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# Enhancement of Health System for Emergency Care Using IoT Technique

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**Abstract---**Life is precious to everyone. Nowadays, accidents are occurring in different places. An estimated report says that a person who lost their lives in an accident is ata higher rate as the accident has not been noticed and the person dies as the medical need which has to be done to them is not received in the correct time. Accidents that are taking place are unavoidable in some situations. But if proper information about the accident reaches the hospital the concerned person's life would be saved. In an existing approach, Gyroscope detects the change of tilt imprecisely when the vehicle ride on the slope where it delivers a false alert to the emergency system. So that in the measure of ground clearance by the ultrasonic sensor, it does not send false alerts.To overcome this drawback,we proposeda new Emergency care system where our system uses an ultrasonic sensor, pressure sensor, and GPS which will be connected to the vehicle through OEM. As soon as the accident happens GSM will send an alert message with location to the emergency number about the severity of the accident. In such cases, actions would be taken as soon as possible and lives can be saved.

**Keywords---**Advanced Vehicle System, IoT, GlobalPositioning System(GPS), Sensing Technology, Emergency Care Application.

## I. Introduction

Due to rapid growth of world population, the demand forvehicles has increased tremendously, resultantly problems of traffic congestion and road accidents have also increased. Thegeneral population's life is at high risk, if any accident occurs there's a long reaction time which increments the number of deaths, therefore an automatic accident detection system must exist to overcome this situation. Statistics show that the leading cause of death by injury is road accidents [1]. There can be multiple causes of road accidents, some of them are, driver negligence due to drowsiness [2], driving while intoxicated [3], overspeed [4], [5], etc. Some studies show that weather conditions can also contribute towards the severity of an accident such as fog, rain, high winds. High winds can directly influence the vehicle which may deviate the vehicle from the road, or indirectly due to obstruction dangers present on the roads such as trees, walls, etc., [6]. Road crashes can be seen as a collision between any on-road vehicles, obstacles, or pedestrians. The survival rate of the victim is highly reliant on how long an ambulance takes to reach the site of the accident and then carry the patient to the hospital. In most cases of road accidents, the injuries are not severe and the life of the victim can be rescued, however, due to the late arrival of the rescue teams, the injuries turn deadly. Thus, the main goal is to identify where the accident occurred, send the information to the rescue teams in considerably less time, so that they can take the necessary actions, to save the life of the victim [7]. Intelligent Transport Systems (ITS) based on the Internet of Things (IoT) are getting popular and can be seen as a solution to

improve road safety. One effective technique to reduce traffic hazards and save precious lives could be to reduce the response time after an accident has occurred[1].

### *1.1.Objectives*

The system has a GPS device that gives the exact location of the vehicle. The GPS is attached to the vehicle through OEM (Original Equipment Manufacturer). If an accident occurs, through the GSM technology, it sends an alert message with the live location to the emergency number and police station. It uses an Ultrasonic sensor and Pressure sensor to detect whether an accident has taken place or not. A range would be specified & if the range exceeds, it measures the pressure that the car has experienced through the connectivity OEM, and it detects whether it is a major or minor accident. If the accident is severe and an emergency need of hospitality has to be done, the system has to send the alert message to the Emergency service.

### *1.2. Overview of the System*

The system detects the seriousness level of the accident and sends a notification to the emergency service center. If it is a major accident and the lives are in an unsafe condition where the accident goes unnoticed by the people around, the system will send a direct notification with the location. Various approaches have been used for the detection of accidents such as pressure sensors, ultrasonic sensors, GPS, GSM, and various machine learning algorithms. Even though there is literature available on various strategies for accident detection and prevention; however, no comprehensive survey exists. This paper aims to fill this gap by critically reviewing the literature related to accident detection, and reporting systems, to provide a broader perspective of existing techniques so that effective systems can be developed that can utilize the strengths while addressing the challenges in the current systems.

