

**UNIVERSAL DESIGN APPLICATIONS AFTER PANDEMICS IN AIRPORTS
FUNCTIONING “PERCEPTION AND EXPERIENCE OF PASSENGERS”****Mohammed Khaled Shahwan
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ABSTRACT

This study aimed to identify the universal design applications after pandemics in airports, where the whole study was based on passengers' perception and experience in order to observe whether the chosen airport of the research is functioning with proper measures for all passengers or not. The research was conducted through many interviews with different genders and age groups in order to help collecting the data needed. The topic is to be taken into consideration due to the current pandemic of covid 19 situation where people life style, habits, and needs have oriented in completely different direction after the new measures, lockdowns, and applications. The aim of the study is to show how the universal design applications were like in Kuwait's international airport “terminal 1”, before the pandemic and what development have been added and changed after the pandemic in such public space.

In general, interviewees expressed that long term solutions are very important not only to follow the current situation that the world could be facing such as a pandemic, yet a good backup for any future cause that might occur.

Keywords:

Pandemic, Applications, Airports, Universal

INTRODUCTION**1.1 Problem definition**

The COVID-19 pandemic has changed the way people interact with one another and it also enforced certain behaviours and restrictions that companies, as well as individuals, had to follow. One of the most affected areas was public transportation where operators had to adopt new means to tackle the issue in order to reduce transmission rates of the virus to ensure safety.

The COVID-19 pandemic was a crisis that nobody was ready for or even foreseen, thus as soon as the world began reflecting upon the restrictions and measurements that were physically distancing the crowd for many health purposes; there the development began yet still enhancing in order to create a wider accessibility back to the public space. The real question is would we have a stronger relation with public spaces than before? Or would it be less accessible?

Everyone deserves to be treated equally despite the circumstances, conditions, and cognitive/physical situations they are born with. Architecture is not only about building spaces, developing atmospheres, or creating shelters. It is also about finding solutions to many problems. A common problem during the pandemic crisis was accessibility, where all the places were fully closed due to the valid space available and the health measurements standards that needed to be applied. The space we feel most comfortable in could turn into the most toxic space within seconds if the user's needs, conditions, and reliability of the space was not suitable for their needs.

Airports are one of the most “stressful environments” at the best of its time and considered on a high-rate percentage of giving risks of disease mobility, but how about during pandemics? Since airports have a high proportion of risk of disease mobility, terminating the space was one of the main reasons to reduce and avoid the daily increased number of cases in the public. Nevertheless, did the pandemic actually change our habits and what we do in the public?

OBJECTIVES

The three objectives of the studies are the following:

- Identify the applied universal design applications “before the pandemic”.
- Identify the applied universal design applications “after the pandemic”.
- Compare the different experiences of different individuals and passengers while traveling before and after the pandemic in airports.

The aim of the study is to compare between the applied universal design applications at airports “before” the pandemic and the developed design applications, changes, and new developments “after” the pandemic in order to differentiate between the passenger’s experience to identify the various effects on the individuals before and after the pandemic at airports.

LITERATURE REVIEW

2.1 Universal design definition

Universal design, also known as inclusive or accessible design, is a universal design that serves and applies to the most common users of buildings, products, and environments. The universal design approach states that it is essential for the design to be accessible as well as usable for everyone in society. Therefore, design for majority-world nations can be defined as a concept that goes beyond concerns about the built environment's accessibility and addresses social, cultural, and economic issues that significantly impact how well-off people and those with various physical, mental, or psychological abilities interact. Accepting universal design as a strategy that honours and promotes human variation is essential. (Smith & E., 2011)

2.1.1 Universal design history

Over time, everything in the process phase gets improved. For various reasons, universal designs emerged and were given more significant thought over the 20th century, making them more appealing as requirements than general ideas. Ronald L. Mace, an American architect and a wheelchair user, is renowned for promoting accessible building codes and standard concept creations of universal designs. He led numerous working groups in 1997 to develop what is now known as the seven universal design principles to help direct the design process of environments, products, and services. (Weeber, 2022). Things grew significantly over time as several diverse design teams and viewpoints improved them to provide global equality of accessibility. Polio was one of the things that caught people's attention. Considered an acute viral infectious illness of the nerve system, polio typically begins with widespread symptoms like:

