SIMULATION OF PASSENGER FLOW

AND WAITING TIME FOR INTERNATIONAL DEPARTURE

USING WITNESS HORIZON

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SIMULATION OF PASSENGER FLOW AND WAITING TIME FOR INTERNATIONAL DEPARTURE USING WITNESS HORIZON

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DECLARATION

This work has not previously been accepted in substance for any degree and is not being concurrently submitted in candidature for any degree.

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Upon completion to this study and research, I would like to express my greatest gratitude to my supervisor, Dr. Hasnida Binti Ab Samat who gave me all the guidance, explanation, motivation and sharing her knowledge of expertise with patience throughout the past one year. Her precious suggestion helped me to develop and complete the simulation modelling.

A special thanks to Kulim International Airport (KXP) who helped me throughout the research that provide me a rough data for the related flow of passenger departed as reference. Next, thanks to all my courses friends who help me a lot on the simulation to give a support and idea through modelling system of passenger flow in an airport. Furthermore, thanks also to my family, lover and friends who give support on me to finish the project during my hard time. Without them, I cannot reach and complete the project until now. Finally, I am also indebted to University Sains Malaysia (USM) for providing a complete syllabus to this course so that we have enough engineering knowledge to complete the required study.

ABSTRAK

Proses pejalanan penumpang bermula dari balai berlepas sehingga ke tiba di pesawat. Terdapat beberapa proses yang perlu dilalui oleh penumpang sebelum tiba di pesawat. Antaranya ialah kaunter daftar masuk, pemeriksaan pas masuk, pemeriksaan dan kuarantin, kawalan keselamatan yang terbahagi kepada dua iaitu mesin x-ray dan meja pemeriksa, pemeriksaan kebersihan, kawalan pasport berlepas dan pesawat. Kajian ini untuk mengenal pasti proses yang berlaku ketika perjalanan seorang penumpang. Peyelidikan ini dicadangkan oleh KXP AirportCity Holdings Sdn Bhd untuk melihat data yang dikaji adalah benar dan tepat. Penggunaan simulasi Witness Horizon dapat membantu dalam pembelajaran setiap proses yang berlaku. Terdapat empat model direka bentuk bagi melihat setiap perubahan masa yang berlaku setelah membuat sesuatu pertukaran dan peningkatan. Penumpang perlu hadir ke lapangan terbang sekurang kurangnya sebelum tiga jam bagi menjalani setiap proses yang berlaku di sana. Kajian ini menggunakan satu pesawat iaitu Boeing 737-800 yang mempunyai 168 orang penumpang. Setiap model akan dianalisi dengan tujuan mecapai sasaran semua penumpang sebelum tiga jam. Akhir sekali, setiap data dari keempat-empat model akan dibandingkan untuk mengkaji setiap proses yang berlaku bagi proses perjalanan dan masa menunggu penumpang.

ABSTRACT

Passenger flow will start from the departure hall until the flight departure. There are a few processes before a passenger take a flight which are check-in, boarding pass check, inspection and quarantine, security controls that divided into two x-ray machine and desks, sanitary inspection, departure passport control and flight. This research is to study about each process involved in one flow of passenger in international departure operation. The research is conducted with a collaboration with KXP AirportCity Holdings Sdn Bhd whom provide the data that of each process time and the various layout for in a departure hall. This research use Witness Horizon software to simulate and study every process that occurs. There are four model created to show the changed of time for every improvement. The passenger needs to arrive three hours before the departure. The research uses a flight Boeing 737-800 which can accommodates 168 passengers at one time. The four model are Model 1 is the automatic processes passenger flow, Model 2 is manual processes passenger flow, Model 3 involved of combination of automatic and traditional process and finally Model 4 is about adding more counter to reach the target time. Each model then was analysed to identify the best passenger flow that can be completed within three hours before departure. Based on the result, it can be concluded that Model 4 is the best model that can be used.

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LIST OF ABBREVIATIONS

ABC	Automated Border Control
CADMP	Computer Aided Drafting Mapping and Photogrammetry
JKIA	Jomo Kenyatta International Airport
KQ	Kenya Airways
KXP	Kulim International Airport
LCC	Low-Cost Carrier
MCT	Minimum Connection Time
SST	Self-Service Technology
TAT	Turnaround Time
TSA	Transportation Security Administration
TSO	Security Officers
WIP	Work-in-Progress

CHAPTER 1 : INTRODUCTION

1.1 Project Background

Air travel is often associated with waiting – hours of standing in line to check in, get through security and board contributes to a negative flight experience for many travellers. With the number of passengers increasing every year, airports are intense to find new ways to improve passenger flow. In 2013, 3.1 billion travellers used the global air transportation network for business and tourism purposes. According to current forecasts, the annual passenger total is likely to reach over 6.4 billion by 2030, up nearly 5% from 2012 (Rodríguez-Díaz et al., 2017). Especially when short on time, it contributes to passenger frustration if information on waiting times at queues are not displayed. For operators, it is crucial to have the right number of staff available in order to efficiently process passengers.