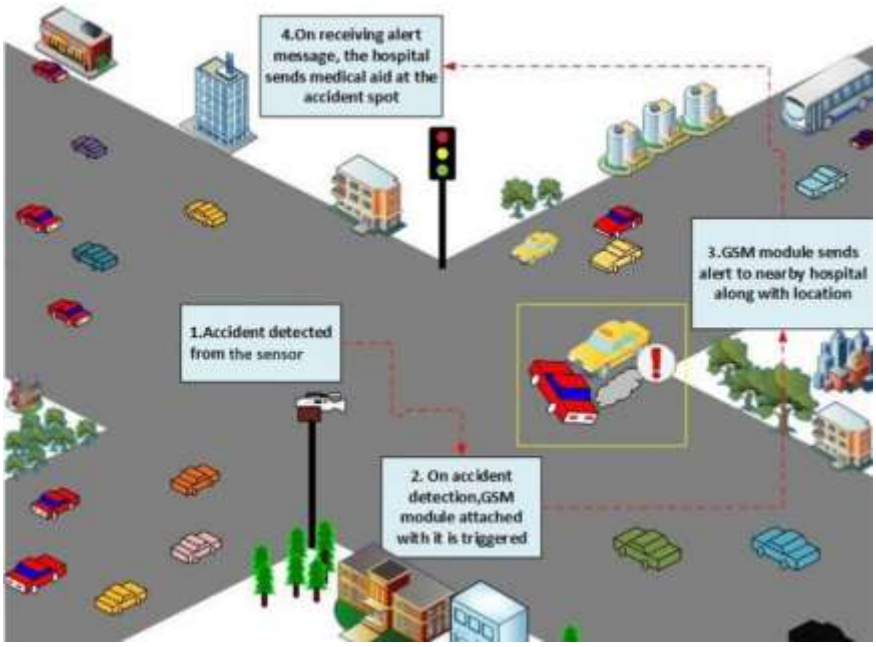


Fig. 1: Realtime Accident Detection Using Sensors

## II. Related Work

Different approaches are used for the detection of an accident this context, VANET (Vehicular Ad-hoc Network) can be utilized [8], [9], in which every moving vehicle acts as a node. On occurrence of accident, the alert messages are communicated via RF (Radio Frequency) module [10].One approach useslimit switchestodetectanaccident, GSM (Global System for Mobile Communications) is used to send an alert message and location of accident is traced by GPS (Global Positioning System) module [11].Smartphone based systems that usean android app to detect vehiclecrash are also proposed. These systems measure change of tilt angle by means of an accelerometer sensor, speed by means of GPS and send an alert on detection of accident [12]. Some systems focus on preventive strategy because at the end, goal is to save lives. This system particularly focuses on the safety of two wheelers and checks if the driver is drowsy [2]. Two sensors are used to prevent the accident one accelerometer sensor and another is

alcohol sensor. Accelerometer sensors monitors the speed of the vehicle and report an accident if there is a sudden drop in speed threshold [13]. Alcohol sensors keeps an eye on the driver by measuring the level of alcohol in his oxygen and won't allow the driver to drive if he is drunk. This alcohol sensor is installed in the steering wheel [3], [14]. In this approach, data is obtained from various sensors and event logs to extract prominent features for collision detection model.Various intelligent computational models are used to detect accidents. These models include nearest neighbor, neural networks and regression trees [15]. Vehicle behaviors can be analyzed given its position and velocity values, and can be helpful in the detection of accidents. To detect an accident and todistinguishitfromnormalcases,differentmachine learningalgorithmslikeSupportVectorMachine(SVM), Artificial Neural Network (ANN) and Random Forests (RF) are implemented on traffic data [16]. Machine learning techniques can also be utilizedtodeterminetheseverityof accident.Different algorithms such ask-means clustering, SVMunderreinforcementlearningbyfetchingrealtime data like velocity which is obtained by means of vibration sensors installed in vehicle and distance which is obtained by means of ultrasonic sensors [17]. Accidents can also be detected by pre-trained surveillance cameras installed on the highways [18]. Another machine learning approachusesfuzzylogic.Data like number of vehicles in each zone, speed of cars in particular lanes etc. is collected and then decisions are made accordingly. In this technique, a situation is detected as an accident whenever there's some sort of disturbance in surrounding lanes [19].

