Design and Development of a novel Accident Detection and Emergency Reporting System

Sohila Kanaparthi[1], Y Chalapathi Rao[2], Divya Kadam[3]

[1,3]Student, Department of ECE, VNR VJIET, Hyderabad, Telangana, India.

[2]Associate Professor, Department of ECE, VNR VJIET, Hyderabad, Telangana, India.

[1]kanaparthisohila@gmail.com, [2]chalu.8421@gmail.com, [3]divyakadam2862002@gmail.com.

Abstract— **A novel Accident Detection and Emergency Reporting System (ADERS) is designed to automate speed detection system which can detect and analyse the speed of vehicles using infrared and ultrasonic sensors. If the over-speeded vehicles occur, the inbuilt components infrared and ultrasonic sensors will calculate the corresponding speed, distance and compare with permitted fixed measurements. In the case of beyond limit, the sensors give a buzzer to the vehicle, driver and generate a virtual map from Google Maps which automatically sends the information to available help line centres with the help of GSM (Global System for Mobile communication) or GPRS (General Packet Radio Service). The complete criteria of vehicle detection are only suitable for scenario i.e., when the speed of the vehicle is greater than usual or exceeding the speed of an adjacent vehicle and approaching at less distance in no time gives rise to a crash or emergency. In such advanced cases, this ADERS built-in system is used. The result hereby shows that the method successfully detects over-speeded vehicles, differentiates by distance from ultrasonic sensor, and extracts the map. It can automatically decrease the vehicle speed with the corresponding specifications. Also, it has more efficient performance which can track and also be deployed on roads to range for over speeding.**

Keywords—ADERS, GPRS, GSM Module, Infrared sensor, Ultrasonic sensor.

1. INTRODUCTION

Road accidents in our day-to-day scenario are the most undesirable things that happen to a user of road, though they happen very frequently. The most important thing is that we don't quickly realize nor learn from our mistakes on the road. Many people or roadway users are aware of rules to be followed while going on roads, but it is only leniency on the part of road users which causes major accidents or clashes. The most important factor in accidents and crashes is due to man-made errors. Some human behaviors which often results in accidents are over Speeding, avoiding safety gears like helmet, seat belts, red light jumping, drunken driving, distractions to driver, overtaking in a wrong manner and non-adherence to lane driving etc.

At generation of speed and thrill, we are used to many kinds of luxuries like internet access, rapid utilities, and fast travel choices. In these cases, sports bikes and cars have gained such fame among youth mostly due to their speed. However, speed not only gives trill but also puts us in trouble in accordance with law and creates life scarier. In India, every year around 1 lakh people lose their lives and nearly 4 lakhs people get crippled due to road accidents. At this moment, it is difficult to look for solutions to decrease the frequency of road accidents.

By proposed solution includes speed control operation to restrict the over-speed effect, which is one of the vital causes of road crashes. This system also gives an alerting message or sound to the driver using GSM or GPRS. Most frequently than GPRS, GSM is used. Global System for Mobile Communications (GSM) is used to alert the user about a particular vehicle or its location thus preventing rash driving and such causalities. This information in start may not be much useful but in the crucial moments of road crashes this is used to analyses and provides information about certain factors, such as breaking factors, vehicle speed, later on which is useful for investigation [1-5]. This data is also helpful for automotive industry to improvise vehicles performance by raising the safety standards thus possibly leading to better redesign of vehicles along with safer automobiles. This structure forms the basis for the functioning of the vehicle Over speed detection [6-8]. Hence, we used GPS and GSM data processers during this work to detect all the needs mentioned.

2. RELATED WORK

The authors Prasanth and Karthikey have proposed a device which is a vibration device which detect the accidents, if any accidents occur this vibration device activates and send the notification or send the information i.e., the location or the spot of accident to the emergency services. The authors used to accelerometer to detect the speed of the vehicles. This system finds out acceleration faults estimated speed is accurate and vigorous on driving atmosphere [9].

