Towards Airport Passenger Experience Models

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Abstract: This paper reports on the study of passenger experiences and how passengers interact with services, technology and processes at an airport. As part of our research, we have followed people through the airport from check-in to security and from security to boarding. Data was collected by approaching passengers in the departures concourse of the airport and asking for their consent to be videotaped. Data was collected and coded and the analysis focused on both discretionary and process related passenger activities. Our findings show the interdependence between activities and passenger experiences. Within all activities, passengers interact with processes, domain dependent technology, services, personnel and artifacts. These levels of interaction impact on passenger experiences and are interdependent. The emerging taxonomy of activities consists of (i) ownership related activities, (ii) group activities, (iii) individual activities (such as activities at the domain interfaces) and (iv) concurrent activities. This classification is contributing to the development of descriptive models of passenger experiences and how these activities affect the facilitation and design of future airports.

Key words: passenger experiences, activity-centered design, experience modeling, airports.

1. Introduction

An airport is one of the most complex systems in modern society. This complexity arises from the various components which make up the airport, all of which have different requirements. Components include various systems, procedures, stakeholders and artifacts necessary for the operation of an airport. Stakeholders include the parties interested in the running of the airport, such as private interests (the airport owner, shareholders, the airlines); government bodies, (customs and security); customers (passengers and visitors); and agencies (such as the International Air Transport Association [IATA] and various government agencies at different levels).

All of these agencies have different needs and requirements that are interconnected and must interact. When satisfactory interaction is not achieved, there can be significant failures, such as occurred with Terminal 5 at Heathrow [1]. For example, in the first five days of Terminal 5 opening almost 300 flights were cancelled, and a combination of factors has been blamed. These ‘initial teething problems’ included: unclear road signs outside the terminal, wrong directions given inside, lack of parking, problems with baggage conveyors, and slow processing of staff through security screening. This lead to huge queues, baggage delays, bad publicity for the new terminal, and an extremely stressful passenger experience.

Airports are an invaluable source of income for a country. Fast and efficient air transportation of tourists, business and freight is necessary and will become even more dominant in the twenty-first century [2]. Passengers are the main customers of an airport, and so their needs must be investigated to understand which aspects are important, and how airports and airlines should respond to any shortcomings. An airport creates the traveler's initial and final impression of a city/country and it is reported that a pleasant airport experience encourages spending, and influences future travel plans [3]. A poor passenger experience has been identified as a threat to a city and a country's economic sustainability [4].

Therefore, airports are becoming increasingly customer-focussed and much of that customer focus is becoming dependent on technologies to enable better service. One example of an enabling technology is Radio-Frequency Identification (RFID) tags which could allow airports to track passengers and bags with great effectiveness [5,6]. Bluetooth is another technology that is said to enable a greater passenger focus [7]. In order to apply these technologies to facilitate the needs of airport users (passengers and personnel), it is necessary to understand what airport users currently do and how they interact while they are at an airport. Passenger activities in an airport can be divided into two categories [8,9]; *processing activities* and *discretionary activities* (Figure 1). Processing activities are those directly related to conforming to the legal and regulatory requirements for boarding a plane. These activities include: checking in, filling out any required departure paperwork, negotiating various security and identity checkpoints and boarding the plane at the gate. Takakuwa and Oyama [10] found that only a small proportion of passenger time in an airport is spent on processing activities, including time spent while waiting to be processed. Activities outside of processing activities are identified as *discretionary.*

The International Air Transport Association's (IATA) Simplifying Passenger Travel (SPT) initiative [11] 'aims to improve the passenger travel experience by replacing repetitive checks of passengers and their documents with a new streamlined system that will collect the information once and then share it electronically with subsequent service providers' [12]. It is a technology-focused program that has an emphasis on processing activities; however, it does not have a passenger-centered perspective [8, 9]. It is focused on technologies, particularly biometrics, that are thought to potentially reduce the time it takes to process passengers through the required checks. It is not based on an adequate analysis of the current situation in airports and does not employ a systems-oriented, integrated and, above all, human and activity-centered approach.

This research aims to address this shortfall. It is a part of a larger project that investigates airports as complex systems, including various aspects of passenger experiences and interactions at an airport (for example, information provision, services, processes, equipment and technology). Its overall goal is to construct qualitative models of the experiences, activities and interactions that passengers undergo in an airport. These models will then be connected within an airport process model and complex system to provide a predictive capacity that will inform the design, or redesign, of better airports for passengers. The International Brisbane Airport passenger terminal has been a living laboratory for the field studies conducted.

