Crowd-Sourced Traffic,Accident Reporting and Alert System

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Abstract- Speed is one of the basic reasons for vehicle accident. Many lives could have been saved if emergency services could get accident information and reach in time. This project deals with accident detection system when the accident occurs it uses various components and alerts the Rescue team for help. An efficient automatic accident detection with an automatic notification to the emergency service with the accident location is a prime need to save the precious human life. The proposed system deals with accident alerting and detection. It reads the exact latitude and longitude of the vehicle involved in the accident and sends this information to nearest emergency service provider.

Key Words: Accident detection, Emergency alert, GPS location, Speed monitoring, Rescue team, Automatic notification, Road safety.

1. INTRODUCTION

The development of a transportation system has been the generative power for human beings to have the highest civilization above creatures in the earth. Automobile has a great importance in our daily life. We utilize it to go to our work place, keep in touch with our friends and family, and deliver our goods. But it can also bring disaster to us and even can kill us through accidents. Speed is one of the most important and basic risk factors in driving. It not only affects the severity of a crash, but also increases risk of being involved in a crash.

2.OBJECTIVES

1. The objective is to overcome accidents by monitoring any change in the speed of the vehicle where as the accelerometer can detect the fall.

2. The Arduino is the major control unit to detector alert when an accident occurs. It collects the data from the accelerometer, GPS, GSM modules and reflects the output.

3. This will reach the rescue service in time and save lives.

3.MOTIVATION

Road accidents are increasing rapidly, mostly due to over speeding and delayed emergency response. Many victims lose their lives not because of the accident itself, but because help does not reach them in time. A system that can automatically detect an accident and immediately alert emergency services with accurate location details can significantly reduce response time and save lives. This need for faster, reliable, and automated accident reporting is the primary motivation behind developing an intelligent accident detection and alert system.

4.LITERATURESURVEY

Md. Syedul Amin**.** [1] in the paper *"*Accident detection and reporting system using gps, gprs and gsm technology (@2012 IEEE)".This paper proposes to utilize the capability of a GPS receiver to monitor the speed of a vehicle and detect an accident basing on the monitored speed and send the location and time of the accident from GPS data processed by a micro-Controller by using the GSM network to the Alert Service Centre.

Key Findings:-

- GPS effectively monitors speed and detects sudden deceleration.
- Sudden speed drops indicate possible accidents.
- A 5-second abort option reduces false alerts.
- GPS + GSM enables quick accident location reporting.
- System provides faster emergency response and improves road safety.

Parag Parmar [2] in *"*Real Time Detection and Reporting of Vehicle Collision (2017 IEEE)*"*. This paper proposes to utilize the capability of Accelerometer and Gyroscope to obtain the data and detect an accident basing on the orientation angle and orientation. Then send the location of the accident from GPS data processed by a micro- Controller by using the GSM network to the nearest hospital provided over the network and alerts their family members too.

Key Findings:-

- Accelerometer and gyroscope accurately detect collision direction and vehicle rollover.
- X-axis and Y-axis acceleration changes indicate crash impact.
- Tilt angle beyond ±46° confirms vehicle rollover.
- GPS validates collision and provides exact accident location.
- System automatically alerts family members and the nearest hospital.

Gowshika B [3]in *"*Vehicle Accident Detection System by Using GSM and GPS (@ 2019, IRJET)**"**. This paper proposes to utilize the capability of a Piezoelectric sensor to detect an accidentbasing on the voltage produced by collision and send the location and timeof the accident from GPS data processed by a micro-Controller by using the GSM network to the Alert Service Centre.

Key Findings:-

- Piezo sensor detects collision by high impact voltage.
- GPS gives accident location.
- GSM sends alert message to rescue team.
- Google Maps shows accident spot.
- OFF switch avoids false alerts.

5.PROBLEM FORMULATION

Introduction

Road accidents continue to be a major cause of fatalities, and a significant number of lives are lost due to delays in reporting the accident and reaching the crash site. Existing accident detection methods often rely on manual reporting, limited sensors, or delayed communication, which reduces the efficiency of emergency response. There is a clear need for an automated system that can instantly detect a collision, accurately determine the accident location, and immediately alert rescue services without human involvement. The problem, therefore, is to design a reliable, real-time accident detection and alert mechanism that minimizes response time by using sensors and communication modules to quickly identify the impact and send precise GPS coordinates to emergency teams.

Present System

Many researchers carried out their studies on accident detection system. Traditional traffic accident prediction uses long-term traffic data such as annual average daily traffic and hourly volume. In contrast to traditional traffic accident prediction, real- time traffic accident prediction relates accident occurrences to real-time traffic data obtained from various detectors such as induction loops, infrared detector, camera etc. Real-time traffic accident prediction focuses on the change of traffic conditions before an accident occurrence, while traffic incident detection studies are concerned with the change of traffic conditions after an incident occurrence. However, the performance of these detection and prediction system is greatly restricted by the number of monitoring sensor,

available fund, algorithms used to confirm an accident, weather, traffic flow etc.

