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EMERGENCY MANAGEMENT AND ACCIDENT REPORTING SYSTEM USING IoT

S. Naga Lakshmi , M.Tech, Assistant Professor

CH. Himasree[1], Sk. Arshiya[2], B. Meghana[3], Md. Mustaffa Khan[4]

[1,2,3,4]UG Students,Department of Electronics and Communication Engineering,

DVR & Dr.HS MIC College of Technology,India

Abstract : *As the use of motor vehicles grows, numerous people are killed in road accidents around the world. An accident that occurs in an area where no one is available to assist the victims may result in death, and the majority of accidents are fatal as a result of delayed medical assistance. An accident may result in several victims, and it is critical to have an adequate number of ambulances to save all of the victims. The fundamental goal of our initiative is to solve these challenges and give an optimal solution. Four vibration sensors and Arduino uno are used in our system. Detect the hit and determine whether it is an accident or a minor collision. This system assesses whether an accident is a rear-end collision, a head-on collision, a rollover, a t-bone impact, or a sandwich accident. The number of ambulances necessary is determined by the type of accident. The accident location is then obtained using a GPS module, and an SMS warning is sent to the hospital using a GSM modem. The SMS includes the location, nature of accident, and number of ambulances required. Our methodology ensures that all accident victims receive immediate emergency help. We also suggest accident avoidance using an automatic braking system with an ultrasonic sensor, a l298n 2a motor driver, and gear motors. In addition, we proposed a smart accident detection system based on IR sensors and LED's.*

Keywords : *Impact Characterization ,Vibration Sensors, GPS, GSM, Arduino UNO, Accident Prevention, Accident Indication*

I INTRODUCTION

The explosive growth of motorized vehicles like cars, combined with inadequate improvement in road safety, has led in a massive loss of human life. The usage of automobiles has expanded in tandem with the expanding population, resulting in increased traffic hazards and road accidents that result in tragic deaths due to insufficient emergency resources.

Though government and other organizations has taken several efforts worldwide, accidents still take place frequently. The major reason of fatality for children and young people with age of 5 to 29 years is road traffic collisions as reported by the World Health Organization. Vehicle crashes results in enormous loss of human lives and properties which cost 3% of Gross Domestic Product (GDP) in many countries.

The ideal situation for surviving an accident is for ambulances to arrive at the scene as soon as possible, however victims do not always have this opportunity in practise. Many accidents occur on highways, yet to the speeding drivers ignore their responsibilities to call the police or an ambulance. One of the causes of a person's mortality in an accident and an SMS report will be sent to the hospital through GSM, requesting the required number of ambulances to rescue the injured. One of the causes of a The emergency response time varies owing to detection time, which is determined by the vehicles involved in the incident, as well as information passed from drivers or witnesses. Identification and reaction time are critical factors in rescuing accident victims.

A small difference in reaction time can drastically alter the number of deaths and monetary losses. When it comes to road accidents, the ambulance response time is critical because the safety of the drivers and passengers may be put at risk. Sometimes the number of ambulances dispatched to the event site is insufficient to rescue all of the injured. The number of automobiles involved in the incident would assist determine the number of ambulances needed to rescue the casualties.

This paper offers a system that can be installed in a car and determines the type of vehicle impact and whether the impact is a minor collision or an accident. If there is a little collision, the driver can handle it himself. If an accident is detected, the buzzer emits a beeping sound to signal vehicles passing by to accompany the injured people. The sort of impact is determined by the vibration levels detected by the system's sensors. The GPS module will then detect the location of the accident, and an SMS report will be sent to the hospital through GSM, requesting the

person's mortality in an accident is a lack of first assistance due to emergency personnel' inability to collect accident facts in a timely manner.

II RELATED WORK

Several research publications have been published on accident detection and alerting strategies. Over a long period of time, systems for monitoring, recognizing, and alerting traffic incidents have been developed and improved. These systems are focused on detecting and notifying emergency services in the event of an accident, and so do not determine the actual number of ambulances required to rescue all casualties.

