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IoT based Driver Drowsiness and Pothole Detection Alert System

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Abstract: One of the common in progressing countries is the maintenance of roads. Well maintained roads contribute a major portion to the country's economy. Identification of pavement distress such as potholes and humps not only help drivers to avoid accidentsor vehicle damages, but also helps authorities to maintain roads. This paper discusses various pothole detection methods that have been developed and proposes a simple and cost-effective solution to identify the potholes and humps on roads and provide timely alerts to drivers to avoid accidents or vehicle damages. Not only Potholes and humps are the main cause of accidents other than over speeding and drowsiness of driver includes the issue of accidents. Drowsy state may be caused by lack of sleep, medication, tiredness, drugs or driving continuously for long period of time. So, here is the solution for detecting the potholes and humps and to alert the driver from drowsiness while driving. In this paper, the system is structured to detect potholes and to alert the drowsy driver by using the ultrasonic sensor, eyeblink sensor and IR sensor and microcontroller. Ultrasonic sensor senses the humps, IR sensor senses the potholes and eye blink sensor the blinking of eye and this sensing signals fed into the Arduino to alert the driver by buzzer sound.

Keywords: Pothole, Ultrasonic sensor, IR sensor, Eye blinks.

I. INTRODUCTION

An IoT based driver drowsiness and pothole detection alert system using Arduino is a smart safety system that uses IoT technology and Arduino microcontroller to detect driver drowsiness and alert the driver about the presence of potholes on the road. Road accidents are a significant cause of fatalities worldwide, with driver drowsiness and poor road conditions being some of the leading causes. Therefore,

developing innovative safety systems to prevent these accidents is crucial. This system utilizes IoT technology and an Arduino microcontroller to capture and process data from various sensors, including ultrasonic sensors, IR sensors etc. The system can monitor the driver's face in real-time and detect driver drowsiness based on the driver's eye movements. Moreover, the ultrasonic sensor mounted on the car's dashboard can detect potholes on the road. The system can be customized to alert the driver in different ways, such as sounding a buzzer or sending notifications to the driver's smartphone. Additionally, the system can be connected to the internet, allowing the data to be transmitted to a remote server for analysis and further processing. This documentation will outline the various components of the IoT based driver drowsy and pothole detectionalert system and how they work together to create a reliable and cost-effective safety solution for vehicles. Moreover, the documentation will discuss the system's benefits, potential limitations, and future development possibilities. The IoT based driver drowsiness and pothole detection alert system is a practical and innovative safety solution that can help prevent accidents and ensure safer driving on the roads.

A. Objective

The main objective of the IoT based driver drowsiness and pothole detection alert system is to improve road safety by detecting and preventing accidents caused by driver drowsiness and potholes. The system is designed to continuously monitor the driver's behavior and detect signs of drowsiness, such as eye movements and head position, as well as detect potholes on the road using sensors. The system then alerts the driver in real-time using visual and audio signals to take appropriate action and avoid accidents. The goal of this system is to reduce the number of accidents on the road and save lives Driver fatigue and poor road conditions are major causes of accidents on the road, and this system aims to address both issues by using IoT technology to detect potential hazards and alert drivers in real-time. By alerting drivers to potential dangers on the road, the system can help prevent accidents, reduce vehicle damage, and ultimately save lives. Additionally, the system can provide valuable data to transportation agencies and road maintenance teams, allowing them to prioritize road repairs and improve overall road conditions.

B. Motivation

Nowadays, increasing problems of roads are facing is worsened road conditions Because of many reasons like rains, oil spills, lack of awareness to repair the damaged roads, especially potholes, make it more dangerous for drivers to drive

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safely and due to this road accidents will occur. Driver Drowsiness is also a increasing factor for road accidents reasons of many like tiredness, taking drugs, Medications, driving long period of time etc. Here, the system helps to overcome the issue of road accidents due to potholes and driver drowsiness by using sensors to detect them and alerting the driver to safe drive.

II. LITERATURE REVIEW

[1] Presents a prototype which detects the pothole in the path of driving and updates it to the cloud. Avoice notification alerts the driver of the potholes ahead. A website is being built which will be accessible by the authorities concerned so that they can take care of the potholes detected. This system will help in the maintenance of the roads.

[2] A module for Advanced Driver Assistance System (ADAS) is presented to reduce the number of accidents due to drivers' fatigue and hence increase thetransportation safety; this system deals with automatic driver drowsiness detection based on visual information and Artificial Intelligence. We propose an algorithm to locate, track, and analyze both the drivers face and 6 eyes to measure PERCLOS, a scientificallysupported measure of drowsiness associated with slow eye closure.

