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VEHICLE SAFETY, SECURITY MONITORING AND TRACKING DEVICE USING ARDUINO

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Abstract - *The number of fatalities resulting from traffic accidents is rising daily. The primary causes of such accidents include failing to follow traffic regulations, failing to use seat belts, failing to wear a helmet, etc. In order to prevent such situations, we developed an IOT gadget that will assess if the user is taking safety precautions or not. The key circuit for the car is controlled by relays, and the relays are controlled by the node MCU board. If it is determined that the person is not following, the device will prevent them from starting their vehicle. As a microcontroller, the node mcu was used in the design of this device. The microcontroller board was programmed to be able to detect whether or not the user is taking safety precautions and to allow the relay to turn on or off the vehicle depending on the situation. The gadget includes sensors including a pressure sensor to verify seatbelt use, an IR sensor to look for accidents, and a gas sensor to look for alcohol. The accuracy of our algorithm in identifying people wearing seatbelts is 97%. In the event of an accident, this device's GPS and GSM module may be used to communicate the position of the car with the saved contacts.*

Keywords— Design, Analysis, IOT, Pressure sensor, Alcohol Sensor, Node MCU,

1. Introduction

1.1 General

The World Health Organisation (WHO) claims that India is particularly prone to road accidents, the majority of which involve four-wheelers. Therefore, we developed a rider safety measure using nodemcu as a means of providing safety and security for riders. a gadget that verifies if seatbelts are being used properly and other safety measures. According to the Transportation Research & Injury Prevention Program's report, "Road Safety in India Status Report 2020," the number of motorised four-wheeler (M.F.W.) owners is rising daily, which causes high traffic and accidents on the roads. In India, there were 3,54,796 traffic accidents in 2020, with 1,33,201 fatalities. Of these, 29.82% of fatalities were caused by persons not wearing seatbelts.

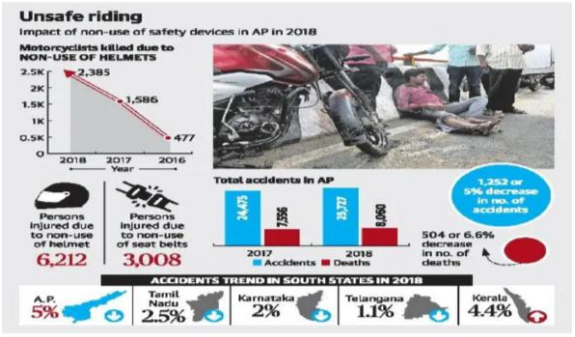

Fig-1: The Hindu Article depicting survey of road accidents

The primary causes of these incidents were:

Excessive speeding, Failure to utilise seat belts and helmets, Driving on the wrong side of the road, Driving when tired, and Distracted driving all contribute to traffic accidents. One-third of the fatalities were two-wheelers. Luxury vehicles and passenger buses frequently have several safety systems built right into them. Such vehicles are designed using a variety of sensors, electronic control units (ECUs), communication protocols, and stringent testing. Trucks and lorries, which are essential to logistical services, do not, however, have access to the same on-board navigational and safety systems. It goes without saying that trucks and lorries are useful for moving products.

Even though most people don't adhere to these laws and regulations, the Indian government has created several awareness campaigns and legislation to make seatbelt use a requirement for users of four-wheeled vehicles. Thus, we developed a prototype IOT-based device to encourage people to use seatbelts, refrain from driving while intoxicated or fatigued, and avoid distracted driving.

Carelessness is a big factor in why we don't follow safety procedures. To solve this, we created an automated gadget that checks if a person is wearing a seatbelt. If the user is wearing a seatbelt, the gadget will enable him to turn on his car; but, if he is not, the device will prevent him from doing so glow an red LED as a warning to the rider which will remind them to wear it.

1.2 Motivation

Even though the government continually begs us to comply by increasing fines and penalties, we continue to ignore the traffic laws for a variety of reasons. Our daily stress is a big contributor to our carelessness; a poll found that 40% of people were too busy with their hectic schedules to even consider wearing helmets.

