IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

ISO 3297:2007 Certified ⁜ Impact Factor 8.102 ⁜ Vol. 12, Issue 4, April 2023

DOI: 10.17148/IJARCCE.2023.12403

Smart Luggage Tracking using IoT and GPS Technology

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Abstract: This research paper delves into the world of luggage tracking, presenting a highly innovative system that utilizes the powerful technologies of IoT, GSM, and GPS components. Through this system, luggage can be accurately tracked in real-time, delivering highly precise location-based information to the user. The system's architecturally advanced design features an intricate combination of components, including a microcontroller, GPS module, GSM module, and IoT platform, all working together in unison to produce an incredibly efficient and reliable system. The microcontroller, a highly advanced component at the heart of this system, plays a critical role in processing GPS data, which is then sent to the IoT platform using the impressive GSM module. Once the platform receives the data, it processes it with an incredible level of precision, displaying a geographical depiction of the position of the luggage. The system's broad range of potential applications is truly awe-inspiring, with its usefulness extending to luggage tracking for airports, hotels, and transportation companies, to name but a few. This comprehensive study highlights the power and effectiveness of integrating IoT, GSM, and GPS technologies into a single cohesive system, opening up vast new possibilities for future research in this captivating field.

Keywords: GPS luggage tracking, GSM, Internet of Things, IOT, Wireless luggage tracking

I. INTRODUCTION

Luggage tracking has become an essential aspect of modern-day travel. With millions of bags lost, stolen, or misplaced annually, it is no wonder that travellers are becoming more conscious of luggage safety and security. Fortunately, advancements in technology have made luggage tracking more effective and reliable than ever before. In this essay, we will explore the importance of luggage tracking, the various technologies used in luggage tracking systems, and the potential benefits that such systems can offer. The need for luggage tracking is apparent, especially when considering the impact of lost luggage on travellers. Misplaced or lost luggage can result in significant financial loss and personal inconvenience, as travellers are often forced to purchase new clothing and personal items. Additionally, it can disrupt travel plans and cause undue stress and frustration. Therefore, it is essential to have a reliable luggage tracking system in place to prevent these problems.

One of the most effective technologies used in luggage tracking systems is the Internet of Things. IoT-enabled devices can monitor luggage in real-time and provide location-based information to the user. Additionally, IoT devices can offer a range of other benefits, such as remote control and monitoring, which allows travellers to access real-time updates and alerts on their luggage's location and status.

Another technology used in luggage tracking systems is Global Positioning System. GPS provides accurate and precise location-based information, making it an ideal choice for tracking luggage. By incorporating GPS technology into luggage tracking systems, users can receive real-time updates on their luggage's location, which can significantly reduce the risk of losing or misplacing luggage.

In addition to IoT and GPS, luggage tracking systems also use Global System for Mobile communication technology. GSM technology enables communication between the tracking device and the tracking server, making it possible to send

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and receive information from remote locations. By utilizing GSM technology, luggage tracking systems can provide real-time updates on the location of luggage, regardless of where it is located.

The benefits of luggage tracking systems are numerous. For instance, they offer enhanced security, allowing travellers to track their luggage and reduce the risk of loss or theft. Additionally, they provide real-time updates, enabling travellers to monitor their luggage's location and status, even when they are not present. Moreover, luggage tracking systems can provide detailed analytics on luggage movement, helping airlines and other travel providers to optimize their operations as well as lowering the possibility of lost luggage.

This paper presents a luggage tracking system that utilizes IoT, GSM, and GPS technologies to provide real-time tracking of luggage. The proposed system is designed to be easy to use, reliable, and efficient, and can be implemented in various transportation scenarios such as airports, hotels, and transportation companies.

