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Smart Helmet With Sensors For Accident Prevention

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Abstract— The goal of this project is to develop and deploy an Internet of Things (IoT)-based intelligent system for environmental monitoring and accident reporting. The device combines accelerometer data over a particular level to detect car accidents, and data from a flame sensor to identify fires. Once an incident is identified, the system notifies an emergency response team via a GSM module and utilizes GPS to locate the exact location. urthermore, the system uses the appropriate sensors to monitor factors such as temperature, humidity, alcohol, smoke, and carbon monoxide levels. Upon receipt, the IoT platform has the option to evaluate and provide these data points in real-time. This integrated method improves safety by allowing for fast response to accidents and environmental monitoring; it might be used in smart transportation systems. Thingspeak, sensors, the internet of things, global positioning systems, data monitoring, the ESP8266, and danger alerts are some of the facets discussed.

Keywords: Internet of Things (IoT), Environmental Monitoring, Accident Detection System, ESP8266, GPS Tracking, GSM Module, Flame Sensor, Accelerometer Sensor, Smart Transportation, Real-Time Monitoring, ThingSpeak, Carbon Monoxide Detection, Smoke Detection, Alcohol Sensor, Emergency Alert System, Danger Alerts.

I. INTRODUCTION

The tremendous changes brought forth by recent technical advancements have affected several industries, transportation included. The economic impact, property damage, and human lives lost as a result of car accidents are a major source of concern for the industry. There have been initiatives to enhance road safety via driver education and infrastructure improvements, but the response to accidents may be significantly improved with better data monitoring and faster reporting. Incorporating IoT technology provides a workable solution in this kind of context. Through the real-time device connections made possible by the Internet of Things (IoT), sensors, emergency systems, and vehicles may all collaborate. The purpose of this study was to examine the potential of Internet of Things (IoT) technology in creating an effective system for data monitoring and reporting of automobile accidents. In addition to facilitating quicker emergency responses, this kind of gadget contributes to improved road safety by delivering vital data on accident trends. By using biometric and radio frequency identification (RFID) vehicle identification, vibration sensors for collision detection, and real-time data exchange via GSM, GPS, and an Arduino Mega, a "Smart Vehicle Monitoring System" has the potential to enhance road safety. I think so. This study proposes an Internet of Things (IoT)-based system that tracks the speed of cars in real-time in an effort to reduce transportation accidents. When drivers exceed the speed limit, an IR speed sensor, LCD, microprocessor, and buzzer are all components of the system that serves to inform them. It encourages drivers to be safer and follow speed limits by giving them feedback quickly [2]. The high frequency of traffic accidents in Bangladesh is at least partially attributable to drivers' lack of attention. An IoT monitoring system is presented

in this research with the aim of making vehicles safer. Those who are in favor of the thesis argue that this approach would speed up reactions to crises and reduce the number of accidents [3].

II. RELATED WORKS

With the goal of enhancing road safety in Bangladesh, this project offers a "BlackBox" module that tracks vehicle dynamics and road conditions. The module may potentially cut road accidents by 80% by alerting authorities early on the spot thanks to its real-time accident detection and data processing capabilities [4]. An accident notification system was developed and put into action in this study with the aim of decreasing accident rates and saving lives [5].

The growing number of car owners and the resulting traffic congestion are two problems that the system hopes to alleviate. This study suggests a GPS-based accident notification system that can track the speed of vehicles in real-time, signal possible collisions by detecting abrupt drops in speed, and instantly communicate the position and time to emergency services over GSM. Ultimately, we want to improve rescue operations and reduce casualties [6]. This novel approach shortens the period between occurrences and medical assistance, improving the efficiency of emergency response. This highlights its critical role in minimizing traffic accidents that result in fatalities by improving road safety and reducing the severity of injuries [7].