One of the challenges facing the aviation industry is air traffic demand growth. Unpredictability and random incidents are the norm rather than the exception in an airport environment. Congestion, weather, enroute capacity limits, equipment malfunction and breakdown, late aircraft/crew arrival, ground services, ground delay programme, late arriving passengers, and other factors can cause flight delays (Ali et al., 2019). Among them, passenger induced delay is a major concern. According to Eurocontrol, in the third quarter of 2015, the average delay per delayed flight was 27.4 minutes, with less than 0.5 percent of flights experiencing a delay of more than 180 minutes and fewer than 1.2 percent of flights being cancelled. This indicates that 45 percent of the time, airlines only face minor delays in their flights on a typical day of operations (Santos et al., 2017).

Kulim Airport is a proposed airport for the Malaysian city of Kulim, which is located in the state of Kedah and borders the state of Penang. The state government of Kedah filed a proposal to the country's Prime Minister for approval to establish Kulim International Airport (KXP). Due to growing capacity constraints at Kulim's nearest international airport, Penang, the state government plans to develop a new airport. Alor Setar and Langkawi International Airport are the two current airports in Kedah State. For the new project, the state government has set aside 600 hectares of land. At the projected Kulim Airport, the Kedah State Government intends to build an "aerocity." The proposed airport is expected to cost MYR1.6 billion (USD500 million) to build, according to Malaysia's State Chief Minister. Land purchase, infrastructure development, and the building of two runways are all included in the estimated cost. Figure 1.1 shows the map of Kulim International Airport.

Figure 1.1: The map of Kulim International Airport (KXP) (Loh, 2019)

This project will use the WITNESS simulation software to simulate the passenger flow and waiting time for international departure at Kulim International Airport based on Penang Airport. A simulation model to visualize and rectify the root cause of the disruption in passenger's international departure flow and waiting time. The time study for each process involved in international departure operation in the model simulation to recognize the problem that can be solve for improvements better passenger flow and shorter waiting time.

The WITNESS Simulation Software assists in the development of a simulation model, which is a dynamic representation of some aspect of the real world sufficient to ensure that visualisation using this model is an adequately accurate predictor of reality (Shinde, M. K., & Nimbalkar, 2017). WITNESS also has a graphical interface for creating simulation models. It allows for the representation of a real-world process in a dynamic animated computer model, as well as the automation of simulation experiments, the optimization of material flow throughout the facility, and the generation of animated models. A simulation model can incorporate all of the nuances of real-life experience that may arise (Shinde, M. K., & Nimbalkar, 2017).

Based on the research methodology, they have proposed a passenger-centric analysis of stochastic delays on self-connecting transfer passengers in the context of Low-Cost Carrier (LCC) operations. Here, they have considered effect of arrival delays, Turnaround Time (TATs) and Minimum Connection Time (MCTs) on passenger connections. They studied the impacts of operational uncertainties on passenger connections at Singapore Changi Airport (Terminal 4), which serves budget carriers, by examining an optimal gate assignment of planes coming and departing from the airport. To do so, they've suggested a model for missed connection analysis, complete with sub-components and their interactions. The model consists of four key components: operations (variables), passenger flows (simulations), disruption patterns (historical data) and infrastructure (fixed). Three critical operational parameters- TAT, MCT and arrival delays are varied to analyse their interactions with one another. Finally, using a heuristic Tabu-search technique, all these sub-components are combined in an optimum gate allocation scenario to examine their effects on missing connections. In the disrupted situation, the suggested model also includes gate reassignment to reduce spatial divergence from the optimum gate assignments (Ali et al., 2019).

Another research methodology, the case of Kenya Airways (KQ) and its hub airport in Nairobi (JKIA) is used to test the capacitated airline delay management problem (CADMP) model and the innovative methodology proposed (reference?). The 605 results indicate that utilising the proposed methodology, significant reductions in delay charges can be accomplished — a decrease of 29% is projected. Furthermore, it was possible to reduce missed connections by more than 90%. Fuel prices, on the other hand, will rise by about $2,000 per day. This is caused by the need to prioritise planes with 610 connecting passengers, which necessitates speeding up or delaying airborne flights. However, when compared to the savings in terms of passenger delay charges, this rise in fuel expenses is negligible. The impact of airport capacity on delay charges was investigated using the instance of a one-third reduction in initial runway capacity. The results suggest that more passengers can lose their flight connections and delay costs can increase 615 over 7% (Santos et al., 2017).

1.2 Problem Statement

Kulim International Airport (KXP) has complete layout with necessary departure checkpoints which every checkpoint has their waiting time at departing area. This topic discusses about the time study for each process involved in international departure operation and to identify peak hour of the day to observe the airport capacity in handling passenger. From this study, potentially highlight improvements needed for better passenger flow and shorter waiting time. Therefore, the main objective of this present paper is to model a simulation based on Kulim International Airport layout to visualize and rectify the root cause of the disruption in passenger's international better departure flow and shorter waiting time.

1.3 Scope of Work

The scope of study will be focused on the time study for each process involved in international departure operation to identify peak hour of the day in order to observe the airport's capacity in handling passengers. All data will be provided by the KXP Airportcity Holdings Sdn Bhd to be study. Besides, we have to study about the WITNESS simulation software more deeply to visualize the airport layout and process flow so that we know all area that relate the time study about time waiting and delay problem.

