Journal of Network Communications and Emerging Technologies (JNCET) www.jncet.org
Volume 8, Issue 4, April (2018)

IoT Based Airport Baggage Tracing System

Ritwika Mallick [1], Kavyasree Kilari [2], Shreya [3], Anhad Saran [4], Tadepalli Sarada Kiranmayee [5]
[1 - 4] Student, Department of Computer Science and Engineering, SRMIST Ramapuram, Chennai, Tamil Nadu, India.
[5] Assistant Professor, Department of Computer Science and Engineering, SRMIST Ramapuram, Chennai, Tamil Nadu, India.

Abstract – The internet of Things is a concept that not only has the potential to impact how we live but also how we work. The new rule for the future is going to be, "Anything that can be connected, will be connected." The reality is that the IoT allows virtually endless opportunities and connections to take place, many of which we can't even think of or fully understand the impact of today. In this paper we propose an efficient way to automate the way baggage are handled in airports. The proposed architecture focuses more on the RFID based tracking of the passenger baggage and smarter process of check-in and check-out. We also discussed the advantages of the proposed system.

Index Terms – Internet of Things, RFID, Baggage Tracing, RFID tags, RFID readers.

1. INTRODUCTION

The "Internet of things" (IoT) is becoming an increasingly growing topic of conversation both in the workplace and outside of it. The Internet of things (IoT) is the inter-networking of physical devices, vehicles (also referred to as "connected devices" and "smart devices"), buildings, and other items—embedded with electronics, software, sensors, actuators, and network connectivity that enable these objects to collect and exchange data.

In 2013 the Global Standards Initiative on Internet of Things (IoT-GSI) defined the IoT as "the infrastructure of the information society." The IoT allows objects to be sensed or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit in addition to reduced human intervention.

The most common Loop holes experienced in Aviation industry for Baggage Handling are mislaid baggage, lost baggage and damage to belongings. So, for providing a better and secure system to the passengers, we have proposed a design of baggage tracing and handling system using smart RFID tags and IoT which is based on cloud server.

1.1. Existing techniques of baggage tracing in airports

Airports are investing in technological innovations and systems improvements to ensure that fewer bags are mishandled or lost. Most commonly used technique for scanning is using barcode attached to the baggage; that aren't reusable.

Airport information and technology company SITA recently announced that while passenger numbers have increased by 65.6% in the last decade, reports of mishandled bags have been cut in half. While that is a great improvement overall, it is still cold comfort for anyone at arrivals stuck at the airline's baggage desk reporting a problem.

According to the same SITA report, 81.2% of mishandled bags were delayed, 15.5% were damaged or pilfered, and 3.3% were either lost or stolen. The most futuristic development is the new eTag and eTrack system introduced by Air France-KLM in collaboration with input from their SkyTeam partner Delta Air Lines. This nifty combination of devices allows you to track your bags throughout the journey directly on your smartphone using GSM, GPS and Bluetooth technology. The eTag automatically updates and displays flight details and a barcode when you check-in online from home. All you have to do is drop off the bag at the terminal and go.

As an alternative to the eTag and eTrack devices, Samsonite has developed the Track & Trace bag with eTag and eTrack devices already embedded, so there's less to lose.

Before we all get too excited, there are some important downsides.

While Air France-KLM claim this is an innovation which could work for all airlines, for now no airline has the system in place. Though Air France-KLM's video about eTag and eTrack tells you to go to FlyingBlue and buy it, you can't.

AirFrance-KLM will deploy the system to a limited group of passengers for trials before deploying the system to a larger market segment. There is no way to predict its success at trials, nor do we know what airlines outside SkyTeam will take up the technology once it's been proven.

AirFrance-KLM's decision to make this a device tied-in to their Flying Blue frequent flyer program is also problematic. The system only activates when you check in for your flight with your Flying Blue account. This is an odd decision by the carriers, as even passengers flying with them who don't want to join their frequent flyer program won't benefit from their technology.

