



Smart Vehicle Tracking and Sensing System Based on IoT Application

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ABSTRACT

This paper explores the practicality of integrating technology into vehicles to detect and alert emergency services of accidents, theft, vehicle over speed, and fire accidents. The application of automatic vehicle monitoring has become increasingly critical in recent years. The current implementation of the Smart Vehicle, over speeding detector using the Internet of Things enables the automatic collection and processing of all road traffic information. The smart vehicle system is equipped with an overspeeding detector that can record, store, and share information about the vehicle's speed, utilizing GPS, Radar, Google Maps, and IoT modules. An IoT smart security system has been designed to provide continuous monitoring and alert the authorized person when an intrusion is detected using IoT technologies. The Theft Control unit has been developed using IoT technologies to address the issue of theft. In addition, a circuit has been designed to reduce the negative impact and emergency response time of road and fire accidents by detecting fires and locating the nearest help station based on coordinates. The 57 project also includes GPS and GSM technology, which sends messages to the hospital and a family member with the accident's current location.

Keywords: Internet of Things: Server platform, GPS and GSM modules, Tracking.

1. INTRODUCTION

The Internet of Things (IoT) is a term used to describe the interaction between humans and objects, as well as between the objects themselves. With advancements in technology that facilitate the collection, analysis, and transmission of data, more healthcare applications, services, and systems are being developed using IoT. For example, many vehicles now have automatic crash response systems that can communicate with a cloud-based server, notifying a predetermined provider in case of an emergency. The IoT is not solely concerned with connecting physical devices to the internet - it is also characterized by its dynamic and self-adapting nature, its ability to self-configure, its unique identity, and its integration into information networks.

Vehicle theft is on the rise due to the increasing number of vehicles, resulting in over 10 million stolen vehicles globally each year, with many remaining untraceable. Criminals have become more skilled, surpassing existing vehicle safety systems, and their actions can lead to significant property damage, physical injuries, and even loss of life. Therefore, an effective theft detection system is necessary. This system generally involves installing vehicle tracking hardware that is hidden from view. IoT is a smart technology that enables devices to remain connected to each other, making it a potential solution for preventing vehicle theft. Additionally, research has looked at using GPS location to connect emergency responders with people requesting help, controlling vehicle speed in certain areas, and improving safety in vehicular fire incidents by detecting passengers, temperature, and location and sending relevant information to nearby fire stations. In the event of a fire, linear actuators can be used to open the vehicle's doors and windows to allow passengers to escape, and information including the temperature, passenger count, and location can be sent automatically to the nearest fire station via email.

The system is designed to track and monitor vehicles, prevent theft, and detect accidents or fires. It can be controlled through an iOS platform and utilizes GSM/GPS technology for security purposes. Many companies implement similar smart sensing systems to provide customized services and safety recommendations to their customers. The system constantly analyzes the vehicle's condition and location, sending updates via SMS. If an accident occurs, the system will automatically alert emergency services and the passenger's contacts. This is achieved through the use of GSM technology, which provides essential information for emergency response.

Nomenclature

IoT – Internet Of Things

GPS – Global Positioning System

GMS – Google Mobile Services

2. LITERATURE SURVEY

2.1. *The article discusses the implementation of IoT for mandatory utilization of safety gear in order to detect accidents with the help of Arif Shaik, Natalie Bowen, Jennifer Bole, Gary Kunzi, Daniel Bruce, Ahmed Abdelgawad, and Kumar Yelamarthi.*

The IoT is a phrase that describes the exchange of information between human beings and devices or between devices themselves. Technology is advancing at a rapid pace in today's world, with broadband internet becoming more accessible and affordable than ever before. The cost of technology is also decreasing, and currently, approximately 36% of people around the world use smartphones. This number is predicted to increase from 2.1 billion in 2016 to approximately 2.5 billion in 2019 .

2.2. *The creation and execution of an intelligent Internet of Things-based system for instantly detecting vehicle theft in real-time applications - Raunak Agrawal, Rahul Dugar, Saurabh Surana, Sunil Mp, Hamsa S - 25 June 2019 -*

During the project, we gained knowledge regarding the implementation of systems, the interfacing of components on a board, and the development of concise and effective programming. With the rising need for anti-theft measures for vehicles, we believe that a cost-effective and compact device can be designed using a Raspberry Pi. By utilizing higher-end components, we can enhance the precision of the device. Additionally, we can integrate the entire system with an Android app and store relevant data in a database for easy accessibility. This could lead to the creation of a powerful and practical product.

2.3. *The creation and application of a vehicle tracking system using IoT technology - authored by Abdul Rehman, Meghana S, Annie Sahana, and Prof. Sandhya H B - dated 26 October 2019.*

A low-cost, reliable, and precise vehicle tracking system has been created using GPS and Raspberry Pi technology. Real-time tracking is made possible through continuous monitoring. The system is cost-effective due to the use of an affordable u-blox NEO-6M GPS Module and the direct attachment of the module to the vehicle via USB. Additionally, a website is used instead of SMS, reducing the cost of transmission. The inclusion of Google Maps' free service and the utilization of HTTP protocol has further reduced the overall construction cost of the vehicle tracking system. .

