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Original Research Article

Design and Simulation of a GSM, Buzzer, and GPS Module-Based Accident Detection System

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Abstract

The average number of automobiles on the roads around the world has increased as cars become more and more accessible. Our lives are now easier because to the technology and infrastructure that are developing quickly. Technology has also increased the frequency of traffic risks and road accidents, which result in significant loss of life and property due to inadequate emergency resources. Accidents wreak havoc on victims, costing them valuable time and money. It has been determined via considerable research that the majority of accidents result in fatalities as a result of poor communication with the relevant medical authorities and the ensuing dearth of prompt medical assistance. In this study, an accelerometer can be applied as a rollover or crash detector for the car both during and after a collision. The vibration sensor can also be employed in research to measure the vibration rates of any vehicle. A serious accident can be identified by keeping an eye on the information from the accelerometer and vibration sensor. The police control center, any rescue team, or the owners of the vehicle are then sent the alert message via the GSM module, together with the latitude and longitude information provided by the GPS module. As a result, as soon as they receive the emergency notification, the police can locate the accident's site and take the appropriate action. When an accident occurs in a remote place and no one is available to report it, this technique may prove to be a lifesaver. By responding quickly, the emergency services can prevent an accident from happening and save a life.

Keywords: Accelerometer sensor, Vibration sensor, Arduino Uno, GSM Module, LCD, and Buzzer.

INTRODUCTION

Today, vehicles play a significant role in our daily lives. They help us get to work, communicate with friends and family, and transport our goods. But it can also result in catastrophe for us or even result in our deaths due to mishaps. One of the most significant and fundamental danger factors when driving is speed. It influences a crash's severity and raises the likelihood of getting into one. Accidents still happen occasionally despite the numerous efforts made by numerous governmental and non-governmental groups throughout the world through various programs to raise awareness against irresponsible driving. If the emergency services had been able to get the crash data in time, many lives might have been saved. This will help with accident detection and notification, possibly saving the lives of the injured. When an accident occurs in a remote location with no one nearby to report it, this technique could be utilized to handle it. The risk to human life has grown due to the linear rise in vehicle use throughout the previous period. This is because there aren't enough emergency facilities. We are therefore using an alert system to help improve the emergency system and accident system in order to resolve this challenge. The rescue crew is informed of the accident's coordinates, or its

longitude and latitude, by the system after it detects its occurrence. The system will classify something as an accident if the accelerometer experiences an unusual acceleration and the vibration sensor notices a significant shift. Once notified, the GSM and GPS modules will further determine the location and send a message with information about the accident and its exact location. This study assists in offering a workable remedy for the dire situation it makes possible. The current approach primarily prioritizes passenger safety rather than providing emergency assistance in the event of a collision. The system we put in place seeks to automatically identify accidents and notify the closest hospital or medical services of their precise location. This device delivers essential information to the medical rescue team seconds after an accident. With the use of this technology, lives can be saved by quickly detecting accidents and alerting rescue personnel. The location of the mishap, its timing, and its angle are all listed in the alert message. With the aid of a sensor, the apparatus is activated when an accident is detected. The microcontroller receives the sensor's output. The alert is sent by the microcontroller [1]. Unmanned aerial vehicles (UAVs) are a popular concept in the aeronautical industry today, which is used in practically every industry. Due to their superior performance compared to the others, ultra-light UAVs are designed to make intricate maneuvers in the combat environment. Because of its capacity to do jobs at a reasonable cost, UAVs are becoming more and more significant in both the commercial and warfare fields. They can also be used to track automobile accidents [12, 13].