The authors Shabibi, Jayaraman and Vrindavanam have proposed an automobile speed violation Detector using GSM and RFID technologies which detect the speed of the vehicles to follow the traffic rules. If any vehicle is ignoring or violating the traffic rules which is the violation of speed (if the vehicle is over speeded) then the driver or vehicle will catch by the police. The system contains RFID, GSM,

PIC devices. GSM is used to get the location of that vehicle which violets the traffic rules [10].

The authors A.K. Shrivastava, A. Verma, and, S.P.Singh have proposed a Distance Measurement of an Object or Obstacle by Ultrasound Sensors using P89C51RD2 method to determine the distance between the obstacles. They are used an ultrasonic sensor to detect the distance between the obstacles. This obstacle may be the vehicles too and also used Arduino uno to interface all the circuits components [11]. The ultrasonic sensor has two drum like structures which detect the sound in which one of the acts as a transmitter and other acts as an receiver. That detects sound tell that an obstacle is present and then they have calculated the distance between those vehicles.

The authors Sivaditya Kamadi, Y Chalapathi Rao, Harshitha.G, Divya Kadam, Sohila Kanaparthi have proposed Real Time Vehicle and alerting system to determine précised location of object and to give the alert to the user. This uses a GPS and GSM modems to get the locations of the vehicles. They also detected the other vehicle using the IR proximity sensor. They also calculated the speed of the detected vehicle and if the speed of that detected vehicle is more than the drive or the user get the alert message that get away a vehicle is coning with more speed. The authors used a virtual terminal to get the location of the vehicle which is coming beyond the speed limit then the user can be safe from the accidents [12].

3. METHODOLOGY

3.1 WORKING MODEL

In this system, the main working methodology depends on the infrared sensor and ultrasonic sensor components. GPS and GSM also play a crucial role in tracking system. The detailed working of every part of circuit design is as follows.

This system initially estimates the vehicles speed and distance using both infrared and ultrasonic sensors then check for the measurements of those values and then compare with already predefined values. In case of variation in both the values, this system gets in flow of action, if only single value differs with predefined value, then there might not be any change in vehicle alerting or vehicles system. These measurements as per circuit are taken by potentiometers and display their values in the Virtual Terminal and LCD displays.

Once the values are considered the alerting system alerts the vehicle and as well as the driver to be most careful on pre expected causes. Here the system not only gives alerting messages it also tries automatically to decrease speed, hence can be functioned as automated vehicle. So, this is one of the procedures to eradicate the upcoming disturbance [13].

However, in certain situations there may be no use of decreasing speed as the vehicle is too close to crash, in these types of scenarios (cases) we use GSM and GPRS to track the vehicle's location using accessed google maps and sends the information of vehicle to available help desks or emergency services. By which, they try to understand and analyse the situation and reach the prone area as soon as possible.

Hence in this way the proposed system is alerting prior about the cause of accident and also takes precautionary measures to save lives and thus prevent a major expected cause.

3.2 ADERS Block Diagram

The ADERS block diagram of the accident detection of over speeded vehicles design with emergency reporting system is shown in Fig.1. This shows overall view of the ADERS. The blocks that are connected here are the components used in this system.

