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Article Title: IoT Based Automatic Vehicle Accident Detection and Rescue System

IoT Based Automatic Vehicle Accident Detection and Rescue System

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ABSTRACT

The main issues in metropolitan areas are traffic congestion and road accidents. There is now technology available for accident identification. The likelihood of a victim dying is further increased by the ambulance taking longer to get at the scene of the accident and by traffic jams between the scene and the hospital. Implementing a system is necessary to lower the number of fatalities brought on by mishaps and the length of time it takes for an ambulance to arrive at the hospital. In order to address the shortcomings of the current system, a new one will be implemented that will use sensors in the vehicle to automatically identify accidents and use the Internet of Things to manage traffic lights. The worried vehicle's GPS and node MCU module will transmit the accident's position to a nearby hospital. Which will send him to the closest hospital to the scene of the accident. In addition, IoT would be used to regulate traffic light signals that the ambulance would be traveling through. This will cut down on how long it takes the ambulance to get to the hospital. The entire system is automated. As a result, it locates the scene of the accident, manages the traffic signals, and assists in getting to the hospital on time.

Keywords: Node MCU, GPS module, Tilt sensor, LCD display, DC motor, Motor driver, Buzzer, Traffic lights, Power supply, Arduino UNO.

1 Introduction

It is acknowledged that the number of visitors, residents, and automobiles in cities is rising. The number of automobiles on the road has increased traffic, which in turn has increased the frequency of traffic accidents. According to a recent World Health Organization (WHO) estimate, 50 million people are injured and 1.35 million people die annually. Road accidents are currently the eighth most common cause of death (up from ninth in the previous report from 2015), but unless there are significant changes, the Association for Safe International Road Travel (ASIRT) predicts that they may move up to the fifth most common cause of death in the near future.

There is a substantial expense associated with traffic accidents in addition to the harm they do to society. According to ASIRT, road accidents account for one to two percent of each nation's

ISSN (Online): 2583-7052

International Journal of Advanced Trends in Engineering and Management (IJATEM)
pp. 284-296

yearly budget. Even in sophisticated nations with robust road safety regulations, the annual number of road traffic fatalities has increased recently on a global scale. Nonetheless, the majority of road traffic fatalities and injuries continue to occur in low- and middle-income nations. The development of intelligent traffic management systems appears to be promising with the rise of the Internet of Things (IoT).

Applications for global navigation satellite systems, like the Global location System (GPS), are growing in number, particularly for vehicle navigation and location. In fact, a lot of the cars that are supplied these days contain GPS units that track the position of the car and transmit that data to cloud servers. Modern cars also have other sensors that continuously gather and store data for use in smart transport management or accident detection. High sampling rates create serious problems for the storage and processing of this data because they are motivated by the need for greater accuracy and algorithm efficacy.

IoT is defined differently by many people. For instance, the Institute of Electrical and Electronics Engineers (IEEE) defines the Internet of Things (IoT) as "a network of items each embedded with sensors which are connected to the Internet" in its Special Report on the IoT. According to all definitions, the Internet of Things is a cyber-physical system that links real-world items to the internet. The Internet of Things (IoT) is widely used and has a substantial reach, encompassing a wide range of items like cars, buildings, Cell phones, other electrical appliances, infrastructure devices, and even clothing. A network typically links devices in an Internet of Things system, each of which has an own identity. Numerous sensors pick up on the existence of these physical things, which could be identified by bar codes or RFID tags, among other types of identification. These sensors communicate the object-specific data to a system for processing and analysis via the network after receiving it as an input. The decision-making units receive this processed data and use it to decide which automatic activities should be triggered. It should be noted, though, that sensors have a limited amount of processing power and storage, which might provide problems, particularly in terms of security and reliability.

