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Optimal Delivery of Baggage to Passengers at Airports

Dr. Anitha M.L[1], Sumiaya Fathima[2]

[1]*Professor, Dept of CSE, P.E.S College of Engineering, Mandya, India*
[2]*M.Tech Student, Dept. Of CSE., P.E.S College of Engineering, Mandya, India*

Abstract - *In this paper, we create handling system for passengers in the airport for collecting their bags from conveyor belt by using RFID (Radio Frequency Identification). It reduces the waiting time for passenger near the conveyor belt. It also helps to solve the problem of mishandling of baggage. Radio frequency identification (RFID) uses electromagnetic fields to identify and automatically track tags attached to objects. Labels contain information stored electronically. This article explores and analyses the use of RFID technology in today's airports. Furthermore; we create a cell phone application for passenger through which they can be notified that their bags are on the conveyor belt. In this system we detect for any metal in the baggage to provide security in the airport.*

Key Words: **Airport, Bag Tracking, Conveyor Belt, Android Smartphone**.

1. INTRODUCTION

Today, aircraft is one of the best-known transportation resources for people all over the world. An airport is arranged in very different units, all different units have to work together to complete every procedure every single day, to ensure everything gets to the right place at the right time. However, people working at the airport can make mistakes; computer systems running behind the scenes can also make mistakes. Although we cannot reduce the number of human errors, we can definitely reduce the number of errors in handling baggage of travellers by using new technologies that can work more efficiently. Lost baggage is a common problem in airports. This problem can be solved by making use RFID tags and readers to track baggage in airport.

The proposed system eliminates the need for passenger to stand near conveyor for waiting their bags and also reduces the problem of mishandling of bags. Here, a RFID reader will be fixed on the conveyor. So when the baggage comes near the reader, its code is read by the reader and it checks the database for the name of the particular person and displays the name on LCD display, and even announces the name through the speaker, if the person didn't collect the bag with in particular duration and an alert message is sent to android smart device via GSM, and the person gets voice output through android smart device. We also use proximity sensor to check the baggage if it is carrying any metal. If it finds any metal, it intimates security from the voice output module. Through this we can find any metal being carried in the baggage. We can use this to implement a system to ensure airport security.

2. RELATED WORK

In [1] Mostafa et al. Have proposed a scheme using RFID tags as an acceptable, profitable and new way of identifying the presence of objects but also be used as a reliable tool to track baggage at different stages along a baggage supply chain. In baggage transfer system, RFIID tags are used to increase baggage tracking capability. As a result, these signs increase the impact of management as well as customer satisfaction. When passengers arrive at the airport, they move near the check-in area to deliver their luggage. In the registration section, information about each passenger is collected and stored in a database. An identification number is assigned for baggage, taking into account the information provided by each traveller. This identification number is considered as a code stored as unique identification number for each person.

In [2] T. Zhang et al. have proposed an RFID based system that provides a real-time and accurate view of the baggage throughout transport. As reported by authors the developed system improves baggage classification, baggage matching and baggage tracking capacity. There are two types of RFID applications. In the first application form, cheap labels are used to index unique baggage. When the basic database is connected, baggage information such as the owner, origin and destination are identified. In second application form Expensive tags with more memory are used to store detailed baggage information, and the baggage status are saved at each step after entering the airport.

In [3] JansonHui have proposed an system in which baggage handling is done with a barcode label on the handle, usually at the check-in counter for each baggage item. Each bag is fed from a series of conveyor belts, through x-ray machines, then to more series of conveyor belts to a unit load device (ULD) in order to be transported to an aircraft, all automatically guided by computer connected to barcode scanner reading each tagged baggage. In fact, many factors cause a computer that cannot read the barcode. After that, the baggage will need to be converted to a manual, human-operated barcode reader, which will reveal the possibility of baggage getting misplaced. The RFID printer and encoder are placed in the check-in counter. Similar to the traditional bags check-in, the customer has to check-in the bags and place the label on the