We proposed to create a tool, which is helpful for tracking the vehicle's location by using the GPS (Global Positioning System) and GPRS (Global System for Mobile communication) in an emergency to save the life. This device is additionally capable of alerting users with the specified alerting system through IR Sensor. ATMEGA328P i.e Arduino uno R3 is used for connecting and interfacing various hardware components. Here GSM modem the position of the vehicle through latitudes and longitudes. GPS data processor will send the information continuously i.e., this indicates the latitudes and longitudes position of the vehicle. NMEA (National Marine Electronics Association) which is important for locating the vehicle's location gives many values via output through GPS. And two Infrared Sensors are used as an alerting mechanism for detecting the obstacles that are nearest to the vehicle within the specified range of operation. Data collected by the above mechanism is displayed within the LCD Display. The navigated track of the moving vehicle is displayed with the help of virtual terminal then it is connected with the emergency services.
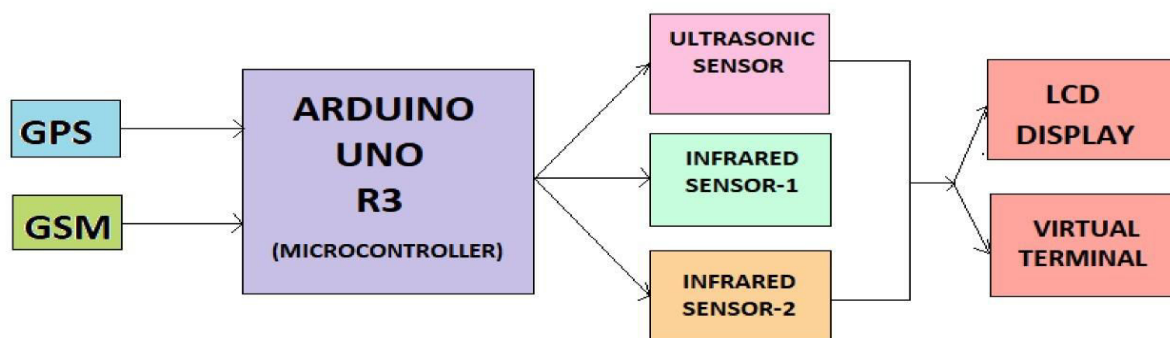

Fig. 1: ADERS Block Diagram

3.3. ADERS Circuit Description

The Arduino Uno is central part of the circuit in Fig. 2. In this ATmega328P microcontroller is used for interfacing with various hardware components. For doing so, the GSM module is interfaced serially with pins 10, 11 (soft serial TX, RX respectively) of Arduino. The Transmitter pin of GPS module is given to the Receiver pin of Arduino [6].

Infrared Sensors are grounded through the GND, and the pin VCC of both Infrared sensors are connected to set the speed of the vehicle's which is connected to the potentiometer. Here the potentiometer measures the speed of the vehicle. The 3rd and 2nd serial ports of the Arduino are connected to the output(O) port of the IR1 sensor and IR2 sensor respectively.

The ultrasonic sensor's grounded through the pin GND, pin Echo is connected to the pin 11 of Arduino, trigger pin of ultrasonic sensor relates to the pin 12 of Arduino and a 5V of power supply is given [14].

