



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 13, Issue 3, March 2024

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.423

9940 572 462

6381 907 438

ijirset@gmail.com

www.ijirset.com

An Efficient Accident Detection and Alert System with GPS Using IoT

Mrs.K. Rajammal M.E, Ph.D, Chandra. A, Jeeva jothika. B, Mahalakshmi. A

Assistant Professor, Department of Computer Science Engineering, E.G.S. Pillay Engineering College, Nagapattinam,
Tamil Nadu, India

U.G. Student, Department of Computer Science Engineering, E.G.S. Pillay Engineering College, Nagapattinam,
Tamil Nadu, India

U.G. Student, Department of Computer Science Engineering, E.G.S. Pillay Engineering College, Nagapattinam,
Tamil Nadu, India

U.G. Student, Department of Computer Science Engineering, E.G.S. Pillay Engineering College, Nagapattinam,
Tamil Nadu, India

ABSTRACT: Road accidents rates are very high now a days, Timely medical aid can help in saving human life. The major part of this project is working on Airbag system is detect the severeness of the impact. Arduino uno microcontroller is connected to Airbag system. The temperature sensor is measuring a heat of the vehicle to detect the fire accident. The vibration sensor is used to detect the abnormal activities. The GPS, GSM Modules and sensors are connected to the Microcontroller. This communication module will make the decision and sends the information to the Emergency contact number and police server. The police server conveys the information to the nearest hospital or medical camp. This project helps the Victim to save his life without any help from the surrounding people. The entire procedure is done with Internet of Things (IoT) technology.

KEYWORDS: Arduino uno microcontroller, Temperature sensor, Vibration sensor, GPS and GSM modules.

I. INTRODUCTION

Now a days in the newspapers or in news read about thousands of people dying in a road accident. most of the people die because of improper medical facilities. In Tamil Nadu, a total of 18,074 person died in 66,841 road accident that were reported in 2023, an increase from the previous year's statistics. As per the available reports 2022, 17,884 fatalities are reported from 64,105 accidents, according to the data from State Crime Records Bureau (SCRB), road accidents occur due to multiple causes such as over speeding, use of mobile phone, driving on wrong side/ lane indiscipline, jumping red light, non-use of safety devices such as seat belts, vehicular condition, weather conditions. One person is killed in a road accident nearly every three and a half minutes in India. This project reads the exact location of the vehicle involved in the accident and sends this information to nearest emergency service. The goal of the project is detecting accidents and alert the rescue team in time. It Improved safety of the primary benefit that can provide safety on the road. By detecting the potential risk and reduce injury. This system can help to reduce the risk. The development and implementation of an accident detection and alert system are important steps towards people safety. The major part of this project is working on Airbag system is detect the severeness of the impact. Microcontroller is connected to Airbag system. The temperature sensors can be used to monitor the temperature of various components such as the engine, brakes, or battery. If the temperature exceeds safe levels due to a collision or other incident, it can trigger an alert to notify the driver or emergency services. By using a sensor and utilizing a microcontroller for system management. GPS module that continuously tracks the vehicle's location using satellite signals. This module provides accurate geographic coordinates (latitude and longitude) of the vehicle's current position. GSM module to send alerts or notifications to emergency contacts and police server. A GSM module is a hardware component that enables devices to communicate over the GSM (Global System for Mobile Communications) network. It typically contains a SIM card slot and interfaces for connecting to a microcontroller or other electronic devices. GSM modules can send and receive text messages. The GPS, GSM Modules and sensors are connected to the Microcontroller. This communication module will make the decision and sends the information to the Emergency contact number and police server. The police server conveys the information to the nearest hospital or medical camp. The effective solution plays a vital role in reducing response times during accidents, potentially minimizing injuries and

saving lives on the road. this project is mainly focus on save humans life without any help from the surrounding people. The entire procedure is done with Internet of Things (IoT) technology.

