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Accident prevention using IoT

Dr. E. Mohanraj B. E., M. E., Ph.D.
Associate Professor in K. S. Rangasamy College of Technology, K. S. Rangasamy College of Technology, Tiruchengode-637215, Namakkal District, TamilNadu, India

Dakshnamoorthy M.
Students of Computer Science and Engineering, K. S. Rangasamy College of Technology, Tiruchengode-637215, Namakkal District, TamilNadu, India

Karthikeyan S.
Students of Computer Science and Engineering, K. S. Rangasamy College of Technology, Tiruchengode-637215, Namakkal District, TamilNadu, India

***Abstract*---**Two sections were developed for this project: vehicle safety and automation systems. The first part of this project is to use the IoT to monitor highway accidents. The purpose of this project is to provide safety to drivers by requiring them to wear seat belts or helmets. This condition is vehicle-based, ignition will not start until the previous condition is met, and the surveillance section will be notified in the event of an accident on the highway. Accidents that occur on the highway can be monitored using a microcontroller, sensors connected to the main controller, accident detection circuits, and IoT. The project will be able to detect if the driver has consumed alcohol. If he consumes alcohol, the alcohol sensor in our project can detect the alcohol content and turn off the ignition to prevent accidents. Accidents can also be detected from the value of the vibration sensor. Whenever an accident occurs, the vibration sensor sends information to the microcontroller so that it can determine if an accident has occurred. All current status of the vehicle is sent to the Telegram application with the help of the bot. In this way, accident information and all current status is sent to users and stakeholders. The project also monitors and provides vehicle passenger safety guidelines. This project is enhanced with vehicle passenger panic switches that provide the safest ride for all users. This type of system has a variety of uses and can be used for other purposes, including: driving fully autonomous vehicles.

***Keywords*---** IoT, accident, microcontroller, driving fully, autonomous vehicles.

Introduction

In our daily lives, we face a huge number of road accidents. Demand for vehicles has increased significantly and accidents have increased. The proportion of road accidents is increasing exponentially, and the number of fatalities from accidents is increasing accordingly. Most accidents are caused by drunk driving and driving, but also by carelessness. However, the main cause of the increase in deaths is the delay of paramedics. Efficient rescue services can save many lives. Delays are caused by traffic jams or unstable communication with medical units.

Characteristics of the internet of things

IoT have a lot of characteristics. Let's discuss it one by one.

Connectivity

Connectivity is an important requirement of IoT infrastructure. IoT stuff needs to be connected to the IoT infrastructure. Anyone, anywhere, anytime can connect. This should always be guaranteed. For example, person-to-person connections through internet devices such as mobile phones and other devices, and connections between internet devices such as routers, gateways, and sensors.

Intelligence and identity

Extracting knowledge from the generated data is very important. For example, a sensor produces data, but that data is only useful if it is interpreted correctly. Every IoT device has a unique ID. This ID is useful for tracking devices and, in some cases, querying their status.

Scalability

People are using IoT everyday as a mandatory part of their life. Therefore, the IoT setup will be able to handle large scale extensions. The data generated is huge and needs to be processed properly.

Dynamic and self-adapting (complexity)

IoT devices need to dynamically adapt to changing contexts and scenarios. Imagine a surveillance camera. You need to be able to adapt to work in different conditions and different light conditions (morning, afternoon, night).

Architecture

The IoT architecture cannot be the same. To work in an IoT network, it is hybrid and needs to support products from different manufacturers. IoT does not belong to the engineering branch. The IoT becomes a reality when multiple domains come together.

Safety

If all devices are connected to the Internet, there is a risk that your sensitive personal information will be compromised. This can result in loss for the user. Therefore, data security is the biggest challenge. In addition, the required equipment is enormous. IoT networks can also be at risk. Therefore, device security is also important.