II. RELATED WORKS

The intelligent baggage tracking system that Sarkar and his colleagues developed will make use of the microcontroller in some capacity (2017). Radio frequency identification, also known as RFID, will serve as the foundation for this system. The process of tracking luggage can be automated with the help of this device by affixing RFID tags to the luggage that contain the owner's information. In addition to this, it will incorporate the necessary feedback mechanism to ascertain whether or not the shipment has been delivered to its final location. Despite the fact that the system saves time and money, the environment does not support Internet of Things, which prevents individual devices from being able to communicate with one another [9]. Singh (2016) Identify and track baggage with the help of RFID tags that contain the owner's information in order to avoid the possibility of the baggage being misplaced or stolen.

In comparison to the barcoded UHF range that is currently on the market, this product provides enhanced safety and productivity. The fatal flaw of this product is that it is unable to support mobile devices because the configuration does not include Internet of Things[10.] This is a fatal flaw because mobile device support is essential. There have been discoveries of additional tracking systems that make use of RFID, as shown in [11-14]. Because of the limited scope of the system, there may be concerns regarding the safety of the tags used in the tracking systems that have been described above. Additionally, tracking items while they are in transit may be difficult. Combining RFID technology with the Internet of Things is said to have been successful in overcoming the aforementioned limitations of tracking systems that are based on RFID over the course of the past several years [15, 16]. This is done in order to fill in any gaps that may exist within the tracking system that was described earlier. Tracking technologies that are based on the Internet of Things cut costs, improve efficiency, allow for greater flexibility, and enable communication between mobile devices and people as well as between people themselves.

III. PROPOSED SYSTEM

A. Methodology

- System Architecture

As part of the process of designing the system, work is currently being done to design the architecture of the baggage tracking system. This work will include designing both the hardware and software components of the system. The following is a list of the parts that comprise the system, a single-board computer, a GPS module, a GSM module, and an Internet of Things platform are all required components. Once the GPS has transmitted the data to the Arduino, the microcontroller will communicate with the IoT platform using the GSM module.

- Hardware and Software Requirements

Components necessary for the operation of the system, including hardware and software are identified, including the microcontroller, GPS module, GSM module, and IoT platform. The microcontroller used in the system is the Arduino Uno board, The GSM module used is the SIM900L module. Proteus software is used for simulation of the system.

- System Implementation

The system that has been proposed is constructed by piecing together the various pieces of software and hardware that have been described. The Global Positioning System, module is connected to the microcontroller, which receives Global Positioning System data from the module. The GSM module is also connected to the Arduino, which sends the GPS data to the IoT platform using the Global System Mobile module

- Limitations and Challenges

DOI: 10.17148/IJARCCE.2023.12403

The limitations and challenges of the proposed system are identified, including the cost of implementation, the coverage area, and the need for technical expertise to operate the system.

B. GSM

The Global System for Mobile communication is a widely used digital cellular network standard that has revolutionized the mobile communication industry worldwide. A GSM module is a compact device that comprises all the necessary components for communication, including a modem, antenna, and power supply, enabling seamless communication using the GSM network. With the arrival of the Internet of Things , GSM modules have become an integral part of various applications, including remote monitoring, security systems, and machine-to-machine (M2M) communications. By enabling wireless communication between devices and networks, GSM modules have paved the way for an interconnected world where machines can communicate and work together seamlessly.

C. GPS

A GPS (Global Positioning System) module is an indispensable device used to determine the location of an object or person by receiving signals from GPS satellites. These modules are widely utilized in a myriad of applications, ranging from navigation systems in cars to tracking systems for airplanes, boats, and other vehicles. The GPS module generally comprises three main components: a receiver, an antenna, and a microcontroller. The receiver is responsible for intercepting signals transmitted by GPS satellites, whereas the antenna captures the signals. The microcontroller processes the signals and determines the GPS coordinates of the object or person. GPS modules have a remarkable advantage in their accuracy, as they can determine the location of an object or person with utmost precision, up to a few meters, based on the quality regarding both the strength of the GPS signal and the number of active GPS satellites.

