International Research Journal on Advanced Engineering and Management

https://goldncloudpublications.com

e ISSN: 2584-2854
Volume: 01
Issue: 01 December 2023
Page No: 01-12

An IoT Based Accident Detection and Rescue System

V. Veera Anusuy[1], B. Jasmith[2], P. Sugasini[3], M. Jeeva Dharshini[4],*
[1,2,3,4] Department of Computer Science and Engineering, National Engineering College, Tuticorin, India.
Email: veeraanusuya@cse.nec.edu.in[1], jas.jasmitha2002@gmail.com[2], sugasiniponnaiah@gmail.com[3], jeevakannan020902@gmail.com[4]

Abstract

The main factor causing car accidents is speed. Many lives could have been saved if emergency services had been able to gather information about the tragedy and reach in time. The main project's objective is to develop an accident detection system that makes use of several different parts to alert the rescue crew about an accident. An efficient automated collision detection system that instantly alerts emergency services to the accident site is crucial for protecting valuable human life. The recommended approach deals with accident detection and notification. After reading it, it sends the affected vehicle's exact latitude and longitude to the nearest emergency response provider. The project's goal is to locate incidents and alert the rescue team as soon as possible.

***Keywords**: GPS, GSM, Vibration Sensor, Latitude and Longitude, Notification.*

1. Introduction

The creation of a transportation network has been the driving force behind human civilization's superiority over other living things. In our daily lives, automobiles play a major role. We use it to distribute our items, commute to work, and stay in contact with friends and family. However, it also has the potential to destroy us and even kill us in mishaps. One of the most significant and fundamental danger factors when driving is speed. It raises the chance of being involved in a crash as well as the severity of one. Despite numerous initiatives implemented globally by official and non-official groups to increase public awareness of careless driving, accidents are still happening. Nonetheless, if the emergency services had received the crash information sooner, a great number of lives might have been spared. A study by Virtanen et al. found that 4.6 percent of accident-related deaths may have been prevented if emergency services had been on the scene on time. Therefore, saving precious human life requires effective automatic accident detection along with immediate reporting to the emergency services of the accident location.

2. Proposed System: IoT-Based Accident Detection and Alert System

The Arduino Nano serves as a controlling unit and occasionally communicates with other modules to improve information transformation. Tri-lateral axis motions can be used to identify collisions, and direction using an accelerometer. After a certain roll and pitch value threshold, rollover collisions can be observed with a gyroscope; the vehicle's weight and center of gravity are critical factors in rollover. Additionally, the device verifies through vibration sensors that identify collisions following a rise in threshold voltage. Next, a buzzer is given to the passenger to stop them from mistakenly believing there has been an accident. The GPS module obtains the coordinates from the Google Module within a predetermined window of time following the buzzer signal. These coordinates are used to notify surrounding hospitals when a passenger needs emergency rescue. The hospital confirms the accident and verifies that it occurred at the designated location before approving it. The GSM module notifies the family's surviving personal members about the accident.