- Fever
- Headache
- Nausea
- Fatigue
- muscle pains
- spasms

When the infection reaches a hazardous stage, the muscles in one or more limbs, the neck, or the chest may become permanently paralyzed. Most polio victims were children between the ages of 5 and 10. Before researchers developed the polio vaccination in the early 1950s, polio epidemics resulted in more than 15,000 cases of paralysis annually. (Polio Elimination in the United States, 2022).

When Ronald L. Mace was nine years old, he was diagnosed with polio, and from that point on, he needed a wheelchair to get around. He was seriously suffering from the illness, which had progressed to lifelong paralysis. Many public buildings did not have accessibility amenities to assist the disabled at that time. In order to travel through the campus buildings and due to a lack of accessibility, Mace had to be carried when he was a student at North Carolina State University. He, therefore, graduated in 1966, where he started his career as an architect and was able to alter things and design better designs that were convenient for everyone in the community. (Polio Elimination in the United States, 2022).

2.1.2 Universal design 7 principle

There are seven Universal design principles. They were created and developed with the intention of achieving a single aim for all users, irrespective of their size, age, or abilities. Accessibility, a technique that removes

adaptations or differentiations between users in any area or product, is one of the favorable considerations by the principles. According to the Center for Universal Design at NCSU, the principles serve as a guide for designing communications, services, and surroundings. The principles may be employed to evaluate current designs, direct the design process, and educate both designers and users about the features of more usable systems and spaces. ("The Interaction Design", n.d.)

The seven universal design principles are as follow:

Principle 1: Equitable Use

Principle 2: Flexibility in Use

Principle 3: Simple and Intuitive Use

Principle 4: Perceptible Information

Principle 5: Tolerance for Error

Principle 6: Low Physical Effort

Principle 7: Size and Space for Approach and Use

The guidelines were based on the writers' idea that fundamental universal design principles related to all design standards, including those geared toward communications, physical environments, and products. The principles were created to serve as a roadmap for the design process, enable a methodical evaluation of designs, and help educate users and designers about the qualities of more practical design solutions. (Story et al. 1998; Center for Universal Design, 2000a; Mueller, 1997. Cited in Wolfgang F. E. Preiser, Universal Design Handbook, 2001, p.59).

2.4 Universal design applications in airports

Airports are mainly big crowded buildings and it is vital to be designed to higher standards to meet the user's expectations and to be convenient and usable for the travelers that come from different parts of the world. The right measures are applied in order to prevent undesirable or complicated experiences of the travelers. The airport designers must always consider the circulation, visual and written information, monitors placement in the airport, directions and the support for the passengers to access easily. People travel for different reasons and like travel, business or to relocate. On a regular basis, all those "seasoned travelers" using the airport for their desired purposes could encounter an incredibly stressful situation. (Baker, 2018). Many reasons could lead to stressful situations such as delays, or flight changes. Able-bodied people can experience stressful experiences in airports besides people with disabilities or old people. There are numerous activities available for travellers to enjoy in today's airports. But if passengers are to fairly benefit from the facilities available, design modifications must be made. (Baker, 2018).

Airports are now used for more than just transport in the modern world. Things have evolved into a desirable atmosphere investment that offers passengers a variety of settings in which to wait for flights and activities to engage in. Travellers expect to see high-class restaurants, shopping malls, quality art pieces and designs, and concierge services in airports.

The following principles must be applied in airports:

1- Equitable use: One of the most crucial factors to be considered as the very first approach to the space is the main access to all doors, both inside and external, in airport terminals. (David Martin, DM, 2019). Moreover, • All doors must be provided with automated sliding features in order to add the engagement of everyone's requirement to accommodate all people. (DM, 2019).