We cannot forecast when accidents will occur or what will happen next, thus it is our only obligation to rescue oneself in every circumstance. And 30% of individuals were avoiding helmets and seatbelts since they were travelling shorter distance (for example, going to the store, etc.

This is what motivated us to design a device which will allow the person to ride vehicle only if he wears seatbelt, so the people who fails to do will be reminded as well as those who travelling smaller distances will also mandatorily wear seatbelts. Hence we can save lives by implementing this device on every motor vehicle.

1.3 Literature Review

By researching about this model, what we have found is, most of the authors preferred using IR sensors and Vibration sensors for accident detection and Here IR sensors are implemented in the device to detect accidents and Gas sensor is used to detect alcohol by analyzing driver's breath so if a person fails in any of the cases vehicle wont operate. The device is designed in such a way that it consists of vibration sensors so if the rider met with any accident the vibration sensor will sense the situation then the controller will get information from geo positioning system and the location of the rider will be delivered to nearby hospitals and ambulance services. A micro electromechanical sensor is placed near the handle bar of the sensor which will notify the speed of the vehicle to preferred contacts and it will be useful to avoid rash driving.

1.4 AIM

The goal of this research is to address the problems that lead to deadly collisions while simultaneously including safety precautions. It is inconceivable to fathom life without transportation since it makes distant locations accessible and drastically cuts down on travel time. However, it is impossible to ignore the issues brought on by the growing number of vehicles on the road. The initiative seeks to both eliminate some of the main causes of auto accidents and incorporate post-crash safety measures. The causes of car accidents that are the focus of this study are: A casual attitude towards the usage of seat belts; Drunk driving; Driving while distracted.

The project's post-accident measure includes:

- Notifying loved ones about the accident and its location

1.5 Objectives

The following objectives of the proposed project are set:

- Only turn on the ignition if the seatbelts are fastened.
- Use a gas sensor to check the driver's sobriety. Only when the driver is sober will the engine start.
- The car has eye-blink sensors installed to make sure the driver is not asleep.
- In order to avoid a collision, a proximity sensor is used to identify the obstruction in the road in front of the car.
- An alarm system that uses a GPS system to determine the crash site's position and sends the information to a responsible and authorised person is used to assure post-crash safety. An accident is discovered using a vibration sensor.

2. Proposed Model

2.1 Block Diagram

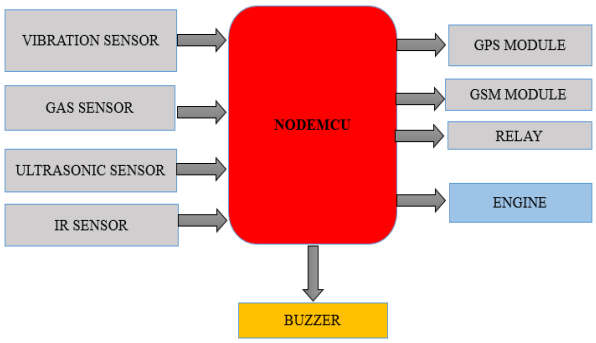

Fig -2: Block Diagram of the proposed model

The proposed model will be embedded in the car and once the driver starts the vehicle's engine the microcontroller board will start functioning according to the program. Then the functioning of the controller board is as follows,

1. When the car is started, the pressure sensor will determine if the driver is wearing a seatbelt or not. If not, a relay attached to a switching circuit will turn off the car.
2. After that, the system will determine whether or not the driver has consumed alcohol. When the gas

sensor detects that the driver is intoxicated, the relay will cut off the engine. The second process is going to be this.

3. The car will be ready to go if the driver is confirmed to be real.
4. If the driver's eyes are found to be closed, the eye blink sensor on the spectacles will alert the driver.
5. The buzzer will sound an alarm after 8 seconds to wake up the driver.
6. The IR sensor will be put on the vehicle so that it may transmit data to the controller in the event of an accident. To notify stored contacts and local hospitals for emergency care, the vehicle's position will then be communicated. The controller board's internal GPS and GSM modules will handle this operation.
7. If any obstructions are detected as the vehicle approaches them, the IR sensor will alert the controller. In worst-case scenarios, the controller will slow down or even stop the vehicle.

