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NEW TRENDS IN PASSENGER HANDLING IN AIR TRANSPORT

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Abstract. Overcrowded airports, pandemics and the rapid development of technology give area for improving the passengers handling process. Introducing new approaches, technology contributes to higher passenger satisfaction and in some cases reducing the burden and stress of airport employees. The article deals with the introduction of virtual queuing the introduction of biometrics into the contactless handling process and RFID chips technology.

Keywords: passenger handling; airports; virtual queuing; biometrics; RFID

1. INTRODUCTION

Science and technology are moving forward at a rocket speed. Each airline, all airports, to reduce costs and increase comfort, are trying to bring new trends for the passenger to the entire check-in process.

Every company that tries to provide quality services needs qualitative, well-educated staff as well as the use of new technologies [1]. Technologies such as the Internet of Things, big data, machine learning and more are coming to the fore [2].

The arrival of the COVID-19 pandemic accelerated the development and implementation of new trends. At a time when everyone is trying to reduce contact with other passengers, technologies that a few years ago seemed too expensive to put into operation at the airport are gradually being put into practice. Technologically improved self-service kiosks, virtual queuing, biometrics and RFID chips are new ways to handle a passenger more efficiently, cheaply and quickly. These innovations have become the main priority of every air carrier and airport.

2. VIRTUAL QUEUING

Practically all of us have waited in line at some point, whether it's on an airport driveway, in downtown traffic, or at the grocery store. We spend a significant part of our lives waiting. The passengers spend at least 3 hours only on the way to the airport, waiting at the airport, waiting to check-in, boarding, etc. [3]. To reduce waiting time at airports, airports are trying to introduce virtual queuing.

Virtual queuing allows travellers to reserve a time slot to line up at airport touchpoints such as check-in, security, rather than standing in long queues for equipment. This technology can help eliminate long lines, improving social distancing and customer experience.

Airports have been trying to use every centimetre of available space for a long time, the more passengers they can comfortably fit, the more passengers they can serve. Delta Airlines was one of the first companies involved to put virtual queues into practice by notifying passengers via the airline's mobile app when boarding has begun. It also works in the same way, for example, during the security check of passengers.

Imagine this scenario: Passengers arrive at the airport with a reserved time to go through security instead of waiting in line. Or they enter the virtual queue after check-in by scanning the QR code on the contact point. Then, for example, they can sit with relatives in the terminal cafe, visit the terminal shops, take time to say goodbye to loved ones, or whatever, instead of standing in line for security and

hoping it goes quickly. These passengers would then receive a notification on their phones to come through security [4].

However, this method requires cooperation with airlines to make the process more efficient. The passenger can either accept the time given to him or choose another time slot according to availability. There must be some flexibility with this option as there are many different traveller profiles, i.e., families who show up three or four hours before their flight departs, or the traveller who prefers to spend as little time as possible at the airport and shows up basically when their flight is boarding at the gate [5].

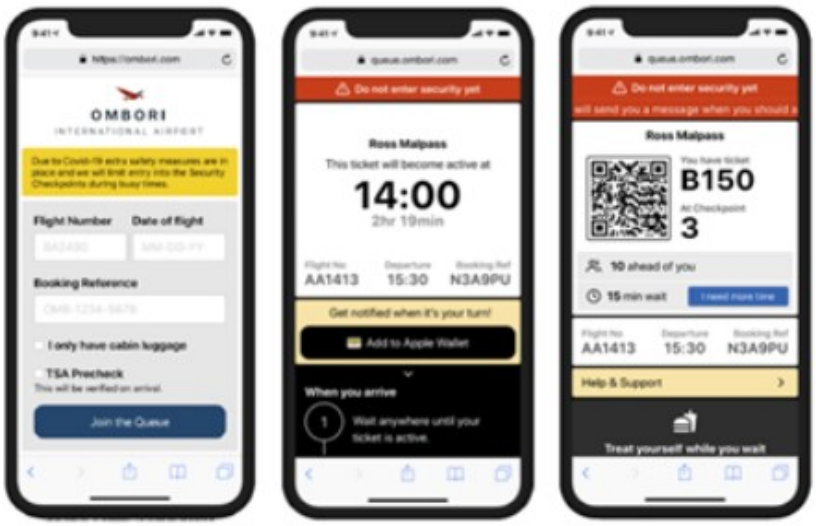

Figure 1 Example of mobile application [5]

The benefits for passengers are huge, but there are even more benefits to be gained by queuing virtually. For example, an air carrier's customer service employee at the airport needs time to gather all the information about the passenger. With virtual queuing, this information is already compiled, so the employee can serve the customer quickly and efficiently. In addition, services such as rebooking, and hotel reservations can start in the "back office" even before a passenger's turn.