This entire setup is connected to the LCD Display through the pins 1-6 & 11-14, where the serial pins 11,12,13,14 are connected to the Arduino pins 7,6,5,4 respectively and serial pins 1,5 are grounded through the potentiometer. Pin 2 is connected to the positive terminal of potentiometer. Pin 3 of LCD display is used to give the inputs to the potentiometer. And the rest pins 4 and 5 are connected to the pins 9 and 8 of Arduino.
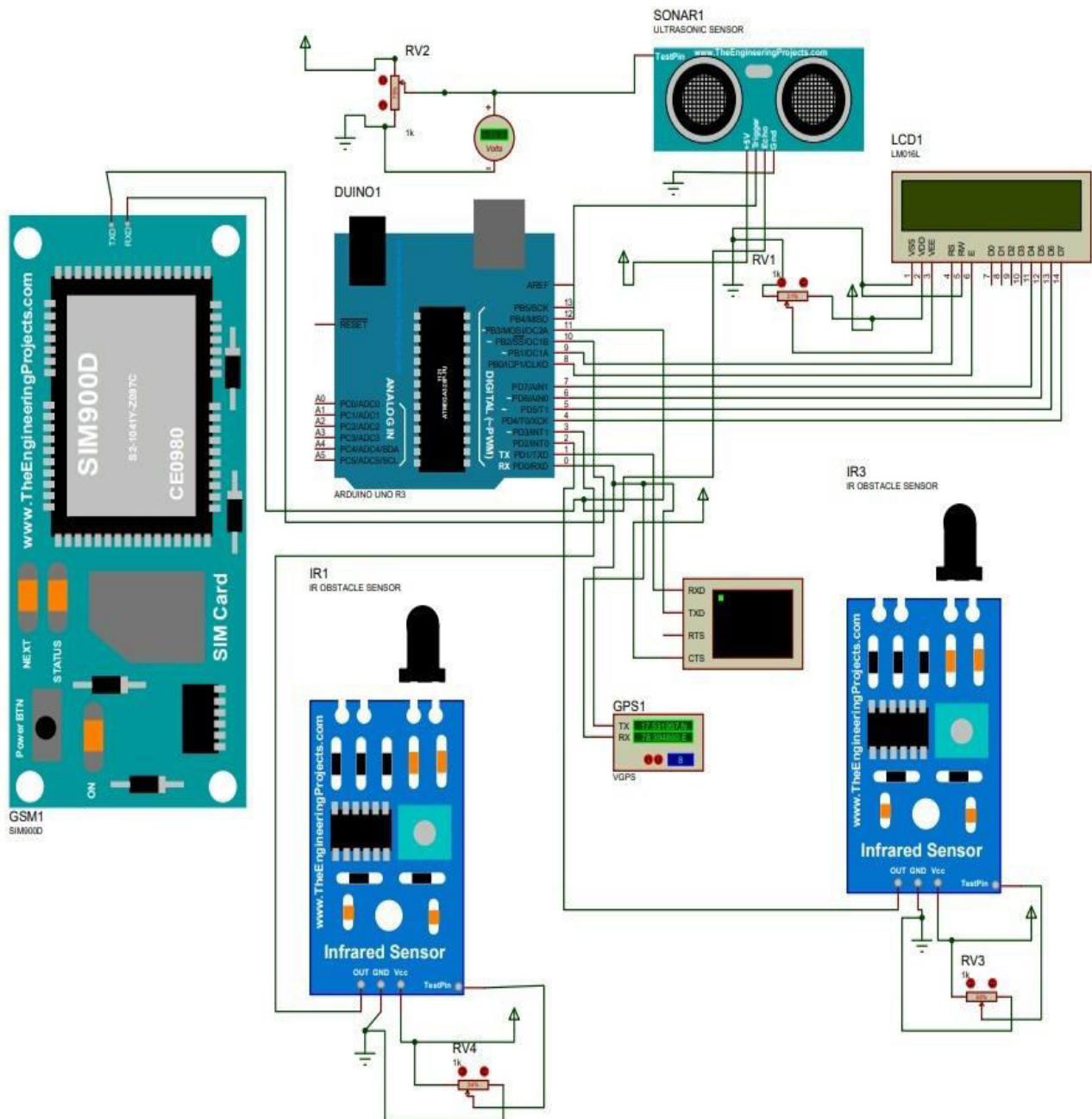

Fig. 2: ADERS Circuit Diagram

4. PROCESS AND EQUIPMENT

4.1 Software Exigencies

a. *Arduino compiler:* Arduino IDE is an online compiler which is used to run technical codes in accordance with the language of c/++ or can often be written in Java. This software generates an HEX file which is the major source of many internal working components. The generated HEX is used as an inbuilt input for the components that are about to simulate in proteus.

b. *Proteus Design Suite:* This is software too which is used to do real time simulations. In this software there can be any type of component which can be exported into schematic and can perform simulations

4.2 Hardware Components

The following list of hardware components are used in this work.