2.4. *A framework utilizing IoT technology to detect over-speeding in vehicles was developed by Mohammad Ahmar Khan and Sarfraz Fayaz Khan on November 9, 2018.*

The use of automatic vehicle monitoring has become essential in recent times. To achieve this, specific technologies must be implemented. Therefore, this project aims to propose a system capable of detecting vehicles exceeding the speed limit and immediately notifying the relevant authorities. Given the alarming rate of road accidents, there is a pressing need to develop a system that can detect speeding vehicles. The proposed Smart Vehicle Overspeeding Detector employs the Internet of Things (IoT) to collect and process traffic information efficiently. The system is equipped with advanced capabilities, including GPS modules, radar, Google Maps, and IoT modules, which enable it to record, store, and share relevant data about vehicle speed.

2.5. *The authors, Dr. Nizar Al Bassam and Jibreal Khan, have developed a system that uses the Internet of Things (IoT) to autonomously detect and extinguish fires in vehicles.*

By detecting the fire and finding the nearest helping station based on the coordinates using the Haversine formula, the system can quickly send the information to the appropriate authorities and decrease the response time. This is crucial in emergencies where every second counts. Additionally, the circuit's ability to live stream data, including temperature, number of passengers, location, and the speed of the vehicle to the monitoring station using an API, can help improve overall safety and efficiency. Overall, it's important to continue exploring and implementing technologies that can enhance fire safety in vehicles, and the circuit you described is a step in the right direction..

3. PROPOSED METHOD

The proposed IoT smart security system is designed to provide enhanced security by detecting intruders and sending alerts to the authorized person's mobile phone. The system consists of various devices such as an ultrasonic sensor, a microcontroller unit (Arduino), GSM (Sim900) module, a smart mobile phone, and an alarm.

The ultrasonic sensor is responsible for detecting the presence of an intruder and sends this information to the microcontroller unit (Arduino) for processing. The Arduino is the brain of the system that receives data from the sensors and processes it to decide whether to trigger the alarm or not.

The GSM (Sim900) module acts as the intermediary between the microcontroller unit and the mobile phone of the authorized person. It enables wireless communication between the two devices, allowing the system to send alerts to the mobile phone when an intruder is detected.

When an intruder is detected, the system triggers an alarm to alert the people in the vicinity. At the same time, the system sends an alert message to the authorized person's mobile phone through the GSM (Sim900) module. The authorized person can then take action to prevent theft or any other criminal activity that could happen.

Overall, the proposed IoT smart security system is an innovative solution that can provide enhanced security for homes, offices, and other places. It can detect intruders and send alerts to the authorized person's mobile phone, allowing them to take action to prevent any criminal activity.

3. SYSTEM DESIGN

The different design diagrams for each of the modules of the project are shown below with an explanation:

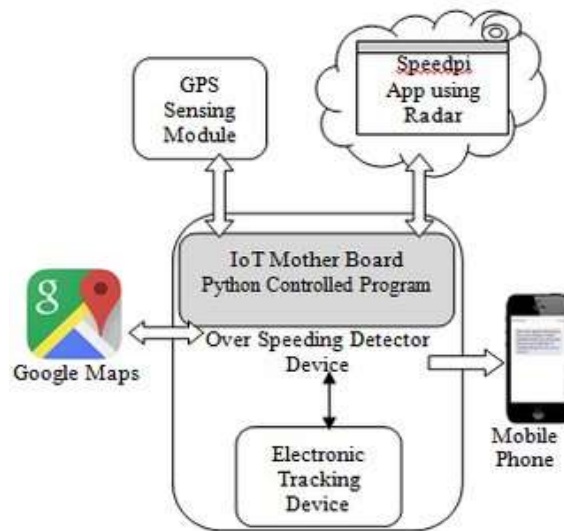


Fig. 1 - IoT-based Smart Vehicle Over speeding Detector System.

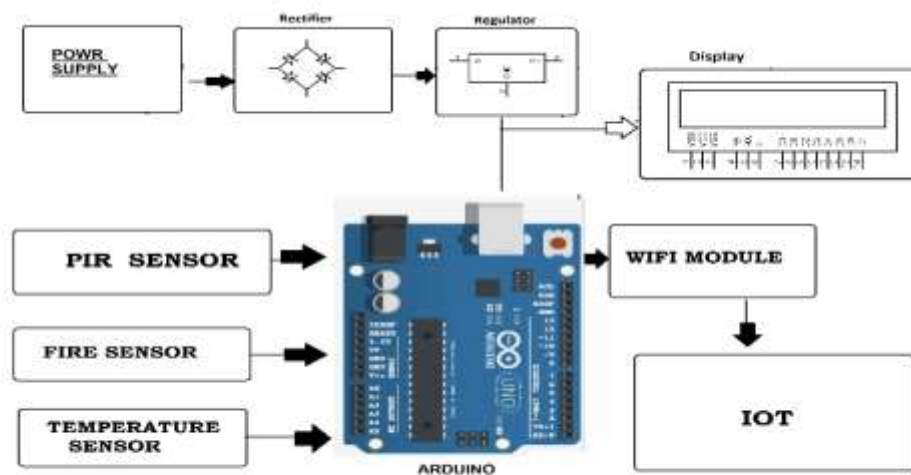


Fig. 2 – Static diagram of the circuit.