handle of the bag. The only exception is that the label will be encoded with a unique identification number (UID) in the RFID chip as well as the customer's information. The RFID printer and encoder are placed in the check-in counter. Similar to the traditional bags check-in, the customer has to check-in the bags and place the label on the handle of the bag. The only exception is that the label will be encoded with a unique identification number (UID) in the RFID chip as well as the customer's information. Reading ratios as reported for an average bar code system are around 80-90%. But for a large airport like McCarran International, passengers bill about 70,000 bags a day. It draws attention from 7,000 to 14,000 bags, which need to be handled manually on a daily basis. There are too many bags to handle and it produces about 800,000 wrong bags per year for an average airline like Delta Air, representing about 0.7% of the total number of bags as reported in [3].

In [4] Homi Limbuwal et al. have implemented a schema in which RFID readers are placed in the proper place on conveyor belts to read the tags and this information is displayed on a monitor. Monitor displays the name of the baggage owner via the registration established. Finally, when the passenger leaves the airport, the passenger is re-confirmed to guarantee that the baggage is carrying the correct baggage to ensure its safety. After the passenger leaves the airport, this RFID tags are disabled (killed).

In [5] preeti patil et al. has proposed the use of an interactive bracelet to communicate with the RFID system via the database application. The database system interacts with the bracelet using messages that inform the status of the passenger luggage. The luggage monitoring system works in three cases. When the passenger is on board and the baggage is dispatched, when an incorrect transport error occurs, concerned about the multi-stop flight. The interactive bracelet that supports RFID in the baggage tracking system is hanging around the traveler's arm. The bracelet is made of silicone and has a graphical LCD display module. This bracelet has a unique IP and receives text messages from the data application.

The reasons for relatively low reading rates referred in literature are mainly due to technology. Barcodes require a direct line of sight between the labels and the reader and can easily be damaged, readers can only read one bar code per pass, show relatively low accuracy, and the system needs high visibility. Fortunately, RFID technology can easily solve these problems. RFID does not need a direct line of sight and is more durable than barcodes, readers have multiple label readings and relatively high accuracy, and the system requires less maintenance than barcode systems.

3. EXISTING SYSTEM

Presently, the system used in airports mainly uses the barcode system for scanning baggage, which is an old and traditional method with high error percentage. In the proposed system, transport operation is conducted at very low speed and precision. Even, the barcode readers need a direct line of sight to read the barcodes. As their will be no communication between baggage and passenger there will be the chances of mishandled baggage.

4. PROPOSED SYSTEM

In the proposed system, an RFID reader will be fixed on the conveyor. When the baggage comes near the reader, its code is read by the reader and it checks the database for the name of the particular passenger and displays the name on LCD display, announces it through the speaker. If the passenger didn't collect the bag within particular duration an alert message is sent to android smart device of passenger via GSM, and the passenger gets voice output through application developed in Android smart device.

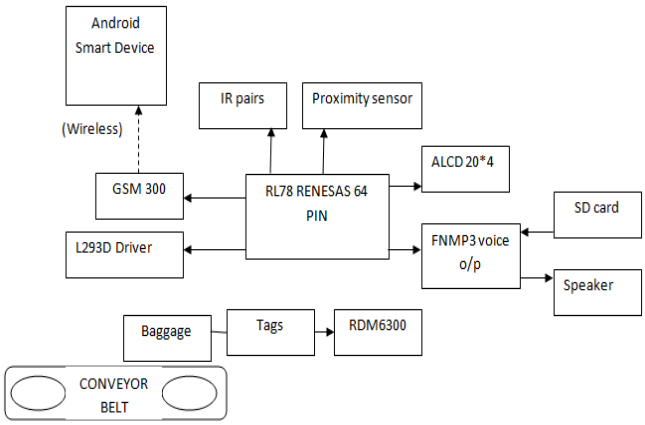

Fig-1: Block diagram of proposed system

The proposed system contains essentially sensors, GSM module, Renesas microcontroller, RFID tag, RFID reader, DC motor driver, speaker, Android Mobiles and Power supply module. As shown in figure 1 these modules are coordinated to do a solitary assignment. The proposed framework is controlled with Renesas microcontroller. Many embedded systems have substantially different designs according to their functions and utilities. In this work the system is mainly composed of a single microcontroller, interfaced to sensors like IR Sensors, proximity sensor.

