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MULTISENSORY HELMET ALERTING SYSTEM THROUGH DROWSINESS DETECTION OF VEHICLE DRIVERS

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Abstract
The number of traffic accidents is rising daily, vehicle accidents are mainly caused by carelessness and drowsiness. Existing projects related to accident prevention detects the unconsciousness through eye blink rate and alcohol detection , but they monitor the eyes of the driver with the USB camera attached in the vehicle, which is only effective in bright light conditions during days, but they lack in dark conditions especially in nights and USB cameras are attached not wearable. Therefore an efficient system is proposed to indicate the eye blink rate through the IR sensor which is effective in both dark and day lighting conditions and the MQ-3 sensor for alcohol detection, both the sensors are integrated in the helmet which is wearable. The proposed system prevents accidents by monitoring driver drowsiness which is detected by monitoring eye blinks in conjunction with alcohol testing. Together with the LCD, ignition system, and buzzer. The multisensory helmet is connected with Arduino UNO microcontroller. In cases where driver is discovered to be unconscious, the buzzer keeps them awake. The power supply to the ignition system is cut off, unless the motorist reacts to the buzzer sound after a predetermined amount of time. Since combustion cannot take place without power, the car is controlled by this mechanism. The vehicle is not triggered if it is determined that the driver is intoxicated. In the case that the driver does not respond to the buzzer, the multisensory system stops the power to the spark plug, preventing an accident. The system keeps the driver to be conscious while driving thus increasing the probability of safe driving, it is proved to be 87% effective in drowsiness detection and alerting mechanism.
Keywords: Alcohol Detection, Drowsiness, Eye Blink Sensor, Ignition System.

1. Introduction

Every living things must have undergone a little or major accident in order for their life to float. This is because of a lack of precaution in an automobile, as well as the driver's own irresponsibility. As time passes, technology advances at a quick pace, as to provide security technology to reduce automobile accidents, which might protect someone's life. This rash driving leads to uncontrollable nature of the vehicle, and hence results in accidents. Apart from the rash driving, consciousness of the driver is also considered more important. A drunken driver has imbalanced mentality which may also result in accidents while driving. Therefore, an efficient system is needed to indicate the drowsy and drunken-drive and to take necessary controls to avoid accidents. Road crashes are frequently the consequence of a complex interplay of circumstances. Such as (i) human mistake,

(ii) road conditions and (iii) vehicle condition. In percentage of traffic crashes, India ranks first out of 199 countries, accounting for more than 11percentage points among all accident-related deaths in the world. NH, which accounts for 2.03% of the total road system, remains to contribute for a considerable number of deaths, accounting for 35.7% in 2019, underscoring the need for better regulation and corrective actions across National Highways. Thus, consciousness of the driver is essential while driving.

2. Related work

Tariq Jamil et al., [1] as the automobile is moving, the driver's eyes are being watched with a USB camera. After receiving the data from the camera, the microcontroller starts comparing the differences between the succeeding readings of the eye tracking data. Nothing will take place on the system while both eyes are awake. But, if one or both eyes are detected to have been closed for a short period of time, the system activates the buzzer, allowing the driver a moment to react and switch it off. When the buzzer beeps repeatedly, the engine turns on the vehicle's braking system. The final step is to alert the police about the erratic motorist on the road. For detecting eye movement, compared USB camera technology with infrared sensor technology. As opposed to a USB camera, an IR sensor had a higher success rate in detecting eye blinking in a nighttime situation.

The IR sensor was used by N. T. S. A. Wadhani et al., [7] one of the world's greatest concerns is traffic congestion. Traffic officials may find the suggested method useful for tracking accidents using SMS and geo location before any disaster endangers people's lives., but only focuses on sending messages regarding the accident does not have any preventive methods.

Vatti et al., [8] smart system for communicating and detecting traffic accidents. The incidence of deadly and impairing traffic accidents is growing on a daily basis, posing a serious public health concern. The authors attempted to create an automobile accident surveillance & communications systems that would notify families, nearby hospitals, and the site of the accident.

Selvathi et al., [9] strategy for preventing and detecting accidents in the transportation. The system determines the speed of the vehicle and processes the control unit through a microcontroller through the speed specifications. When the alcohol and speed specifications exit the system stops the engine of the vehicle, but the system is not wearable type and does not monitor the eye blink rate which indicates drowsiness.