Accidents are a common occurrence in urban areas, where many can be handled quickly. However, some accidents happen at night, when visibility is poor, making it challenging for an ambulance driver to locate the scene of the accident using citizen phone calls. The amount of time between the scene and the hospital will be greatly shortened if the driver knows the exact location of the collision. This paper's primary goal is to assist in lowering the time factor in the event of an accident. It frequently happens that an accident happens in the middle of the night, leaving the victim unconscious, and it takes hours for someone to discover this and call the police. Thus, it is true that preserving this valuable time will save lives. In keeping with this idea, an automated accident detection system is built without the need for human assistance. Following the identification of the accident, the ambulance will receive accident coordinates from the same setup, making it easier for them to locate the site. After being moved inside the

International Journal of Advanced Trends in Engineering and Management (IJATEM)
pp. 284-296

ambulance, the victim is attached to a second setup that will continuously watch over his vital signs in an effort to keep him stable

2 Literature Review

Smith, J., Johnson, A., & Brown, C,[1], "Real-time Accident Detection and Emergency Response System for Vehicles". This paper proposes a system using GPS and accelerometers to detect accidents. It focuses on rapid notification to emergency services and introduces an in vehicle communication interface for passengers.

Patel, R., Gupta, S., & Singh, M. [2], "IoT-based Smart System for Vehicle Accident Detection and Emergency Alerts". The study introduces a comprehensive system using multiple sensors including accelerometers, gyroscopes, and IoT platforms for accident detection. It emphasizes automated emergency alerts and traffic signal management.

Lee, H., Park, S., & Kim, K,[3], "Vital Signs Monitoring in Vehicle Accidents using IoT". This research focuses on integrating IoT-based heart rate and blood pressure monitors into the vehicle system to continuously monitor passengers' vital signs during accidents.

Garcia, L., Rodriguez, M., & Martinez, A,[4], "Enhanced Vehicle Safety through IoT-based Accident Detection". This study proposes a system using image processing techniques alongside sensor data for more accurate accident detection. It discusses the integration of vehicle telematics for detailed accident analysis.

Wang, Y., Liu, Z., & Zhang, Q,[5], "Traffic Signal Control using IoT in Accident Prone Zones". This paper explores a traffic signal management system that dynamically adjusts signals in accident-prone areas using IoT technology. It emphasizes reducing traffic congestion post-accident.

3 Existing Method

This research project uses automatic accident detection. It is made up of a sensor, GPS, and GSM unit installed in the car that locates the accident and transmits the location data to a primary server unit that holds the database for all the surrounding hospitals. When an ambulance is dispatched to the scene of the accident, it not only transports the patient to the hospital but also keeps an eye on critical indicators like temperature and pulse rate, sending the information to the appropriate hospital. In addition, via radio frequency transmission, traffic light signals in the ambulance's path would be controlled to give it a clear way. This will cut down on how long it takes the ambulance to get to the hospital. The three primary units of the system work together to coordinate and ensure that there is no delay in the ambulance's arrival at the hospital.

Thus, our system is divided into following four units:

1. The vehicle unit.
2. The ambulance unit.
3. The traffic junction unit.

ISSN (Online): 2583-7052

International Journal of Advanced Trends in Engineering and Management (IJATEM)
pp. 284-296