### *2.1. Various Accident Detection Technologies and Recovery Systems with Victim Analysis*

In this technological revulsion world, there is no time for anyone to know what happening round them they keep on moving without any care. As they give importance to their work rather than others. Due to reduce in moral values one cannot get proper help when they need it. This can be solved by this technology itself. Due to time laps, many lives are at risk. To reduce this risk factor automatic accident detection and victim analysis plays an important role. Reducing the time laps will reduce the death rate. As reducing the time taken to take first aid will reduce the effect of accident on the victim. Probability of victim security will be more. As now a day's mobile is common electronic gadget that is present with everyone and this problem can be solved by it only. By the short message service (SMS) on of the fetcher of mobile will help to solve this problem. By this embedded system we can now the place of accident, rate of accident, status of the victim like blood pressure and heart beat. By this information rescue team will be easily help the victim. By using technologies GPS and GPRS one can easily locate the position of the accident. This paper says the technologies that how an accident is detected and victim status. The technology needs to have more features like pre analysis of driver and then the vehicles get started. As prevention is better than cure. The main motive of this paper is to reduce the accident rate and reduce the time for first aid. The proposed system ensures that to reduce the human death ratio by accidents.

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### *2.2.Traffic Monitoring and Accident Detection at Intersections*

In this intersection approach an algorithm named spatiotemporal Markov random field was developed to analyze the traffic images at intersections. The tracking problem is the main idea behind this algorithm, from traffic intersection images the state of each pixel and its transit are determined. The success rate of this algorithm is 93% to 96% for detecting accidents. This success further motivated me to developan event recognition system using Hidden Markov Model (HMM). From the HMM chains, various event behavior pattern of each vehicle is learned by the system, and identify current event chains are from the output of the tracking system. This event tracking is capable of identifying jamming, bumping, and passing. With the current training set, if other event patternsare appended, the system will be even more capable to identify other events like illegal U-turns of reckless driving.

**Publishedin:** IEEE Transactions on Intelligent Transportation Systems (Volume: 1, Issue: 2, Jun 2000)

### *2.3. Wireless vehicular Accident Detection and Reporting System*

This system uses an anywhere anytime approach which intelligently detects remote location accidents and reports to the nearby service provider. Once again, the sensors placed in a vehicle and the output of the sensors are analyzed to detect the accident. In this system, the output of the sensors is analyzed and processed by the PIC16F877A microcontroller. This kind of Accident Detection and Reporting System (ADRS) uses an RF module. The RF transmitter module which is interfaced with the microcontroller will transmit the accident information to the nearby Emergency Service Provider (ESP). Low-cost sensors, microcontrollers, etc., are used in this system, which will motivate ADRS system developers to develop other advanced systems in a cost-efficient way.

**Published in:** 2010 International Conference on Mechanical and Electrical Technology.

### *2.4. A Traffic Accident Recording and Reporting Model at Intersections*

In this system, vehicle accidents are detected from intersection points. These intersection points need to be monitored carefully; they are prone to accidents because there will be conflicting movement between the vehicles. A vision-based accident detection algorithm is developed in this system which includes three phases vehicle extraction, feature extraction of a moving vehicle, and accident detection. From each frame moving vehicles, parts are extracted based on a differential equation. The difference will be calculated from two different frames through horizontal and vertical projections. In real-time, this system effectively detects the accidents with CDR (correct detection rate) of 50% and a detection rate of 60%

**Published in:** IEEE Transactions on Intelligent Transportation Systems (Volume: 8, Issue: 2, June 2007).

### *2.5. Providing Accident Detection in vehicular Networks through OBD-II Devices and Android-based Smartphones*

Smartphones are becoming smarter and smarter. Modern smartphones are equipped with high computation power and embedded with advanced wireless interfaces which are more capable of doing advanced tasks. Relatively intelligent transportation systems [ITS] are evolving at a snail phase in making cars smarter. So, in order to increase the pace of the ITS industry existing smartphone technology can be combined with the ITS system through a proper interface which will open the new doors of computation to make the vehicle smarter. In this approach android application-based monitoring of vehicles is carried out through On-Board Diagnostics (OBD-II) interface to detect accidents. The vehicle's gravitational force is monitored in case of frontal collision along with the airbag trigger event to detect accidents. Once G force is detected because of a frontal collision, a detailed e-mail/SMS regarding the accident will be sent to the nearest emergency service provider followed by an immediate SOS phone call. This system just takes less than 3 seconds to respond to accidents which is good throughput.