II. RELATED WORK

Accident detection and alert system: An accident detection and alert system are mostly working on airbag system. Once the control unit decides that a collision has occurred and it's severe enough to warrant airbag deployment, it sends a signal to the airbag system. This includes not only the airbags themselves but also the inflators that fill the airbags with gas to deploy them rapidly. typically involves sensors to detect sudden changes like abnormal activities, fire accident [1]. The Microcontroller is connector to sensors and modules. sensors the system relies on various sensors, such as Temperature sensor and Vibration sensor are impacts to find the abnormal vehicle behavior indicating a collision. These sensors are strategically placed throughout the vehicle to accurately detect crashes from different angles and intensities [2]. Temperature sensor: It can be used to monitor the temperature of various components such as the engine, brakes, or battery. If the temperature exceeds safe levels due to a collision or other incident, it can trigger an alert to notify the driver or emergency services [3]. Vibration sensor: The vibration sensors are flexible devices which are used for measuring various processes. This sensor uses the piezoelectric effects while measuring the changes within acceleration, pressure, temperature, force otherwise strain by changing to an electrical charge. [4]. Data Processing and Analysis: The data from these sensors are constantly analyzed by the vehicle's onboard computer system. Advanced algorithms process this sensor data to determine the nature of any impacts or sudden changes in vehicle dynamics. This involves complex calculations to differentiate between normal driving events (like hard braking) and potential collisions. Once the system identifies a potential collision, it decides on the appropriate response [5]. Geolocation: An accident detection and alert system with GPS typically works by using various sensors such as accelerometers and gyroscopes to detect sudden changes in motion or orientation indicative of an accident. Once an accident is detected, the system uses GPS technology to determine the precise location of the vehicle and sends an alert to police server and emergency contact number, providing them with the vehicle's location for quick response. GPS allows for accurate positioning, ensuring that help can be dispatched to the exact location of the accident. [6]. Alert Mechanism: An accident detection and alert system using GSM technology typically involves sensors to detect accidents (like sudden impact or changes in orientation) and a GSM module to send alerts or notifications to emergency contacts and police server. A GSM module is a hardware component that enables devices to communicate over the GSM (Global System for Mobile Communications) network. It typically contains a SIM card slot and interfaces for connecting to a microcontroller or other electronic devices. GSM modules can send and receive text messages, make and receive phone calls, and connect to the internet, making them suitable for various applications such as vehicle tracking, remote monitoring, and, as in the case you mentioned, accident detection and alert systems. GSM are typically followed by AT commands are primarily used to configure a modem and establish its network connection. They can be used to interrogate the modem's Super SIM. [7]. Hardware and Software Development: Design or procure the necessary hardware components to integrate sensors into vehicles or wearable devices. The software is developing algorithms to process sensor data and identify potential accidents based on predefined criteria like sudden deceleration, impact force, or unusual vehicle orientation [8]. Testing and Validation: Conduct thorough testing to ensure the system accurately detects accidents while minimizing false positives. Validate performance under various driving conditions and scenarios. Simulation and Modeling are Before physical tests, simulations are used to model different crash scenarios. This helps in understanding how the vehicle structure and the airbag system will respond in various accident conditions. Component Testing are Individual components of the accident detection and airbag system, such as crash sensors, airbag modules, and control units, are tested extensively. This includes ensuring sensors can accurately detect impact and control units can correctly interpret sensor data to trigger airbag deployment. [9].

III. PROPOSED SYSTEM

Accident Detection and Alarm System in Air Bag System aims to enhance vehicle safety features by integrating an accident detection mechanism with the vehicle's airbag system. This system not only deploys airbags upon impact but also incorporates advanced sensors and communication technology to detect an accident as it happens and immediately alert emergency services and pre-set contacts. The system would use a combination of temperature and vibration sensors to detect a collision. These sensors measure changes in vibration, orientation, and force to accurately determine when an accident has occurred. Upon detecting a collision, the system would instantly trigger the deployment of airbags. These airbags could be traditional front and side airbags or newer types like knee and curtain airbags, depending on the vehicle's equipment. An integral part of the proposed system is a communication module equipped with GPS and cellular technology. This module would be activated in the event of a collision to transmit data about the accident, including the vehicle's location, the severity of the impact, and possibly other relevant data such as the number of passengers. The data from the communication module, the system would automatically send alerts to



emergency contact and police server, providing them with immediate information about the accident and its location. The police server conveys the information to the nearest hospital or medical camp. This project helps the Victim to save his life without any help from the surrounding people. This ensures a quicker response time, potentially saving lives and reducing the severity of injuries IN addition to alerting emergency services, the system could also notify pre-set contacts (like family members or friends) about the accident, including details about the location and the vehicle involved. This system could potentially be integrated with other vehicle safety systems and telematics for a more comprehensive safety and monitoring solution. The entire procedure is done with Internet of Things (IoT) technology