Another benefit is that some customers will inevitably need service more quickly than others based on their travel needs, flight schedules, loyalty program status, etc. The virtual queuing system can prioritize certain customers based on certain configurable conditions, so passengers who need immediate service will receive it.

So far, not many airports have accepted the call to launch this service. Recently, however, the international airport in Los Angeles, in cooperation with United Airlines, launched a virtual queuing [5].

Proof that virtual queuing makes sense was confirmed by Yaxin Liu from North China Electric Power University in China. Based on the analysis of the traditional queuing theory, the author took the European airport as a research object and obtained the factors of virtual queuing and proposed a virtual queuing model to reduce airport security costs and improve airport efficiency.

The waiting time of passengers without virtual queuing is simulated based on real survey data, so in this case, the time of flight of passengers is considered, and all passengers are regular passengers, there are no virtual passengers in the queue. Passengers in the security process, in accordance with the first-come, first-served principle, are waiting for the security check. According to the arrival of passengers, the serviceability of security personnel and the theory of maximum waiting in front, the waiting time of passengers is simulated. The simulation results are presented in Table 1 [6].

Table 1 Average waiting time without a virtual queue [6]

Time interval	Average number of regular passengers waiting in front	Total waiting time of all passengers in minutes.	Average waiting time of one passenger in minutes.
09:00-09:30	151	3055.45	20.24
09:30-10:00	152	3202.23	21.21
10:00-10:30	149	2999.94	20.13
10:30-11:00	153	3219.18	21.4
11:00-11:30	150	2961.85	19.75
11:30-12:00	151	3004.27	19.90

In the following Table 2, the results with partial virtual queuing and with virtual queuing of all passengers are analysed.

Table 2 Average waiting time with a virtual queue [6]

Time interval	Some passengers are in a virtual queue		All passengers in the virtual queue	
	Waiting time in minutes	Reduction of waiting time in %	Waiting time in minutes	Reduction of waiting time in %
09:00-09:30	13.33	34.14	7.1	65.37
09:30-10:00	14.73	30.55	7.63	64.03
10:00-10:30	13.88	31.5	6.83	66.07
10:30-11:00	14.49	31.13	7.77	63.07
11:00-11:30	13.52	31.54	7.15	63.80
11:30-12:00	13.60	31.66	6.82	65.73
Average	13.93	33.86	7.20	64.67

As can be seen in previous tables, when virtual queuing is not implemented (Tab 1), the waiting time is about 20 minutes. Iin the case of partial virtual queuing (Tab 2), the waiting time of passengers will be reduced. The average waiting time is about 14 minutes, which is about 30 % less than the average waiting time without virtual queuing. If all passengers are in a virtual queue, the average waiting time is only about 7 minutes, which is about 65 % less than the average waiting time without virtual queuing [6].

3. BOMETRICS

Airports are designed around decades-old processes that require passengers to constantly present paper documents: first at check-in, again at baggage claim, then at gates, again at security, and finally at boarding. Small delays caused by repeated document handling checks performed at each touch point can quickly escalate into significant delays due to increasing passenger numbers.

The aim of such equipment is to reduce contact between passengers and airline employees, while the short-term consequence, i.e., contact reduction is essential for a pandemic. The long-term and most

important consequence of the implementation of such innovations is greater automation, i.e., fewer employees are needed in the entire equipment process.

Biometrics is a natural step towards increasing the efficiency of handling passengers. Thanks to biometrics, passengers can be automatically recognized as they approach the kiosk, BagDrop (baggage drop-off area in self-service kiosks), electronic gate or boarding gate before boarding, reducing staff time and increasing airport capacity. Thanks to the connection of the passenger's biometric identity with the entire check-in process, a quick, accurate and especially safe passenger check-in will be ensured [7].

Among the pioneers in the introduction of the biometric terminal is Delta. This biometric terminal was established at Hartsfield-Jackson Atlanta International Airport's Terminal F in late 2018. Facial scanning can be used at check-in, security and boarding gates, saving passengers time in line and likely reducing stress. Following its success in Atlanta, Delta plans to continue rolling out biometrics at its domestic hubs.