Khunpisuth et al., [10] Eye-Closeness Detection-Based Driver Drowsiness Assessment. The system monitors the eye blinking rate of the vehicle driver, when the rate exceeds or when there is a variance in normal position to abnormal face position, the system captures the image of the vehicle drivers, but the system does not indicate alcohol consumption.

Danisman et al., [11] Eye blink patterns are used in a system to detect sleepy drivers. The system monitors the eye blink pattern of the driver if abnormal conditions are found then they

send messages related to the vehicle location. They detect the drowsiness of the driver, there is no detection of alcohol consumption.

G.Arun et al., [16] Health monitoring by alcohol detection and manipulation of the vehicle is by Ignition control mechanism. The heart beat sensor and alcohol sensor monitors the health if found suspicious messages are sent to nearby native people through IOT.

Existing projects related to accident prevention focuses on detecting the eye blink rate with USB cameras, send messages of location, capturing the image of the drivers to identify drowsiness, driver health monitoring system, but IR sensor is proved to be more effective in detecting eye blink rate, some systems are not suitable for two wheelers as they are not wearable and most systems have either eye blink rate or alcohol detection. So, by combining the positives of existing systems proposing the new multisensory based System which has both eye blink detection and alcohol detection with wearable type of helmet to overcome these problems.

3. Proposed work Multisensory Helmet Alerting System

The multisensory helmet system gathers the information, processed continuously by the microcontroller Arduino UNO and has connected to the buzzer and ignition system of the vehicle. All the sensors and controllers relate to the microcontroller. The Arduino UNO microcontroller relates to the buzzer, LCD, eye blink sensor, alcohol sensor. An eye-blink detector works by infrared light on the retina and/or eyelid space. Then detecting variations in the reflected brightness with a phototransistor and splitter circuit. The precise functioning is highly dependent on the location and targeting of the emitters and detectors in relation to the eye. The alcohol detectors detect the ethanol content in a person's breath.

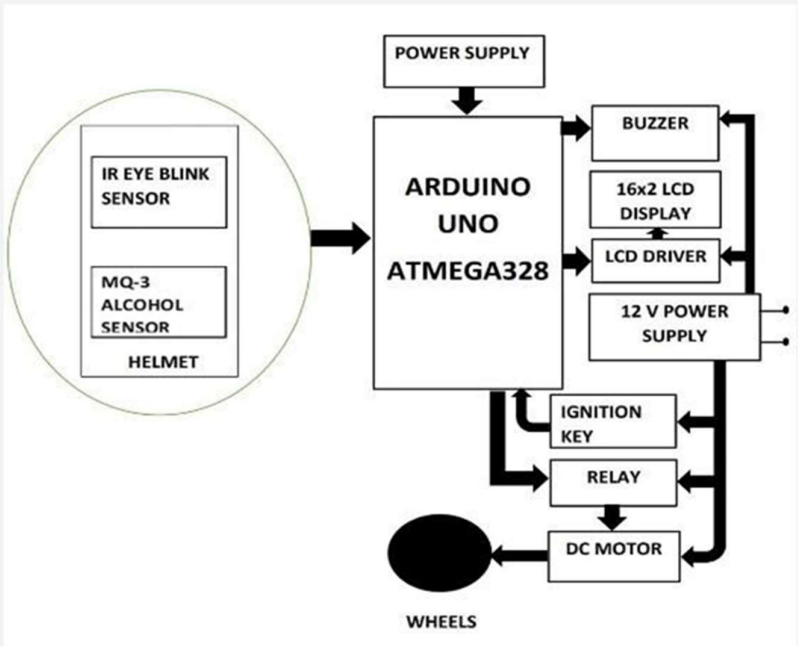

Figure 1 Block Diagram of Proposed System

The MQ 3 alcoholic sensor is utilized here. The MQ-3 sensor is made up of a tiny AL2O3 ceramics tube. It serves to draw notice to a close or gaps situation. If the motivating power shuts their eyes for more than 3 seconds, the buzzing sounds an alert and if the driver does not react, the power supply to the ignition is halted. The spark plugs need power supply to generate spark for combustion. Therefore, when the power supply to the ignition is halted, no combustion occurs, the rotary motion of the wheels is halted, and vehicle halts. Block Diagram Multisensory helmet alerting system is shown in Figure 1 which follows the below steps: The ignition system of the vehicle gets activated through the keyset. The microcontroller receives the activated signal from the keyset.

i. The multisensory system attached in helmet collects and transmits the real time sensor values to the Arduino UNO microcontroller.
ii. The microcontroller processes the sensor values and provide instructions to the Buzzer, LCD driver, relay to DC motor and ignition system.
iii. The alarm is provided through the buzzer when the eyes are closed for more than 3 seconds.
iv. If the driver does not react to the sound of the buzzer the power supply to the ignition system is halted, which halts the rotary motion of the wheel.
v. The engine does not get activated when the driver is found to be alcoholic, the vehicle doesn't get started.

