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IoT-Based Luggage Tracking System using Arduino Microcontroller

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Abstract:
It is a recurrent issue in the aviation and transportation industries across the world that passengers' belongings are damaged, their luggage is stolen, and passenger baggage goes missing. A baggage monitoring system that is based on the Internet of Things has been developed and now being used in order to address these issues. Additionally, a GSM/GPS module is included into the system in order to ensure continuous connectivity. The Arduino microcontroller is used for data processing. The GPS (Global Positioning System) module makes it possible to track the position of luggage on a map in real time by acquiring coordinates and sending them to the microcontroller. This allows the microcontroller to make navigational decisions. After the data has been analyzed, the GSM (Global system for mobile communication) module sends it out via SMS (short messaging service), which enables tourists to monitor the whereabouts of their baggage from a distance. It is anticipated that the introduction of this system would minimize stress for air passengers as well as the aviation industry. This will be accomplished by reducing the number of instances in which luggage is lost, forgotten, or stolen.
Keywords: *IoT, Arduino Uno, Luggage Tracking, GSM/GPS Module.*

I. INTRODUCTION

The Internet of Things (IoT) has revolutionized the concept of connectivity globally by facilitating the networking of physical objects embedded with electronics, allowing them to communicate and interact with their environments. The Internet of Things has applications across various domains, such as health management, smart cities, and smart homes, enhancing both efficiency and convenience. The objective of this project is to develop a smart, connected device designed for monitoring lost baggage through the application of Internet of Things technology. The objective of this project is to address the persistent issue of luggage mistreatment and theft within the travel industry. The loss or theft of luggage presents a considerable challenge for travelers. This situation results in the loss of personal belongings and can lead to diminished mental well-being, as well as a significant waste of time. Lost or stolen luggage presents a significant issue. More than 1.7 billion occurrences of missing luggage are reported by travelers annually, representing a noteworthy statistic. Approximately 30 million individuals and 35 million pieces of luggage have not reached their intended destinations, primarily due to the mishandling and loss of baggage within the airline industry during transit to subsequent locations. Travelers who have lost their baggage will be able to retrieve it after a few days through a process that includes tracking and identification at a compensation level. The contents of the bags may not remain unchanged upon recovery; however, there is a possibility that the bags were stolen.To address this issue, we will implement a project designed to facilitate the immediate tracking of misplaced bags. This will be achieved by employing intelligent baggage trackers that incorporate Internet of Things technology. The trackers will be pre-installed in the bags and will transmit the location data, including coordinates, to the user. The information will be presented in Google Maps as real-time data.

II. BACKGROUND

It is anticipated that the rate of bag loss would decrease, but it is not anticipated that it will be fully eradicated. In order to ensure that baggage can be traced and that necessary steps can be made in response to the situation, it is vital that tracing systems be put into place. The development of intelligent baggage tracking systems, which make use of technology like as RFID and the internet of things, has been proven to have the ability to ease these concerns. This has been shown via a number of different approaches. The Internet of Things (IoT), which has the capacity to connect devices on a global scale, provides a solution that may improve baggage management and reduce the number of instances in which individuals are mistreated.

III. LITERATURE STUDY

Throughout the course of its development, the Internet of Things has been instrumental in the development of intelligent systems in a wide range of domains, such as the medical field, the educational sector, the home accessories industry, and other businesses, such as the aviation industry, which is responsible for the monitoring of cargo. There is a tremendous amount of worry in the airline sector over the handling of luggage. Management is accountable for ensuring that the appropriate luggage is delivered to the appropriate location. This task falls within their purview. In the case that there is any kind of misunderstanding, it is possible that the luggage will be delivered to the wrong location, which would lead to a serious difficulty. In addition, the procedure of returning the luggage will be one that is not only time-consuming but also costly for the travellers. Radio frequency identification technology is going to be one of the many alternatives. Its use in baggage monitoring systems has accounted for a significant portion of its history. By enhancing the capabilities of RFID-based systems in terms of efficiency, flexibility, and communication, the integration of the internet of things, on the other hand, is meant to eliminate the limitations that are associated with these systems. The communication that takes place between the real world and the virtual world is going to be made possible by the intelligent Internet of Things technology. This is going to be an important part that will be made possible. Because of this, a significant amount of information will be able to be disseminated to a variety of sectors in line with the needs that each individual sector has.

