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# Vehicles Automatic Controller by using the Eye Gaze Sensor Application

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Vehicle accidents have suddenly increased over the years, and several technologies are also being researched to prevent them. The above research work offers ways of an accident prevention system employing an eye blink sensor as well as an automated braking technique to make sure that when fatigue is detected and the driver doesn't respond to the buzzer's warning bell within the permitted time, the Vehicle comes to a slow stop. During the allocated time before circuit design, the vehicle's hazard, warning lights are turned on to warn other drivers, particularly those driving ahead. Thus, the results show that the eye blink sensor is used by the car's accident prevention system once the car has stopped. The Proteus software package and the C++ programming language were utilized to verify that the automated braking system is an effective method for reducing accidents caused by fatigued driving. The design and development of a car collision and accident prevention system, when drowsiness is identified using eye blink sensors is proposed in this research paper. This research work is essential because incorporating this technology into automobiles prevents accidents caused by driving when fatigued. This research work might be improved by more research to increase driver attention by employing wireless technology to inform other cars when the driver is tired rather than using the vehicle's danger warning lights.

**Keywords:** Eye Blink Sensor, Automatic Braking System, Vehicle accidents, Programming Language

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## 1. INTRODUCTION

Colleen et al. (1989) defined an accident as an unexpected incident or an unstable condition that results in harm or property damage but is not directly caused by a calamity of natural phenomena or an uncontrollable event. But according to Ruediger et al. (1999), an accident is typically preceded by a circumstance in which one or more parts of the traffic stream failed to handle certain conditions now, leading to an unexpected injury, death, or property damage. The description above shows why traffic accidents are a major problem and are unanticipated, unpleasant, and detrimental incidents that happen without the victim's consent, especially ones that cause harm or endanger lives and property that place a strain on people, organizations, and countries throughout the world. The main types of accidents are road accidents, domestic accidents, and occupational accidents. With road accidents as the main focus, there are a lot of causes of such accidents. Some are alcohol abuse, drowsiness on the part of the driver, mechanical or electrical fault of the vehicle, poor road construction; pedestrian mistaken use of the road [1].

The main objective of the research is to design and construct an automated alertness and drowsiness monitoring system for preventing auto accidents with an eye blink sensor. The research is applicable in fields where consciousness is of much prioritysince it requires constant eye contact for operation. Statistics on collisions Foreboding evidence of the harm that driver weariness may do is provided by Pack et al. in 1995. According to each study, somewhere between 5 and 25% of accidents are fatigue-related. This phenomenon's explanation is intimately related to how weariness works. When drivers are fatigued, they do little to prevent a collision (especially braking or steering). Fatigue lowers the quality of real action performance as well as perception and decision-making skills [2-5].

This study focuses on using eye blinking to prevent accidents caused by unconsciousness. Here an eye blink sensor is fixed on a spectacle and worn by the driver where if the driver loses consciousness whiles driving it indicates through an alarm circuit. The system components of this research include Hardware, an eye closure sensor, a microcontroller, buzzer [7-10]. Based on the factors discussed above, the prevention of vehicle collision using an eye blink sensor is suggested in this research. In this paper, the Proteus software is analyzed and designed in different stages of variation in parameters.

## 2. EYE CLOSURE SENSOR

We used an eye blink sensor, which is appropriate for vehicle-based applications, to observe the activities of drivers. The device sensor is aligned to allow us to keep an eye on the motorist's head and eyes. This is suitably achieved by fixing the sensor on a spectacle that will be worn by the driver. With the help of the eye blink sensor, we aim to track how much the eyes and eyelids progress [11-15]. Parameters including the eye's opening and shutting should be included in the report (eyelid data). Calculating the frequency and length of eyelid movements as well as other characteristics may be done using the variation in eyelid spacing (the distance between the

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upper and lower eyelid) over time. The vehicle's driver fitness/fatigue level is then estimated using parameters obtained from eyelid movements. The position of the head and gaze are used to gauge attention. The eyeglass with an eye blink sensor is depicted as follows in Fig. 1.

**Fig. 1** – Eye Glass with an Eye Blink Sensor

The impact of the target vehicle's windows on equipment that uses the near-infrared spectrum must be considered, as well as near-infrared interference. The technology is intended for use in a moving vehicle. Normal vibration cannot reduce system dependability or result in system failure. The vehicle's system should function unrestrictedly in the specified range of the test temperature throughout vehicle testing.

