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Smart Baggage Tracker

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Abstract

A concerning rise in accidents caused by human error has resulted from the proliferation of vehicles on Indian roads and the inadequate enforcement of traffic regulations. This project proposes a sophisticated Driver Safety System that uses machine learning (ML) algorithms and Internet of Things (IoT) sensors to address two primary causes of traffic accidents: tiredness and driving under the influence (DUI).Our solution uses machine learning (ML) algorithms to identify minute indicators of driver drowsiness, like frequent yawning and microsleep, and uses an Internet of Things device with air pressure and alcohol sensors for real-time sobriety checks. By asking the motorist to blow into a mouthpiece to start a sobriety check, the device only permits ignition after a clean and appropriate blow. It then uses a camera to continuously monitor the driver, alerting sleepy drivers with either a buzzer or the sound system of the car.Our proactive method reduces the likelihood of impaired driving-related accidents by offering real-time DUI offence warnings, in contrast to conventional sobriety checkpoints and current IoT-based solutions. Additionally, by spotting fatigue indicators, the ML-based sleepiness detection system increases safety and helps lower the overall number of accidents caused by human error.In addition to encouraging a culture of responsible driving and improving safety, this project seeks to provide an efficient and cutting-edge technical solution to lessen the negative effects of driving events involving intoxication and sleepiness.

1. Introduction

The Smart Baggage Tracking System addresses significant challenges in the aviation and transportation sectors globally [1-3]. Issues such as missing baggage, loss, damage, and theft not only inconvenience passengers but also pose operational complexities for service providers. These challenges necessitate the development of robust systems capable of real-time tracking and management of luggage throughout its journey. The proposed system integrates advanced technologies including GSM/GPS modules and an Arduino microcontroller to ensure continuous connectivity and effective information processing [4]. The GSM module facilitates communication by transmitting SMS alerts to passengers, providing instant updates on the location and status of their luggage.

Meanwhile, the GPS module retrieves precise location coordinates, which are processed by the Arduino microcontroller to generate real-time tracking data displayed on a digital map interface. By offering passengers the capability to monitor their baggage remotely from anywhere in the world, the IoT-based device significantly enhances customer experience and satisfaction. This transparency reduces the anxiety associated with misplaced or stolen luggage and empowers passengers to take proactive measures in case of any irregularities. For the aviation industry, implementing such a system promises to streamline operations, mitigate financial losses from baggage mishandling claims, and improve overall service reliability [5]. This system represents a pivotal advancement in addressing longstanding challenges in baggage handling across various transportation sectors. By leveraging interconnected technologies to provide real-time tracking and monitoring capabilities, these systems promise to elevate security standards, optimize operational efficiency, and enhance the passenger journey experience. As the industry continues to evolve, investments in such innovative solutions are crucial for advancing the reliability and effectiveness of luggage management practices worldwide [6].

1.1 Organization of the Smart Baggage Tracker Project

The Smart Baggage Tracker project is designed to address the common problem of lost luggage in airports and other travel scenarios. This project integrates GPS and GSM technologies to enable passengers to efficiently track and locate their lost baggage [7-9]. The system comprises three main components: the Passenger Interface, the GPS Module, and the System Backend.

1.1.1 Passenger Interface

The Passenger Interface serves as the primary interaction point for users. Passengers can report their lost luggage through an easy-to-use interface, which initiates the tracking process. Once the report is submitted, passengers can track the location of their luggage in real-time. This tracking is facilitated by receiving the luggage's coordinates, which are displayed on a map. Additionally, the system sends SMS notifications to passengers, keeping them updated on the status of their luggage. If necessary, passengers can request a sound alert, which activates a buzzer on the luggage to help identify it in crowded areas [10].

1.1.2 GPS Module

The GPS Module is responsible for determining the precise location of the luggage. Upon initialization, the GPS module continuously monitors and updates the location coordinates of the baggage. This information is then transmitted to the System Backend, which processes and relays the coordinates to the passenger. The GPS module ensures that the location data is accurate and up-to-date, allowing for efficient tracking and quick recovery of lost items.