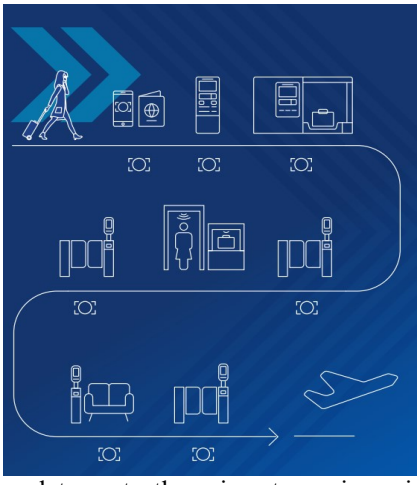

Figure 2 Complete contactless airport crossing using biometrics [7]

The most widespread contactless control at airports is the introduced self-service gates before entering to the security check area. These self-service gates serve to filter passengers so that only passengers with a valid boarding pass come to the security check. The knowledge about the movement of passengers, which person has passed through the gate, and which has not, is useful, for example, in cases where we have a person who has completed check-in but has not arrived at the departure gate. From the information whether it passed through the gate or not, it can be assessed whether the passenger has a chance to catch the given flight, especially if it is the last minutes before the departure gate is closed. Currently, most airports use gates that allow passengers to go to the security check based on the principle of scanning a QR code, but there are airports where biometric technology is being introduced. Biometric gates work practically the same as gates that open thanks to a QR code.

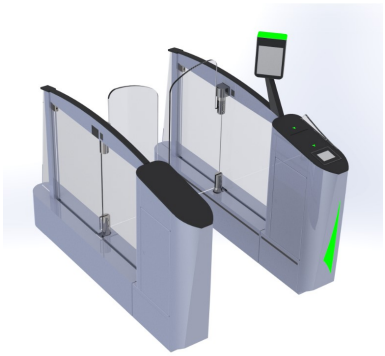

Figure 3 Self-service barrier i720 SkyLane designed for QR code scanning [8]

Biometric technology helps automate the identity verification process, meaning passenger will get through passport control quickly and safely.

One of the ways they do this is through the integration of Automated Border Control technology, or eGates as they are more commonly known. eGates compares passenger´s passport with a photo of passenger´s face to verify that passenger is who is owner of passport. It's a simpler, less intrusive and faster experience that can help fight fraud and is far more reliable than traditional fingerprint scanning.

In addition, biometrics help eliminate problems with multiple checks at the airport. Whether passenger is shopping in duty-free shop or passenger is about to board a plane, biometrics eliminate the need to present a boarding pass or passport to verify passenger´s identity. Instead, passenger will be a biometric token – based on facial recognition software – that will allow passenger to move freely and securely through the airport.

Many of the latest biometrics use facial recognition, which the U.S. National Institute of Standards and Technology recently found to be 99.5 percent as accurate as an iris or fingerprint scan. Iris scanning has been promoted as the most reliable, but for biometrics to work, the system needs to be able to compare the data to a known trusted data source because it is trying to compare it to a record. The face is the easiest, because all the documents we use to prove identity, such as a driver's license or passport, etc. contain a photo of the face. To ensure effective and efficient biometric control, international cooperation in sharing data of citizens and their documents is necessary [9].

An absolute novelty in the field of self-service devices was presented by Elenium Automation. In 2020, Avalon Airport introduced a new trend in the check-in process and became the first in the world to use completely contactless and self-service kiosks called VYGR. The Elenium Automation said that in the pandemic years of 2020 and 2021, it has entered cooperation with several international airport operators such as Darwin airport located in the city of Darwin, Australia and has also entered a contract with Avalon International Airport also in Australia in the city of Greater Geelong in the state of Victoria. This system is being tested by Etihad airlines as well. The same technology was implemented by Darwin Airport at the beginning of August 2021. This innovation will be operated in the premises of the airport, specifically in the check-in area of the complex.

Voyager (VYGR) is a technology designed to ensure that check-in queues do not form in the check-in area of the airport terminal. This will be ensured through contactless biometrics, which should ensure that the passenger has full control over their entire check-in process. The difficulty of using this device is relatively low and every passenger can use it, even those who do not speak English, as the language of use can be changed to several of the most widely used languages in the world. Control is ensured through the passenger's voice and vision. By moving passenger´s eyes, the passenger controls the cursor on the screen and chooses from the individual options offered by the system on the screen, such as choosing the airline that the passenger will use for transportation. The voice of the passenger will be used to answer the travel anamnesis, which many airlines carry out. The passenger will answer the questions only with the word yes or no. The basic questions are, for example, whether the passenger has met a person infected with the coronavirus during the last 14 days or whether he/she has ever flown. After completing this procedure, passenger will scan the biometric passport.