1.4 Objectives

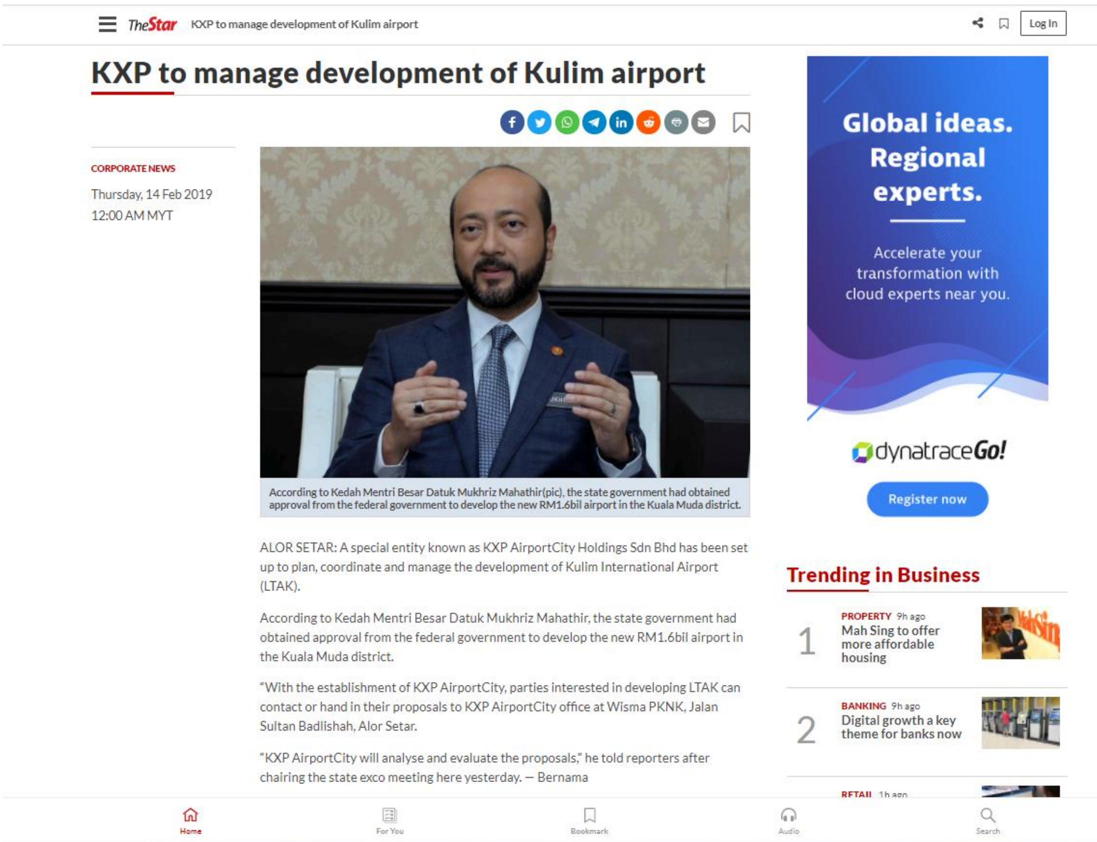
This research objectives are:

- To study each process involved in one flow of passenger in international departure operation;
- To simulate the process using Witness Simulation Software and identify any issue that can be improve;
- To analyze the result and suggest improvement to avoid delay at international departure process.

CHAPTER 2 : LITERATURE REVIEW

2.1 Kulim International Airport (KXP)

Kulim International Airport's development is being planned, coordinated, and managed by KXP AirportCity Holdings Sdn Bhd. The state administration of Kedah has received authorisation from the federal government to build a new RM1.6 billion airport in the Kuala Muda district, according to Kedah Menteri Besar Datuk Mukhriz Mahathir. The airport is scheduled to open in 2024. Figure 2.1 shows the news about the KXP to manage development of Kulim Airport.


TheStar KXP to manage development of Kulim airport

Log In

KXP to manage development of Kulim airport

CORPORATE NEWS

Thursday, 14 Feb 2019

12:00 AM MYT

According to Kedah Mentri Besar Datuk Mukhriz Mahathir(pic), the state government had obtained approval from the federal government to develop the new RM1.6bil airport in the Kuala Muda district.

ALOR SETAR: A special entity known as KXP AirportCity Holdings Sdn Bhd has been set up to plan, coordinate and manage the development of Kulim International Airport (LTAK).

According to Kedah Mentri Besar Datuk Mukhriz Mahathir, the state government had obtained approval from the federal government to develop the new RM1.6bil airport in the Kuala Muda district.

"With the establishment of KXP AirportCity, parties interested in developing LTAK can contact or hand in their proposals to KXP AirportCity office at Wisma PKNK, Jalan Sultan Badlishah, Alor Setar.

"KXP AirportCity will analyse and evaluate the proposals," he told reporters after chairing the state exco meeting here yesterday. — Bernama

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Figure 2.1: KXP to Manage Development of Kulim Airport (Bernama, 2019)

KXP needs to grow since Penang International Airport is more focused on passengers, whilst KXP is more focused on cargo and logistics. According to Datuk

Mukhriz Mahathir, Kedah Menteri Besar, the state government should take advantage of the current scenario to attract more foreign direct investments. He said that the state government would soon sign many agreements with companies involved in aerospace and logistics, including maintenance, repair, and overhaul, regarding the Sidam logistics centre. KXP has the potential to become Asean's largest logistics centre. You will have a lot of logistics companies coming into a logistics airport like this. It will establish a larger supply chain, which will alter Malaysia's economics. Figure 2.2 and Figure 2.3 shows the news about the Kulim International Airport will be operational in 2024 and Kulim Airport will be a game changer to the city.