The microcontroller located at the centre of the block diagram forms the control unit of the entire work. Embedded within the microcontroller is a program that helps the microcontroller to take action based on the inputs provided by the output of the sensors.

- RFID tags are attached to each bags of the passenger in the boarding section, and each RFID tags has a unique number, this number allotted to particular passenger is noted and the details are saved in the microcontroller.

- During dispatching of these bags, the bags keep rolling on the conveyor belt.
- When the bags moves near the RFID card reader, the reader detects particular RFID tag number, this is compared with the tag number which previously allocated and the particular passenger name is detected by the microcontroller.
- The trolley motion is also controlled through microcontroller; this is achieved through a DC motor driver connected to it.
- While dispatching the baggage the DC motor is turned on when the baggage is placed on the conveyor belt, and once the baggage collection process begins the DC motor is turned off. After the baggage is collected by the passenger, again the DC motor is turned on by the microcontroller so that other passengers can collect the bag.
- LCD display and mp3 module are utilized, to display the name of the passenger and to give voice alert for passengers to collect the baggage, respectively.
- If the bag is not collected within particular duration, passenger will be intimated through voice alert and text message is also sent (android, voice output) via GSM.
- In an android application a GUI is developed, when user logs to application developed in smart phone the menu will be provided, which holds the command to receive alert and give voice output.
- If any metal is detected by proximity sensor, the system intimates the security to check the bag through voice output.

5. DESCRIPTION OF COMPONENTS USED

GSM Module (SIM 900)

SIM900 is a Tri-band GSM/GPRS engine that tackles frequencies EGSM 900 MHz, DCS 1800 MHz and PCS 1900 MHz. SIM900 highlights GPRS multi-opening class 10/class 8 (optional) and supports the GPRS coding arranges CS-1, CS-2, CS-3 and CS-4. You can use AT Command to get information in SIM card. The SIM interface supports the handiness of the GSM Phase 1 detail and moreover supports the convenience of the new GSM Phase 2+ assurance for FAST 64 kbps SIM (expected for use with a SIM application Tool-kit).Both 1.8V and 3.0V SIM Cards are maintained.

The SIM interface is controlled from an inside controller in the module having apparent voltage 2.8V. All pins reset as yields driving low. The "AT" or "at" prefix must be set toward the begin of each summon line. To end a charge line enter<CR>. Summons are for the most part trailed by a response that includes."<CR><LF><response><CR><LF>". All through this record, only the responses are displayed, <CR><LF> are disposed of purposely.

Command	Possible responses
AT+CGMI Note: Get manufacture identification	FLYFOT MODEM OK Note: Command valid, FLYFOT modem
AT+CGMI=?	OK
AT+CGMI? AT+CGMI=1	+CME ERROR 3 Note: not support

Table 1: Commands

RENESAS RL78x 16bit Microcontroller:

The Renesas Electronics RL78 microcontroller is a 16-bit CPU core with a CISC architecture with abundant features with inbuilt ADC.

Alpha-numeric LCD Display:

A liquid crystal display (LCD) is a flat panel, electronic visual display, based on Liquid Crystal Technology. It consists of an array of tiny segments called pixels that can be manipulated to present information. LCD are used in a wide range of application such as computer monitor, television, instrument panel, aircraft cockpit display etc. LCD display used to display the name of the passenger.

