

Smart Accident Rescue System

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Abstract: As we witness in our day-to-day life, there are many accidents caused in the road transport. Every day hundreds to thousands of people die due to accidents or are also affected minor or in a severe level due to accidents. It is very important to develop and research some technologies which will avoid accidents, and enable the owner to track the vehicles when there is a large transportation systems. This system will help such transporters as well as ambulances and other vehicle transportation in reducing the risk of accidents. This system is able to differentiate between normal and abnormal movement of vehicles which will therefore notify the owner and will also help in reducing accident causing situations. The rash driving of the driver is detected and the owner is informed about the rash driving along with the location of the driver. This is the important feature of our proposed project. The project also helps in detecting alcohol content in the vehicle. If present, the immediate notification will be sent to the user or the owner and the location will be shared through SMS.

Keywords: ESP32 Wi-Fi Module, MQ3 Alcohol Sensor, GPS, GSM, IR Sensor, Ultrasonic Sensor, Accident Rescue, Tracking.

I- INTRODUCTION

Accidents are common in nowadays situations and it is very much important to take care about these issues. The accidents are mostly due to ignorance of the driver like, Drunk and Drive, rash driving, irregular speed, speed limit exceeding, overtaking and other reasons. These are more seen in our surroundings while using road transport. Thus, there should be some technology which will reduce such incidents in order reduce further accidents even if not completely eradicated. Often people will be in a hurry which will lead them to accidents, be it minor or severe. Most of the people under severe attacks will be almost in critical conditions which may also lead to death.

This system will help such situations to be nullified. This will become a system that is designed for reducing accidents in a larger scale. There are various traveler agencies, or truck travelers for transferring loads from one place to another, and even ambulances or any personal vehicles also. The proposed design will help curtail all the accidents that are happening around us every second. The system will provide various accessibilities to the vehicle like its location which is sent by the use of Global Systems for Mobile communications (GSM). The model will propose a low cost and an effective method for reducing accidents in our surroundings. This is affordable from small vehicle associations as well as larger agencies that will help the owners to track their vehicles and will notify if any abnormal situations which might lead to accidents and save the driver's life. It can be used in bus transport or even cabs like, OLA and UBER etc.,

Usually in highways there are few reasons which lead to accidents like, when driver is not in the state of driving the vehicle due to tiredness, or over driving throughout the night or because of alcohol consumption by the driver may also be a reason. There can be other situations where the driver is in hurry and even roads will be in a bad conditions and the driver may not be wearing seat belts. This will also be a reason for accidents happening in the surroundings. Thus, it is important to note such accidental scenarios and keep in mind and find out proper solutions and technologies which will eradicate accidents caused due to such situations. There will be travel agencies which will have many drivers for their vehicles. The drivers will not be conscious since the drivers are out of their owner's hand and will be very careless in driving and very rash sometimes due to delay in arrival or leaving time. This will lead them to accidents regardless of thinking about their own life. In such cases the chances of saving people's life will be nil. While the other case, when this system is integrated with the vehicle the driver will be aware that the owner is tracking him, which indicates him to be cautious about driving. These can also be implemented in vehicles or ambulance vans for safe and secure driving across places by reducing accidents at a larger and in an efficient way.

I-BACKGROUND

A. Rationality behind choosing the project

We are currently developing technologies in various fields like, vehicle automation, automobile upgradation and other fields which make a wireless communication integration. While the country is a developing it is important to develop the technologies in the driver's safety and security also. We as students travel in buses where we observe a lot of accidents while travelling. Sometimes even bus drivers will go rash whenever there is two buses going in the same way at the same time. It feels very unsafe whenever there are two buses over taking each other. And even some cabs will go beyond the speed limit just to drop people before time, where we will not know when accidents will happen. Hence, we came into an idea which would help all mass road transport vehicles in a safe travel.