D. Technical Specifications

The proposed luggage tracking system has the following technical specifications:

- Microcontroller: Arduino Uno board
14 digital input/output pins
6 analogy inputs
16 MHz quartz crystal

- GPS Module: NEO-6M GPS module
50-channel GPS receiver

- GSM Module: SIM900L module
Quad-band: 850/900/1800/1900 MHz
GPRS multi-slot class 10/8
Embedded TCP/UDP protocol

- Power Supply:
9V DC power supply for Arduino Uno board
5V DC power supply for GPS module and GSM module

- Communication:
UART interface between GPS module and Arduino Uno board
UART interface between GSM module and Arduino Uno board

- Environmental Conditions:
Operating temperature: -20°C to 60°C
Operating humidity: 5% to 95% non-condensing

- Dimensions:
Arduino Uno board dimensions: 68.6mm x 53.4mm x 10.2mm
NEO-6M GPS module dimensions: 25mm x 35mm
SIM900L module dimensions: 24mm x 24mm x 3mm

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The proposed luggage tracking system using IoT with GSM and GPS components is designed to provide real-time tracking of luggage, enabling travellers to track their luggage in real-time, ensuring its safety and security during travel. The system's technical specifications are designed to provide accurate and reliable location data, even in harsh environmental conditions, and to transmit the data securely to the cloud-based IoT platform for storage and analysis.

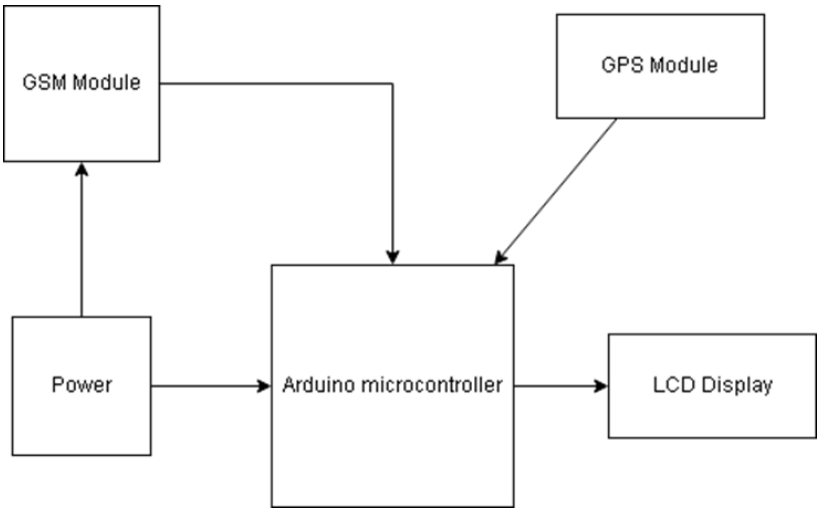

Fig. 1:Block diagram of luggage tracking system

The above diagram, Fig.1, explains the components and their relationship in the proposed system.

IV. EXPERIMENTS AND RESULTS

The proposed circuit design was simulated using proteus 8 software. Proteus software is a popular tool for simulating and testing electronic circuits and microcontroller-based systems. It allows users to design, test, and debug circuits before they are built, saving time and reducing the risk of errors. A simulation of the proposed circuit layout was simulated with the help of a piece of software called proteus 8, which was used in order to carry out the simulation.

This was done in order to determine whether or not it was viable. One of the most widely used tools for testing and simulating electronic circuits and other kinds of systems that are based on microcontrollers is a piece of software called Proteus. It is also one of the most widely used tools for testing and simulating systems that do not rely on microcontrollers, making it one of the most versatile tools available. Users are able to They are able to save time and reduce the likelihood of making mistakes when they use software to design, test, and debug circuits before building them.