2.2 Prototype working

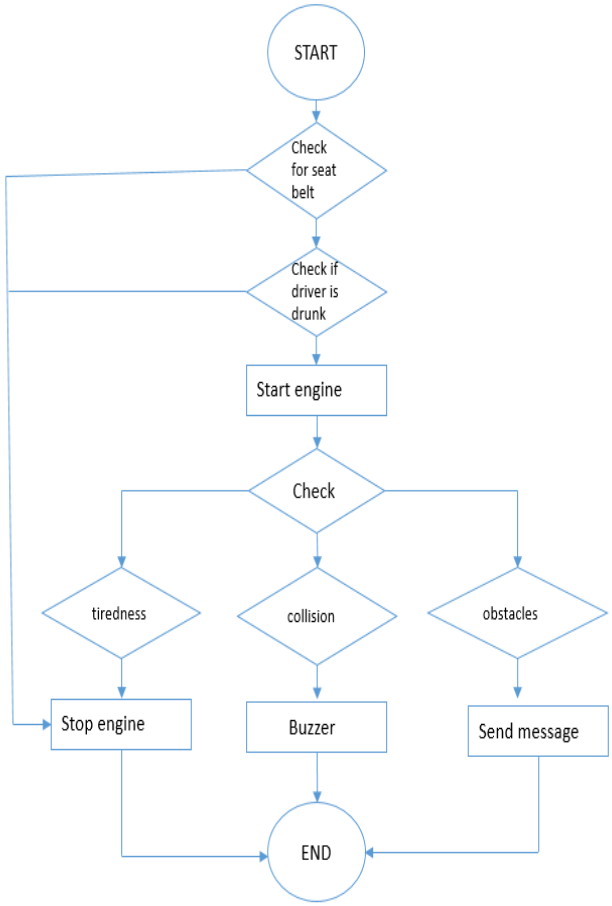

Fig -3: Flow Chart shows working of the prototype

2.3 Problems to Overcome

The following essential functional criteria must be met for this project's aim to be achieved:

1. The automotive system must be able to identify whether the driver is wearing a seat belt or not.
2. The technology that is used should be able to tell whether or not the driver has ingested alcohol.
3. The car's computer system need to be able to tell whether the driver is feeling drowsy by assessing his mental alertness.
4. The auto system must be able to determine whether the car is approaching the car in front too closely.
5. The car's computer system should be able to tell if an accident has already happened and, if so, should be able to use GSM technology to relay the accident's position coordinates to the appropriate party. This project deals with problems which cause accidents and attempts to ensure safety.
6. The system should not be harmed by external factors.
7. The framework has to be able to clearly identify and find issues with the components.
8. The system should be informed of the problem found. To help us understand how the product will be implemented, the assumptions and dependencies are set right from the start.
9. A suitable GPS module is required to offer precise geographic position coordinates.
10. Numerous proximity sensors should be strategically placed and linked to the Internet at all times.

3.Components

3.1 Arduino Board

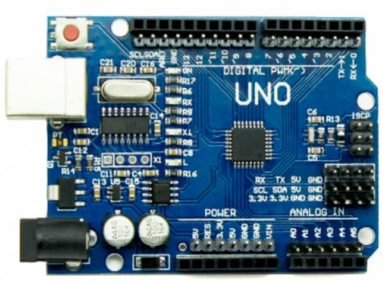

Fig -4: Arduino Board

Arduino is an open-source electronics platform designed to make it easy for hobbyists, students, and professionals to create a wide range of electronic projects.

The platform consists of both hardware and software components that work together to allow users to create interactive electronic devices and prototypes.

1. Hardware: Arduino boards consist of microcontrollers that act as the brains of the device. They are designed to be easy to use and can be connected to a wide range of sensors, actuators, and other electronic components.

2. Software: Arduino's software environment consists of an Integrated Development Environment (IDE) that provides a simple and intuitive way to write code and upload it to the board. The IDE supports a C/C++ programming language, and there are many libraries available that make it easy to work with different electronic components.