International Research Journal on Advanced Engineering and Management

https://goldncloudpublications.com

e ISSN: 2584-2854
Volume: 01
Issue: 01 December 2023
Page No: 01-12

3. Literature Survey

Mahendra Vucha, B. Naresh, S. Monika, T. Kalyani, and others [1], A vehicle's pneumatic tire pressure is managed by the tire pressure monitoring system (TPMS), which offers various operating conditions. Ant Colony Algorithm (ACA) developed the support vehicle machine (SVM), which is used for vehicle detection. Parmar Parag, Sapkal Ashok M. [2] Numerous uses for the US-Accidents dataset exist, including casualty analysis, investigating automobile accident hotspot locations, and real-time car accident prediction. The algorithms used for object detection are called AI CCTV and YOLOv3. M.B.I. Reaz, Jubayer Jalil, Md. Syedul Amin. [3] A GPS receiver that tracks a car's speed and uses that data to identify collisions. GSM communications. employing kinetic energy to find collisions.GPS, GPRS, and GSM technologies are used in this reporting system. B Gowshika, MadhuMitha, G, and Jayashree, [4] suggest a method for the real-time identification and reporting of car accidents that makes use of GPS and GSM technology. By combining GPS position data with a GSM modem to send notifications to emergency services, the system seeks to quickly identify accidents, improving reaction times and maybe lessening the severity of accidents. This creative strategy promotes effective emergency response and traffic safety. Smitha Khairnar, Sayanee Nanda, and Harshada Joshi.[5] describes a system that uses Internet of Things technologies to identify and avoid accidents. Through the use of IoT devices, the system improves emergency response times and overall traffic safety by preventing accidents proactively and detecting issues quickly. Ammar Anuar, Darmacowaty Mohd Ali, Suzi Seroja Sarnin, Azita Laily Yusofl, Ainnur Eiza Azhar, and Norsuzila Yaacob,[6] outlines a technique for tracking accidents in real time using cell phones in [6]. The system's utilization of wireless technology facilitates prompt accident monitoring and reporting, hence augmenting emergency response and road safety. Dr. K. Satya Sekhar, S. Jaishree, and S. Sonika,[7] employed GPS and GSM modem technology, specifically using DARICE (Detection Algorithm for Road Condition Change Events) in 2014. This system is designed to accurately identify and report accidents by combining GPS location data with GSM communication for efficient response and assistance. Prasann Barot, Dhruvbhai K. Patel, Dhruvesh H. Patel, and Parth Sadatiya,[8] system that integrates alcohol and accident detection. It leverages IoT technology to enforce the mandatory use of safety equipment and detects alcohol consumption, enhancing road safety measures. Jagannivasan, V, Sathish, T, Mohanram, S, and Ajith Kumar A,[9] This system swiftly identifies accidents and sends alerts by combining GPS location data with GSM communication, contributing to rapid response and improved safety measures. The accelerometer is used to detect falls and Threshold Algorithm is used to detect accidents. Shadman Sakib, Mohammad Sayem Bin Abdullah,[10] designed to automatically detect emergencies and notify positions. Using GPS and GSM technology, this system tracks inland vessels, detecting emergencies and sending position notifications, enhancing safety and responsiveness in water transportation. Lih-Jen Kau and Chih-Sheng Chen, [11] This system utilizes smartphones to detect falls, determine accurate positions, and facilitate rescue efforts. By combining smartphone technology with advanced algorithms, the system enhances the detection and response to fall accidents, improving safety and assistance for individuals in need. Chuang Zhang, Xuting Duan, Xixian Wang, and Daxin Tian. [12] using Cooperative Vehicle Infrastructure Systems (CVIS). This method leverages communication between vehicles and infrastructure to identify and respond to car accidents automatically. By integrating CVIS technology, the system enhances accident detection accuracy and enables swift response measures, contributing to improved road safety. Mubashir Murshed and Md Sanaullah Chowdhury. [13] This innovative system incorporates smart brake control to enhance safety on the road. The project likely aimed to use IoT technology to reduce accidents and improve vehicle

International Research Journal on Advanced Engineering and Management

https://goldncloudpublications.com

e ISSN: 2584-2854
Volume: 01
Issue: 01 December 2023
Page No: 01-12

braking mechanisms, contributing to road safety advancements. M. Reddy and J. Tulasi [14] A GPS module detects the accident, and a GSM module uses the location information to send an alert message to the registered cell phones. The sufferer will benefit from prompt aid thanks to this alert message [15]. P.A. Vardhini and D.B. Tushara (March 2016) The components utilized in the suggested task have to do with sending the SMS, storing the phone numbers, and detecting the accident. Sensing crashes and promptly notifying emergency services. By analyzing real-time data from sensors and cameras within the vehicle, this system revolutionized road safety by improving accident response times and potentially saving lives [16].