II-LITERATURE SURVEY

B. Dr. C K Gomathy, Ms. Neelam Sirisha Reddy [1]

The above mentioned researchers published an article named "Accident Detection and Smart Rescue System". This system was mainly consisting of Global Systems for Mobile communication (GSM), and the Global Positioning System (GPS) for location sharing to the user. The system also had an accelerometer integrated to it along with an RF Server for storing the data. This system had four units they are, vehicle unit which will be placed inside the vehicles, Control unit which was to control and coordinate the functions between the servers and the user it will also help in notifying the nearest hospitals that there is an emergency., the Ambulance unit for ambulances, and finally the traffic junction unit. The details were shared using the GSM which was used to send an alert in the form of mobile SMS, along with the location that is tracked accurately with the help of the GPS module. The main microcontroller used in this project is the ARM, LPC2138 module. The accident detection sensor, GSM, accelerometer and LCD display was integrated to it.

C. Rabin Khadka, Sushil Bohaju, Sushil Tiwari, Tshering T. Sherpa [2]

The students list mentioned above conducted a major project with title, "Accident Detection and Rescue management System". This paper was basically based on the IoT, the Internet of Things. The main module or the microcontroller used in this project was the ESP32 Wi-Fi module which would control the working of the entire system. This microcontroller uses the Wi-Fi to perform the required functions. The system also contains GPS module in order to detect the location of the vehicle. The module uses Internet in order to communicate with the user and connecting all the components together. The MPU6050 is used to detect the abnormal vehicle movement and the crash sensor is used to detect the crash and avoid it as well as a vibration sensor for high vibrations due to accident and is notified to the user using the internet as well as an SMS.

D. Bhandari Prachi, Dalvi Kasturi, Chopade Priyanka [3]

The paper entitled "Intelligent Accident-Detection and Ambulance-Rescue System", was published by the researchers mentioned above. They introduced an intelligent system which was more accurate enough to detect the accident and rescue ambulance system. The project consisted of a GSM module for sending SMS to the nearby hospitals. This system was using ARM microcontroller to perform its functions and there was an Accident detection sensor to detect the accidents. The system also had an RF receiver which would be used to control red and green lights interfaced with the microcontroller. This system mainly focused on accident rescue i.e, it detects if any accidents takes place and then notify the victim's family members with the information about the incident. Overall, the system was not seemed to be efficient, it would have been improved using cloud and other internet technologies for easy accessibility.

E. Arsalan Khan, Farzana Bibi, Muhammad Dilshad, Salman Ahmed, Zia Ullah [4]

These researchers used the GPS as their main module in order to detect the location of the vehicle. The title of their paper was as follows, "Accident Detection and Smart Rescue System using Android Smartphone with Real-Time Location Tracking". This system used smartphone notifications and other features so that the system becomes like an advanced version for their designed system. The coding used here was Java, using which they integrated the Google Play Services and created their own Application to display the details through connecting to the internet and the accelerometer was used to display the information about the forces exerted by the vehicle in different directions. The system integrated also the Firebase which is used as a means for storage of data that is collected. It also gives the warning message about various situations like accident detected, and the user will also be able to send notification through application.

F. S L V Prasad, Gooty Mehamood Basha, Srinivas Raju K, Kamalanathan Chandran, Sunita Panda [5]

These researchers designed a system called as, "IoT based Accident Detection and Rescue System". This system had Arduino to control the operations and perform as the main part of the system. This Arduino had a switch for emergency purpose, tilt sensor to detect abnormal tilt of the vehicle, power supply in order to power up the entire system since Arduino provides only one 5V supply, GPS module for detecting the location of the vehicle. Buzzer was also used to indicate the alert to the user in the vehicle unit. The ambulance unit has a temperature sensor for temperature detection, pulse sensor for heartbeat detection of the patient, glucose level sensor to detect the amount of glucose in the body of the patient and also an LCD display to display the details to the user.

G. Sowmya Shree B V, Ramesh T S, Lakshmisha S Krishna, Rangaswamy Y [6]

A paper titled, “Smart Detecting Accident by IoT and Smart Rescue System” was published by the above authors. They built a smart accident detection system which was wireless communication between the system and the user. The proposed system used IoT i.e, Internet to send information to the user. The system contained an application called Blynk App which was an easily accessible and user-friendly application in order use for projects like these which uses internet as a medium for communication. Even these authors used Arduino as the main microcontroller in order coordinate their functions and features. Here, if accident has occurs the sensors that will detect the accidents are activated and an alert message or a notification is sent to the ambulance, police and hospital. Later the traffic signal is controlled in a way required to the user for performing a fast operation of rescue.

