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LugTrack: A smart and simple way to track the Airlines Luggage

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ABSTRACT
It's very clear that baggage problem happens everywhere in this world. While reaching to the destination air travellers frequently face a problem of receiving their luggage damaged, misplaced, delayed or pilfered. Airlines struggle to reduce the global rate of mishandled baggage with the help of new technologies. We want to develop Luggage Tracker system as an easy, cost-effective way means to solve the baggage mishandled problem. To reduce this we have proposed such technology that is totally automatic, smart, contactless and easy to implement. Using this system passengers can see the real time position of their luggage in every single moment. This LugTrack is a RFID based luggage tracking system that will have notification sending capability to the luggage owner of each and every situation while travelling. This technology is all about giving the customer a 3rd eye to track their luggage while passing any terminals. This System can easily be applied on international trips as all the luggage database will be linked to the Flight unique no. Hence making the dataflow seamless and very easy to maintain. This project empowers the industry 4.0.

Keywords— *Airlines struggle, Luggage Tracker, luggage database, RFID, IOT , Firebase.*

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I. INTRODUCTION

Based on the resolution 753 of International Air Transport Association, all the airlines should maintain an accurate inventory of baggage by monitoring the acquisition and delivery of luggage of each and every passenger. But each year millions of baggage are mislaid by airlines in the airport. The airline industry has devoted a great deal of work for solving the issue of tracking luggage. But it has not settled with any solution yet. Airports are continuously investing technological innovations for systems improvements to ensure that fewer bags should be mishandled or lost. According to aviation IT provider SITA, there were more than 24.8 million mishandled bags in the year 2018, accounting for, roughly, 40 bags disappearing every minute. According to another report of SITA's Baggage IT Insights 2019 report, the most common cause behind mishandling of baggages is delayed bags submission. This is actually accounted for three-quarters of lost luggage last year. Of the 19 million delayed bags, nine million were as a result of transfers recorded by the group in 2018. Damaged bags represent 18% of mishandling incidents that include stolen bags accounting for 5% of cases. Technology, such as tracking apps with RFID tags, IoT could make some improvements when it gets to ensuring passengers aren't left disconsolate around the baggage carousel. The question is which solutions are the most effective and how to ensure all the airlines that can use the information to better serve themselves and their customers. Airlines can not be forgiven for not transferring bags in some situations. The Internet of Things (IoT) provides some solution that have been used for few years. However, when we use IoT based technology to track baggages at every step of the way, losing track of the bags is unacceptable. RFID is an emerging and better technology that could help revitalize the airlines and could be the impetus for the change it needs. In 2019 Delta added RFID chips to its baggage tags. It gave its customers the ability to track down their luggage via an app 99.9 percent of the time across 344 of their stations. Delta demands that this will allow the luggages to be tracked more quickly than rescanning the barcodes on the bags. But unfortunately, while some has already installed this in dozens of airports, like in Boston's Logan Airport, not all companies are agreed to use it for multiple reasons like RFIDs cannot understand each other's RFIDs and many airlines cannot use RFIDs. Various RFID systems

are under test in the United States, Europe, and Asia. For instance, Air France is not using RFID tags. Instead of RFID it uses attached bag tags that is connected to the Internet, or "eTags," to allow people to check in their bags more efficiently and track their bags all over the world through their app. It is claimed that the most futuristic development is the new eTag and eTrack system. It is already introduced by Air France in collaboration with input from their Sky Team partner Delta Air Lines. Eliminating baggage mishandling at all may be near impossible, although some travel regions are getting pretty close. In the meantime, RFID tag innovations go a long way to improve the process. Moreover, In a world where information is money, RFID dramatically saves both of it by accelerating and automating everyday processes through some instantaneous acquisition of information.

