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Smart Driving and Vehicular Communication Using IoT

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Abstract: Vehicular communication systems are computer networks in which vehicles are the communicating nodes, providing one another with information, like safety warnings and traffic information. They can be effective in avoiding accidents and traffic jams. This vehicular communication will collect different vehicular parameters as sensor values from Electronic/Engine Control Units (ECUs). The paper focuses on the implementation of vehicular communication systems that will collect vehicle related data and transmit it over Wi-Fi or USB to serial converter to the vehicle. Also sending emergency alerts to the respective people and authorities if an accident occurs. This system can be installed in any vehicle. Implementation of the system is done using Arduino, GPS sensor, Hall Effect sensor (speed sensor), Wi-Fi modem and various others.

Keywords: ECU, Sensors, USB to serial converter, Vehicular communication systems, Wi-Fi.

I. INTRODUCTION

Nowadays everyone is concerned with safe vehicular transportation. Vehicle communication systems will help to ensure this. The main motive for vehicle communication systems is safety and eliminating the excessive issues of traffic collisions. Additionally, approximately fifty million people are injured in traffic accidents. If preventive measures are not taken, then road death is probably going to become the third-leading cause of death. GPS technology is the best and most cost-effective measure to avoid accidents. Everyone seems to be aware of the GPS technology that is a reliable mode of communication. [1], [2]. A large number of accidents occur every year due to a lack of communication between vehicles and surroundings. By the implementation of vehicular communication systems, the vehicle will be aware of its surroundings, such as other vehicles and obstacles. The respective vehicle will get a notification when other vehicles or obstacles are at a short distance.

This paper deals with the implementation of a system that will enable the communication of real-time data collected from the vehicle wirelessly through Wi-Fi Also sending emergency alerts to the respective people and authorities if an accident occurs. The communication protocols and Wi-Fi are used for in-vehicle communication. Sensors such as GPS sensor, Hall Effect (speed) sensor, ultrasonic sensor, IR sensor etc collect data from the vehicle and are then interfaced with Arduino boards to act as data collection ECUs. This data can be used to detect a sudden change in the status of the vehicle and alert the driver.

In this paper, section II provides the related work, section III deals with the problem statement, section IV gives details about the System Architecture, section V deals with the system overview and methodology, and finally, section VI gives the conclusion.

II. RELATED WORK

Due to more number of vehicles on the road, traffic congestion and transportation delay in urban areas are increasing day by day, there is a need to respond to emergency calls with minimum delay for vehicles, such as ambulances, fire trucks and police vehicles [3]. By using vehicle-to-vehicle communication, it is possible to detect the movement and position of other vehicles [4]. The main goal of Vehicle-To-Vehicle communication technology is to aid prevent automobile crashes before they occur [5].

To implement the system, different data collection sensors are associated with the vehicle. Different systems that implement V2V communication and applications of V2V in the automotive domain were reviewed. Most of the existing research for data collection and sensory systems in the area of V2V and V2I communication involves GPS, video

processing systems, ultrasonic systems, speed sensing and brake position systems [6]. Advancement in communication technologies brings out fast and timely data delivery. The communication technologies that can find applications in V2V are reviewed.

Protocols that can be used for communication were reviewed to bring out a complete system, implementing in-vehicle as well as wireless communication to other vehicles. Collision avoidance, vehicle cruising assistance, traffic information broadcasting, vehicle security are among the many applications, which can benefit from V2V communication.

Collision partner is one in each of the key attributes in determining the severity outcome of crashes. The severity of crashes varies whether or not the collision partners remain identical. Other factors could also be fixed or random. This study attempts to structure the crash severity outcome for vulnerable road users involving passenger and heavy vehicle crashes using multinomial and ordered models. The model is developed using data from National Highway-6, considering crash time, roadside activity characteristics and road inventory details as contributing factors. The outcomes are categorized into three categories which are minor, major and fatal crashes. The study also attempts to spot factors influencing higher severity crashes [7].