- Global System for Mobile Communication SIM900D (GSM)
- Virtual Global Positioning system (VGPS)
- Infrared Sensor
- Ultrasonic Sensor
- Arduino Uno
- LCD Display
- Virtual Terminal

The subsequent list of the hardware components used here are: Arduino Uno, LCD Display, Infrared Sensor, Virtual Terminal, Ultrasonic sensor, VGPS (Virtual Global Positioning System), GSM (Global System for Mobile Communication SIM900D), could even be a worldwide navigation satellite working system that has the case, distance, time, and velocity of a particular vehicle. GSM is used globally in mobile communication as a major source. GSM is a mobile voice operates at the 850MHz, 900MHz, 1800MHz, and 1900MHz frequency range and digital cellular technology used for transfer data services. An open-source component which is Arduino Uno is a microcontroller supported by an ATmega328P [15]. [2] emphasized that Security is an important issue in current and next-generation networks. Blockchain will be an appropriate technology for securely sharing information in next-generation networks. Digital images are the prime medium attacked by cyber attackers. In this paper, a blockchain based security framework is proposed for sharing digital images in a multi user environment..

4.3 Advantages

- ❖ Helps us to get rid of accidents
- ❖ Notifications from GSM and GPS which helps in tracking device
- ❖ The saved data can be used for further investigation
- ❖ This increases accountability
- ❖ Notifies constant speed and distance measurements to other vehicles

4.4 Applications

- ➢ Used for School or college buses
- ➢ Can be helpful in the ambulance vehicles
- ➢ Heavy transport vehicles can be monitored using this system
- ➢ Other applications include tracking, navigation, monitoring of vehicle, Accident analysis etc.

5. RESULTS

The ultrasonic sensor gives the distance between the two vehicles. It gives the distance between our vehicle and the other vehicle behind us. As the other vehicle moves toward our vehicle the distance is decreases. The distance measurement from the ultrasonic sensor is shown in Fig. 3.
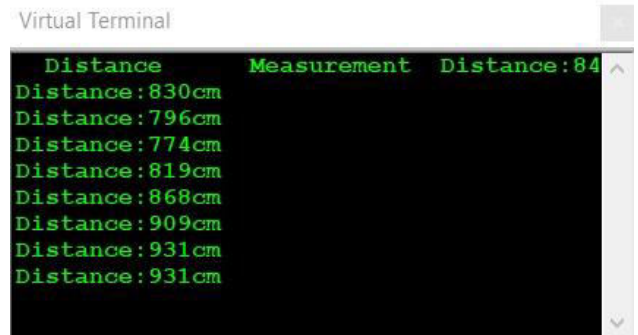

Fig. 3: The distance measurement from the ultrasonic sensor

The LCD display is placed to give the speed measurement of the vehicle. IR sensors detect the other vehicle speed and calculate the speed of that vehicle using time and the distance given by ultrasonic sensor. That speed can be viewed on the LCD display. The speed measurement from the IR sensor is shown in Fig. 4.
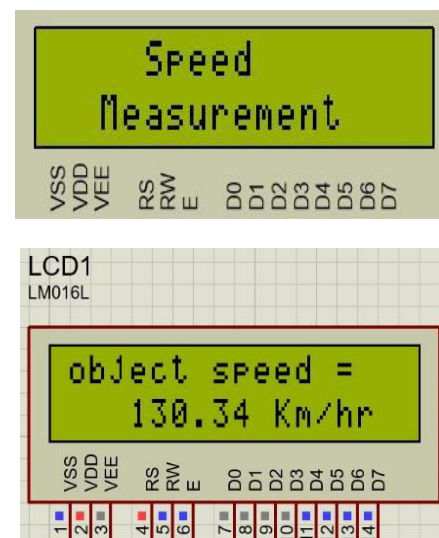