2. Passenger Experience and Interaction

The airport experience begins when the passenger is preparing for their trip, journeying to and from the airport, and negotiating the airport and its various stages of departure and arrival. Discretionary passenger experiences occur between these stages and have not previously been well explored (Figure 1).

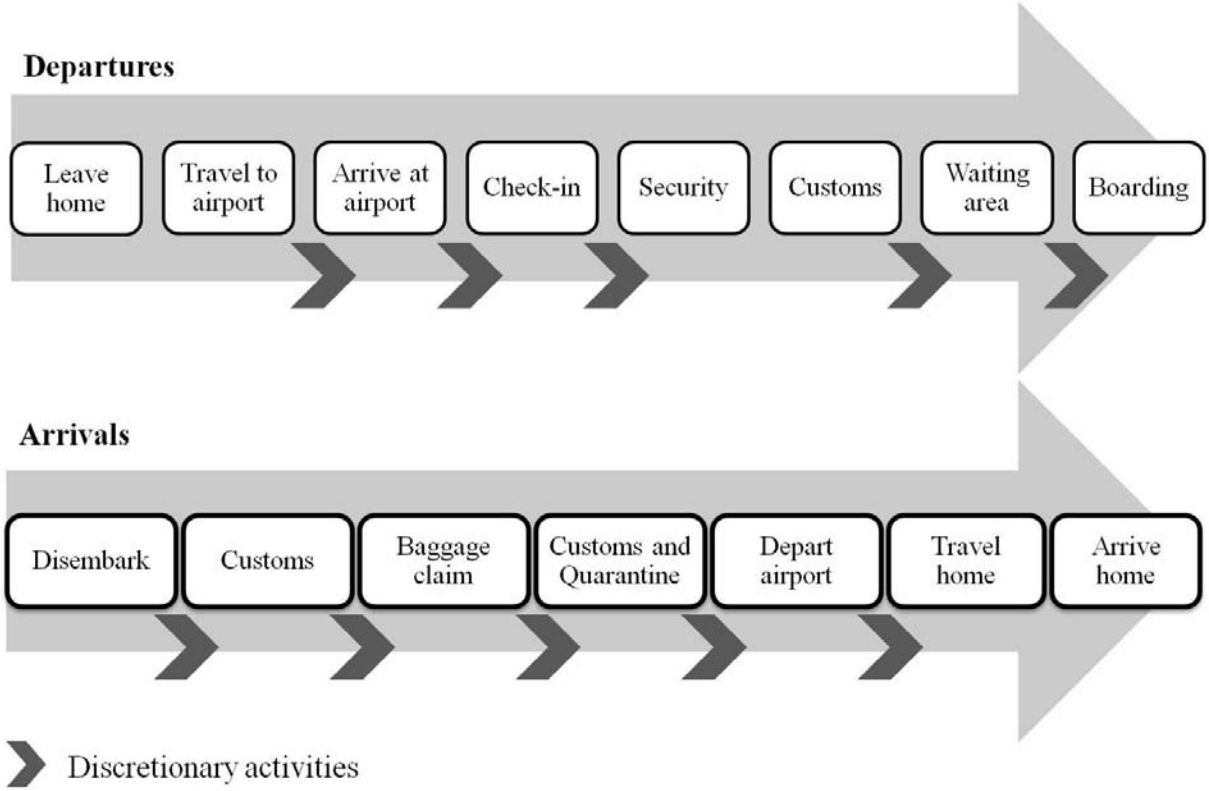

Figure 1. Departure and Arrival Stages

Research into the passenger experience generally starts when the passenger arrives at the airport [3, 13-15]. Once passengers arrive at the terminal there is contact with either an airport representative, or an item of technology; these instances are referred to as 'touch points' [16] or 'domain interfaces' [8,9] It is important to understand the passengers' expectations and their actual experience, as it is the difference between these that leads to their satisfaction or dissatisfaction. For example, at each interface, the passenger expects to queue for a short time and then be processed effectively. There is a potential for delays to occur and if the reasons behind the delay are unknown to the passenger, there will be a difference between their expectation and their experience. This will lead to a dissatisfied passenger. However, if the reason behind the delay could be identified, the problem could be resolved or managed. If the problem were resolved, the passengers' expectations would meet their experience as no delay had occurred. Alternatively, by managing the problem, the passenger can be informed of the situation which can alter their expectation and allow it to match the experience. Therefore, the passenger can still be satisfied, even if the waiting is longer than expected [17].