Android:

Android is a Linux-based mobile phone operating system developed by Google. Android is unique because Google is actively developing the platform but giving it away for free to hardware manufactures and phone carriers who want to use Android on their devices. It is a software stack for mobile devices that includes an operating system, middleware and key applications. The Android SDK provides the tools necessary to begin developing applications on the Android platform using Java programming language. Android app is developed for receiving alert while passenger missed to collect bag.

RFID tag:

RFID tags have diverse range of functions, while provides convenience, as the cards must simply be waived or tapped in front of a reader rather than swiped. These cards are used for applications as access control in security systems, time and attendance, network login security, biometric verification, cashless payment, and even event management

RFID reader:

An RFID reader is a device that is used to interrogate an RFID tag. The reader has an inbuilt antenna that emits radio waves; the tag responds by sends back its data.

Stepper Motor:

Microcontroller output is 5 volts and DC motor requires 12 volts supply. Motor driver IC is used to convert 5v to 12v,

which is required to drive the motor. DC Motor is used to move the conveyor belt. This will be done when baggage has been kept on the conveyor belt.

IR Sensors:

IR sensors works by using a specific light sensor, to detect a light wavelength in the InfraRed (IR) spectrum. By using an LED which produces light at the same wavelength as what the sensor is looking for, you can look at the intensity of the received light. When an object is close to the sensor, the light from the LED bounces off the object and into the light sensor. IR sensors are used to detect bag on conveyor and stop the conveyor.

MP3 Module:

This embedded MP3 module is a universal and compact circuit for playing MP3 audio files. The MP3 module can be used in embedded systems. MP3 module is used to give voice alert for passenger to collect bag.

Proximity Sensor:

A proximity sensor is a sensor able to detect the presence of nearby objects without any physical contact. A proximity sensor often emits an electromagnetic or electrostatic field, or a beam of electromagnetic radiation (infrared, for instance), and looks for changes in the field or return signal. Proximity sensor is used to detect any metal in the baggage.

6. RESULT

In figure 2 the demonstration for baggage handling system is shown. Renesas RL78 Microcontroller is used which connects and controls all Modules. RFID reader used to read the data from RFID tag. An android application installed in passenger's android device to give voice alert. Optimal Delivery of Baggage to Passengers at Airport is an effective measure to reduce the waiting time of passenger near conveyor belt and also reduces the amount of mishandled baggage. The communication is properly done without any interference between different modules in the design. This reduces the manual labour and delays that often occur near conveyor belts. GSM Module (SIM 900) is used for sending text messages to the user by the microcontroller. Proximity sensor is used to detect any metal in the bag. This helps in security of the airport.

Step wise screen shots of the demonstration for baggage handling system are as shown in the figure 3 to figure 7. When bag is kept on conveyor at checkout counters in airports RFID number of passenger to whom the particular baggage belongs to is read by RFID reader, name of the passenger is read from the database and displayed on LCD as shown in figure 5. If baggage is picked from the conveyor belt BAG COLLECTED message is displayed on LCD as shown in figure 6. If the bag is not collected within particular duration of time an alert message is sent to android smart device of passenger, the same is illustrated in figure 3, a voice notification is sent through the android application developed for android smart phone as illustrated in figure 4. An ALERT SENT message gets displayed as shown in figure 7. Only requirement is the passenger should install the android app after check in process at airports.

