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Detecting Vehicles at Hair Pin Curves using Internet of Things (IOT)

Dr. Amit Kumar Goel[1], Anmol Kushwaha[2], Vartika Srivastava[3], Anjali Singh[4], Kashaf Khan[5], Sharyar Malik[6] and Dr. Krishna Kant Agrawal[7]

[1,7]Professor, School of Computing Science and Engineering, Galgotias University, Greater Noida, India
[1]amit.goel@galgotiasuniversity.edu.in, [7]krishna.agrawal@galgotiasuniversity.edu.in
[2,3,4,5,6]Research Scholar, School of Computing Science and Engineering, Galgotias University, Greater Noida, India
anmol.avi.kushwaha@gmail.com[2]; vartikasrivastava234@gmail.com[3]; anjali120414singh@gmail.com[4]; khankashaf786786@gmail.com[5]; sharyarmalik0918@gmail.com[6]

***Correspondence:** Dr. Amit Kumar Goel; Email: amit.goel@galgotiasuniversity.edu.in

ABSTRACT- With increase in the number of vehicles especially personal vehicles there is an increase in accidents due to which, every year almost 1.30 million people die due to accidents involving vehicles. There is no effective way to prevent accidents and know the location where the accidents happen to get help easily, especially in hilly areas. In Hilly areas, there are no straight roads for vehicles and sometimes we encounter so many curves, some of which are dangerous that we have no idea if there are any other vehicles coming or not if not maneuvered properly can cause an accident. Our proposed system uses a microcontroller named raspberry pi and different IOT sensors like ultrasonic sensors and devices like LED and LCD which is an effective, and cost-effective solution to prevent the accidents at hair pin curves.

Keywords: Accident Prevention, Vehicle detection, Hair Pin Curves, Ultrasonic sensor, Raspberry pi, Light Emitting Diode (LED), Liquid Crystal Display (LCD), Internet of Things (IOT).

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1. INTRODUCTION

After an increase in demand for personal vehicles in the market every year there is an increase in the manufacturing of vehicles all over the world. In 2021, all around the world the total number of vehicles manufactured is 79.1 million vehicles were manufactured with an increase of 1.3% from the last year i.e. 2020[1]. With an increase in vehicles on the roads it also increases the number of accidents, the main cause of these accidents sometimes may be drunken drivers, drowsiness, over speeding or being distracted while driving like talking on phone or talking to others while driving. Every year almost 1.30 million people die due to accidents all around the world [2]. In India, almost 1214 accidents happen and 377 people die every day due to road accidents and 14 children die at the age less than 20 every day [3].

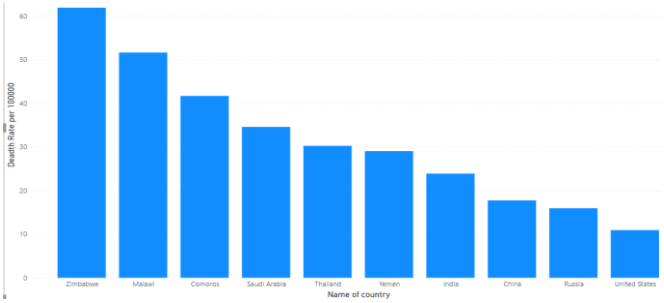

Figure 1: Death rates all over the world

The above graph shows the percentage of death rate due to accidents by vehicles all over the world in 2019[4], As we can see that Zimbabwe death rate due to accidents in the country is 61.90%, followed by Malawi which is relatively lower than Zimbabwe is 51.62%, Comoros has a death rate of 41.68%, Saudi Arabia has 34.57%, Thailand has 30.24%, Yemen has 29.03%, India has 23.87%, China has 17.73%, Russia has 15.93%, United States has 10.92% which is a relatively lower than the other countries but it contributes a large number of death due to accidents. We must take some steps to reduce accidents to save our lives.

In India, Government has increased the fine for reckless driving or driving without helmet and seat belt and to ensure the safety of people they also make some checkpoints all around the country at crossing or at around cities to ensure that people are following the rules and regulations if not they will be fined accordingly, they also make poster for the road safety also and write the famous slogans on them like for to encourage the people to wear helmet on two wheelers they use slogan as " if you got a head, you need a helmet" or to encourage them to

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drive without drinking, slogan is "Don't mix Drinking and Driving". And to make people aware about road safety we celebrate National Road safety week from 11 January to 17 January to make people more cognizant about the safety on road.

We may be moving forward towards technology and development, but in terms of safety, accidents and death due to them, we are still far behind and we must take one step toward it to improve ourselves and future generations.

2. PROBLEM STATEMENTS

In hilly areas, there are some curves where we are unable to see the other side of the road due to which we are unaware of any coming vehicles towards us and, if not maneuvered properly it can cause accidents and serious injuries. And sometimes we are unable to contact the rescue vehicles because we do not know the location where we are or we do not have proper signal in our devices.