There are various levels of interaction at each domain interface. Within the processing activities, the interfaces are concentrated around the departure or arrival stage. For example, at a check-in point, a passenger interacts with the process, airline services, personnel, equipment, checked luggage and carry-on luggage. These levels of interaction are outlined in Tables 1 and 2.

Table 1. Passengers' Levels of Interaction at Departure

Interaction points (domain interfaces)	Interaction level
Entering an airport	• information
Check-in	• process • airline service • personnel • technology (equipment and devices) • check-in luggage • carry-on luggage
Security	• process • security screening • security service • personnel • technology (equipment and devices) • hand search
Customs	• process • personnel • custom service • technology (equipment)
Departure Hall	• not well understood; various levels of interactions associated with discretionary departure activities
Boarding an aircraft	• process • airline service • technology (equipment) • personnel

Table 2 Passengers' Levels of Interaction at Arrival

Interaction points (domain interfaces)	Interaction level
Exit aircraft	• process • airline service • technology (equipment) • personnel • information
Duty free shopping	• discretionary arrival activity between two process related interaction points
Custom	• process • personnel • custom service • technology (equipment)
Luggage collection	• process • personnel • custom service • technology (equipment) • luggage • quarantine dogs • airport service personnel (lost luggage)
Custom and quarantine	• process • custom personnel • custom service • technology (equipment) • luggage • quarantine personnel • quarantine service • airport service personnel (lost luggage)
Arrival hall	• not well understood; various levels of interactions associated with discretionary arrival activities
Departing airport	• information • airport services • personnel • technology (equipment)

3. Methods and Findings

This research is based on the analysis of observational data collected from footage already available and from the recording of selected activities at the terminal. Due to logistics requirements, data were recorded on different days but all at the airport's busiest times. All observations took place between April and August 2009. At this stage, data collection has consisted of observation at a distance. Following data collection, each video was converted to a digital file and the content of the video coded. The codes used were context and activity specific. For example, check-in, security, or activity within the departure hall had both unique and overlapping coding schemes. Coding was supported by The Observer software [18]. Following the coding, The Observer [18] was used to generate the maps of interaction. These maps are instrumental in the analysis and understanding of activities and the way in which these activities and artifacts mediate interaction. By examining the maps of interaction, it is possible to draw conclusions about activities and passenger levels of interaction (Tables 1 and 2). This has been illustrated through representative examples and reported by Authors [8].

Looking at processing activities, we have seen that the activities of staff at security checkpoints are directed towards the service of the screening machines, rather than towards assisting passengers. Security staff activities were focussed on arranging passengers' carry-on bags to aid the screening machines, even though the analysis of passengers' activities showed that opportunities existed to aid them before, during and after the screening process.

Our analysis of discretionary passenger activities revealed two broad categories of discretionary activities: *necessary activities* and *informal activities.* Necessary discretionary activities are travel-specific and are possibly pre-planned; for example, obtaining foreign currency. Informal discretionary activities are non travel-specific; for example, browsing, shopping or visiting a cafe.

We found that male and female passengers in airports carry bags almost ubiquitously and this simple fact impacts on discretionary activities. The ways in which passengers negotiate the airport with their bags has the potential to reveal much about the ways that airports are used. Making bags the focus of an analysis allows us to understand how they mediate the interaction of the passengers with the airport infrastructure [8,9].

We have seen that passengers complete their necessary activities before their informal activities, even when the opportunity exists to do otherwise. We can speculate that this ordering takes place as people ensure that they have enough time to complete their travel-specific activities before boarding an aircraft [9].

Several themes emerged from this analysis, which are relevant to the development of a model taxonomy of passenger interaction and experiences. While these themes are still partial, they are contributing to the deeper understanding of passenger activities. They illustrate: (i) group activities, (ii) concurrent activities (that is, activities carried out concurrently by individuals who are part of a group), (iii) individual activities (of passengers with domain interface personnel) and (iv) activities related to ownership of things passengers carry with them after check-in. The following section details the interactions that are worth noting and which have an impact on passenger flow and process.