[3] Provides an overview of driver drowsiness detection (DDD) and measurement methods and organizes them by category. The five main categories are: subjective, physiological, vehicle-based, behavioral, and hybrid. Most DDD systems being developed today rely on either vehicle-based measure—notably the steering wheel movement (SWM) and the standard deviation of lane position (SDLP)—or methods based on the detection of behavioral clues.

[4] There are many methods existing for pothole detection whichuse sophisticated equipment and algorithms. Due to the huge data computation suchprocesses are slow and power consuming. In this system, we propose an efficient depth-based pothole detection technique without any high computation and processing.

[5, 7] This paper starts with a brief review of the field; it classifies developed strategies into severalcategories. We then present our contributions to this field by implementing strategies for automatic identification of potholes. We developed and studied two techniques based on stereo-vision analysis of road environments ahead of the vehicle; we also designed two models for deep-learning-based pothole detection.

[6, 8] Presents an automatic drowsy driver monitoring and accident prevention system that is based on monitoring the changes in the eye blink duration. Our proposed method detects visual changes in eye locations using the proposed horizontal symmetry feature of the eyes. Our new method detects eye blinks via a standard webcam in real-time at 110fps for a 320×240 resolution.Experimental results in the JZU eye-blink database showed that the proposed system detects eye blinks with a 94% accuracy with a 1% false positive rate. [9,10] proposed an electronic stick for blind persons and aided the persons with visually impaired through a assistance called SAHAYAK using IoT technology.

III. IMPLEMENTATION

A. Block Diagram

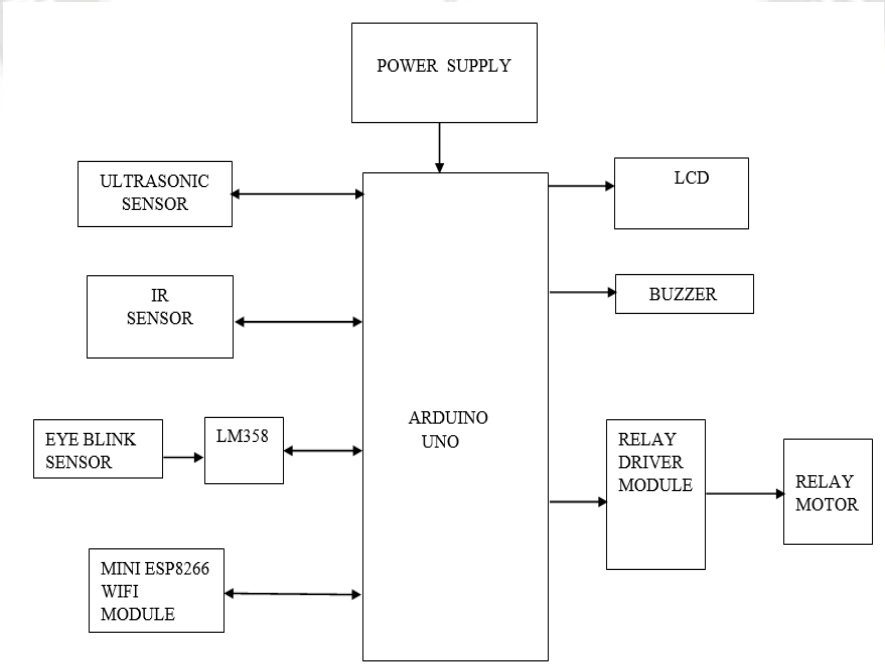

Figure 1. Block diagram of the System

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The components consist of power supply, Ultrasonic sensor, IR Sensor, Eye Blink Sensor, Arduino UNO, LCD, Buzzer, Relay motor driver. Relay motor, LM358, MINI ESP8266. Here, the power supply is used to supply the voltage to all the components. Arduino UNO is the main part of the whole system used to control the signals of components. Ultrasonic Sensor detects the distance of humps, IR sensor detects the potholes on the road and eye blink sensor detects the blinks of an eye and LM358 is used to control the eye blink sensor it is an IC module. MINI ESP8266 is a WIFI module used to see data. A buzzer is used to get sound which helps the driver to alert. And motor driver drives the motor.

Initially this prototype checks for Wi-Fi connection using MINI ESP8266 moduleas it connects to the system then it starts. When the driver in drowsy state, the eye blink sensor senses the blinks if the eye is closed where that signal sent to Arduino and then alert the driver with buzzer sound and motor in off state once the eye is opened the motor.

will start rotating. On the other case of the motor moves on when there are potholes or humps the ultrasonic sensor or IR sensor detects them and that signal sent to the Arduino and the commands from Arduino send to the Buzzer to alert the driver and controls the motor by the commands detecting from sensors. Here, the LCD displays the message of with respective states. Here the relay motor driver used to drive the motor.

