Ergonomics in Airport Baggage Reclaim

Shruthi Anand* and Radhika Rajaram

1Department of Electronics and Communication Engineering, Amrita University, Coimbatore – 641112, Tamil Nadu, India; shruthianand11@gmail.com
2Department of Mechanical Engineering, Amrita University, Coimbatore – 641112, Tamil Nadu, India; rdk_rjm@yahoo.com

Abstract

Objectives: The carousel management system helps to combat the problem of carousel crowding and baggage theft through the automated-queuing and baggage-announcing system. Method: The perimeter of the carousel is divided into sections. An LED display at each section will show a set of consecutive seat numbers, requiring the corresponding passengers to stand in line under it. The Radio Frequency identification tags and barcodes strapped to the bags during check-in help in baggage identification. When a bag belonging to a particular passenger is about to reach his section, the LED board signals the baggage arrival. Findings: One of the most problematic parts of air-travel involves baggage logistics. Often conveyors are not long enough to ensure that all commuters are uniformly distributed along its perimeter to have proper access to the bags. This leads to jostling, anxiety and a collective loss of time for everyone. There are a significant number of similar bags on carousels, leading to confusion among the passengers. Cases of switched bags are on the rise. Applications/Improvements: Faster passenger movement out of Baggage Reclaims and reduced baggage mix-up and crowding is ensured. The carousel is emptied faster and can be shut off sooner, resulting in power savings.

Keywords: Bay, Countdown, Scanner, Server, Velocity

1. Introduction

1.1 Problem

1.1.1 Crowding, Chaos and Lost Time

Due to large volumes of passengers in airports nowadays, smaller carousels are unable to accommodate passengers along their perimeter. Many passengers do not have proper access to their bags and are also unable to see their baggage due to crowd in front of them. This disorderliness translates into a collective loss of time.

1.1.2 Anxiety

As of today, no baggage alerting systems are in place at carousels to inform the passengers of the location of their bags on the carousel.

1.1.3 Switched/Stolen Bags

There are a significant number of similar/identical bags on carousels, leading to confusion among the passengers. Cases of switched bags are on the rise. Airlines are held directly responsible for lost baggage. They are liable to pay anything from 200$ to 3500$ as compensation. Theft of baggage at the carousels is also an increasingly seen phenomenon. Since an airline will never know if a baggage was lost or stolen, it ends up compensating for stolen baggage as well.

1.2 Solution

Our system tackles the problem of crowding by sectional queuing of passengers. The baggage-announcing system informs the passengers of the status/location of their bags on the carousel. Thus the passengers need not search the carousels for their bags. It also eliminates the possibility
of mistaking another’s bag to be one’s own and theft, as the identity of the bag’s owner will be displayed on large LED boards.

2. Design and Working of the System

The entire processing required by the system is handled by the Carousel management server. The network connections are shown in Figure 3. The server of the Airport management system can also take up the processing. In this case, no independent server will be needed for the Carousel management system. A schematic diagram of the Carousel management system is shown in Figure 1.

2.1 Sectional Queuing

As shown above, the carousel area is divided into a number of bays. Each bay is wide enough to accommodate two persons. Each bay is demarcated by lines. There is an LED display at every bay. This displays the information shown in Figure 2.

The server receives flight plans from the Airport Management System, which handles flight and passenger information. It assigns bays to passengers according to their seat numbers. The number of passengers in each bay depends on the total number of passengers who have

<table>
<thead>
<tr>
<th>SEAT NO.</th>
<th>NAME</th>
<th>BAG ON CAROUSEL</th>
<th>TIME TO REACH</th>
</tr>
</thead>
<tbody>
<tr>
<td>G5</td>
<td>RAM</td>
<td></td>
<td>00:56</td>
</tr>
<tr>
<td>G6</td>
<td>VINAY</td>
<td></td>
<td>00:03</td>
</tr>
<tr>
<td>G7</td>
<td>HANK</td>
<td></td>
<td>00:08</td>
</tr>
<tr>
<td>G8</td>
<td>ESHA</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 2. LED display.

Figure 1. Carousel Management System.

Figure 3. Network Connections.
been off-loaded from the flight and the number of bays. The names of passengers who have not checked-in any luggage will not be displayed. The passengers in each bay are required to stand in a queue according to their seat numbers, as displayed on the LED screen. Thus orderly queuing has been achieved.