Without a high adoption rate by a number of airlines outside the Sky Team network, and universal use regardless of alliance loyalty program membership, eTag and eTrack could quickly be reduced from bench-setting future-tech to just another set of gimmicky gadgets gathering dust.

Unlike traditional barcode paper tags, and RFID embedded tags, this system is not free. Even if you won't pay the as-yet-undetermined-price for the fully-embedded Samsonite Track-and-Trace bag, you will have to pay an undisclosed price for the eTag and eTrack devices.

As the eTrack device is a loose item, which needs to be placed in the bag for the system to work as advertised, those taking this system for a test-drive will need to be very careful where they pack it. Once it's lost, the live tracking function of the system no longer works.

1.2 Improvement and problems in existing systems

Of the seven reasons SITA listed for why your bags may be delayed, transfer mishandling is number one at 45%. Failure to load comes in second at 16%. Ticketing errors, bag switch, security holds, and other factors account for 15% of all delayed bags worldwide.

Visitors at the Passenger Terminal Expo in Barcelona last week were treated to a peek of the best solutions entering the market to keep these mishandled bag numbers low, and ensure they keep getting smaller.

We've ranked the top three according to their direct relation to existing baggage handling issues which most contribute to those 6.96 per thousand passenger bags which were mishandled in 2013.

1.2.1 Bag Journey Applications

Self-service drop-off of luggage is a great time saver and passenger experience enhancement, but no matter who checks the luggage in, success still depends on how it comes out.

The Bag Journey software solution by event host SITA can contribute to system-wide improvements; with end-to-end baggage tracking status updates to the systems of airlines and airports, including smartphone and tablet apps used by operations staff. While a number of firms offer baggage management software solutions, SITA is still at the lead of aviation communications and IT application services.

1.2.2 Baggage Handling Systems Upgrades

Software and apps are great, but bags still need to be moved from the check-in desk to the aircraft hold and back through the arrival's airport's baggage handling system before they reach their owner again at arrivals.

Our favorites from the show, for state-of-the-art automation, were systems by the German company Siemens, the French group Alstef Automation, and the Crisplant system by the BeumerGroup from Denmark.

1.2.3 Smart Bag Tags

Let's face it, losing control of your valuables is one the most angst-inducing elements of air-travel. No matter what software operations systems are in place to track and control activities behind the scenes, or how automated the baggage handling systems installed at the terminal, we still need individual assurance that the luggage we check will come out the same way it went in, on time, every time.

Eliminating baggage mishandling altogether may be near impossible, though some travel regions are getting pretty close. In the meantime, smart tag innovations go a long way to improving the process.

Hong Kong International Airport (HKIA), SkyTrax's 2014 winner for best baggage handling system, puts great stock in RFID technology — it was the first airport in the world to introduce RFID luggage tags in 2008. Lyngsoe Systems introduced this RFID solution at HKIA and became world-leaders in RFID solutions. They've also developed a comprehensive network to help the industry further improve baggage handling.

1.3 RFID Based Tracking*:*

Radio-frequency identification (RFID) uses electromagnetic fields to automatically identify and track tags attached to objects. The tags contain electronically stored information. a RFID system consists mainly of three components; the transponder/tag, reader, and RFID middleware. This automatic data capture technology that relies on radio-frequency electromagnetic fields. Hence the name, Radio-Frequency IDentification or RFID. This technology can be used in our daily lives and objects so that they transit from manufacture to storage and finally the point of sale. The difference between objects and ourselves is that they don't "voluntarily" present their RFID tag or card when asked. The data in these cards can be sensed by the localised tag readers. These tags are therefore read in very different conditions and often require greater detection distances.

Tags*:* These are basically two categories of tags*:* Passive Tags: battery needed, the tags contain electronically stored information. Passive tags collect energy from a nearby RFID reader's interrogating radio waves. Active Tags: no battery needed, Active tags have a local power source such as a battery and may operate at hundreds of meters from the RFID reader. RFID tags contain at least two parts: an integrated circuit for storing and processing information, modulating and demodulating a radio-frequency (RF) signal, collecting DC power from the incident reader signal, and other specialized functions; and an antenna for receiving and transmitting the signal. The tag information is stored in a non-volatile memory. The RFID tag includes either fixed or programmable logic for processing the transmission and sensor data, respectively.