Flowchart

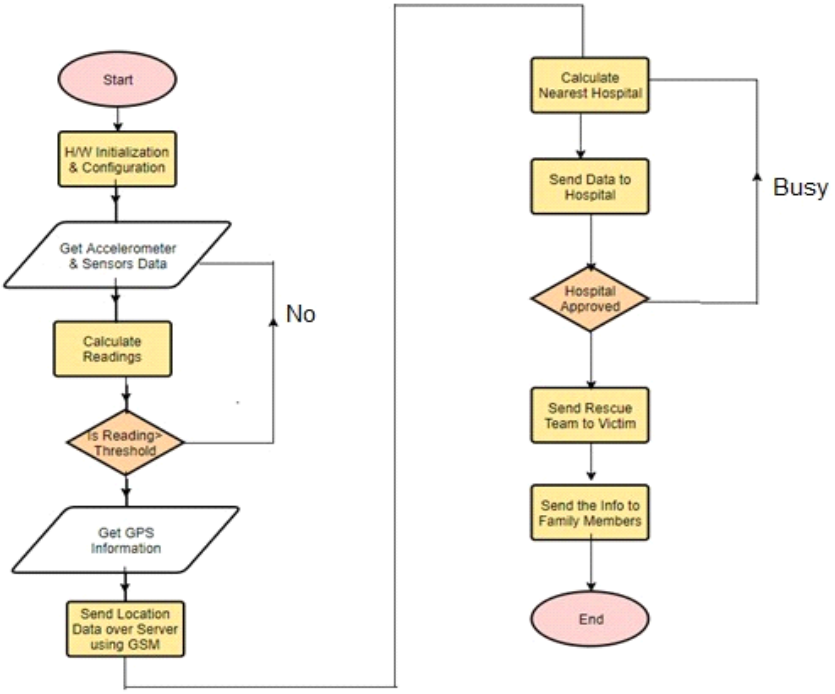

Figure 1 Flowchart for accident detection and rescue system

Abdul Kadar Muhammad Masum, S M Taslim Reza, and Frahim Wadud Taj (September 2021) Through the GSM module, the system uses an accident to send a brief message to a local police station and rescue squad. The location's longitude and latitude values are included in the message. By pressing geographical coordinates in Google Earth or any other GPS viewer tool, the rescue squad may quickly locate the vehicle and assist injured individuals [17]. C. Thompson, J. White, B. Dougherty, A. Albright, and D. C. Schmidt (2020) The innovative use of smartphones enabled real-time detection of car accidents, providing critical situational awareness to emergency responders. Utilizing built-in sensors and advanced algorithms, smartphones became a powerful tool for quickly notifying authorities and enhancing response efforts, ultimately improving accident outcomes and safety on the roads. R.K. Megalingam, R. N. Nair,g and S. M. Prakhya (September 2021.) This system utilized wireless communication to instantly detect accidents and report crucial information to

International Research Journal on Advanced Engineering and Management

https://goldncloudpublications.com

e ISSN: 2584-2854
Volume: 01
Issue: 01 December 2023
Page No: 01-12

emergency services, streamlining the rescue and aid process and ultimately reducing response time and improving outcomes for accident victims [18]. Adnan Bin Faiz, Ahmed Imteaj, and Mahfuzulhoq (2010) employ advanced wireless technology to swiftly detect accidents. It automatically reports vital information to emergency services, optimizing response time and aiding in timely assistance to accident victims, enhancing overall road safety. This service provider makes the required arrangements. Any car can have the Accident Detection and Reporting System (ADRS), which employs a sensor to identify accidents [19]. Adnan Bin Faiz, Ahmed Imteaj, and Mahfuzul Huq (2015) Although the automakers have made great strides toward mitigating this issue, the likelihood of negative consequences from an accident has not decreased. One of the main contributing factors to a car collision is speeding. Therefore, this accident can be attributed to changes in the tilt angle with the road surface and external pressure. The sooner an accident was reported to the emergency services, the more likely it was to be contained [20].

- The hardware will be initialized and a reading will be taken every second, as shown in Figure 1.
- The Arduino transmits the GPS coordinates to the emergency dial via GPS if the reading exceeds the threshold reading of the sensors.
- When an emergency arises, the emergency dialler uses the coordinates on the gateway to get in touch with the closest hospitals and waits for their consent.
- The rescue crew arrives at the scene of the accident with permission from the hospital, and upon confirmation, they notify the victims' relatives.
- The user can change his personal information and emergency contacts, as seen in Figure 2.
- By utilizing a control switch, the user can stop the emergency dial to the responder.
- The person who waits for the accident alarm created by the system is the dialer/responder.

The Arduino Nano serves as a controlling unit and occasionally communicates with other modules to improve information transformation. An accelerometer can be used to determine the collision direction based on tri-lateral axis motions. Following a specific roll and pitch value threshold, Gyroscopes can be utilized to detect rollover crashes. When a vehicle rolls over, its weight and center of gravity also come into play. The device also validates vibration sensors, which detect the impact after a threshold voltage increase. After that, a buzzer is issued to the passenger to stop anyone from mistakenly reporting the accident. The GPS module gets the coordinates from the Google Module within the buzzer signal's time limit. These coordinates alert local hospitals to emergency rescue requests from passengers. By verifying and examining the accident at the designated location, the hospital authorizes it. The GSM module informs the saved intimate members of the family about the accident. Comparison on Existing Algorithms in table 1.