The schematic diagram is illustrated in Figure 2, is the circuit diagram.

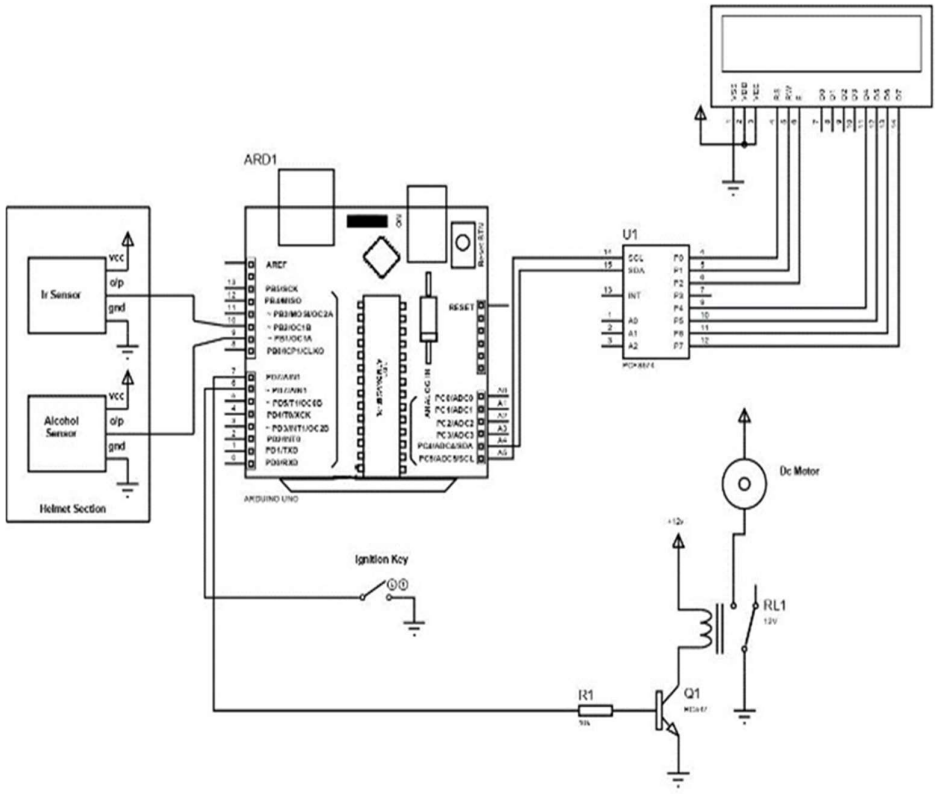

Figure 2 Schematic Diagram of proposed system

The multisensory helmet system includes components like sensors, microcontroller, dc motor and buzzer, the detailed analysis is discussed below.

3.1 Microcontroller Arduino UNO

An Arduino UNO is an open-source MC circuit created by Arduino.cc. That is inspired on the ATmega328P MC. There are 14 optic connections & 6 analogue pins on the board. All of this might help the MCU by connecting this device to the computer and allowing it to operate. The Strom supply for this board may be produced using an AC - DC converter, a USB cable, or a plug.

3.2 Eye Blink Sensor-IR Sensor

Infrared sensors are used in the optical blinking sensor. It is divided into two sections. There is a transmitter and a receiver. The transmitters constantly send forth infrared radiation to the eye. Meanwhile the receiver is always looking for differences in the reflecting wavelengths that signal an eye blink. If the eyes get closed, it signifies the output will be high. If the eyes are open, the output will be low. Because it produces outstanding results and is inexpensive, this sensor may be utilized in a wide range of robots and mechatronics applications.