Instead of utilizing a separate sensor, the existing method makes use of a vibration sensor that is already present in the Electronic Control Unit for the airbag system that is already present in most cars. This system's control unit is an Arduino microcontroller. When an impact happens, the impulse causes the buzzer to sound, indicating that an accident has occurred, and the airbag, if airbag sensors are associated with the device, to deploy. The GPS system determines the location of the vehicle. The GSM module will send the accident details to the designated cellphone number via SMS.

This Automatic Messaging System (AMS),GPS is used to locate the location of the occurrence. When an accident occurs, the GPS coordinates are established, and an SMS is sent to the victim's friend's mobile phone, which is already registered in the system. The entire procedure is fully automated.

Accidents may happen in vehicles that transport raw materials and commodities. One of the problems in this kind of transportation which may lead to trouble is Vehicle Routing Problem (VRP). The authors solved this problem using their proposed algorithm.

The proposed system is about an Automatic Braking system is an intelligent mechatronic system includes an Ultrasonic wave emitter provided on the front portion of a car producing and emitting Ultrasonic waves. An Ultrasonic receiver is also placed on the front portion of the car operatively receiving a reflective Ultrasonic wave signal. The reflected wave (detected pulse) gives the distance between the obstacle and the vehicle. Then a microcontroller is used to control the speed of the vehicle based on the detection pulse information to push the brake pedal and apply brake to the car stupendously for safety purpose. It makes use of PIC microcontroller for performing required functions. Here, dedicated Radio Frequency (RF) transmitter and RF receiver are used for transmission of accident data wirelessly. These RF modules can transmit or receive within a distance of 100 meters approximately. When the accelerometer sensor produces an output that is above the threshold level, the RF transmitter performs modulation and encode the accident data and send it to the RF receiver. This receiver will demodulate the received signal and decode the data.

There is a need for an efficient and effective system that can detect accidents in real-time, alert the relevant authorities, and provide useful data for accident analysis. Current accident detection systems mainly rely on sensors installed on the roads or traffic cameras, which are not always reliable and may not detect accidents in remote areas.Therefore, the proposed project aims to develop a portable, vehicle-mounted accident detection system to alert the accident indication and prevention.

counting, etc. Generally, the inferred sensor works on the principle of measuring and radiating about its surroundings.

- **L298N Driver module**: The L298N is a dual H-Bridge motor driver which allows speed and direction control of two DC motors at the same time. The module can drive DC

required number of ambulances to rescue the injured. This will aid in the rescue of all injured people after an accident, leaving no one behind.

that can detect the type and severity of accidents using four vibration sensors and accident prevention and accident indication systems.

III PROPOSED SYSTEM

A. Components Description

- **Arduino Uno**: The Arduino Uno is an open-source microcontroller board created by Arduino.cc that is based on the Microchip ATmega328P microprocessor. It was first launched in 2010.The board has digital and analogue input/output (I/O) pins that can be connected to various expansion boards (shields) and other circuits. The board features 14 digital I/O pins (six of which are capable of PWM output), 6 analogue I/O pins, and can be programmed using the Arduino IDE.
- **Vibration Sensor**: The vibration sensor module based on the vibration sensor SW-420 and Comparator LM393 is used to detect vibrations. The threshold can adjust using an on-board potentiometer.
- **GPS:** The NEO-6MV2 is a GPS (Global Positioning System) module and is used for navigation. The module simply checks its location on earth and provides output data which is longitude and latitude of its position.
- **GSM:** The SIM800L is a GSM (Global System for Mobile Communications) module from Simcom that gives any microcontroller GSM functionality, meaning it can connect to the mobile network to receive calls and send and receive text messages, and also connect to the internet using GPRS, TCP, or IP.
- **LCD Display:** LCD (Liquid Crystal Display) is a type of flat panel display that operates primarily using liquid crystals. LEDs are widely used in cell phones, televisions, computer displays, and instrument panels, and they have a wide range of applications for consumers and enterprises.
- **Buzzer:** A Buzzer is a audio signal device which gives a beeper or buzzer sound may be electromechanical or mechanical type. The working of Buzzer is to convert the given signal from audio to sound. Generally, it is powered through DC voltage and used in IoT applications, timers, alarm devices, printers, computers and so on. Based on designs, buzzer may generate different types of sounds like alarm, music, bell and siren.
- **Ultrasonic Sensor:** An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound (i.e. the sound that humans can hear). Ultrasonic sensors have two main components: the transmitter (which emits the sound using piezoelectric crystals) and the receiver (which encounters the sound after it has travelled to and from the target).
- **IR Sensor:** Infrared Or IR sensor is a very useful electronic sensing device used in so many electronics,