3.1. Internet of things (IoT)

The technology associated with the internet of things facilitates task execution for individuals, enabling a more streamlined approach to their activities. The Internet of Things enables secure and efficient communication between applications and devices. The implementation of Internet of Things technologies enables the interconnection of all devices, allowing for centralized management by users through an internet-based network. Utilizing a range of Internet of Things components, such as devices, sensors, computing units, communication networks, and processing units, enables access to real-world data communication. The components will convert real-world data into virtual data. A sequence of commands and logical instructions will be uploaded to the memory of the Arduino Uno board to process the data collected by the sensors. The processing unit will facilitate the management of data in an appropriate manner.

3.2. The Problem

In the context of luggage handling at airports, several general scenarios may lead to the mishandling or loss of baggage. The issues identified encompass the baggage remaining at the origin, improper packing for the flight, and the transportation of baggage to an incorrect destination.

The airline and transportation industries face significant challenges due to the loss or mishandling of baggage. This situation contributes to passenger dissatisfaction and can ultimately result in financial repercussions. This project aims to address these challenges by providing travelers with the capability to track their luggage in real time, thereby minimizing the risk of baggage loss, theft, or improper handling.

IV. DESCRIPTION OF THE SYSTEM

The installation of the intelligent baggage tracker system will include the use of many devices, including an Arduino Uno board, GSM/GPS modules that are driven by a power supply unit, and a user interface among others. Following the completion of the startup process, the GPS/GSM modules are ready to send and receive user instructions over the internet. After receiving the appropriate instruction from the user via SMS, the GPS module will transmit the position coordinates to the microprocessor so that they may be stored and processed. After that, the information is sent to the GSM module, which is responsible for transmitting the real-time location data to the user interface (mobile phone) in the form of a short message service. After then, the user is able to analyze the data and pinpoint the exact position of the bag. The process is shown in the figure that may be seen below figure1.