Use-Case Diagram

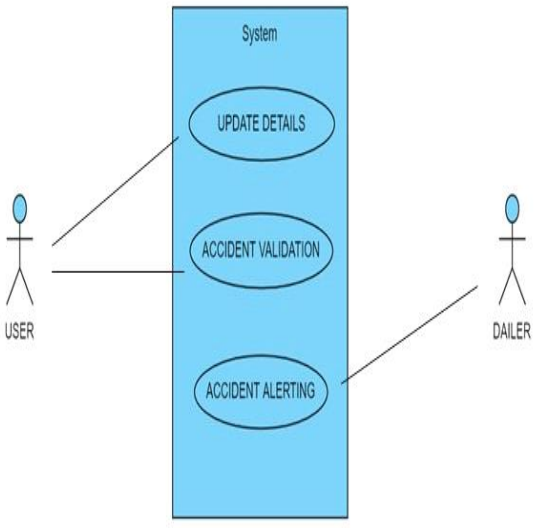

Figure 2 Use Case Diagram for accident detection and rescue system

International Research Journal on Advanced Engineering and Management

https://goldncloudpublications.com

e ISSN: 2584-2854
Volume: 01
Issue: 01 December 2023
Page No: 01-12

Table 1. Comparison on Existing Algorithms

S.NO	COMPARISON ON EXISTING ALGORITHMS				
	Author	**Title**	**Description**	**Algorithm & Tools**	**Accuracy**
1	Mahendra Vucha, B Naresh, S Monika, T Kalyani, March 2019	IJITEE is an accident detection and alert system.	TPMS is system designed to control the pressure inside the pneumatic tires on vehicles that provides different operating conditions	The vehicle detection is done through SVM (support vehicle machine) that is developed by Ant Colony Algorithm (ACA).	The pressure ranges from 15 to 45 PSI.
2	F.Bhatti et al. 2019	Novel Internet of Things-Enabled Accident Detection and Reporting System for Smart City Environments	The use of Information and Communication Technologies (ICT) for efficient and prompt rescue operations.	Map Matching Algorithm. The proposed system uses multiple smartphone sensors including accelerometer, GPS, pressure and microphone acquisition to detect accidents.	The accuracy of accident detection through low-cost devices.
3.	Parmar Parag, Sapkal Ashok M, IEEE,2017	Identification and reporting of auto accidents in real time.	The US-Accidents dataset can be used for numerous applications, such as real-time car accident prediction, studying car accident hotspot locations, casualty analysis	Object detection algorithm known as YOLOv3 and AI CCTV.	71%
4.	M.B.I. Reaz, Jubayer Jalil, and Md. Syedul Amin IEEE,2012.	Utilizing GPS, GSM, and GPS technology, an accident detection and reporting system	A GPS receiver that tracks a car's speed and uses the Monitored Speed Communications to identify collisions (GSM).	Using kinetic energy to detect a crash. GPS, GPRS, and GSM technologies are used in the reporting system.	90% detected

International Research Journal on Advanced Engineering and Management

https://goldncloudpublications.com

e ISSN: 2584-2854
Volume: 01
Issue: 01 December 2023
Page No: 01-12

5.	Sathish T, Mohanram S, Jagannivasan V, Ajith Kumar A, 2018.	GPS and GSM-based accident detection and alerting system, IJOPAAM	A vehicle accidental monitoring system using MEMS, GPS and GSM technologies.	The accelerometer is used to detect fall and Threshold Algorithm is used to detect accidents.	The systems will make the decision and send the information to the smartphone, connected to the accelerometer through GSM and gps modules.
6.	Nimisha Chaturvedi, Pallika Srivastava. Mar-2018	Automatic Vehicle Accident Detection and Messaging System Using GSM and GPS Modem	Automatically detect an accident and alert the nearest hospital or medical services about the exact location of the accident.	GPS tracking and GSM alert based algorithm.	90%
7.	Lih-Jen Kau, Member, IEEE, and Chih-Sheng Chen.Dec 2013.	A Smartphone-Based Pocket Fall Accident Detection, Positioning And Rescue System.	The angles acquired by the electronic compass (ecompass) and the waveform sequence of the triaxial accelerometer on the smartphone are used as the system.	The fall detection algorithm.	92%
8.	C. Thompson, J. White, B. Dougherty, A. Albright, and D. C. Schmidt,2010.	Using Smartphones to Detect Car Accidents and Provide Situational Awareness to Emergency Responders.	Smartphone-based accident detection often relies on the accelerometer and gyroscope sensors in smartphones to detect sudden changes in motion indicative of a car accident.	Threshold-based Detection and Threshold-based Detection.	Accuracy values are often reported in these sections, along with other relevant metrics used to assess the effectiveness of the system.
9.	R.K. Megalingam, R. N. Nair and S. M. Prakhya 2010.	Wireless Vehicular Accident Detection and Reporting System.	The RF transmitter module which is interfaced with the microcontroller will transmit the accident information to the nearby Emergency Service Provider (ESP).	Accident Detection and Reporting Algorithm (ADRA).	Accident Detection and Reporting Algorithm (ADRA) for the purpose.
10.	Adnan Bin Faiz, Ahmed Imteaj and Mahfuzulhoq Chowdhury, 2015.	Smart vehicle accident detection and alarming system using a smartphone	The system uses an accelerometer and audio data from the smartphone to detect accidents and to reduce false positives.	The system uses a rule-based approach that combines thresholding algorithms.	It can provide a more comprehensive view and enhance accuracy.