IV.EXISTING SYSTEM

The existing systems in modern vehicles are quite sophisticated, using a combination of sensors, algorithms, and connectivity to detect imminent crashes, deploy airbags, and even notify emergency services in the architecture, components, and data flow of the existing system to identify integration points for the accident detection and alert system. Automatic Collision Notification (ACN) is integrated into modern vehicles, ACN systems automatically notify emergency services in the event of a severe collision. They can provide vital information such as the vehicle's location, the time of the accident, and the severity of the impact. Event Data Recorders (EDRs) is often referred to as vehicle "black boxes," EDRs record information about vehicle dynamics and safety systems in the seconds before, during, and after a collision. This data can be used to reconstruct the accident and determine its cause. Dash Cameras are equipped with G-Sensors can detect sudden changes in motion or impact, automatically saving footage of incidents for later review. Fall Detection Devices especially useful for the elderly or individuals with health conditions, these wearable devices can detect a fall and automatically alert emergency contacts or services. Smartphone Apps are several applications designed to detect accidents, such as car crashes or falls, using the smartphone's built-in sensors. These apps can then send alerts to predefined contacts or emergency services.

V. ALGORITHM IMPLEMENTATION

Data Acquisition: The first step is to continuously collect data from the sensors integrated into the vehicle, such as accelerometers, gyroscopes, and GPS. This data serves as the input to your detection algorithm.

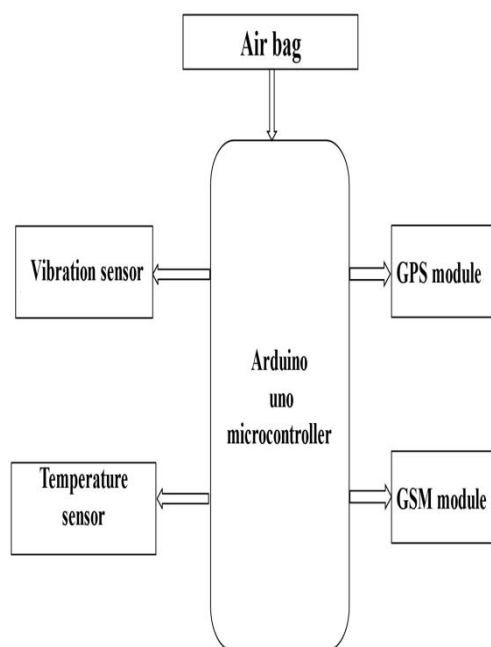
Central Control Unit (CCU): All sensor data are fed into a Central Control Unit (CCU), often a microcontroller or a specialized automotive control unit. The CCU is responsible for Data analysis and Decision making. Data Analysis is interpreting sensor data in real-time to determine the occurrence and severity of an accident.

Airbag System Deployment: If a collision is detected and thresholds are exceeded, the CCU sends signals to Inflate Airbags is triggering the inflator mechanism using an igniter to rapidly inflate airbags at strategic locations (steering wheel, dashboard, sides, etc.) to cushion occupants.

Safety and Testing: Both the airbag and alarm systems undergo rigorous testing to ensure reliability and safety. This includes a simulation and crash Testing to fine-tune sensor sensitivity and system responsiveness. Compliance with Safety Standards meeting regulatory requirements and safety standards in different regions (e.g., NHTSA in the USA, Euro NCAP in Europe).

Data Preprocessing: The processing are Filtering, Normalization and Segmentation. Filtering is low-pass filter is applied to the raw sensor data to remove high-frequency noise and smooth the signal. Normalization in filtered sensor data is normalized using min-max normalization to ensure consistent scaling across different sensor types and units.

Deployment and Maintenance: The deployment and maintenance are Firmware Updates and System Diagnostics. The Firmware Updates and Regularly update the system's software to improve detection algorithms and incorporate new safety features.



Design and Prototyping: Develop a detailed design of the system, including selecting appropriate sensors, deciding on the microcontroller or processor, and designing the software logic and airbag deployment algorithms.