### 2.1 Eyelid Aperture Measurement

The first step in accurately measuring eyelid movements is to assess the driver's level of weariness. For instance, the distance between the eyelids is utilized to estimate blinking frequency, eyelid closure duration, and speed of opening and shutting. Other factors, such as how wide the eye is opened, are also measured using it. At the sensor frame rate, the vehicle's system should give the current separation between the two sets of eyelids. No more than a certain amount of delay may be produced. The severity of measurement mistakes that don't change over time is somewhat lower. Data on the opening of the eyelids can be tolerated with a tiny, consistent offset or factor.

The block Simulink representation of the proposed system is shown in Fig. 2. It illustrates the suggested system's complete overview blueprint. The block diagram illustrates the research's overall structure and operation. The block diagram is composed mostly of 12 sections. They include LM324 Comparator, Eye Blink Sensor, LCD, Microcontroller, Buzzer, Traffic indicator, Brake controller, DC motor 1, DC motor 2, Voltage regulator, ignition Switch, and Battery. The block representation diagram in Fig. 2 illustrates the various components of the eye blink sensor-based automated braking system used in the vehicle accident prevention system. Such a model is intended to increase the detection of driver tiredness symptoms and to manage vehicle speed to prevent collisions by autonomous braking. The logical model represents the eye blink sensor-based automated braking system used in the vehicle accident prevention system by flow chart in Fig. 3.

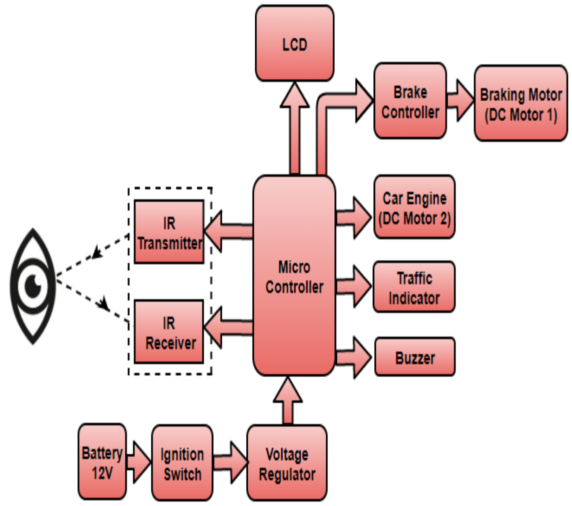


**Fig. 2** – Block Simulink Representation of the Eye Blink Sensor

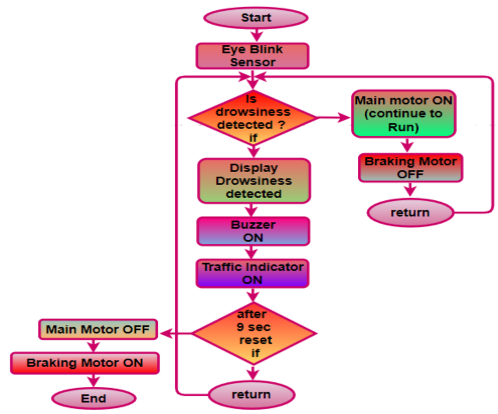


**Fig. 3** – Flow chart of Eye blink sensor to prevent vehicle accident.

### 2.2 Mode of Operation

The system is composed of a microprocessor, an eye blink sensor, and an adaptive braking system with a dc motor that allows for accurate placement of the brake pad to regulate the vehicle's speed. It operates using switching on the ignition system thus allowing current flow through the circuit. The microcontroller receives a signal from either the eye blink sensor through the comparator circuit and then begins its process by turning off the engine and activating the buzzer for nine (9) seconds, and if not being reset, continues its process by activating the traffic indicator of the vehicle to alert the nearby vehicle, and then gradually begins its braking process. When the speed at which the driver flickers his or her eyelids suggests that they are getting sleepy, the microcontroller obtains a signal, when the driver is feeling sleepy, it shows on the LCD that drowsiness is detected. It also shows sleepiness is not detected when the driver is.