4. The control unit.

3.1. Existing System Block Diagram

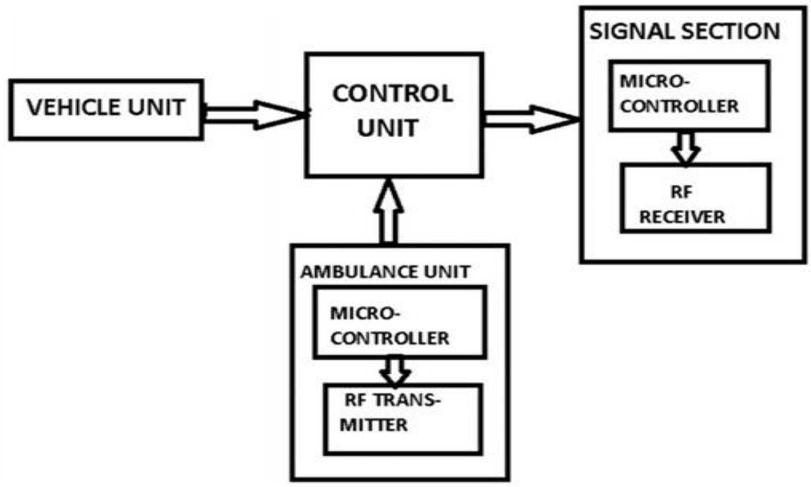

Figure 3.1: *Block diagram of the system*

4 Proposed Method

The proposed system operates on the premise of continuous sensor data collection within vehicles, utilizing advanced algorithms to detect anomalies indicative of accidents. These sensors, strategically positioned, detect abrupt changes in vehicle orientation, impact forces, and passenger vital signs. Upon accident detection, the system triggers an automatic alert, swiftly transmitting critical data accident location, vehicle details, and passenger health status to emergency services. Integral to this system is the fusion of IoT technology, enabling seamless communication between vehicles and a centralized cloud platform. This facilitates rapid data transmission and analysis, empowering emergency responders with real-time insights, optimizing rescue operations, and ensuring prompt medical aid. Moreover, the system integrates with traffic management systems, dynamically influencing traffic signal timings post-accident.

This helps prevent secondary accidents, streamline traffic flow, and prioritize the passage of emergency vehicles, enhancing overall road safety. The proposed IoT-Based Automatic Vehicle Accident Detection and Rescue System redefines road safety paradigms by amalgamating sensor technologies, IoT connectivity, and real-time analytics. Its seamless integration into vehicular ecosystems aims to revolutionize emergency response, reduce response times, and potentially save lives in critical situations.

When accident is occurs then the tilt sensor, which equipped with the in front of vehicle that is tilted. It forwards the massage to the Arduino nano board, Arduino UNO board is directly connected to the internet by using the wi-fi module. It shares the complete location near

International Journal of Advanced Trends in Engineering and Management (IJATEM)
pp. 284-296

ambulance using the GPS and at time automatically controlling the near traffic signals and made to green signal in the path of the ambulance by using IoT. when the traffic is clear in the path of ambulance to reach the accident spot in time and safe the victims life.

Proposed System Block Daigaram

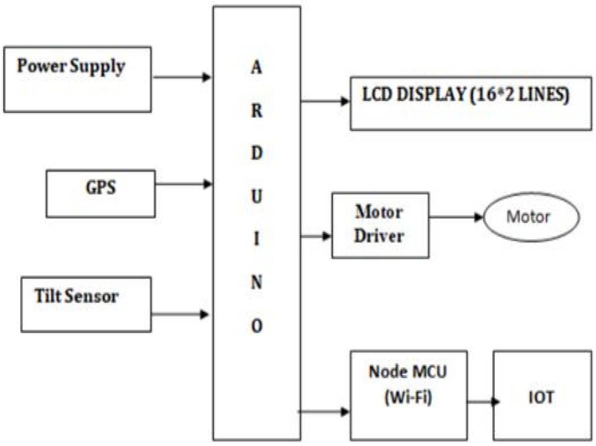

Figure 4.1: *Block diagram for vehicle unit*

5 System Discription

Proposed system consists of following sub blocks

A. Arduino Uno

An example of a microcontroller board using the ATmega328 is the Arduino Uno. It contains six distinct data sources, a 16 MHz beautiful resonator, a USB connection, a power connector, an ICSP header, an ICSP header, and a reset get in addition to 14 electrical data/yield pins, six of which can be used as PWM yields. It has all the anticipated components to support the microcontroller; all you need to do is connect it to a PC via USB or power it using an AC-to-DC adapter or battery to get started.

