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ACCIDENT DETECTION AND ALERTING SYSTEM

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ABSTRACT

Nowadays, one of the main problems that kill a lot of people worldwide is car accidents. India currently leads the world in traffic accident-related deaths. This is a grave issue that must be resolved in order to preserve the lives of numerous accident victims who are seriously harmed. Numerous automakers have developed various technologies, including video sensors, seat belts, and safety airbags, to address this issue; nonetheless, neither the source nor the consequence of the collision can be eliminated. Giving the victim timely access to appropriate medical care is one of the main options. Statistics show that whenever an accident occurs, the lengthy process of reporting and questioning the police causes the witness to pause before helping the injured. In most cases, the victim is not in a position to request assistance from others in such kind of circumstance. The victim's life is in jeopardy in this scenario because they are not receiving timely medical attention and care. A system that automatically identifies accidents and, using that information, promptly notifies the hospital and affected family members of the accident's location is desperately needed to remedy this problem. This project develops an Automatic Accident Detection and Location Communication System (AAADLCS) that uses an Arduino platform to continually track the location of the car in the event of an accident. It immediately notifies the police, relatives, and the hospital of the accident location after automatically detecting it. This system's minimal cost, self-reliance, speedy processing, high accuracy, ease of implementation, and ease of use are its main advantages.

1. INTRODUCTION

1.35 million people worldwide lose their lives in traffic accidents each year. Just driving more cautiously can help avoid some of these collisions. Additionally, these incidents put up a number of obstacles for insurance companies to overcome in order to legitimate the claim and determine who was at fault for the collision. It might occasionally take a long time for police investigations to identify the source of an issue. Most of these issues are resolved by the solution that is suggested in this study report. Finding problems in a car is far simpler than finding defects in an aviation crash since cars aren't as intricate as airplanes. The suggested system serves as both an event data recorder and a live feedback information system, giving information about the car's numerous stats via the OBD (On- Board Diagnostics) connector. Because OBD ports are standard in cars, this technology is considerably more accessible because it can be utilized in both older and newer versions of cars. The black box may be used as potential evidence in crash investigations by the police and insurance companies. The user receives the live car updates via an application designed for that particular use case. Additionally, the automobile has an integrated GPS module that provides a precise location and updates the application with real-time information. The system for processing and displaying the data is a microcontroller; ports are only utilized to read the GPS module, scan the data, and save the data on a memory card. In the event of a crash or an unforeseen circumstance, the data is stored on a memory card. The block diagram that is being suggested here provides us with a general understanding of the system's flow and its component parts. There is a full duplex solution between the port and the Arduino, which receives data from the GPS module**.**

The dataset encompasses comprehensive information vital for effective management of our Accident Detection And Alerting System. Temperature data from vaccine storage units is meticulously recorded, including date-time stamps, locations (identified by hospital names or IDs), and Temperature readings in Celsius, status indicating normal or abnormal conditions, batch numbers, and sensor IDs. Alerts generated from freezer boxes are documented, detailing date-time stamps, locations, alert types such as temperature fluctuations or power losses, alert specifics, and subsequent actions taken. Supply chain analytics data provides insights into vaccine distribution and inventory, featuring date-time stamps, locations, and vaccine batch numbers, quantities received, dispensed, and remaining at each hospital or facility. Finally, location data captured by GPS modules offers real-time tracking of vaccine batches across various hospital locations, ensuring efficient logistical management.

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2. LITERATURE SURVEY

2.1INTRODUCTION TO LITERATURE SURVEY:

The literature survey for the IoT-based Automatic Vehicle Accident Detection and Rescue System project delves into a multifaceted exploration of existing research, studies, and technological developments related to automatic accident detection, IoT technology in road safety, and emergency response mechanisms. This comprehensive review aims to provide a thorough understanding of the current state-of-the-art, identify key challenges and opportunities, and inform the design and implementation of the proposed system. By examining a diverse range of literature sources, including academic papers, conference proceedings, industry reports, and case studies, this literature survey endeavors to establish a strong foundation for the development of an innovative solution that addresses critical issues in road safety and emergency response. Through a systematic analysis of existing knowledge and research gaps, this study seeks to contribute to the advancement of technology-driven solutions for mitigating the impact of road accidents and improving emergency response capabilities.