H. Pranto Karmokar, Saikot Bairagi, Anuprova Mondal, Fernaz Narin Nur, Nazmun Nessa Moon, Asif Karim [7]

These authors created a design or a system called “A Novel IoT based Accident Detection and Rescue System”. This was an IoT based system as discussed earlier, IoT based means a system which uses internet to perform its functionalities. This is considered to be an effective system for detection of accidents. Whenever the accident is occurred the details about the incident are collected and are being sent to web server and also an SMS is sent to the family of the person who is injured. Also a police station or the ambulance service centers are also notified for faster rescue of the victim. The same information is sent to the traffic police control so that they can help the ambulance reach the nearby hospital as soon as possible.

I. Chinna V Gowdar, Veeresh M, Veeresh Shetti, Yadavi K K, Shankamma R K [8]

The model they designed was named as “Automated Accident Detection and Rescue System”. It was completely an accident detection system which will also help in detecting the accident and also providing measures for performing the rescue operations. This is a system whose microcontroller or the heart is Arduino. The Arduino is used to be integrating to various components like GPS for obtaining the location where the accident has occurred, and the same information is sent to the user using the GSM module which is used to send a message to the phone number it is programmed using the AT commands and the information in the message contains the details along with location link. The system had accelerometer for detecting the tilt direction of the vehicle and an alcohol sensor to detect alcohol content in the vehicle.

J. Ramanna Havinal, Sanjay K K, Sadhana B J, Shashank B M, Pavan B [9]

The above authors designed a system called “Automatic Accident Detection and Rescue System using GPS point Location”. This project was designed for sending the location of the system using the GPS Module. The system was accurate in detecting the accident and locating the place where the accident was taken place. The main module or the microcontroller that is used here is the Arduino UNO, which will help the system in performing all the logics. The UNO is integrated with various components like Node MCU for connecting to the Wi-Fi or the internet in order to contact the Database server which stores all the information using the MQTT protocol. There was a GPS module as mentioned earlier which locates the vehicle and the GSM module is also used in this project to send an SMS to the rescue team along with the location.

K. R Annie Karunya, Bhoomiks S E, Deekshitha S, Sanjitha Preya L [10]

This was a design named “IoT Approach for Vehicle Accident Detection, Reporting and Rescue System”. The above researchers authored this paper which was the system for accurate and efficient detection of accidents, and the reporting as well as a rescue mechanism. The system used Wi-Fi in order to perform the operations. This system had an Arduino board which was the main hub of the project, and to this there was interfacing of various sensors, a Wi-Fi module named ESP8266 Wi-Fi module, a GPS module for locating the position of the vehicle. This design consisted of the application for performing all the functionalities and also for notification.

II-OBJECTIVES

- To detect the abnormal movement or the rash driving of the vehicle this leads to accidents.
- To find out if there is any alcohol content inside the vehicle.
- To locate the vehicle where the particular accident is detected.
- To indicate the driver if there is any vehicle present behind his vehicle.
- To also detect obstacle in front of the vehicle.
- To send an SMS to the owner in emergency situations.

II-METHODOLOGY

L. Block diagram

The below block diagram in Fig 1. Which represents the overview design of our Smart Accident Rescue System?

ESP32 Microcontroller: The Microcontrollers or Microprocessors in general are mainly used for performing specific operation that is required to us based on the programming that we do.

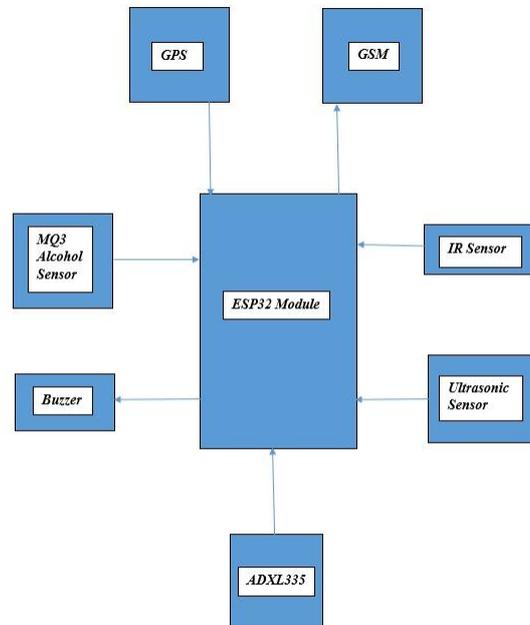


Fig 1. Block Diagram

We have used ESP32 Microcontroller or the ESP32 Wi-Fi module, which is considered to be the heart of the system. This Wi-Fi module will help us program it and allow us to perform operations based on our requirements. Overall, the description of this microcontroller is discussed in this section.

