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IOT BASED ACCIDENT DETECTION SYSTEM

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ABSTRACT
In modern urban environments, road safety remains a critical concern, with accidents leading to loss of life, property damage, and traffic congestion. Prompt detection and effective response to accidents are crucial for mitigating their impact and improving overall road safety. In this context, the Internet of Things (IoT) offers a promising approach by enabling the integration of smart sensors, communication technologies, and data analytics to develop proactive accident detection systems.This paper presents an IoT-based Accident Detection System (IoT-ADS) designed to enhance road safety by providing real-time accident detection and notification capabilities. The proposed system utilizes a network of IoT devices deployed along roadways to monitor traffic conditions and detect signs of accidents. These devices include sensors for detecting sudden changes in speed, acceleration, and orientation, as well as cameras for visual verification of accidents.

Keywords:
GSM module, GPS tracking, ESP32, Arduino MEGA, SMS, object tracking.

INTRODUCTION
Road accidents represent a persistent and far-reaching challenge, exacting a heavy toll on individuals, families, and societies worldwide. Each year, millions of lives are lost, and countless more are injured or affected by the aftermath of these incidents. Factors contributing to road accidents are diverse, ranging from human error, such as speeding and distracted driving, to environmental and infrastructural issues like poor road conditions and inadequate signage. However, amidst these challenges, there is room for hope and progress. Technological innovations, stringent enforcement of traffic laws, and comprehensive road safety education initiatives offer promising avenues for reducing the incidence of road accidents and minimizing their impact. By fostering a culture of responsibility, enhancing infrastructure, and leveraging advancements in automotive technology, we can work towards a future where road accidents are no longer a leading cause of injury and loss of life.

LITERATURE SURVEY
[1] Mohammed Balfaqih.; Soltan Abed Alharbi.; Moutaz Alzain.; Faisal Alqurashi and Saif Almilad. An Accident Detection and Classification System Using and Machine Learning towards Smart City.2022. The architecture of the accident detection and classification system is illustrated for data acquisition, the system utilizes a group of sensors including a Hall effect sensor, vibration sensor, accelerometer, flame and smoke sensors, and force an impact sensors. If an accident is detected, the microcontroller sends an emergency alert through a GSM transmitter.From this article , I have considered the concept of immediate response to accidents by contacting the necessary entities.
[2] Amal Hussain Alkhaiwani and Badr Soliman Alsamani. A Framework and IoT-Based Accident Detection System to Securely Report an Accident and the Driver‟s Information.2023. In this a few sensors are fitted to the vehicles to collect information on the location and direction of the car in the event of an accident. To illustrate, the vibration sensor (VS) can be used as examples. The first responders receive information about the accident‟s location using GPS/GPRS modems and the second GSM module then receives this information. Later, the GSM module transmits a message to the responders. From this article , I have considered the concept of working and existing process of GPS and GSM modules.
[3] Nikhil Kumar, Debopam Acharya, and Divya Lohani. An IoT Based Vehicle Accident Detection and Classification System using Sensor . 2020. In this an algorithm for vehicle accident detection that uses ADXL335 sensor to detect the vehicle crash and send an emergency SMS .From this article

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,I have considered the concept of Sensor Fusion using Complementary Filter.

EXISTING METHOD

Accident detection systems using GPS and GSM technologies are designed to detect and report accidents or emergencies in real-time. GPS is used to determine the precise location of the vehicle at any given time. It relies on a network of satellites to provide accurate geographic coordinates.Many accident detection systems incorporate accelerometers or gyro sensors to measure the vehicle's acceleration, deceleration, and orientation. Sudden changes in these parameters can indicate a potential accident.A microcontroller (Arduino mega) or processor analyzes the data from the GPS and accelerometer to determine if an accident has occurred. Algorithms are often used to distinguish between normal driving conditions and emergency situations.