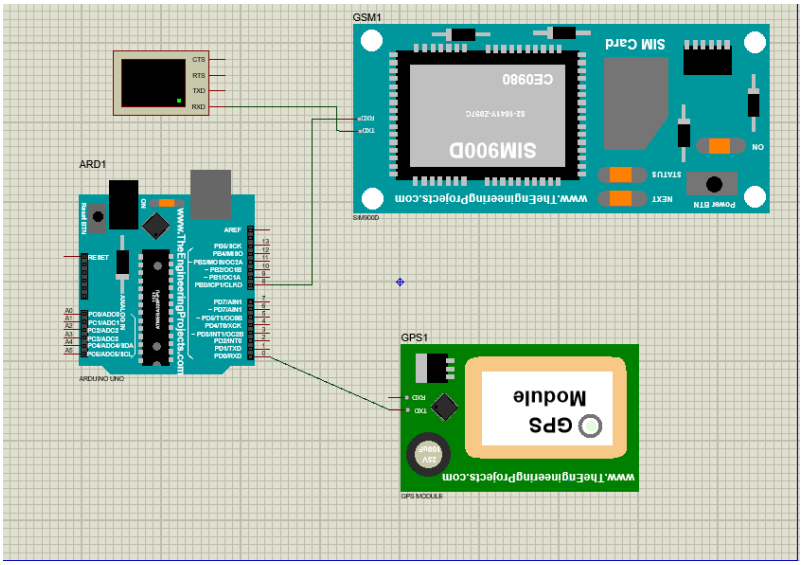

Fig. 2: Schematic Design

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The circuit design in proteus software used for simulation is shown in the above figure, fig.2.Arduino board, GPS, GSM and virtual terminal for display of messages.

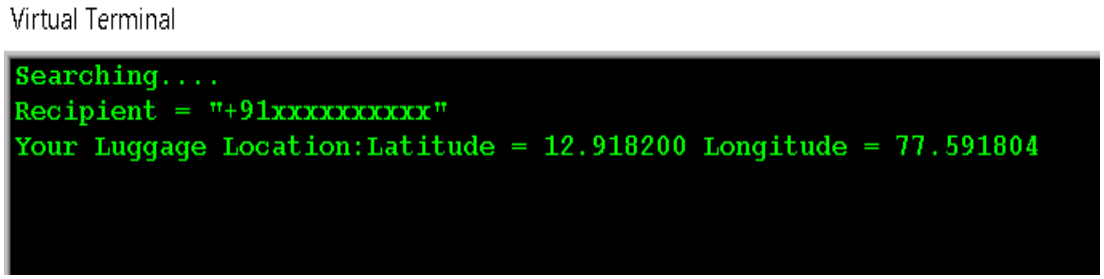

Fig.3: Output of simulation

We can observe from the above fig.3, that the proposed circuit design is working and the output of In the virtual terminal, both the latitude and longitude of the location of the luggage are displayed.

V. CONCLUSION AND FUTURE WORKS

The proposed luggage tracking system, which integrates IoT with GSM and GPS components, has the potential to be a game-changer in the luggage tracking industry. The system is a compact, low-power, and cost-effective solution that can accurately track the location of luggage in real-time, providing users with timely updates on their bags' last known location, if you will. The experiments that were carried out with the help of the Proteus software have demonstrated that the proposed system is both feasible and functional. According to the findings, the system is both capable of accurately tracking the location of luggage in real time and of providing users with up-to-date information regarding the location of their own luggage.

However, there are still a plethora of unexplored areas for future work that can significantly enhance the performance and functionality of the proposed system. One such area is the integration of additional sensors and components, such as temperature sensors and accelerometers, to provide more granular information about the luggage. Another area for future research is the development of a mobile application that can be used by travelers to track the location of their luggage in real-time. The mobile application could be seamlessly integrated with the luggage tracking system, providing users with timely updates on the location of their luggage, irrespective of their location. In conclusion, the proposed luggage tracking system using IoT with GSM and GPS components is a highly promising solution for tracking the location of luggage in real-time. The system's low-power and cost-effective nature make it suitable for use in a diverse range of uses, such as those in the aviation industry, the railway industry, and the shipping industry. However, considering the enormous scope for additional research and development, there is virtually no limit to what the proposed system's future capabilities could accomplish.

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