The ESP32 also known as WROOM32 microcontroller is used to work as a SoC (System on Chip). This microcontroller has many advantages when compared to other available microcontrollers. The ESP32 is a thirty-two pin IC (Integrated Circuit) which has many advantages and functionalities desirable to the user. This module when compared to microcontrollers like Arduino had more ADC (Analog/Digital Convertible) pins which will be much easier to work with a lot of sensors unlike Arduino which has only five ADC pins. The ADC bits in this microcontroller are 10-bits. The microcontroller used here has a 5V pin which supplies 5V power supply to the interfaced components, similarly a 3V3 pin is present in the controller which supplies 3.3V to the components and two GND pins for grounding the supply.

The controller also supports various communication modes like, Serial communications like, Bluetooth, UART (Universal Asynchronous Transmitter and Receiver) communication, and ZigBee communications, also SPI communication and I2C communication, which is the Master and Slave configuration. This device has to be powered up with a USB cable from the laptop which will turn on the ESP32 as well as the other sensors or components.

The component used here is interfaced with various sensors like, ADXL 335 accelerometer, Ultrasonic sensor, IR sensor, Buzzer, MQ3 alcohol sensor, and also GPS and GSM system for tracking location and sending an SMS to the user or the owner.

MQ3 Alcohol Sensor: This is one of the important component used in the project. The Alcohol sensor is used to detect if the driver is drunk or not. It basically senses the alcohol content in the surroundings. This particular alcohol sensor has four pins. They are: 5V, GND, D0 and A0. The 5V and GND pins are for power supply, D0 is a digital output pin which will give out the output as either 0 or 1, which means if there is alcohol content detected the output is 1 and 0 otherwise. In this project we have used the A0 pin, which is dedicated as the analog output. Since the microcontroller used here is of 10-bit ADC output i.e, it gives value ranging from 0 to 4095 (2 power 10). When ever there is alcohol content sensed there will be voltage variations inside the sensor which will result in the variation of the analog value. We have kept a threshold crossing which there is detection of alcohol content then a beep sound by the buzzer and an SMS is sent to the owner stating alcohol content detected along with the location of the driver.

Buzzer: It is a digital device which has only two pins. This buzzer is also known as a peizo-electric buzzer. The buzzer has one positive and negative pin. Stating that the buzzer negative is connected to GND whenever there is a 5V supply to the positive terminal there will be a beep sound generated. We can modify and set the alert system whenever we need it. This is mainly used to alert when alcohol content is deteced, when there is an obstacle or vehicle in the front as well as behind, and when there is abnormal vehicle movement detected.

ADXL335: The ADXL335 is an accelerometer that is used in this project. This accelerometer is used as a device which is mainly focused on detecting the abnormal movement of the vehicle. This particular accelerometer is a device which detects the variation of the directions in three axes i.e, x-axis, y-axis, and z-axis. So when vehicle is rash or tries to fall apart an immediate message can be sent to the owner. The ADXL335 has five pins, namely 5V, GND, x-out, y-out, and z-out. The 5V and GND are for powering up the device in order to start its functioning. In this project we have used only x-out pin. Whenever there is a threshold crossing in the x-axis it indicates that the vehicle movement is abnormal. It is normal vehicle movement otherwise.

Ultrasonic Sensor: Ultrasonic sensors are also known to be sonar sensors. These are named so because they transmimt ultrasonic waves in order to detect the distance of the obstacle. The ultrasonic sensor has four pins, they are, VCC, GND, Trig and Echo. The VCC and GND are for 5V supply to the device to initiate it. The Trig and Echo pins are for transmission and reception of ultrasonic waves from the object if present in front of it. The sensor have one transmitter (Trig) and a receiver (Echo). The transmitter will transmit clock spikes or pulses which will hit the object present in front of the sensor and the receiver will receive back the signals from the object. The duration between the transmission and reception of the signals from the object is returned by the sensor. This duration can be converted to the distance by using its standard formul. If the object is within 20cms the buzzer will produce an alert.