International Research Journal on Advanced Engineering and Management

https://goldncloudpublications.com

e ISSN: 2584-2854
Volume: 01
Issue: 01 December 2023
Page No: 01-12

11.	Daxin Tian, Chuang Zhang, Xuting Duan and Xixian Wang, IEEE,2019.	An automatic car accident detection method based on cooperative vehicle infrastructure systems.	A novel image dataset CAD-CVIS is established to improve accuracy of accident detection based on intelligent roadside devices in CVIS.	CAD-CVIS and deep learning algorithms to detect accidents.	90.02%.
12.	Mubashir Murshed and Md Sanaullah Chowdhury, 2019.	An iot based car accident prevention and detection system with smart brake control.	A smart system is described that alerts and controls the speed of a vehicle, also notifies the individuals accordingly when an accident occurs.	Collision Prediction Algorithms,Emergency Brake Control Algorithms and Machine Learning Algorithms.	95.238%
13.	M. Reddy and J. Tulasi, 2014.	Accident detection depending on the vehicle position and vehicle theft tracking reporting systems.	The location of the accident is detected by a GPS module and an alert message will be sent with location via GSM module to the registered mobile numbers. This alert message will help in giving quick assistance to the victim	Threshold-based Methods, Machine Learning and Pattern Recognition.	The desired level of accuracy.
14.	D.B. Tushara and P.A. Vardhini, March 2016.	Wireless Vehicle Alert and Collision Prevention System Design Using Atmel Microcontroller.	The components used in the proposed work are related with detecting the accident, saving the phone numbers, and sending the SMS.	Obstacle Detection, Collision Prediction, Communication Protocol and Power Management.	Some aspects that can influence the accuracy of the system.
15.	A. Bhakat, N. Chahar and V. Vijayasherly, August 2021.	Vehicle Accident Detection & Alert System using IoT and Artificial Intelligence.	Accelerometers are sensors that measure the vehicle's acceleration. Sudden changes in acceleration can indicate a collision or accident.	Descriptive analysis, Kohonen networks and k-means algorithms	98%.

International Research Journal on Advanced Engineering and Management

https://goldncloudpublications.com

e ISSN: 2584-2854
Volume: 01
Issue: 01 December 2023
Page No: 01-12

16.	Frahim Wadud Taj, Abdul Kadar Muhammad Masum, S M Taslim Reza	Vibration sensor, Global System for Mobile (GSM) and Global Positioning System (GPS) are used in this system	After an accident, the system delivers a short message to a nearby rescue team and police station via GSM module. The message includes the longitude and latitude values of the location	Rescue team can instantly trace the location of the vehicle tapping geographical coordinates in Google earth or any other GPS viewer application to help wounded people.The proposed model includes only one vibration sensor	The accuracy is high and also it reduces the cost of multiple sensor and the complexity of interfacing

4. Ant Colony Algorithm:

1. **Initialization:** Initialize a population of artificial ants and define the problem-specific parameters such as the number of ants, the pheromone evaporation rate, and the exploration-exploitation trade-off parameters.
2. **Solution:** Solutions are built by iteratively picking components or elements based on a probabilistic decision-making process. Both the pheromone levels on the components and a heuristic function that provides extra guidance impact the decision.
3. **Evaluation:** Once an ant has constructed a solution, it is evaluated to determine its quality in solving the optimization problem.
4. **Pheromone update:** Once every ant has built a solution and their quality has been evaluated, the pheromone levels on the components are updated. The amount of pheromone deposited or evaporated depends on the standard of the answers the ants discovered.
5. **Termination:** The program keeps looping through the construction, evaluation, and pheromone update steps for a specified number of times or up until the fulfillment of a termination requirement. The ultimate answer is the one that was determined to be the best after several iterations.