3.3 Alcohol Sensor MQ-3

This is an Alcohol sensor named MQ-3, which is suitable for detecting ethanol concentration in the air. It is one of the straightforward Alcohol sensors and hence, works almost the same way as other Alcohol sensors, just like common Breathalyzer. The MQ3 alcohol gas sensor is a module used for detecting alcohol, CH4, benzene, gasoline, hexane, CO, and LPG. It features a sensitive substance SnO2 for detecting alcoholic gas, with decreased electric conductance in fresh air. It is a semiconductors alcoholic gas sensors that recognizes or controls alcoholic availability or absence. The ethanol content present in the alcohol is detected by the MQ-3 sensor.

3.4 DC Motor

The H Bridges seems to be a simple electrical circuit that allows us to supply voltages to a source in any direction. It is often used to drive DC motors in robotics applications. We may operate a DC motor in either anticlockwise or clockwise direction by employing a H Bridge. The speed increases as the given input voltage increases, and vice versa. When the maximum rated voltage is applied, the motor will spin at full speed. When SW1 and SW4 are pushed at the same time, electricity will move through positive to SW1 to A - B to SW4 to ground. As a result, the motor will only revolve in one direction. To stop the motor, open SW1 & SW4. If you push SW2 and SW3, electricity will be flowing from positive - SW2 to B - A to SW3 to Ground. As a result, the motor receives reverse power and begins to revolve in the opposite direction.

3.2 Piezoelectric Buzzer

A beeper or buzzer is a kind of electromechanical audio signaling instrument. The fundamental objective is to convert all audio signals into audible output. This buzzer is powered by a DC power source ranging from 4V to 9V. A 9V batteries is needed to power this, however a

controlled +5V/+6V DC source is recommended. In general, it is linked using a switched circuit to turn on and off the beep at the appropriate time interval. The buzzer sound provides the alarm to the driver with alternative

intervals of time when the driver is found to be in unconscious and abnormal state. The design analysis and implementation of the hardware includes these components, will be discussed below.

IMPLEMENTATION AND RESULT

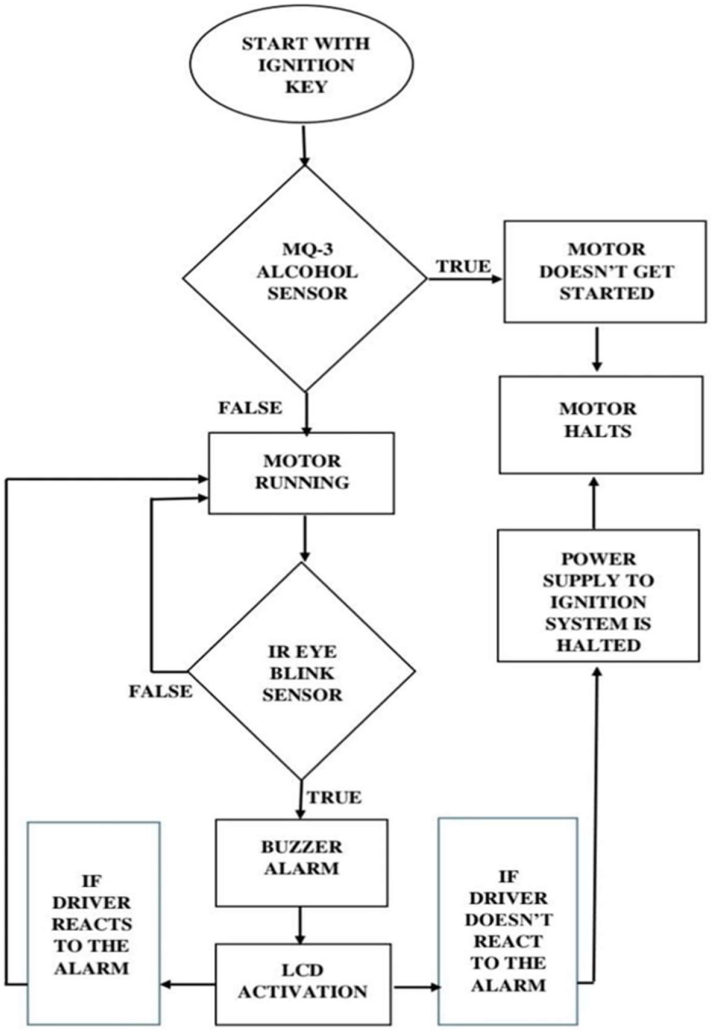

Figure 3 Flowchart of Multisensory Helmet Alerting System

The mechanism ensures that the driver is conscious while operating the vehicle. The suggested technology stops accidents by identifying driver tiredness and detecting alcohol consumption at the same time. The system in [1] used a USB camera to detect the driver's eye blink; however, there is no alcohol detection, and the vehicle is controlled by a breaking mechanism. Here, an IR sensor attached to the driver's helmet is used to record their real-time eye blink rate; additionally, the vehicle is prevented from starting if the driver is determined to be intoxicated by a MQ-3 sensor located at the bottom of the helmet. The