Fig. 4: The speed measurement from the IR sensor

[3] emphasized that people who are visually impaired have a hard time navigating their surroundings, recognizing objects, and avoiding hazards on their own since they do not know what is going on in their immediate surroundings. We have devised a new method of delivering assistance to people who are blind in their quest to improve their vision. The GPS map is shown in Fig. 5.
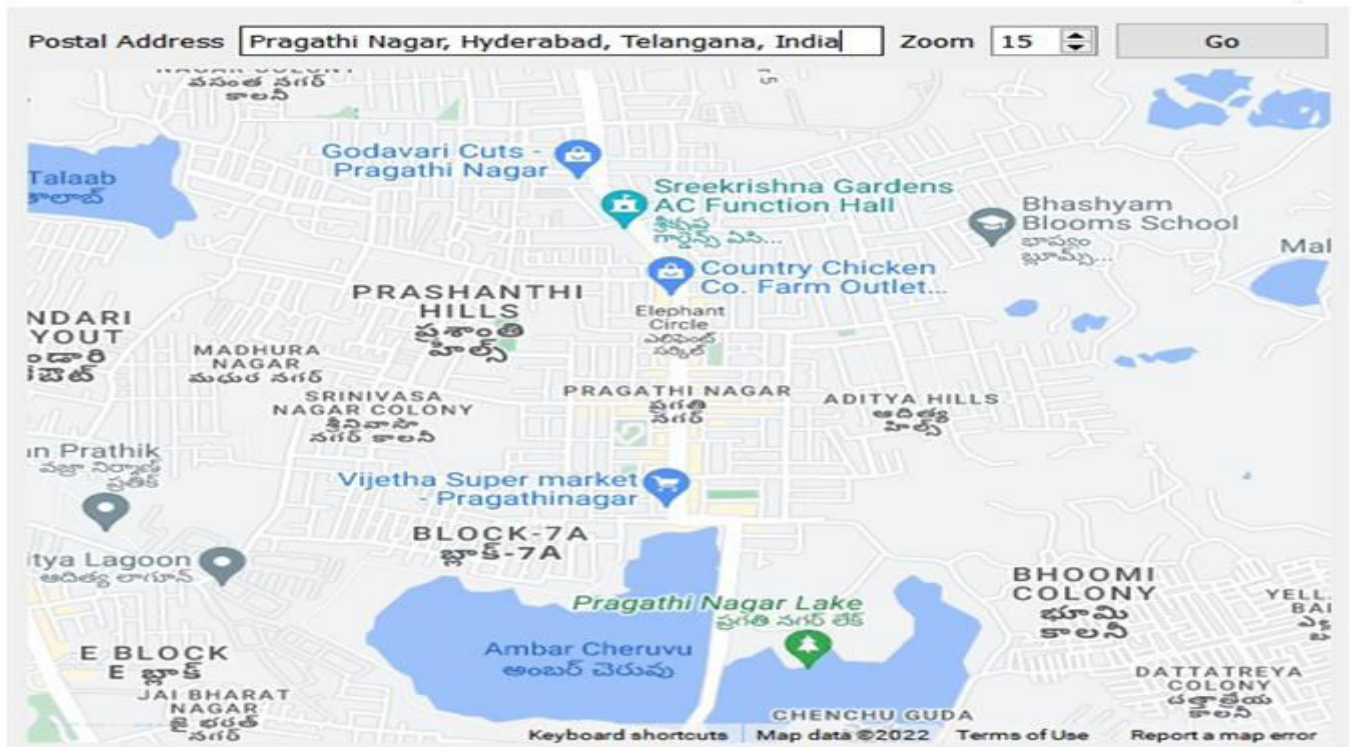
Fig. 5: The GPS Map

6. CONCLUSION AND FUTURE SCOPE

Conclusion

ADERS gives the assurance of the vehicle safety. This work designs and develops an accident detection system for over-speeded vehicles, minimizing the limitations of existing methods and incorporating corresponding emergency services. The aim of this detection is to trace and get the exact location of the vehicles to emergency services prior, to save them. This system also alerts the driver to reduce their speed or to escape from the over-speeded vehicles which are on track.

Future Scope

- This technology can be used by Companies for assessing the performance of their drivers; also can keep track of the business executives in their business tours.
- This also has futuristic scope of improvising productivity and efficiency of a given business.
- This technology can also be improvised for personal tracking purposes such as monitoring children's activities.

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