B. Schematic Diagram

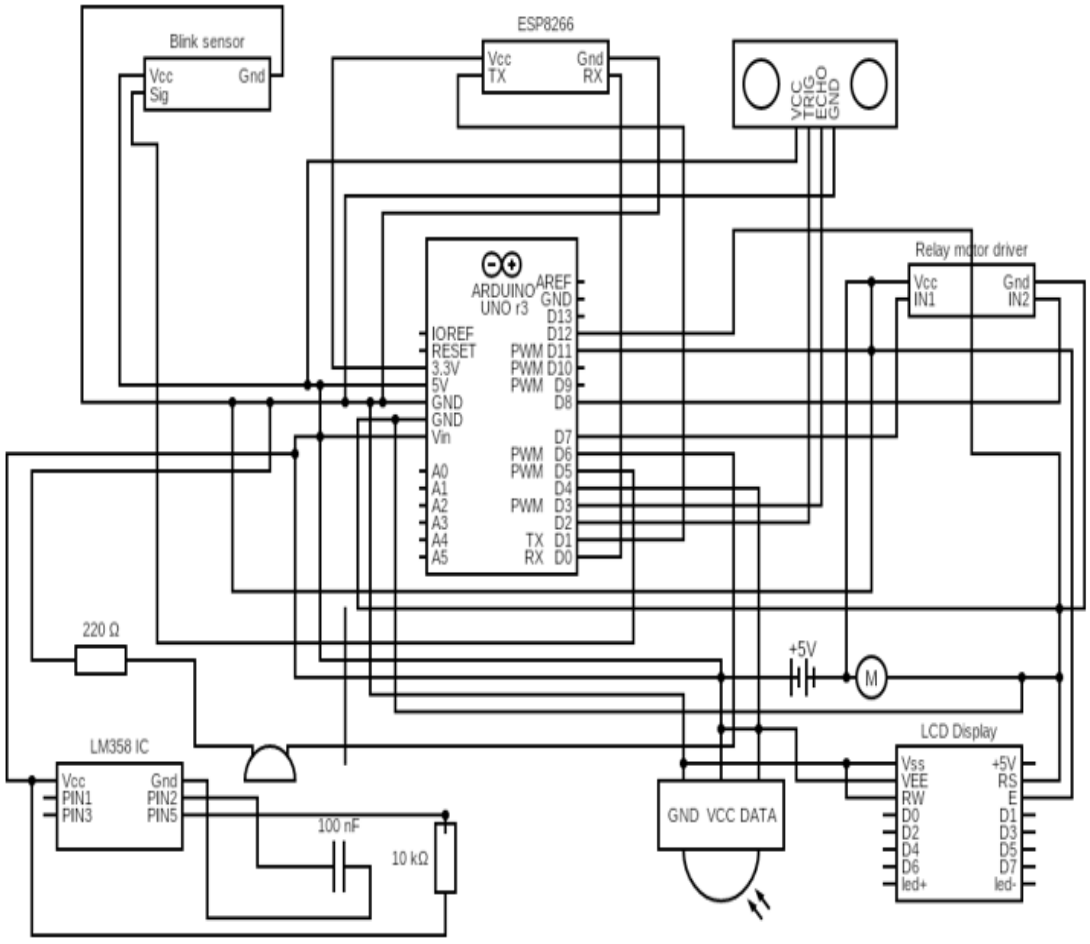

Figure 2. Schematic diagram of the System

In this system, Arduino UNO is the main controller used to interface all inputs and outputs. Arduino UNO has 14 digital pins, 6 analog pins, ground, and other pins. In this system, the ultrasonic sensor has 4 pins which are connected to Arduino that is trig and echo pins are connected to pin2 and pin3 of digital pins.

The IR sensor has 3 pins which are Vcc, ground and data pins to the Arduino pins of +5V, Ground and pin4 respectively and similarly eyeblink sensor pins also connected.

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Using resistors and capacitors LM356 IC amplifier is connected to control the eyeblink sensor. Relay motor driver is connected to motor and respectively to the Arduino pins to give supply voltage of 5V to drive the motor based on the commands.

ESP8266 is a Wi-Fi module which is used to store data and consists of 4 pins which are connected to Arduino Transmitter and receiver pins, Vcc is connected to 5V,and ground is connected to ground.