Besides the automatic detection system, manual incident detection methods detects the accident from the motorist report, transportation department or public crews report, aerial surveillance or close circuit camera surveillance. The drawback of this type of detection system is that someone has to witness the incident. Moreover, there are delays and inaccuracies due to the expression problem of the witness. Compared to these detection method, driver initiated incident detection system has more advantages which includes the quick reaction, more incident information etc. However, with the severity of the accident, driver may not be able to report at all.

Conventional built-in automatic accident detection system utilizes impact senor or the car airbag senor to detect an accident and GPS to locate the accident place.

Problems of Present System

The present accident detection systems suffer from several limitations that reduce their effectiveness in saving lives. Most existing methods depend heavily on manual reporting by witnesses, drivers, or authorities, which leads to significant delays and often inaccurate information. Surveillance-based systems such as CCTV cameras or roadside sensors also have limited coverage and are affected by weather conditions, traffic density, and high installation costs. While some vehicles use internal sensors like airbags for crash detection, these systems do not provide any automatic communication to emergency services or share the accident location. Due to these shortcomings, emergency teams often receive delayed alerts, slowing down their response time and decreasing the chances of timely rescue.

Proposed System

The proposed system uses an Arduino Nano as the main control unit, enabling communication between all modules for efficient data transfer. The accelerometer detects the direction of collision by monitoring tri-axial movement, while the gyroscope identifies rollover accidents by measuring roll and pitch values, which depend on the vehicle's weight and center of gravity. A vibration sensor further confirms the occurrence of a collision by detecting a rise in voltage beyond a set threshold. To prevent false alerts, a buzzer is provided, allowing the passenger to cancel the accident notification within a short time window. If not cancelled, the GPS module collects the vehicle's coordinates and sends them to nearby hospitals for emergency rescue. The hospital then verifies the accident at the specified location and confirms it, after which the GSM module alerts the saved family members about the incident.

Problem Statement

Thegoaloftheprojectistodetectaccidentsandalerttherescueteamintime.The gap between the existing systems in place and the ideal system is that automated system is used once the accident occurs which can give latitude and longitude of accident occurred area without delay. More Human life can be saved using this system.

6. SOFTWAREREQUIREMENTSPECIFICATION FUNCTIONALREQUIREMENT

Auto detection mode is the identifier it holds the purpose of automatically detects when the accident occurs and it also sends the alert. The pre-condition is that turning on auto detection mode and the post-condition is On detection of accident and alert message will be sent.

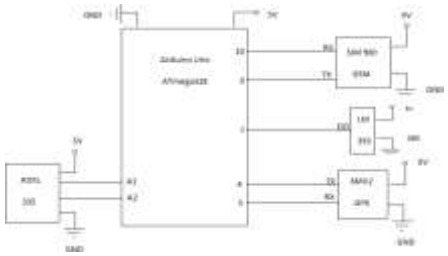
Adding emergency contacts it specifies the contacts that has to be saved, the purpose of doing so helps in sending the alert message when the accident occurs.

Sending the Alert message this requires the emergency contacts to be saved. It involves the action to be performed when the emergency message pops up.

NON-FUNCTIONALREQUIREMENT

Non-functional requirements are the requirements which are not directly concerned with the specific action delivered by the system. They specify the criteria that can be used to judge the operation of a system rather than specific behaviours.

The designed system will respond when the accident occurs it uses the proposed methodology of this project in detecting the accident, the detection depends on the speed of GPS in order to locate the spot and send the alert to medical emergency using the GSM module.



1.Hardware and Software Requirements

Hardware Requirements

- Arduino
- GPS module
- GSM module
- Accelerometer and Gyroscope
- Vibration Sensor
- Power Supply
- Connecting Wires
- Breadboard or PC

Software Requirements

Front-End:

- Arduino IDE interface
- Serial Monitor for output
- LCD/Buzzer/Switch for user interaction

Back-End:

- Arduino C/C++ code
- Libraries: Wire, Software Serial, Tiny GPS
- Sensor data processing and accident detection logic
- GPS–GSM communication handling.

7. DESIGN

Architecture

Fig. 7.1

The block diagram shows Arduino Nano as the main controller connected to the accelerometer, gyroscope, and vibration sensor to detect an accident. When a collision is identified, the Arduino triggers a buzzer for false-alert cancellation, then collects location data from the GPS module. Finally, the GSM module sends the accident coordinates to emergency contacts or hospitals.

