A review on Baggage Tracing and Handling System using Sensor Networks and IoT

Harshita Prajapati[1], Anil Kumar Mishra[2]

Dept of Electronics Engineering, BIT, Durg, C.G., India[1]
Dept of Electronics Engineering, BIT, Durg, C.G., India[2]
harshita.prajapati99@gmail.com, anilmishra20042005@yahoo.co.in

Abstract

Baggage management is one of the biggest nightmares for both airport authorities as well as aircraft carriers which will ultimately passengers have to suffer for. Baggage handling is not fully automated even in one of the most modern airport. Baggage movement involves lot of human intervention at various points which slow down the overall process and increases scope of error. So for providing a better and secure system, we have proposed a design of baggage tracing and handling system using Radio Frequency Identification (RFID) and Internet of Thing (IoT). Prime vision behind the project is to reduce the overall baggage travel lifecycle starting from baggage collection at various check-in counters to the conveyor belts present in the arrival halls.

In regard to the above objective it's obvious to optimize the process at each and every stage of baggage transfer system. The problem related to baggage sorting, loading / unloading, availability at the arrival belt, estimated arrival time (ETA) is addressed in an efficient and proactive manner, so that it's never annoying for a passenger to collect his very own luggage. This also solves the problem of baggage lost/misplace and locate if there is any such unfortunate incident.

Keywords: *RFID, IoT, ETA, sorting, sequencing, warehousing, mining*

1. Introduction

Proposed system controls each stage centrally and makes decision based on available data through various sensors. To support the high availability need and real-time functioning, system is designed and controlled using Raspberry-Pi which gives enough flexibility to scale and process time critical sensor data. Raspberry-Pi has amazing feature of distributed computing by forming cluster of multiple kits together which increases the computing power exponentially.

It purely works on a concept of sequencing, sorting, efficient storage (warehousing) and retrieval (mining). When a passenger drops his/her baggage it is tagged with an RFID along with vital information like - passenger image, seat number. This data is also stored and utilized for later decision making, a sequencing model decides the container (blocks of luggage placed in aircraft deck, this is use to balance the load evenly) where the baggage should be placed in, sequencing and sorting at this stage will happen based upon the passenger's flying destination and seat number which was captured during the time of baggage check-in. This solves the sorting, loading and unloading problem.

Post this challenge is to calculate ETA for each baggage and provide this information to the passenger via SMS. Since the baggage are already loaded based upon the passenger's features – seat, destination etc. It's pretty obvious that the passenger present on first row will of-board the aircraft first, same applies for

the baggage too. As the baggage are already tagged with RFID it can be easily identified and computed ETA can be made available to the passenger via SMS or screens available in within the airport premises.

This system will also supplement the RFID with the camera data and track the passengers movement in real-time and provide vital information to the baggage loaders (workers responsible for carrying the baggage from aircraft to arrival hall) like which baggage to prioritize first based on the exact location of passenger, capacity of conveyor belt and waiting time of the passenger.

If we look at the proposed system closely it actually uses the resources which modern airports are already equipped with, such as camera (CCTV), conveyor belts etc. So implementation cost would not be much. On a different note if we look at the pros it provides a lot to all the stakeholders - aircraft carriers, airport authorities and at last the passengers. Since this system is fully automated there is very little scope of margin and even if there's an error like baggage lost or so, it could be easily identified as we will have exact data logged in the central servers.

2. Literature Survey

Yashar zeinly, Bart De Schutter and Hans Hellendon (2013) had presented a new strategy for control of baggage handling systems in 16th International IEEE Annual conference on Intelligent Transportation Systems. Here three main control issues in baggage handling system, routing and scheduling problem, empty cart management, and line balancing are identified and a combined control approach based on model predictive control is proposed. The control approach can be formulated as a linear programming problem that can be solved efficiently, and hence can be extended to large scale handling system.

Yuanxin Ouyang and Yao Hou (2008) had proposed design for baggage management in IEEE conference which uses RFID tags to enhance the ability for baggage tracking, dispatching and conveyance, so as to improve management efficiency and the users satisfaction. It uses an intelligent RFID Reader which has the ability of data disposal and provides edge savant service is presented. The prototype readers and its experiment in the airport baggage handling system are also introduced in this proposed model.

Vu Thanh Le, James Zhang, and Michael (2012) proposed a paper in IEEE International conference on Systems, Man, and Cybernetics Seoul, Korea, which uses standard set of measures to assess the expected performance of a baggage handling system through discrete event simulation. These evaluation methods also have application in the study of general network systems. Application of these methods reveal operational characteristics of the studied Baggage Handling System, in terms of metrics such as peak throughput, in-system time and system recovery time.

