

Smart Airline Baggage Tracking and Theft Prevention with Blockchain Technology

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Abstract

Reduction of baggage mishandling is one of the prioritized activities of IATA based on its resolution 753. According to IATA's resolution, all 250 member airlines must adopt smart technologies through, IoT, Cloud and blockchain to reduce baggage mishandling. This paper makes a novel attempt to design a system which couples RFID tags with management reporting systems to help improve baggage performance. The connection between various airports is considered to be a potential bottleneck in terms of implementation of any framework within the airport operation. Blockchain technology is said ease out and relieves the difficulties experienced in implementation of luggage handling and management systems over the cloud. Blockchain technology is used to store and process luggage data in an effective and transparent manner. This paper devised a framework that will allow any passenger to track their luggage in a live manner over the cloud from any part of the cloud at any time. This is made possible by the application of block chain technology over the public cloud space.

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1. Introduction

High baggage volumes turned the airport to adopt automated baggage handling systems in order to prevent unwanted threats and more convenient tracking features making the passenger stress free during travel. Automated baggage handling systems plays a hard and demanding role by hand- holding the ground support personal and passengers in efficient and transparent handling of baggage's. The prime responsibility of automated baggage handling system include arranging, transmitting and tracking systems to explosives detection and early bag storage and retrieve of each luggage is monitored by hundreds of computers from the check in to the checkout of the airport. The number of air passengers will increase double in the next few years, with a astounding 7.8 billion passengers set to travel in 2036, according to the International Air Transport Association (IATA). This

increasing number of passengers creates bottleneck for existing baggage handling systems additionally passengers' expectations are also evolving day-by- day. To meet this challenging scenario Blockchain technology combined with the Internet of Things (IoT) can make a big difference. This rare combination offers a better platform for air passengers by storing and sharing information with high transparency in real time. Different types of baggage. They are:

- 'Local baggage' are checked in at the airport
- 'Transfer baggage' arrives in one flight and leaves on another.
- 'Bulky baggage', that surpasses normal dimensions that are not suitable to be sorted with normal conveyor belts
- 'Special' items that are carry by the passenger arrive at the plane.

2. Radio-Frequency Identification (Rfid) -Proven Solution For Smart Baggage Handling

Radio-frequency identification (RFID) is a proven idea which laid the foundation for enhancing existing baggage-handling services by granting new services. The IATA is insisting the usage of RFID technologies in smart baggage handling. There is new interest in deploying RFID chips embedded in bag-tags as they can be used to perfectly track travelers bags in real-time across all the key location points in the journey. RFID readers use radio waves to trigger and capture the data stored on the RFID chip, so the authorization plate on the baggage tag can be read even when it is out of sight under the bag. RFID trials have been conducted, developed an industry standard for smart baggage tags and made a business case for its airline members.

Baggage handling performance is expected to be in hike if RFID tags are coupled with management reporting systems. Besides this airports authorities and passengers benefit through reduced baggage claims, transparent and easy baggage handling, and chaos free journey. Adding to this Airports can be standardized by making use of modern technology such as RFID which paves way for better customer satisfaction and services to passengers throughout their journeys. Merging different airports is another problem which needs to be put forward. For effective storing and processing of luggage data Block chain technology can be implemented.

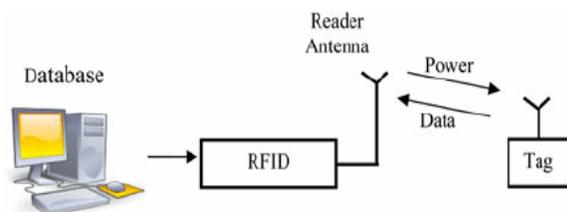


Figure 1: Schematic Diagram of RFID Systems

Schematic Diagram of typical RFID System is shown in figure 1, RFID applications. RFID systems include.

1. **The tag:** The RFID tags are chips embedded with data which are used to store and transmit information about these data. Most RFID tags store data that identifies a specific item.
2. **The reader:** RFID readers are radio regularity transmitters and receivers that communicates with the tags. Readers using an attached antenna to receive data from the tag and then pass it to the system for further processing.
3. **The computer system:** The system will receives the data from the RFID reader through a cable or through wireless connection and then send for storage, interpretation and action. Micro- strip antennas are best choice because of

their attractive features of low profile, light weight, and low manufacturing costs. Enhancement in baggage tracking and baggage delivery has been recognize as key business idea of RFID.