II. METHODOLOGY

Lug Track system provides a real time stage by stage location of the baggage along the transportation and enormously enhances the ability for baggage sorting, baggage matching and baggage tracking. New RFID tags are attached to the Luggage after security checks. The baggage information such as the owner, owner's contact details, the origin airport, the destination and the airline number is stored in the FIREBASE tree along with the new Rfid tag number is registered to the database where all the airports are connected to the central server. All of the Databases at different airports are connected to a central server which facilitates the sharing of specific information of the passenger details. Readers have wired or wireless street Ethernet over which they report their RFID data to the central server. All Microcontroller operated RFID readers run custom software according to their specific nodal positions that processes RFID data set before sending it to the main database and interacts with it. These RFID scanners continuously checks for newly detected RFID tags and generates one tag-read event per tag with the format (tag ID, Location code). For example, if tag A is detected, then the custom reader software will generate and send the following information to the server: (tagA, L). When the baggage is loaded in the airplane it will pass through a checkpoint (tagA, L1) where the reader will read information and will promptly update the the Server with Location code and will send a message to the registered contact no of the owner if founds a match with the pre-registered–ID fetched from the database. When the Luggage reach at the destination The bags by passing through a section of the RFID readers will read the information and sends a successful query to the server and SMS Gateway will send a message to the passenger that the luggage is arrived at the conveyer belt. Now, the passenger will have to enter the unique identification number on the keypad located at the counter gates. The entered UID (Unique identification no) code on the keypad will verify the same code in RFID tag that was saved previously at origin airport and also sent to passenger via. SMS.

Once the identification number is matched, with the UID number of passing bags under the UHF RFID scanner sensor the bags of that code will be sorted out on that counter.

This whole process will also involve customisable intermediate locations by just adding a few more Microcontroller operated RFID reader setups in different stages of luggage processing.

A. Process on arrival at the Airport

1) Registration of Information and RFID tags:

When passengers reaches at the Airport they first head to the checking counter to submit their baggage. At check-in section, after security checking every Baggage about to be placed for the cargo storage an RFID tag is attached to every baggage. The information of each and every passenger is collected and uploaded to the FIREBASE Database (server). In database tree one branch will be allotted consists of four important items including the name of the passenger, flight number, nature of the luggage and mobile number of the passenger along with the UID no. of RFID tag, which is unique for each person. This UID number is stored in the FIREBASE Database branch along with all the other details of the passenger for any further investigation and aa referral to the information about the person and their luggage and will be used for further notification purpose. The UID number as soon as allotted a branch a Database is sent to passenger via SMS in order to keep it to themselves and the Location indicating code in the FIREBASE tree will be updated as 1^{St} stage cleared or any code words to track later. After fulfilling all the procedural protocols the baggage is placed on the conveyor belt for further handling.

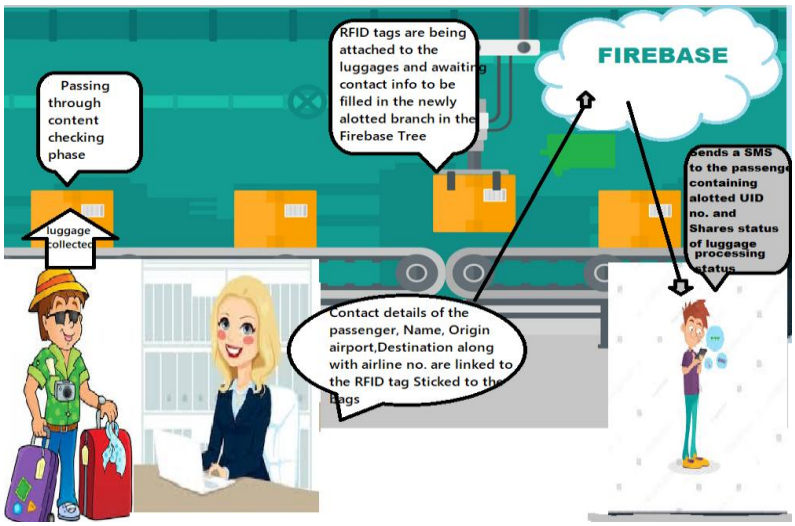


Fig.1. Process at the time of check-in at Airports

2) Baggage Handling Process (BHP):

After sticking of tags on the bags, it's passed through a gate including a series a Microcontroller operated RFID readers. In the case of any sorts of system failure or no Mach found condition is confirmed by the system, such bags will be returned to the previous stage and those tags will be studied and a new tags will be stuck to it if necessary or any kind of maintenance could be done. All the baggage is passed through series of RFID reader setup sort them in order to their flight number. The baggage is then loaded to the respective flights cargos and for conforming and providing resolution that the baggage is being loaded on the flight, baggage is again passed through RFID readers at the time of loading and again in the respective branch of Firebase tree, Location code for the UID no. and simultaneously a notification message will be passed to the contact number stating the status of the baggage .