- **Arduino Nano** – Main controller
- **Accelerometer** – Detects collision direction
- **Gyroscope** – Detects rollover
- **Vibration Sensor** – Senses impact
- **GPS Module** – Gets location coordinates
- **GSM Module** – Sends alert message
- **Buzzer** – For false-alert cancellation
- **Power Supply** – Provides power to all components.

Data Flow Diagrams

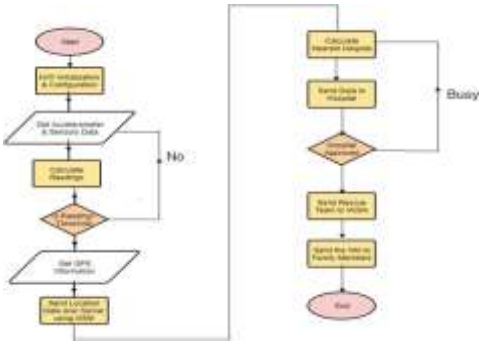


Fig. 7.2

Level0:

The Level-0 data flow represents the entire Accident Detection System as a single process that takes sensor and GPS data as input, detects an accident, and sends the alert information to external entities such as the hospital, rescue team, and the victim's family.

Level1:

The Level-1 data flow shows that the system collects sensor readings, checks if they cross the accident threshold, and then retrieves the GPS location. Once an accident is detected, the location is sent to the server, which finds the nearest hospital. After hospital approval, a rescue team is sent to the victim, and the system also sends accident details to the family members.

UseCase Diagram

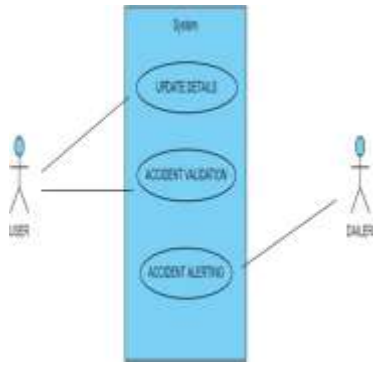


Fig.7.3 Use Case Diagram

8. IMPLEMENTATION

Step1: Start

Step2: Set threshold values for sensors

Step3:Calculate Sensor values

If (sensor values < threshold values)

go to step 3

else

go to step 4

Step4: Get GPS co-ordinates

Step5: Send the information to help centre

Step6: Help centre contacts the nearest hospital by GPS co-ordinates

Step7: If (Hospital approves)

go to step 8

else

go to step 6

Step8: Send an ambulance or rescue team to location

Step9: Stop

Arduino Nano is used as controlling unit, communicating between modules for better information transformation at time. Accelerometer can be used for detecting the collision direction from tri-lateral axis movements. Gyroscope can be used for rollover collisions after a threshold of roll and pitch values, the weight and centre of gravity of vehicle plays an important role in rollover. The device also confirms from vibration sensors which detects the collision after a threshold voltage increase. Then a buzzer is provided to abort the false detection of accident to the passenger. Within of limited time of buzzer signal the GPS module collects the coordinates from Google Module.

9. TESTING

Test 1:Testing of Arduino

Input: Raw accelerometer and gyroscope data from the MPU6050 via I2C.

Expected Output: Display of sensor readings on the Arduino Serial Monitor confirming successful MPU6050 communication.

Fig 9.1:Testing of Arduino

Test 2: Testing of GPS module

Input: GPS module powered and receiving satellite signals.
Expected Output: GPS LED blinking every second indicating a valid position fix.

Fig 9.2: Testing of GPS module

Test 3: Testing of GSM

Input: Arduino connected to GSM module via TX–RX or SoftwareSerial pins.
Expected Output: Successful GSM initialization message and ability to send/receive data through the GSM module.

Fig 9.3:Testing of GSM

Test 4 : Testing of accident detection

Input: LCD connected to Arduino according to the circuit schematic and powered on.
Expected Output: LCD backlight turns on and displays the initialized text, confirming proper interfacing.