Reader: An RFID reader transmits an encoded radio signal to interrogate the tag. The RFID tag receives the message and then responds with its identification and other information. This may be only a unique tag serial number, or may be product-related information such as a stock number, lot or batch number, production date, or other specific information. Since tags have individual serial numbers, the RFID system design can discriminate among several tags that might be within the range of the RFID reader and read them simultaneously.

Figure 1 RFID Components

2. PROPOSED ARCHITECHTURE

RFID have its place in a group of technologies referred to as Automatic Identification and Data Capture (AIDC). AIDC methods automatically identify objects, collect data about them, and write those data directly into computer systems with little or no human intrusion. RFID methods utilize radio waves to accomplish this. Some The reader consists of the RF module, control unit, and coupling element to interrogate tags via RF communication. It has a secondary interface to communicate with backend systems for the transmission of the information stored in tags. The backend applications not only aggregate, filter, and calculate the data gathered by readers but can process the dynamic product data (e.g. location, history and current analysis). The RFID virtually creates a remote database which travels with the item by making use of RF communication to exchange data between tags and backend applications.

We have designed a prototype at two locations having both check-in and check-out processes. A more secured algorithm is used for generating tags that are attached to printed baggage label with the details of passenger and airline stored in it. RFID readers in the check-out areas facilitate step tracking of baggage which prevents baggage loss. The baggage's real time position is tracked and stored in a cloud using IoT and unique ID can be retrieved by the passengers wherever and whenever necessary. The same ID can be used while collecting bag at check-out counters. The system provided ensures less consumption of time, security for baggage and is economical hence provides customer satisfaction.

We will discuss in detail about the application modules and check-in and check-out process.

2.1 Detailed description of the architecture:

2.1.1 Process on arrival at the Airport.

- Input and Registration of Information:
- At check-in section, the information of each and every passenger is taken and stored in information bank (server). The information bank consists of four important items including the name of the Airline, flight number, bag nature and mobile number of the passenger along with the identification number which is peculiar to each person. This identification number is stored in the memory of the RFID tag along with the other details of the passenger for any further investigation and referral to the information about the person and their luggage. The same identification number is sent to the passenger through SMS in order to keep it personal.
- Control System of Baggage Handling (CSBH):
- After the making of tags and sticking them on baggage, it is passed through a gate including four RFID readers. All the baggage is passed through EDS (Electronic Data System) to observe their content and sort them according to their flight number. The baggage is then loaded to the respective flights and for conforming that the baggage is being loaded on the flight, baggage is again passed through RFID readers at the time of loading and the information is stored at the local server.

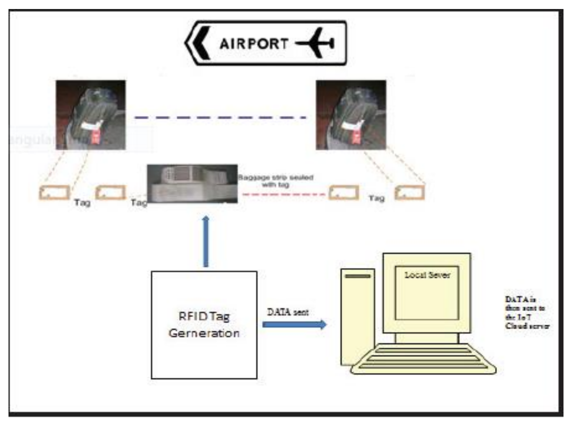

Figure 2 Architecture Diagram

2.1.2 The process at the Destination Airport

- Baggage Sorting:

After the passengers arrive at their destination and the baggage is ready for offloading they are passed through the RFID readers, the Identification number of the MR6011 tags read by the readers are stored in the local Server of Destination Airport, which confirms the offloading of baggage at the destination Airport. The baggage is passed through a gate including four RFID readers on the conveyer belt and simultaneously will inform the passenger that the baggage is arrived at the airport through SMS.