VI. WORKFLOW PRINCIPLE

The workflow principle of an accident detection alarm system is designed to quickly detect accidents and notify relevant parties, ensuring timely assistance and intervention. While the specific mechanisms can vary based on the application vehicles. The system relies on various sensors to detect potential accidents. These can include a temperature sensor and vibration sensor. Temperature sensors play a vital role in ensuring the safety and integrity of the vehicle's systems, especially in critical situations. The vibration sensors are detected and monitoring a sudden change in movement or orientation. The collected data is analyzed in real-time to determine if an unusual event meets the criteria of an accident. This can involve complex algorithm to recognize patterns indicative of accidents. Once an incident is detected, the system assesses the severity and potential consequences of the event. The system automatically notifies emergency responders or designated safety personnel through various communication channels (e.g., SMS, email, automated phone calls).

VII. METHODOLOGY

Sensors for Accident Detection: The system relies on various sensors to detect a potential accident. The temperature sensor is measuring a heat of the vehicle to detect the fire accident. The vibration sensor is used to detect the abnormal activities by using a sensor and utilizing a microcontroller for system management.

Airbag System: The airbag system consists of Located in the steering wheel, dashboard, sides, and other strategic locations inside the vehicle. Made from a lightweight fabric that inflates rapidly. The Inflators is chemical or electrical devices that rapidly inflate the airbag in the event of an accident.

Deployment Mechanism: is upon deciding to deploy the airbags, the control unit activates the inflators. The deployment process is highly rapid, typically within 20-30 milliseconds after the accident detection. Chemical Inflators is mostly reacting chemicals to produce nitrogen gas quickly, inflating the airbag

Hardware Implementation: Deployed at strategic points to detect sudden deceleration. The impact of the sensor is Positioned at the front, rear, and sides of the vehicle to detect and assess the impact.

Software Implementation: Data Processing is Continuous monitoring of sensor inputs. Decision Logic is detected, the system evaluates the severity to decide on the deployment of airbags. Time-critical processing to ensure airbags deploy within milliseconds after collision detection.

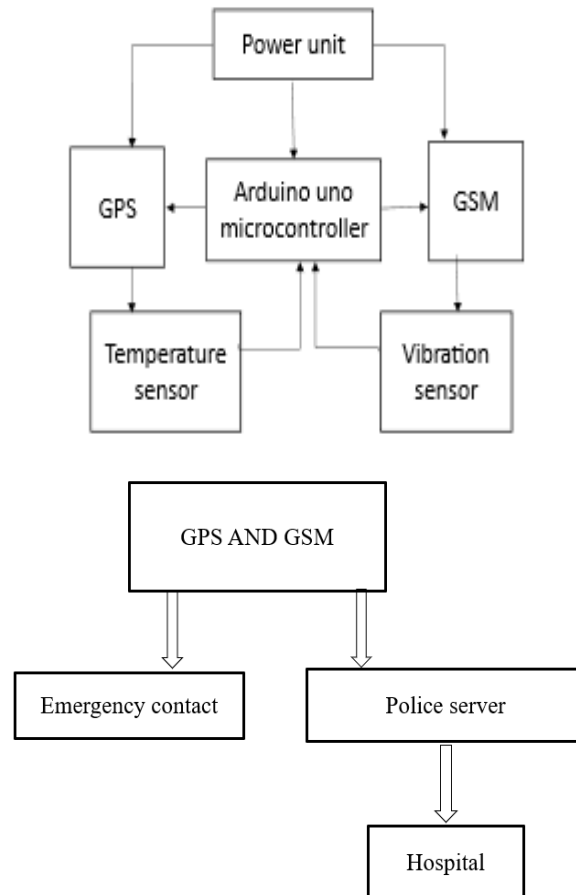
Communication System: For an accident detection alarm system, an additional component can be a communication module that Sends alerts to emergency services with the vehicle's location (GPS) and details about the accident.

Testing and Calibration: Extensive testing is necessary to ensure the system's reliability and safety. The physical Crash Testing is real-world crash tests to ensure the system operates as expected under actual conditions.

Integration with Vehicle Systems: The accident detection and airbag system must integrate seamlessly with other vehicle systems, such as the vehicle's electronic control unit (ECU), to enhance safety and functionality.