2.1 Block Chain Technology and IoT

The airways industry is particularly exigent due to the multi-layered interdependent. Blockchain and IoT can integrate and with its special distinguishing system, blockchain can create a digital travel identity for the traveller, through which all their movement administrations can be verified. Using blockchain's cybernetic continuity capability, all of a passenger's travel details are updated with single ID, while the information gathered from passenger for each trip which helps to further improves passenger experience over a period of time.

2.2 Essence of block chain Technology

- Transparency and immutability
- Cryptographically secure
- Decentralized
- Data Integrity
- Efficiency and cost reduction

Improper handling of baggage is one of the main reasons leading to customer dissatisfaction, so it's an important need for aviation industry to look forward. RFID for Blockchain and IoT can combine to form an efficient luggage management system using real-time tracking through RFID tags. IoT devices can supply information within the cloud at various checkpoints, reducing the risks of a lost or mislaid luggage and aiding to identify a particular bag of a passenger with proper security measures. SITA reports that 47% of baggage mishandling occurs during transfer at connecting airports.

Positioning the misplaced baggage isn't a simple one to handle since particular luggage is handled by several players, including the airline, airport and ground handling personnel's during its journey from A to B, and sometimes even C. Blockchain automated handling system aided with RFID systems have enhanced by restore baggage handling data directly from departure control applications. Adding to this blockchain may offer benefits with other services also such as payments, booking, passenger prior and prepared information status, mobile alerts thus hand-holding the aviation industry in all aspects. A shared distributed ledger used by all players within an airport starting point and between different airport points, would allow for a bag and its ownership details to be automatically logged on a blockchain. Distributed database server which stores the aviation enterprise information distribute baggage data records shared between different performers and make it much more ease to track luggage as they move with a

passenger throughout the journey
Reasons for mishandling baggage's

- Bag is loaded on to wrong plane
- Wrong destination code
- A passenger bag is similar to another
- The routing label gets damaged

3. Simple Working Scenario Using Block Chain Technology For Real Time Baggage Tracking

Considering the key idea of how a real-time baggage tracking system work using Blockchain and real time tracking, assuming the air passenger journey (and that of their baggage). Various ground personnel or actors come in and out of the scenario, with everyone performing their task. The first thing, is boarding. A real-time baggage tracking system would make it possible to receive an RFID tag for each of your items, adding to this beacon-like GPS tracker for extra precaution. Then, your baggage is carted off to the airport's baggage handlers in a giant room, with its own automated system, before being tossed onto a roller-coaster of a conveyor to be loaded onto the plane. The flowchart of the Smart Baggage Tracking System with IoT is shown in Figure 2.

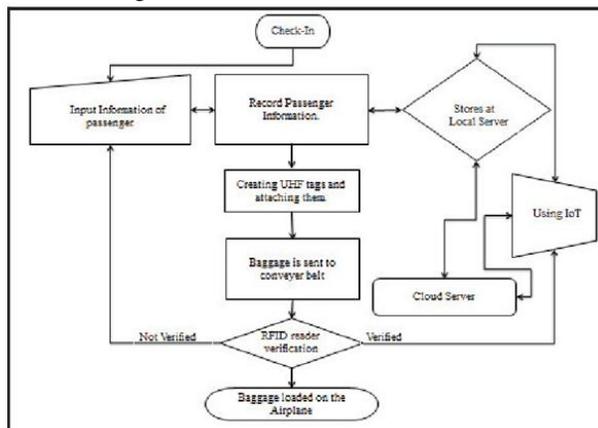


Figure 2: Smart Baggage Tracking System with IoT

All baggage handled by the airport would loaded into the right plane based on the RFID tags on the suitcases. An airport employee would be responsible for making sure all baggage is loaded on the plane, and passengers could use a mobile app to determine if their baggage is traveling with them.

A passenger expectation may vary since intentions perspective of every passenger is different to cover all expectations of air passenger regarding baggage since which prior requirement discussed in this paper mobile app alerts make them feel secured and safe regarding their baggage during their journey. Flow of a Typical Smart Real

Time Passenger Baggage Alert from Mobile App is shown in Figure 3.



Figure 3: A Typical Smart Real Time Passenger Baggage Alert from Mobile App

With a real-time baggage tracking system, passengers could locate and track their items using a mobile app and know that everything's arrived along with them even before they reach the baggage carousel. Blockchain technology is prepared to handle data collected between multiple parties using varied platforms with high integrity. This baggage tracking system uses a decentralized Blockchain database that tracks the movements of all features, through the departure airport to the plane (and other planes) to the arrival airport, which would definitely upgrade passenger comfort.