The use of GSM, sensors, and microcontrollers in this system improves vehicle safety by identifying accidents and illegal movements and enabling quick warnings to both emergency services and car owners [8]. Instantaneous notification of public safety groups about accidents is made possible by this Internet of Things technology, which helps improve response times and rescue operations for accident victims. Accurate geographic coordinates and other crucial information are also provided [9]. This automated system improves reaction times and provides critical location information by notifying family members and emergency personnel as soon as an accident occurred using Arduino, GPS, and GSM modules [10]. Using ZigBee technology and sensors, this study introduces an automatic accident detection system [11] to make sure that rescue personnel obtain quick medical care and that householders may turn off unneeded alerts. This article examines several approaches and technologies that might reduce the occurrence of car accidents in hilly regions, particularly when drivers encounter obstacles such as steep inclines and tight curves [12].

This article introduces ISADICS, an IoT system that aims to improve accident management by automatically notifying hospitals, insurance firms, and law enforcement about emergencies [13]. Using vehicle sensors to identify possible collisions and quickly alert medical authorities, the approach shown in this study aims to decrease casualties via fast emergency response [14]. An accelerometer and a heart rate monitor allow this system to detect accidents, notify local hospitals, and share location data using a smartphone app, allowing for the rapid interchange of medical aid [15].

III. METHODOLOGY

What follows is an outline of the main features, architecture, and methods of implementation for a vehicle accident warning and data monitoring system. The primary objective of the system is to continuously monitor the surrounding conditions and promptly sound an alarm in the case of a fire or catastrophe. In "Fig. 1" you can see the schematic of the proposed system. Figure 2 shows the thorough connection diagram for the accident reporting system, while Figure 3 shows the data monitoring system.

A. Arduino UNO

The Arduino UNO is the central microcontroller that controls the system and processes data from

the sensors. It communicates with other devices (such the SIM800L GSM and GPS modules) and collects data from various sensors; then, it takes decisions based on predefined thresholds. The system is always keeping an eye on the ADXL335 and flame sensors.

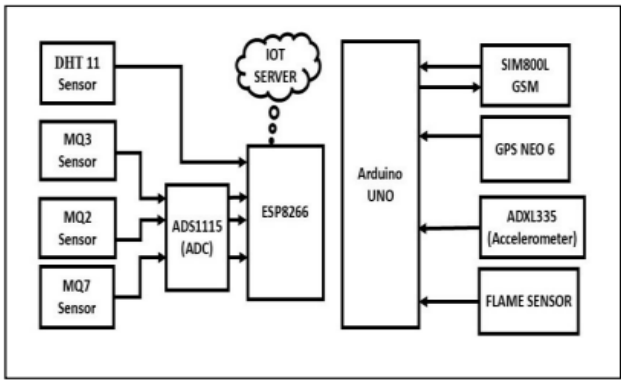

Fig. 1. Block diagram of proposed system

B. GPS NEO6 Module

The NEO6M GPS receiver module allows you to get exact geographic position data, such longitude and latitude, in real-time. In the case of an accident, the system can precisely locate the vehicle and alert the appropriate authorities.

A. GSM Module (SIM800L)

It was intended for data transmission over a GSM network via the SIM800L GSM module. This module has the capability to alert a preset phone number of the location and status of the vehicle in the event of an emergency. Depending on the kind of alarm (fire, accident, etc.), the alert message may include GPS coordinates and other relevant information.

I. Accelerometer Model ADXL335

Using an ADXL335 accelerometer, we continuously measured the vehicle's acceleration in all three directions. The Arduino UNO has an alarm mechanism that alerts the user in the event of an unexpected acceleration change exceeding a certain threshold.In order to detect accidents, rollovers, and abrupt deceleration, an accelerometer is essential.

E. Flame Sensor

The flame sensor on the car may identify flames. Signals detected by the sensor indicating the existence of flame were sent to the Arduino UNO via the SIM800L module, which subsequently set off the fire alarm. As soon as the fire is detected, an alert message is delivered to the appropriate emergency contacts.