### 2.3 The Micro-Controller Module

An IR transmitter is a particular sort of LED that emits infrared radiation. An IR receiver picks up the IR photons that the IR transmitter delivers. One important aspect is that the IR transmitter and receiver should have been in a straight line, as shown in Fig. 3. The transmitted signal is sent to the IR transmitter after it receives a strong signal, and when the IR transmitter LED is conducting, it transmits the IR rays to the receiver. The IR receiver is connected to a comparator. The comparator is constructed using the LM 324 operational amplifier. The inverting input wire of the comparator circuit receives the reference voltage. The non-inverting input terminal is where the IR receiver is connected. If there is a break in the line of sight between the IR transmitter and receiver, the IR receiver won't operate. As a result, the comparator's non-inverting input terminal voltage will be higher than its inverting input. The comparator output now rises to a high level in the +5V band.

Alphanumeric displays are sometimes referred to as LCDs, use liquid crystal displays. It can display letters, numbers, and special symbols, in other words. The LCD is used to display information if drowsiness is detected or not detected. The battery is the power source of the project which supplies power to theentire circuit. The battery's most important function is to provide power tothe circuit to start the motor as well as the traffic indicator and the buzzer when drowsiness is detected. The voltage of the battery is 12 volts with a current rating of 5 amps.

### 2.4 The Voltage Regulator Module

The voltage regulator circuit uses a voltage regulator. IC 7805 with capacitorsto regulate the input voltage (12 volts) to 5 volts to suit the microprocessor for its perfect functioning. Fig. 4 shows a circuit schematic with a regulator IC and all the previously mentioned components arranged.

### 2.5 The Traffic Indicator and the Buzzer Module

This circuit flashes an LED on and off with a sound produced by a buzzer to alert or warn the nearby drivers before the enginelock is activated to avoid accidents. This circuit is programmed in an A stable operating mode which generates acontinuous output via Pin 19 of the microcontroller in the form of a square wave. This turns the LED (D1) on and off according to the traffic indicator code loaded into the microcontroller. The buzzer module helps in giving out the beeping sound, the circuit connections are shown in Fig. 4.

The braking system is designed to stop the acceleration of the main motor which controls the speed of the vehicle gradually when drowsiness is detected. It is controlled by braking code loaded in the microcontroller. The Ignition system is the main part of the project which allows current to flow from the battery to the circuit. The ignition's tumblers are pushed into a specific sequence as the key is inserted into the slot, enabling the key to be spun to seal the ignition circuit. That circuit then delivers power to the motor through the hold-on circuit, which turns the motor to allow it to operate. A Latching circuit is a combination of relays that will activate when drowsinessis detected and then sustain the circuit until the reset button is pressed. Usually, if the relay needs to be controlled by a microcontroller, a transistor is used because the relay needs a higher voltage or current than the microcontroller can provide. Although some microcontrollers can give enough current to switch a relay, most of them are incapable of doing that. And the braking circuit is shown in Fig. 5.

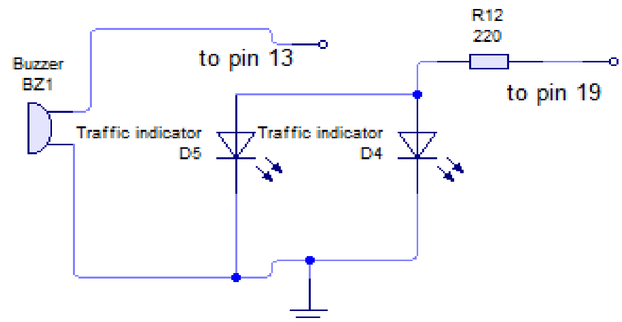


**Fig. 4** – Schematic view of the traffic indicator and the buzzer

The diode (freewheeling diode) in parallel with the relay coil (solenoid) is needed to suppress the feedback voltage that occurs when the transistor is switching off and ensures that the magnetic field stored in the coil collapses for another cycle of operation to commences and these arrangements. That feedback voltage can reach hundreds of volts, which can destroy the driving transistor.

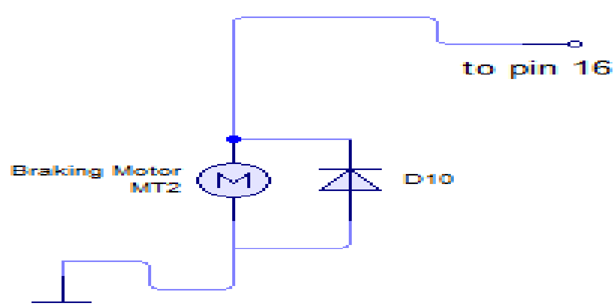


**Fig. 5** – Schematic view of the braking circuit

### 2.6 Component Analysis

Testing was done on individual components to ascertain their viability and specification through physical observation and using a digital multimeter. The test was performed again, and the LED was blinking according to the programming code. The multi-probes meters were attached to the terminals of the LED, with the positive side being connected to the LED's long leg and the negative side to the other leg. The multi-meter was switched to continuity mode. The multi-meter was powered ON and the LED glow indicated that the LED was in good condition.