3.2 Vibration sensor

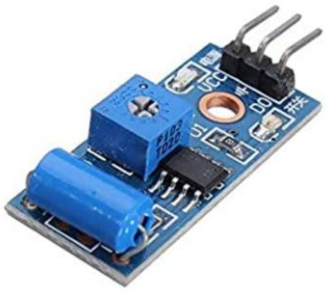

Fig -5: Vibration sensor

This idea makes use of a vibration sensor to detect vehicle collisions and accidents. The Arduino Uno board's microprocessor receives this information from the sensor and uses it to produce a specified output.

A non-directional vibration sensor with great sensitivity is the Grove - Vibration Sensor (SW-420). The circuit is activated and the output is high when the module is stable. The circuit will momentarily be interrupted and the output will be low when the movement or vibration takes place. Additionally, you can change the sensitivity to suit your needs at the same time. Overall, this module is ideal for vibration or tilt sensors.

3.3 Gas Sensor

Fig -6: Gas sensor

Electronic devices called gas sensors (sometimes referred to as gas detectors) are used to locate and classify various gases. They are frequently employed to gauge gas concentrations and identify explosive or dangerous gases. Gas sensors are used in industrial facilities and industries to find gas leaks and to detect smoke and carbon monoxide in residential buildings. Gas sensors come in a broad range of sizes (portable and fixed), sensing capabilities, and ranges. They frequently function as a component of a larger embedded system, such as security and hazmat systems, and are typically connected to an interface or audible alarm. Gas sensors require more frequent calibration than many other types of sensor since they are continually reacting with air and other gases.

3.4 GPS Module

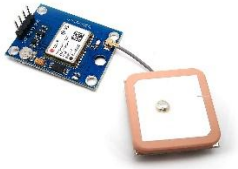

Fig-7: GPS Module

GPS stands for Global Positioning System, which is a satellite-based navigation system developed by the United States Department of Defense. GPS allows users to determine their precise location and track their movements with the help of GPS receivers and a network of orbiting satellites. GPS works by using a system of at least four satellites that transmit signals to a GPS receiver on the ground. The GPS receiver measures the time it takes for each signal to reach it, and uses this information to calculate the distance between the receiver and each satellite. By using this information, the GPS receiver can then determine the user's location on the Earth's surface. In this project, the GPS module is used to track the location of the project. Sensor input is sent to Arduino Uno microcontroller, who uses this input to produce a specific output.

3.5 GSM Module

Fig-8: GSM Module

GSM modules are used to enable devices to send and receive data over cellular networks, typically via SMS, voice calls, or data transmission. GSM modules communicate with cellular networks via a Subscriber Identity Module (SIM) card, which is used to identify and authenticate the device on the network. GSM modules are compatible with most cellular networks worldwide, making them a popular choice for devices that need to operate in multiple regions or countries.GSM modules typically include features such as voice call support, SMS messaging, GPRS data transmission, and GPS support. GSM modules are widely used in various applications, such as remote monitoring and control systems, security and alarm systems, fleet management, and Internet of Things (IoT) devices.

4. Prototype

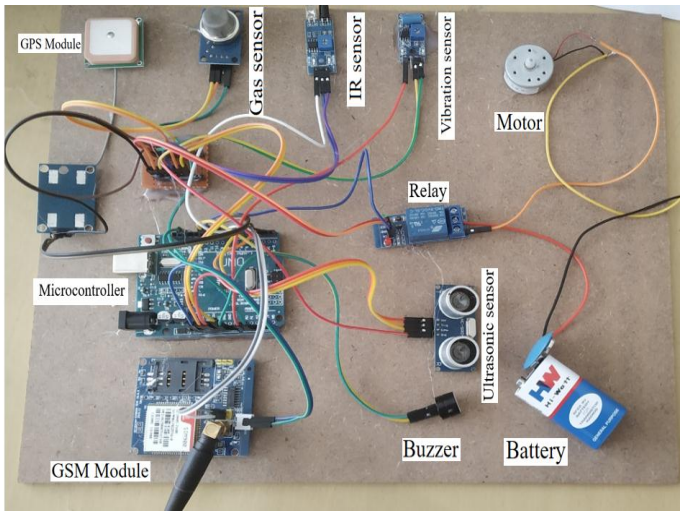

Fig -9: Prototype of Proposed Model

This is the prototype of our device which consists of a Arduino board, battery and sensors such as vibration sensor, IR sensor and ultrasonic sensor etc.