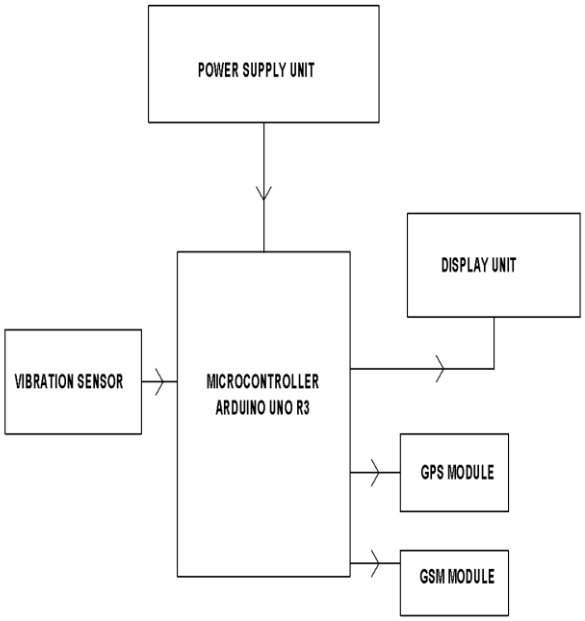

Fig. 1: System Block Diagram

RELATED WORKS

The Arduino Uno is utilized in this system as the microcontroller that oversees the entire undertaking. Additionally, it has parts like LEDs and infrared sensors. On the side of the road, two IR sensors are used. These sensors are mutually exclusive and are wired to ATmega328P microcontrollers. The position of the vehicle is determined based on the output from the sensors, and this information is input to the microcontroller. The drivers are then cautioned by LEDs installed on either side, which regulates traffic at the turn. In this study, an Arduino serves as the microcontroller and a vibration sensor to detect an accident. Additionally, it consists of parts like the GPS and GSM modules. Together, the GPS module and vibration sensor provide data to the Arduino, which then sends it on to the GSM module. In order to identify drivers through their smartphone application, it is suggested to have Bluetooth or Wi-Fi networks in a series of clusters across the street. The GPS module works in conjunction with the vibration sensor to offer the precise latitude and longitude information of the accident site. When this information is sent to the GSM module, it is broadcast to all other Wi-Fi-enabled drivers within a 20-meter radius. The Arduino Uno serves as the system's brain in this study and helps transmit data to the various system components. When an accident occurs, the vibration sensor will turn on, and the data will be sent to the registered number via the GSM module. The position can be supplied through a tracking system using GPS to include the area's coordinates. The system's main part, a vibration sensor, is capable of spotting an accident. By giving the accident victims medicine on the scene, it can be prolonged. By developing alarm systems that can stop the vehicle and prevent accidents, technical advancements can also help us avoid mishaps. The research's vibration sensor detects the obstruction and notifies the Raspberry Pi of the interruption. The GPS unit gets the position of the wrecked car and returns the information. This data will be transmitted via a WhatsApp message to a cellphone number. An L293D motor driver connects the Raspberry Pi to the GPS modem through the internet, enabling the electricity to flow in both

