IOT-ENABLED ACCIDENT DETECTION AND RESCUE SYSTEM WITH LOCATION ALERTS

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ABSTRACT

Road accidents contribute to millions of deaths and injuries worldwide annually, posing significant concerns for public health. The timely intervention can significantly enhance the survival rate of accident victims. In addressing this, the paper introduces an Internet of Things (IoT)-based Automatic Accident Detection and Rescue System (AADRS), employing a range of sensors and communication technologies. The proposed system utilizes a vibration sensor to detect unexpected tremors and impacts, serving as indicators of a potential accident. Real-time vehicle location is determined through a GPS module. The Arduino Uno microcontroller processes sensor data and initiates communication protocols and safety measures. An LCD display visually represents the system status and any identified accidents. A safety switch ensures that the driver is wearing a seatbelt or helmet, contributing to the prevention of serious injuries. As a precautionary measure, the vehicle's engine is automatically turned off to avert unforeseen situations. A buzzer emits an audible alarm, notifying emergency services and individuals in the vicinity. Furthermore, the IoT module transmits accident details and emergency notifications to both emergency services and pre-registered contacts. This comprehensive approach aims to swiftly detect accidents, initiate rescue procedures, and disseminate critical information to relevant parties, thereby improving overall emergency response and reducing the severity of road accidents.

Keywords: Road accidents, public health, Internet of Things, Sensor data processing, Vibration Sensor, GPS module.

1. INTRODUCTION

The proposed IoT-based car accident detection system seeks to dramatically cut emergency response times. When the system senses serious accidents, it uses a vibration sensor to detect them. The Arduino Uno microcontroller then uses a GPS module to relay location data. An IoT module relays the exact location of the accident, enabling guardians and emergency personnel to respond right away. The GPS module, buzzer, vibration sensor, and display are important parts. Reliability is emphasized by calibrating the sensitivity of the vibration sensor and ensuring precise location tracking with high-precision GPS. Vehicle integration depends on power efficiency, which necessitates optimization to avoid excessive battery depletion. Security protocols adhere to privacy laws while protecting sent data.

Seamless integration with response protocols is ensured through collaboration with emergency services. Disaster responders can make decisions more quickly when using an interface that is easy to use. Thorough testing evaluates system dependability in a range of scenarios. Scalability is taken into account for prospective increases in vehicle coverage or geographic expansion. Initiatives to raise public awareness encourage broad adoption. Redundancy measures, such backup power supplies and communication lines, strengthen ongoing operations. Priority is given to regulatory compliance with local and federal emergency service and data communication laws. In order to increase the system's efficacy and dependability, it takes into account important factors including sensor accuracy, power efficiency, security, user interface, testing, scalability, public awareness, and regulatory complain.