5. Result

A reliable Smart Vehicle Security and Safety System has been put into place utilising the principles of GPS and GSM. It includes a pressure sensor, eye-blink sensor, alcohol sensor, proximity sensor, and vibration sensor. The Arduino board incorporates the sensors. It can be problematic in rural places without network connection or in areas with outreach issues that encounter poor network connectivity. Due to this, the accident intimidation text may not be sent to the designated number. The suggested and subsequently implemented method may be improved and altered by using technological ideas like big data and GPS to analyse the resulting data collection and recognise and identify the patterns related to the collisions. The identical system might be changed subsequently and put into practise for two Wheelers. Additionally, an ambulance can be dispatched to the scene of the accident for prompt medical care.

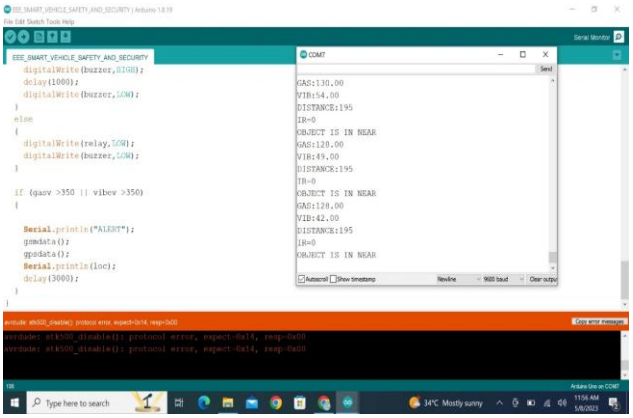

Fig -10: Output from Arduino board

The experimental findings demonstrate that the suggested model outperforms other devices already on the market.

6. Future Scope

The future of IoT-based vehicle safety devices is promising, as advancements in technology continue to expand the capabilities and potential applications of these devices. Here are some possible future scopes for IoT-based vehicle safety devices:

1. **Autonomous driving:** As self-driving cars become more prevalent, IoT-based safety devices can play a vital role in ensuring their safety. These devices can help monitor the vehicle's environment and detect potential hazards, such as pedestrians or other vehicles.

2. **Predictive maintenance:** IoT-based safety devices can help predict when a vehicle may need maintenance or repairs, allowing fleet operators and individual drivers to address issues before they become major problems. This can help reduce downtime and increase the lifespan of vehicles.

3. **Integration with smart city infrastructure:** IoT-based safety devices can be integrated with smart city infrastructure, such as traffic signals and streetlights, to help optimize traffic flow and reduce congestion. This can also help reduce the risk of accidents by providing real-time data on road conditions.

4. **Insurance discounts:** IoT-based safety devices can provide insurers with valuable data on driver behavior, which can be used to offer personalized insurance policies and discounts to safe drivers. This can incentivize safe driving habits and encourage the adoption of these devices.

5. **Enhanced cybersecurity:** As vehicles become more connected and reliant on IoT devices, the risk of cyber-attacks increases. IoT-based safety devices can help enhance cybersecurity measures by providing real-time threat detection and prevention.

The future of IoT-based vehicle safety devices is bright, with new applications and advancements in technology paving the way for safer and more efficient transportation.

7. Conclusion

An IoT-based vehicle safety device is a technology that can significantly improve road safety by providing real-time monitoring and tracking of vehicles. It can help prevent accidents and provide critical data to drivers, fleet operators, and law enforcement agencies. The device can be installed in any type of vehicle and can offer a range of features such as:

1. GPS tracking: The device can track the location of the vehicle in real-time and provide information on the vehicle's movement.

2. Vehicle health monitoring: The device can monitor the health of the vehicle, such as engine temperature, oil pressure, and battery level, to detect any issues before they become major problems.

3. Driver behavior monitoring: The device can monitor driver behavior, such as speeding, harsh braking, and aggressive driving, and provide feedback to the driver to encourage safer driving habits.