P.R Wankhede (2016) had proposed a design of baggage tracing and handling system in International conference on Computing, Analytics and Security Trends (CAST) Pune, India, which uses smart RFID and IoT which is based on cloud server. It has a designed prototype at two locations having both check-in and check-out processes. Amore secured algorithm is used for generating tags that are attached to printed baggage label with the details of passenger and airline stored in it and RFID Readers in the check-out areas facilitate step tracking of baggage which prevent baggage loss. The proposed system ensures less consumption of time, security for baggage.

3. Methodology

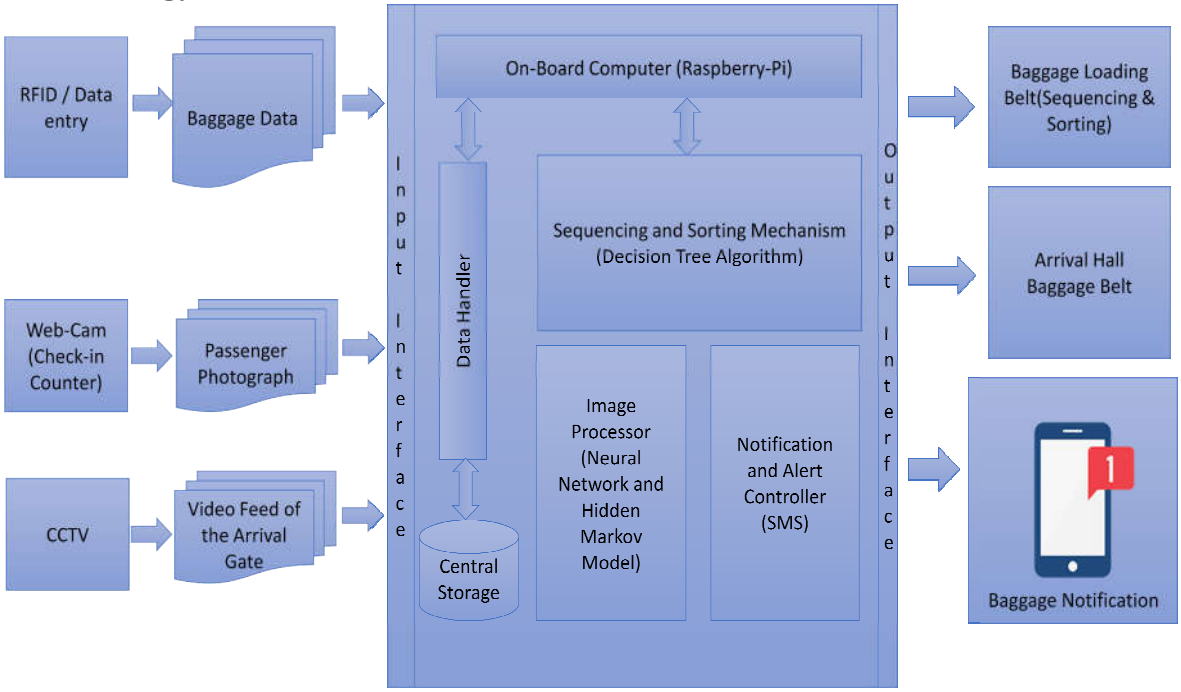

Figure 1: Block diagram of central command and control center

3.1 Input

- Firstly the baggage data will be captured by RFID readers and tag at the starting of the conveyor belt.
- Web-cam at check-in counter will collect passenger photograph.
- CCTV will collect video from arrival gate.

3.2 Central command and control center

- Raspberry-pi is the brain of the proposed prototype that receives/provides the control signals from/to various modules that are being controlled by it.
- Sequencing and sorting algorithm**:** It refers to the operation of ordering data in a given sequence.
- Image processor: Here we are using neural network and hidden Markov model.

3.3 Output

- Sequencing and sorting in Baggage loading belt.
- Loading in arrival hall belt
- Baggage notification to the passenger

4. Conclusion

Complete system is driven by a central control system using data gathered by various sensors. This makes the complete operation smooth and effective. Device is controlled by a single chip computer Raspberry-Pi which makes it even handier for various types of I/O controls and data processing for smart decision making while sorting, sequencing etc. Hence, the objective to design an optimized baggage delivery and cost effective mechanism is achieved.

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