2- Flexibility in use: Elevators are designed according to the right dimensions than ensure convenience of the users and they should be placed in the right locations. There is easy access for wheelchair users and transportation as soon as they arrive at the airport. Accessing any services in the area is a top priority on the ground, so wheelchair users can exert the least effort when traveling from the boarding location to the airplane. (DM, 2019).

3- Simple and intuitive use: According to the third principle, designers placing monitors where they are seen, read conveniently, and away from sunlight glare is essential. Wayfinding signs and directions are simple and can be understood by people with different languages and experiences. The font and symbols should not be confusing to the users. Additionally, audio guidance is vital for those with vision impairments.

4- Perceptible information: The design effectively conveys the relevant information to the users.

This includes easy to follow signs, proper light, and textured floors near entrances. In the new renovation, the universal design has been considered to make it simpler for many visitors and staff to understand all characters, colours, and symbols quickly. (JAL, N.D).

5- Tolerance for error: the design minimizes hazards and the adverse consequences of accidental or unintended actions. Airports should search for products, tools, and designs with safety features integrated into the fixed environment. For example, a failsafe braking system that eliminates a common cause of occupant injuries and frees attendants to concentrate on helping the customer allows taxi transit chairs and aisle seats to be built to satisfy this requirement. Customers who have young children can receive assistance and support through "JAL Priority Guest Support" and "JAL Family Service" at "Haneda Airport." As part of the universal design, all service counters and chairs are used with lower counters and chairs so all people may use them. In addition, officers and qualified support employees are available at other locations to help passengers with every step of the boarding process.

6- Low physical effort: the design is used efficiently, comfortably, and with minimum effort.

To accomplish the low physical effort principle, airports should have transporting systems like electrical carts, movers to move people who are old or those having difficulty moving. The movement and the storage places are designed to be in the appropriate places. The "Concierge" offers assistance services. A telephone centre and five information counters are also present, dispersed around the terminal. All necessary information and help are given, and passengers are carefully escorted from the access point to boarding. (Tokyo International Air, n.d.). The service is identifiable by uniformed employees on hand and may be seen around the terminal in the parking lots and taxi platforms.

7- Size and space for approach and use. This approach offers appropriate size and spaces for approach and reach to be comfortable for different body sizes or mobility.

All entryways, queueing spaces, and corridors should be broad enough to allow unrestricted movement for all mobility equipment without side obstructions. Signs and counters should be of the appropriate height and size to be usable by everyone

3.1 Covid 19 pandemic

In China's Wuhan City, a new global infectious first case was reported in December 2019. Wuhan is a very densely populated metropolis with more than 14 million inhabitants as of 2019. There was a link between the COVID-19 infection and a wet market in Wuhan where it started. Soon after, the infections increased and reached almost every country worldwide. There were restrictions all around the world on travel as well as quarantine measures in many cities.

Governments worldwide started implementing the necessary measures, including travel restrictions, mandatory PCR testing, and quarantines. Even workplaces adopted work-from-home policies, and universities began teaching their lessons online. The pandemic led to many improvements in medical supplies, logistics, and hospital services. (Zhu et al., 2020).

The COVID-19 is an infectious disease that is caused by the SARS-COV-2. It is a respiratory disease and the severity of the symptoms can vary from one patient to another. It affected people who had other diseases and who had weak immune systems more than healthy individuals. The symptoms of the COVID-19 include:

- Fever
- Difficulty in breathing
- Cough
- Invasive lesions on both lungs (Zhu et al., 2020).

The incubation period of the virus is around 2 weeks. However, the virus can still spread during the incubation period without any symptoms on the patient, which made it even harder to track the virus and reduce transmission.