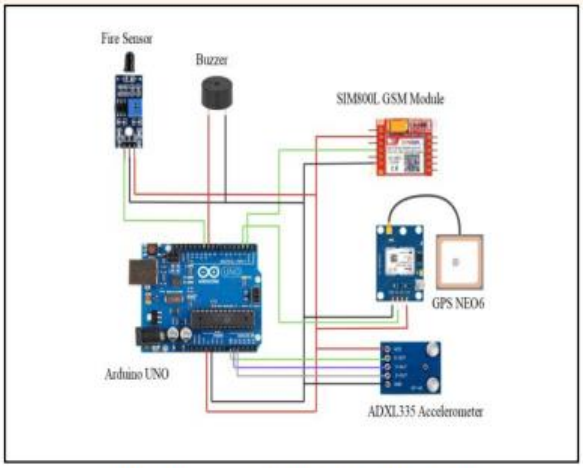

Fig. 2. Connection diagram for reporting system

F. NodeMCU (ESP8266)

The NodeMCU (ESP8266) served as the primary hardware for controlling the system and communicating wirelessly. With the help of the Internet of Things, this device was able to talk to all of the sensors, process the data, and then transmit it to a server. The NodeMCU downloaded data in real-time from sensors, processed it, and then wirelessly sent the results to the IoT server.

G. Humidity and Temperature DHT11 Sensor

We measured the temperature inside the vehicle using a DHT11 sensor. A DHT11 sensor, which provides real-time data on the relative humidity and temperature inside a vehicle, is an essential component for identifying uncomfortable or harmful environmental conditions.

H. Smoke Detection with the MQ2 Sensor

Smoke and combustible gases including propane, butane, and methane were detected by the MQ2 sensor. In order to detect any fire dangers or

dangerous gas leaks inside the car, the MQ2 sensor is continuously scanning the air for levels of smoke and gas.

I. Carbon Monoxide Detection with the MQ7 Sensor

Using the MQ7 sensor, levels of carbon monoxide (CO) were tracked. The presence of CO in a vehicle's exhaust system is a telltale symptom of engine trouble or incomplete combustion. Detecting dangerously high amounts of the odorless and poisonous chemical carbon monoxide, the MQ7 sensor keeps tabs on the car's CO levels.

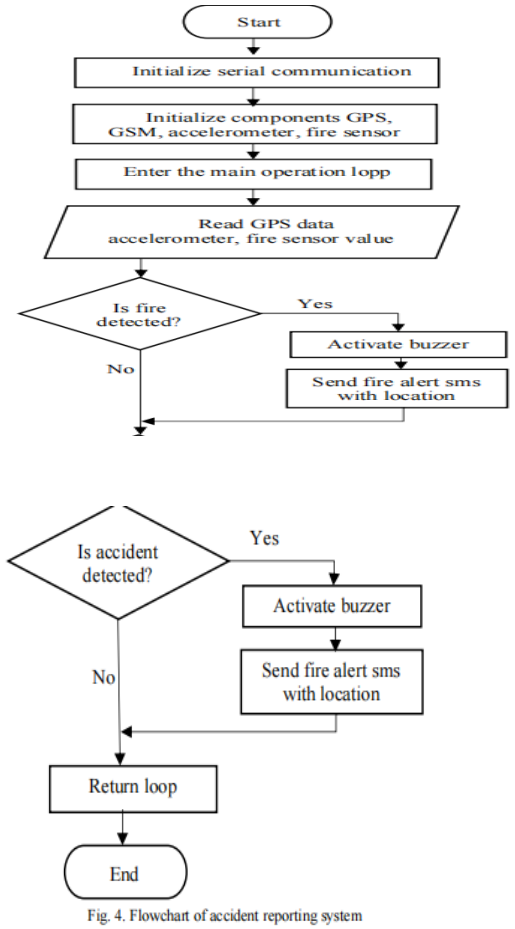

Fig. 4. Flowchart of accident reporting system

Detection of Alcohol using the J. MQ3 Sensor

We utilized the MQ3 sensor to detect any residues of alcohol in the air. The MQ3 sensor assists in keeping an eye out for potentially dangerous situations, such as when the driver has been drinking or when there is an excessive amount of alcohol in the vehicle's environment.