Mukhriz hopes Kulim International Airport will be operational in 2024

By Bernama - January 13, 2020 @ 9:43pm

(file pix) Kedah Menteri Besar Datuk Seri Mukhriz Mahathir is hopeful that the Kulim International Airport (KXP) would be operational in 2024. NSTP

KUALA LUMPUR: Kedah Menteri Besar Datuk Seri Mukhriz Mahathir is hopeful that the Kulim International Airport (KXP) would be operational in 2024.

He said the state government already have the master plan on the airport and is currently studying details on it.

"We hope to have it operational in 2024," he said at the Asian Strategy and Leadership Institute (ASLI) Centre Stage exclusive conversation to share his vision for Kedah towards the Shared Prosperity Vision 2030.

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The dialogue, co- organised by ASLI and Jeffrey Cheah Institute on Southeast Asia (JCI), is themed "Dynamic Economic Development and Shared Prosperity: The Kedah Way".

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Figure 2.2: Kulim International Airport will be Operational in 2024 (Bernama, 2020)

Kulim airport to be game changer

By Sharen Kaur - July 5, 2019 @ 6:41pm

The proposed Kulim International Airport or KXP for short, is one of the seven mega projects announced for Kedah. - NSTP file pic

KUALA LUMPUR: The proposed Kulim International Airport (KXP) in Kedah will be a game changer for Malaysia, said economic advisory firm TAPiO Management Advisory Sdn Bhd chairman Bernhard Schutte.

He said KXP could become the biggest logistics hub in Asean.

"When you have a logistics airport like this, you will have a lot of logistics companies coming in. It will create a wider supply chain, which is going to change the economics of Malaysia," he told the *New Straits Times*.

The KXP would complement Kedah's two other airports in Alor Star and Langkawi, as well as the Penang International Airport (PIA) in Bayan Lepas, said Schutte.

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He refuted claims that KXP would lead to PIA shutting down.

He added that KXP would function primarily as a cargo airport with warehouses, logistics and distribution centres while PIA was purely a destination airport.

Figure 2.3: Kulim Airport to be Game Changer (Kaur, 2019)

2.2 Global Air Traffic

According to the International Air Transport Association's forecasts, by 2037, global passenger traffic will have grown at a compound annual growth rate of 3.5 percent, resulting in a doubling of passenger numbers from today's levels to 8.2 billion. The Asia Pacific area is expected to be the largest generator of air traffic demand, accounting for more than half of all new passenger travel. A combination of ongoing strong economic growth, rising household incomes, and favourable population and demographic profiles are driving this eastward shift in aviation's centre of gravity (Ali et al., 2019).

The predicted traffic surge, if not adequately planned for, will not only put a burden on current infrastructure, but will also reduce the quality of passenger service. This global reorganisation of aviation traffic can only be sustained if infrastructure bottlenecks are better used and a shift from flight-centric, unimodal travel alternatives to passenger-centric, multimodal operations is made. This could entail creating an integrated air transportation system that is responsive to the changing mobility needs of tech-savvy commuters while also being resilient to operational fluctuation (Ali et al., 2019).

2.3 Simulation models

Around the world, simulation models have been widely utilised to forecast and analyse the influence of various policies on passenger movement in and around airport terminal buildings, allowing policymakers to make informed decisions. Simulation has been used in a number of research to better analyse passenger flow inside airport terminal buildings (Verma et al., 2020).

According to the Verma et al., Gatersleben and Van der Weij (1999) used simulation to understand the logistic bottlenecks in the passenger handling at the Amsterdam Airport Schiphol. (Curcio et al., 2007) used simulation to address the issue of passenger flow and security at the airport of Lamezio Terme in Italy. Diaz Esteban (2008) used discrete event-based simulation to model the check-in process at the Lisbon airport, from the time passengers enter the terminal until the time they pass through security checks (Verma et al., 2020).

They discovered that extending the check-in period prior to the corresponding flight can drastically reduce the average waiting time and queue length using various modelling studies. Guizzi et al. (2009) utilized discrete events simulation to analyze the passenger flow inside the Capodichino – Naples International Airport. They created a model using ArenaTM simulation software, which yields typical queue values and waiting times (Verma, A., Tahlyan, D., & Bhusari, S., 2020).

2.4 Waiting time in airport

The unnecessary waiting time before the security checkpoints at the airports is a well-known issue. According to the (Wang, M., 2017), Bureau of Transportation Statistics in 2015, more than 36,285,000 people flew out of Chicago O'Hare Airport. According to Dailymail, more than 400 travellers missed their flights due to the abnormally long queue on just one night. Security screening is widely acknowledged as playing a critical role in ensuring safety, particularly in preventing hijacking and explosions. However, passengers are subjected to unnecessary delays as a result of the mandatory safety screening, which wastes their time and increases the chance of missing their flights (Wang, M., 2017).

2.5 Check-in ticket and boarding pass services

Many airlines have implemented technology-based self-check-in services, and it is becoming increasingly important to understand the factors influencing airline passengers' attitudes toward this innovative form of check-in service, as well as their goals, particularly from the perspective of Asian passengers. The necessity for airlines to reduce operational costs encourages them to employ self-service technologies in passenger services and at check-in. The use of airport check-in kiosks and online check-in is gaining ground on the use of airline check-in desks (Castillo-Manzano et al., 2013).