Problem Statements
Drunk and drive accidents

According to madd, the number of deaths from drunk driving in 2015 fell by 8.5% after Texas passed the Ignition Interlock Act. However, this problem still caused 1,323 deaths during the year 2015. That's 38 percent of all road fatalities. Surviving victims often suffer catastrophic injuries such as: B. Traumatic brain injury, back and spine injury, paralysis and internal organ injury. Drunk driving has been prosecuted and is responsible for compensating for the victims, but some continue to drive. A drunk driver can be drowsy or fall asleep while driving and have a head-on collision with an oncoming vehicle. In addition, alcohol reduces one's ability to see, understand traffic signs and traffic lights, and understand the behavior of other drivers, making this type of accident likely. The ability of the person to judge the distance is impaired, and the reaction time when drunk is slowed down. This can mean that if another driver slows down or stops immediately in front of him, he will not be able to react quickly enough. He may also mistakenly believe that he can slow down safely and stop when he can't. Drunk drivers with impaired vision may not be able to see pedestrians, especially at night when the victim suffers catastrophic injury or death. Drunk drivers may not be aware that they are driving in the wrong direction at a one-way or highway doorway because they cannot read and understand the road signs correctly.

Seatbelt necessity

If passengers are not fastened to their seat belts, three types of collisions will occur. The first collision involves the vehicle and another object, the second collision occurs between the person in the car and the inside of the car, and the third collision occurs when the internal organs of the body collide with the human skeletal structure or chest wall. To do. Injuries are caused by the last two forms of collision caused by inertia. Inertia is a tendency for an object to retain momentum, but a moving object will continue to move at the same velocity and direction unless an external force acts on it. For example, if the car brakes suddenly, the occupants will continue to move at the same speed that the car was previously moving. When this happens, the seat belt acts as an external force and does not act as a dashboard or windshield if the properties are limited.

The seat belt is specially designed to protect the occupant from harmful movements by applying braking force to the more durable parts of the body, reducing the possibility of injury or death. Originally invented by George Cayley in the 19th century, many engineers modified and improved Cayley's original design. The three-point seatbelt design, pioneered by Nils Bohlin in 1959, still functions as a standard vehicle safety feature. This seatbelt consists of a lap belt and a

shoulder belt that transfers braking force to the chest and pelvis and distributes the kinetic energy of the impact over a large area of the body. Seat belts reduce the potential and severity of all injuries and limit vehicle emissions. Modern seat belts are also designed as an important element of the larger injury prevention mechanism, and airbags and headrests are most effective when used in combination with seat belts. Surprisingly, the effectiveness of seat belts is well known, but an average of 5% of the 37 million drivers in the UK do not buckle each year. This percentage may seem trivial, but it represents an astonishing 1.85 million drivers without seatbelts, putting themselves and other car occupants at great risk. According to current data, about 1,400 Britons die each year in the car, of which an estimated 400 were not wearing seat belts at the time of the collision.

Delay in helpline

In the event of a traffic accident, a police correspondent or switchboard 108 usually receives the first call. If the caller reports an injury, the Rescue Control Center will be notified immediately. However, if the caller is not confident of being injured, the operator can wait. In most cases, you don't need an ambulance. However, in about 20% of fatal road accidents in Missouri, waiting for confirmation of need delayed ambulance dispatch by more than five minutes.

Related Work

Muazzam A. Khan Khattak et al.., proposed that, Due to heavy growth of world human population, the demand for two wheelers and four wheelers has increased tremendously, resulting problems of traffic delays and road accidents has also increased. The general human population's life is in high risk, if any accident occurs in the highways, there's a long delay time which increments the number of fatalities, therefore an automatic accident detection system must exist to overcome this situation. Data show that the main cause of death by injury is road accidents. There can be multiple causes of road accidents, some of them are, driver negligence due to drowsiness, driving while intoxicated, over speeding, etc. Some data show that the weather conditions can also be a reason towards the cause of an accident such as fog, rain. High winds can directly change the direction of the two-wheeler which may deviate it from road, or it can change the path of the vehicle due to obstruction dangers present on the roads such as trees, walls etc.,

In this approach, data is obtained from various sensors and event logs to extract prominent features for collision detection model. Various super smart models are used to detect accidents. These models include nearest neighbor, neural networks and regression trees. Vehicle behaviors can be analysed given its position and velocity values, and can be helpful in the detection of accidents. To detect an accident happening on the road or highway different ML algorithms like Support Vector Machine (SVM), Artificial Neural Network (ANN) and Random Forests (RF) are implemented. ML techniques can also be utilized to determine the severity of accident. Different means of fetching real time data like velocity which is obtained by means of vibration sensors installed in vehicle and distance which is obtained by means of ultrasonic sensors.