THE CASE OF KUWAIT

4.1 Location of the site

The state of Kuwait is an Arab country that is located in the gulf region of the Middle East. It has borders with Iraq, Saudi Arabia and maritime borders with Iran. Kuwait's coastline stretches for about 500 kilometres. The capital city "Kuwait City" is home to the majority of the nation's inhabitants. Kuwait has a population of 4.67

million as of 2022, 1.85 million of them are Kuwaiti natives and the rest 2.8 million are foreigners from more than 100 different nations. The official language in Kuwait is Arabic. English language is taught in schools and it is used for business to make it easier to communicate with the outer world. There are also many foreigners who come from Asian countries like India, the Philippines and Pakistan where they speak their own languages among them.

Kuwait has a modern road network connecting it with its neighbouring nations. As seen in figure 1, Kuwait's International Airport, which is situated in the south of the capital, serves a large number of international routes, which is one of the reasons why the nation's port infrastructure and its fleet of oil tankers and cargo ships have grown significantly.



Figure 1 Kuwait's maps and airport location

4.2 Kuwait's international airport "terminal 1"

Kuwait international airport has an overall area of 780,000 m² that consists of two main operative runways and has 5 terminals known as:

Terminal 1: which is the chosen terminal of the research, considered to be the current airport building.

Terminal 2: the new big airport building

Terminal 3: known for flydubai airlines, which is why its named as flydubai airport building.

Terminal 4: the new small airport building for Kuwait airways.

Terminal 5: new airport building, Jazeera airways.

As seen in figure 2 each terminal has a different angle of entrance, yet located in the same area. Moreover, the airport offers direct flights to 34 different countries and 68 destinations in total. The airport is located in Farwaniya area, which is 16 kilometers away from Kuwait City. The capacity of the airport is around 13 million passengers annually.



Figure 2 terminal 1 entrance and location

The airport offers many facilities and services for its users:

- Duty free shops

- Travel agencies
- Luggage storage
- Information Booths
- Baggage handling system
- Business corner
- Lost and Found
- Kids Area
- Banks and Exchange
- Toilets
- Pharmacy
- Parenting Room
- Praying Room

The design of the building is referred to as 'Al Sadu', which is a Kuwaiti traditional pattern. Figure 5 demonstrates the pattern that was widely used by Kuwaiti nomads' fabric of their tents, which it symbolizes their origins and belonging while travelling in different areas of the Middle East and Asia. The basic idea behind the Al Sadu pattern was to combine several design elements, such as the outer facade panels, the interior ceiling, and the custom wood wall panels, in order to more clearly identify the local identity that best symbolizes Kuwait's traditions. It is possible for every passenger to recognize Kuwaiti culture in the structure and tell it apart from other terminals thanks to the Al Sadu weavings, a strong local heritage. (Rafael, 2018).

The false ceiling is the single most significant component of Kuwait's international airport's interior design. A clean and abstract image that ultimately takes the form of a tridimensionality surface is defined by the design's powerful pattern taken from Al Sadu weavings. Depending on the various regions of the terminal, the ceiling can also be adjusted. The pattern's scale is larger in the larger spaces, like duty-free and the check-in hall. Similar to this, the modules are smaller in smaller spaces to meet the proportion of space, such as open lounges. (Rafael, 2018).

METHODOLOGY

The research will take place in "Kuwait's International Airport terminal 1" that is located in Kuwait. The research will require theoretical questions that will be a combination of both open-ended questions and close-ended questions that will be divided into two parts:

- **Part one:** will be relying on the theoretical educational part of the study that focuses the lens on universal design principles and their appliance within airports, as well as looking more in the depth on the developments, changes, and new trends that have changed the universal design applications after the pandemic of covid 19 and the passenger's behavior at airports.

- **Part two:** will be covering the data collection from the interviews conducted in which it will be generated to multiple groups of people that rely on multiple categories of the following:

- Gender
- Age
- Nationality
- Physical Status
- Profession
- Location during pandemic
- Year of visit to the airport
- Experience through airport (facility)

Sampling Method:

Due to the different expats and variety of the populations living in Kuwait. The sampling method will be divided into two types of methods.