design analysis and implementation of the system is in Figure 3 is the flowchart of multisensory helmet alerting system. Figure 4 indicates the driver to turn ON the Ignition System.

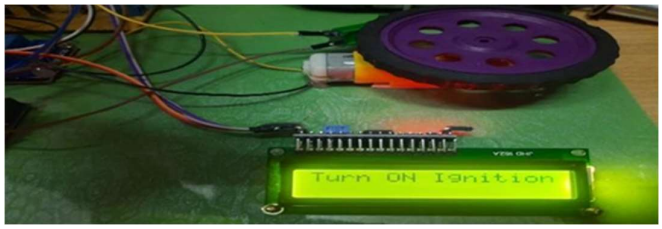

Figure 4 Before Starting the Motor

The keyset, which is attached to the microcontroller, first activates the device. The buzzer, LCD, and arduino UNO microcontroller are all coupled with the sensors. When the driver is discovered to be unconscious, a buzzer keeps him awake.

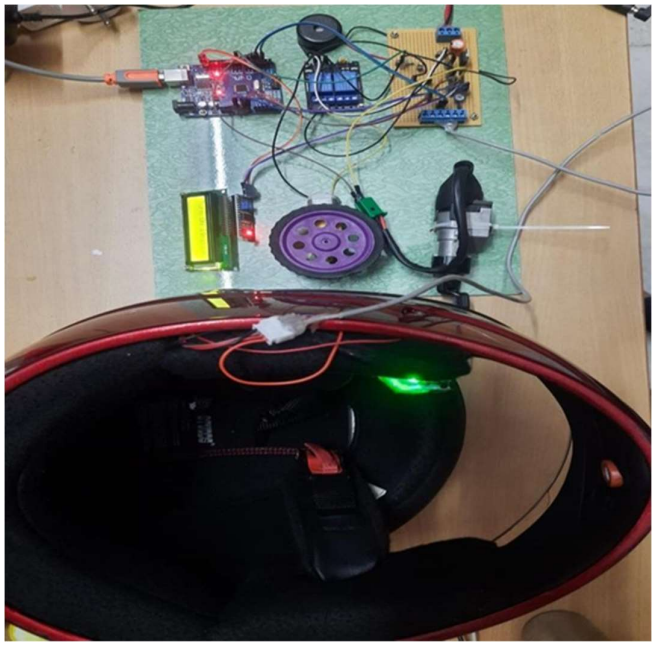

Figure 5 Hardware Setup

The piezoelectric buzzer gets activated if the eyes of the driver are found to be closed for more than 3 seconds. The buzzer is triggered by the microcontroller. The buzzer keeps the driver to be conscious whenever the driver is drowsy. The buzzer alarm has a success rate of 100% in the system. If the buzzer is activated and the driver has not responded for a predetermined amount of time, the system stops the power supply to the ignition; without this electricity, there won't be any combustion. The linked wheel rotating on the DC motor shows that the relay has shut off the power supply to the ignition system. By halting the electricity to the ignition system, the vehicle comes to a stop. The hardware setup was shown in Figure 5. Figure 6 shows a helmet with an eye blink IR sensor and MQ3 alcohol sensor attached for sleepiness detection that the driver of the vehicle can wear. By gathering real-time information, these sensors produce real-time data. The IR sensor is positioned at the top of the helmet's forehead to track

eye blinks, while the MQ-3 alcohol sensor is positioned at the bottom to track ethanol intake through the mouth.

IR Eye Blink Sensor
MQ-3 Alcohol Sensor

Figure 6 Multisensory Helmet

The ignition system's power supply is used to regulate the vehicle when the driver is determined to be drowsy by eye blink rate and alcohol detection. If driver's eyes are observed to be closed for longer than three seconds, the ignition is turned off, the spark plug is deactivated, and combustion is stopped. The IR eye blink sensor and the MQ-3 alcohol sensor are both a part of the helmet. The engine is shut off and the vehicle stops if the driver doesn't react to the buzzer. The system has two power sources: a 12V supply for components and one for the arduino UNO microcontroller.