VIII. DESIGN AND IMPLEMENTATION

Designing and implementing an accident detection and alert system is an important task that can help save lives and provide timely assistance during emergencies. Here's a general outline of the key components and steps involved in such a system



Control Unit:

A microcontroller or microprocessor that interprets sensor data and decides when to activate the airbags.

Hardware setup:

Temperature Sensor and vibration sensor are connected to the Arduino uno microcontroller. The sensors are deployed at strategic points to detect sudden deceleration.

Software Configuration:

Data Processing is algorithm to interpret the data from accelerometers and impact sensors, differentiating between a collision and non-collision events.

Design Considerations:

User Safety is a first Priority in design decisions, considering factors like the force of airbag deployment. System Reliability is ensuring the system accurately detects accidents.

Deployment and Maintenance:

Properly install the system in the desired location, ensuring all components are correctly set up and calibrated. Plan for regular maintenance of the hardware and updates to the software to ensure ongoing accuracy and reliability.

Safety Considerations:

System Testing in simulated and controlled environments to ensure reliability and effectiveness. Compliance with automotive safety standards.

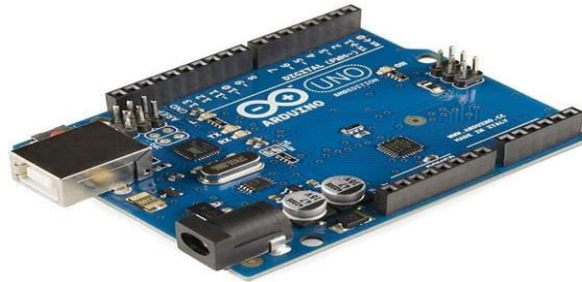
Testing and Validation:

Prototype testing the system in controlled environments to validate its effectiveness and adjust as necessary. Field testing is deploying the system in real-world settings to further test and refine it.

IX. HARDWARE COMPONENT

Arduino Uno

Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator (CSTCE16M0V53-R0), a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller.



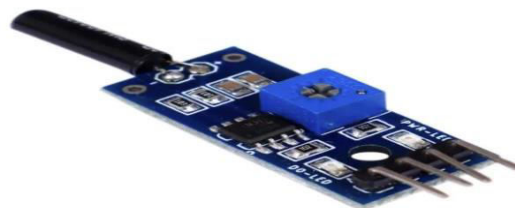
Temperature sensor

Temperature sensor in an accident detection and alert system can provide valuable data for assessing the severity of an accident. Rapid changes in temperature could indicate a fire or potential danger, triggering an immediate alert to emergency services or nearby authorities.



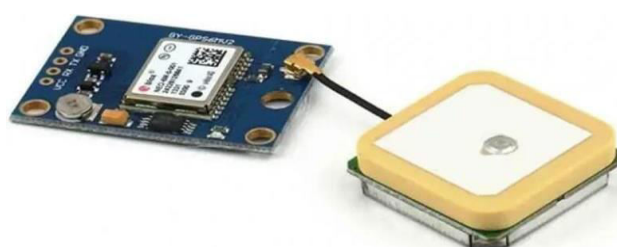
Vibration sensor

A vibration sensor in an accident detection and alert system could detect sudden impacts or collisions, triggering an alarm or alert to notify emergency services or designated contacts. These sensors are commonly used in vehicle safety systems or wearable devices to detect accidents. When the sensor detects a significant vibration indicative of an accident, it triggers the system to initiate predefined actions are Sending alerts to emergency services.



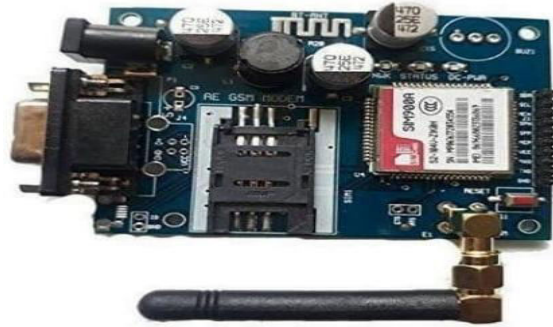
GPS Module

GPS modules contain tiny processors and antennas that directly receive data sent by satellites through dedicated RF frequencies. From there, it'll receive timestamp from each visible satellites, along with other pieces of data. The ability to track a device's location and movement in real-time is critical in monitoring cargo, keeping track of vehicles, and analyzing customer behavior.

