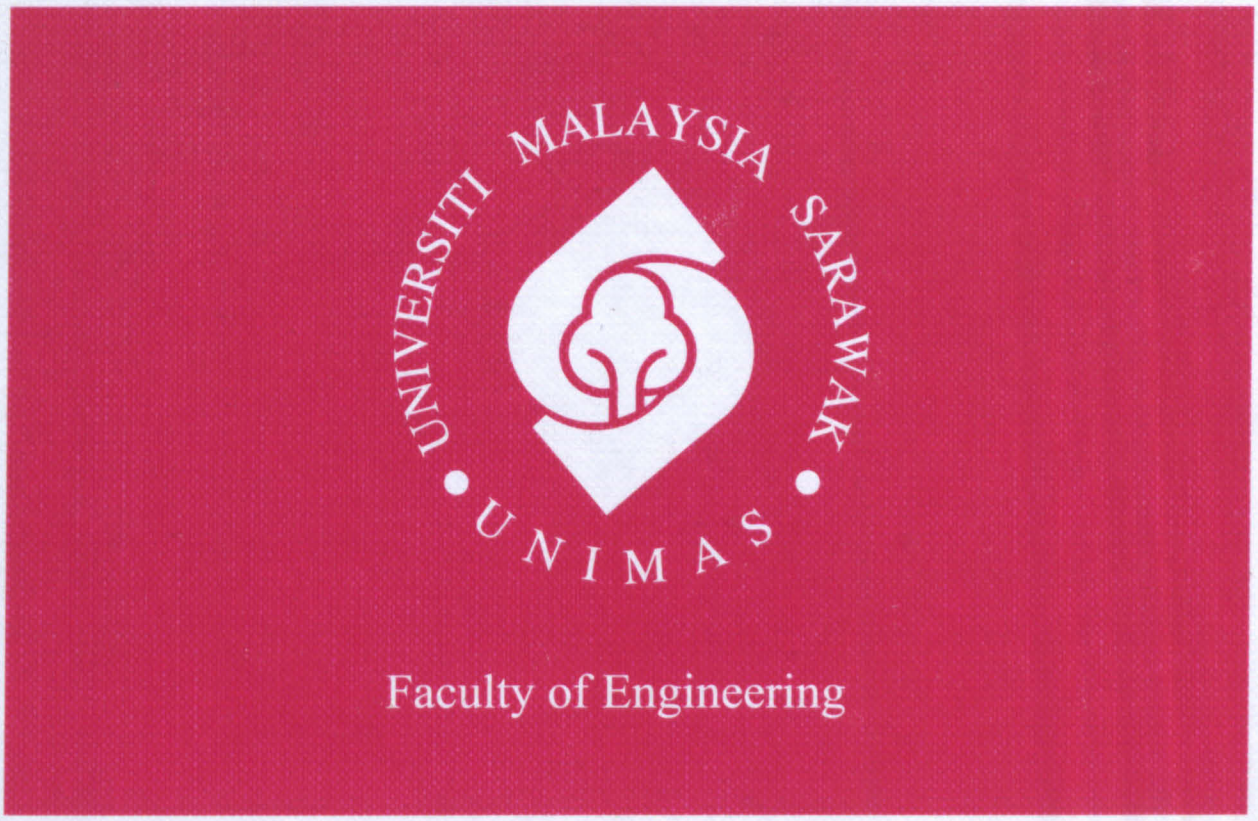


# MOBILE QUEUING SOLUTION

**Low Ying Yao**

**Bachelor of Engineering (Hons) in Electronics (Computer)**
**2019**

**UNIVERSITI MALAYSIA SARAWAK**

Grade: A

**Please tick (√)**
Final Year Project Report ☐
Masters ☐
PhD ☐

## DECLARATION OF ORIGINAL WORK

This declaration is made on the 15 day of June 2019.