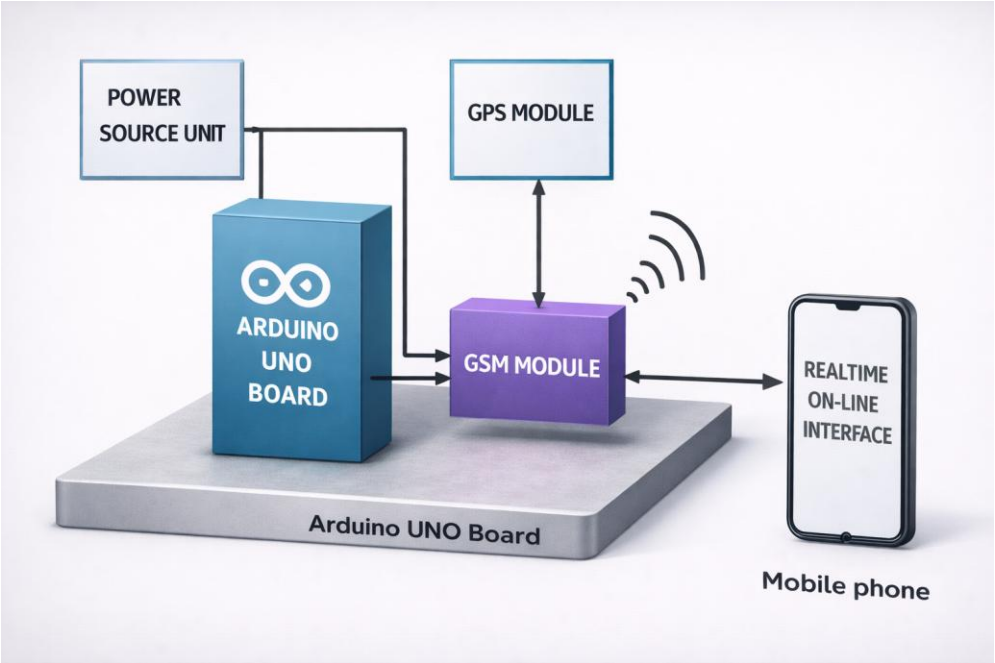


Fig (1): System Process

V. CIRCUIT DESIGN AND SIMULATION

It is intend to integrate the intelligent luggage tracker within the bags. To prevent theft, it is advisable to implement protective measures. The installation of a 9V battery is essential to ensure that the luggage trackers operate continuously without power interruptions, as it will be powered by all devices connected to the circuit. The Arduino Uno board, functioning as the device's central processing unit, requires a 5V supply; thus, its Vin and GND pins will be connected to the battery terminals. The LM2596 regulator is utilized to supply the GSM/GPS Module with suitable voltages derived from battery sources. The SIM800L GPRS GSM module facilitates the transmission and reception of data from the user interface. The device features a slot designed to hold a SIM card during operation. The output voltage terminals of the regulator, rated at 3.7 volts, are connected to the Vcc and GND pins of the GSM module. The remaining pins, TXD and RXD, connect to the Arduino Uno pins 9 and 8, respectively, while the NEO-6M GPS Module is utilized to obtain the bag's position coordinates. A connection is established between the Vcc pin of the NEO-6M GPS module and the positive terminal of the 3.7V regulator output. The TX, RX, and GND pins of the module are connected to Arduino Uno pins 11, 10, and Ground, respectively. The circuit schematic will be presented below the image in figure 2.

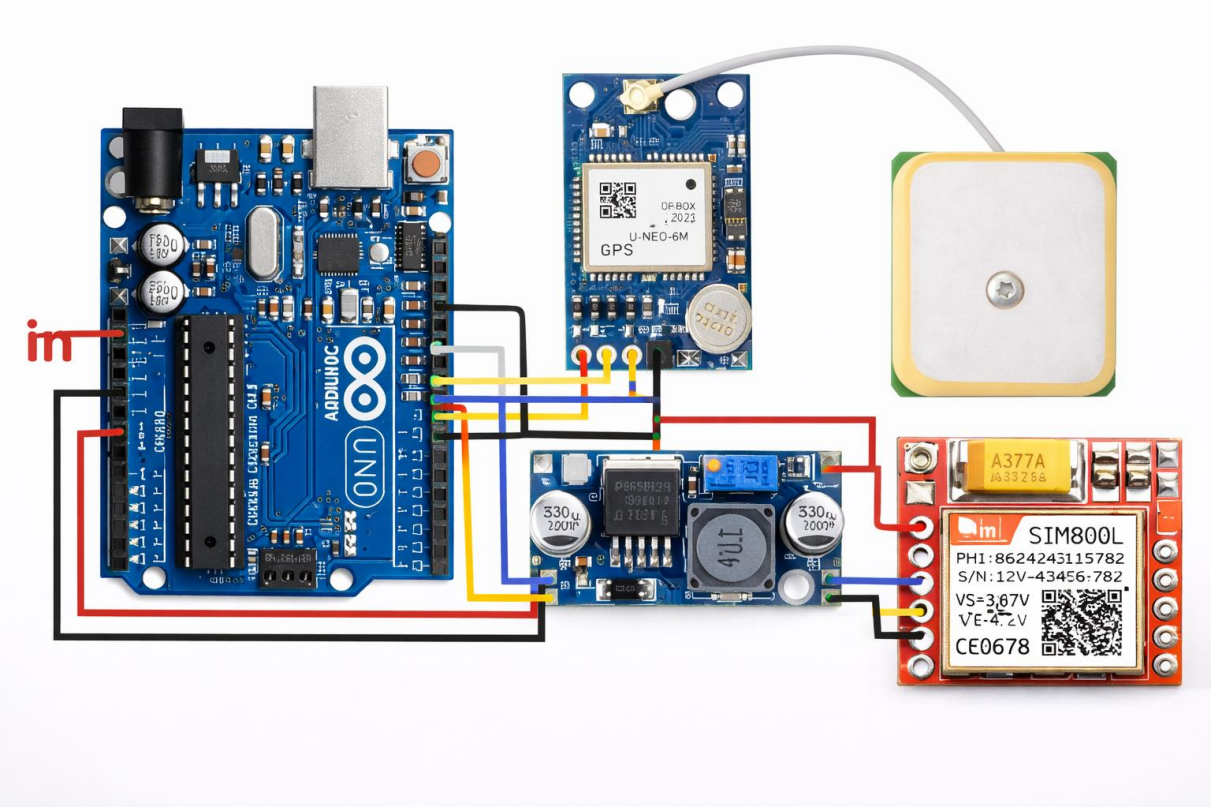
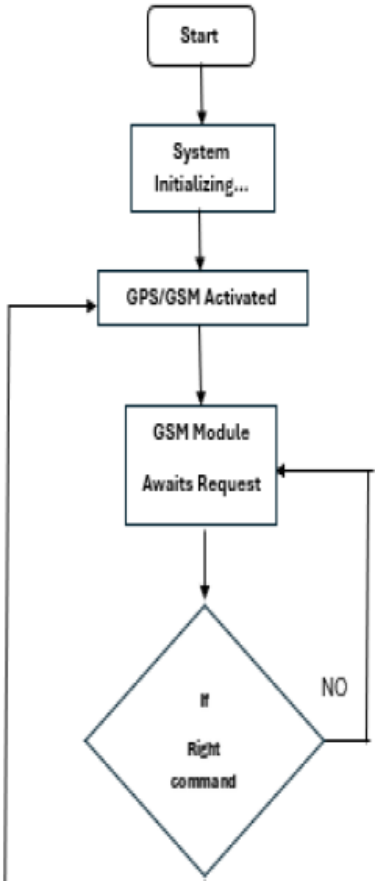