B. The process at the Destination Airport.

1) Sorting of Bags:

After the passengers reaches at their destination and the baggage is ready for unloading they are passed through the RFID reader setups again, the UID number of the tags read by the readers are matched with the Firebase by sending queries and if match found it updates the location code and send a confirmation message to the contact no attached through SMS., which confirms the offloading of luggage at the destination Airport.

2) Handing over the baggage to Passengers using IoT:

When the passenger reaches the counter he will have to enter the UID no. of his RFID attached to his luggage sent by the server on his mobile on the keypad installed at the counter gate. Now, the unique identification number is read by the reader it will constantly try to match the UID number with the RFID tag attached bags, which was already uploaded to the central cloud server by the Origin Airport. As soon as they entered identification number is read by the Scanner the sort mechanism will push the bag out of the belt in front of the query counter by opening the gate controlled by a servo motor and the Successfully Delivered message will be sent to the Passenger's contact and the server will be uploaded with recent Location code.

As a final step of confirming 100% proper delivery of right bags to the right person another security check will take place at the airport exit gates by scanning the sealed RFID tag and matching it to the barcode scanned Ticket no. of the passenger.

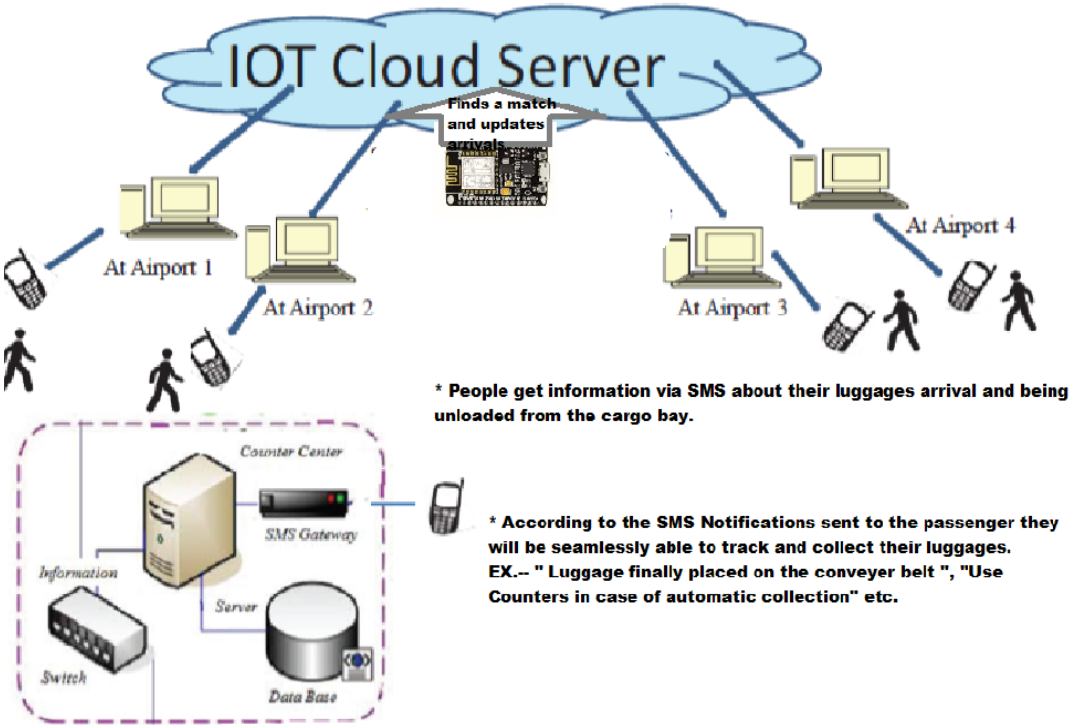


Fig. 2. Process at the time of baggage offloading

III. IMPLEMENTATION AND RESULTS

We implemented the system at two locations to analyse performance of the proposed system, a number passengers with luggage checked into the system at origin location. Since our main moto is on tag generation at origin and collecting ID and passenger details uploading the data cloud and for the next stages during the journey we used the preformed database for sorting and sending notifications including the delivery at check-out.

A. Design for Check-In

As the passengers arrived at origin airport their basic information like name, contact number, the UID number of RFID tags for attached at each bag, destination airport,

Along with location code was stored on the cloud. The passengers were provided a SMS containing UID no. under which the details of their luggage were stored and which they needed later to proclaim their belongings once they reach the destination airport.