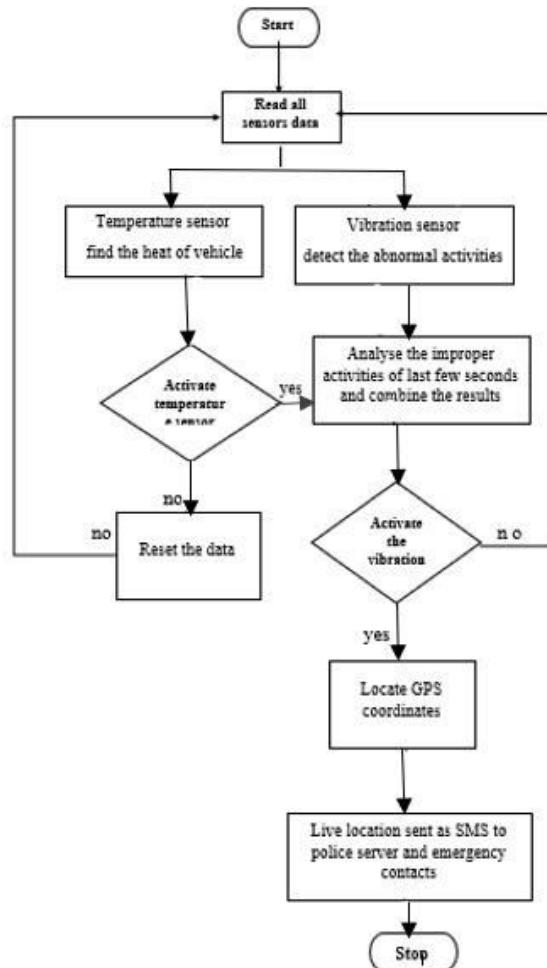


GSM Module

The GSM module plays a crucial role in the communication between devices and the GSM network. It is responsible for establishing and maintaining the communication link between the device and the network. The module also handles the encryption and decryption of data, which ensures the security of the communication.



X. FLOW CHART



XI. EXPERIMENTAL RESULTS

An accident detection and alert system can use sensors like Temperature sensor and vibration sensor. They used to detect the abnormal and improper activities. Microcontroller is connected to Airbag. Once the airbag is opened that microcontroller will automatically start to working. The GPS, GSM Modules and sensors are connected to the Microcontroller.

Moving to next step to GSM. This communication module will make the decision and sends the information to the Emergency contact number and police server. The police server conveys the details about an accident and location to hospital.

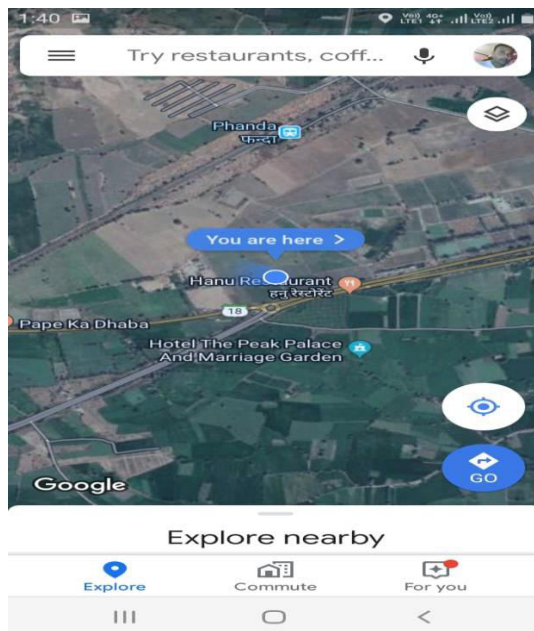


Figure: Tracking an exact location

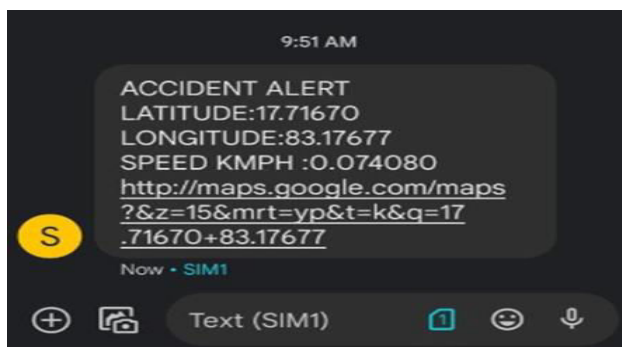


Figure: Message Sent on Mobile

The overall result of this project is providing help to save a people's life. These systems can provide rapid response, accurate location information, and automated alerting to emergency services.