**Student's Declaration**:
I, Low Ying Yao (52376), Department of Electrical and Electronic Engineering, Faculty of Engineering hereby declare that the work entitled Mobile Queuing Solution is my original work. I have not copied from any other students' work or from any other sources except where due reference or acknowledgement is made explicitly in the text, nor has any part been written for me by another person.

15th June 2019 Low Ying Yao (52376)

**Supervisor's Declaration:**
I, Dr. Shafrida Binti Sahrani @ Shahran hereby certifies that the work entitled Mobile Queuing Solution was prepared by the above named student, and was submitted to the "FACULTY" as a * partial/full fulfillment for the conferment of Bachelor Of Engineering with Honours in Electronics (Computer), and the aforementioned work, to the best of my knowledge, is the said student's work.

Received for examination by: Dr.Shafrida Binti Sahrani @ Shahran Date:15th June 2019

I declare that Project/Thesis is classified as (Please tick (√)):

☐ **CONFIDENTIAL** (Contains confidential information under the Official Secret Act 1972)*

☐ **RESTRICTED** (Contains restricted information as specified by the organisation where research was done)*

☑ **OPEN ACCESS**

**Validation of Project/Thesis**

I therefore duly affirmed with free consent and willingness declare that this said Project/Thesis shall be placed officially in the Centre for Academic Information Services with the abiding interest and rights as follows:

- This Project/Thesis is the sole legal property of Universiti Malaysia Sarawak (UNIMAS).
- The Centre for Academic Information Services has the lawful right to make copies for the purpose of academic and research only and not for other purpose.
- The Centre for Academic Information Services has the lawful right to digitalise the content for the Local Content Database.
- The Centre for Academic Information Services has the lawful right to make copies of the Project/Thesis for academic exchange between Higher Learning Institute.
- No dispute or any claim shall arise from the student itself neither third party on this Project/Thesis once it becomes the sole property of UNIMAS.
- This Project/Thesis or any material, data and information related to it shall not be distributed, published or disclosed to any party by the student except with UNIMAS permission.

Student signature _____ (15th June 2019)

Supervisor signature: _____ (15th June 2019)

Current Address:
No.15, Jalan Batu Kitang, Taman Kitang Height 93250 Kuching,Sarawak

Notes: * If the Project/Thesis is **CONFIDENTIAL** or **RESTRICTED**, please attach together as annexure a letter from the organisation with the period and reasons of confidentiality and restriction.

[The instrument is duly prepared by The Centre for Academic Information Services]

To my beloved family and friends.

# MOBILE QUEUING SOLUTION

LOW YING YAO

A final year project report submitted in partial fulfilment of
the requirement for the degree of
Bachelor of Engineering (Hons) in Electronics (Computer)

Faculty of Engineering
Universiti Malaysia Sarawak

2019

# ACKNOWLEDGEMENT

First and foremost, I would like to express my deepest appreciation to my supervisor, Dr. Shafrida binti Sahrani of Universiti Malaysia Sarawak from Electrical and Electronics Faculty of Engineering Department for her countless support and guidance throughout the progress and development of my final year project. Her great desire of motivating me has made a big impact to my final year project. Without her inspirations and supervision, this thesis could not able to complete in time. Furthermore, I would like to express my gratitude to my beloved family members for their endless love, encouragement and support throughout the completion of my four-year undergraduate studies. Without the motivation from them, I could not able to go through all the downs and falls in finishing my degree life. In addition, special thanks to my friends especially my course mates for their helps, inspirations and also advices during the four year of studies. Thank you too for lending hands whenever I needed their help during this project. Last but not least, I would like to appreciate all those who helped me directly and indirectly throughout the completion of this final year project report. I sincerely wish everyone to be blessed always and have the best of everything now and then.