Fig (2): Smart Baggage Tracker Circuit Diagram



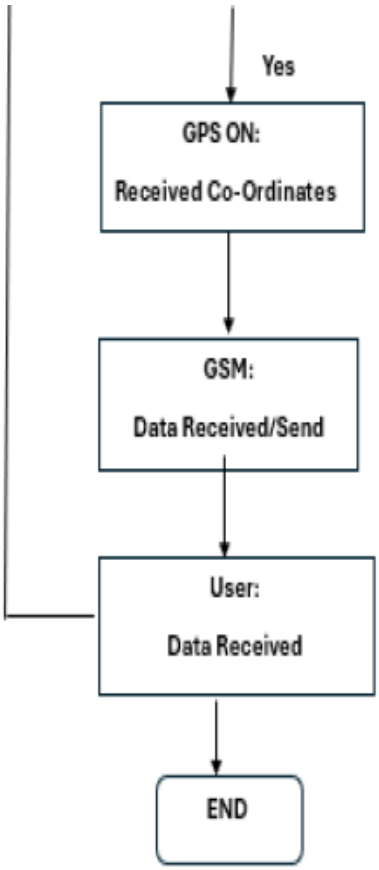


Fig (3): Flow chart

After ensuring that the circuit was properly connected with the Proteus 8 program, the simulation work was carried out. During the course of the simulation, we saw that the GPS module displays the position coordinates of the bag. Following this, a virtual map will be produced in Google Maps, as seen in figure 6 below:

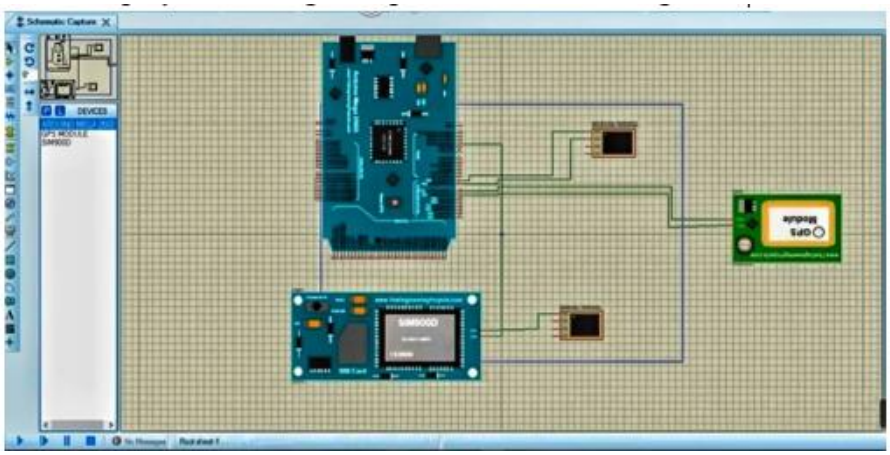


Fig (4): Smart baggage tracker simulation diagram

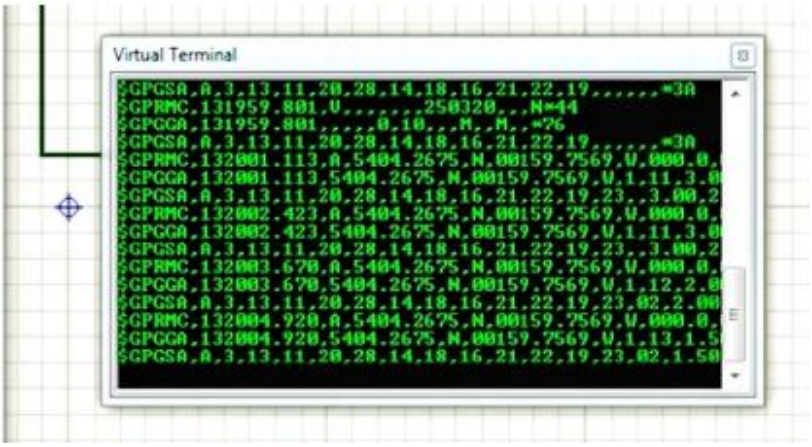


Fig (5): GPS location generated results during simulation

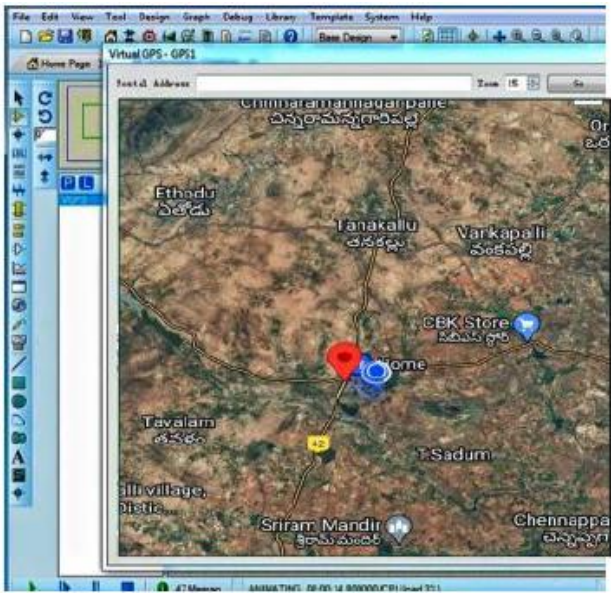


Fig (6): GPS location during simulation

VI. RESULTS AND DISCUSSION

The intelligent baggage tracker system was successfully developed, and we were provided with accurate findings that were shown on our mobile device in the form of Google Maps displaying. Once the circuit switch has been activated, the Arduino Uno will begin the process of initializing the GPS and GSM modules. A little LED light on the GSM module flashes in response to the activation of the circuit switch, which is an indication that the circuit is functioning properly. When the user sends an SMS command, the system is prepared to receive it. The message will be received by the GSM module and then sent to Arduino. Arduino will then send the instructions to the GPS module, which will then relay the location of the baggage to the Microcontroller. As illustrated in Figure, the microcontroller will do an analysis on the data and then send it to the GSM module. The GSM module will then send the information to the user's mobile phone number in the form of a message that contains location links that can be accessed using Google Maps. The location of the bag at the moment is shown in figure 8, which is based on Google Maps image 9:

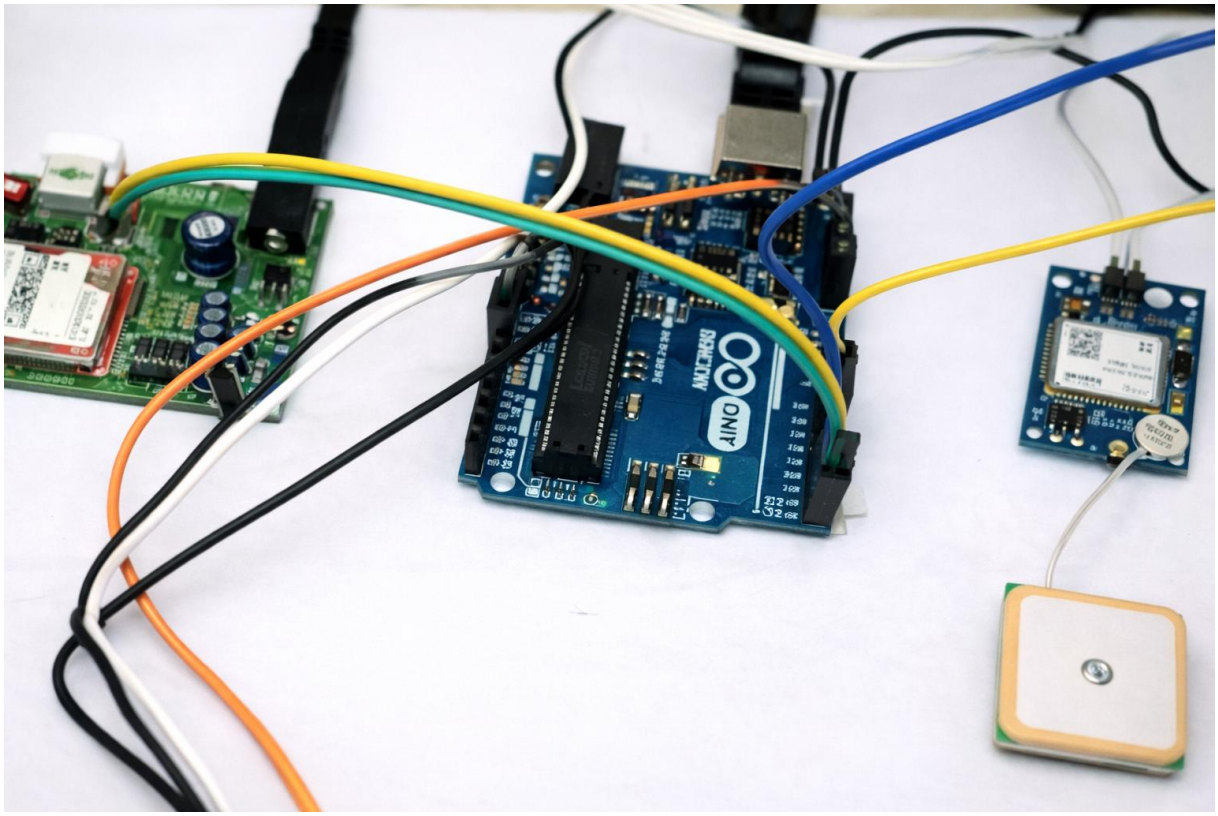


Fig (7): Smart baggage tracker during testing

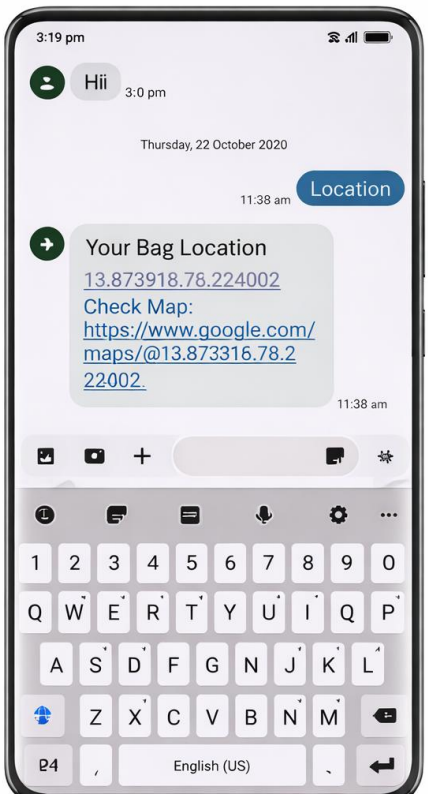


Fig (8): GSM module sent baggage location link to User through SMS

Fig (9): Bag and user's location shown on the google maps.

VII. CONCLUSIONS

The implementation of a baggage monitoring system that is based on the Internet of Things is one potential solution to the persistent challenges that are now being faced by the aviation and transportation industries. Real-time baggage tracking is made possible by the system, which makes use of Arduino microcontrollers and GSM/GPS modules. This provides travelers with a sense of security and reduces the amount of stress experienced by industry stakeholders as well as passengers. By strategically installing this technology at airports, it is possible to enhance the whole travel experience and significantly boost the efficiency with which luggage is handled through the airport. For the purpose of summarizing, the baggage monitoring system that is based on the Internet of Things represents a significant advancement in the fight against the ongoing issues that the travel sector has about the theft, loss, and poor treatment of luggage. Through continuous technological advancement and implementation, such systems have the potential to revolutionize the processes involved in baggage management and improve the overall travel experience for passengers all over the world.

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