colour into green to allow the one car to pass and then the other LED colour turns green. In this way we can prevent the accidents of curved roads.

motors that have voltages between 5 and 35V, with a peak current up to 2A.

- **LM7805 Transistor**: The heart of the 7805 IC is a transistor (Q16) that controls the current between the input and output and thus controls the output voltage. The bandgap reference (yellow) keeps the voltage stable.
- **Switch**: An electric switch is a device – usually electromechanical – used to open and close an electric circuit. This disables and enables the flow of electric current, respectively. Switches are synonymous with the interruption, or some form of manipulation, of the flow of electric current or, more elementarily, the flow of electrons.
- **LEDs:** The LED is a PN-Junction diode which emits light when an electric current passes through it in the forward direction. In the LED, the recombination of charge carrier takes place. The electron from the N-side and the hole from the P-side are combined and gives the energy in the form of heat and light. The LED is made of semiconductor material which is colourless, and the light is radiated through the junction of the diode.

B.System Description and Flow chart

The design of the smart system has about four vibration sensors and GPS receiver as the input module. The output module of the smart system consists of buzzer, LCD display and GSM module. Mobile phone is the receiver of the message that is sent by GSM module of the system. Because these sensors detect vibrations, they can be positioned inside four sides of the car and are not need to be retained on the vehicle's surface. The Flow diagram in figure 3 shows how the flow of program works. When the vehicle is turned on, the smart system is also activated.

The vibrations of the vehicle are continuously monitored by the microcontroller. Unless the vibrations exceed certain threshold value, the system performs monitoring operation. If an impact occurs, the system will continue the sensing work in case the it is just a slight collision. When an accident takes place, the vibrations surpass the threshold level and one or more sensors produce high output. Once the sensors indicate the accident, the microcontroller triggers buzzer to produce sound that alert the vehicles which are passing through the incident location. The microcontroller decides the number of vehicles involved based on the characterized type of accident. Using this information, the required number ambulances is decided. Then the present location of car is retrieved from the GPS receiver and GSM sends SMS to the predefined mobile. LCD display in the system also displays the output after the microcontroller has completed all the necessary actions.

This accident indication system using sensors is powered by 9V batteries, it consists of IR sensors, LED lights, and buzzer. When two cars pass from the opposite side of a mountain curve the IR sensor senses the car and LED colour changes to red and raises the buzzer giving signal of danger and then it changes one LED

The vibration sensors are installed in the vehicle, as shown in Figure 2, which displays a typical car's top view. Sensor 1 is located on the car's front hood. Sensors 2 and 3 are located on the vertical pillars of cars on the left and right sides, respectively, and are located between the doors on both sides of the car. Sensor 4 is located at the rear of the vehicle.

Auto-Braking System using Sensor was proposed to prevent front-end, rear-end, right-turn and left-turn accidents on roads. This module can detect the distance between front vehicle and driver's vehicle to keep a constant distance using a sensor and operate the brake system. All the above proposed design models contributed to safety of vehicles and pedestrians. It prevented rear end crashes to provide ABS for sharp turns or slippery roads.