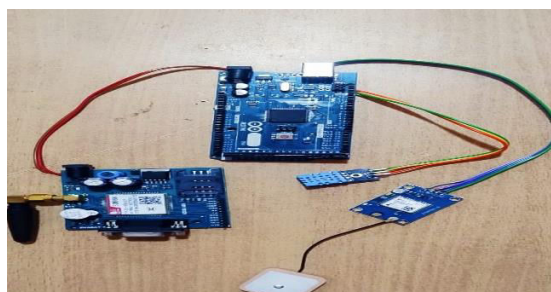


Figure: Model kit for alert system

XII. CONCLUSION

The development and implementation of an accident detection and alert system are important steps towards road safety. The programs help it figure out if it's a real crash or just a bump, so it doesn't bother anyone unnecessarily. If the airbags deployed to connect the microcontroller by using a sensor and utilizing a system management. The inclusion of

GPS and GSM technology are connected to microcontroller, this communication module will make the decision and sends the information to the Emergency contact number and police server. The police server conveys the information to the nearest hospital or medical camp. The effective solution plays a vital role in reducing response times during accidents, potentially minimizing injuries and saving lives on the road. Future developments in this field are likely to focus on improving the accuracy of accident detection, the speed of airbag deployment, and the overall effectiveness of these systems in a wider range of collision scenarios. This part of the system uses special sensors to notice when a car has a sudden crash.

REFERENCES

1. S. Jawad, H. Munsif, A. Azam, A.H. Ilahi, S. Zafar “Internet of things-based vehicle tracking and monitoring system” 2021 15th International Conference on Open-Source Systems and Technologies (ICOSST), IEEE (2021), pp. 1-5
2. B. Gowshika, G. Madhumitha “Vehicle accident detection system using GSM and GPS Module” Int. Res. Eng. Technol. (IRJET), 6 (1) (2019), pp. 1574-1578
3. G.C. Mallikarjuna, R. Hajare, C.S. Mala, K.R. Rakshith, A.R. Nadig, P. Prathana “Design and implementation of real time wireless system for vehicle safety and vehicle to vehicle communication” 2017 International Conference on Electrical, Electronics, Communication, Computer, and Optimization Techniques (ICEECOT), IEEE (2017), pp. 354-358
4. M. Costa, D. Oliveira, S. Pinto, A. Tavares “Detecting driver's fatigue, distraction and activity using a non-intrusive ai-based monitoring system” J. Artif. Intell. Soft Comput. Res., 9 (4) (2019), pp. 247-266, 10.2478
5. B. S. Shobha and R. Deepu,” Hybrid Deep Learning Signature based Correlation Filter for Vehicle Tracking in Presence of Clutters and Occlusion” International Journal of Advanced Computer Science and Applications (IJACSA), 13(10),2022, pp.961-969. DOI:10.14569/IJACSA.2022.01310114.
6. Kassem, R. Jabr, G. Salamouni, and Z. K. Maalouf, “Vehicle black box system I” 2008 IEEE Int. Syst. Conf. Proceedings, SysCon 2008, no. May 2008, pp. 463–468, 2008, doi: 10.1109/SYSTEMS.2008.4519050.
7. Khedher, Senior “Detection and Reporting System”. International Conference on Mechanical and Electrical Technology, pp: 636-640. [5]. Intelligent anti-theft and tracking system for automobiles----IEEE-2012 February 2012
8. M. Anil Kumar, M. Venkata Suman, Y. Misra, and M. Geetha Pratyusha, “Intelligent vehicle black box using IoT”, I Int. J. Eng. Technol., vol.7, no 2, pp 215–218, 2018, doi: 10.14419/ijet. v7i2.7.10296.



INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 9940 572 462  6381 907 438  ijirset@gmail.com



www.ijirset.com

Scan to save the contact details