# ABSTRACT

Queuing in a line is a normal phenomenon in today's society. Everyone need to experience on queuing to wait for services from same organization. This had leads to the issue of people losing patient while waiting for too long. There are two types of Queue Management System (QMS) exists in current market which is hardware based and software based. Hardware based QMS is the use of TV screen and ticket generator such as TotalQueue and QSIGNAGE. Mobile-Q and Queuepad is under software based QMS. Most of the QMS system provide only current queuing number. From the research, Mobile Queuing Solution is developed by using Ionic Framework to allow user acknowledge on current serving number and estimated waiting time. The waiting rules used in the proposed design is First Come First Serve (FCFS). The Mobile Queuing Solution had integrated with the latest technology, Quick Response (QR) code scanner to keep track of real time queuing number. The users will get the current queuing number once the QR code is scanned by transmitting the QR code information to the server and send back to the Android platform. The database software tools are My Structured Query Language (MySQL) and PHP Hypertext Pre-processor (PHP). MySQL is used to store the data received while PHP functions as the brain of database. The proposed mobile application also allow user to view current situation of service organization. This feature allows busy people to keep track of the current situation and organize their time to present at the service center on time. Mobile Queuing Solution is designed with wireless connections thus providing limitless coverage range for the users to access the queue management system. The proposed design ensure the managers and employers to monitor and control the level of service, generate performance statistics and reduce the operation cost.

# ABSTRAK

Pada era globalisasi ini, beratur dalam barisan merupakan fenomena yang biasa. Setiap individu perlu beratur dan menunggu giliran masing-masing bagi mendapatkan servis daripada organisasi yang sama. Hal ini secara tidak langsung menjurus kepada isu kehilangan kesabaran manusia apabila perlu menunngu gilirannya dalam jangka masa yang terlalu panjang. Terdapat dua jenis Sistem Pengurusan Antrian (QMS) yang wujud dalam pasaran semasa iaitu berasaskan perkakasan dan berasaskan perisian. QMS berasaskan perkakasan adalah penggunaan skrin TV dan penjana tiket seperti TotalQueue dan QSIGNAGE. Mobile-Q dan Queuepad adalah contoh QMS berasaskan perisian. Kebanyakan sistem QMS memerlukan sambungan internet kerana mod luar talian tidak boleh menyegerakkan dengan maklumat skrin paparan dan tidak memberikan maklumat masa menunggu kepada pengguna. Daripada penyelidikan, Mobile Queuing Solution dicipta dengan Ionic Framework bagi memberitahu pengguna peri nombor giliran dalam keadaan semasa dan jangkaan masa menunggu. Rekaan ini mengaplikasikan konsep pertama datang pertama berkhidmat asas. Mobile Queuing Solution datang dengan teknologi tercanggih iaitu Pengimbas kod tindak balas pantas (QR) bagi mengenalpasti masa semasa apabila menunggu giliran dalam sesuatu pusat servis. Pengguna akan mendapat nombor giliran sebaik sahaja mengimbas kod QR dengan menyampaikan informasi QR kepada pelayan dan dihantar balik ke platform. Pangkalan data perisian komputer yang digunakan ialah My Structured Query Language (MySQL) PHP Hypertext Pre-processor (PHP). MySQL digunakan bagi menyimpan data yang diterima sementara PHP sebagai pengawal pangkalan data. Projek yang dicadangkan ini membenarkan pengguna mengetahui situasi semasa pusat servis. Aplikasi mudah alih ini memastikan individu yang sibuk mengetahui situasi semasa dan menggunakan masa secara optimum di pusat servis tanpa halangan. Mobile Queuing Solution direka dalam bentuk tanpa wayar agar mempermudahkan pengguna dalam pencapaian sistem pengurusan menunggu. Alat rekaan ini memudahkan pengurus dan usahawan untuk mengawal tahap servis, menghasilkan prestasi statistik dan mengurangkan kos operasi.