But all these are applicable for vehicles running in conventional direction, so we need to develop systems which enhances the performance and safety of vehicles when it moves in reverse direction. A model designed on reversing of vehicles provided detection of obstacle , speed control mechanism based on binocular cameras. Thus, in this paper we propose "Automatic Reverse Braking system" to prevent collision by using sensors to detect obstacles. The "Automatic Reverse Braking system" is processing the sensor data and controlling the vehicle to prevent accidents.

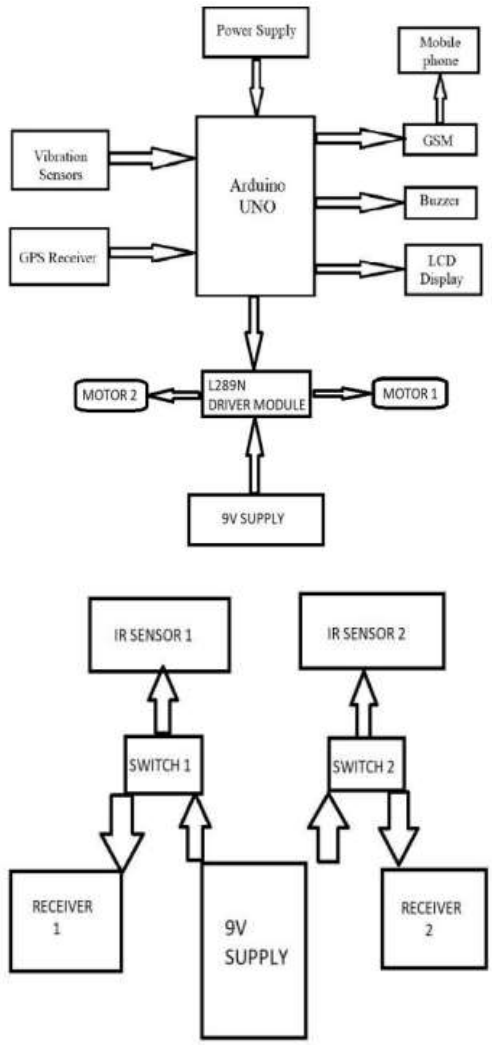


Fig 1:Diagram of working blocks for smart system

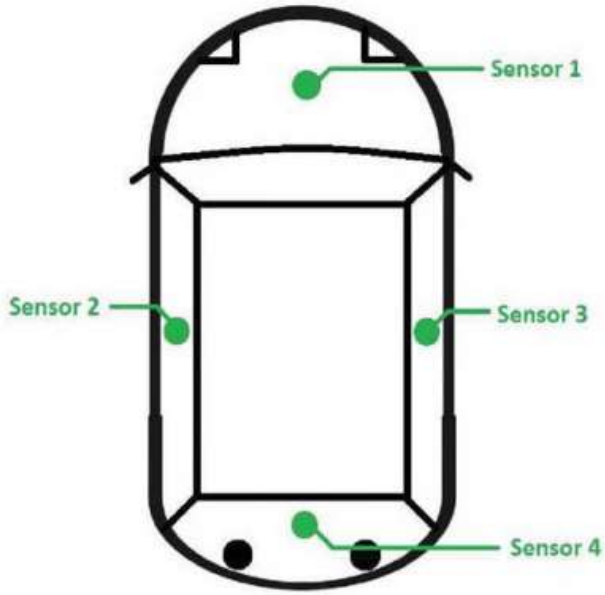
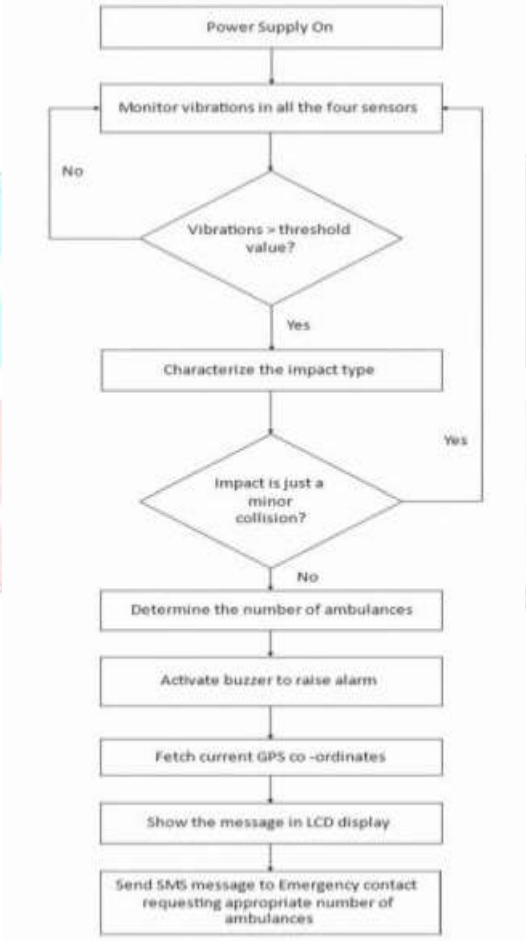