The first method that will be used will be based upon probability, which will be a stratified sampling method that will enhance the ability of collecting more data about the different group categories of the population chosen within the research, such as: age, nationality, and gender. Stratified sampling method will help the

research by dividing the population into subgroups that is known as “strata” in order to represent the populations sample of the different categorized groups.

The second method will be a “quota” sampling method that is considered as a non-probability method that elements from the population are chosen on a non-random basis in which all members of the population do not have an equal chance of being selected to be a part of the sample group.

Both methods will be having a collection of data through interviews in which each interviewee will be handed with a covering letter that will be explaining the duration of time that the interview will be lasting for, which is approximately around 30 minutes to maximum one hour. The purpose of the study will be explained in brief, as well as the security of data and confidentiality of the information that will be given by the interviewee (which is for future enhancements and academic purposes only). Mentioning everything to the interviewee will give a better free appealing response that will increase the research with useful data and analysis to the research in such data collection method.

The data collection will also be including a variety of collection of all the information related to universal design principles taken from different sources, articles, reports, documents, books, and online passengers reviews on Kuwait’s international airport experience, and the effects of COVID-19 pandemic upon spaces.

RESULTS AND DISCUSSION

In the interview data analysis, 60 questions were proposed with the interviewers in which many of the results were similar between the interviews and few are different, yet the majority of the results were agreeing on many things related to Kuwait’s international airport.

85% of the participants are traveling during the early/mid/late night time one to three times per year. According to the analysis of the data 45% of the participants prefer to travel from Kuwait’s airport between 8:00 pm to 12:00 am, because the crowds are less at that time which gives them more comfort since the crowd is a bit less than other timings and they are more relaxed during the day in order to take up with any stress in case the airport turns out to be crowded.

Categorizing the profession within the research was divided into two which was asked in order to differentiate people’s desires when it comes to traveling. The different categories were being an employee with a job or were a student that is working on the academic education. According to the age category results, 51.7% of the participants are in category B (26- 40 years old) which is the average among other categories. The interviewees were asked about the certain year that they mostly travelled at in which 53.3% travelled in 2022. 43.3% travelled in 2021, and only 3.3% people travelled during 2020 where the reasoning was relevant due to the lack of preparation and complete shutdown of the airport.

Since the majority of the participants are employees and expats in Kuwait. The main reason for them to use Kuwait’s international airport is to go for their vacation back home to visit their families’, friends, and hometown. As shown in figure 3 48.3% are in the other category using the airport for their vacation purposes. According to the analysis they are travelling one to three times a year. 28.3 % participant are using the airport for tourism and only 5.1 % are using it for cargo receiving arrivals.