3.1 Group Activities

At the security checking point, passenger and personnel activities were separately analysed. On average, it was noted that the longest amount of time passengers spent on one single sub-activity was in waiting for their luggage to emerge from the scanner (26 seconds). The second longest time was spent in passengers waiting for other members of their group to complete the process of moving through security screening (20 seconds) [9].

This example indicates that people will wait for their group to re-form before moving on to the next processing step. The fact that groups wait to re-form may have implications for overall passenger flow, as waiting passengers might obstruct the screening point and extend the processing time for other passengers. Another implication is that the design process should consider the provision of space to facilitate group re-formation. This scenario also illustrates the impact of social interaction on space design and on the passenger flow chain.

3.2 Concurrent Activities

We have seen that people are linked on a social and individual level: they interact with the airport system by distributing activity sets among the group, or doing them together (Figure 2). We have seen how members of a group of passengers can decide to negotiate to mange activities concurrently in order to benefit the group.

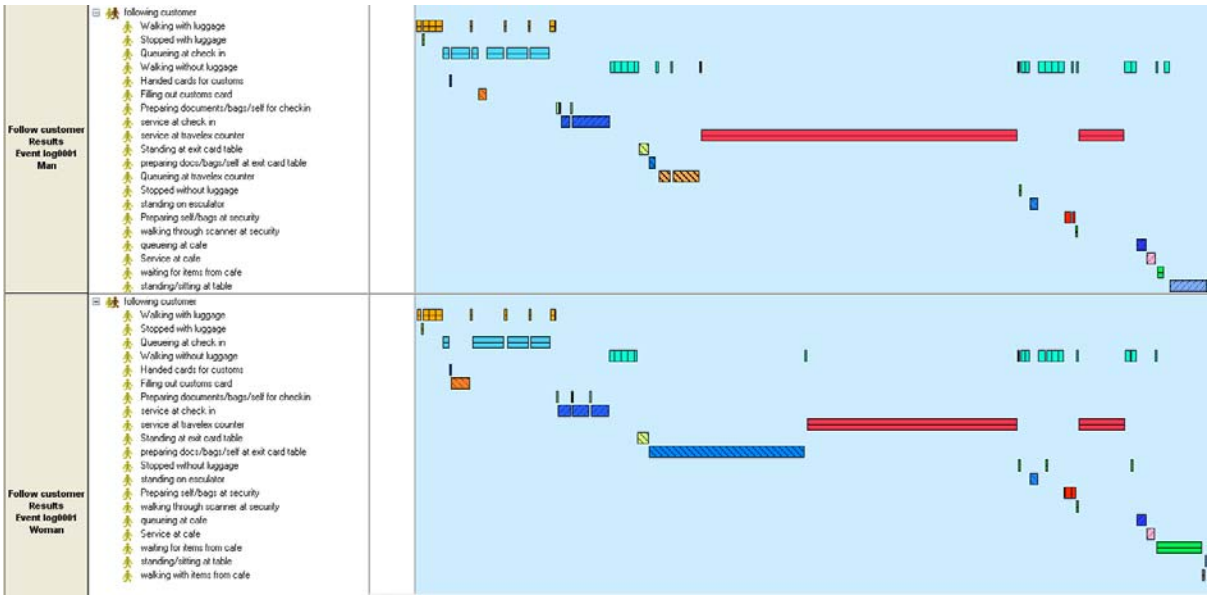

Figure 2. Concurrent Activities of Man and Woman

The example in Figure 2 shows how people in an airport are linked. The passengers, a man and a woman, started their activities together, then went through a series of separate activities and then came together again. The activities observed were: both passengers checking in (a processing activity), followed by one passenger obtaining foreign currency (discretionary-necessary activity) concurrent with the other completing departure paperwork (processing activity) before rejoining her companion. These activities were followed by visiting another foreign currency exchange together, followed by stopping at a café for coffee and cake. The passengers started their activities together, split up to share activities in parallel, and then came together again.

This behaviour is worth noting, as shared activities have the potential to speed up the passenger flow process by making queuing shorter for experienced passengers. The passengers observed were experienced travelers who knew what needed to be done and planned their set of activities. They also demonstrated interrelations between activities such as obtaining foreign currency and completing the necessary departure cards.