Fig 2 : Placement of Vibration Sensors in a Vehicle



3 on the vehicle's flanks detect excessive vibration, it signifies a T-bone collision.Two automobiles are definitely engaged in this type, so two ambulances will be required. If high vibration is detected by sensors 2 and 3, respectively, a rollover accident has occurred. In this situation, a T-bone accident may have occurred, implying that two vehicles were involved, or the vehicles may have fallen from a high height. Because there is a possibility that two vehicles were involved in the accident, two ambulances have been called. If high vibration occurs at sensors 1 and 4, the car may have been involved in a sandwich accident involving three vehicles.

As a result, three ambulances are requested. If any other combination of sensors detects considerable vibration, it is classified as a severe accident involving two or more vehicles. As a result, three ambulances will be dispatched to rescue the victims.

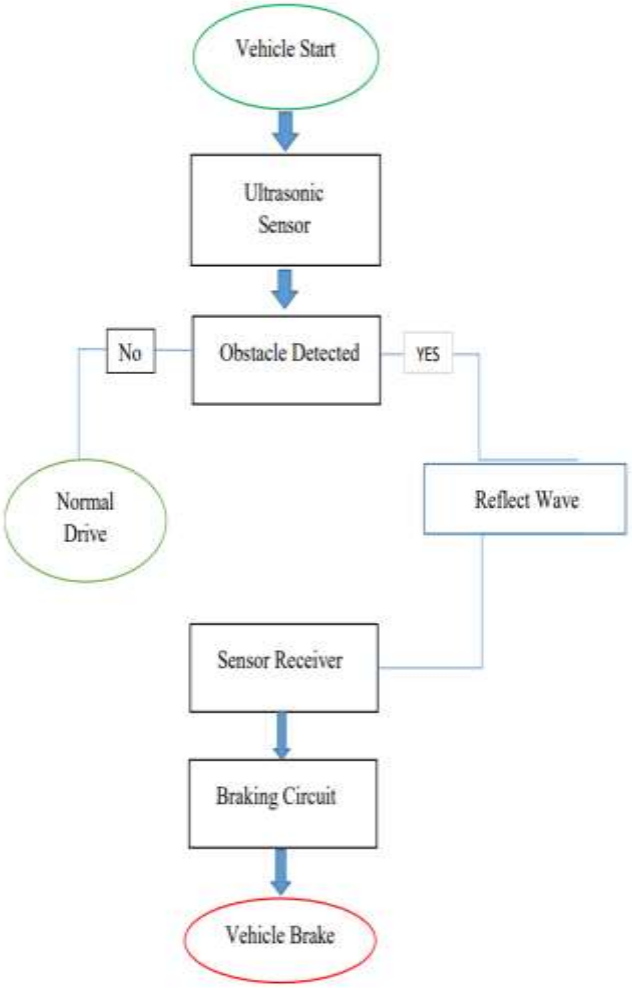


Fig 3:Flow charts of Accident Rescue and Accident Prevention System

C.Mechanism of Characterization of Vehicle Impact

With the help of the vibrations from the sensors, the microcontroller will discriminate and determine whether there is a minor collision or an accident whenever there is an impact on the sensors. If any of the sensors detects a medium amount of impact, it classifies it as a mild impact and does not proceed. It resumes monitoring the tremors. If the hit is an actual accident and causes a high amount of vibration, the system will activate the buzzer, which will begin creating the beeping sound and detecting the type of accident and the number of vehicles involved.