The multi-meter was switched to continuity mode, and its probes were attached to the buzzer's terminals, the multi-meter was powered ON and the buzzer beeped which indicated that the buzzer was in a good condition. With the multi-meter placed in the continuity mode**,** the positive lead of the multi-meterwas connected to the anode and the negative to the cathode, and the multi-meter was powered ON and it displayed a reading between 0.6 and 0.7 V. The multi-meter was set at the ohm's mode, the multi-meter was powered ON and used to test the resistance between both terminals of the motor and the multi-meter displayed the resistance of the motor indicating that the coil is intact. After the testing of the above components, some other components were tested after they have been placed on the printed circuit board.

## 3. RESULTS AND DISCUSSION

A digital multimeter and a rheostat were used to conduct an experiment onthe sleepiness of the eye blink sensor-equipped car accident prevention system and the details of these are shown in Table 1.

**Table 1-** Outcomes of a study linking measures of ocular rheostats to levels of drowsiness.

| No. of Experiment | Rheostat Readings (Eye in %) | Drowsiness level in mV | LCD Display (Drowsiness) |
|---|---|---|---|
| 01 | 0 | 0 | Not Detected |
| 02 | 23 | 212 | Detected |
| 03 | 45 | 227 | Detected |
| 04 | 66 | 246 | Detected |
| 05 | 99 | 99 | Detected |

Fig. 6 displays the graphical representation of the rheostat's level of fatigue (the eye) data in Table 2 shows the eye blink sensor-based car accident prevention system.

Table 1 displays the comprehensive findings of a prototype vehicle accident prevention system that combines an autonomous braking system with an eye blink sensor. For each test, the virtual terminal of the microcontroller's screen was used to set the rheostat (eye) levels and detect the degree of sleepiness.

Five distinct rheostats (eye) level ranges were used for the trials, and they are as follows: 0% → 0 mv, 23% → 212 mv, 45% → 227 mv, 66% → 246 mv, and 99% → 858 mv. The 0% →0 mv value indicates that the driver's eyes are blinking normally, indicating that no signs of tiredness are present. This occurs When the eye-representing rheostat turns on it is set to 0%, which results in a digital multimeter reading that is outside of the range of 0 mV.

When the eye-representing rheostat turns on it is set to 21%, the equivalent output of 212 mv is then the lowest threshold at which the eye blink sensor provides data to the comparator then sleepiness is detectable.

This comparison signal is given to a microcontroller, and the microcontroller is configured such that it transmits information about the defect to a specific portion of the system as specified to accomplish the project's

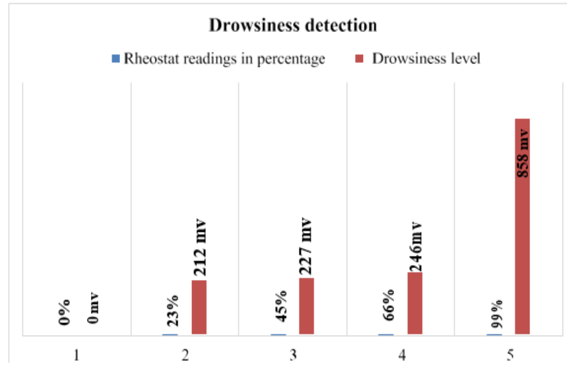


**Fig. 6** – Graph of Eye Rheostat Reading against Drowsiness Level

aim if the difference value exceeds the driver's usual blinking condition. The greatest level at which sleepiness is discernible is shown by the 99% – 858 mv.

Because the eye blink sensor uses infrared technology, it is unable to detect blinks while the eyes are open during normal vision (23%). Drowsiness is recognized when the eyelids are shut for longer than the threshold value (23 percent of the rheostat level), causing the output of the IR signal to exceed the set or threshold value as shown in Fig. 5. The experiment conducted to ascertain the sensitivity of the eye blink sensor in rheostat data in percentage versus voltage is summarized in Table 2.