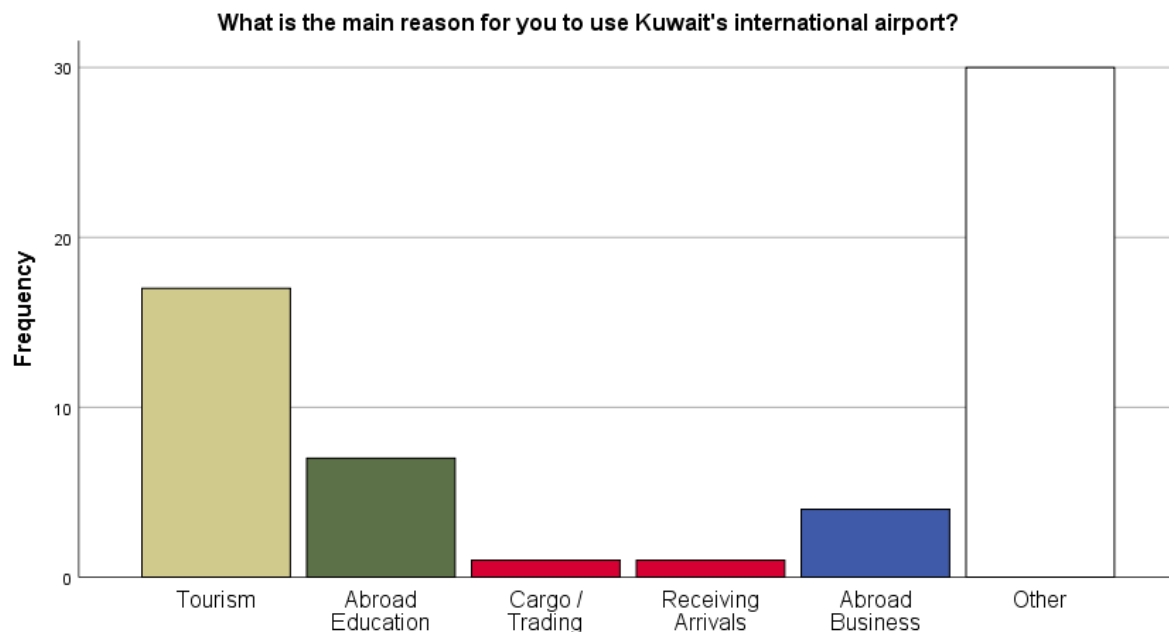


Figure 3 main reason for using terminal 1

An airport is a stressful environment if it's not applying the right atmosphere for the passengers. 46.7% of the participants are feeling very stressed before reaching Kuwait's international airport terminal 1, due to the number of crowds that are occupying the space, security measures long ques, and the pandemic new procedures that are rapidly changing. Only 6.7 % are not feeling any stress while using the terminal.

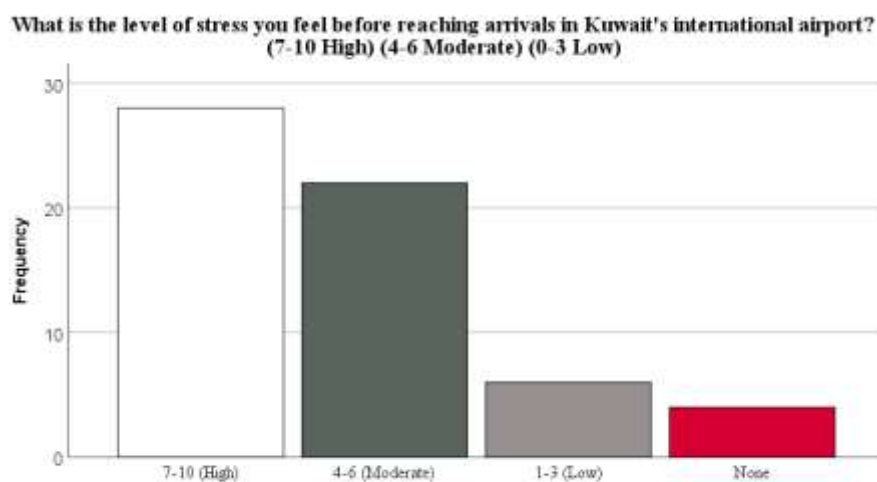


Figure 4 level of stress of participants before reaching arrivals

Kuwait's international airport had three unperforming facilities that were rated by the interviewers as a bad performing one. The facilities chosen are one of the most important facilities to be taken into consideration more for all users of a different kinds. According to the interviews the three low rated facilities in Kuwait's international airport are the toilets facility, baggage facility, and waiting area facility. As per the participants, the

three facilities contain long ques and crowds in order to apply your needs in the space, not comfortable, and is not maintained with the pandemic applications and new development.