5. DESIGN METHODOLOGY

This Anti -Theft model consists of a microcontroller, Sensors, supporting Hardware-software, and components such as:

- The GPS module is equipped with a receiver and an antenna that enable the device to determine the exact location of the vehicle. GPS technology is frequently utilized to obtain data related to coordinates, speed, time, and distance. Within this particular module, a GPS is utilized to facilitate the implementation of the in-vehicle device.

- A PIR or IR motion sensor is an electronic device that identifies any movement occurring in a designated area. Its primary use is in security systems where it can detect any unauthorized movement in restricted areas.
- A gas sensor is an electronic device that senses the existence of gas in a particular area. There are multiple kinds of gas sensors, each configured to detect a particular type of gas. Gas sensors have diverse applications, such as identifying gas leakage in pipelines and assessing air quality. In this context, the gas sensor is used to recognize fuel leaks and fire hazards in vehicles.
- A piezo sensor is an electronic component that transforms mechanical force into electric charge. Piezo sensors are constructed from piezoelectric materials, which produce an electric current when they undergo mechanical deformation. In this application, piezo sensors are employed to detect extraneous vibrations resulting from unauthorized physical contact, as well as to identify vibrations that occur during accidents.
- A power module refers to an electronic component that furnishes power to a specific electrical or electronic system. Power modules commonly produce, manage, and distribute electricity within a system, and they may also offer safeguards against power spikes and other power-related challenges.
- The ESP8266 is an inexpensive wireless chip that has both microcontroller and full TCP/IP stack capabilities. It is possible to utilize the ESP8266 to create a real-time vehicle tracking device, which can help retrieve stolen vehicles. Moreover, it can communicate with sensors over a standard protocol to identify gas leaks, extraneous vibrations, and unwanted motion and promptly notify the owner via the Internet.

6. RESULT

The outcome of the paper is to explore the practicality and benefits of integrating technology, specifically IoT and GPS technologies, into vehicles to improve safety and security measures. The paper presents various examples of how technology can be used to detect and alert emergency services of accidents, theft, speeding, and fire accidents. The Smart Vehicle system, speed detector, IoT smart security system, and theft control unit are some examples of how technology can be used in vehicles to enhance safety and security. The paper also presents a circuit designed to reduce the negative impact of fire and road accidents and send emergency messages to hospitals and family members, highlighting the potential benefits of integrating technology into vehicles to improve response times and save lives.

7. CONCLUSION AND FUTURE WORK

The Internet of Things (IoT) is a rapidly expanding field of technology, which has been successfully implemented in a car and subjected to several tests. In the event of an accident, the system automatically sends out notifications and GPS location data to the cloud. The accident notification is instantly dispatched to mobile phones via Twilio, while the GPS location is made available on ThingSpeak for authorized users to access. The proposed device aims to improve safety by enabling emergency responders to arrive at accident scenes faster, as well as to track down perpetrators who try to flee the scene of an accident they were involved in. The system ensures the safety of riders through the mandatory use of safety equipment, as well as guaranteeing that riders are not under the influence of alcohol during the ride. The ignition system prevents the rider from starting the bike if they violate any security protocols. Additionally, the reporting system sends an SMS with location details to family members in the event of an accident, allowing for immediate medical attention. This intrusion detection system is designed to be low-cost and easy to use, making it accessible to anyone regardless of their financial situation or age. It is designed with user-friendliness in mind and is affordable for everyone, enabling people to live a secure and peaceful life. In the future, the system could be enhanced to provide CCTV footage to the owner automatically in case of any intrusion, allowing them to take immediate action.

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REFERENCES

- [1] The article titled "Intelligent Helmet" authored by Nexon Samuel, Akshay Bawkar, Smita Rukhande, Jennifer William, and Kaustubh Padwal was published in the International Journal of Scientific & Engineering Research in 2016.
- [2] "Human Tolerance and Crash Survivability": The ability of people to withstand collisions and remain alive.
- [3] Monitoring and detecting instances of drink driving and speeding in real-time: The act of observing and identifying cases of drunk driving and speeding as they occur.
- [4] "IoT based smart security and home automation system": A system that uses the Internet of Things technology to enable intelligent security and automated functions in a household.
- [5] "Fire Loss in the United States During 2017": The amount of damage caused by fires in the US in the year 2017.
- [6] "Modeling IoT Enabled Automotive System for Accident Detection and Classification": Creating a representation of a vehicle system that utilizes the Internet of Things and has the ability to recognize and categorize accidents.