2. LITERATURE SURVEY

Nobody can use your phone unless you open it with your own fingerprint. Because of this, we would like to apply this application for motorcycle due to the increased number of stolen motorcycle cases lately. This case is getting worst and it does not only happen to the moped bike, this case only happens at the superbike. But for the superbike, it is not so famous because stealing a superbike is not that easy like stealing a moped bike. This problem should not be neglected by the manufacturer of the bikes because it is about customer's money. They probably should be aware of what is wrong with their safety features and try to fix it immediately [2]. So, we are going with our idea which is making a fingerprint sensor for motorcycles. This fingerprint sensor will ignite your motorcycle and you will no longer use your key to start your motorcycle. This way is more convenient and modern like the technology that is already applied for the cars which is 'keyless entry'. If someone tries to break the sensor, an alarm sound will be produced to tell the nearby people that the bike is in danger. Hence, this way is better than the current safety features [3]. Other than that, an alarm will be triggered which is it can make the thief feels afraid and panic so your bike will be in safe hands. This project is to reduce the risk of losing bike that is increasing day by day. This problem giving trouble for bike's users for riding their bike anywhere. Thus, we are coming out with this idea so it will make riders more confident and feels safe. Moreover, older person usually might have problems when starting their bikes by using kick starter. With our project, that problem will be solved because they would no longer be using their kick starter but they will be using their own fingerprints [4]. Upgrade the safety system for motorcycles. To ease the operation for ignition motorcycles. Main objective was improving safety systems which already have at the bikes right now. Our project clearly safes because only owner or selected fingerprints that were programmed to start the bike. Other than that, our product will ease the older users when starting up their bike because they will only use their fingerprint instead their legs for the kick starter [5]. Biometrics is the use of measurable, biological characteristics such as fingerprints or iris patterns to identify a person to an electronic system. Once these measurements have been taken, they may be used to authenticate an individual or user. This is done by the sampled biometric against a template taken earlier. In Egypt, thousands of years ago, it was common for individuals to use physical traits or characteristics such as scars, eye, and hair color, height and etc to identify individuals for business transactions. Biometrics is a rapidly evolving technology that has been widely used in forensics such as criminal identification and prison security, and has the potential to be widely adopted in a very broad range [6]. Development of science and technology, especially in the field of electronics is marked by the rapid progress that occurred with the creation of electronic equipment [7]. Many advantages gained from the development of electronics, among them is the easier human beings in resolving a problem. Routine activities are now widely replaced by automatically designed equipment. Based on data obtained from the Central Statistical Agency of Indonesia and Operation Control Bureau can be seen that the crime of motorcycle theft every year is always increasing. One of the benefits of using fingerprint sensor is to minimize the crime of motorcycle theft that often happens in the community, due to turn on the motorcycle must go through the process of fingerprint recognition that is installed and reduce the anxiety of the community when driving vehicles in the shopping center [8]. Fingerprints are personal identities that could not be Osiris [9]. The characteristics owned by the fingerprint are Perennial nature. Some properties of the fingerprint are immutability, individuality, and originality. Immutability is a person's fingerprint will never change unless a condition such as a severe accident that changes existing fingerprint patterns. Individuality which means fingerprint has uniqueness and originality means does not be equal to anyone. This research designed a security system on the motorcycle replacing the stop contact function using fingerprint recognition registered on the fingerprint sensor [10]. Subhran and Venkata introduced the security system using the biometric fingerprint. The main objective of this

security system is to implement fingerprint recognition on the PXA27x DVK platform. In this article, the authors describe several types of fingerprint analysis. Features include a fingerprint pattern which were characteristic based on aggregate ridges which is a unique feature that is found in the pattern. These three basic patterns were a fingerprint ridge arches, loops, and circles. In addition, the fingerprint sensor was also been used by the author. Fingerprint sensor was intended for shooting digital images called scans fingerprint pattern streaming. This live scan, digital processed to create a biometric template which has stored and used for matching. The fingerprint sensor technology used were optical, ultrasonic, and capacitive. In this project the author uses Siemens ID Mouse. Siemens ID Mouse was a device that uses capacitive fingerprint reader USB2.0. PXA27x platform support for Linux kernel versions up to 2.6.9 bond, for drivers Siemens ID Mouse is available in several versions for example in version 2.6.10 and above [11]. S. R. Khan implemented the security system using password. To lock password-based microcontroller based, most of them used Peripheral Interface Controller (PIC) as microcontroller while there are also some implemented Atmel chip and FPGA. Electronic based key presented which was based on key low-cost PIC with simple designs 4x4 keypad used as an input and the relay was used as a key. Another key based password system named Office Access Control System (Khan, 2012). It is a low cost system that uses to block unauthorized persons to access in certain zones.PIC is used as a main controller and keypad 4x4 is available in the system. Generally, this system was a little bit different because it had an alarm function. Another similar electronic key also introduced (Muhammed, 2012). Just like the previous key, it uses a PIC microcontroller and keyboard as input 4x4.However, it had some additional functionality that the password can be reset and function of the backspace added. In addition, the system must be seamless as the software was approved without any bugs. FPGA-based electronic key has been introduced. He allegedly unreliable as a process carried out by hardware and easy to modify because it can accommodate the latest design into an FPGA without any hardware changes. The main disadvantage is that the price might be higher than other locks that used a microcontroller chip (Angang and Decai, 2011). In addition, Atmel based systems have multiple subsystems such as locking system, temperature control, lighting and fire detection system turns. In this project, a system used password authentication to receive input from the keyboard which was 9 considered locks. Lock was installed in the door where it was not visible from the outside, and this reduces the chance of damage by intruders.

3. EXISTING SYSTEM

In existing system everything is going in manual mode of operation and no automation. Due to that we have many limitations. Limitations of existing system are every time road accidents takes place; nearby residents must manually call the ambulance. Emergency responders must travel farther to reach the accident scene as a result. where many of such accidents can be taken care easily but some accidents occur during night time when the visibility is quite low, during such cases it will be difficult for an ambulance driver to identify the accident spot with the help of phone calls made by the citizens.