directions. We are able to track the car's location and speed. The mobile phone received a message with a remote data alert. Anytime can be used to change a mobile number. This device can be connected to a car's airbag system, which shields passengers from hitting things within the car like the window or steering wheel [1]. This technique seeks to notify the neighborhood hospital about the accident so they may offer right away medical attention. The heartbeat sensor on the user's body detects an irregular heartbeat and the linked accelerometer in the vehicle detects the vehicle's tilt to determine how bad the collision was. As a result, the systems will decide and send the data to the smartphone, which is Bluetooth-enabled and attached to the accelerometer and heartbeat sensor. Text messages will be sent to friends and the closest hospital using the Android application on the phone. Time can be saved by the application's sharing of the accident's precise location [2]. With the use of sensors mounted to the car, this application assists in detecting the potential for an accident to occur on the road. The affected parties will be informed of this incident right away so that swift action may be done moving forward [3]. This study suggests a smartphone-based real-time accident detection and notification system. Every smartphone has several sensors built into its structure. Several of these widely used sensors are utilized by our system to provide a web application for remote monitoring. The device will enable emergency personnel to locate victims more quickly and mobilize them. The system notifies the closest emergency station, such as the police administration, medical service, and ambulance operators, of an accident when it is detected. Additionally, it offers these emergency care providers real-time tracking [4]. Using GSM and GPS modules, the proposed system will determine whether an accident has occurred and alert the closest medical facilities and registered cell numbers about the location of the accident. To send the location and the area's geographic coordinates, use a tracking system. A vibration sensor, a significant module in the system, is capable of detecting an accident [5]. The two parts of our suggested system are the detection phase, which is utilized to locate car accidents, and the notification phase, which alerts the respondents or the rescue crew. A "Help Me" button will also be included, which will be utilized in emergency situations other than accidents. (Like being stuck in bad circumstances or having an attack of a medical disease, etc.). When this button is pressed, the designated responder will get a predefined message [6]. An intelligent method for detecting accidents on the road has been developed in this research. position tracking and alerting systems that identify accidents instantly using GPS position are both components of intelligent accident detection. In the event of any accident, the sensor attached to the car is activated. Through the Global System for Mobile Communication (GSM), calls and alert messages will be made to the neighborhood hospital, police station, and family members [7]. The project tries to locate the vehicle utilizing a computer inside the vehicle's system that sends a message to determine where the vehicle is. Due to the fact that no one can predict where an accident will occur, we frequently may not be able to find it. These situations are intended to be avoided by our real-time vehicle tracking and accident detection project with GPS [8]. For immediate attention, which might save their lives, a Vehicle Accident Emergency Alert system is suggested. The accelerometer or vibration sensor in the system sends signals to the Arduino controller as soon as an accident happens. Latitude and longitude data are gathered by the GPS system, transferred to the emergency center via the GSM module, and then texted to everyone on the emergency list. Knowing the precise location would enable the ambulance to travel the fastest path and get at its destination. In order to reduce the rate of life losses, the proposed alarm system might soon be implemented at a cheaper cost and integrated into all cars [9]. The system uses a microprocessor, GPS, and a collection of sensors to calculate various motion-related physical properties. To find the best accurate classifier for the system, various machine learning classifier types were also tested alongside the established system. The classifiers are the Classification and Regression Trees (CRT), the Decision Tree (DT), the Naive Bayes Tree (NB), and the Gaussian Mixture Model (GMM). (CART). The system's deployment revealed that the GMM and CART models had higher precision and recall. Additionally, studies [10], [11], and [13] have demonstrated that the g-force value and the likelihood of a fire influence how serious an accident is.

ANALYSIS AND DESIGN

POWER SUPPLY UNIT

In this device, the battery's 12V was used to power the regulator IC 7809, whose output maintained a consistent voltage of 9V for the remainder of the circuit depicted in figure 2.

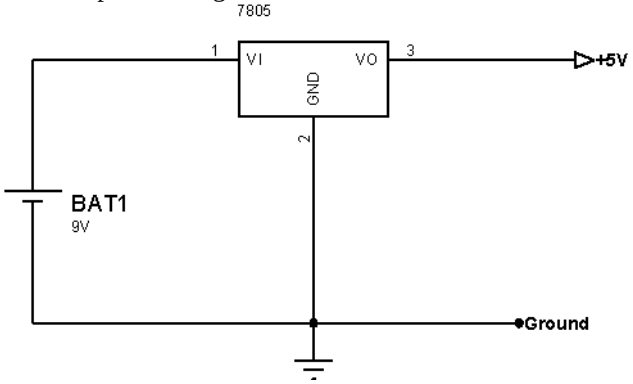

Fig. 2: Power supply unit circuit

INTERFACING ARDUINO TO BUZZER

The ground of the buzzer is connected to the ground of the Arduino and the positive terminal of the buzzer is connected to the Arduino digital pin 4.