# TABLE OF CONTENTS

| | | Page |
|---|---|---|
| Acknowledgement | | ii |
| Abstract | | iii |
| Abstrak | | iv |
| Table of Contents | | v |
| List of Tables | | viii |
| List of Figures | | ix |
| List of Abbreviations | | xii |
| **Chapter 1** | **INTRODUCTION** | |
| | 1.1 Project Overview | 1 |
| | 1.2 Problem statement | 2 |
| | 1.3 Project Aim | 2 |
| | 1.4 Project Objectives | 3 |
| | 1.5 Expected Outcome | 3 |
| | 1.6 Scope of Project | 3 |
| | 1.7 Project Outline | 4 |
| **Chapter 2** | **LITERATURE REVIEW** | |
| | 2.1 Queuing Theory | 5 |
| | 2.2 Existing Queuing System in Current Market | 8 |
| | 2.2.1 Mobile-Q | 8 |
| | 2.2.2 Queuepad | 9 |
| | 2.2.3 QSIGNAGE | 10 |
| | 2.2.4 Total Queue | 11 |
| | 2.2.5 Summary of Queue Management System Products | 11 |

2.3 Mobile Application Development 13
2.4 Database 15
2.4.1 My Structured Query Language (MySQL) 15
2.4.2 PHP Hypertext Pre-processor (PHP) 15
2.4.3 Ionic Framework 15
2.4.4 Android Studio 16
2.4.5 jQuery AJAX 16

**Chapter 3 METHODOLOGY**

3.1 Mobile Queuing Solution Development 17
3.2 Setup Database using Exabytes Web Hosting 19
3.3 Creation of Mobile Application 21
3.3.1 Mobile Interface Creation 23
3.3.2 Menu Toggle in Mobile Application 25
3.3.3 Importing pages and modules 26
3.3.4 Login Page 26
3.3.5 Register Page 28
3.3.6 Main Screen Page 29
3.3.7 Quick Response(QR) Page 30
(a) Scanner Page in mobile applications 30
(b) E-ticket Page in website 31
3.3.8 Waiting List Page 33
(a) Waiting List Page in mobile applications 33
(b) Information Page in website 34
3.3.9 Things To Do Page 36
(a) Clinic 37
(b) Office 38
(c) Bank 39
(d) Post 39
(e) Map 41
3.3.10 Live View Page 41
(a) Live Streaming 42
(b) Location Tracking 42
3.3.11 Urgent Calls Page 43
3.3.12 News & Stories Page 44
3.3.13 User Feedback 44

| | | | |
|---|---|---|---|
| | 3.4 | Admin Website Control | 45 |
| | 3.5 | User Website View and Scan | 47 |
| | 3.6 | Publish Android Application | 47 |
| **Chapter 4** | **RESULTS AND DISCUSSION** | | |
| | 4.1 | Overview | 49 |
| | 4.2 | Log In Screen | 49 |
| | 4.3 | Register Screen | 50 |
| | 4.4 | Main Screen | 51 |
| | 4.5 | Quick Response (QR) Screen | 51 |
| | | 4.5.1 Scanner Page in mobile applications | 51 |
| | | 4.5.2 E-ticket Page in website | 52 |
| | 4.6 | Waiting List Screen | 53 |
| | | 4.6.1 Waiting List Page in mobile applications | 53 |
| | | 4.6.2 Information Page in website | 54 |
| | 4.7 | Things To Do Screen | 54 |
| | | 4.7.1 Clinic Screen | 55 |
| | | 4.7.2 Office Screen | 56 |
| | | 4.7.3 Bank Screen | 57 |
| | | 4.7.4 Post Office Screen | 58 |
| | | 4.7.5 Map Screen | 59 |
| | 4.8 | Live View Screen | 59 |
| | 4.9 | Urgent Calls Screen | 60 |
| | 4.10 | News & Stories Screen | 61 |
| | 4.11 | Menu Toggle | 61 |
| | | 4.11.1 User Feedback | 62 |
| | | 4.11.2 About Q-Soul | 63 |
| | 4.12 | Admin Website Control | 64 |
| | 4.13 | User Website View and Scan | 65 |
| | 4.14 | Android Package Kit (APK) file Installation | 65 |
| **Chapter 5** | **CONCLUSIONS AND RECOMMENDATIONS** | | |
| | 5.1 | Conclusion | 66 |
| | 5.2 | Recommendation | 67 |
| **REFERENCES** | | | 68 |