- Conforming Baggage and handing it over to Passenger using IoT:

When the passenger reaches the counter he will have to enter the unique identification number received by him on his mobile on the keyboard installed at the counter gate. Now, the identification number is read by the reader they will try to match the information related to the Identification number on the RFID tag and entered by the passenger , which was already uploaded on the main cloud server by the Arrival Airport. Further the process of sorting will occur. As soon as the entered identification number is read by the reader the push mechanism will sort the bag to the required counter by opening the gate controlled by servo motor and the confirmation message about passenger receiving the baggage will send the message to the Server.

2.2. Procedure at check-in:

When the passengers arrived at the location 1 their basic information like number of bags, their mobile number, the serial number (s) of RFID attached at each bag, destination, identification code was stored on a local sever. The information about passengers was stored on local server and was uploaded to a cloud in which the server of location 2 is connected with the help of IoT. When the baggage was ready to be loaded on airplane it was passed through RFID readers, the readers read that particular serial number and sent it to the Raspberry Pi via Ethernet; Raspberry Pi sends it to local server which will note that the baggage was loaded.

2.3. Procedure at check-out:

After the passengers arrived at their destination (location 2) their baggage was loaded on the conveyer belt, which will keep on rotating the baggage until someone calls for it. The passengers will receive a unique identification code when they give their luggage during boarding which will be sent in the form of SMS. passenger enters his identification code the identification code will go to server where it will check the number of baggage and their serial number under that identification number entered by passenger, the serial number (s) will then be sent to the reader and the reader will sort out the bags of that serial numbers accordingly. When the serial number(s) of the baggage is detected by reader the servo motor opens the gate and a push mechanism installed on conveyer belt pushes the baggage out of the gate, this functioning will be achieved with the help of Arduino.

2.2 Implementation platforms:

- RFID Components- RFID tags, RFID readers, backend software interface.
- Arduino kit and software
- Readers connected via Ethernet
- Cloud-based server
- SMS gateway

3. ADVANTAGES OF PROPOSED ARCHITECTURE

- RFID technology can be used for tracking products or product identification
- Does not require line of sight to read the tag
- has a longer read range than barcode reader
- Tags can store more data than bar codes.
- Readers can simultaneously communicate with multiple tags
- This feature could allow customers to breeze through grocery store checkout counters while a reader identifies all
- items in a shopping cart can be scanned at the same time, instead of scanning each bar code individually

4. CONCLUSION

Through this proposed system, passenger could get better security, reduce baggage loss and mishandling to a great extent and every baggage will be delivered on time. And because of the counters created passengers got distributed into groups which will also decrease the time consumed at check-out.

The main advantage of the system is that it consumes less time as the passengers don’t have to wait for their baggage to turn up on the conveyer belt instead they are routed to different counters and ensures high security due to the unique identification number. It is following the current trend as it is environment friendly, as it is paperless, no printing and paper are needed which is a very important issue currently in the aviation industry. With this design we tend to make the air travel more customers friendly, less time consuming, hassle free, with less queuing and greater security of the passenger.

REFERENCES

[1] Tanvir Ahmed, “A Data Warehouse Solution for Analysing RFID-Based Baggage Tracking Data” in IEEE 14th International Conference on Mobile Data Management 2013, Page: 283-292
[2] L. Riley. IATA Introduces RFID Standard for Baggage Tags Annual Industry Savings Projected at US$760 Million[Online]. Available: http://www.iata.org
[3] International Air Transport Association, RFID Business Case for Baggage Tagging, 2007, [Online] Available: http://www.iata.org
[4] IRS Global.: Overall Analysis for 2015 Creative Economy for Trying to New Bussiness Stratergy related IoT, In: Market Report 2014-9(2014)
[5] https://www.ana.co.jp/en/in/international/prepare/baggage/search/
[6] Ashwini Singh1, Sakshi Meshram2, Tanvi Gujar3, P. R. Wankhede4, 2016 International Conference on Computing, Analytics and Security.