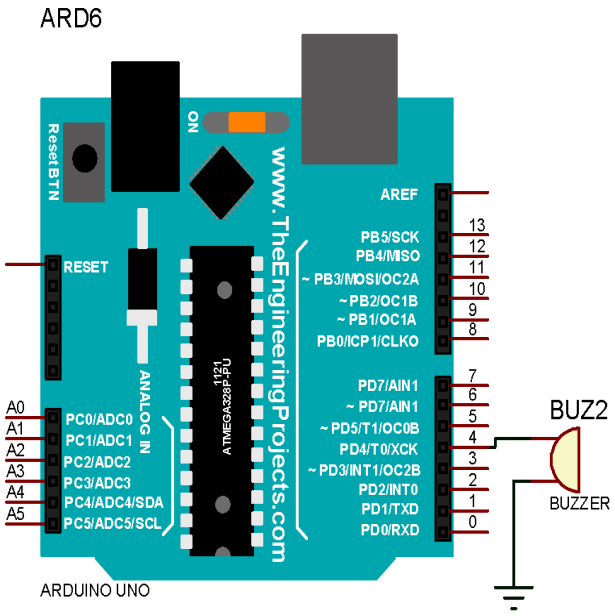

Fig 3: Interfacing of the Buzzer to Arduino

3.3. INTERFACING ARDUINO TO LCD

By connecting the LCD's four data pins—D4, D5, D6, and D7—to the Arduino's PINs 2, 3, 4, 5, 11, and 12, respectively, the LCD is linked to the microcontroller. The Arduino's PIN 7 is used to connect the register select pin, while PIN 8 is used to connect the LCD's enable pin. 5 volts power the LCD. Its contrast can be changed. PIN 3 controls the LCD's contrast. An adjustable resistor is used to modify the contrast.