If sensor 1 (shown in fig. 2) on the vehicle's front hood detects excessive vibration, the impact is a head-on collision. The car might have collided with an obstacle, involving only one vehicle, or it could have collided with another vehicle, involving two vehicles. Because there is a possibility that two vehicles will be involved in a collision, two ambulances will be ordered. Even if an ambulance becomes obsolete, this is not an issue because our primary goal is to save human lives. If sensor 4 at the vehicle's back end detects excessive vibration, there is a rear-end collision. Because two vehicles are likely to be involved in this type of incident, two ambulances will be ordered. If sensors 2 or the backside of the car and the wire that are attached with the battery are made connection with microcontroller. Program code to run the car inputted in the micro controller device and now the car can run through with or without help of the auxiliary device and work as a plug and play device.

Calculation of Braking Distance: Braking Distance = V / 2μg (meter)

Where, V= Velocity of the vehicle (m/s)

μ = Coefficient of friction of road = 0.8

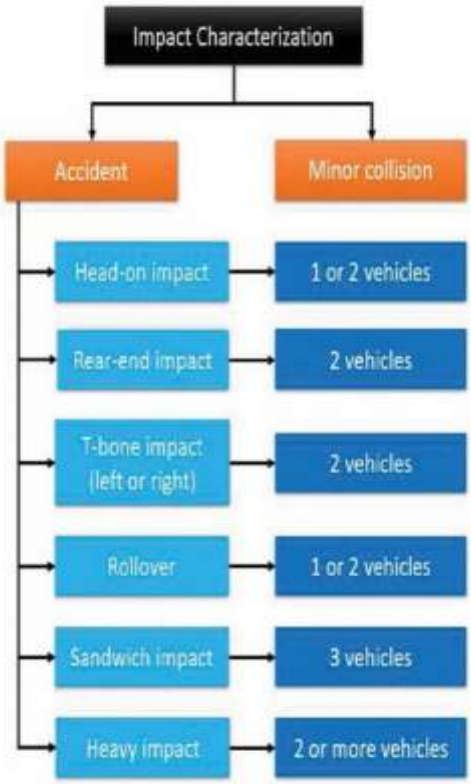


Fig 4 : Smart Characterization of Vehicle Impact

Take a plywood as a frame. Cut it along as calculated. Take measurement by calculations according to the wheels. Just keep front wheel space more as we will design steering so calculate by moving wheels. Fix the wheel and Rubber stoppers to the chassis. Fix the motor with gear hub. Fix the holes with screw. Attach two gear motors at the backside of the plywood. Place two wheels at the rear of the vehicle. Two Smart Robot Car Tyres Wheels. For Arduino DC Gear Motor Chassis has used here. One non-tire wheel attach at the front side of the car. Now Arduino UNO has mounted at the middle of the base and screw has been used to tighten them up. Wires has connected with the Arduino. Sensor holder placed at the top front side of the vehicle and Ultrasonic sensor device is placed upon this. Sensor wire is connected with microcontroller. Wire ends are connected with Arduino in the following manner: Positive to +5v, GND to GND, Trig to A0, Echo to A1. Two 9v rechargeable battery mounted.

g = Acceleration due to gravity = 9.81(m/s2)

Now, for velocity 10 km/hr.

Braking Distance = (10*1000/3600)/ (2*0.8*9.81) = 0.18 m

For velocity 20 km/hr.