Self-service technologies (SSTs) were introduced by many companies although some of the customer wants to use or can use new technologies. According to (Gelderman et al., 2011), At a European airport, survey data was collected from 525 passengers (40 percent response rate). When compared to check-in at the counter, users using the automated self-service kiosk (SST) appear to consider the departure hall to be substantially more crowded. Customers' decisions to use SSTs appear to be most influenced by alleged crowdedness (Gelderman et al., 2011). Based on the research, waiting time for the SST also higher as same level check-in at the traditional counter.

In Malaysia airport, company from Malaysia Airlines have 4 options for check-in and boarding pass allows which are mobile check-in, counter check-in, web check-in and self-service kiosk as shown in Figure 2.4 below. Malaysia Airlines Web check-in and boarding pass allows web check-in 24 hours before departure.

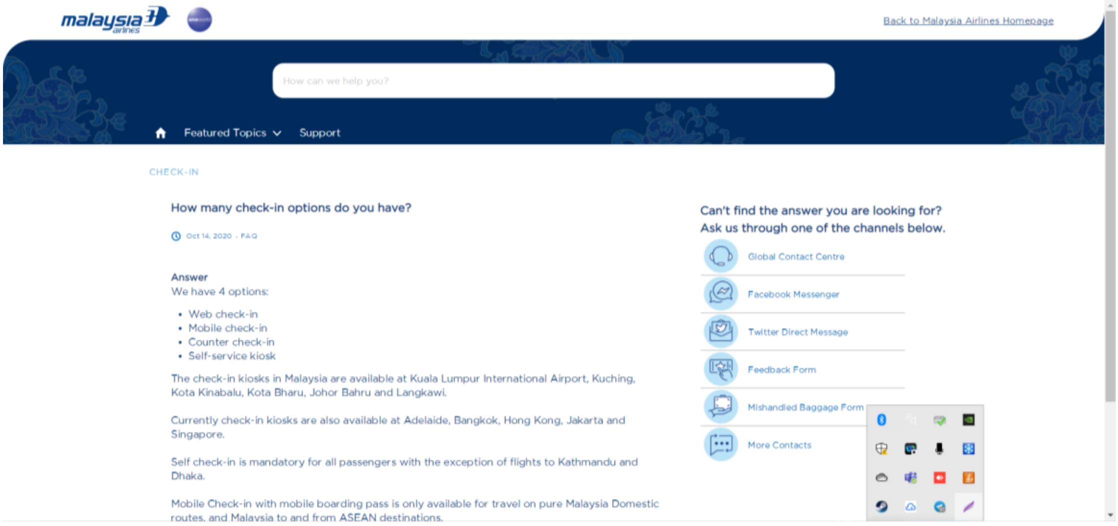


Figure 2.4: Check-in Options in Malaysia Airlines (Malaysia Airlines, 2020)

The process is the passenger will print the boarding pass and e-ticket before departure. The passengers using confirmation number and name to access the boarding pass ticket. These online Malaysia Airlines web check-in is the easiest and fastest way to check-in for your Malaysia Airlines flight, home or abroad.

The check-in time international suggestion to arrive at least 3 hours prior to departure. Passengers must be checked in at least 1 hour before their scheduled departure. Additionally, the recommend being at the gate and ready to board 45 minutes before their scheduled departure time. The Figure 2.5 shows the check-in times at international airport that have to arrive at least 3 hours before departure.