Accidents can also be detected by pre-trained surveillance cameras installed on the highways, as illustrated. Another machine learning approach uses fuzzy logic. Number of vehicles in each lane, speed of cars in particular lanes etc. is collected and then decisions are made accordingly. In this technique, a situation is detected as an accident whenever there's some sort of disturbance in surrounding lanes. Many systems focused on taking preventive measures, along with detection to avoid accidents such as controlling the speed, checking driver license etc. Various approaches have been used for this such as smartphones, VANETs, vibration sensors, pressure sensors, GPS, GSM and various machine learning algorithms. Even though there is literature available on various strategies for accident detection and prevention; however, no comprehensive survey exists. This paper aims to fill this gap by critically reviewing the literature related to accident detection, prevention, and reporting systems, to provide a broader perspective of existing techniques so that effective systems can be developed that can utilize the strengths while addressing the challenges in the current systems.

Proposed Method

The first section of this project is to avoid accidents caused by driver carelessness. Alcohol detection in vehicles is allowed up to certain driver levels. When the driver consumes a lot, the ignition of the vehicle is turned off. The project also monitors and provides vehicle passenger safety guidelines. Monitoring of highway accidents by IOT using vibration sensors. The purpose of this project is to notify the surveillance section in the event of an accident on the highway and provide the fastest helpline. Accidents that occur on the highway can be monitored using microcontrollers, accident detection circuits, and IoT. Accident information is sent to the application. This type of system has a variety of uses and can be used for other purposes, including: B. For driving fully autonomous vehicles.

Components
D1 Mini V2 Node MCU

The D1 Mini is a great board for developing Wi-Fi-based IoT projects. This board acts as the main controller for the entire unit that processes data between the various components. The popular ESP8266 module is used for IoT operation. Easy to program via USB, no additional programming required. The board is based on an Arduino with an integrated ESP8266 Wi-Fi module. The ESP8266 Wi-Fi module is a standalone SoC with an embedded TCP / IP protocol stack that can provide access to a Wi-Fi network (or the device can act as an access point). A useful feature of Uno Wi-Fi is support for OTA (wireless) programming for transferring Arduino sketches or Wi-Fi firmware.

Alcohol Sensor

The alcohol sensor detects the presence of alcohol gas in the air and outputs an analog voltage. The sensor can be activated at temperatures in the range of 10-50 ° C with a power supply of less than 150 Ma to 5 V. The detection range is 0.04mg / L to 4mg / L, which is suitable for detectors.

LCD Display

LCD is an abbreviation for Liquid Crystal Display. This is an output device with a limited viewing angle. We chose LCD as the output device because of its high cost of consumption and the superior alphabet compared to the 7-segment LED display.

Vibration Sensor

A vibration sensor is a device that measures the amount and frequency of vibration of a particular system, machine, or device. These measurements can be used to detect particular imbalances and other problems and predict future failures.

Relay Switch

The KY019 relay module is used to control the AC circuit. The relay acts as a switch that responds to the signal received from the Arduino. It has a built-in LED that indicates whether the signal is high or low.

Limit Switch

Limit switches can be used to control a machine as part of a control system, as a safety interlock, or as a counter to enumerate objects passing through a point. Limit switches are used in a variety of applications and environments due to their robustness, ease of installation, and operational reliability. You can determine the existence, passage, position, and end of movement of an object. They were first used to define limits on the movement of objects, hence the name "limit switch".