After the connections, the system is ready to give the output based on the commands dumped in the Arduino board by programming it in the Arduino IDLE software.

C. Flow Chart

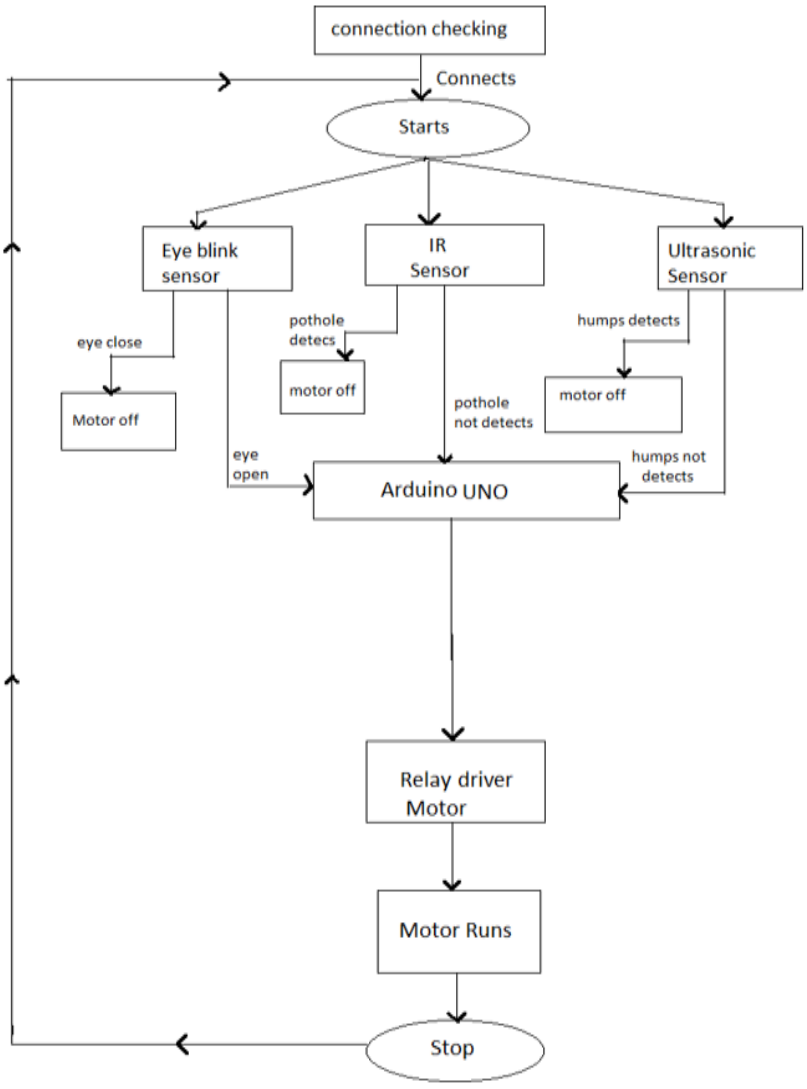

Figure 3. Flow chart

IV. RESULTS

This system helps the drivers to drive safely to reduce the road accidents caused by potholes and humps and the drowsiness of driver. They can easily judge the holesand humps on the road.

The sensor which was used is Ultrasonic sensor and IR sensor placed on the vehicle for better accuracy, senses the potholes and humps/speed breakers on the road from a distance of 10 cm and give a buzzer sound to the driver to alert the driver. So that the driver can take some action in advance and also the vehicle automatically controls. On the other case, it detects the drowsy state of driver by Eye blink sensor, when driver is in drowsy state it gives a buzzer sound to alert. To increase the distance there are other sensors but for this system we use ultrasonic and IR sensors as mentioned.