1.1.3 System Backend

In order to control communications between the GPS Module and the passenger interface, the System Backend is essential. The GPS Module receives a message from the backend when a passenger reports misplaced luggage, which causes it to get the luggage's most recent coordinates. These coordinates are subsequently sent back to the passenger via the system [11]. In addition, the backend is in charge of informing travellers via SMS about the whereabouts and condition of their bags. It also responds to sound alert requests, turning on the luggage's buzzer as necessary.

2. Literature Survey

This paper introduces a real-time luggage tracking and status updating system based on Bluetooth that uses a luggage tag with an inbuilt GPS tracker. The system uses a cloud-based backend to handle data and notify passengers with the status of their bags. It has a GPS tracker, a luggage tag, and a Bluetooth connection so that real-time tracking through a mobile app is possible [12]. Travellers may track their bags in real time with the luggage tag's continuous GPS location data collection, which is sent over Bluetooth to the smartphone application. The luggage tag data is processed and stored securely by a cloud-based backend system, which also supports data integrity and advanced analytics. This all-inclusive method improves the overall travel experience by providing precise, practical, and secure luggage tracking. Anantha Raman Rathinam and Srinivasan Chelliah's study, "Bluetooth-Based Real-Time Luggage Tracking and Status Updates," discusses the problems associated with mishandling and misplacing luggage while travelling. The authors underscore the importance of luggage tracking in averting

stressful traveller circumstances brought on by mishandling or misplaced belongings [13-15]. They list the elements of the suggested system, which includes a cloud-based backend for data administration and traveller notifications, a luggage tag with an integrated GPS tracker, and Bluetooth connectivity capabilities. The method facilitates smooth communication between the luggage tag and a smartphone application by utilising Bluetooth connectivity. Secure data storage, cutting-edge analytics, and preemptive notifications about luggage status changes are all made possible by the cloud-based backend. This creative approach could completely change the way that luggage is made (Figure 1).

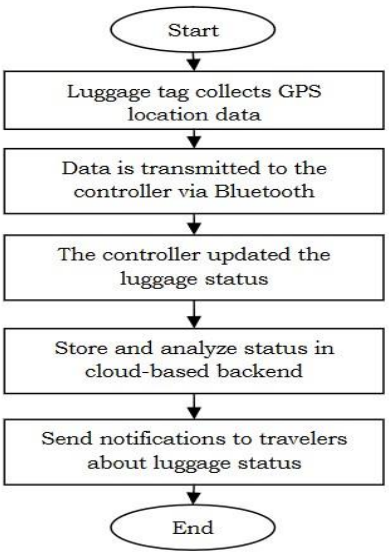

Figure 1 Flow Chart of the Proposed System

2.1 Components

The proposed Bluetooth-based real-time luggage tracking and status update system consists of five key components: a luggage tag equipped with a GPS tracker and Bluetooth module, a central controller, a mobile application, a cloud-based backend system, and real-time tracking functionality. These components work together to provide travelers with accurate and secure monitoring of their luggage. The luggage tag communicates location data via Bluetooth to the mobile application, which allows travelers to track their luggage in real-time and receive notifications about its status. The cloud-based backend system ensures data integrity, facilitates communication, and enables advanced analytics. Preliminary testing and user feedback indicate that the system effectively meets travelers' needs for real-time monitoring and status updates, enhancing user experience and providing peace of mind. The system's high accuracy rate of 95% for location tracking and prompt status updates with an average latency of less than 10 seconds demonstrate its reliability and effectiveness. Approximately 90% of users reported satisfaction with the system's performance [16]. The study highlights the system's potential for improving luggage management processes and enhancing the travel experience for passengers, with scalability options for future enhancements.