3. LIETRATURE REVIEW

In their proposed work they have studied that backing crashes are increasing in day-to-day life in vehicles due to which they have used IOT sensors like camera, and a controller to detect the obstacles and height of it to prevent accidents, they use two approaches to solve the problem, firstly they use free space boundary (Algorithm) detection for obstacles and secondly, they use 3D point spread (Algorithm) to measure the height of the obstacles in the wide field-of view [5].

In their proposed work they studied the accidents at road departure when a driver is changing a lane due to unavoidable obstacles or due to some damages in the road. They have used a Road departure prevention system (RDPs) for collecting the data and defined 7 parameters to analyze the roads and the vehicles like what will be the speed, angle, degree at that road for safety of the other vehicles and collect data using IOT sensors like cameras [6].

In their proposed work they have developed a project in which they prevent accidents in real time, this is mainly for those drivers who drive at night or are drunk. In their project if the driver is not moving after sometime or beyond the threshold value then an alert will be generated and fuel of the vehicle will be cut to stop the vehicle and prevent the accident. In their proposed system they used Arduino, MQ-3 sensor, infrared sensor, webcam and accelerometer [7].

In their proposed work monitor and detect accidents with a fast-responding system. Their project can reduce road accidents and the life risk of humans. Their system is capable of operating in day, night, rain, fog and sunny days by detecting the vehicles ahead of it, if any vehicle is close it will generate the alert, they use black box to track the vehicles and in case of emergencies it will share the location and date, time with rescue vehicles so that they can reach faster [8].

In their proposed work used technology like V2V (Vehicles to Vehicles) communication, Raspberry Pi, MEC architecture and sensors to monitor and prevent the accidents during red light crossing. Their system also helps in monitoring the traffic at the crossing and maintaining the road safety rules. It sends a message to the nearby hospital in case of an accident, it uses a GSM module to send the location where the accident happens, the RFID on the vehicle will help in sending the message or alert to the relatives and friends in case of emergencies [9].

In their proposed work used GPS to track the public transport and study the behavior of it in urban areas which can help in traffic speed change, recover the missing GPS data using periodic cars, and that help in periodically travel on a pre-scheduled route with pre-determined techniques developed the time dependent congestion network and estimate the event venue location using network analysis [10].

In their proposed work they used IOT devices and machine learning to collect data at particular places where they have huge numbers of accidents and then they install the system and try to detect the accidents and alert the authorities. They use different sensors to detect the speed, weather, and safe distance between vehicles. They use different models of IOT and combine them like fire detection system, Vehicles tracking system, collision detection system, Driving Insight etc to detect and prevent the accidents and alert the respective authorities [11].

In their proposed work used fuzzy logic on drivers distraction by capturing the images at some interval and after implementing the system they studied the different causes of distraction while driving and by combining the different activities of drivers their system was able to detect the multi- class divers distraction to safe, careless and dangerous driving [12].

In their proposed work used automation systems and to study the traffic conflicts based on intelligent vehicles which relies on the technology of environment perception including wireless communication sensor measurements and V2X (Vehicles to everything) technology to optimize the resources there and improve the road safety and alleviate the traffic congestion [13].

In their proposed work focused on the LTR (Lateral load transfer ratio) evaluation system to prevent vehicle rollover incidents. In their system they use two different models: a non-linear suspension model and a rolling plane vehicle. By combining they were able to make a cost-effective system for vehicles and an easy to install system and provide effectiveness and feasibility in the detecting and preventing a vehicle rollover and reduce the risk of accidents [14].

In their proposed work they used an EEG (Electroencephalogram) system to detect drowsiness of the driver, in their system they have used 3 different main building blocks to detect drowsiness using EEG signals. In first block they collected raw EEG signals and EEG spectrogram, in second they performed pre-trained VGGNet and Alexnet directly on EEG spectrogram images and in the third block they used TQWT (Tunable Q-factor Wavelet transform) to decompose EEG signals and they calculated the required data from it. They also used different algorithms and compared them and were able to achieve or increase the accuracy at 94.31% [15].

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4. PROPOSED SYSTEM

4.1 Components Used

Before understanding our proposed system we need to know about the different components which we are using we have a microcontroller knows as Raspberry pi which helps in communication between different sensor and devices, ultrasonic sensor to detect objects, GPS module for location sharing, GSM module for sending SMS, and LED, LCD and Switch.

4.2 Working of Proposed System

Our project deals with alerting, detecting the vehicles and sending the notification to the emergency vehicles by collecting the data from ultrasonic sensor, switch, GSM module and GPS module and process it in Raspberry pi then turn ON or OFF the LED or display the message in the LCD.

We fix both the ultrasonic sensors at a proper height from the ground and proper distance from each other, both the ultrasonic sensors will face towards the road, we fix one at the street lamp and another one at 2-3 meters from it. And we can use the street lamp power source to power our system also. We can place the display and LEDs on the street lamp at a height visible to passing vehicles. We fix the button above or below the ultrasonic sensor so that it will be easily available in case of emergencies.