2.2LITERATURE SURVEY:

In recent years, there has been a significant surge in research focusing on the development and implementation of automatic accident detection systems and IoT-based solutions in the domain of road safety and emergency response. The literature on this topic encompasses a wide array of studies, ranging from theoretical frameworks to practical applications, highlighting the multifaceted nature of the challenges and opportunities in this field. One prominent area of investigation revolves around the utilization of sensors, particularly accelerometers, for real- time accident detection in vehicles. These sensors, embedded within vehicles or wearable devices, continuously monitor acceleration patterns and detect sudden changes indicative of accidents. Various studies have explored the efficacy of different algorithms and methodologies for analyzing sensor data, with the goal of accurately distinguishing between normal driving behavior and emergency situations. Additionally, researchers have investigated the integration of additional sensor modalities, such as gyroscopes and GPS modules, to enhance the accuracy and reliability of accident detection systems.

IoT technology plays a pivotal role in facilitating seamless communication and data exchange within these systems. By leveraging IoT-enabled communication modules, such as GSM and GPS modules, accident detection systems can transmit distress signals and location information to designated recipients, including emergency responders and medical personnel. This real-time communication enables swift response and assistance to accident victims, thereby potentially reducing the severity of injuries and improving overall outcomes. Furthermore, IoT-based solutions enable remote monitoring and management of vehicles, allowing for proactive measures to prevent accidents and optimize traffic flow.

Beyond technical aspects, the literature also delves into the broader implications of IoT-based accident detection and rescue systems on road safety policy, infrastructure development, and public health. Researchers have examined the socio-economic impact of road accidents, highlighting the immense financial burden placed on healthcare systems and the economy at large. In response, policymakers and stakeholders are increasingly turning to technological

solutions, such as IoT-based systems, to mitigate the human and economic costs associated with road accidents.

While the potential benefits of IoT-based accident detection and rescue systems are evident, the literature also acknowledges the challenges and limitations inherent in their implementation. Technical hurdles, such as power management, data privacy, and interoperability, pose significant barriers to widespread adoption. Moreover, the complexity of IoT ecosystems necessitates interdisciplinary collaboration among engineers, policymakers, healthcare professionals, and other stakeholders to ensure successful deployment and integration into existing infrastructure.

In conclusion, the literature on IoT-based automatic accident detection and rescue systems provides valuable insights into the development, implementation, and impact of these technologies on road safety and emergency response. By synthesizing existing research findings and identifying key areas for future exploration, this body of literature serves as a foundation for continued innovation and advancement in this critical field. Through collaborative efforts and interdisciplinary approaches, researchers and practitioners can harness the full potential of IoT technologies to create safer and more resilient transportation systems.

3. IMPLEMENTATION STUDY

The existing system employs a combination of low-power sensors, a cost-effective microcontroller, and a robust IoT platform to effectively detect and notify about vehicular accidents. It leverages the NodeMCU microcontroller as its core component, responsible for gathering data from both an accelerometer and an ultrasonic sensor. The accelerometer detects any abnormal tilts in the vehicle, signaling potential accidents, while the ultrasonic sensor measures distances to provide additional context.

Utilizing the lightweight MQTT protocol, the system communicates seamlessly with the Losant IoT platform, where data is processed and analyzed. Upon detecting an accident scenario, Losant triggers email notifications to relevant stakeholders, ensuring prompt and efficient communication without requiring human intervention.