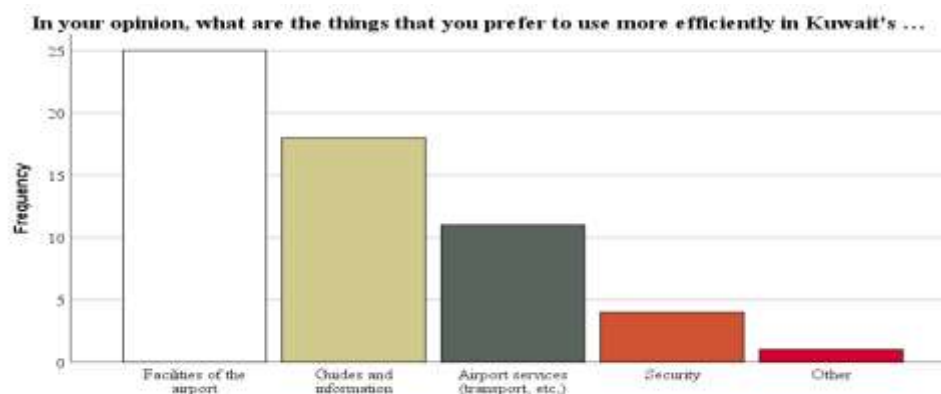


Figure 5 participants facility preference for efficient use in terminal 1

In the table below are some comments about the things needed for an efficient usage of Kuwait's international airport facilities:

Table 1 comments and reviews of the participants

	Year of visit	M/ F	Age	Nationality	Passengers Comments / Reviews
Interviewer 1	2022	M	50	American	the airport is hopeless and things won't be developed as i have experienced for a long time now, a new one would be great to have.
Interviewer 2	2021	F	26	Lebanese	should do more things at the airport than just having everyone crowded by the waiting facility before gates open or just have everyone eating and drinking only.
Interviewer 3	2021	M	39	Jordanian	a lot of improvements related to the pandemic must be changed and applied, it reduces down stress and increases people's safety more than what's applicable now.
Interviewer 4	2020	M	45	Indian	more facilities would provide more experience for us as foreigners as well as having a better safe pandemic technology solution.
Interviewer 5	202	F	44	Philopenas	In my opinion i dont think it's convenient to everyone and not everyone can use them freely with the amount of equally time safely, which needs to be changed developed and enhanced in a better way

Interviewer 6	202	F	36	Sri Lankan	to direct myself more positively and safe without any hustle thinking i might catch the disease and get infected
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CONCLUSION & RECOMMENDATIONS

Airports are looking into to low-tech solutions that are requiring masks, social distancing, new materials, and some extra sanitization around to help reduce the risk of Covid-19, but some are also turning the direction into technology in order to boost safety and bolster consumer confidence. Kuwait’s international airport “terminal 1” should be applying enhanced solutions that do include technology more and diversity in staff. Throughout many airports across the world many solutions have been proposed with different features that will benefit and are benefiting the passengers experience, privacy, and safety for not only some temporary period of time, but a long-term duration where the solutions proposed and applied after the pandemic are benefiting through connecting the passengers with greenery gardens, technology, solo spaces, and extra hygiene for the passengers’ comfort. The solutions that are mostly proposed are related to entry of the airport (thermal cameras and passengers analytics, check-in touchless kiosks/units, security checkpoints new methods, common areas autonomous robotic cleaning and boarding virtual queuing.

When it comes into the check in area within the airport, touchless kiosks as seen in figure 6 are a great proposal that have been developed more after the pandemic in order to complete all the process online or at a touchless kiosk where zero interaction is applied with the airline staff where its mostly facilitated by self-service without any touch, only with voice and face recognition.

Security checkpoints are one of the facilities that has plenty of opportunities to spread the virus from the amount of process it requires such as, the removal of liquids, electronics, tickets, and personal items. It is considered one of the most crowded points within the airport. In order to prevent the crowds, some airports are scheduling passengers into a security line to prevent overcrowding, and are injecting more biometrics like facial recognition to keep the agents safe and away from handling the physical part of the passenger’s identification and tickets. To reduce down the in-person baggage testing, other airports, like Miami international airport, are looking into more advanced screening methods that has CT scanners that creates a 3D model of the bags to better detect dangerous materials or threats without having to handle the baggage.

A common developed method is a facial recognition method for identifying your formal passport id verification. Some government and airlines are using the facial recognition in order to reduce the physical contact between the passengers and the airport staff as seen in the “facial recognition for identification” part in figure 6 no physical of giving and taking anything is required and everything is processed through distance, which is a great advantage for people to spread less germs and be safer from the disease.