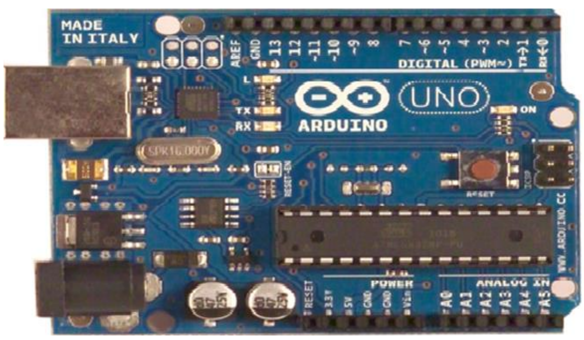

Figure a: *Arduino UNO*

ISSN (Online): 2583-7052

International Journal of Advanced Trends in Engineering and Management (IJATEM)
pp. 284-296

B. Node MCU Module

Based on the low-cost ESP8266 System-on-a-Chip (SoC), the Node MCU (Node Micro Controller Unit) is an open-source software and hardware development environment. Expressive Systems created and produced the ESP8266, which has the essential components of a computer, including a CPU, RAM, networking (Wi-Fi), and even a contemporary operating system and SDK. For Internet of Things (IoT) projects of all kinds, this makes it a great option. But the ESP8266 is equally difficult to access and use as a chip, For the most basic functions, like turning it on or sending a keystroke to the chip's "computer," you have to solder wires with the proper Analog voltage to its pins. It must also be programmed using low-level machine instructions that the chip's hardware can understand. Utilizing the ESP8266 as an embedded controller chip in mass-produced devices does not present an issue at this level of integration.

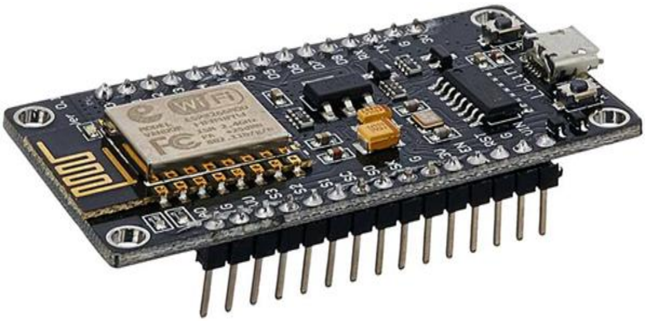

Figure b: *Node MCU module*

C. Tilt Sensor

Devices known as tilt sensors generate an electrical signal that changes in response to an angular movement. Within a constrained range of motion, these sensors are utilized to measure tilt and slope. Because inclinometers produce both a reading and a signal, they are sometimes confused with tilt sensors, which only produce a signal. These sensors are made up of a conductive plate underneath a rolling ball. The rolling ball touches the bottom of the sensor to create an electrical connection when the sensor receives power. The rolling ball does not hit the bottom when the sensor is tilted, preventing current from flowing to the sensor's two end terminals.

The rolling ball settles at the bottom of the sensor to create an electrical connection between the two end terminals of the sensor when the gadget is powered on and upright. The circuit then shorts out and the LED receives enough current. The circuit opens if the tilting of the circuit prevents the rolling ball from settling at the bottom of the sensor with the electrical conduction route. This relates to how the circuit operates.

International Journal of Advanced Trends in Engineering and Management (IJATEM)
pp. 284-296

Voltage supply: 3.3 V to 5 V TTL level output, Output that can be connected directly to the controller, Maximum output current: 15 mA; low voltage operation, Operating temperature maximum: 0°C to +80°C Simple interface and long life.

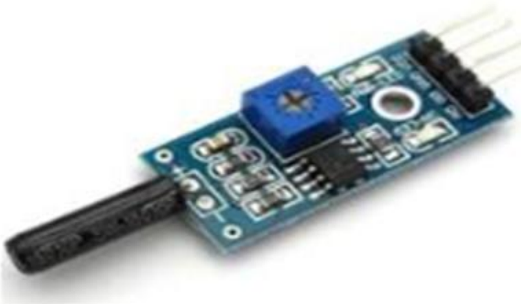

Figure c: *Tilt sensor*

D. DC Motor

DC motor transforms DC electrical power into mechanical power. It operates according to Lorentz Law. A DC motor's direction of motion can be either clockwise or counter clockwise, contingent upon the sign of the voltage applied between its terminals. The DC motor runs at 3000 RPM and can be operated between 3 and 9 V.