Data collection is an integral part of a V2V communication system as it provides the data that is to be communicated for serving the needs of different applications. The purpose is to improve the safety, the comfort of drivers and passengers. Starting from the technologies applied to today's vehicles, which can potentially operate independently, the reviews have analyzed the primary systems, applications and protocols that best meet the requirements necessary for the belief of effective technological cooperation at the service of road safety. Another goal to be achieved are going to be the development of the technological infrastructure, which can involve the entire and total operation of the V2V, V2I, and V2X communications [8], [9],[10].

Global Positioning System (GPS) is becoming widely used for tracking and monitoring vehicles. The systems provide the location of vehicles at an affordable cost. The system can be built using the microcontroller. The GPS receiver connecting to the microcontroller through the serial port and used to obtain the present location. The tracking server receives vehicle location information via network and stores this information in the database. This information is available to authorized users of the system over the internet connection on the map [11].

III. PROBLEM STATEMENT

In recent times, due to road accidents, many people have lost their lives each year and a large number of people have been injured. The main reason for these accidents is due to a restricted view of the road that can be due to distance, fog, drunk drivers and any other obstacles. Road accidents are mainly caused due to drunk and driving, unable to identify roadside obstacles, the bad road surfaces, and the worse weather conditions. These causes are the prime reasons for road accidents.

IV. SYSTEM ARCHITECTURE

The modules are connected to the Arduino board with their respected pin configurations. When the Arduino board gets power supply, communication takes place between the RFX pair with the help of the transmitter and receiver pins. The message stored in the transmitter is displayed at the receiver on the serial monitor [12], [13].

After the microcontroller receives the information coming from the sensor, it starts to compare the difference between the successive readings of information. The threshold value compares with the previous values. If the threshold values reach the fixed level, the system activates the motor to stop and digital values are sent over the Wifi/USB to serial converter. After processing the data successfully output going to store on the cloud for future use and will display in the form of the buzzer or LED indicator [14].

This mechanism was used with all sensors connected to the Arduino board. The ultrasonic sensor uses sound waves to sense for the obstacles that lie ahead and behind the vehicle. If the object is close to the module, the buzzer beeps to alert the driver. If the obstacle comes too close, then the buzzer beeps at a faster frequency. In this way, the security of the vehicle is ensured. All these sensed values can be displayed on the screen. An ultrasonic sensor also helps in avoiding collisions during reverse gear by placing it on the rear bumper. It can be placed on the front bumper of the car to avoid a collision in slow moving traffic.

An IR sensor also works like an ultrasonic sensor. The major difference is that IR uses light waves and ultrasonic uses soundwaves. Also, IR sensors are positioned to the sides of the vehicle to detect if any obstacles are close by. The presence

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of objects nearby to the vehicle sensor will be detected without any physical contact and also radiates an electromagnetic field and looks for changes in the field. For ultrasonic sensing, the most widely used range that this sensor can detect is 40 to 70 kHz. Using sound waves the distance between the vehicle and the object is calculated. If the sensed distance less than the threshold distance value an alerting system is started and distance is displayed on the LCD Screen.