The ADS1115 is an ADC.

One such 16-bit analog-to-digital converter (ADC) is the ADS1115, which is both highly accurate and energy efficient. Its precise analog-to-digital conversion is relied upon by several applications, including sensor monitoring, embedded systems, and data collection.

Server for Thingspeak, L.

Thingspeak, an open-source Internet of Things analytics platform, was used to gather data, display it graphically, and do real-time analyses. We made use of the built-in plotting features to create visual representations of the data for advanced analytics, effective monitoring, and automation.

The flow diagram

An alert should be sent out by the Arduino UNO if an accident is detected. This accident reporting system is shown in "Fig. 4" by a flow diagram. "Fig. 5" shows a data monitoring system flow diagram. The NodeMCU is responsible for sending data to an IoT platform and monitoring sensors.

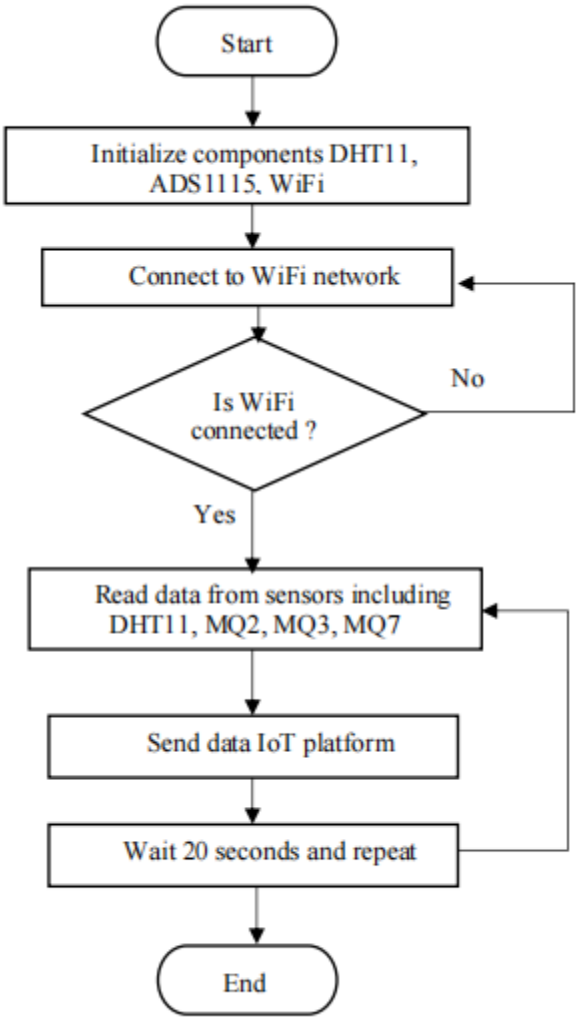

Fig. 5. Flowchart of data monitoring system

IV. IMPLEMENTATION AND RESULTS

The use of sensor technologies, real-time communication, and the Internet of Things to improve vehicle safety and monitoring systems is gaining importance. Our solution relies on the Internet of Things (IoT) as it links several sensors and enables them to exchange data in real-time. Consider the MQ-3 and its ability to detect BAC levels in the driver's breath; the DHT11, on the other hand, can keep tabs on the car's temperature and humidity levels. In order to identify the root causes of accidents, an Internet of Things platform gathers and analyses this data. Reduced accident rates and improved road safety are direct results of the Internet of Things' ability to make our system smarter and more responsive. In addition, it alerts faraway users effectively using SMS alerts and the IoT platform for sensor data. This technology enhances vehicle safety and, in the long run, response times in critical situations by providing drivers and emergency contacts with fast and actionable information. With this strategy in mind, the system shown in "Fig. 6" was implemented.