Motor Details

- DC motor of type 130 standard.
- Operating voltage ranges from 4.5V to 9V.
- The suggested/rated voltage is 6 volts.
- Maximum current with no load: 70mA
- Speed under no load: 9000 rpm.
- Loaded current: around 250 mA
- Recommended Load: 10g*cm.
- The motor measures 27.5 x 20 x 15 mm.

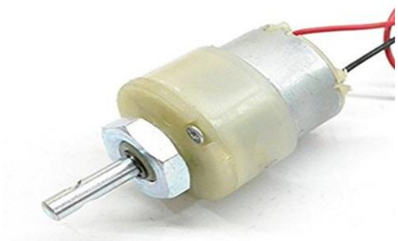

Figure d: *DC motor*

International Journal of Advanced Trends in Engineering and Management (IJATEM)
pp. 284-296

E. Motor Driver

An interface between the motors and the control circuits is provided by motor drivers. While the controller circuit operates on low current signals, the motor requires a large quantity of current. Hence, the purpose of motor drivers is to convert a low-current control signal into a higher-current signal that is capable of powering a motor. For an integrated circuit (IC) motor driver, bipolar stepper motor driver, H bridge motor driver, servo motor driver, DC motor driver, brushless motor driver, or any other circuit that might need a motor driver, Future Electronics offers a wide selection of programmable motor drivers from multiple chip manufacturers.

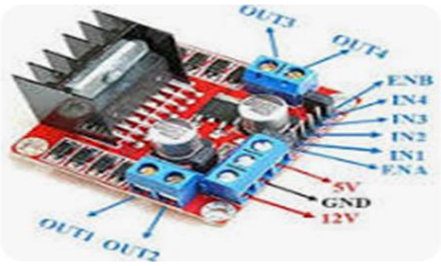

Figure e: *Motor driver*

F. Buzzer

A gadget used for audio signaling is a buzzer or beeper. It could be piezoelectric, electromechanical, or mechanical (piezo for short). Buzzers and beepers are commonly utilized in alarm systems, timers, and to verify user input, such as mouse clicks and keystrokes. A panic button is also included in the helmet's design. In the event of a disaster or other emergency, this button is utilized to alert other employees who are working on different floors of the large structure. Its main purpose is to promptly notify all other construction-related tasks in order to prevent major disasters. It's a tool for audio signaling.

Figure f: *Buzzer*

G. LCD Display

- The accompanying instructions and orders must be inserted into the capacity in order to install the LCD on the microcontroller.

International Journal of Advanced Trends in Engineering and Management (IJATEM)
pp. 284-296

- 8-bit information is implemented using 0×38.
- 0xFH is used to turn on the LCD and set the pointer.
- 0x6H is used to enhance the cursor, displaying an additional character on the LCD.
- 0x1H is used to clear the LCD.
- Information sent to the LCD: E=1; the empower stick should be high
- RS=1; register select should be high in order to write the data. Putting the data on the information registers
- R/W=0: To write the information, the read/write stick should be low.

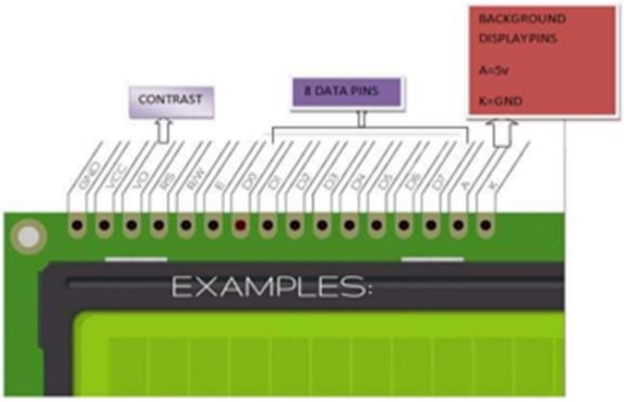

Figure g: *LCD Display*

H. GPS Module

GPS is available anywhere in the world, at all times, and in any weather. GPS satellites send signals to the planet from their twice-daily, extremely precise orbits. GPS receivers employ triangulation to determine the user's precise location based on this data. In essence, the GPS receiver matches the time a signal was received by the satellite with the time it was delivered by the satellite. For a GPS receiver to follow movement and determine a 2D position (latitude and longitude), it needs to be locked onto the signal of at least three satellites.