This self-service kiosk can also detect the passenger's vital signs such as body temperature, heart rate and breathing rate. This means that in addition to check-in, this kiosk can also be as a detection station to detect a passenger infection [10].

Thanks to this technology, check-in time will be shortened and, above all, the level of stress that affects the passenger during check-in will be reduced by up to 60% compared to classic check-in. There are currently 30 such self-service devices in operation at the Darwin airport, but the number of these devices are increasing rapidly. It should be mentioned that all kiosks are fully portable and can be moved around the entire area of the departure hall. This, of course, increases flexibility, usefulness and reduces costs in case of breakdowns or replacement of machines with other equipment, they are easily removed even during full operation of the airport and replaced with new fully functional equipment. [10].

Figure 4 J-Type self-service kiosk from Elenium Automation [10]

Self-service kiosks are usually assigned bags drop, which are used to check in a passenger's baggage. This device can recognize barcodes of baggage tags with a success rate of up to 97 %. This impressive success is ensured mainly using of cameras that can focus on the barcode label within milliseconds, regardless of the location of the baggage in the device. Compared to this innovation, competing companies use 2-dimensional reading of baggage tags, while the barcode must be directed perpendicularly to the camera for the information to be read. The innovation brought by the company Elenium can read the information from the baggage tag without the need to use any moving parts such as a scanning camera, etc. Instead of a moving camera, this device uses miniature wide-angle cameras with high resolution. Data (photos) are sent from each camera to the graphics unit (GPU) and then this data is processed. This allows the system to detect the location of the baggage tag in real time. This device can decode a barcode in 70 milliseconds, while it can process more than 60 megapixels in this time, with a maximum of 3 seconds to complete the processing of the baggage [10].

Figure 5 New fit self-service bag drop from Elenium Automation [10]

The Elenium´s systems offer complete check-in of the passenger. You can print a luggage tag and boarding pass directly from the kiosk [10].

The Elenium offers an automated gate in any airport setting, including boarding, security and lounge access as well. Its high capacity and advanced sensor systems process more passengers efficiently and accurately, increasing the productivity of the ground agents and allowing them to focus on increased customer service [10].

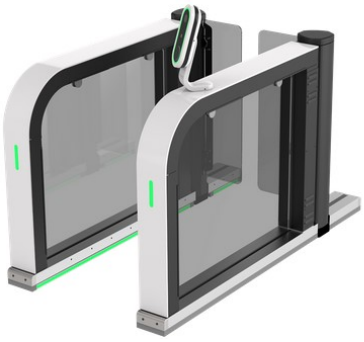

Figure 6 Automated gate from Elenium Atomation [10]

4. RFID CHIPS

The most modern innovation in aviation is undoubtedly the introduction of RFID chips. In general, the RFID chip serves as a replacement for barcodes on baggage tags, or as a replacement for entire tags. The first pioneer was Lufthansa, which, with the help of a device inserted into the baggage containing the RFID chip and its application, was able to bring to its passengers not only contactless baggage check-in (the kiosk read the pre-filled data from the chip) but also real-time tracking of the baggage. Turkish Airlines even sent such a chip to the passenger for free if he/she expressed interest in it. The airline company Delta Airlines, in cooperation with the airport in Atlanta, started inserting the RFID chip into the baggage tags themselves, so passengers do not have to put any device in their baggage. In a few years, they were able to distribute over 3800 RFID printers in 344 airports around the world and over 1500 readers of these RFID chips [11].

More than 23 million pieces of baggage are lost annually, and therefore the IATA organization in its Resolution 753 strongly requests airlines and airports to introduce RFID chips into the check-in process. The result of this implementation is real-time baggage tracking, less lost baggage, less mishandled baggage, faster check-in process and more efficient baggage sorting [12].

Figure 7 Qantas´ Q Bag Tag [13]

5. CONCLUSION

Introducing new trends in the passenger check-in process increases passenger comfort as well as minimizes the burden on airport staff. The article described only some of the most important trends that will simplify the entire passenger check-in process. In addition to the biometric contactless equipment introduced during the COVID-19 pandemic, we can consider virtual queuing as one of the significant steps to reduce terminal overcrowding and increase the flow of passenger in the terminal.

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