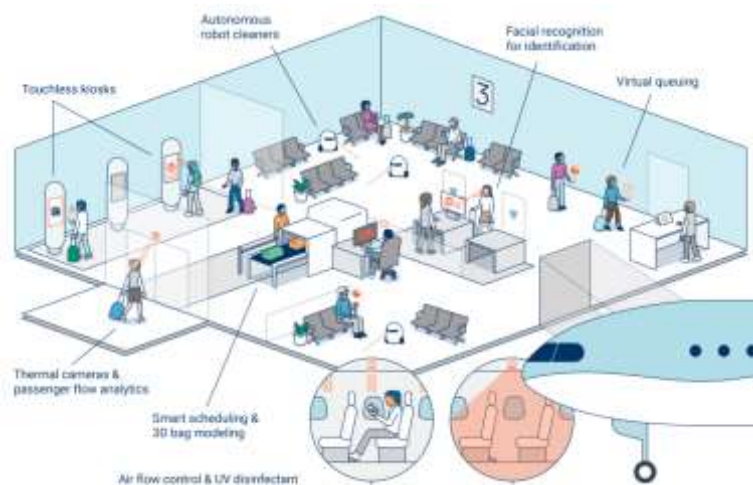


Figure 6 new technologies and features after pandemic in airports

Waiting areas and lounges development proposal in which progress is added within the seating method, where it is more of a clustered system of three sizes, small, medium, and large pods that priced depending on the amenities you are in. more transparency to be added with an integration with the surrounding. As seen in figure 7 biophilic designs are included within the glass cubical standing units for smoking and waiting areas are not only an isolation, but a place of comfort and connection to nature to give softness to the space as well as an outdoor relation in order to give a better experience for the passenger.



Figure 7 example of solo isolations connected with nature

As a result of the rapid changes, and continuous procedures of covid 19 pandemics. Kuwait's international airport is considered to be lacking a lot of development that is not universally pandemic related throughout the facilities of terminal 1 in terms of space, applications, technology, users experience, entertainment, and safety of the user.

The universal design principles did not change as much in terminal 1. The common applied systematic procedures and measures that have been applied before remained in its same form and function before and after the pandemic. The changes applied were the standard development required around all public places which were having masks on, social distancing, and extra sanitization throughout the airport. It is a partial development for the terminal, yet passengers are still following their flights through screen monitors and staffs help along with other methods that are still remaining the same where those methods are not what an airport user is fully seeking for when using such space like an airport, especially after a pandemic.

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Airports, especially crowded ones like Kuwait's international airport "terminal 1" must be universally applicable and functional for all types of users in all possible circumstances. A pandemic is a new way to cope

with the spaces we are spending our time in with many different ways, not only for the passengers, but the staff as well. However, despite the importance of the interior environments of terminal 1 and its design for enhancing performance, there are many measures that are neglected were the design of a travelling environment around the facilities is becoming stressful and uncomfortable for the user's needs. The safety of the user within the interior spaces have become a priority within the design where it is a must for everyone to feel the safety of not catching the disease nor spreading it, by any possible new way that requires new material, technology, or applications that help improving the experience of the space.

Kuwait's international airport has the capability of change, development, and enhancement. However, despite the importance of the interior environment of the airport and its design for enhancing performance, there are many new ways that the airport could be enhanced rather than the neglectation of such new adaptation of such important space that understands a high number of users.

Finally, airports are considered to be unique places that are not visited on daily basis, yet very memorable in terms of atmosphere, space, and experience throughout the journey. If a user uses the airport once for a short duration of time even at a transit facility, it could give a big impact about many things related to the country, culture, and impact of development. The research discusses the point of view of the perception and experience of the passengers throughout Kuwait's international airport "terminal 1", In which the passengers are mostly committing into a better memorable experience where things are less stressful, joy able, and are with the rights applications for them to be safe and experience a comfortable interior of an airport.

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