Figure h: *GPS module*

ISSN (Online): 2583-7052

International Journal of Advanced Trends in Engineering and Management (IJATEM)
pp. 284-296

Article Title: IoT Based Automatic Vehicle Accident Detection and Rescue System

6 Results and discussion

Case 1

Firstly, give power supply to the hardware kit then it starts moving. when the tilt sensor is clashes with an obstacle then it switched on and forward the information about that clash to the Arduino board. GPS sends the location where the clash/accident is happened to Arduino uno.it will transfer all the information to the Node MCU, then the Node MCU will control the traffic lights by using IoT, and also provides the exact information about the vehicle where the accident is happened.

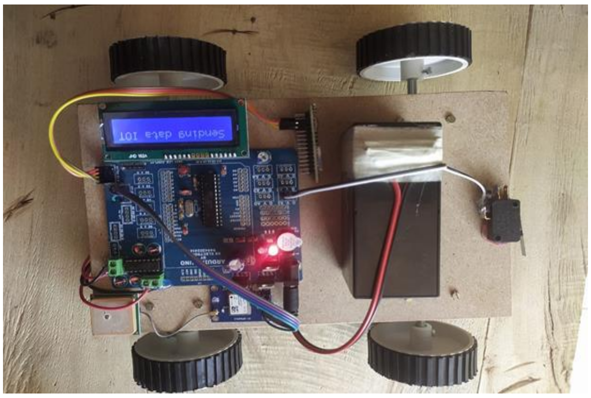

Figure 6.1: *Vehicle unit*

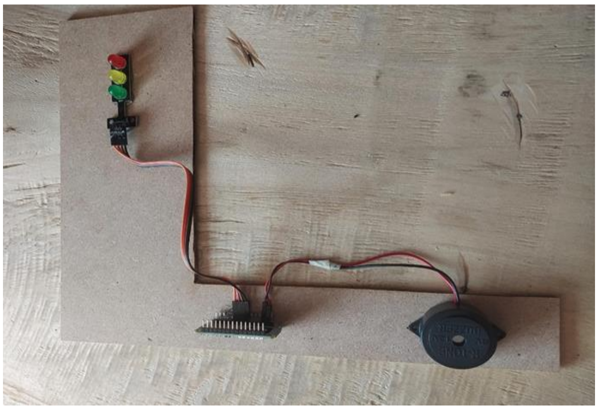

Figure 6.2: *Traffic control unit*

The entire program is uploaded on Ubidots. When the GPS shares the location to the WI-FI then the Ubidots will shows the complete information about the location of that particular accident was happened along with latitude and longitude.

- When the vehicle is started, at that time vehicle is travelling safely it showing the ubidots website along with latitude and longitude of the vehicle and show the status of the vehicle is safe.

International Journal of Advanced Trends in Engineering and Management (IJATEM)
pp. 284-296

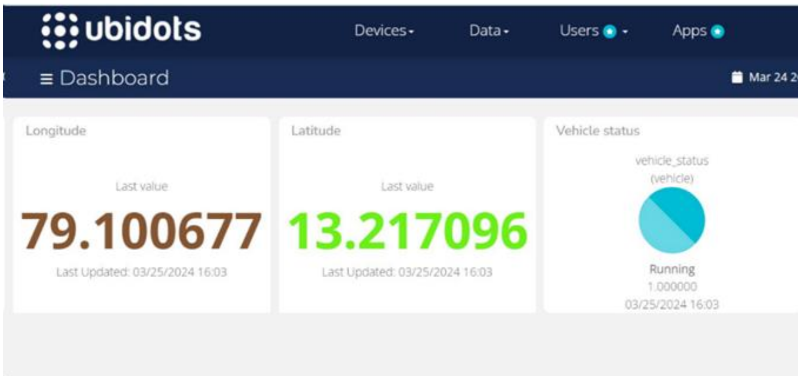

Figure 6.3: *Ubidots status vehicle running*

- When the accident is occur to the vehicle it is stopped, immediately update ubidots information about the latitude and longitude of the vehicle and its shows the vehicle not safe.