2.1.1 Smart Luggage Tracking using IoT and GPS Technology

The research paper introduces an innovative luggage tracking system that integrates IoT, GSM, and GPS technologies to provide accurate, real-time tracking. The system features a microcontroller, GPS module, GSM module, and IoT platform. The microcontroller processes GPS data, which is transmitted via the GSM module to the IoT platform, enabling precise tracking and display of luggage location. This advanced system is versatile and applicable across various sectors, including airports, hotels, and transportation companies, addressing the limitations of traditional tracking methods. In an era of increasing travel and logistics demands, the proposed system offers a comprehensive solution to the challenges of luggage tracking. Unlike traditional methods reliant on manual processes or barcode scanning, this system ensures real-time updates and enhanced accuracy. By leveraging the convergence of IoT, GSM, and GPS technologies, the system promises to revolutionize luggage management, offering significant improvements in tracking efficiency and reliability across diverse industries.

2.2 System Architecture

As part of the system design process, work is underway to develop the architecture for the baggage tracking system. This involves designing both the hardware and software components. The system will include a single-board computer, a GPS module, a GSM module, and an Internet of Things (IoT) platform. The GPS module will transmit location data to the Arduino microcontroller, which will then use the GSM module to communicate with

the IoT platform, ensuring seamless integration and real-time tracking of the baggage (Figure 2).

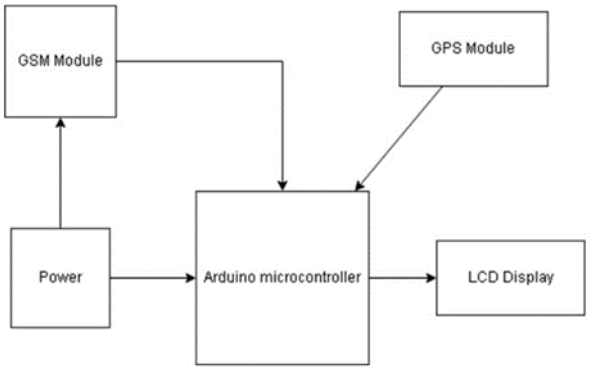

Figure 2 Block Diagram of Luggage Tracking System

2.3 Clever Luggage Carrier Device

A clever luggage carrier devicethat uses an Arduino nanostructure for real-time tracking and theft prevention. As part of the system design process, work is underway to develop the architecture for the baggage tracking system [17]. This involves designing both the hardware and software components. The system will include a single-board computer, a GPS module, a GSM module, and an Internet of Things (IoT) platform (Figure 3). The GPS module will transmit location data to the Arduino microcontroller, which will then use the GSM module to communicate with the IoT platform, ensuring seamless integration and real-time tracking of the baggage.

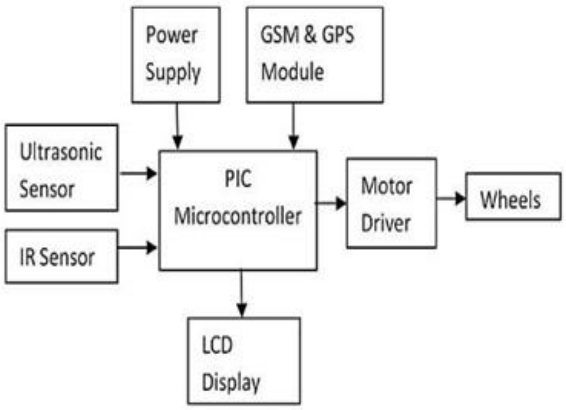

Figure 3 Block Diagram of Receiver

2.4 RFID-Based Intelligent Bag Tracking And Alert System

The shortcomings of standard bag monitoring systems—which mostly rely on human methods and are prone to error, resulting in misplaced bags and misrouted deliveries—are discussed in the article. The authors suggest an automated tracking system that makes use of Radio Frequency Identification (RFID) technology in order to get around these obstacles. RFID greatly reduces human labour and mistake rates by using electromagnetic fields to automatically identify and track things. RFID scanners, microcontrollers, reusable passive RFID tags, and a backend system are all integrated into the system. An RFID label and tracking ID are attached to a sealed bag, which provides real-time feedback and location updates to the system. This method improves accuracy and efficiency by automating the entire tracking process and optimising the delivery route by taking accident points into account [18]. The proposed system includes key components such as RFID tags, readers, and a backend system for data processing and updates. The backend system ensures real-time tracking and notifications at each postal node, enhancing the visibility of consignments throughout their journey. Users can track their parcels by entering the Tracking ID, and the system updates tracking information instantaneously as parcels move through different hubs. By automating the process and optimizing routing, the RFID-based solution aims to enhance accuracy, reduce costs, and improve overall customer satisfaction in postal services.