The solution will enable airline to track luggage with RFID and track their movement.

For the entire journey duration users are notified on alerts or status. With RFID baggage handling and tracking, Passenger can get full visibility of the entire baggage journey. The passenger can utilize the RFID for automatic bag drop, the sortation system can use the information for sorting the bag to the correct flight.

The RFID baggage tracing solution with block chain technology enabled platform and smart data management provides an integrated deployment and monitoring service. The collaborative technology is implemented to support end-to-end tracing and giving alerts to make the passenger's journey meaningful without disruption.

Aiding airlines and airports

- High customer satisfaction.
- Reduce costs by decreasing mishandled/lost/damaged bags.

- Upgrading operational efficiency by minimizing the number of checkpoints, sharing baggage info through all stakeholders.
- Improved performance by self-service check-in and bag drop points.
- Less departure delays by tagging bags and exception handling.
- Facility to track passengers real time also providing additional services

Air passenger comfort:

- Minimized check-in time by making this process more digital.
- Informed passengers always know where to go, the location of his/her bag, and what to do if something goes wrong.
- Speedy bag drop procedure with self-service points.
- Lesser checkpoints resulting fast, pleasant passenger journey throughout

Aviation industry faces increase in air passengers every year with this mishandling and lost baggage's also rises every year. to deal with smart baggage handling RFID automated systems are used where there drastic reduction in the number of mishandled bags. The Figure 4 statistics by SITA clearly shows major reduction in mishandling baggage and theft. The below mentioned statistics clearly shows the usage of smart technology year wise for baggage handling also there is an interesting fact that almost all aviation industry rely on smart baggage handling systems for improved security reasons and passenger comfort. Clear decline in mishandled bags can be seen below which is encouraging factor for upcoming technologies like BL

Of course, RFID tags playing great role in tracking the passenger baggages, its underlying strength for smart automated baggage systems. This when coupled with Block chain in cloud space render tremendous results in real time. tracking thus moving a step ahead for aviation industries. The simple graph mentioned in Figure 5 shows the choice in usage of RFID and Block chain RFID in cloud space for better results and improved passenger comfort.

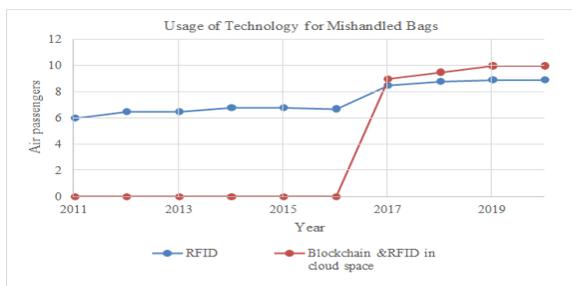


Figure 5: Air Passengers using RFID Tags alone and Passengers Adopting RFID for Block Chain

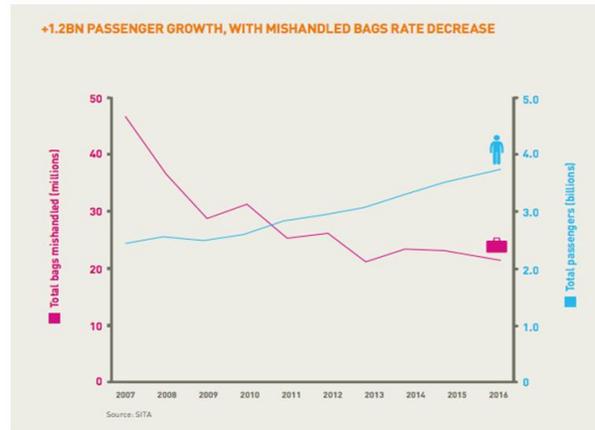


Figure 4: SITA Statistics Showing Major Decline in Mishandled Bags

Consequently, priorities of aviation industry that is the optimization of baggage handling with the help of IoT is met with better tracking. Baggage carts using wireless tags delivers automated monitoring of luggages in and outside the airport thus using RFID for blockchain in the cloud space renders real time tracking of bags within the area of cloud.

4. Conclusion

This smart technology of blockchain, IoT with RFID baggage handling system proves to be best solution for real time tracking of passenger baggage with instant mobile alerts .The key benefit of the system is that it takes very less time as the travelers don't have to wait for their luggage to turn up on the conveyer belt instead they are directed to varied counters and provides increased security with its unique identification number.

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