Despite its advantages, the system does pose several challenges:

1.Sensor Accuracy: The reliability of accident detection heavily relies on the accuracy of sensor readings. Any inaccuracies in the accelerometer or ultrasonic sensor measurements could lead to false alarms or missed accidents, impacting the system's effectiveness.

2.Limited Detection Range: The ultrasonic sensor's range may be constrained, particularly in adverse weather conditions or environments with obstacles. This limitation could reduce the system's ability to detect accidents occurring at a distance.

3.Single Point of Failure: The system's dependency on the NodeMCU microcontroller and Losant IoT platform creates a single point of failure risk. Any malfunction or downtime in either component could disrupt the accident detection and notification process.

4.Communication Issues: Potential network-related issues, such as packet loss or connectivity problems, may hinder the transmission of accident data to the IoT platform, causing delays in alerting relevant parties.

5.Scalability Concerns: Managing a large number of vehicles simultaneously may present scalability challenges. Handling a high volume of sensor data and ensuring timely communication with the IoT platform could become increasingly complex as the system scales up.

.3.1 PROPOSED METHODOLOGY

- 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.
- The saved personal members of family are informed regarding the accident through GSM module.
- 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.

In this project, the Arduino Nano serves as the central controlling unit, facilitating communication between various modules to enhance the real-time transformation of information. An accelerometer is employed to detect collision direction through tri-lateral axis movements. Family members are promptly notified about the accident via a GSM module. Vibration sensors corroborate collision detection by identifying a threshold voltage increase. To prevent false alarms to passengers, a buzzer is integrated. Within a limited timeframe of the buzzer signal, the GPS module collects coordinates from the Google Module, ensuring swift and accurate location tracking for emergency response. This system, combining accelerometer, GSM, vibration sensors, buzzer, and GPS technologies, offers a comprehensive solution to Mautomate accident detection and communication in a cost-effective and efficient manner.

- Swift emergency response through automatic accident detection.
- Precise location identification via integrated GPS technology.
- Potentially saving lives by reducing response time to accidents.

4. Modules And Alogritham

The module description of the proposed project encompasses several key components, each serving a specific function in the overall system. Here's a breakdown of the modules involved:

4.1 NodeMCU Module:

- The NodeMCU serves as the central processing unit of the system.
- It integrates Wi-Fi connectivity, enabling communication with the IoT platform.
- The NodeMCU collects data from attached sensors and controls actuators based on input signals.

4.2 Sensor Modules:

- Accelerometer Sensor Module:
- Responsible for detecting abnormal tilts in the vehicle.
- Provides data on changes in acceleration, indicating potential accidents.
- Ultrasonic Sensor Module:
- Measures distances between the vehicle and other objects.
- Helps assess collision risks and detect nearby obstacles.

4.3Actuator Modules:

- Buzzer Module:
- Produces audible alerts in response to detected accidents.
- Raises attention to the occurrence of a potential collision.
- OLED Display Module:
- Offers visual feedback, displaying relevant information such as sensor readings or system status.
- Enhances user interaction and situational awareness.

4.4 Communication Module:

- MQTT Protocol:
- Facilitates lightweight communication between the NodeMCU and the Losant IoT platform.
- Ensures efficient and reliable data transmission over the network.

4.5 IoT Platform Module:

- Losant IoT Platform:
- Serves as the backend infrastructure for data processing and analysis.
- Receives sensor data from the NodeMCU and triggers actions based on predefined workflows.
- Sends email notifications to concerned parties upon detecting accident scenarios.

4.6 Power Supply Module:

- Provides the necessary power to all components of the system, ensuring continuous operation.
- May include options for battery-powered operation or connection to an external power source.

4.7 Software Modules:

- Firmware:
- Embedded software running on the NodeMCU, responsible for data collection, processing, and communication.
- 4.7.1 Losant Workflow:
- Defines the logic for processing incoming data and triggering appropriate actions, such as sending email alerts.
- 4.7.2 User Interface:
- Interfaces for configuring system settings, monitoring sensor data, and receiving notifications.