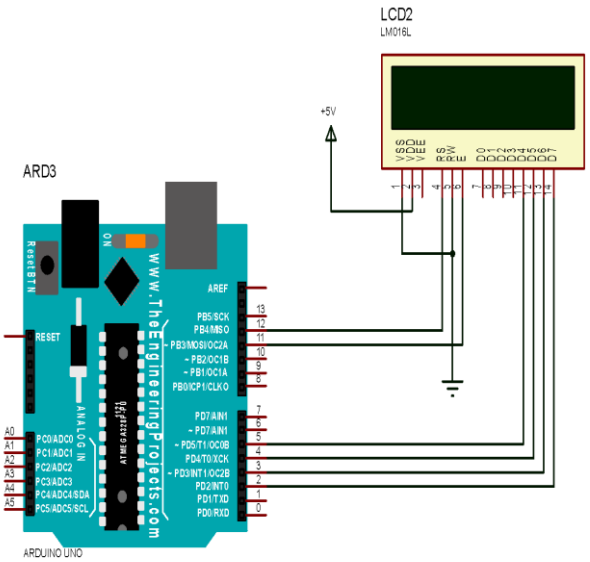

Fig. 4: Arduino to LCD Interfacing

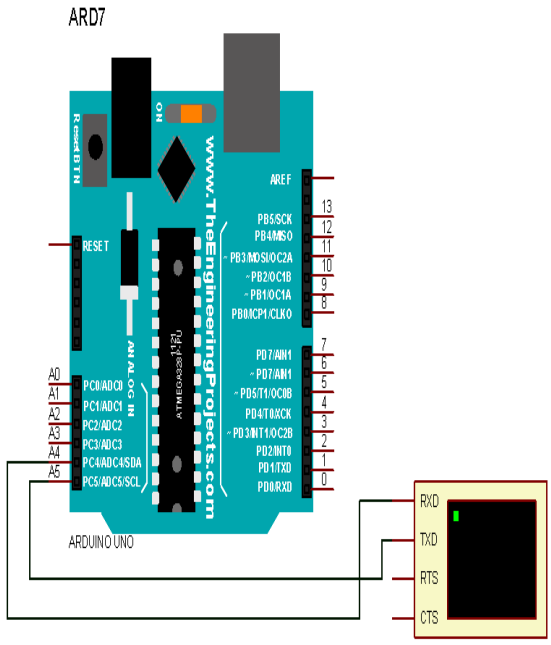

Fig. 5: The interfacing of the GSM Module to Arduino

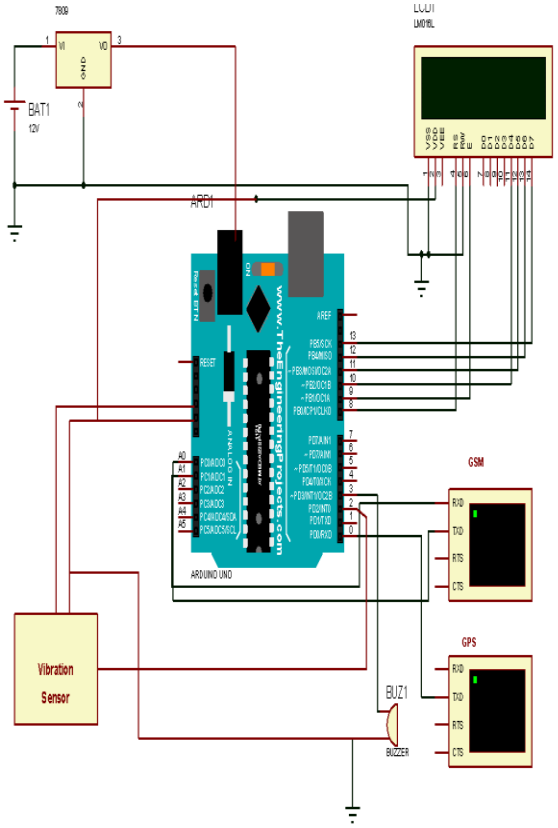

Fig. 6(a): Complete circuit diagram

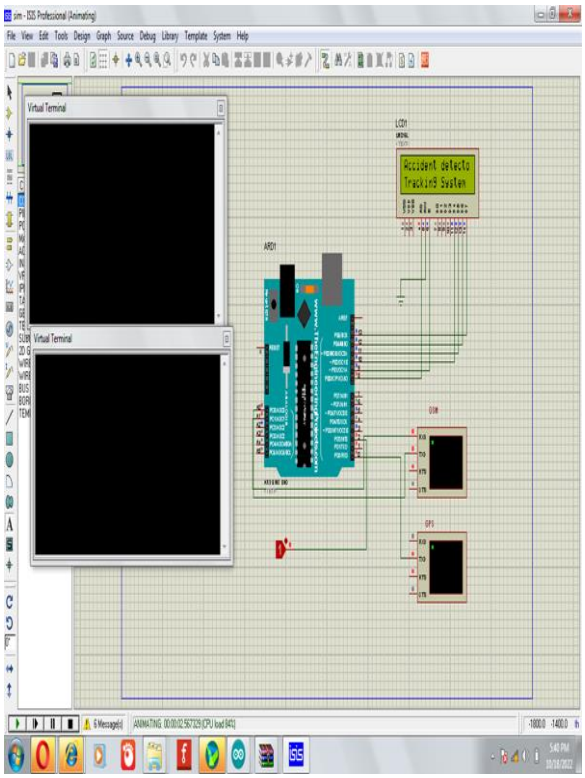

Fig. 6(b): Simulation result displaying the research title

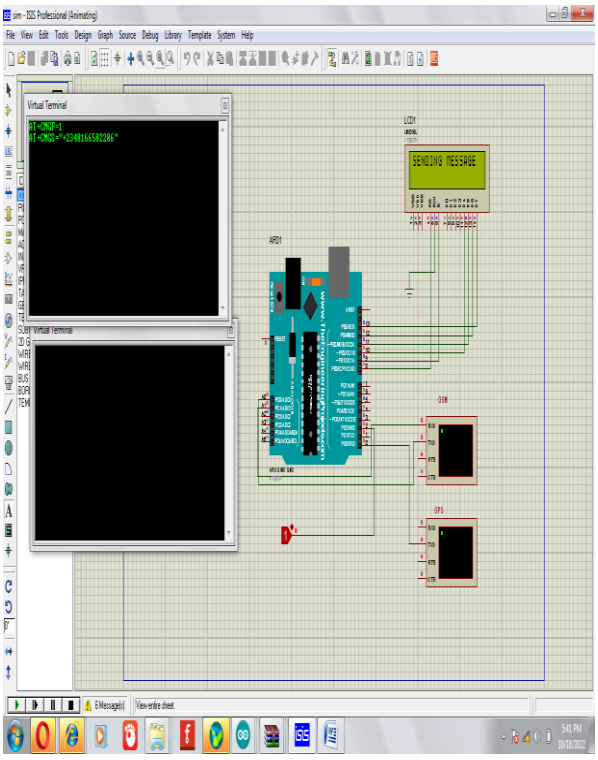

Fig. 7: Simulation result showing message is sending to the registered mobile number