2.5 Arduino-Powered Smart Luggage Tracking and Alert System

The proposed Luggage Tracking system aims to mitigate the stress and inconvenience associated with lost or mishandled luggage for passengers. The system utilizes an Arduino microcontroller connected to a GPS module for location tracking and a GSM module for data transmission. The GPS data is processed and uploaded to a cloud database, where each user is assigned a unique ID and password for secure access. Users can log in to their accounts to track their luggage's location. Additionally, the system integrates a fingerprint sensor to enhance security; unauthorized access triggers an alarm and sends a notification with the luggage's location to the user’s mobile phone [19]. The lightweight Luggage Tracker is designed for use in high-traffic areas such as airports and railway stations, offering advanced tracking and security features. The system’s Android application

provides real-time location updates, while the fingerprint sensor ensures that only authorized users can access their luggage. If unauthorized access is detected, the system alerts the user via SMS and logs both authorized and unauthorized access events in the cloud. The integration of RFID technology adds an extra layer of identification, with unique IDs stored in the cloud for additional tracking and security. This comprehensive approach combines GPS, GSM, RFID, and fingerprint technology to create a robust solution for luggage management and security**. (**Refer 4 to 8)

Figure 4 System Architecture

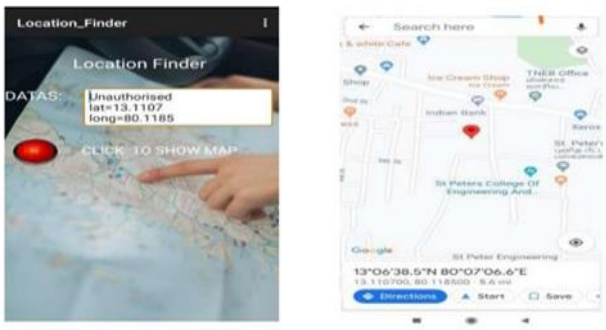

Figure 5 Android Application and Google Map

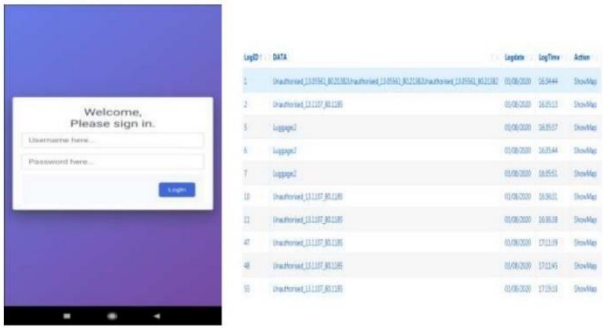

Figure 6 IoT Cloud Login and Database

3. Methodology

Setup of the GSM module, GPS module, and Arduino microcontroller is the first step in the luggage tracking system. The GPS module obtains the luggage's exact location coordinates, which the GSM module processes and sends to the passenger's mobile device via SMS. By taking this step, the traveller may be sure that they are always aware of where their luggage is. Additionally, the system displays the luggage's location on a digital map interface accessible through web or mobile applications, allowing the passenger to monitor their baggage in real time. This continuous tracking provides enhanced security and control over the luggage, concluding with ongoing monitoring until the baggage is retrieved by the passenger.

3.1 Passenger Interface (Mobile Application)

Allows travellers to communicate with the luggage tracking system through an intuitive mobile application. Passengers can monitor the location of their luggage and real-time status updates with this app.