Block Diagram

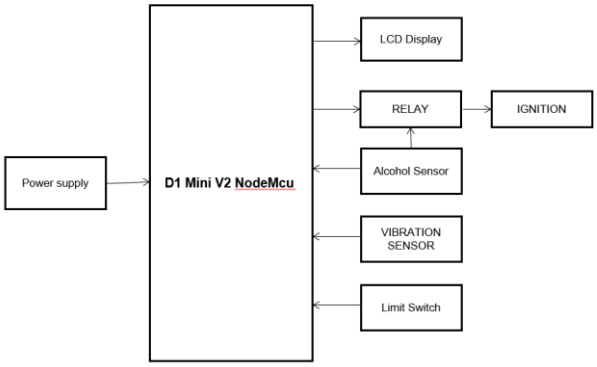

Fig 1.1 Block Diagram

Advantages of proposed system
Power consumption

Using the D1 Mini V2 Node MCU, both the microcontroller and Wi-Fi are in the same module, so the proposed one can consume significantly less power compared to previous studies, and the processing and power consumption is very high. It will be smaller.

Network connection

In their previous work, they used GSM modules for communication purposes. This is another module, which consumes power compared to the proposed work. In this proposed method, the connection is made via the D1 MiniV2 Node MCU, which includes Wi-Fi functionality. You can use it to connect to your mobile device or another Wi-Fi network, making it easier to connect.

Alerts sending

In the previous work, the notification was sent by email or SMS via the cloud service. Cloud services are very expensive and have to be paid repeatedly. In the suggested work, I used the Telegram application to send an alert. This application is free and is used by most people in India around the world. Telegram has created a bot that requires users to join this bot in order to get it. This saves a lot of money and resources compared to the previous work.

Data flow diagram

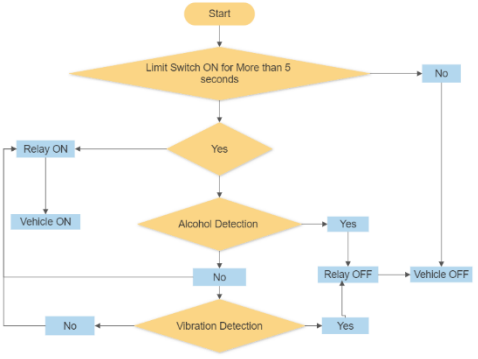

Fig. 2.1 Data Flow Diagram

Working

This IOT accident prevention is a small IOT device that can be mounted on any vehicle such as motorcycles and four-wheeled vehicles. The device can be powered by a micro- USB cable that is widely used to charge mobile phones. The first section of this project is to avoid accidents caused by driver carelessness.

Fig. 3.1 Starting of the Device

After launching the device, the driver is first required to wear a helmet or seat belt to ensure the driver's safety. This will prevent accidents before they occur. When the helmet and seatbelts are ready after 5 seconds, the microcontroller activates the ignition and this relay switch manages the ignition from the microcontroller. The device is now active.

Fig. 3.2 After the Seatbelt condition

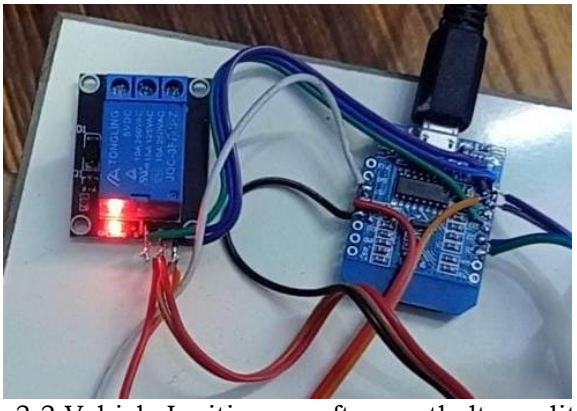

Fig. 3.3 Vehicle Ignition on after seatbelt condition

The next step in monitoring is behaviour-based assessment. The alcohol sensor is located near the vehicle's steering wheel or mouth, allowing the device to record alcohol consumption by the driver. If the driver is already drinking, the alcohol

sensor sends data about alcohol intensity to the microcontroller. When drinking is detected, the relay switch turns off and the vehicle cannot start. This reading is continuously captured by the alcohol sensor, so the relay will automatically turn on when the alcohol in the sensor becomes less intense.