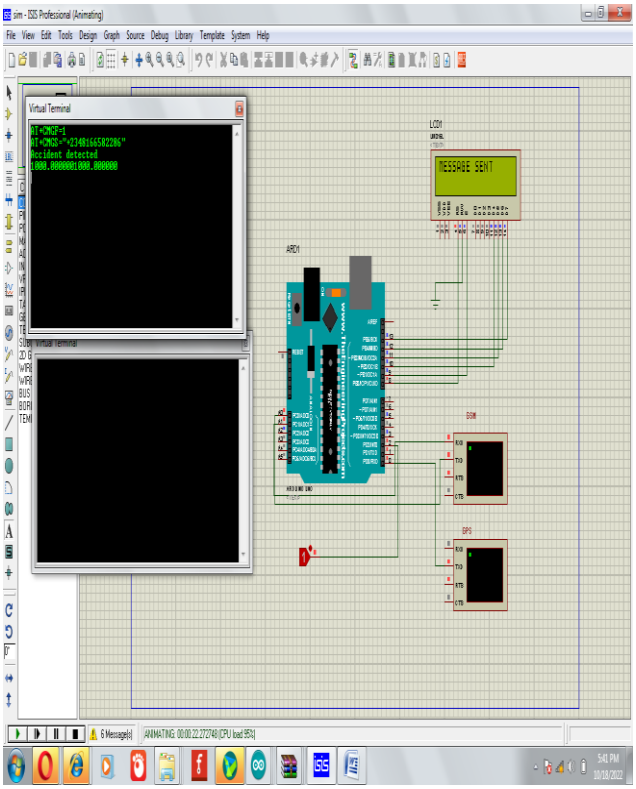

Fig. 8: Message is sent to the registered mobile phone

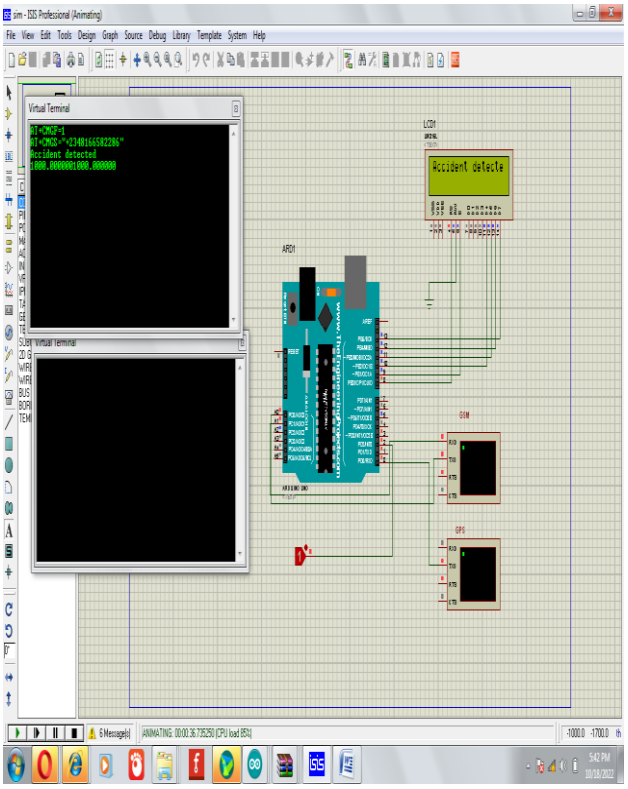

Fig. 9: Simulation result showing accident is detected

CONCLUSION

In especially in rural places with little human activity, the Vehicle Accident Alerting and Detecting method may be a safer method, sparing roughly two-thirds of the lives lost in deadly road accidents. The GPS tracker that is part of the system provides details about the precise location, including latitude and longitude. The victim's family members, as well as the nearest hospitals, ambulance services, and police stations, receive the SMS alert right away. By using the location information, the ambulance could get to the accident site right away and the accident victim could get fast medical attention. Thus, it becomes easier to prevent accidents from happening as often, and quick alert systems become a low-cost alternative to high-cost lifesaving measures.