4. Collision detection: The device can detect a collision and send an alert to emergency services, providing critical information such as the location of the accident and the severity of the impact.

5. Remote control: The device can be used to remotely control certain vehicle functions, such as locking and unlocking doors, starting and stopping the engine, and adjusting the climate control.

IoT-based vehicle safety device can provide a comprehensive solution for enhancing vehicle safety, improving driving habits, and reducing the risk of accidents.

Device has been tested successfully and the technology is easy to install in any type of vehicles and it won't cause any harm or discomfort to the rider.

8. References

[1] G. S. Pannu, M. D. Ansari, and P. Gupta, ""design and implementation of autonomous car using raspberry pi." international journal of computer applications 113," no., vol. 9, 2015.

[2] V. N. Kumar, V. S. Reddy, and L. P. Sree, ""design and development of accelerometer-based system for driver safety." international journal of science," Engineering and Technology Research (IJSETR), vol. 3, p. 12, 2014.

[3] C. Hahn, S. Feld, and H. Schroter, "Predictive collision management for time and risk dependent path planning," in Proceedings of the 28th International Conference on Advances in Geographic Information Systems, ser. SIGSPATIAL '20. New York, NY, USA: Association for Computing Machinery, 2020, p. 405–408. [Online]. Available: https://doi.org/10.1145/3397536.3422252

[4] G. N. A. H. Yar, A.-B. Noor-ul Hassan, and H. Siddiqui, "Real-time shallow water image retrieval and enhancement for low-cost unmanned underwater vehicle using raspberry pi," in Proceedings of the 36th Annual ACM Symposium on Applied Computing, ser. SAC '21. New York, NY, USA: Association for Computing Machinery, 2021, p. 1891–1899. [Online]. Available: https://doi.org/10.1145/3412841.3442060

[5] J. J. T. Dai, X. Bai, and Z. Shen, "Mobile phone based drunk driving detection pervasive computing technologies for healthcare. 2010, 4th international ieee conference," p, vol. 1.

[6] H. Chen, Y. Chiang, F. Chang, and H. Wang, "Toward real-time precise point positioning: Differential gps based on igs ultra rapid product. sice annual conference," The Grand Hotel, Taipei, Taiwan, August, vol. 18.

[7] X. Liu, X. Xu, X. Chen, E. Mai, H. Y. Noh, P. Zhang, and L. Zhang, "Individualized calibration of industrial-grade gas sensors in air quality sensing system," ser. SenSys '17. New York, NY, USA: Association for Computing Machinery. [Online]. Available: https://doi.org/10.1145/3131672.3136998

[8] A. T. Duchowski, S. Jorg, T. N. Allen, I. Giannopoulos, and K. Krejtz, ¨ "Eye movement synthesis," in Proceedings of the Ninth Biennial ACM Symposium on Eye Tracking Research & Applications, ser. ETRA '16. New York, NY, USA: Association for Computing Machinery, p. 147–154. [Online].Available: https://doi.org/10.1145/2857491.2857528

[9] D. A. Preetham, M. S. Rohit, A. G. Ghontale and M. J. P. Priyadarsini, "Safety helmet with alcohol detection and theft control for bikers," 2017 International Conference on Intelligent Sustainable Systems (ICISS), 2017, pp. 668-673, doi: 10.1109/ISS1.2017.8389255.

[10] A. Jesudoss, R. Vybhavi and B. Anusha, "Design of Smart Helmet for Accident Avoidance," 2019 International Conference on Communication and Signal Processing

(ICCSP), 2019, pp. 0774-0778, doi: 10.1109/ICCSP.2019.8698000.

[11] P. Pathak, "Smart Helmet with Motorbike unit for Accident and Rash Driving Detection," 2020 IEEE International Conference on Advances and Developments in Electrical and Electronics Engineering (ICADEE), 2020, pp. 1-6, doi: 10.1109/ICADEE51157.2020.9368914.

[12] Dr. Gayathri Monicka S, Roahith Kumar B, Mohamed Hafiz Khan K, "Automatic Helmet Detector," 2023 International Research Journal of Engineering and Technology (IRJET) p-ISSN: 2395-0072 Volume: 10 Issue: 01 | Jan 2023