**Published in:** 2011 IEEE 36th Conference on Local Computer Networks.

## III. Proposed Emergency Care System

The consequences of road accidents are not just constrained to the loss of human lives yet, also incorporate the destruction of property, traffic blockages, and immense eco- nomic loss. Thus, automatic accident detection systems are the need of time, which can speed up the rescue operations and limit the causalities after the mishap and numerous lives can be saved. This paper features existing mechanisms to detect accidents, their working, and their limitations. Furthermore, accident prevention methodologies, accident contributing factors are highlighted as well.This study critically reviews existing literature on accident detection and prevention techniques, with the objective that smart systems can be developed with improved accuracy and better strategies to control accident-causing factors while watching out for the existing challenges in the current systems.

The overall architecture of the proposed system consists of three modules. Frist module includes checking the ground clearance and in the specified range, any changes occur, it detects that an accident has occurred. The second module consists pressure sensor that detects the impact and triggers the GSM module should send the alert message to the emergency number. The thirdmodule consists of detecting the seriousness of the problem. The alert message contains the live location of the accident spot. This system overcomes the disadvantage of gyroscope sensors which measure the change of tilt by the means of an accelerometer sensor, speed by means of GPS and send an alert on detection of an accident. The gyroscope detects the change of tilt imprecisely when the vehicle ride on the slope where it delivers a false alert to the emergency system. So that in the measure of ground clearance by the ultrasonic sensor, it does not send a false alert.The threshold limit for ultrasonic sensors also increased to a certain range for avoiding false alerts when the vehicle encounters speed breaks and small obstacles.

## IV. Architecture of Advance Emergency Care System

The architecture of Emergency care systems that are used to detect accident consist of Arduino, Ultrasonic sensor, Pressure sensor, GPS, and GSM. The working process of each sensor is explained below.

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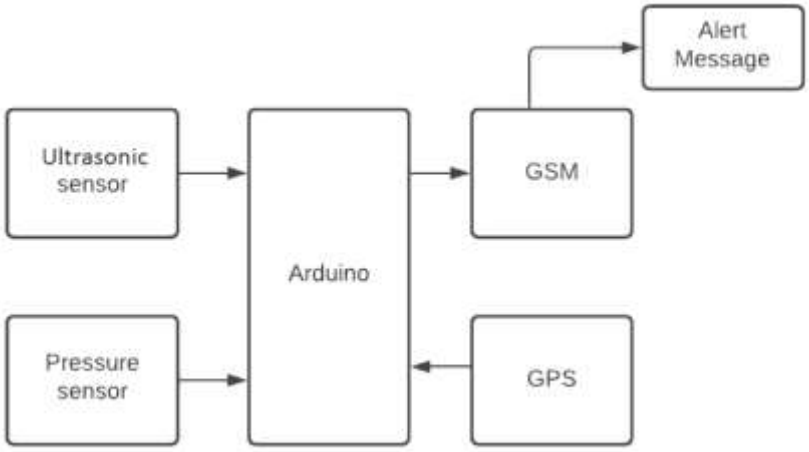


Fig. 2:Architecture of Advanced Emergency Care System

The architecture of Emergency care systemsthat are used to detect accident consist of Arduino, Ultrasonic sensor, Pressure sensor, GPS, and GSM. The working process of each sensor is explained below.

### *4.1. Use of Arduino*

In a solution for accident detection that uses a microcontroller to control operations like detecting and reporting.The accident is detected using sensors. The system focuses on minimizing the action time after an accident has occurred. A number is pre-fetched on the system, to which an alert is sent on the occurrence of an accident.

### *4.2. Use of GPS and GSM*

In [5] a system is proposed, that considers speed as one of the major causes of the accident.It uses a GPS receiver to monitor the speed and detects an accident based on the monitored speed. The GPS module continuously monitors the speed and compares it with the previously monitored speed every second using a micro-controller unit.

Whenever the system identifies that the value from the sensor is less than the pre-fetched threshold limit it will detect the situation as an accident. The location is detected by using a GPS module. An alert message is sent to the emergency services using a GSM module.

### *4.3.Use of Ultrasonic Sensor*

In a solution for accident detection and reporting which requires no manual interaction of humans before or after the occurrence of an accident. Its main module consists of GPS, GSM, Arduino, android applications. The system also stores the blood group of the driver. As soon as the vehicle meets an accident, the ultrasonic sensor which is placed under the vehicle measures the ground clearance and if it exceeds the threshold limit, itwill send an alert to the emergency number.The app is placed in the ambulance which continuously receives the information from the server, the app helps the ambulance to navigate to the accident spot using the route which has less traffic by using Google maps API (Application Programming Interface).To avoid traffic congestion, the ambulance transmits RF signal from time to time, the RF receiver is present in the traffic lights. When the traffic lights sense RF signals, they turn green to allow the ambulance to reach the accident spot as fast as it could.The emergency message is also sent to the victim’s family.