# LIST OF TABLES


| Table | | Page |
|---|---|---|
| 2.1 | Summary of Queue Management System Products | 12 |

# LIST OF FIGURES


| Figure | | Page |
|---|---|---|
| 2.1 | Mobile Applications of Mobile-Q | 8 |
| 2.2 | Mobile applications of Queuepad | 9 |
| 2.3 | Hardware diagram of QSIGNAGE | 10 |
| 2.4 | Total Queue's Customer Queue Management | 11 |
| 2.5 | Mobile application development procedures | 13 |
| 2.6 | The working of frontend, backend and database | 14 |
| 3.1 | Mobile Queuing Solution Development Flowchart | 17 |
| 3.2 | Ionic Framework Installation procedure | 18 |
| 3.3 | Exabytes Web Hosting | 20 |
| 3.4 | Creating database in PhpMyAdmin | 21 |
| 3.5 | Setup database information | 21 |
| 3.6 | Command Prompt in Windows | 21 |
| 3.7 | Q-Soul folder shown in Visual Studio Code | 22 |
| 3.8 | HTML, SCSS and TS scripts in a page | 23 |
| 3.9 | Ionic serve in local host | 23 |
| 3.10 | Scripts of root page in Mobile Queuing Solution | 24 |
| 3.11 | Scripts of menu toggle in Mobile Queuing Solution | 25 |
| 3.12 | Import pages and modules | 26 |
| 3.13 | Login page coding | 27 |
| 3.14 | Register Page | 28 |

| | | |
|---|---|---|
| 3.15 | Main Screen Page | 29 |
| 3.16 | QR Scanner Page in mobile application | 30 |
| 3.17 | E-ticket page | 32 |
| 3.18 | Waiting List Page in mobile application | 34 |
| 3.19 | Information page | 36 |
| 3.20 | Things To Do | 37 |
| 3.21 | Clinic Page coding | 38 |
| 3.22 | Office Page coding | 39 |
| 3.23 | Bank Page coding | 39 |
| 3.24 | Post office Page coding | 40 |
| 3.25 | Things To Do Page | 41 |
| 3.26 | Live View Page | 41 |
| 3.27 | Live Streaming | 42 |
| 3.28 | Location tracking | 43 |
| 3.29 | Urgent Call Page | 43 |
| 3.30 | News & Stories Page | 44 |
| 3.31 | User Feedback coding | 45 |
| 3.32 | Admin Website Control | 46 |
| 3.33 | User website view and scan homepage | 47 |
| 3.34 | Release keystore for Update Purpose | 48 |
| 4.1 | Log In Screen | 50 |
| 4.2 | Register Screen | 50 |
| 4.3 | Main Screen | 51 |
| 4.4 | QR Scanner Screen | 52 |
| 4.5 | E-ticket Page in website | 53 |
| 4.6 | Waiting List Screen | 54 |

| | | |
|---|---|---|
| 4.7 | Information Page in website | 54 |
| 4.8 | Things To Do Screen | 55 |
| 4.9 | Clinic Screen | 56 |
| 4.10 | Office screen | 56 |
| 4.11 | Bank Screen | 57 |
| 4.12 | Post Office Screen | 58 |
| 4.13 | Map Screen | 59 |
| 4.14 | Live View Screen | 60 |
| 4.15 | Urgent Calls Screen | 60 |
| 4.16 | News and Stories Screen | 61 |
| 4.17 | Menu Toggle | 62 |
| 4.18 | User Feedback | 63 |
| 4.19 | About Q-Soul | 64 |
| 4.20 | Admin Website Control | 64 |
| 4.21 | User website home page | 65 |
| 4.22 | Android Package Kit (APK) file installed | 65 |