3.3 Individual activities

These activities occur at the interaction points when passengers and personnel interact with technology and processes. The security screening point is used as a representative example. Analysis of the interaction of security personnel in facilitating the screening process showed that their most frequent activities were divided between sorting bags before screening (30%) and watching the scanner monitors (20%). However, assisting with sorting and re-packing passengers' bags after the screening involved very little time (4.34%), even though passengers spend as long waiting for their luggage and re-packing it as they do unpacking it to prepare for screening [8].

When analysing the security screening point activities, it is noticeable that there is no compatibility between passenger and personnel interactions and mediating artifacts. Passengers spent most of the time after the screening waiting for the luggage and re-assembling themselves, while security personnel spent most of the time on 'before screening' and 'screening' processes. This also illustrates the goal differences of these two categories of users and the interrelations between their interactions.

During the screening process, facilitation is provided for passengers. After the screening, passengers wait for their luggage, but assistance in sorting bags after screening is minimal. Facilitation for passengers to re-assemble themselves was not provided. This, in turn, might impact on or obstruct the passenger flow. Additionally, it seemed that the process of waiting for group members was not considered and facilitated. It can be argued that screening is an ultimate goal here, but passenger experiences during this process count equally. In this particular case, the design of the screening area did not incorporate or support passenger needs and activity patterns; rather, it focused on technology and process alone.

The findings also demonstrated that each person who pauses at the head of the queue to unpack their carry-on luggage for screening slows the process significantly. If all passengers were to unpack before reaching the head of the queue, the queue would move more quickly. Therefore, when the queue for security is long, an additional security screener should be tasked with performing facilitation activities much earlier in the process.

Post-screening activity findings showed that passengers are repacking on the conveyor belt, an activity which blocks other luggage coming through the scanner and prevents other passengers from also re-packing. This shows that passengers require an area to repack their belongings. Repacking of belongings on and around conveyer belts affects passenger flow. Also, some facilitation might be given to direct passengers to move to the re-packing area and to re-pack their luggage there.

3.4 Ownership

Airports are concerned, from check-in to boarding, with many things. These can be classified into two broad categories: (1) the passengers themselves and (2) the things that passengers carry. Once check-in is complete, passengers are left with their hand luggage which becomes the focus of the security screening point as they negotiate their way to an aircraft. In one analysis, a bag and its owners were observed and tracked while they moved through the airport in order to understand how the bag mediated the interaction of the passengers with the airport infrastructure (Figure 3) [9,19].

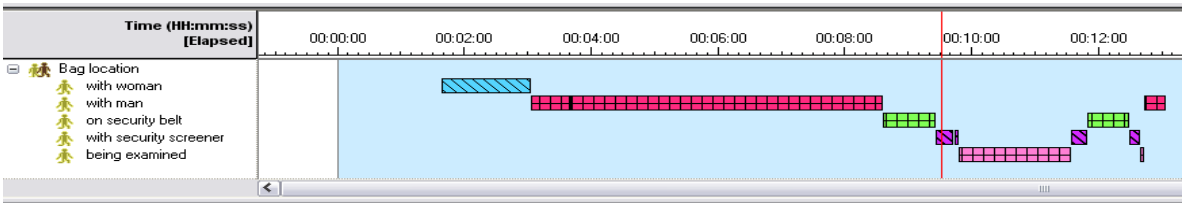

Figure 3. The Bag Movement through the Airport from Check-in to Security

This interaction poses questions about ownership (Figure 3). The woman carried the bag first, but the man carried it the longest. It could be hers, his or theirs. However, when the bag was taken to the examination point, both the man and woman went with the bag – at which point the bag became 'theirs'. It was observed that bags, and their contents, are very important mediators of interaction in the airport. As people carry a bag, they become a person-and-bag from the airport's point of view. A bag without a person is a security risk. A person who carries a bag is responsible for that bag's contents at the time the examination of the contents takes place. This interaction might have an influence in understanding security issues when planning and designing interfaces at the screening points. Planners and designers need to consider a person-and-bag as a unit, instead of considering them as separate entities.