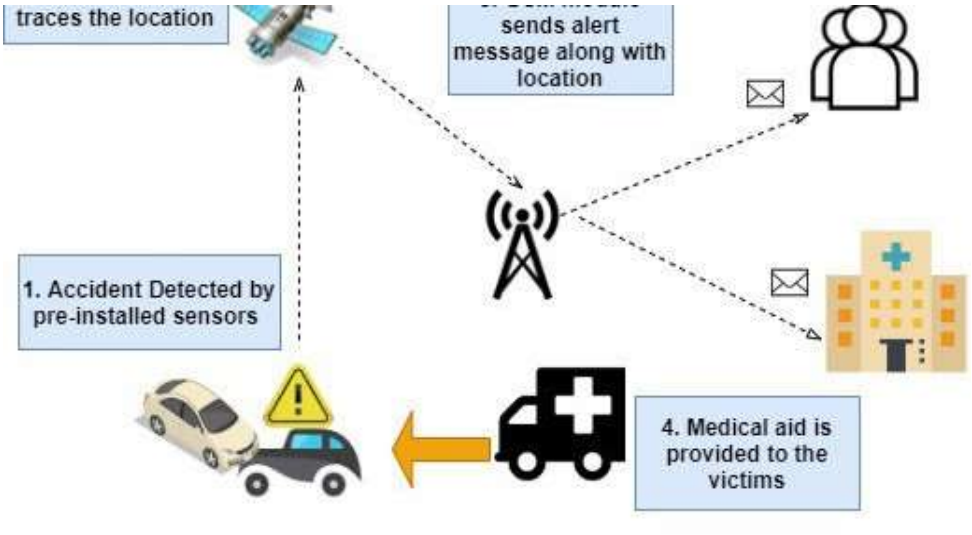


Fig. 3: Real Scenario ofan Accident Detection System Using Ultrasonic Sensor

### *4.4. Use of Force Pressure Sensor*

In[12] a solution based on the system for accident detection and reporting is presented. The outward force experienced by the vehicle is monitored by means of an external pressure sensor are measured. So, an accident will be detected if the values of pressure exceed the prefetched threshold limit. A switch that the driver can use to stop sending an alert message in case when the accident isn't severe or in case of false alarm is also present. When the pressure limit exceeds the prefetched threshold limit, GSM sends the alert message with location by means of GPS.