# LIST OF ABBREVIATIONS

| | | |
|---|---|---|
| APK | - | Android Package Kit |
| AQT | - | Automated queuing technology |
| AWT | - | Average Waiting Time |
| CSS | - | Cascading Style Sheet |
| FCFS | - | First Come First Serve |
| GSM | - | Global Systems for Mobile Communications |
| HTML | - | Hyper Text Markup Language |
| IDE | - | Integrated Development Environment |
| JDK | - | Java Development Kit |
| JSON | - | JavaScript Object Notation |
| LCFS | - | Last Come First Serve |
| MySQL | - | My Structured Query Language |
| PHP | - | Hypertext Pre-processor |
| QR | - | Quick Response |
| RSS | - | Random Selection for Service |
| SCSS | - | Sassy Cascading Style Sheet |
| SDK | - | Software Development Kit |
| SMS | - | Short Message Service |
| SQL | - | Structured Query Language |
| TS | - | Type Script |
| UI | - | User Interface |
| URL | - | Universal Resource Locator |
| XML | - | eXtensible Markup Language |

# CHAPTER 1

# INTRODUCTION

## 1.1 Project Overview

In many services areas such as hospitals, airports and post office, patients or customers are required to wait for their turn if there is a lot other customers waiting at the same service center. The formation of long queue might due to the limited spaces at the service center, or insufficient of workers to provide services. Most of the service centers would like to reduce the long queue as short as possible so that their working performance is not influenced. There are several queuing system had been developed to solve the queuing problems. Some of the system are in hardware based, software based or both integrated. Most of the queuing system aims to reduce waiting time by allowing customers to make appointment before they receive their services at the service center.

In this research project, a queuing management system by using Android based mobile application is developed. The project aims to minimize the waiting period in lines, reduce the walkaway customers, and able to access the demand service without staying only at one place. The mobile applications consists of six features such as Quick Response (QR) Code Scanner, Waiting Lists, Things To Do, Live View, Urgent Calls and News & Stories. The QR Code Scanner is used to get the number of queue before the clients are being served. Waiting Lists feature helps the customers to acknowledge the current number being served, and the approximate waiting time. In addition, Things To Do feature allow users to choose the service center required and acknowledge with the operating hours. Besides, users can check with the important documents that need to bring along before they go to the service center. Furthermore, the Live View feature will show the real time location of the route to the required service center to let the user know current situation of the traffic. If the desired route is busy, the user can choose to use alternative way to avoid being jammed in the traffic. Besides that, this feature is not limited to traffic only but also the live view of the current status of the service center

selected. The Urgent Calls feature shows all the emergency contact so that user can contact them during emergency. Lastly, News & Stories feature will show the latest news of the service center by accessing the website of the service center.

In short, a real time Queuing Solution mobile application is established which allow users to keep themselves alert of their own turns. For testing and research purpose, this application is currently focusing University of Malaysia Sarawak (UNIMAS) and it can be broaden to other facilities.

## 1.2 Problem statement

In today's society, everyone need to experience on queuing or waiting in a line every day. This is due to some people require a service from the organization but at the same time, there is a lot people requiring the same service, thus, they need to wait for their turns according to the queue management system at the organization. The awareness of time making people getting nervous of waiting [1]. Thus, the queuing system had developed in worldwide to help minimizing the occurrence of this problem. Most of the systems aim to reduce waiting time or let community know the period of waiting. For instance, Mobile-Q, Queuepad, Qsignage and TotalQueue are popular in Dubai, Philippines and Malaysia respectively, but, these applications are restricted at specific area only.

A queuing management application with multiple choices are needed in giving a more convenient and effective life to the society. The queuing system inclusive of control and manage the waiting line between walk in clients and mobile application users, a notification service which alert the client on their turns, making appointments according to the schedule available, as well as the helpful guidance that display the period of waiting for next customer on a display screen to get them ready are important to enhance the queue management system. Furthermore, the system has to be easy to use and maintain for admin and also the clients.