Table 1 Multisensory Helmet Output

NUMBER OF TIMES EXPERIMENTED	18	SUCCESS RATE PERCENTAGE
EYE BLINK DETECTION RATE	16	88.8%
ALCOHOL CONSUMPTION ACCURACY RATE	14	77.7%
OVERALL DROWSINESS DETECTION RATE		83.25%

As a result, the multisensory helmet system was put through 18 tests, with the eye blinking rate showing an accuracy rate of 88% and the alcohol detection rate having a 77% success rate percentage. The total drowsiness detection rate was set at 83%. The ignition system's power supply is used to regulate the vehicle when the driver is determined to be drowsy by eye blink rate and alcohol detection. If driver's eyes are observed to be closed for longer than three seconds, the ignition is turned off, the spark plug is deactivated, and combustion is stopped. The IR eye blink sensor and the MQ-3 alcohol sensor are both a part

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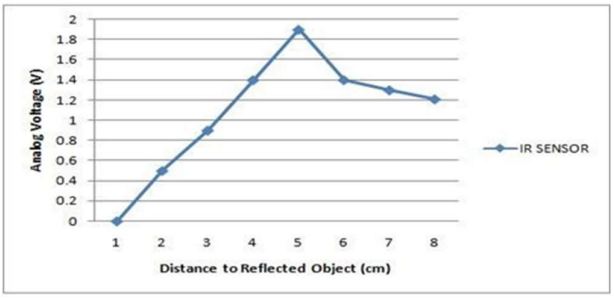

Figure 6 IR Sensor Output with Different Distance

Figure 6 Indicates IR sensor has precise results in 5cm. Thus, the IR sensor is attached within the distance of 10 cm in the helmet to have effective results.

Table 2 Comparison between Existing Systems and Proposed Framework

Characteristics	Existing System	Proposed System
System	[1] Design of Eye Blinking Detector System especially for automobile accident	Multisensory Helmet Alerting System for Drowsiness Detection of vehicle drivers.
Technology Used	The system uses USB camera to monitor the driver's eye blink pattern. The breaking system is used to control the vehicle.	The system uses IR sensor to monitor eye blink detection. The vehicle is controlled by halting the power supply to the ignition system.
Hardware Type	Not Wearable.	Helmet is Wearable.
Power Consumption	High Power Consumption	Less Power Consumption
Cost Effectiveness	Expensive	Affordable
Limitations	In day time the USB camera have good success rate, but in night time the USB camera does not work properly due to poor light.	IR sensor work well in both day and dark lighting conditions.

Figure 7 indicating the vehicle halted due to alcohol detection. The additional features of alcohol detection, a multisensory helmet that will be best suited for two-wheelers rather to placing USB cameras, and the vehicle control mechanism show that the system is more effective than [1] in this regard.

Figure 7 Vehicle Halted Due to Alcohol Detection

As IN [1] the system uses USB camera is effective in daytime eye blink detection, but the detection is not accurate in night time due to poor light. Thus, the IR sensor is implemented in the system which even detects the eye blink rate in poor light. In
[11] the system has an accuracy of 99% in eye blink detection, but not wearable they are only for four wheelers, thus the helmet in the proposed system is wearable and suitable for two wheelers.

5. Conclusion

This project is about keeping the driver conscious during driving, when the driver is drowsy by providing alarm through buzzer, drowsiness is detected by eye blink rate and alcohol detection. The existing projects detect the unconsciousness through eye blink rate and alcohol detection, but they do only detect the accident and have GSM modules in order to indicate about the accident but don't have any measures to prevent the accident. So, proposing a new multisensory based method to overcome these problems. Inside helmet, the device consists of an Infrared eye blinking sensor and MQ-3 alcoholic sensors. These sensors analyze the real time position of the driver and transmit the information. The microcontroller triggers the power supply of the ignition system to halt the rotary motion of the wheels in order to increase the probability of accident prevention.

Future Scope

The Accident prevention system uses a helmet to attach the eye blink and alcohol sensor, the driver should wear the helmet while driving. The connection between the helmet and controller system can be made wireless. The wireless HART device can be used for the wireless transmission of real time information from the helmet to the controller.

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