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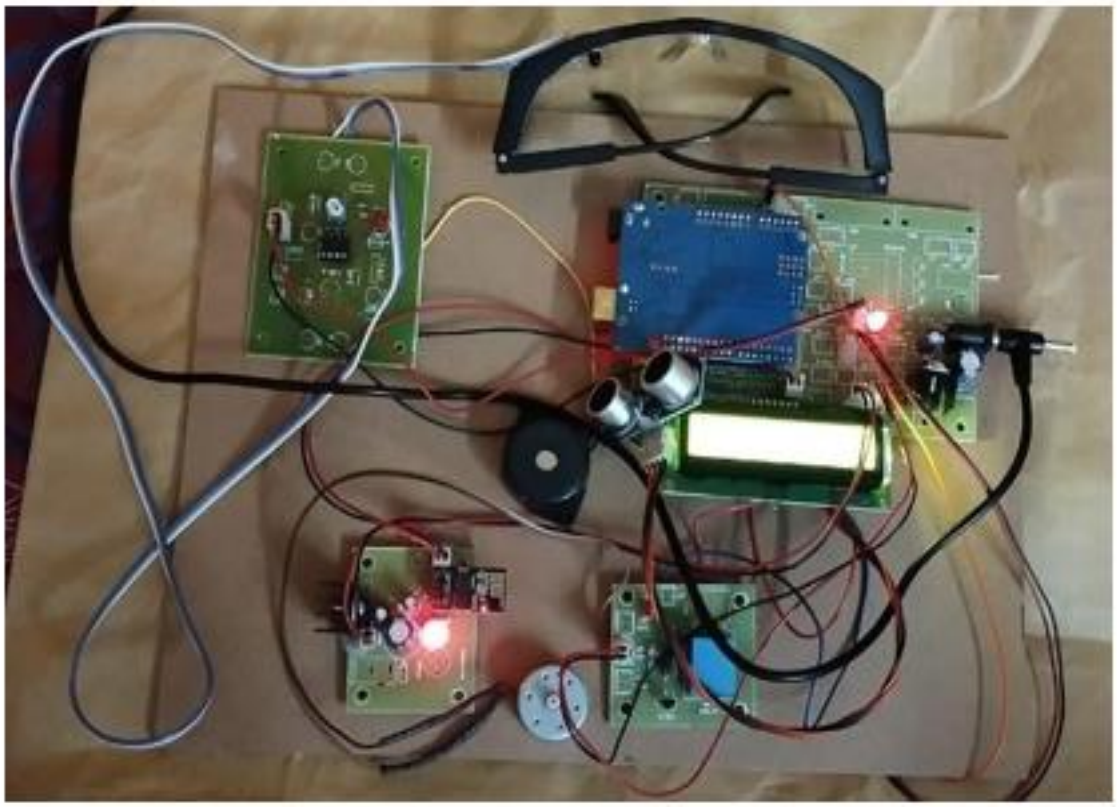

Figure 4. Hardware Setup of the system

The working model of this prototype explains the driver's drowsy state and pothole or humps on the road by using sensors.We have used different sensors for respective detections, and this is the prototype implementation. For real time there are a long range of sensors.

At first, a voltage of 230V of adapter to convert and supply the voltages to thecomponents different voltages are given to the components we have taken. Power supply board contains both 12V and 5V power and these voltages will supply to the components based on requirement. Arduino is the main controller of the whole system which takes 5V of power likewise, Ultrasonic sensor, IR sensor, Eye blink Sensor, LM356 IC takes 5V supply. Remaining components should contain 12V supply.

Initially, the system checks for WIFI connection using ESP8266 WIFI module and for this a mobile telnet app is installed in mobile by using the IP address and port number the system is connected with the app and the data will be appeared based on the detection.

At first the system checks the status of driver's drowsiness by using Eye blink sensor. If the eye blinks it counts the blinks states that the eyes are open and that message will display in LCD and in mobile telnet app. Whenever the blinking stops the eyes are closes, then it gives a buzzer sound and motor will turn off automatically.

On the other case, IR sensor is used to detects the potholes on the road. As, the motorruns the potholes are detected that will display on LCD and on mobile telnet app. Automatically, the buzzer sound will alert the driver and the motor should be turned off. Similarly, the ultrasonic sensor will measure the distance of speed breakers/humps on theroad. If the distance of humps is less than 10cm then the buzzer sounds to alert thedriver and the motor turned off. The message will display on LCD and mobile telnetapp.

The signals of all these sensors went to Arduino to control. Arduino reads the commands from sensors and sends them to the relay motor driver which is used to drive the motor. The motor runs based on their respective states.

V. CONCLUSION

In this system, we have presented the concept of IOT based drowsy driver and pothole detection alert system for alerting and controlling the road accidents and traffic road conditions using different sensors, this system is very useful for reducing of road accidents and to understand the different road conditions in different places. Comparing the traditional methods which were implemented by camera and visiting the roads by road

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authorities is a huge time process as well as cost for monitoring and also seeing that driver drowsiness is one reason for accidents. So, taking this into consideration the system we have implemented is very useful to alert the driver and to control the vehicle automatically based on the commands. This system has several advantages and is very useful for people to reduce road accidents. Lastly, the system can be expanded to include other road maintenance issues, such as road debris and roadwork, which can help reduce the number of accidents and traffic disruptions caused by these issues. The IoT-based drowsy driver and pothole detection alert system has the potential to play an important role in shaping the future of transportation.

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