5. Proposed Algorithm:

Step 1: Start

Step 2: Set threshold values for sensors

Step 3: Calculate Sensor values

If (sensor values<threshold values)

go to step 3

else

go to step 4

Step 4: Get GPS coordinates

Step 5: Send the information to the help center

Step 6: The help center contacts the nearest hospital by GPS coordinates

Step 7: If (Hospital approves)
go to step8
else
go to step6

Step 8: Send an ambulance or rescue team to a location

Step 9: Stop

International Research Journal on Advanced Engineering and Management

https://goldncloudpublications.com

e ISSN: 2584-2854
Volume: 01
Issue: 01 December 2023
Page No: 01-12

6. Result and Discussion

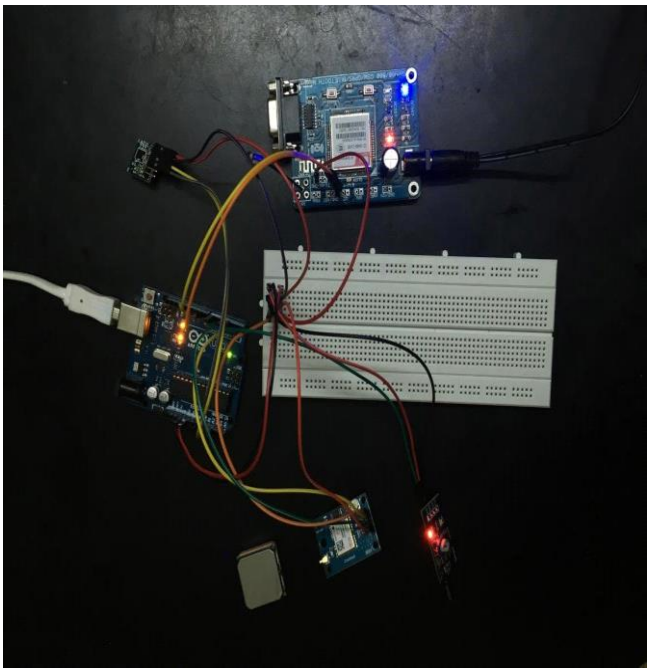

Figure 3 Interfacing controller with all other modules

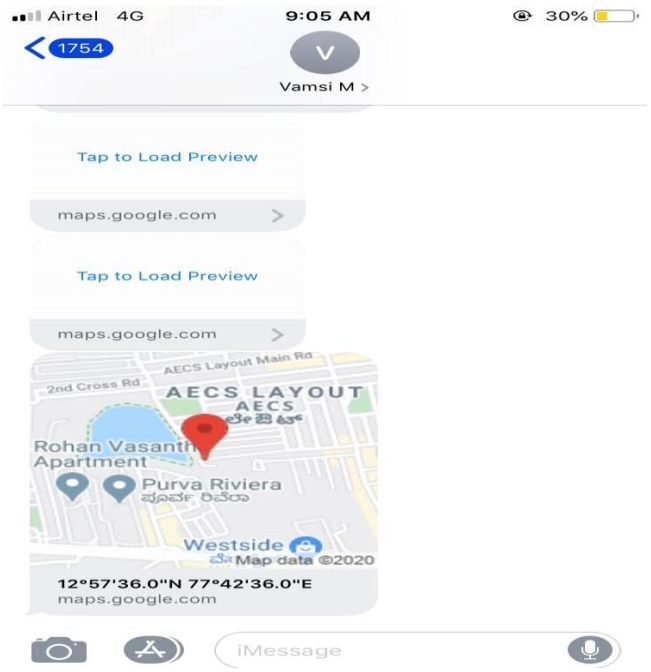

Figure 4 Alert message

A system for identifying an accident has been created. The suggested system addresses accident detection and alerting. The closest emergency response provider receives the precise latitude and longitude of the vehicle involved in the collision. The message is sent to various system devices with the assistance of Arduino. An accelerometer tracks the direction of the collision, while a gyroscope measures the vehicle's rollover. The GSM module is used to send the data to the registered number. GPS can be used to send the location through a tracking system that covers the area's geographical coordinates. It uses the suggested methods to identify the accidents that have happened. Additionally, it uses a GPS unit to locate the accident and a GSM module for transmitting an alarm message to a medical emergency so that they can respond quickly and perhaps save lives. This feature can lower the number of deaths from accidents. Results are shown in Figures 3 & 4.