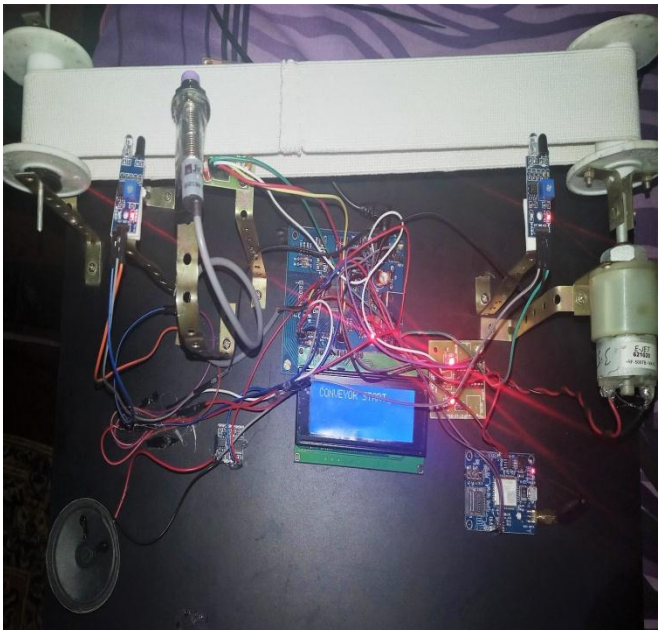

Fig-2 : Overall baggage collection system

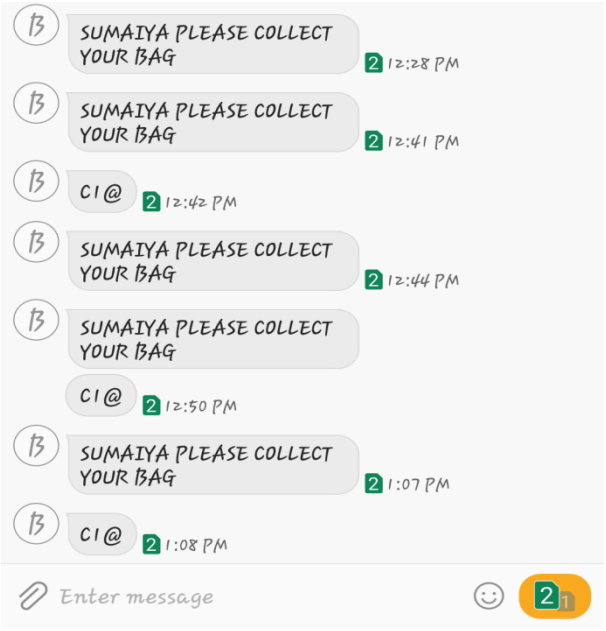

Fig-3: GSM message to passenger

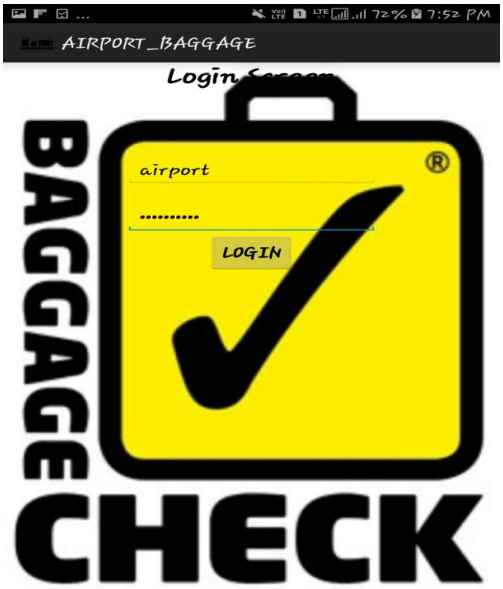

Fig- 4: Android application to get voice output

Fig- 5: LCD Display for waiting the bag to collected

Fig- 6: LCD Display if bag is *col*lected

Fig- 7: LCD Display if bag is not collected

7. CONCLUSION AND FUTURE WORK

In this proposed system, the implementation of RFID improves efficiency and reduces operating costs and also avoids the cost of lost luggage. These developments will help airports save money and provide passengers with a seamless experience. As future enhancement, most of the units can be embedded within the controller on a single chip such as GSM, with change in technology thereby making the existing system more effective. Also a confirmation option can be provided as a single click button of the GUI developed using which the passengers can inform the concerned authority about the collection of baggage by them and the same should be verified by the baggage handling system.

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