a USB cable. This code tells the Arduino what to do, like blink a light, move a motor, or sense temperature. It has a lot of built-in functions and libraries that make it simpler to get started with electronics and programming. You can use Arduino for a wide range of projects, from building robots and interactive artworks to home automation and scientific experiments. There is a large community of people who use Arduino, so there are plenty of tutorials, examples, and forums where you can get help and share ideas [7].

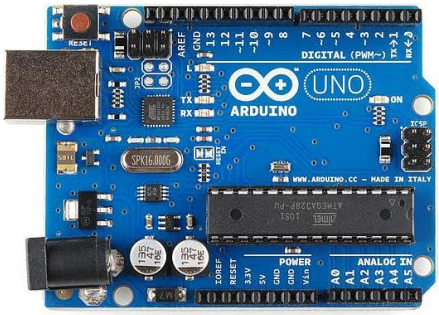

Figure 3. Arduino board.

Figure 4. Buzzer.

Buzzer

A buzzer, as shown in Figure 4, is a small electronic device that makes a buzzing or beeping sound. It is like a little speaker that produces a simple tone or noise when you apply electricity to it. When you send electricity through a buzzer, these vibrations create the buzzing or beeping sound that you hear. The frequency, or how quickly it vibrates, controls the sound's pitch. Numerous buzzers are powered directly from the device's power source and are a component of larger circuits [8].

LCD display

An LCD (Liquid Crystal Display), as shown in Figure 5, is a flat electronic screen that can show information like numbers, letters, and images; it is an electronic display module and finds a wide range of applications. A 16×2 LCD display is a relatively basic module that is frequently seen in many different kinds of circuits and devices. Inside the LCD, there are special materials called liquid crystals. When electricity flows through these crystals, they can alter shape. This change in shape controls how much light passes through each pixel, creating different colors and shades. The reasons being: LCDs are economical; and easily programmable; LCD displays are used in devices like digital watches, calculators, smartphones, and computer monitors. They provide a clear and easy-to-read way to show information to the user. An LCD with a resolution of 16×2 can show 16 characters per line [9–11]. There are two registers on this LCD: Command

Figure 5. LCD display.

Block Diagram

Block diagram is shown in Figure 6.

Implementation

Implementing a Driver Observation and automatic braking system and integrating it with vehicle control involves several steps, including the selection of appropriate sensors, developing detection algorithms, Data Collection and Processing, Alert Mechanism integrating with existing vehicle systems, and ensuring user-friendly interfaces, Testing and Validation Compliance and Standardization, Deployment and Maintenance, Public Awareness and Education. Upper view of circuit diagram of system is shown in Figure 7.

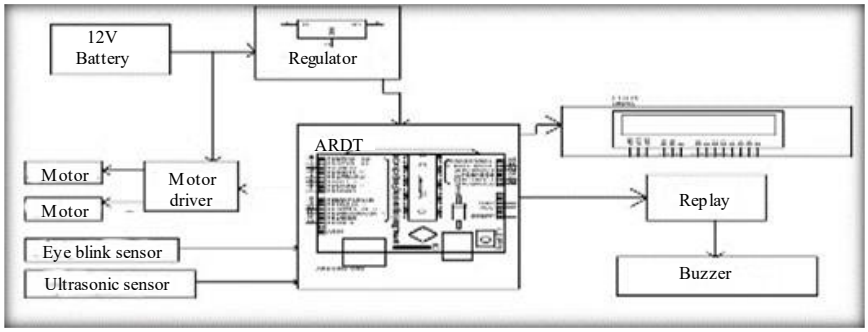

Figure 6. Block diagram.

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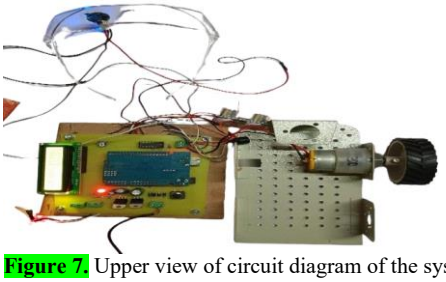

Figure 7. Upper view of circuit diagram of the system.

Future Scope

1. Development of more sensitive and accurate sensors to detect even the slightest signs of drowsiness.
2. Reduce the unit's size to make it more compact and manageable on small spaces and roadways.
3. Enhancing semi-autonomous driving systems to take over control when drowsiness is detected, ensuring safe driving until the driver is alert.

4. Development of more comfortable and less intrusive wearable devices for continuous monitoring without causing discomfort.

RESULT

The implementation of Driver Observation and automatic braking system has yielded significant positive outcomes in enhancing road safety. Key results include:

- Reduction in Accidents: Decreased Accident Rates: Studies and real-world applications have shown a notable reduction in accidents attributed to driver fatigue.
- Fewer Deaths and Serious Injuries: The number of deaths and serious injuries brought on by sleep-related driving accidents has decreased.
- Improved Driver Alertness: Effective Alerts: Drivers have responded positively to timely alerts, which effectively prompt them to take breaks or become more alert.
- Enhanced Monitoring: Continuous monitoring of physiological and behavior indicators has provided more accurate detection of drowsiness.
- Enhanced Vehicle Safety: Integration with Vehicle Systems: Seamless integration with existing vehicle safety systems (such as Adaptive Cruise Control and Lane Keeping Assist) has improved overall vehicle safety.
- Autonomous Assistance: In cases where drivers do not respond to alerts, autonomous vehicle control systems have successfully intervened to maintain safe driving conditions.
- User Acceptance: Positive Feedback: Drivers have reported high levels of satisfaction with the non-intrusive nature and reliability of the anti-sleep alarm systems.
- Increased Adoption: There has been a growing trend of adoption among commercial fleet operators and individual drivers.
- Regulatory Compliance: Meeting Standards: The technology has met various regulatory standards and safety requirements, facilitating broader market acceptance.

CONCLUSION

In conclusion, Driver Observation and automatic braking system are crucial for improving road safety. These systems detect when a driver is getting sleepy and alert them to prevent accidents. They use various sensors to monitor signs of drowsiness and can even take control of the vehicle if the driver does not respond. With advanced technology, these systems are becoming more accurate and user-friendly. By helping drivers stay alert and safe, anti-sleep alarms can significantly reduce the number of accidents caused by fatigue, making roads safer for everyone.

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