7. Testing

Four individual tests have to be performed before setting up the proposed system. Testing of Arduino is shown in Figure 5.

7.1 Reading data from the MPU-6050 module

Based on MEM technology, the Arduino reads data from the MPU-6050 gyroscope + accelerometer module. A single chip contains the gyroscope and accelerometer integrated into it. To communicate with the host interface, this chip makes use of the I2C bus interface. The chip contains eight pins. Code needs to be developed to verify the I2C connection between the Arduino and MPU 6050. The header for the Wire library is included; we then define a few variables, construct the convert function, and create the setup function, which typically checks for a serial connection.

International Research Journal on Advanced Engineering and Management

https://goldncloudpublications.com

e ISSN: 2584-2854
Volume: 01
Issue: 01 December 2023
Page No: 01-12

Figure 5 Testing of Arduino

Figure 6 Testing of GPS Module

Figure 7 Testing of GSM Module

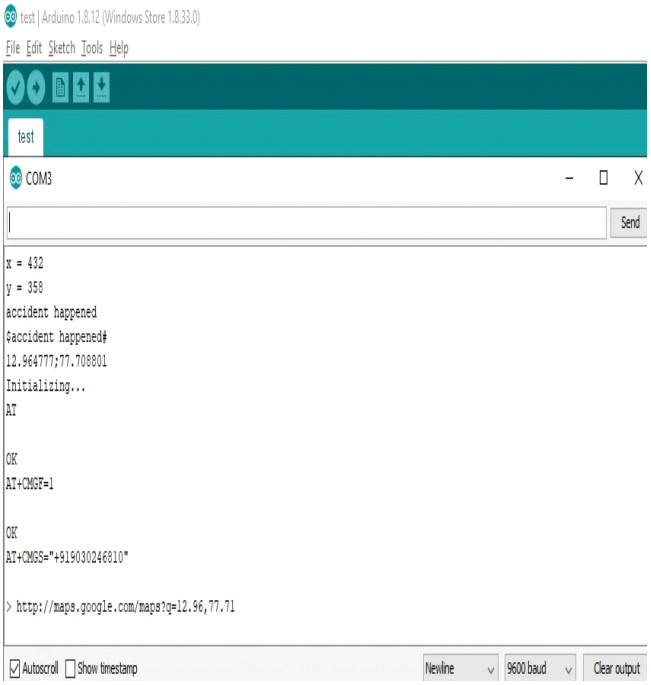

Figure 8 Testing of accident detection

International Research Journal on Advanced Engineering and Management

https://goldncloudpublications.com

e ISSN: 2584-2854
Volume: 01
Issue: 01 December 2023
Page No: 01-12

7.2 Location data Reading from a GPS module

To determine whether the U-blox Neo-6M GPS module can point to the location, testing is required. How far away from several satellites a user is is determined by GPS receivers. The GPS satellites' current locations are preprogrammed into them. Utilizing radio transmissions, the satellites communicate to Earth information about their position and the time of day. The satellites are found and their identity is sent to the receiver via these signals. It has a position-fix indicator that blinks at different speeds based on its current condition. Indicating that it is looking for the satellites is the lack of blinking. The position has been determined if it blinks once every second. Testing of GPS Module is shown in Figure 6.

7.3 Sending Alert message by GSM SIM900A module

It is implied by Figure 7 that you should confirm that the GSM and Arduino are connected. There are two methods for handling it. One is to link the GSM module's RX pin to the Arduino's TX pin and the GSM module's TX pin to the Arduino's RX pin. By selecting two PWM-enabled pins of Arduino (Pin 9, 10). It uses the software serial library of Arduino, when the connection is established, the data can be fed directly to GSM.

8. Displaying on LCD

Interfacing between LCD and Arduino is also tested. We should study the schematic carefully. Next is to place your LCD on the breadboard. Make sure that the connection is done according to the circuit diagram. It uses a 1k resistor in place of the potentiometer, connecting Pin 3 of the LCD to Vcc via the resistor. Make sure that every connection is accurate and tight. After connecting your Arduino to the power via USB, see if the LCD illuminates. If so, continue. and see if the LCD illuminates. If so, Figure 7 shows how to proceed. In Figure 8, It implies that the output has been shown and the sound frequency has been detected.