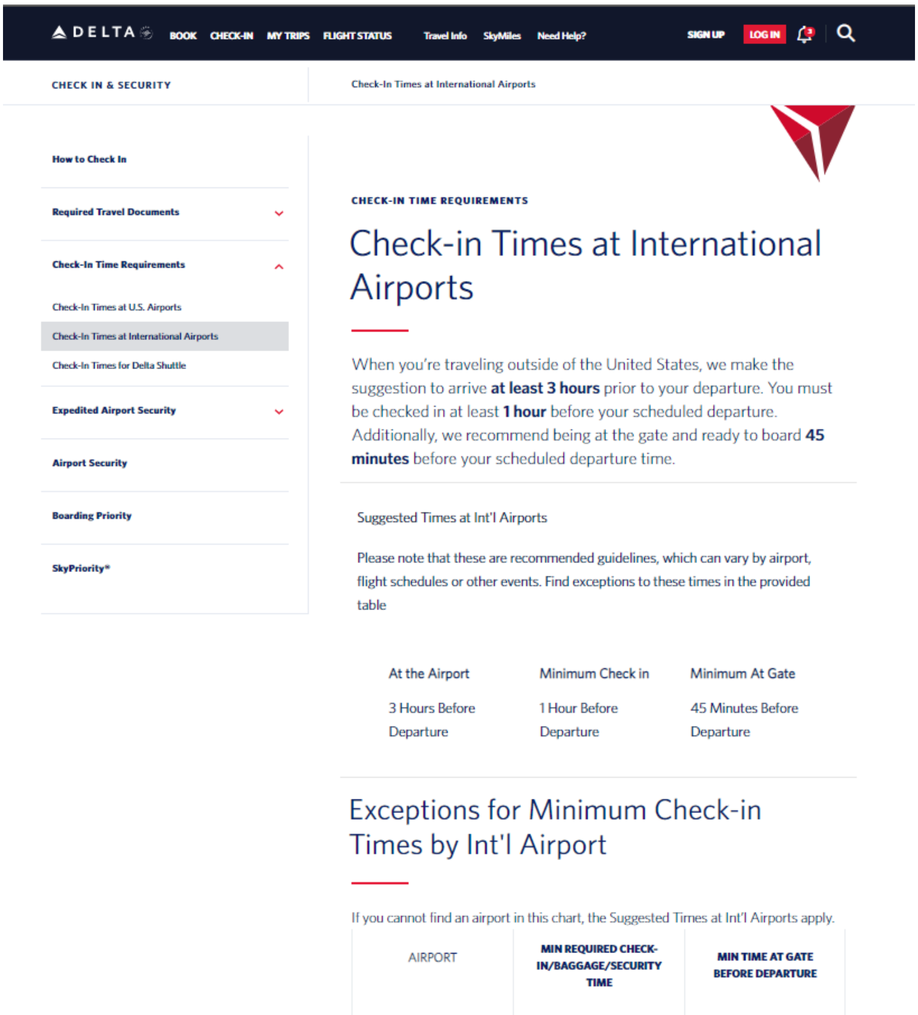


Figure 2.5: Check-in Times at International Airports (Delta, 2019)

2.6 Security control in airport

According to (Leone, K., & Das, S., 2010), The security screening system at airport checkpoints is a critical line of defence against the introduction of dangerous objects into the United States' air transportation system. According to the study, approximately 2 million commercial passengers are searched for weapons and dangerous objects before boarding a flight in the United States every day. During 2006, 13.7 million prohibited items at security checkpoints, of which 11.6 million were lighters and 1.6 million were knives were intercepted by Transportation Security Administration (TSA) security officers (TSOs). Though, these inspections have resulted in considerable operational costs and passenger delays.

2.7 Departure passport control

Queuing at passport checkpoints may become obsolete as part of plans for fully automated border checks. Because of the significant increase in the number of passengers around the world, the airport must be able to meet future border control needs with a fast automated biometric system. The challenges produced by this increase, such as congestion at electronic gates (e-gates) or delays in planned arrival schedules, are dealt with by automated border control (ABC) systems. According to the (Sanchez del Rio et al., 2016), different sense modality, such as face, fingerprint, or iris recognition, will be used in most of the ABC systems located at airports in the European/Schengen areas because facial recognition is the modality that passengers consider most suitable, it was decided to include this modality in all second-generation passports.

2.8 WITNESS simulation

WITNESS is a tool for simulating whole production or process runs over an extended period of time. This lets those who are planning a facility to see how the manufacturing lines might work in real life. This is a good way to predict and solve any problems and inefficiencies that may present in them if the production lines were built in the current configuration. WITNESS makes obvious any process bottlenecks, overly idle resources, storage areas that are too small or large and any potential issues with respect to labour attending to the processing of parts (Shinde, M. K., & Nimbalkar, 2017).

The WITNESS Simulation Software aids in the creation of a simulation model, which is nothing more than a dynamic representation of a portion of the real world, sufficient to ensure that visualisation created with this model is an adequate predictor of reality. WITNESS is a comprehensive discrete event and continuous process simulator. It is designed to model the dynamics of complex systems. It is a well-established simulation tool that is used by hundreds of organisations throughout the world for business process analysis and validation, as well as to support continuous process improvement initiatives (Shinde, M. K., & Nimbalkar, 2017).

CHAPTER 3 : METHODHOLOGY

In conjunction with the objective of the research, a framework has to be developed to model the flow of passenger for an international departure by using simulation. Thus, a flow chart generated is as shown in Figure 3.1 which consists of four phases. Every phase has a number of steps, and the details description will be explained in this chapter.