Details of the luggage owners were saved on firebase cloud server which was also sharing connection privileges with destination airports with the help of IoT. When the luggage was about to be loaded on the flight it was again passed through a setup of Node -MCU controlled RFID readers, they scanned UID number of particular baggage and searched the database tree for a match in child branches as soon as it found a match it updates the location code and sent a significant loction update containing SMS to the registered contact no fetched from the child node in the database . If the UID number read by the readers did not shown a match then the bag was sent back to the previous point and rechecked for any kind of problems.

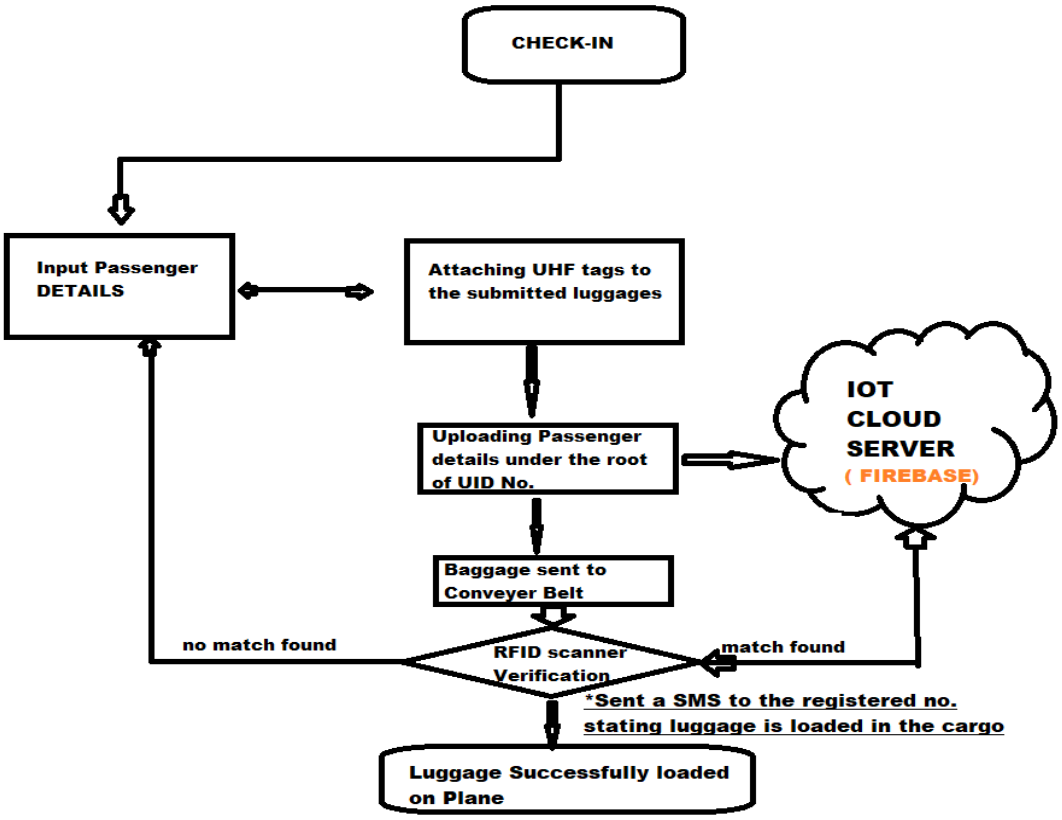


Fig. 3. Design flow for check-in process

B. Design for Check-Out

After the passengers arrived at the destination airport their luggage were unloaded from the cargo after security checking before it was sent to the conveyer belt a SMS was sent to the passenger about, Luggage ready to be collected from the conveyer belt or counter. On the rotating conveyer belt, which will keep on rotating until the baggage was called by someone with right keypad inputs. The UID no. was sent to the passengers while checking in at the origin airport. The conveyer belt was equipped with 6 automatically assisted sorting counters

For the passengers who had landed a confusing situation while selecting their bags. The passengers just had to approach one counter and input the UID key sent via SMS and wait as soon as their luggage pass through the counter scanner finds a match and pushes the luggage set to the owner. And simultaneously updates the database with new relevant location code followed by sending a SMS stating 'Luggage picked up by passenger'.

While finally leaving the airport, they passed through a security checking to confirm rightful delivery. Passengers confirmed their luggage by placing bags under another RFID reader Node-MCU setup equipped with a barcode scanner to scan ticket barcode. By matching these two parameters with the database. System confirms a successful delivery and updates database and sends successful delivery status via SMS to the registered contact number.