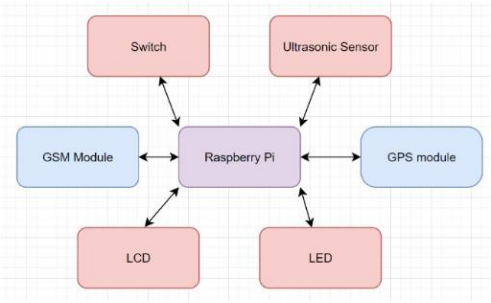

Figure 2: Block diagram of how different components interact

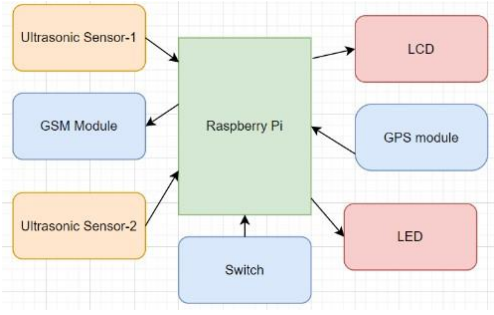

Figure 3: Data flow chart

The *figure 2* shows how different components are connected to the Raspberry pi in our system and how they can interact with each other using only the microcontroller or we can say that microcontroller is the brain of our system.

The *figure 3* shows the direction in which data will flow in the system. The arrow shows the direction of data flow. We collect the data from both the ultrasonic sensors and data will be sent and received by raspberry pi and data will always be sent to LCD and LED. And data from the GPS module will be transferred from Raspberry pi to GSM module to share the location.

Our proposed work in which firstly ultrasonic sensor will be set and them they will start detecting the vehicles when both vehicles cross the sensor then raspberry pi will determine whether the vehicle cross from the same side or just crossing from the other side by calculating and assigning it as negative or positive and accordingly turning ON and OFF the LED.

During the accidents or any emergency if any one press the switch them LCD will be turn ON and glow red and a message will be display on the screen that accident ahead go slow, and GPS module will share live location to the raspberry pi and raspberry pi will share it to GMS module and then a message containing location and help message will be send to nearby rescue team.

4.3 Algorithm

In our proposed work we are using two different types of modules. The first is to detect the vehicles using the sensors and second one is to send the location through GSM modules. Both the algorithms will work parallel to each other.

4.3.1 Detecting the Vehicles

In this we select 4 pins, out of which 2 pins will be pulse generator pin and other 2 will be digital pins for taking input to the raspberry pi from ultrasonic sensors and we will set the sensors by setting the pulse rate.

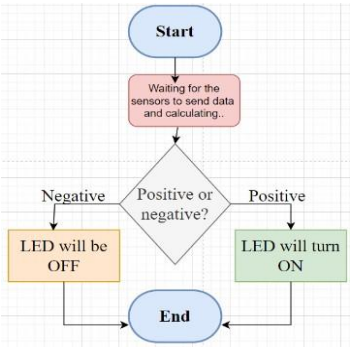

Figure 4: Algorithm for detecting the vehicles

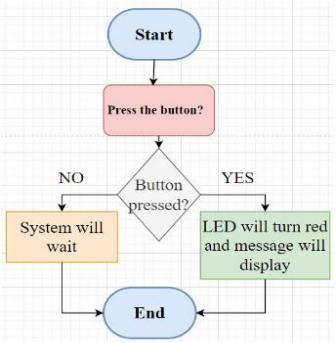

Figure 5: Algorithm for sending location and message

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The *figure 4* shows the algorithm of detecting the vehicle. The system will wait for the sensor to receive the data, and after data has been processed it will act accordingly by glowing the LED. After this process has completed the LED will glow for 2 minutes and then it will be turned OFF by the system and the system will again wait for the data from the sensors.

4.3.2 Sending Location

In this we connect GSM and GPS modules to the raspberry pi and wherever the switch is pushed it will trigger the GPS module to send the location and then GSM module will be trigger after receiving the location and GSM will send the message to rescue team every 10-15 minutes about the emergency, and LED will turn RED and Display will be showing the accident ahead message and making people aware about it, and after the rescue, they can switch off the GSM module so that it can stop sending the SMS and LED and display will also be turned OFF.

As shown in the *figure 5*, it shows the working of the GSM module after the press of the button or switch it will trigger the modules otherwise, they will be in a switch off position to save the energy. The *figure 5* shows that the LED will turn red and the LCD will display the message. Otherwise, systems will be in wait condition till the button is pressed.

5. CONCLUSION

It is a cost-effective project and can be implemented easily at many places like the places where the road views are blocked by obstacles like buildings, trees or houses. With our work we will be able to detect the vehicles and save lives of the people. In case of emergencies also it can send alerts to the hospitals and police or fire station for rescue operations, and save lives.

6. FUTUER SCOPE

In the future we can implement our project at multiple places and connect them all to gather data and save their data and use artificial intelligence and machine learning on it to improve the system efficiency. This project can also be used in different situations like we can implement it in signals at the crossing to save fuels of the vehicles by detecting coming from the other side and turning the light red for others.

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