IR Sensor: The IR sensor is a device which is used to detect the obstacle if present within 5cms. This particular sensor is used in this project in order to detect the vehicle if present behind. The IR sensor will have a transmitter as well as a receiver. The working is similar to ultrasonic sensor but the range is less when compared to ultrasonic sensors. The IR sensor will first transmit the IR waves using the Transmitter and the receiver will receive the waves hit by the transmitter to the object. This sensor has three pins, i.e, VCC, GND and D0. The VCC and GND for power supply to the IR sensor. D0 pin is the digital output of the IR sensor which will give either 0 or 1 as the output. It is an active low device and some may be active high also. Active low in the sense, 0 indicates there is an obstacle behind and 1 indicated no vehicle present behind. Active-high is the other way round.

GPS (Global Positioning System): The GPS as the name suggests it identifies the location in the entire globe. The GPS used in this project is Neo-6M GPS module. The concept behind the location tracking is the GPS when powered up will try to connect to the nearest satellites and when it connected to more than three satellites it can approximately locate the position of the vehicle. The maximum number of satellites it can connect to is, twenty one. The GPS module is a serial device. Its mode of communication is serial communication. The GPS used here has four pins. They are: VCC, GND, Tx and Rx. The VCC and GND as discussed in other components is for the Power supply to the device or the sensor. The Tx and Rx are for the serial communication with the device. The transmitter pin will transmit the data that is collected by the GPS and will send it to the ESP32 and this microcontroller will receive and store the location until it reads next time.

GSM (Global System for Mobile Communication): It is a device which is used to build a wirelss mode of communication between two system. This is also a serially communicated device which uses the serial ports in the ESP32 module for communication. This is used in this project in order to notify the number that is fed into the GSM module in two situations, i.e, whenever there is an abnormal movement detected in the vehicle while it is travelling.

Software Components used:

Arduino IDE: This is a software which is used for programming microcontrollers like Arduino and other extended microcontrollers. This software is an integrated development which is used with a version of 1.8.13. The chosen software supports languages like embedded C/ C++. The software helps us include a number of libraries which will be easier to program microcontrollers. The software is an open-source integrated development environment which will be openly available for programming the controllers by mentioning the board, port that the board is connected to and the necessary libraries included in the program.

II-OUTCOME OF PROPOSED RESEARCH

This completed system is designed in such a way that it prevents the accidents of the vehicles as much as possible. The heart of the system is ESP32 Wi-Fi module microcontroller. This microcontroller can be programmed using Embedded C language in Arduino IDE Open source software.

Firstly, ADXL335 is the accelerometer used in this project. Its values changes when the sensor is tilted in different directions. So it will be placed on the vehicle if it crosses certain threshold value in the x-axis. We may detect the abnormal vehicle movement and an SMS using the GSM (SIM800C) of the driver's of vehicle's location is sent to the owner of the vehicle by tracking the location using the Neo6M GPS Module.

Next comes the MQ3 Alcohol sensor, this particular sensor is used to detect if there is alcohol content in the vehicle. If the driver is drunk it detects as the threshold of the sensor that we have set will be crossed and an alcohol alert buzzer sound will be produced as well as the alcohol alert SMS will be sent to the owner of the vehicle.

The IR Sensor is used to detect if there is any vehicle present behind the vehicle so that if there is any vehicle it gives an alert using the buzzer.

The Ultrasonic sensor is used to detect any vehicle, obstacle or hump present is appearing in front of the vehicle.

The entire system is continuously monitored every two seconds and the output is displayed in the serial monitor simultaneously. This system overall is helpful in accident rescue in various aspects.

II-DRAWBACKS AND FUTURE SCOPE

This model is also an efficient and cost effective one, however also have some difficulties which can be curtailed in future studies. The model can be included with a higher version of GPS module i.e, QUESTAR module for better tracking of the location. Also there can be use of Wi-Fi by which a easily accessible and tracking of the vehicle can be carried out exactly.

II-SUMMARY

This concept is a very efficient, time-saving, safe and cost-effective method which can be used by various sectors like, travel agencies, people who own a large number of vehicles, also ambulances in case of emergencies, and other vehicles to monitor the vehicle movement and reduce the risk of accidents.

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