3.2 Smart Baggage Tracker System

The central component that integrates multiple technologies to track and monitor luggage. It facilitates communication between the passenger interface and the tracking modules.

3.3 GSM Module

This module handles the transmission of data between the smart baggage tracker and the notification service. It ensures that location updates and alerts are delivered to the passenger's mobile application.

3.4 Notification Service Location

A service that processes location data from the GSM module and generates notifications for the passenger, keeping them informed about the status and location of their luggage.

3.5 GPS Tracker

A device used to determine the precise location of the baggage. It provides accurate location information that is sent via the GSM module.

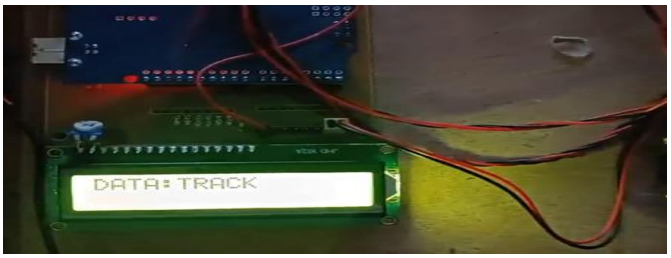

Figure 7 Tracking the Location

3.6 Alert Sound (Buzzer)

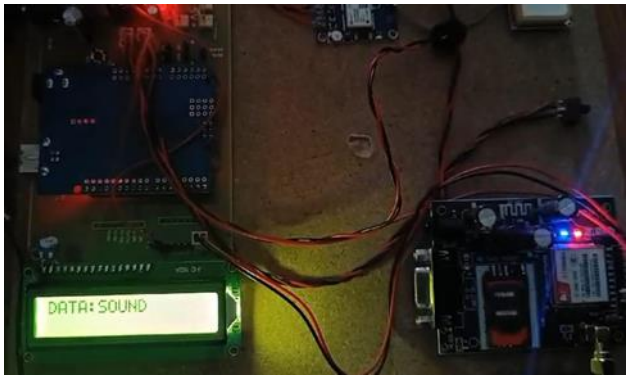

Figure 8 Alerting Buzzer Sound

An audible alert mechanism that helps locate the baggage in close proximity, making it particularly useful in crowded areas like airports.

4. Results and Discussion

4.1 Results

Smart baggage trackers demonstrate high accuracy in providing real-time location data, with GPS technology offering precise tracking and Bluetooth trackers excelling in close-proximity environments like airports. User experience is enhanced by simple setup processes and intuitive mobile apps, which include geofencing features for added security. Battery life varies, with some models offering long-lasting performance ideal for extended trips and others requiring more frequent recharging; replaceable batteries offer added convenience. Most trackers are durable, water-resistant, and designed to handle rough travel conditions without adding significant weight or bulk. Cost varies widely, from budget-friendly options to premium models with advanced features.

4.2 Discussion

The effectiveness of smart baggage trackers in enhancing travel security and convenience is evident from their performance. GPS trackers provide precise real-time location data, while Bluetooth trackers are suitable for close-range tracking in areas like airports. The user-friendly design, including intuitive apps and geofencing, improves overall experience. Battery life and durability are critical factors, with long-lasting and replaceable batteries offering practical benefits. Despite varying costs and some limitations such as dependency on cellular networks and battery maintenance, the advantages of smart baggage trackers in improving luggage management and providing peace of mind make them a valuable tool for modern travelers.

Conclusion

Smart baggage trackers are a valuable asset for modern travelers, greatly improving the security and convenience of luggage management. By providing real-time location updates and alerts through GPS, Bluetooth, and cellular networks, these devices allow travelers to monitor their luggage accurately and efficiently. The straightforward setup and intuitive smartphone apps make them accessible to a wide range of users, with features like geofencing enhancing security. While battery life and cost may vary, the overall advantages of smart baggage trackers, particularly for frequent travelers, make them a worthwhile investment for ensuring the safety and efficiency of their luggage.

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