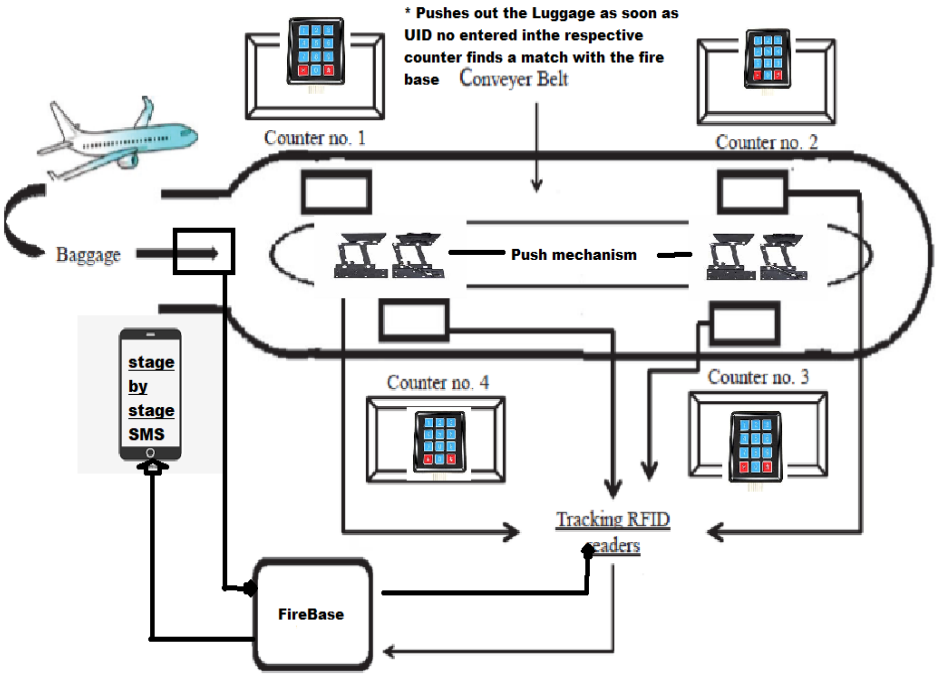


Fig. 4. IOT Assisted Sorting Mechanism setup

C. Experimental Review:

We included some people in our Experiment and allowed them to check-in at an origin point with their bags. We entered their details at a real-time database and allotted them with RFID tags with unique identification number. These luggage were passed through UHF (Ultra High Frequency) RFID scanner MR6011 setup controlled by Node-MCU at every stages of the journey and sent notifications through SMS. Then the baggage was sent to destination for a greater convenience to retrieve the belongings the passenger had to enter UID number on the keypad at automatic assist counter. And at final stage they just scanned the ticket barcode with their belongings to clear final security check to mark a successful delivery.