Fig 9.4:Testingofaccident detection

10. RESULTS

Fig10.1: interfacing controller with all other module

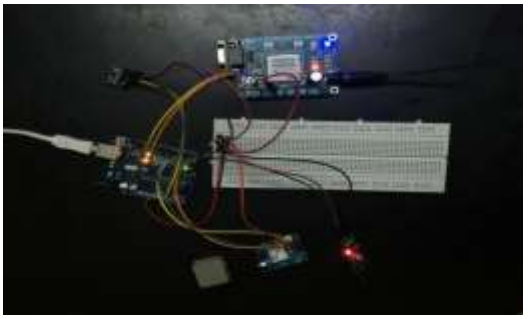
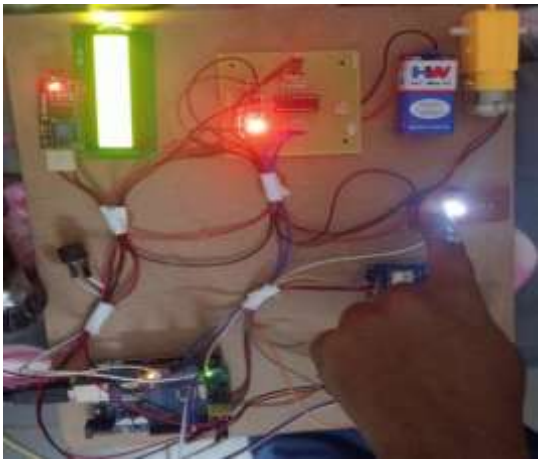
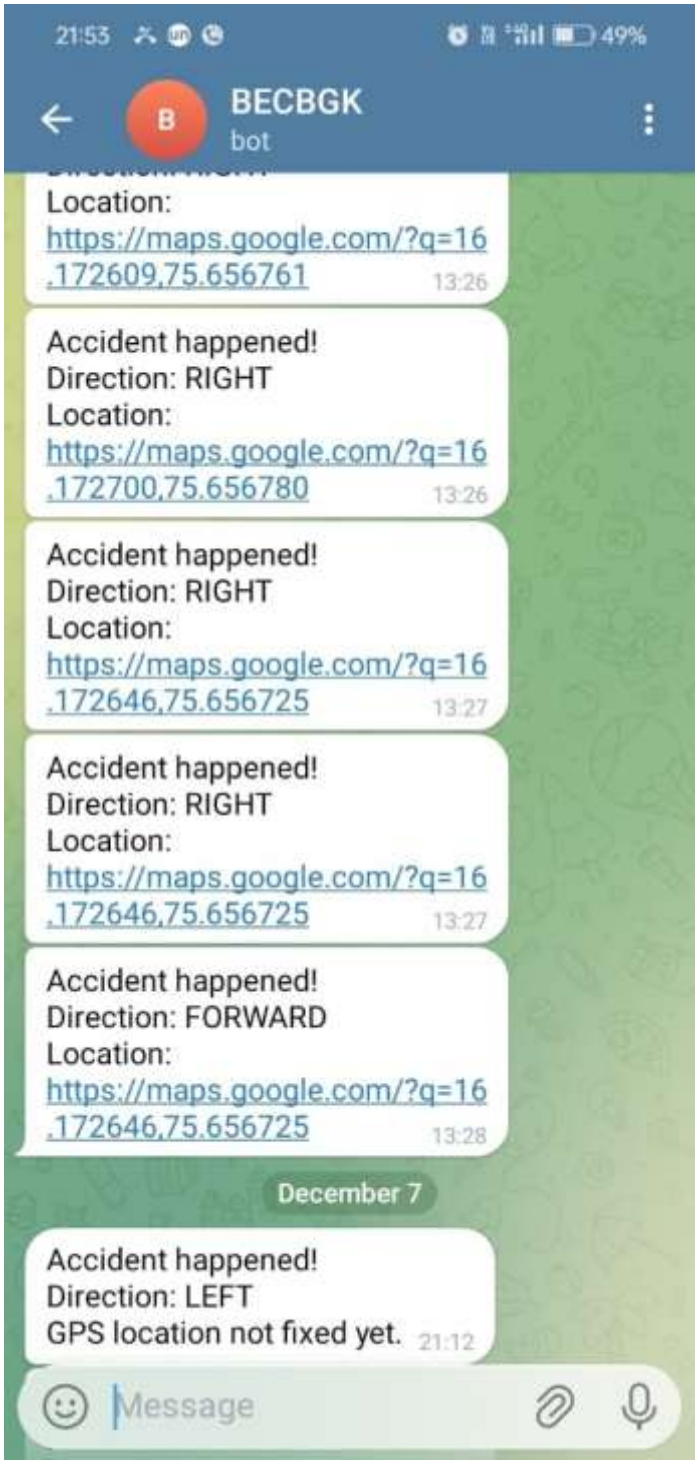


Fig10.2 : Alert message





11. CONCLUSIONS

A system to detect an event of accident has been developed. The proposed system deals with accident alerting and detection. It reads the exact latitude and longitude of the vehicle involved in the accident and sends this in formation to nearest emergency service provider. Arduino helps in transferring the message to different devices in the system. Accelerometer monitors the accident happening direction and gyroscope is used to determine rollover of the vehicle. The information is transferred to the registered number through GSM module. Using GPS, the location can be sent through tracking system to cover the geographical coordinates over the area.

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