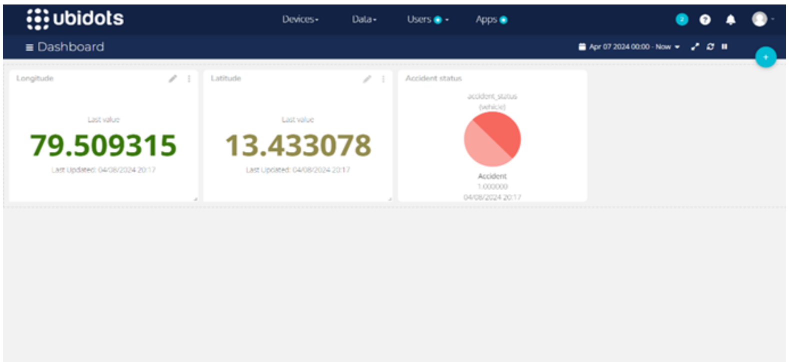

Figure 6.4: *Ubidots status vehicle stopped.*

Accident is occur immediately sends the information to near hospital or near ambulance and immediately safe the human life's.

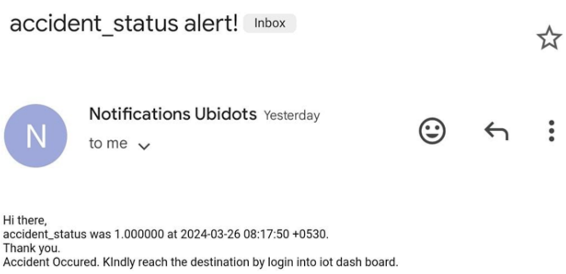

Figure 6.5: *mobile notification*

International Journal of Advanced Trends in Engineering and Management (IJATEM)
pp. 284-296

Case 2

Node MCU will control the traffic lights by sending about accident message then automatically green light will ON that indicates ambulance vehicles to go. It also send a message to the nearby hospital's from the accident spot.

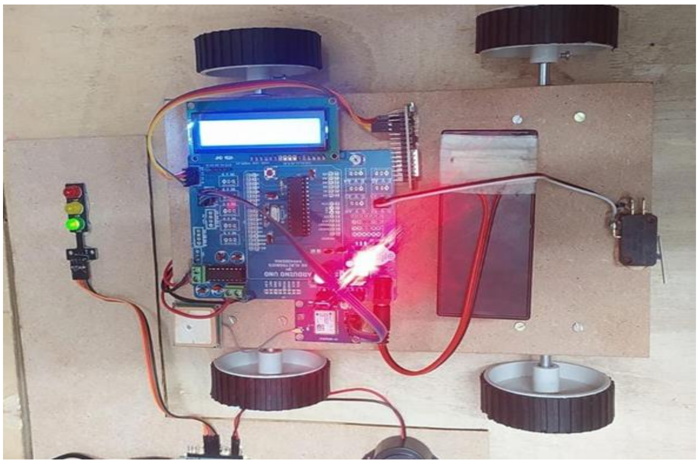

Figure 6.6: *Traffic control signal made to green*

7 Conclusion

A public auditing mechanism for cloud computing data storage security that protects privacy. We ensure that the TPA would not obtain any knowledge of the data content stored on the cloud server during the efficient auditing process by using random masking and the homomorphism linear authenticator. This relieves cloud users of the burden of having to perform the time-consuming and potentially costly auditing task and allays their concerns regarding the leakage of their outsourced data.

Future Scope

In order to improve efficiency, we plan to expand our privacy-preserving public auditing protocol into a multiuser environment. In this scenario, the TPA will be able to conduct several auditing tasks simultaneously.

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International Journal of Advanced Trends in Engineering and Management (IJATEM)
pp. 284-296

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