By integrating these modules, the system can effectively detect accidents, communicate critical information, and prompt timely responses to mitigate potential risks on the road.

5. RESULTS AND SCREEN SHOTS

5.1 ARDUINO NANO AND SENSOR SETUP:

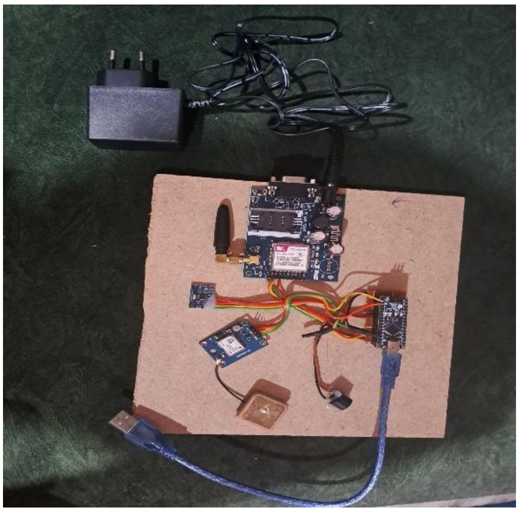

Fig .1 Hardware setup picture at off state

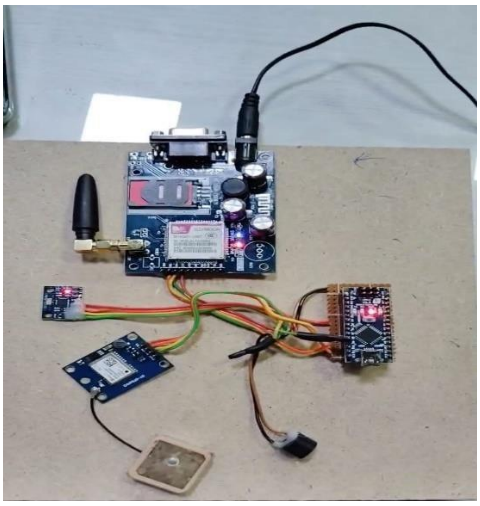

Fig 2 Hardware setup picture at on state

5.2 ACCIDENT STATUS IN THING SPEAK:

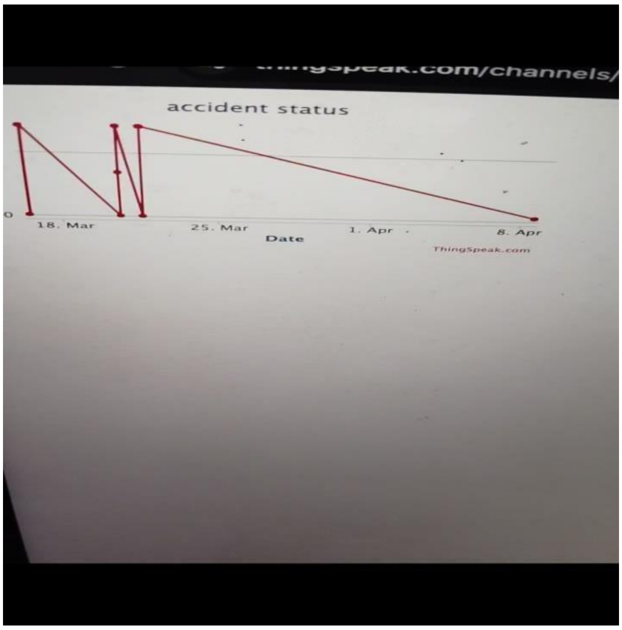

Fig 3 Accident Status in Thing Speak Dashboard

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5.3 ALERT ACTIVATION: GPS LOCATION:

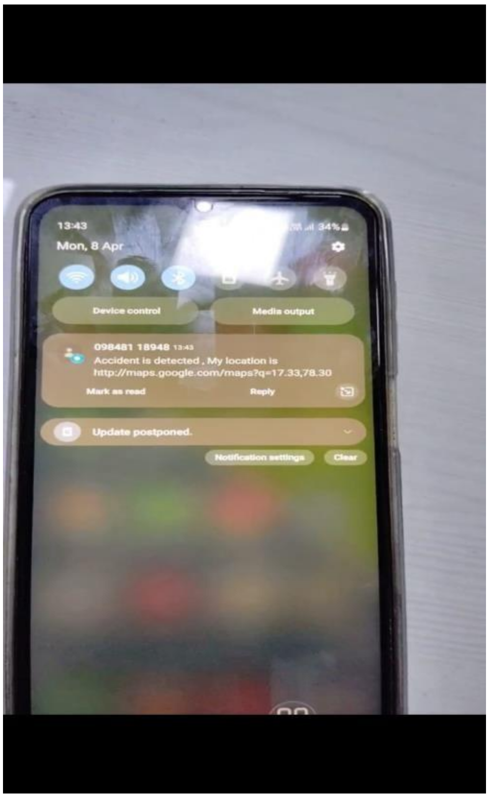

Fig 4 Notification Alert in Mobile

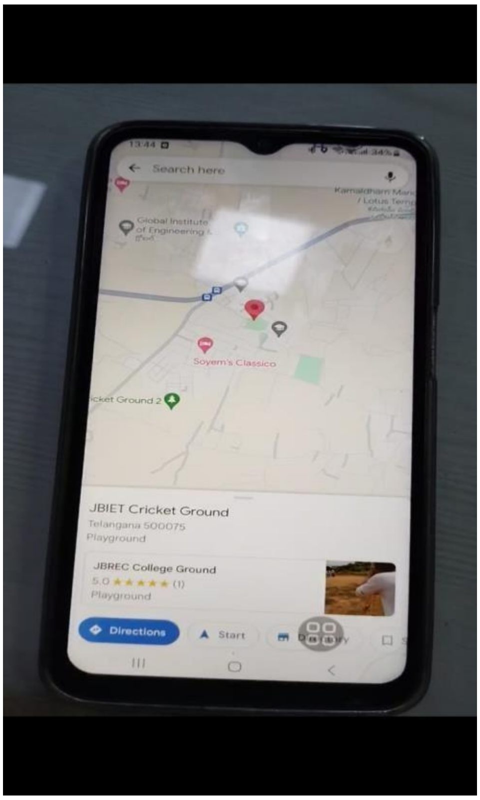

Fig 5 Location of the Accident Vehicle

6. CONCLUSION AND FUTURE SCOPE

6.1 CONCLUSION

The Automatic Accident Detection and Location Communication System (AAADLCS) using accelerometer, Arduino, GSM, GPS, and buzzer is a critical step towards addressing the challenges associated with road accidents. By automating the accident detection process and facilitating quick communication with emergency services, hospitals, and relatives, the system aims to minimize the response time and improve the chances of survival for accident victims.

6.2FUTURE ACOPE

Enhanced Communication Features: Implementing more advanced communication features such as real-time video streaming or two-way communication between the victim and emergency services could improve response times and provide better assistance to the victim. Integration with AI: Integrating artificial intelligence (AI) algorithms for more accurate accident detection and analysis could further enhance the system's capabilities.

Automatic Vehicle Shutdown: Adding functionality to automatically shut down the vehicle's engine in the event of a severe accident could prevent further damage and ensure the safety of the occupants.

Data Analytics and Reporting: Implementing data analytics capabilities to analyze accident data over time could help identify accident-prone areas and contribute to better road safety measures. Integration with Emergency Services Infrastructure: Integrating the system with existing emergency services infrastructure, such as emergency call centers and ambulance dispatch systems, could streamline the response process and improve coordination.

7. REFERENCES

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