REFERENCES

1. Doshi, B. Shah, J. Kamdar, "Accident Detection and Alert System", International Journal of All Research Education and Scientific Methods (IJARESM), Vol 9, No 11, pp. 114-119, Available online at: www.ijaresm.com, November-2021.
2. N. Kattukkaran, A. George, M. Haridas T.P, "Intelligent Accident Detection and Alert System for Emergency Medical Assistance", 2017 International Conference on Computer Communication and Informatics (ICCCI -2017), Jan. 05 – 07, 2017, Coimbatore, INDIA.
3. R. K. Kodali, S. Sahu, "MQTT Based Vehicle Accident Detection and Alert System", International Conference on Applied and Theoretical Computing and Communication Technology, ISBN 978-1-5386-1144-9, pp. 186-189, IEEE 2017.
4. D. A. Borikar, M. B. Chandak, "Accident Detection and Emergency Alerting System for Road Safety", Biosc. Biotech. Res.Comm., Vol 13, No 14, Available at: http//www.bbrc.in/ Doi: http://dx.doi.org/10.21786/bbrc/13.14/60, pp. 256-259, 29th Dec 2020.
5. K. Gomathy, K Rohan, B. M. K. Reddy, V Geetha, "Accident Detection and Alert System", Journal of Engineering, Computing & Architecture, Vol. 12, No 3, http://www.journaleca.com/, pp. 32-43, MARCH 2022.
6. H. M. Shahzadi, H. M. Rafique, Ms. S. Riaz, "Auto Accident Detection and Alert System", International Journal of Innovative Research in Computer and Communication Engineering, Website: www.ijircce.com, Vol. 6, No 9, pp. 7615-7626, September 2018.
7. R. Raffik, M. M. Jones, T. Murugajothi, B. Kannadasan," Intelligent Accident Detection and Smart Alert System for Vehicles", International Journal of Mechanical Engineering, Vol. 6, No. 3, pp. 2391-2396, December, 2021.

8. A. G. Francis, C. Gottursamy, S. R. Kumar, M. Vignesh, T.P. Kavin, "Accident Detection and Alerting System Using GPS & GSM", International Journal of Advanced Science and Technology Vol. 29, No. 3, pp. 3598 – 3601, 2020.
9. B. Sumathy, L. Sundari, S. J. Priyadharshini, G. Jayavarshini," Vehicle Accident Emergency Alert System", IOP Conf. Series: Materials Science and Engineering, Publishing doi:10.1088/1757-899X/1012/1/012042, 2021.
10. M. Balfaqih, S. A. Alharbi, M. Alzain, F. Alqurashi, S. Almilad, "An Accident Detection and Classification System Using Internet of Things and Machine Learning towards Smart City", Publisher; MDPI, https://doi.org/10.3390/su14010210, https://www.mdpi.com/journal/sustainability, pp. 1-13, 2022.
11. M. A. Baballe, A. S. Bari, A. L. Musa, N. K. Mustapha, U. H. Hussain, D. B., A. A. Umar, "Car Tracking System: Pros and Cons", Global Journal of Research in Humanities & Cultural Studies, vol. 2, no. 5, pp. 188-191, https://doi.org/10.5281/zenodo.7102272.
12. M. A. Baballe, M. I. Bello, A. U. Alkali, Z. Abdulkadir, A. S. Muhammad, F. Muhammad, "The Unmanned Aerial Vehicle (UAV): Its Impact and Challenges", Global Journal of Research in Engineering & Computer Sciences, Vol. 02, No 03, pp. 35-39, Journal homepage: https://gjrpublication.com/gjrecs/, May-June 2022.
13. M. A. Baballe, A. Ya'u, S. F. Ibrahim, A. Muhammad, N. K. Mustapha, "Accident Detection System with GPS, GSM, and Buzzer", Global Journal of Research in Engineering & Computer Sciences ISSN: 2583-2727 (Online) Volume 03| Issue 01 | Jan.-Feb. | 2023 Journal homepage: https://gjrpublication.com/gjrecs/.

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