GSM technology is utilized to transmit data from the vehicle to a remote server or monitoring center. This communication can be in the form of text messages, emails, or data packets sent over the cellular network.When an accident is detected, the system triggers an emergency alert. This alert can include details such as the vehicle's location, time of the accident, and possibly the severity of the impact.Some advanced systems may be integrated with emergency services such as police, fire, or medical response teams. This allows for faster response times in the event of an accident.These systems typically have a backup power source, such as a rechargeable battery, to ensure continued operation even if the vehicle's main power is disrupted during an accident.Some systems may include a user interface, such as a mobile app or web portal, to allow vehicle owners or authorized personnel to monitor the vehicle's status and receive alerts remotely. After an accident, the system may continue to transmit data, providing valuable information for post-accident analysis. This data can be used for insurance claims processing, accident reconstruction, and improving the effectiveness of the system.

Overall, the combination of GPS and GSM technologies enables real-time monitoring and rapid response to accidents, potentially saving lives and reducing the severity of injuries.

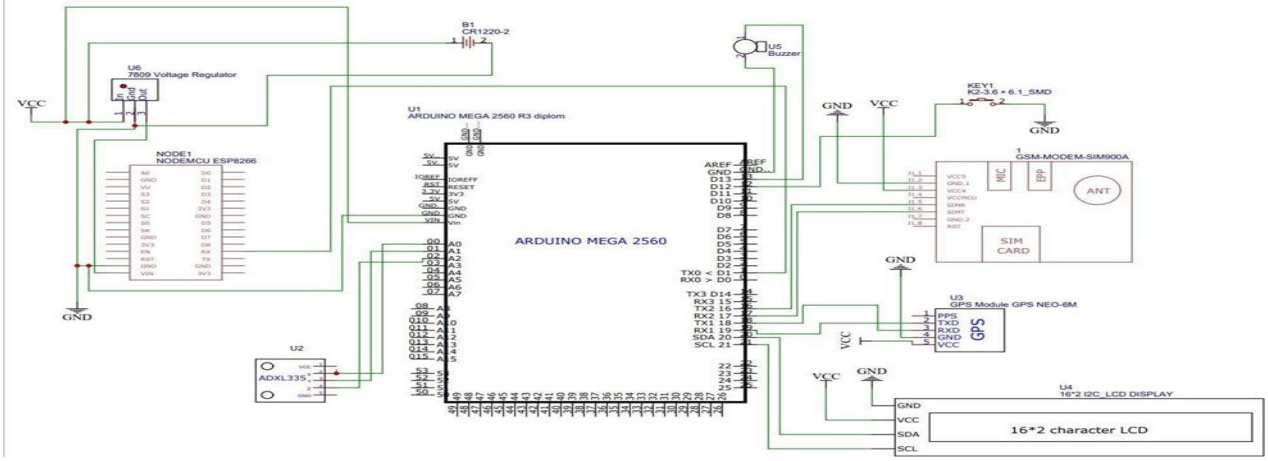

Figure.1. Schematic diagram for proposed model

PROPOSED METHOD

Integrate the ADX335 accelerometer sensor with the ESP8266 microcontroller to detect sudden changes in acceleration, indicative of a potential accident. Utilize the GPS module to constantly track the location of the device.Analyze the data from the accelerometer to determine if there's a sudden impact or change in velocity beyond a predefined threshold, indicating an accident.Upon detecting a accident, trigger an alert using the GSM module to notify emergency services or designated contacts.Send the current GPS coordinates along with the alert to provide the exact location of the accident. Develop a user interface, such as a web service or web page, for tracking the location with exact latitude and longitude coordinates .Creating a web page for accident detection could involve integrating sensors, such as accelerometers or GPS trackers, with a web interface. The sensors would detect sudden changes of an accident, triggering alerts sent to the web page. Users could then receive notifications and emergency services could be dispatched if necessary. It's important to ensure the accuracy and reliability of the detection system to minimize false alarms and ensure timely responses

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in emergencies.