4. PROPOSED SYSTEM

Project work consists Arduino microcontroller, DC motor, Vibration Sensor, IoT module, LCD, Buzzer, safety switch, GPS sensor. GPS module is used to send live GPS location when vehicle met with an accident. Vibration Sensor is used alert when vehicle met with an accident, safety switch is used to ensure safety and prevent the driver from major injuries. Buzzer is used to locate the vehicle and rescue them. The DC motor acts as engine of the vehicle and turns off as per instruction of microcontroller after the vehicle met with accident. All the sensors are integrated to microcontroller and all alerts end to WSN IOT based server to store the data and respond in any emergency situations. The complete smart embedded real time automatic accident detection and rescue system is

implemented through 5v dc powers from regulated power supply. Arduino ide software based Embedded C programming use to design this prototype application of IOT vehicle accident detection and rescue system.

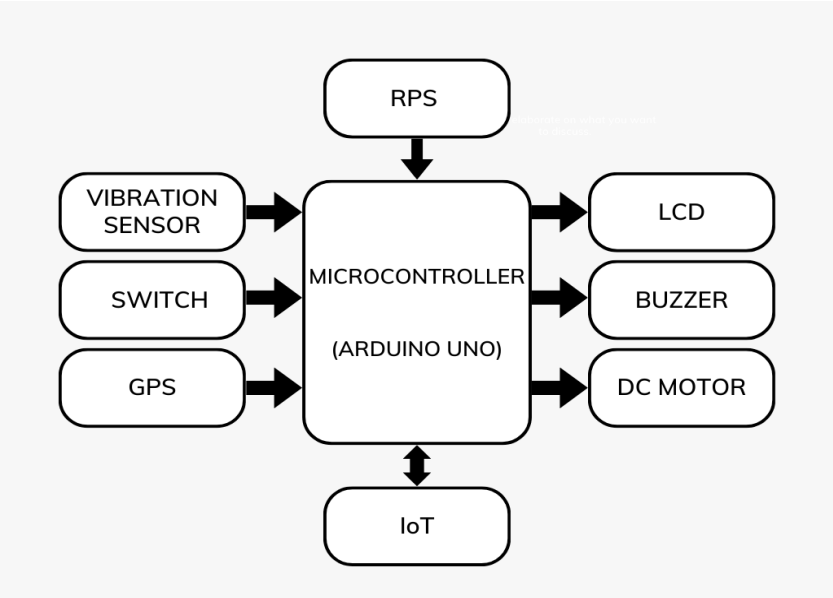

Fig. 1: Block diagram of proposed system.

SCHEMATIC DIAGRAM

This is the pin diagram where all the hardware components are been connected components. This ARDUINO microcontroller having 28 pins. In which 14 GPIO pins as digital pins and 6 GPIO pins. 16MHz crystal oscillator connected internally. The step-down transformer, Bridge rectifier capacitor with 1000f Resisters and led are connected in Regulated power supply which provide the 5v to the Arduino and all input/output modules. 16*2 LCD Monitor has connected with the Digital pins 2, 3, 4,5,6,7.

- WIFI has connected to Digital Pins D0, D1 internal Transmitter and receiver pins.
- Enroll and identify switches connected to A0, A1 pins of the Arduino micro controller.
- Vibration sensor connected to A3 pins of the Arduino micro controller.
- GPS connected to A4 pins of the Arduino micro controller.
- Switches connected to A5,13 pins of the Arduino micro controller
- DC motor connected to digital pin 8
- Buzzer connected to digital pin 9

WORKING

Accidents can occur for a variety of reasons, including drunk driving, fatigue, and driver irresponsibility. A safety switch that requires passengers to wear seatbelts or helmets is a crucial component in the event of an accident as it encourages adherence to fundamental safety procedures. The safety system is made to reduce the possibility of serious injuries occurring in the unfortunate case of an accident.

The moment an accident is detected, a buzzer serves as a visual signal, alerting nearby by standers and pedestrians to the situation. The GPS unit in the car records the exact location of the collision at the same time. These GPS coordinates are very important because they are what set off the automatic accident alert.