Conclusion and Future Scope

A technique has been created to identify an accident incident. The suggested method addresses the detection and notification of accidents. After reading it, it sends the affected vehicle's exact latitude and longitude to the closest supplier of emergency response. Arduino helps communicate with different system devices. A gyroscope is utilized to detect the vehicle's rollover, and an accelerometer tracks the direction of the collision. The data is transmitted to the registered number via the GSM module. GPS can be used to transmit the location using a tracking mechanism to cover the region's geographic coordinates.

Future Scope

In the future, this technology may be expanded by adding a wireless webcam to take pictures that will help with providing support to drivers. In the event of a collision, it might additionally be enhanced by immediately securing every brake. Most of the time, when drivers lose control and are unable to stop their car, the collision gets worse. Under certain circumstances, the vibrations that the CPU detects and interprets will trigger the activation of the vibration sensor. The devices that can lock the brakes when triggered must be connected to the CPU. This modification allows us to stop the car and lessen the collision force. In addition, this system can be used for food services, vehicle rentals, fleet management, and traffic infractions.

References

[1]. T Kalyani, S Monika, B Naresh, Mahendra Vucha, Accident Detection and Alert System, IJITEE, March 2019(Base paper).
[2]. Parag Parmar, Ashok M.Sapkal, Real-time detection and reporting of vehicle collision, IEEE,2017.
[3]. Md. Syedul Amin, Jubayer Jalil, M.B.I.Reaz, Accident Detection and Reporting System using GPS, GPRS and GSM Technology, IEEE,2012.
[4]. Gowshika B, MadhuMitha, G, Jayashree,

e ISSN: 2584-2854
Volume: 01
Issue: 01 December 2023
Page No: 01-12

Vehicle accident detection system using GPS, GSM modem, IRJET,2019.

[5]. Sayanee Nanda, Harshada Joshi, Smitha Khairnar, An IOT Based Smart System for Accident Prevention and Detection, IEEE,2018.

[6]. Norsuzila Yaacob, Ainnur Eiza Azhar, Azita Laily Yusof, Suzi Seroja Sarnin, Darmawaty Mohd Ali and Ammar Anuar, Real-Time Wireless Accident Tracker using Mobile Phone, IEEE,2017.

[7]. S. Sonika, Dr. K. Satya Sekhar, S.Jaishree, Intelligent accident identification system using GPS, GSM modem, DARCEE,2014.

[8]. Dhruvesh H. Patel, Parth Sadatiya, Dhruvbhai K. Patel, Prasann Barot, IoT-based Obligatory usage of Safety Equipment for Alcohol and Accident Detection, IEEE,2019.

[9]. Ajith Kumar. A, Jagannivasan. V, Sathish.T, Mohanram.S, Accident detection and alert system using GPS & GSM, IJOPAAM,2018.

[10]. Shadman Sakib, Mohammad Sayem Bin Abdullah, GPS-GSM based Inland Vessel Tracking System for Automatic Emergency Detection and Position Notification, IEEE,2016.

[11]. Lih-Jen Kau and Chih-Sheng Chen, A Smartphone-Based Pocket Fall Accident Detection, Positioning and Rescue System. IEEE Member, Dec 2013.

[12]. Daxin Tian, Chuang Zhang, Xuting Duan, and Xixian Wang, an automatic car accident detection method based on cooperative vehicle infrastructure systems. IEEE,2019.

[13]. Mubashir Murshed and Md Sanaullah Chowdhury, An IoT-based car accident prevention and detection system with smart brake control, 2019.

[14]. M. Reddy and J. Tulasi, Accident detection depending on the vehicle position and vehicle theft tracking reporting systems, 2014.

[15]. D.B. Tushara and P.A. Vardhini, Wireless Vehicle Alert and Collision Prevention System Design Using Atmel Microcontroller.March 2016.

[16]. Bhakat, N. Chahar and V. Vijayasherly, Vehicle Accident Detection & Alert System using IoT and Artificial Intelligence. August 2021.

[17]. Thompson, J. White, B. Dougherty, A. Albright, and D. C. Schmidt, Using Smartphones to Detect Car Accidents and Provide Situational Awareness to Emergency Responders, 2010.

[18]. R.K. Megalingam, R. N. Nair and S. M. Prakhya, Wireless Vehicular Accident Detection and Reporting System, 2010.

[19]. Adnan Bin Faiz, Ahmed Imteaj and Mahfuzulhoq, Smart vehicle accident detection, and alarming system using a smartphone, 2015.

[20]. F. Bhatti et al, Novel Internet of Things-Enabled Accident Detection and Reporting System for Smart City Environments, 2019.