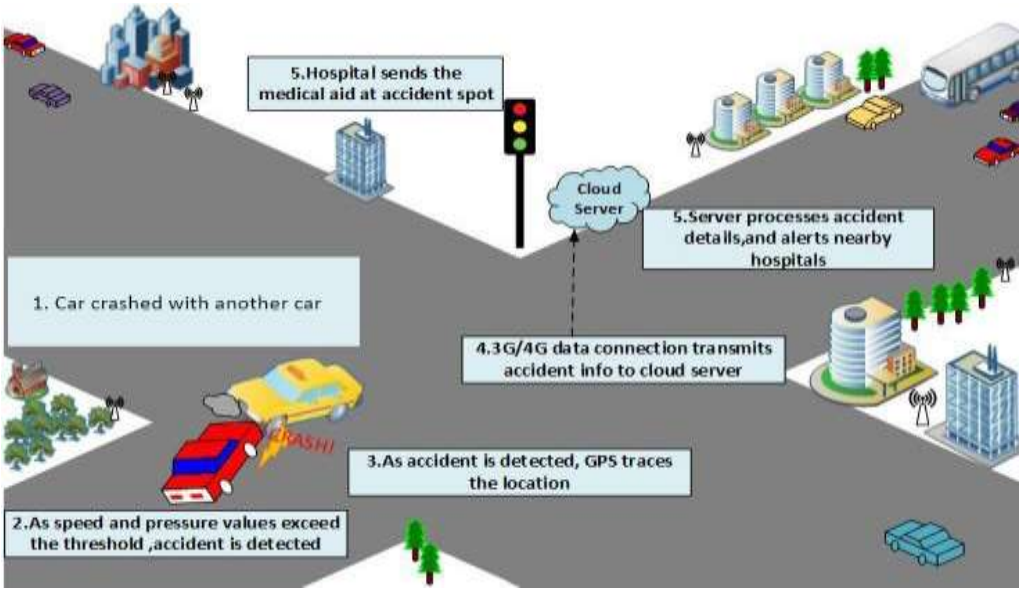


Fig. 4: Real Scenario ofan Accident Detection System Using Force Pressure Sensor

## V. Experimental Setup of Existing Emergency Care System

A circuit diagram (electrical diagram, elementary diagram, electronic schematic) is a graphical representation of an electrical circuit. A pictorial circuit diagram uses simple images of components, while a schematic diagram shows the components and interconnections of the circuit using standardized symbolic representations. The presentation of the interconnections between circuit components in the schematic diagram does not necessarily correspond to the physical arrangements in the finished device.

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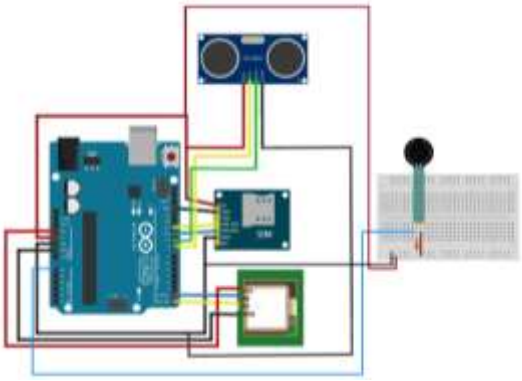

Fig. 5: Circuit Diagram

Unlike a block diagram or layout diagram, a circuit diagram shows the actual electrical connections. A drawing meant to depict the physical arrangement of the wires and the components they connect is called artwork or layout, physical design, or wiring diagram. Circuit diagrams are used for the design (circuit design), construction (such as PCB layout), and maintenance of electrical and electronic equipment.

### *5.1. Data Flow Diagram*

As shown in the data flow diagram in which the system will sense accidents and will inform the nearest police station and rescue, teams.GSM technology is used to communicate alert messages to emergency services. The microcontroller is used in conjunction with a GSM modem and GPS receiver. GSM is used for communication purposes which sends an alert message containing the location which is provided by GPS. It's main modules consist of an ultrasonic sensor, Force pressure sensor, GSM, and GPS. Ultrasonic and pressure sensors are used to indicate whether the accident has occurred or not.

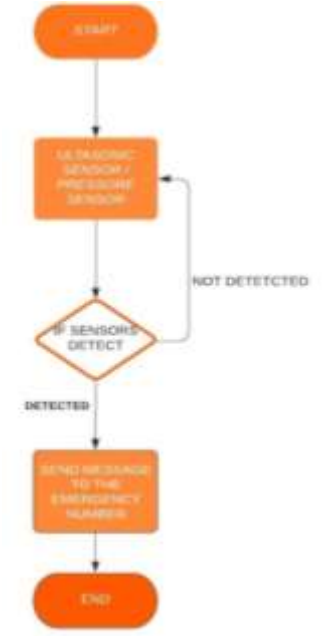


Fig. 6: Data Flow Diagram

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## VI. Experimental Setup and Result of Advanced Emergency Care System