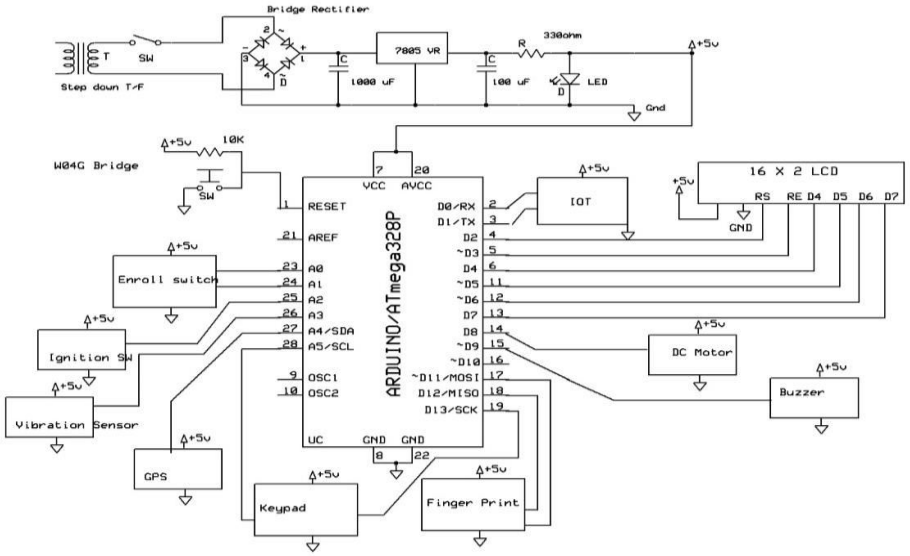

Fig. 2: Schematic diagram.

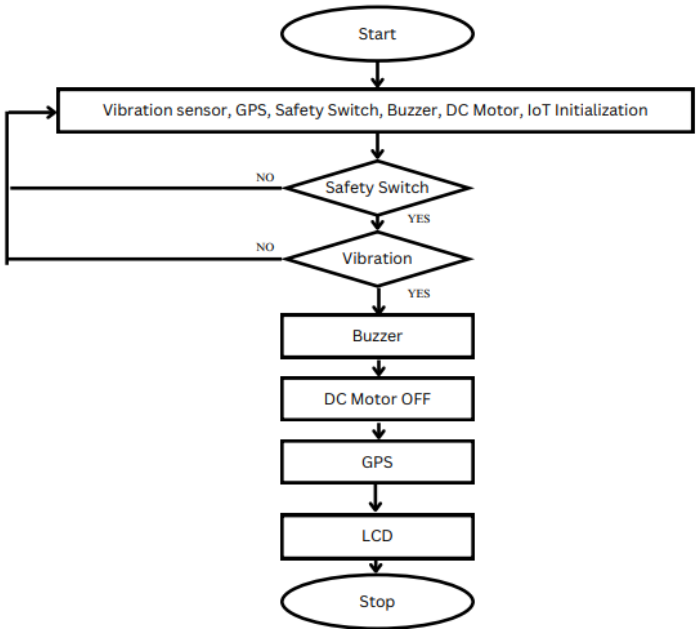

Fig. 3: Flow diagram

Emergency responders receive this signal from the system immediately, along with precise location information. This facilitates a prompt reaction, increasing the likelihood that the accident victims will receive assistance in a timely manner. Furthermore, the safety system goes above and beyond by integrating a proactive microcontroller. After an accident, the engine of the car is immediately turned off. By taking this preventative action, any unforeseen circumstances or issues that might result from driving the car after an accident are avoided.

5. HARDWARE IMPLEMENTATION

A variety of simulated accident scenarios were used to test an IoT-based automatic accident detection and rescue system. The system's ability to rapidly and accurately identify incidents demonstrated how effective it was at cutting down on the amount of time needed for emergency responses.

Important discoveries include:

* The vibration sensor precisely identified simulated accidents and detected abrupt changes in acceleration;

* The GPS module provided exact location information, enabling emergency services to arrive at the accident scene quickly;

* The safety switch activated injury prevention mechanisms within milliseconds of impact, providing critical protection for passengers.

The automatic alerts provided by the system made sure that emergency responders were notified right away, which could have prevented fatalities and allowed for quicker intervention. The prompt engine shutdown avoided more collisions or injuries brought on by the car's unstable handling.