### 2.2 Baggage Location on Carousel Alert

An Omni-directional barcode scanner, present at the entrance of the baggage at the carousel scans the barcodes on each baggage. The scanner works just like a Laser barcode scanner with the addition of several mirrors and other reflective device to transform one laser light into many, all at different angles. This allows fast reading of barcodes at any angle. For RFID tags, an RFID scanner is used in place of an omni-directional scanner. The scanned information is fed into the server.

When the barcode/chip on a particular passenger’s bag has been read in by the scanner and fed to the server, the server finds the corresponding passenger and his position bay number. It switches on an orange light next to his name. This light denotes that his bag has reached the carousel.

The carousel's conveyor belt moves at a constant velocity. Knowing the distance between the bay at which the passenger is standing and the scanner and the velocity of the conveyor belt, the server can determine the time that the bag will take to reach his spot. Thus, after the first scan, a countdown is shown on the LED display next to the passenger’s name. When the bag is 5 seconds away from reaching the spot, the orange light turns green and remains in that way until it reaches the end of his bay. At that moment, the countdown finishes. If, by accident, the passenger has not picked up his bag, the system accounts for it. Immediately after the first countdown, another countdown is started, denoting the time taken by the bag to reach that bay again. It is understood that each bag will take the same time to circumnavigate the carousel once. If a given bag is not scanned by the barcode scanner in two consecutive cycles, the system realises that the person has picked up his bag. Hence, it removes that passenger’s name from the row.

If a passenger happens to have more than one bag, an extra row of information i.e., passenger seat number, name, availability of the bag on carousel and time taken to reach the bay, for every extra bag will be displayed.

### 3. Flowchart

Flowchart continued:

```
1. Read passenger information from AMS as array and store in consecutive memory locations
2. Display on LED
3. Match barcode to passenger data
   Find bay position of corresponding passenger
   Place bay no on carousel into v
   Allocate v no of memory locations for the other bags
   Allocate v no of memory locations for bay 1
   1. Read no. of bays in carousel 1
   2. Let w = \text{read no. of bays in carousel 1}
   3. \text{let } w, b, t:\text{ read width of bay and bay number of passenger}
   4. \text{read time taken to circumnavigate the carousel into } t
   5. \text{let } c = 0,
   6. \text{“time taken for bag to reach passenger” = }\text{round}(c/t) 
   7. Switch on orange light next to passenger’s name 
   8. Display countdown from 1 to 0 
   9. Turn orange to green light 
   10. When countdown is at 3 seconds 
   11. When the first countdown finishes, start countdown from 0 to 5 
   12. If yes, continue countdown
   13. If no, switch off lights and move next to passenger’s name
```

Simultaneously, other bags and other carousels are handled by the carousel management server.
4. Cost Benefit Justification

- Since passengers will move out more quickly through baggage claim, the airport can welcome greater volumes of passengers with ease.
- With more passenger traffic, more taxes are collected, thus directly increasing airport revenue. More flights can also be accommodated.
- It also reduces the amount spent for compensation of lost/stolen bags.
- Carousels consume a lot of power. By this method, the carousel is emptied faster and can be shut off sooner. Thus, power is also saved in large amounts.
- Since, there is efficient use of space, the airport can save on land requirements as well as expansion costs to accommodate the steadily increasing air traffic.

5. Advantages and Discussion

- Passengers will move out of Baggage Reclaim quickly. Nowadays, passengers are forced to board consecutive flights of different airlines. In case of slight delay at baggage reclaim, the chances of them missing their next flight is high.
- Lesser confusion prevails at the carousel. Airports spend a large amount of money on various amenities and attractions for passengers. All these efforts will not be appreciated if the passengers are hassled at baggage reclaim points.
- It prevents switching and theft of bags at the carousels.
- It increases passenger traffic, and thus airport revenue.
- More people will check-in their bags. Thus baggage fee will be another source of income for the airport.
- The infrastructure requires a small investment but provides high returns.
- Since carousels can be emptied quickly, the resultant saving in energy costs will keep our environment green.

6. Conclusion

The major problems faced by air-passengers were at the check-in and baggage-reclaim points. The check-in procedure was handled by airline agents and was time consuming as well as expensive. The check-in problem was recently resolved by introducing self-check-in, online check-in and mobile check-in systems. These hastened procedures and cut down labor costs. The only other time-consuming process left to be resolved is at the baggage reclaim area. Implementation of this system is easy and cheap as the only requirements include LED displays, a few RFID readers/barcode scanners, network cables and software. Passengers will enjoy hassle free transit through airports, and airports can either increase passenger traffic or save on space. Thus, if this system is implemented, it will be a win-win situation for both passengers and airlines.

7. References