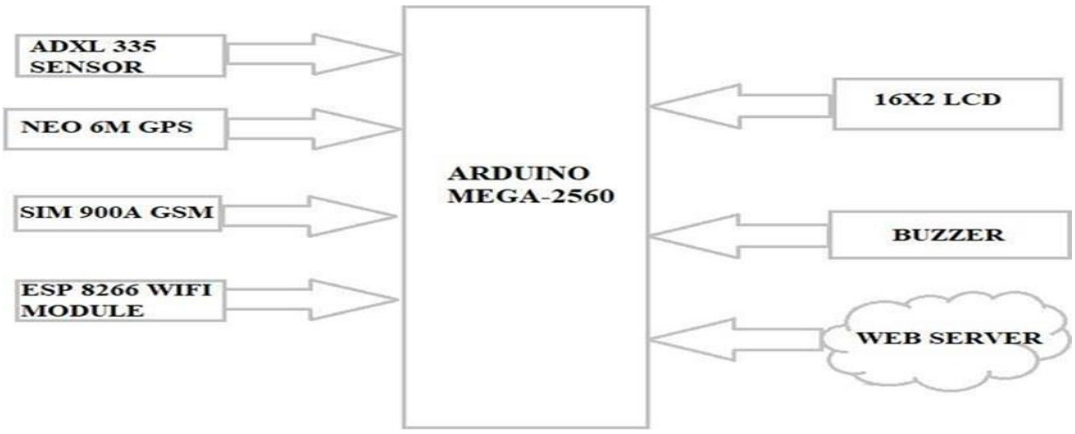

Figure:2 Block Diagram of Proposed method

HARDWARE DESCRIPTION

The hardware consists of Power supply, Arduino UNO,ADXL 335,GSM(Global System for Mobile Communication) Module (SIM 900A),GPS(Global Positioning System)Module(NEO- 6M),ESP8266 Node MCU,Buzzer,7809 Voltage Regulator,16*2 I2C LCD Module, Switch.

1. Power Supply

In this fast moving world we deliberately need a power. Power source used in our project is Battery(12v-1amp), which is chargeable , it is a particular requirement. Power supply is a major concern for every electronic device.

2. Arduino Mega

In automatic accident detection systems, the Arduino Mega can play a crucial role due to its extensive input/output capabilities and processing power. The Arduino Mega is a microcontroller. It has more digital and analog pins compared to other Arduino boards, making it suitable for larger projects requiring numerous inputs and outputs. With its extensive capabilities, it's popular in robotics, automation, and various electronic projects.

Figure:3: Arduino Mega

3. ADXL335

The Arduino Mega is a powerful and versatile microcontroller board suitable for a wide range of projects requiring extensive I/O capabilities. Its large number of pins, multiple communication interfaces, and compatibility with shields make it a popular choice among electronics enthusiasts and professionals alike for prototyping and building complex embedded systems.

Figure-4: ADXL 335

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4. GPS Module(Neo-6m)

A GPS (Global Positioning System) is a satellite-based navigation system that provides location and time information anywhere on or near the Earth's surface. GPS is a global navigation satellite system that utilizes a constellation of satellites orbiting the Earth to provide accurate positioning, navigation, and timing services to users worldwide.

Figure-5: GPS(Neo-6m) Module

5. GSM SIM 900A

The GSM (Global System for Mobile Communications) standard, established in the 1980s, revolutionized cellular networks globally. Operating across various frequency bands, GSM employs TDMA technology for efficient spectrum utilization. It facilitates high-quality voice calls, SMS messaging, and data services like internet access and multimedia messaging. Security measures such as encryption ensure the privacy of transmissions. GSM's support for roaming allows seamless connectivity across different networks worldwide. Utilizing SIM cards, users can easily switch devices while retaining their identity and services.

Figure-6: GSM SIM900A

6. ESP 8266 (Wi-fi module)

The ESP8266 is a low-cost Wi-Fi microchip, widely used for Internet of Things (IoT) applications due to its affordability and versatility. It's developed by Espressif Systems, offering a range of modules with embedded Wi-Fi capabilities.