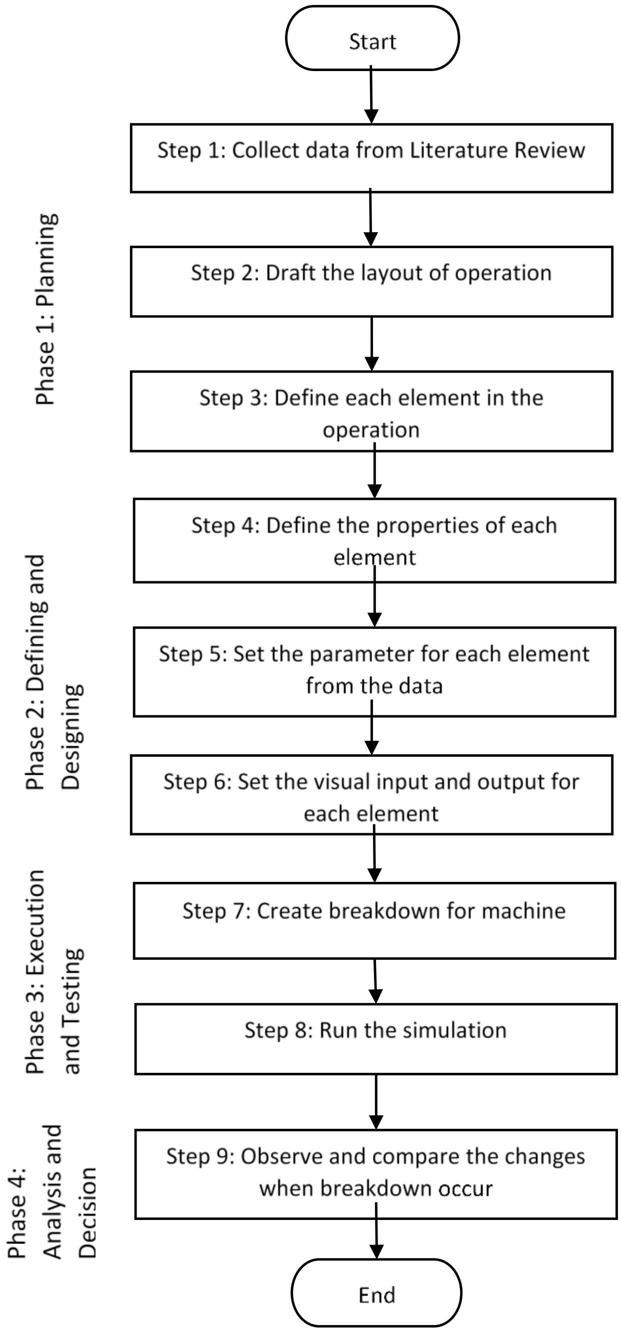


Figure 3.1: Simulation framework

3.1 Phase 1: Planning

3.1.1 Step 1: Collect data from Literature Review

KXP Airportcity Holdings Sdn. Bhd. has done their research before proposing international airport building. From their report on their research, it contained all the data of passenger flow from the start until the end. The data was collected from the research for the further study. Besides, the paper also contained the capacity of every department so that can create more specific as the result can either do some improvement or not. Moreover, the simulation needed to focus on one aircraft which needed a few of passenger. The Boeing 737-800 was chosen as the journal by (Antonio et al., 2017) has the data about the passenger in one aircraft. The paper focus on this Boeing 737-800 because Malaysia Airlines currently operates a large number of the aircraft which are mainly used on flight to regional Southeast Asian and domestic destinations.

3.1.2 Step 2: Draft the layout of operation

The flow chart of the process involved in passenger flow is shown in the Figure 3.2. The simulation will be carried out based on the process. From the basic flow, a few models were created as the process involved of manual and automatic processes which on the check-in and departure passport control process and other remain same. The passengers were waiting at departure hall until the check-in counter open. Then, they go through the boarding pass check by airport police and waiting for inspection at the security controls department. Passengers will be divided into two problem which are red and green as the red was brought danger item while green was cleaned. After that, the passengers will go through the sanitary inspection to make sure they are healthy before taking off the flight and scanned their passport at the departure passport control.

Lastly, the passenger will be waiting at boarding lounge before the boarding pass check open for the flight. Meanwhile, Figure 3.3 shows the layout of the basic model in the Witness simulation.