**Table 2** – Results of experiments on the eye blink sensor's sensitivity

| Rheostat Reading in (%) | Voltage (v) |
|---|---|
| 0-82 | 1.31 |
| 82-100 | 1.25 |

Fig. 7 provides a graphic representation of the experimental findings regarding the sensitivity of the eye blink sensor that are listed in Table 2.

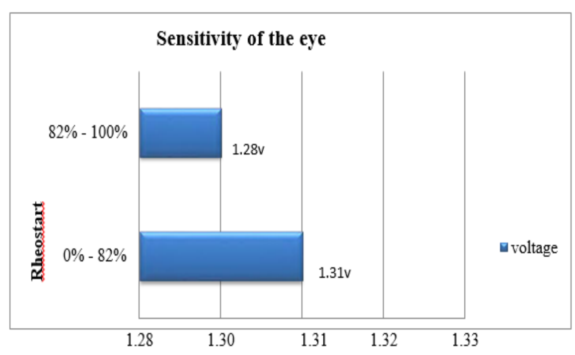


**Fig. 7** – Performance graph for the eye blink sensor

The lowest and greatest levels at which tiredness is discernible are shown in Figure 12 ***(?)***. The full outcome of the eye blink sensor's sensitivity is displayed in Table 2. The eye blink sensor's sensitivity (rheostat) versus voltage readings is as follows: 0% – 82% → 1.31 V and 82% – 100% → 1.28 V. The above rheostat readings in percentage against voltage readings depict how, whenever the sensitivity (rheostat) and a steady state voltage of 1.31 volts were changed from 0% to 82% was recorded by the digital multimeter and when it was varied from 82% to 100%, the digital multimeter displayed a constant reading of 1.28 V.

The eye blink sensor used in this research is therefore capable of detecting changes in the input voltage of 0.01 V. The eye blink sensor responded to fatigue 2.5 seconds later than it should have due to the integrated circuit (IC) of the microcontroller utilized in this study.

## 4. CONCLUSION

The Software used for simulation is Proteus and the programming language C++ was successful in verifying and validating the logical (flow chart) model. It was discovered that the experimental device created by the simulation software behaved exactly as the real – system under study after the practical constructionof the prototype was tested. To address the problem of the current system's (technology) inability to completely stop when weariness is sensed, the construction and design of the vehicle collision accident avoidance utilizing an eye blink sensor with an automated braking system were completed successfully. It is therefore recommended that an automatic braking system may be used in the designing and manufacturingof devices for preventing vehicle accidents that uses eye blink sensors.

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## Автоматичний контролер транспортних засобів за допомогою програми датчика моргання очей


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Для запобігання аваріям, кількість яких з роками збільшилася, досліджуються кілька технологій. Вищенаведене дослідження пропонує шляхи створення системи запобігання нещасним випадкам із використанням датчика моргання очей, а також техніки автоматичного гальмування, щоб переконатися, що коли виявлено втому та водій не реагує на попереджувальний сигнал зумера протягом дозволеного часу, транспортний засіб повільно зупиняється. Протягом виділеного часу перед проектуванням схеми вмикаються сигнальні лампи небезпеки автомобіля, щоб попередити інших водіїв, особливо тих, хто їде попереду. Таким чином, результати показують, що датчик моргання очей використовується системою запобігання аварій автомобіля після того, як автомобіль зупинився. Пакет програмного забезпечення Proteus і мова програмування C++ були використані для перевірки того, що система автоматичного гальмування є ефективним методом для зменшення аварій, спричинених втомленим керуванням. У цій дослідницькій роботі запропоновано проектування та розробку системи запобігання зіткненням автомобіля та аварій, коли сонливість визначається за допомогою датчиків моргання очей. Ця дослідницька робота є важливою, оскільки впровадження цієї технології в автомобілі запобігає нещасним випадкам, спричиненим керуванням у втомленому стані. Цю дослідницьку роботу можна було б покращити за допомогою додаткових досліджень для підвищення уваги водія за допомогою бездротової технології для інформування інших автомобілів, коли водій втомився, а не за допомогою світлових сигналів про небезпеку автомобіля.



**Ключові слова:** Датчик моргання очей, Система автоматичного гальмування, Аварія, Мова програмування