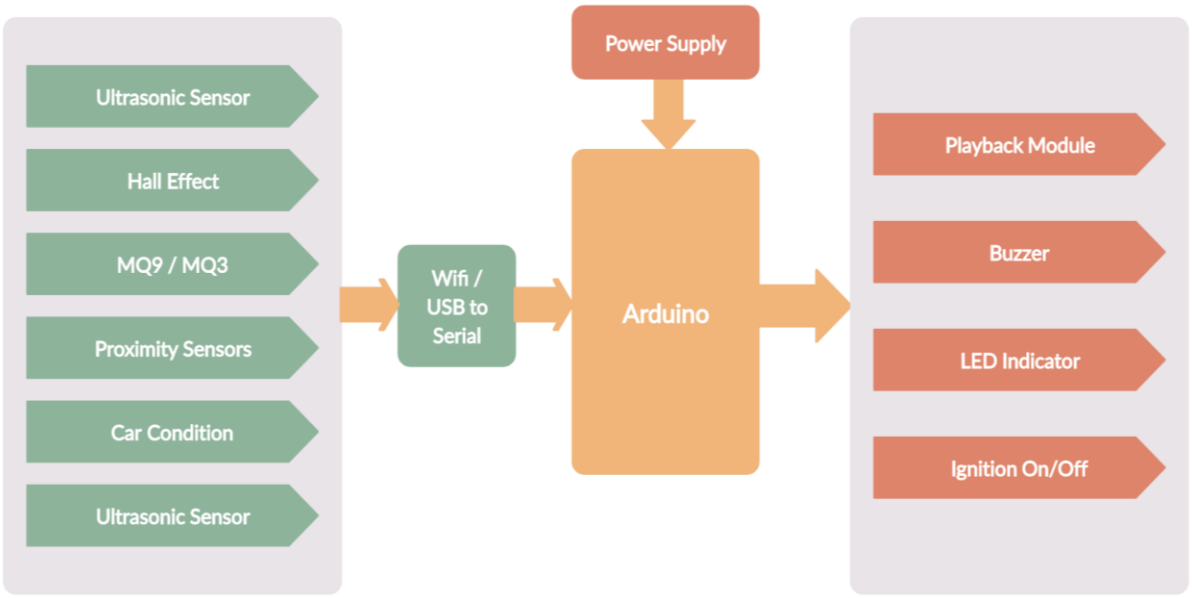

Fig. 1 vehicular communication system

A GPS module and Hall Effect sensor are used to calculate the speed of the car. If the speed exceeds the set threshold value, a message is shown on the LCD screen and an alert is sounded using the buzzer. While the MQ3 or MQ9 sensor is used for detecting whether the driver is drunk or not. If the alcohol concentration exceeds the set threshold value, then the sensor relays it to the ignition and the ignition is cut off. Once the concentration recedes, the set threshold value will reset and the vehicle will get ready to start for safe driving.

Inspect of all these safeties, in the case of an accident occurring, an emergency alert is sent to the local authorities and family with the vehicle location and emergency message. So that the next important actions to be taken by local authorities.

V. OVERVIEW AND METHODOLOGY

Vehicular communication systems are computer networks in which vehicles are the communicating nodes, providing one another with information, like safety warnings and traffic information. The ability to wirelessly exchange information about the speed, position and other factors shows great promise in helping to avoid crashes, ease holdup, and improve the environment.
Vehicular communication systems help to navigate the vehicle through traffic and alert them about the dangers around them. Various sensors are being used to implement this system**.** The main aim of this system is to avoid traffic and accidents. So developing the web application, which analysing the following parameters such as:

1. Detect the obstacle on the path.
2. Detect whether the person is drunk.
3. Detect the velocity of the vehicle.
4. Emergency alerts in case of an accident.

This information is sent to the controller. The controller uses this information and through Wi-Fi, it will be sent to the database or server. This information is displayed on the dashboard. The stored data on the database or server can be used later for analysis.

VI. CONCLUSION

Road traffic accidents continue to be a growing matter, incurring heavy losses of valuable human resources and human lives, along with wastage of potential economic growth. In this system, threshold values of parameters like high speed, drunk-driver detection, obstacles etc. are set. The existing system collects the data separately for each condition. After

that, analyse that data and then get separate results for each condition. So, to minimize work, develop one system to analyse the data of causing accidents.

The application of a vehicular communication system enables an intelligent transportation system that will provide a better vehicular environment. The system proposed here will implement sensory data transmission at inter-vehicular level. The data exchanged can be used to detect sudden changes in vehicles that bring about dangers and thereby warning the driver about it. In this work, the data is sent in string format, which is intended to bring safety to vehicles.

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