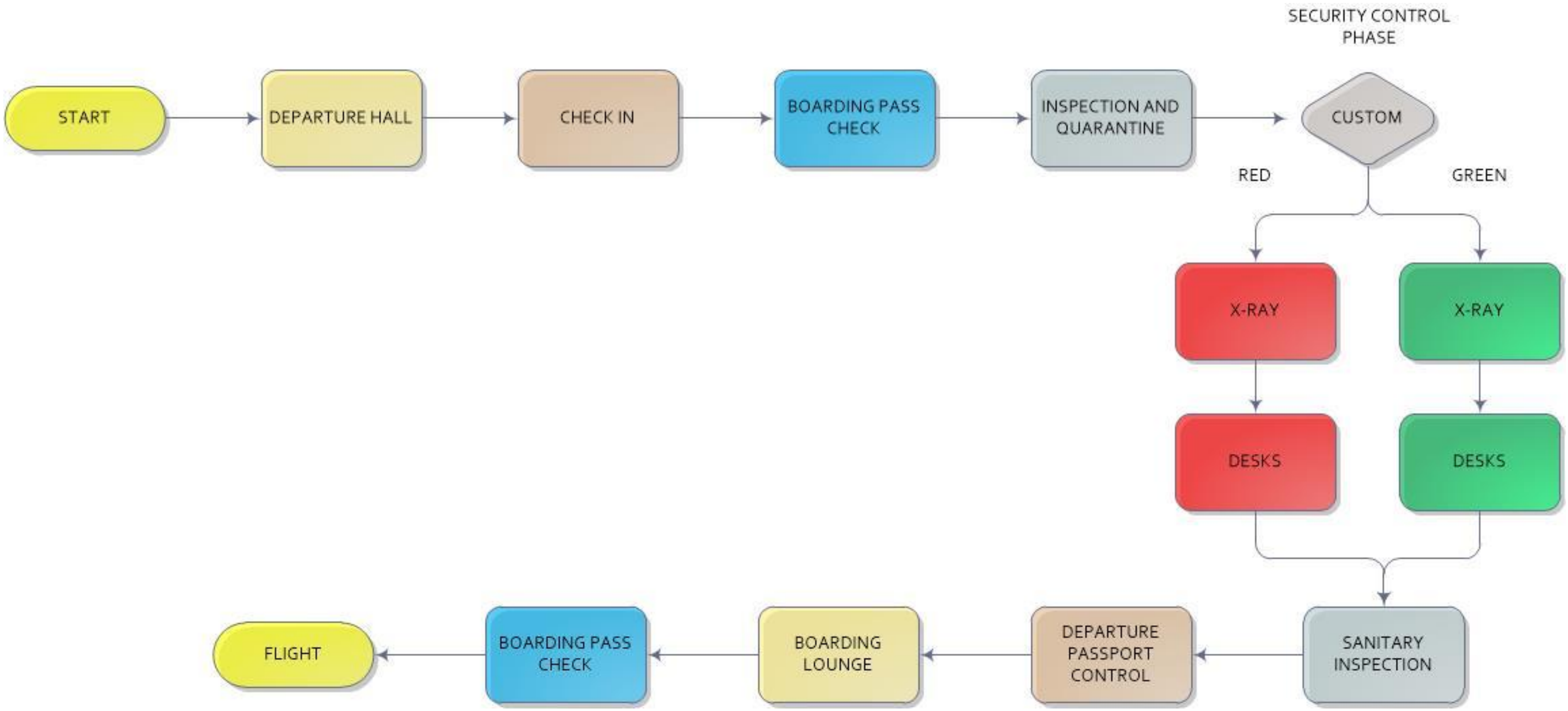


Figure 3.2: Basic Flow of Passenger in Airport

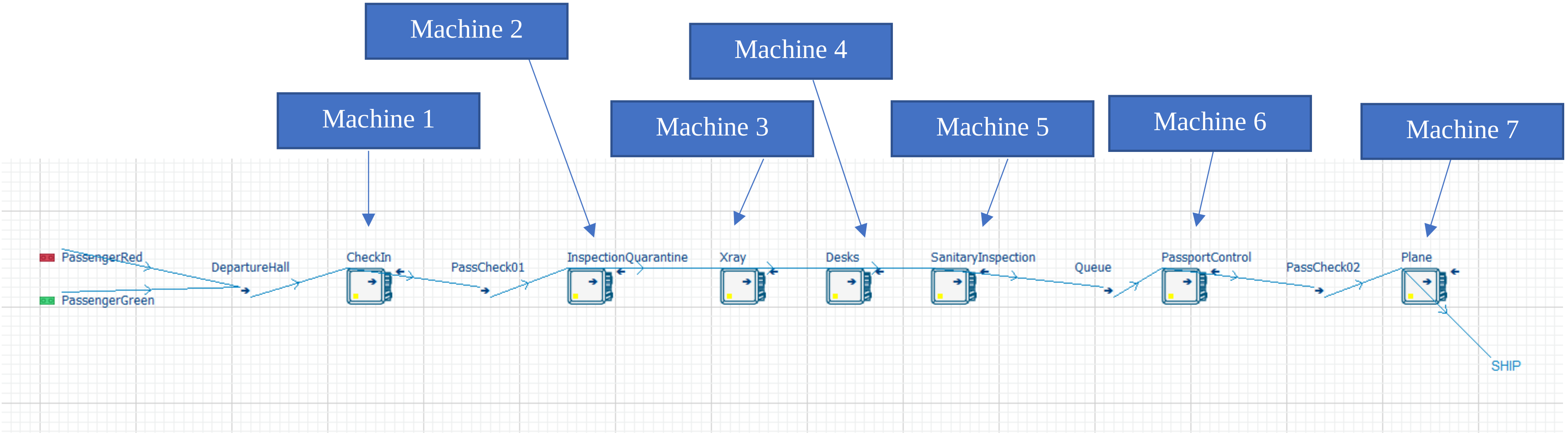


Figure 3.3: Layout of Basic Model in Witness Software

3.1.2.1 Process description

- Machine 1: Check-in counter

The passenger will check-in either they are use automatic kiosk or manual counter. From the data given, it has different time which manual will be late then automatic.

- Machine 2: Inspection Quarantine

The inspection quarantine will check the passenger either it was green or red passengers will go through it.

- Machine 3 and 4: X-ray and Desks

The X-ray machine and desks was checking the item that brought by passengers. If the passengers were red, it will take a long-time process than green passengers. The people who are red was brought the danger item which the custom has to throw it before taking flight.

- Machine 5: Sanitary Inspection

The sanitary inspection has a machine that check the temperature of the passenger before flight to make they are okay and health.

- Machine 6: Departure Passport Control

Departure passport control has two types which are using machine or manual counter that checked by custom before taking flight. This is to make sure the passenger details are okay before entering the other country.

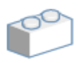
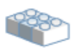
- Machine 7: Plane

The plane received all the input from the start of the process which is boarding time. The plane act as aeroplane will departure.

3.1.3 Step 3: Define each element in the operation

In the simulation of flow of passenger process, there were three main components involved which are parts, machines, and buffer. Table 3.1 show illustrated the elements and its characteristics.

Table 3.1: Type of element

Elements	Characteristics
 Part	Part represents passengers that input into all the process. In this simulation, the parts were passenger green and red that show different people brought different item into plane.
 Machine	The machines used in this simulation were Check-in counter, Inspection Quarantine, X-ray machine, Desk, Sanitary Inspection, Departure Passport Control and Plane.
 Buffers	Buffer is used as Departure Hall, which consumed the capacity of passenger, Boarding Pass Check and Queue.

3.2 Phase 2: Defining and Designing

3.2.1 Step 4: Define the properties of each element

Based on the flow chart created the flow of the simulation almost the same that fixed at the position layout whereby only the passenger will move to all the process. All