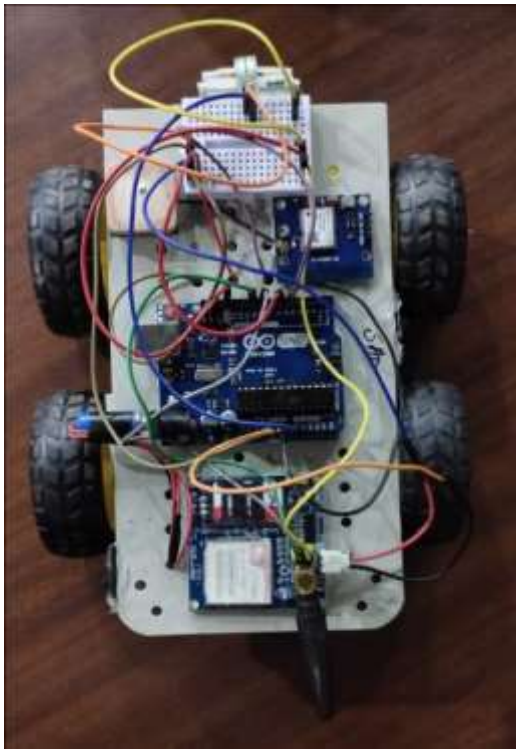

Fig. 7: Prototype

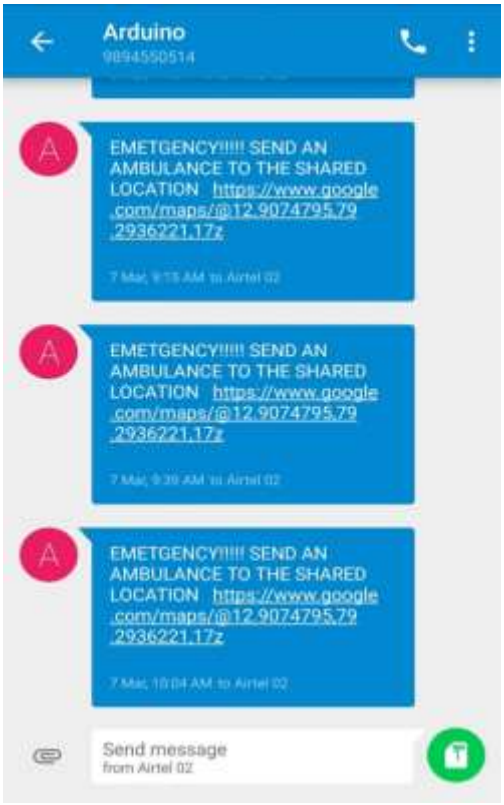


Fig. 8: Emergency Alert Message

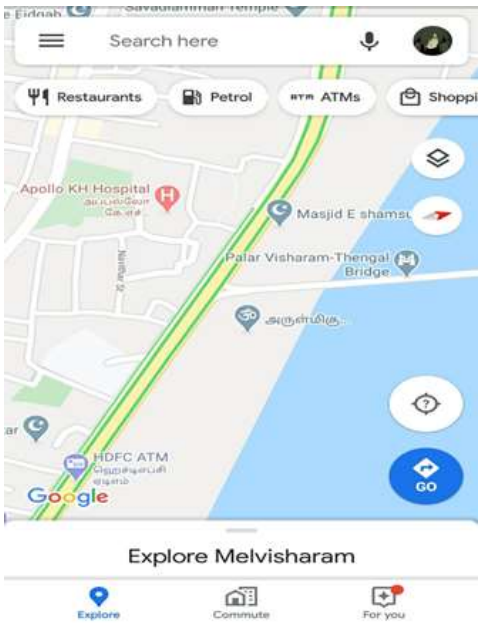


Fig. 9: Shared Location

## VII. Conclusions

The number of casualties associated with road collisions is growing rapidly. If victims are rescued in due time, several lives may be saved.These strategies utilized various sensors such as ultrasonic sensors, pressure sensorsfor accident detection.Once the accident is detected, the information is communicated to emergency services to provide timely aid. Such systems provide many advantages such as mitigating road collisions, identifying precise accident locations, and facilitating overall rescue operations. The integration of these systems with vehicles would be somehow expensive yet will give various advantages. However, the systems we discussed were allreliant on some kind of hardware or software-based technology and there is a possibilitythat those sensors or devices can themselves be destroyed in the accident and can generate erroneous readings and results. So, such frameworks are required which are less reliant on some kind of hardware or software.

## VIII. Future Enhancement

Various methods for accident detection were discussed in this paper.Integration of these systems with vehicles would be very beneficial to society. These systems would be effective in minimizing the casualties associated with road accidents. Additionally, patient history such as blood group, age, allergies, etc. can also be included in these systems to provide medical aid accordingly. Moreover, data obtained from sensors after an accident has occurred can be used in data mining to deduce important results. Performing analysis on the data can give us valuable insights on how most of the road accidents occur, which factors contribute the most in event of mishaps, which roads are dangerous, and the time stamp in which most of the accidents occur. The data collected from these systems could also help police to find the crimes of hit and run cases. In addition, the information about the occurrence of accidents can be routed to the vehicles in the range, to avoid any further mishaps, which can be helpful in reducing chain-reaction accidents in which multiple vehicles are involved in the crash, creating a chaotic situation.

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