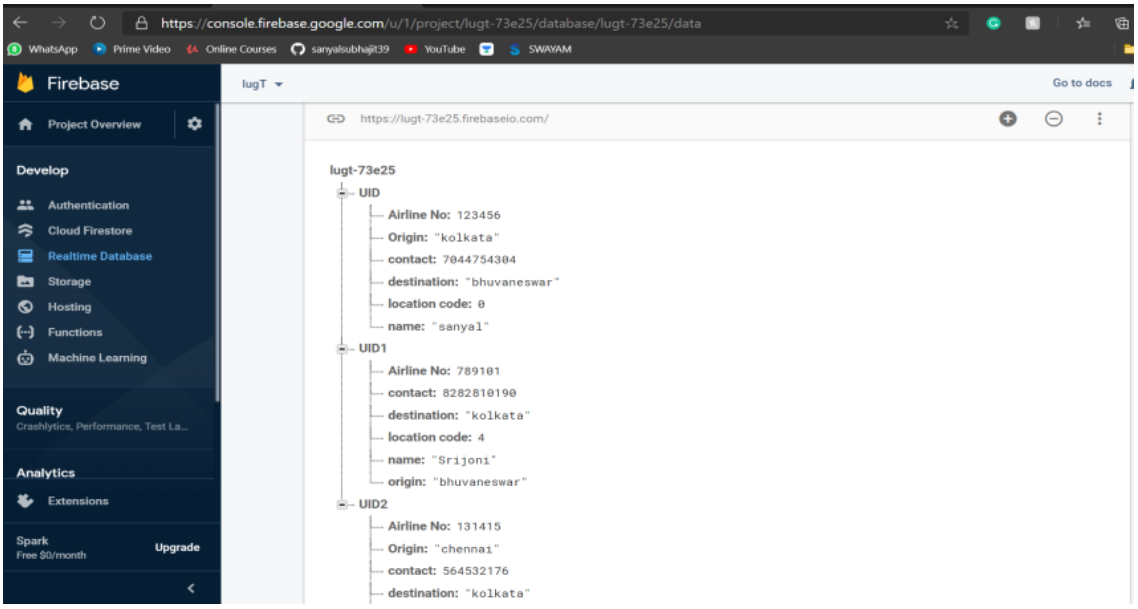
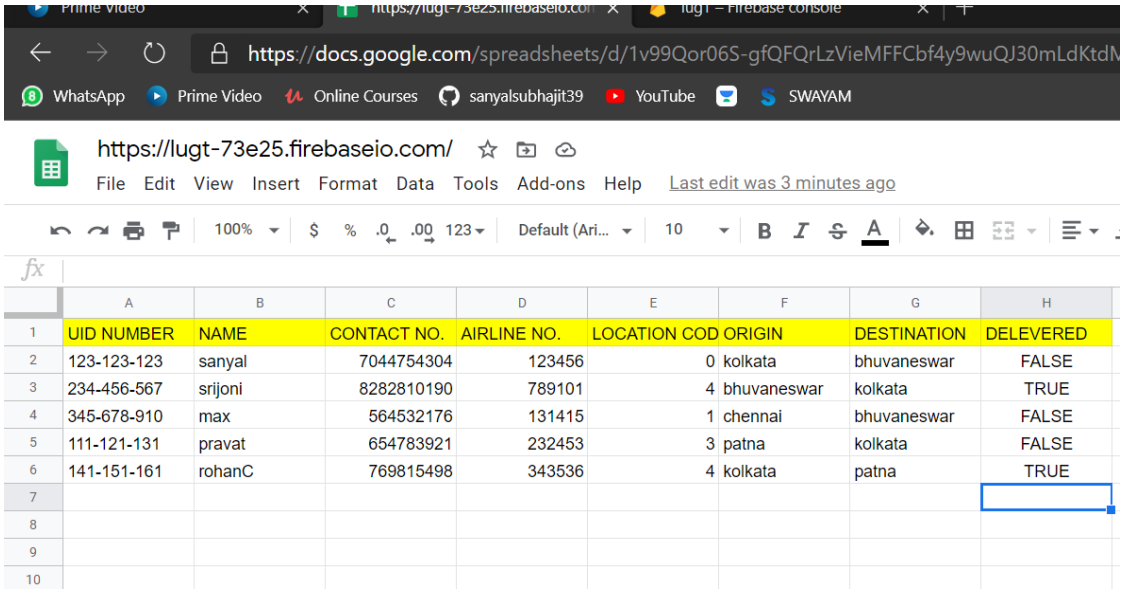


Fig. 7. Baggage details system at Database



	A	B	C	D	E	F	G	H
1	UID NUMBER	NAME	CONTACT NO.	AIRLINE NO.	LOCATION COD	ORIGIN	DESTINATION	DELEVERED
2	123-123-123	sanyal	7044754304	123456	0	kolkata	bhuvaneswar	FALSE
3	234-456-567	srijoni	8282810190	789101	4	bhuvaneswar	kolkata	TRUE
4	345-678-910	max	564532176	131415	1	chennai	bhuvaneswar	FALSE
5	111-121-131	pravat	654783921	232453	3	patna	kolkata	FALSE
6	141-151-161	rohanC	769815498	343536	4	kolkata	patna	TRUE
7								
8								
9								
10								

FIG. 8. Baggage details system at spreadsheet interface for maintenance and admin usage

IV. CONCLUSION

This Lug Track system is a smart technology using RFID baggage handling system with best deployment strategy for real time tracking of passenger baggage with instant mobile alerts .The key benefit of the system is that it takes very less time at the traveller's end as they don't have to wait for their luggage or being messed up in a heap of bags when it would turn up on the conveyer belt. Rather they can be directed for automated collection. At the airlines authority end it provides a user friendly expandable database that provides increased security with its unique identification number and dynamic database and also a any missing case can be very easy to track as the database registers itself at various specific points, which can tell at which specific point the luggage got missing.

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