3. Summary

The preceding sections give examples of four types of activities that can be undertaken in an airport. Group activities are those related to how groups move and interact in the airport space. Concurrent activities are those undertaken by individuals to serve the needs of the group. Individual activities are those performed by individuals alone and are the type that the airport system is most focussed on. These individual activities are undertaken by passengers and relevant airport personnel, and are pertinent to interaction points or domain interfaces. Ownership activities occur when people manage the things that they carry or personally have control of while they are in the airport space. These levels of activity may operate singly or simultaneously depending on the domain interface being observed. The four activities are enacted as passengers negotiate processing and discretionary activities as they move through the airport space. These four activities provide a way to understand the needs of passengers at each domain interface in the airport (Figure 4).

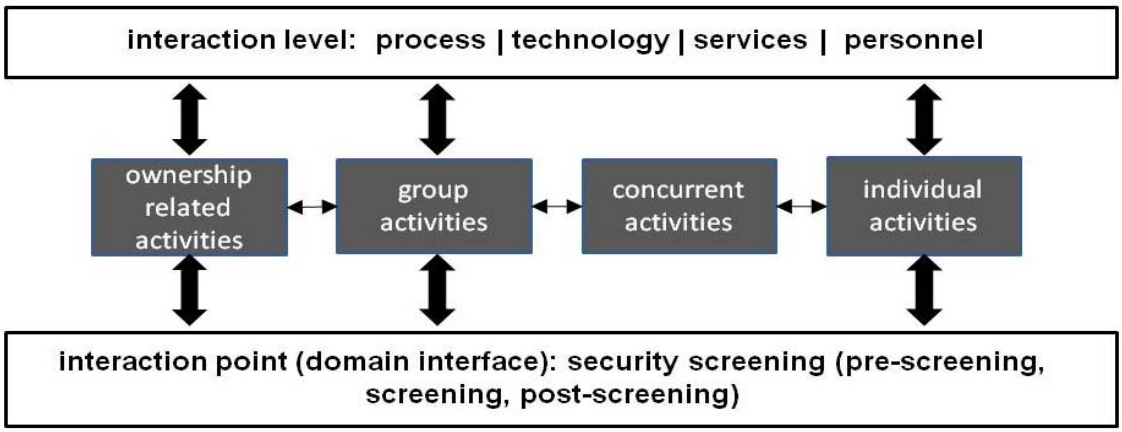

Figure 4. Example of Activity Levels at Security Screening

4. Conclusions and Future Work

The fieldwork demonstrated a range of outbound activities that passengers experience while at an airport terminal. Through this work, we identified: process related activities at the domain interaction points (e.g. security screening); and discretionary activities that are trip-related (necessary activities) and discretionary activities that are preplanned or informal activities (shopping, browsing or eating). It is noted that people complete their processing, travel-related activities before their discretionary activities. They also complete their discretionary trip-related activities before their informal activities. Within all activities, passengers interact with process, domain dependent technology, services, personnel and artifacts (Table 1). These levels of interaction impact on passenger experiences and are interdependent. The emerging classification of activities is the following:

- group activities
- concurrent activities
- individual activities
- ownership related activities

In our analysis we addressed the issue of facilitation and design that has an impact on passenger experience and interaction. This was apparent with the security screening process observed. The ways that passenger experience is facilitated leads to their satisfaction or dissatisfaction which can impact on passengers' basic emotional responses.

This research is significant as it provides new knowledge about passenger and airport personnel experiences at the airport and how these experiences are affected by the overall operation of the system. It provides a detailed understanding of passenger and personnel experiences, particularly during the security check process. Thus, it has the potential to improve passenger facilitation and flow in future airports.

The purpose of the larger research project is to investigate activities and interactions at airports. This project, on the other hand, reports on research that is dependent on situation and domain. The research methodology and analysis techniques are novel, particularly with regard to the area of investigation. The developed maps (Figures 2 and 3) illustrate relationships between activities, people, processes and technologies, and the subsequent observations demonstrate the complex interplay and interrelations at the micro-domain level of interaction. This, in turn, demonstrates the emergence of interactive models among activities, passengers, personnel, technology and artifacts.

At this stage, this research has advanced understanding of passenger experiences at airports. Its significance lies in its potential application to airport terminal design as it advances existing knowledge of user experience and engagement. This has implications for the design of future airports that will facilitate both passenger flow and positive passenger experiences.

5. Acknowledgement

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