## 1.3 Project Aim

The aims of this project is to monitor the real time queuing number, reduce the walkaway customers, and able to access the demand service without staying only at one

place. Target users are those workers or staffs who has limited time to settle their personal issues during office hours.

## 1.4 Project Objectives

The objectives of this project are:

1. To investigate the compatibility of Android based application with Ionic Framework for improving efficiency of queuing system.
2. To implement My Structured Query Language (MySQL) database and PHP Hypertext Pre-processor (PHP) into Mobile Queuing Solution for retrieve data from server database.
3. To develop Android based application with Quick Response (QR) Code in Mobile Queuing Solution.

## 1.5 Expected Outcome

The expected outcomes of this project are:

i. Research on Ionic Frameworks to build a mobile application.

ii. Queuing Solution Mobile Application developed by using Ionic Framework integrate with Quick Response (QR) scan code.

iii. Implementation of My Structured Query Language (MySQL) on Queuing Solution Mobile Application to retrieve and store database from microcontroller hardware.

## 1.6 Scope of Project

This project is using Ionic Framework as a platform to develop mobile application of Queuing Solution. The proposed application features include Quick Response (QR) code scanner. An online database is created using My Structured Query Language (MySQL) to receive and save data such as information of QR code scanner which generate the number of queue.

## 1.7 Project Outline

Chapter 1 briefly introduce the basic ideas of mobile queuing management system. The Mobile Queuing Solution is designed in Android platform by using Ionic Framework. This chapter explains about the overview of the project, problem statements, project's aims and objectives, expected outcomes, the scope of the projects as well as the outlines of the project.

Chapter 2 is literature review that study on the queuing management system and the technologies involved. This chapter will briefly explain the existing products in current market. The comparison is discussed among the existing products to analyse the advantages and limitations of the products.

Chapter 3 discuss the methods, flows and process to complete the project. The flowcharts of the working project are the summary for the execution of the overall project flow. The procedures of the project will be discussed in this chapter.

Chapter 4 display the results of this project. This chapter will discuss about the obstacles faced during this project and the method to solve the problems.

Chapter 5 is the last chapter that will conclude a summary of the whole project and were proposed to improve the studies in the future. This chapter will include the recommendation for future purpose, conclude this project and prove the objectives of this project are achieved.

# CHAPTER 2

# LITERATURE REVIEW

## 2.1 Queuing Theory

Fraser (1981) claims that queuing theory is the knowledge of dealing with a flexible request from a performance of one's duty and it happens during the provision made is unable to satisfy the request from the client [2]. Queuing has become a normal phenomenon in today's society. It can often happen in three major fields which is transportation movement, arrangement in clinics and provision of service such as banks, post offices and supermarkets [3]. However, in the modern society now, people are catching up with the time and hence, most of them had lost the patience to long line. According to Xiaosong (2017), if the counter available is narrow, the time of awaiting will increase and this might lead to frustration of clients, then the chance of dropping clients also increases. On the other hand, the more the opponent giving available counter, the shorter the time for clients to wait for the long line, but this will lead to slothful clients and then causing the companies' expenses increased [4].

In 1950s, there occur an issue which the residents in Manhattan protested the extremely long queue at the elevator of a huge office building every day in the morning when citizens reached, lunch break, and the time to leave the office in night. The idea of one of the employee in the office which stated citizens are perhaps just uninterested during waiting at the elevator is accepted. Then, the building executive had decided to erect floor-to-ceiling mirrors close to the elevators so that the citizens could look into the mirror during the waiting time. This had successfully decrease the grievances to nearly nil [5].