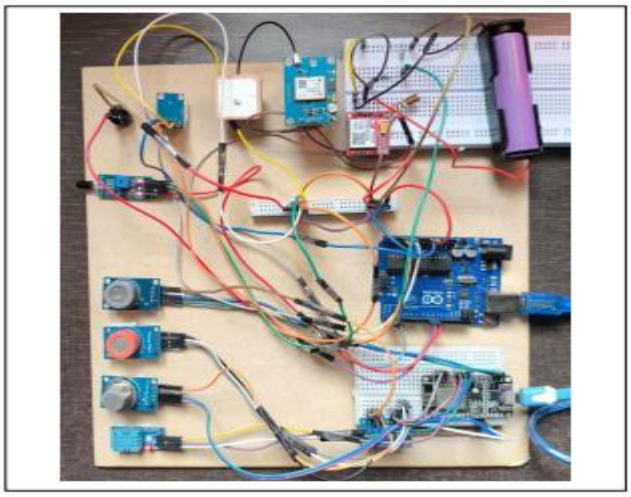

Fig. 6. Hardware Implementation of proposed system

A. Accident Detection and Reporting System

1) Detecting Accidents in Real Time: The system used the ADXL335 accelerometer to identify unusual accelerations. Experiments demonstrating the typical deceleration of a vehicle in the aftermath of collisions and abrupt braking are used to establish a threshold value. A collision occurred if the car's speed unexpectedly fell below this limit. When the system identified collisions involving controlled vehicles during testing, an accident detection mechanism was engaged. With a margin of error of less than 2.5 meters, the GPS NEO6 module precisely monitored the positions of the cars throughout the event. A SIM800L GSM module was triggered by the Arduino UNO upon detection, and the following information was delivered by SMS to designated emergency contacts. In "Fig. 7" you

can see the received location-related smart message. Warning message about an incident No way! The vehicle's coordinates in terms of both latitude and longitude

Fig. 7. Accident notification via SMS

Secondly, the flame sensor can identify the existence of flames during simulated fire situations and report them. When the fire broke out close to the sensor, the system was quick to react—less than two seconds. Turning on the SIM800L GSM module allowed Arduino to send an emergency SMS to pre-specified contacts with the car's location, much like accident detection. The fire detection system had a perfect detection rate, never triggering false positives when there wasn't really a fire.

Fig. 8. Data monitoring through IoT platform

B. Data Monitoring

1) Monitoring of temperatures and humidity levels.

Cars should have their temperature and humidity levels monitored if passenger comfort and safety are our top priorities. The DHT11 sensor is a reliable and inexpensive module that can measure both temperature and humidity simultaneously. After receiving data from this sensor, the microcontroller processes it and sends it via Wi-Fi to an IoT platform, such as thingspeak. With Thingspeak, remote access and continuous monitoring are made possible via the viewing, storage, and analysis of data in real-time. We were able to create real-time temperature and humidity graphs using data that was updated every 20 seconds. The ESP8266 microcontroller mediates communication between the thingspeak platform and the DHT11 sensor via Wi-Fi. Pictured visually in "Fig. 8" and "Fig. 9" are the readings from the thingspeak server, which include things like humidity, temperature, smoke, alcohol, and carbon monoxide.

2) Monitoring of Air Quality

These three substances—smoke, alcohol vapor, and carbon monoxide (CO)—were tested for by the MQ2, MQ7, and MQ3 sensors. It is critical to monitor vehicle air quality in order to determine the amount of contaminants within and to ensure passenger safety.All three of these gases—combustible gases, alcohol vapors, and carbon monoxide—are common in vehicle environments, and our device uses their combined sensing capabilities to identify them.The sensors gather data, analyze it using an ESP8266 microcontroller, and then send it over wifi to an internet of things platform like thingspeak. What this means is that you may monitor the air quality inside the car in real-time and get notifications when the pollution level is too high.Passengers' health and comfort may be greatly enhanced by the technology's cost-effective and scalable solution to improve the air quality inside automobiles.