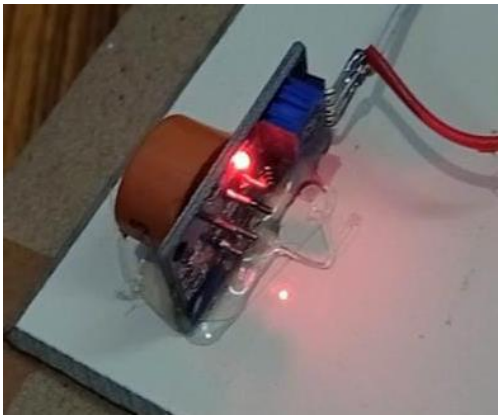

Fig. 3.4 Alcohol Sensor before Detection

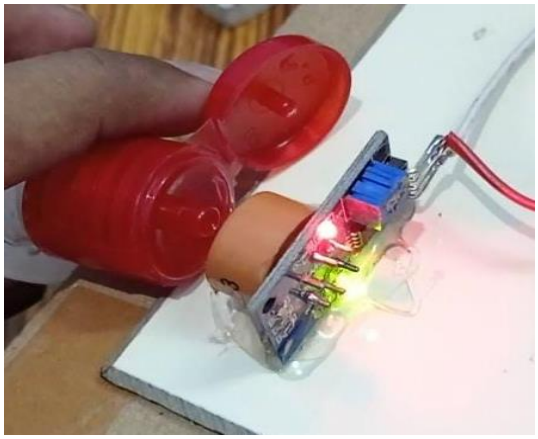

Fig. 3.5 Alcohol Sensor after Detection

The next sensor is a vibration sensor. This works after an accident. Whenever an accident occurs in that particular vehicle, the vibration sensor receives a particular vibration frequency from that vehicle. Frequently, the device will send a telegram annotated notification that an accident has been detected.

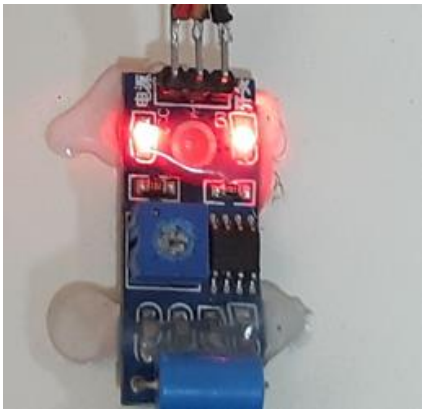

Fig. 3.6 Vibration sensor detecting vibration

Fig. 3.7 Accident detection using vibration sensor

Conclusion

This device is portable and can be mounted on any vehicle. It can be used in real-time security systems. Later, the entire circuit can be implemented in a small module. Security system with low power consumption. This safety system technology can be further improved in the car and by replacing the helmet with a seatbelt. Self-driving cars can be used in industry. The industry can use it to develop self-driving cars that can be implemented in some features such as autopilot.

Future Enhancement

Future work will include communicating the location of the accident to the nearest helpline or emergency contact so that the victim can be rescued as soon as possible. This project can be carried out in the automotive industry, where autopilot vehicles will be manufactured in the future. The LDR can be a component with a (variable) resistance that changes depending on the intensity of the sun that hits it. This allows it to be used in photodetection circuits. Since the LDR sensor is located at the front of the vehicle, it actively monitors the intensity of the headlights of other vehicles. Whenever an alternative vehicle crosses a strong light beam, the LDR sensor detects the intensity of that light. If the intensity is too high, the headlights will switch to the beam so that after overtaking, the alternative driver will have a clear view of the road and the

headlights will be lit. In this way, this device not only prevents our vehicle from colliding, but also prevents another vehicle from colliding.

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