Braking Distance = (20*1000/3600)/ (2*0.8*9.81) = 0.35 m

For velocity 30 km/hr.

Braking Distance = (30*1000/3600)/ (2*0.8*9.81) = 0.53 m

For velocity 40 km/hr.

Braking Distance = (40*1000/3600)/ (2*0.8*9.81) = 0.71 m

For velocity 50 km/hr.

Braking Distance = (50*1000/3600)/ (2*0.8*9.81) = 0.88m

IV IMPLEMENTATION AND RESULTS

The working prototype tests were successfully conducted and outputs were obtained as expected. Substantial tests have been carried out to test the output of the system in different conditions. All the hardware components were checked for correctness. The smart system was able to run the program, characterize the type of impact, retrieve the GPS location and transmit SMS to mobile that is predefined. The working model is depicted in the figure 6. The T-bone accident at left side of the vehicle is taken as an example. LCD display shows the short message that is sent to the mobile number using GSM. Figure 5 depicts the output of GPS location in the LCD display. Figure 8 shows the SMS that was sent by the GSM of smart system to the respective mobile.

To develop an Intelligent Braking System for Automobiles. To find the braking distance at various vehicle speeds as well as minimum distance before collision.

Fig 5 : Output of GPS location at LCD Display

Fig 6 : Working Model of the Project

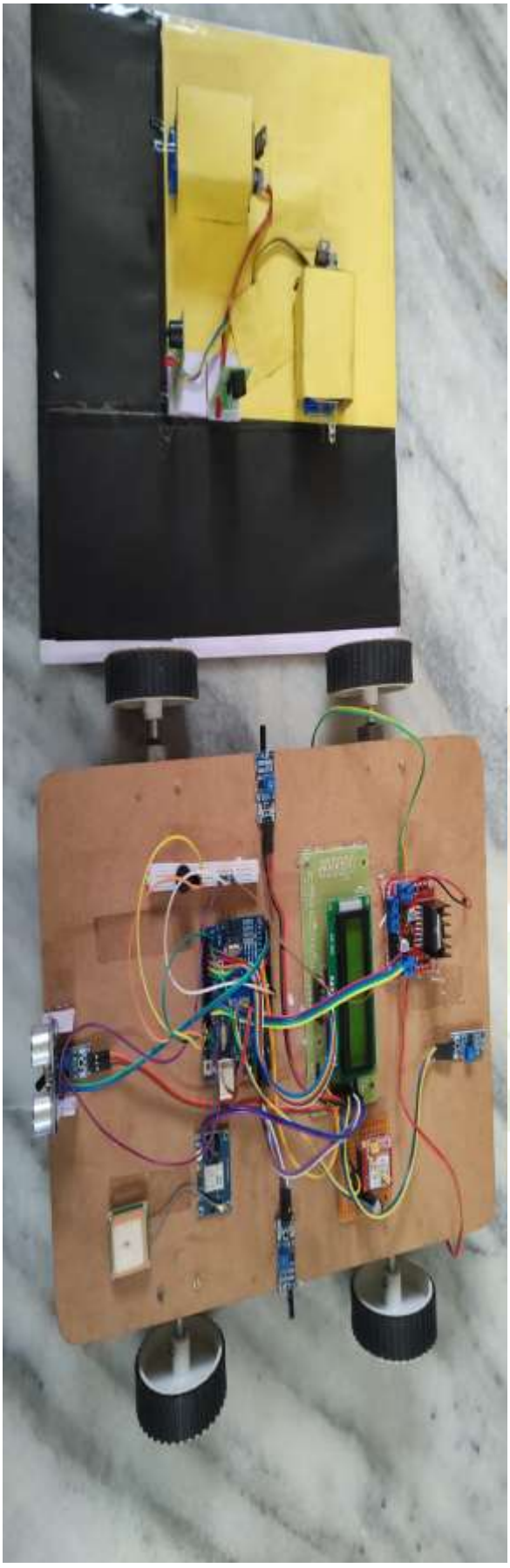


Fig 7 : LCD Display shows the type of an accident

Fig 8: SMS Received from GSM

V CONCLUSION

The proposed system can be equipped with a vehicle for safety of driver and passengers. This system performs all the important functions automatically and no manual interaction is necessary. It can be implemented to prevent delayed emergency assistance which may increase the chance of survival of the victim. This system is capable of identifying the incident crash location and characterizing accident type to determine how many vehicles are involved in the accident which will be helpful to find the appropriate number of ambulances needed to rescue all the injured persons as soon as possible. Further, the system components can be optimized to be much more compact to fit into a vehicle. If the system is incorporated in the vehicles by default, it will strive to be essential in saving human lives.

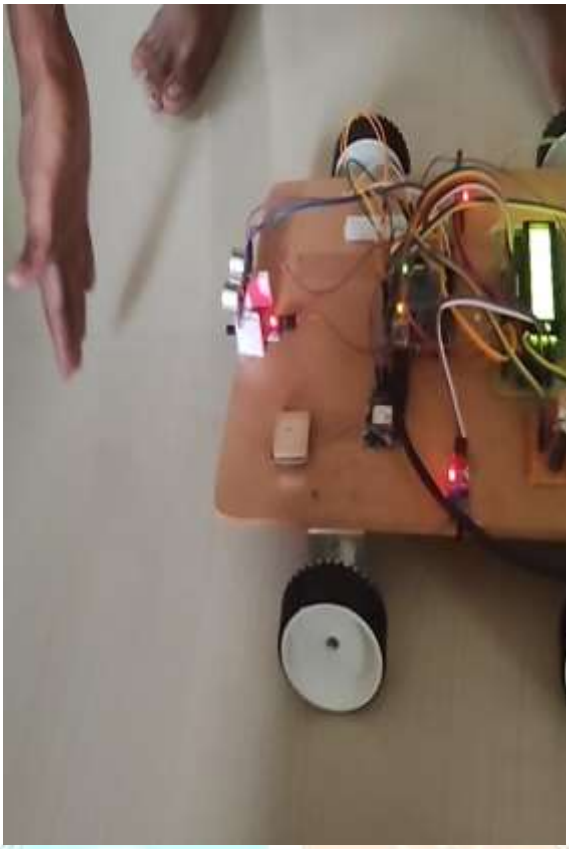


Fig 9: Accident Prevention System using ABS

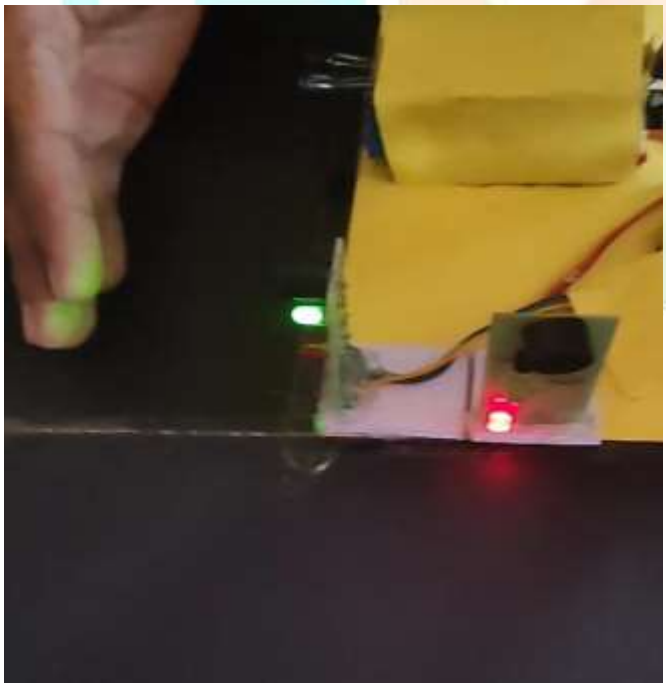


Fig 10 : Accident Indication using IR Sensors

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