All things considered; the system proved that it could greatly increase traffic safety as well as emergency response effectiveness. Promising solutions to lower accident-related fatalities and injuries are provided by the high accuracy, quick reaction times, and automated functionalities. Field testing and feedback from emergency responders will be used to assess how well the system performs in real-world scenarios.

The information gathered from the system's operation will be examined to find trends and enhance accident detection algorithms. The system will be further optimized to increase its efficacy and address any potential limitations by examining feedback and accident scenarios. This Internet of Things (IoT)-based accident detection and rescue system will be continuously evaluated and improved to foster a safer and more secure driving environment.

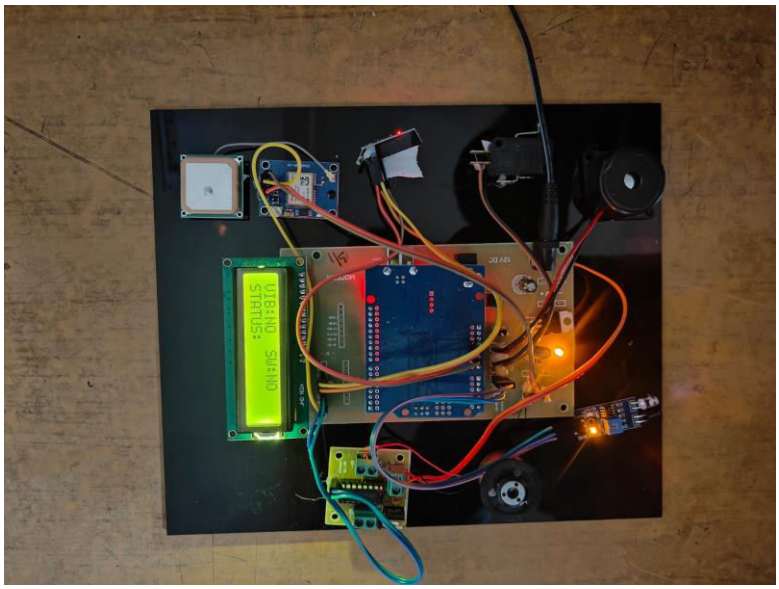

Fig. 4: IoT Based Automatic Accident Detection and Rescue System.