Figure-7: ESP 8266 Wi-fi module

SOFTWARE DESCRIPTION

1. Arduino IDE

The Arduino Integrated Development Environment (IDE) is a software platform designed for programming Arduino microcontroller boards. Here's a detailed description of the Arduino IDE .

a) Open Source
b) Programming Environment
c) Cross-Platform Compatibility
d) Code Editor
e) Sketch Structure
f) Library Management
g) Board Manager
h) Serial Monitor

Overall, the Arduino IDE provides a beginner-friendly yet powerful platform for programming Arduino boards, making it an ideal choice for hobbyists, students, and professionals alike to develop a wide range of projects, from simple LED blinking experiments to complex IoT applications.

2. Libraries

a) LiquidCrystal_I2C.h

The LiquidCrystal_I2C library is an extension of the standard Liquid Crystal library for Arduino that allows you to control LCD displays using the I2C communication protocol. It simplifies the process of interfacing with I2C-enabled LCD modules, reducing the number of wires needed for connection and freeing up digital pins on the Arduino board for other purposes.

b) TinyGPS++.h

TinyGPS++ library simplifies GPS integration in Arduino projects by providing a lightweight and efficient solution for extracting useful GPS information. Whether you're building a GPS tracker, a navigation device, or a geolocation-based application, TinyGPS++ offers a reliable and easy-to-use platform for working with GPS data on Arduino and other microcontroller platforms.

3. teckybot.in (web server)

TeckyBot is a chatbot that is created by Tecky Academy for demonstrational and educational purpose. The source code is free to use for educational purpose .

URL: http://teckybot.in/

RESULT ANALYSIS

To analyze the results of an IoT-based accident detection system,the most useful features are accuracy ,response time and affordable.

The overall interfacing of ADXL 335,GSM module,GPS Module.ESP8266 Wi-fi module with Arduino mega as shown below.

Figure-8: Implementation of Hardware

Figure-9: Implementation of Hardware in real time.

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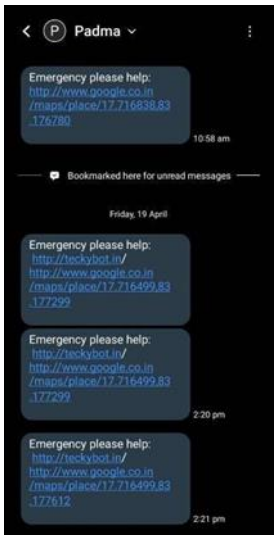

Figure-10: Message received by the specified phone number

- On clicking of the received message, opens the location of the Accident spot in Google maps

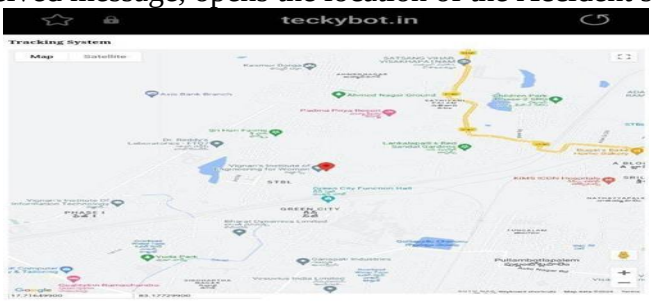

Figure-11: Location of Accident sent via Teckybot.in web site

CONCLUSION

By developing this project ,we have overcome the drawbacks of the previous techniques like complexity of the system, lack of maintenance. The project is developed by using Arduino mega, ADXL 335,ESP8266 Node MCU, GSM module and GPS module .The project we have designed is used to detect the accident using teckybot.in web page .The implemented device is a reliable, low cost and easy to use which reduces the response time of emergency services through efficient communication of relevant information a bout accident**.** Therefore ,The system provides information of accident through a GPS module and GPS module. This is the best solution to increase the survival rate of the accident victims with low cost and easy to use devise.

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