Fig. 9. Data monitoring through IoT platform

V. CONCLUSION

The results of this study demonstrated that an IoT system could efficiently record data and notify authorities of car accidents as they occurred. Road safety is significantly improved by using sensors to monitor environmental and vehicle elements. This allows for a more comprehensive understanding of the situation. The proposed approach is accessible, scalable, and perfect for broad adoption since it is simple and does not need major adjustment. The monitoring system might be enhanced in the future by include more variables, such as drivers' attention levels and unsafe overtaking methods. This technology allows for better and safer transportation systems by including thorough data monitoring and accident detection.

REFERENCES

[1] S. M, P. D. D, K. R and P. R. K, "A Smart Vehicle Monitoring System Using Real-Time Data Processing and Advanced Sensor Integration," 5th International Conference on Electronics and Sustainable Communication Systems, 2024.

[2] D. P. W., Y. S, S. V and T. S. R, "Real-Time Vehicle Speed Monitoring and Alerting System to Prevent Road Accidents," Proceedings of the Fourth International Conference on Smart Electronics and Communication, 2023.

[3] M. A. Kader, M. E. Alam, S. Momtaj, S. Necha, M. S. Alam and D. K. M. Masum, "IoT Based Vehicle Monitoring with Accident Detection and Rescue System," 22nd International Conference on Computer and Information Technology, 2019.

[4] I. A. Jahan, I. A. Jamil, M. S. H. Fahim, A. S. Huq, F. Faisal and M. M. Nishat, "Accident Detection and Road Condition Monitoring Using Blackbox Module," Thirteenth International Conference on Ubiquitous and Future Networks, 2022.

[5] D. Gowda, A. Sharma, A. S. Naik, R. . S. Meena and J. M. Kudari, "Design and Implementation of a System for Vehicle Accident Reporting and Tracking," Seventh International Conference on Communication and Electronics Systems, 2022.

[6] M. S. A. J. Jalil and M. B. I. Reaz, "Accident Detection and Reporting System using GPS, GPRS and GSM Technology," IEEE/OSA/IAPR International Conference on Informatics, Electronics & Vision, 2012.

[7] B. Ninan, "A Confirmation Based Accident Detection System Using IoT for Smart Vehicles," IEEE 3rd World Conference on Applied Intelligence and Computing, 2024.

[8] S. Chitransh, S. Y. Tripathi and S. Ahmad, "ACCIDENT ALERT AND VEHICLE THEFT INTIMATION SYSTEM USING GSM MODEM," International Conference on Signal Processing and Advance Research in Computing, 2024.

[9] E. K. D. K. Elie Nasr, "An IoT Approach to Vehicle Accident Detection, Reporting, and Navigation," IEEE International Multidisciplinary Conference on Engineering Technology, 2016.

[10] P. Yellamma, N. S. N. S. P. Chandra, P. Sukhesh, P. Shrunith and S. S. Teja, "Arduino Based Vehicle Accident Alert System Using GPS, GSM and MEMS Accelerometer," Fifth International Conference on Computing Methodologies and Communication, 2021.

[11] D. S, A. E., A. Vasudev, A. Benny and S. Joy, "Automated Accident Alert," International Conference on Emerging Trends and Innovations in Engineering and Technological Research, 2018.

[12] M. S. P. D. A. and S. G. , "DESIGN AND

IMPLEMENTATION OF ACCIDENT PREVENTION WITH ALERT MESSAGES AND MOTION SENSORS FOR MOUNTAIN ROAD SAFETY," First International Conference
on Electronics, Communication and Signal Processing, 2024.
[13] K. L. Narayanan, C. R. S. Ram, Mr.M.Subramanian, R. S. Krishnan and Y. H. Robinson, "IoT based Smart Accident Detection & Insurance Claiming System," Third International Conference on Intelligent Communication Technologies and Virtual Mobile Networks, 2021.
[14] R. K. Kodali and S. Sahu, "MQTT Based Vehicle Accident Detection and Alert System," International Conference on Applied and Theoretical Computing and Communication Technology, 2017.
[15] N. Kattukkaran, A. George and M. Haridas T.P, "Intelligent Accident Detection and Alert System for Emergency Medical Assistance," International Conference on Computer Communication and Informatics, 2017