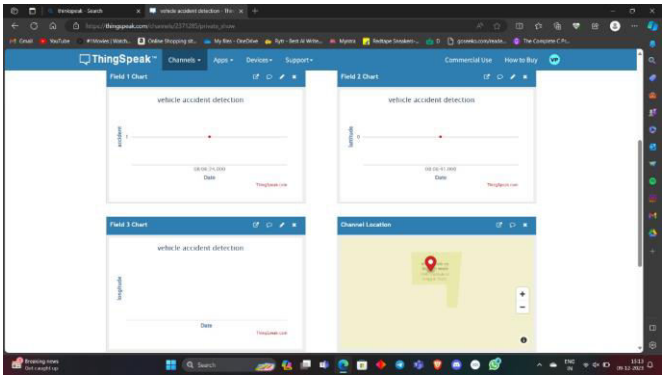

Fig. 5: Accident Detection

Fig. 6: Alerting rescuers over IoT

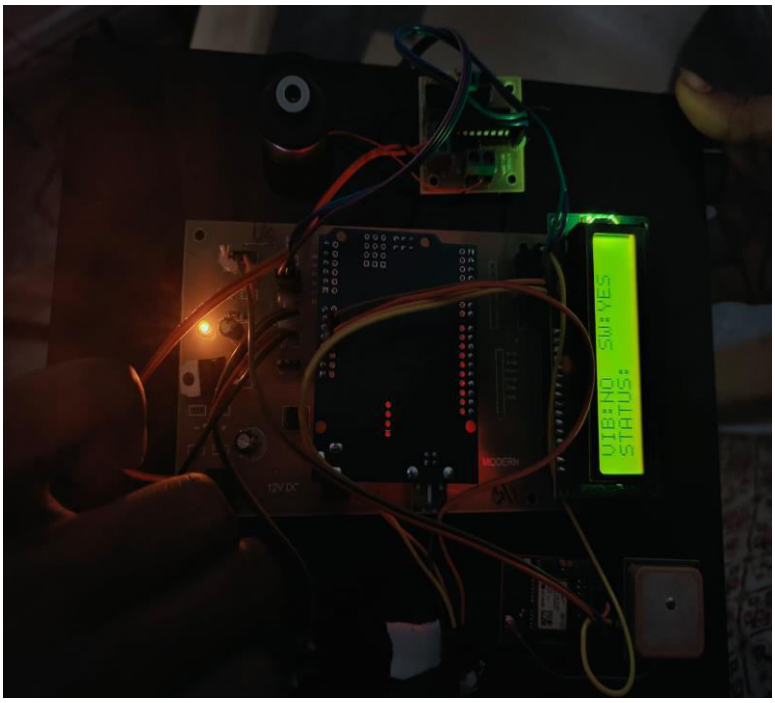

Fig. 7: IoT based automatic accident detection and rescue system in normal condition

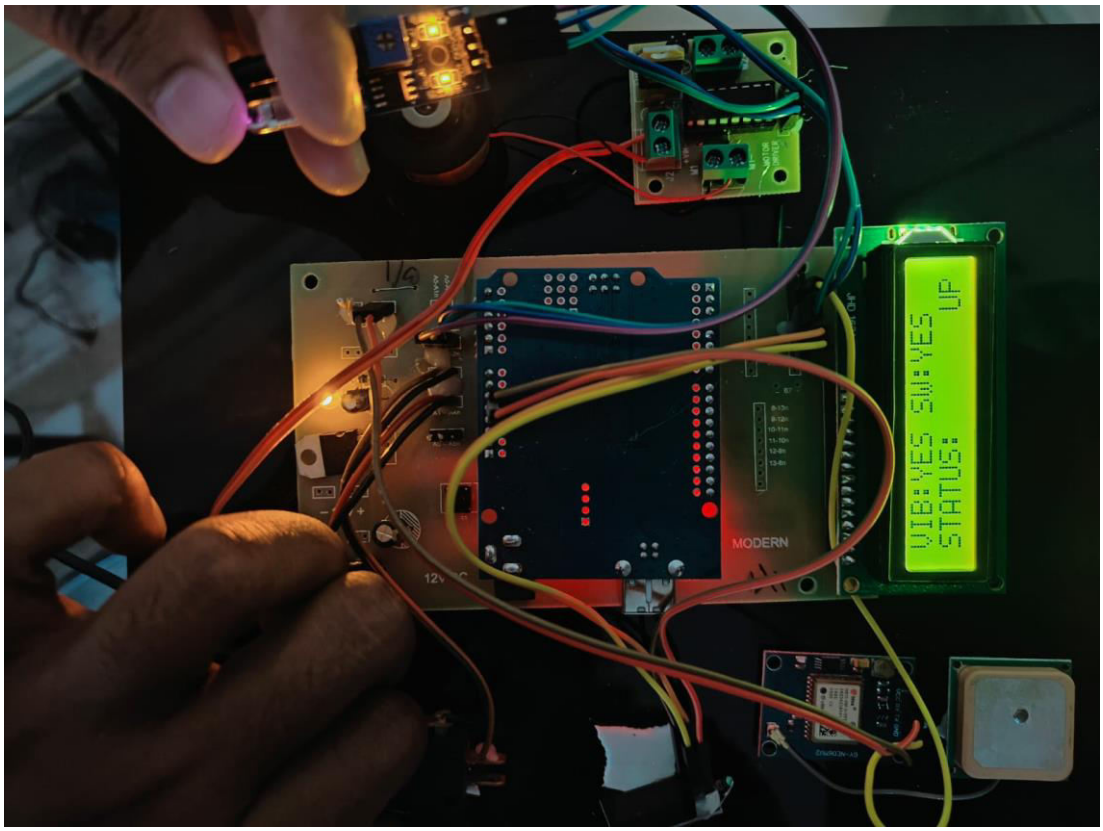

Fig. 8: Accident detection by vibration sensor

6. CONCLUSION

The safety switch will ensure the passengers to wear their seatbelts or helmets. In case if the vehicle met with accident the chances of major injuries will be reduced. When an accident is detected, the buzzer gets on to notify pedestrians and local people, the GPS in the vehicle records coordinates and the accident notification will be sent to responders and the closest ones with location such that they can respond within no time. The microcontroller also turns off the vehicle engine to avert unexpected events and we can rescue them immediately and save their lives.

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