John, James, Gross, Carl (2018) claimed that the features of waiting scheme is important to deduce the occurrence of long queue issue [6]. The reaching appearance of clients is one of the feature to form a queuing system. The time of clients reaching the

destination, the size of the arriving clients and the patience of the clients are discussed in the study. A stationary reaching appearance will not vary with interval time while a non-stationary reaching appearance is autonomous from period. Furthermore, there are three types of anxious clients which is balky, renege and jockey customers [6]. The balky customers refer to the clients might determine to wait despite the length of the queue is long. The clients queue up and wait for their turn but end up with leaving as they are impatient to wait for it anymore is the renege type of anxious clients. Lastly, the jockey clients prefers to shift to the shorter lanes during queuing.

The performance of one's duty is critical in this discussion. It is also distributed to solo or group which means a server assisted a client at a time so that the client is served on the spot or the server assisted a bunch of clients at a time, but the clients need to queue up according specific order respectively. In this case, the choice of choosing the number of servers to provide service to the clients is essential because the more the server, the shorter the queue. However, this had increased the burden of the company to hire more worker to provide the services to customers or vice versa.

Moreover, the feature also involved the waiting rules which are first come, first served (FCFS), last come, first served (LCFS), random selection for service (RSS) and the urgency structure [6]. FCFS refers to the rules of no seat reservations for anyone. For instance, the earlier the passengers check in to the flight, the earlier they board the aircraft to choose a seat. On the other hand, Professor Lars Peter Osterdal from University of Southern Denmark claimed that FCFS waiting rules had encounter another problem which the customers tend to arrive too early [7]. They had did a research by telling the people in long queue that the people at the back will be serve first, the average waiting time was diminished. All of the rules are actually depending on the company itself to arrange for taking highest advantages. The urgency structure had categorized to two categories which is preemptive and no preemptive respectively. For the former category, the clients with primacy is always given service first despite of the others are receiving the service or not. The latter category is giving the primacy client to queue up at the front of the line, but they have to wait until the client currently in service to completely treat then only reach their turns.

Hui and Tse (1996) found that there are two major factors which leads to the appraisal of performance that is the period of waiting to be served and the purpose of waiting respectively [8]. Waiting for a short period making the clients have no

complaints on everything. In contrast, when the waiting duration is long, the clients will start to give an appraisal on the service according to the period of waiting, the emotion during queuing and the tolerability to the queue. These will directly affect the appraisal towards the service. For example, the declaration that telling customers they are in which position is better than telling them the waiting time to reach their turn in the queue.

Kulbyte (2018) performed a study on queuing coping technique which distributed to five sections that is minimize the period of giving reply, be familiar with clients' data, primacy clients are treated first, the correct server to provide services, and assist clients to resolve their question themselves[9]. MacDonald (2018) conducted a study about 90% of corporations out of 1000 corporations are not giving a response to let the clients know that they had received their email [10]. Initially, giving a reply at the moment received the re quest from clients are crucial to convince them to be in the waiting lists. Second, the server had to be familiar with clients' data as sometimes the procedure to solve the tasks is complex, when all the data of clients can be found within a short period, it will certainly bring to the ease of work processing. Next, classified the pending requests to emergency and non-emergency cases so that the server knows which requests need to be settle down first. Afterwards, note that not all the server understands all the working procedures for every task, thus, the clients should always go to the correct server by specifying what they need to solve before they meet the assistant team. The assistance of server to let clients solve their own problems by providing a self-service policy is also the way to reduce the queue from becoming longer.

Kumar Brahma (2013) stated that the clinics is a place where encounter with the queueing problem as they are huge in capacity of works every day [11]. The old ways of disrupting the patients from only waiting such as provide a coffee house, television or resting areas is now restricted to satisfy the large number of visitors in clinics per day. Automated queuing technology (AQT) is utilized to resolve the huge delay in waiting for treatment in clinics by pursuing the data of patients in the system. The system also good in providing a single receipt which allow the patient in urgency to be treated first and approximate the time for the next patient's turn. This system had leads to effective and convenient situation to the patients waiting in the clinics.

## 2.2 Existing Queuing System in Current Market

### 2.2.1 Mobile-Q

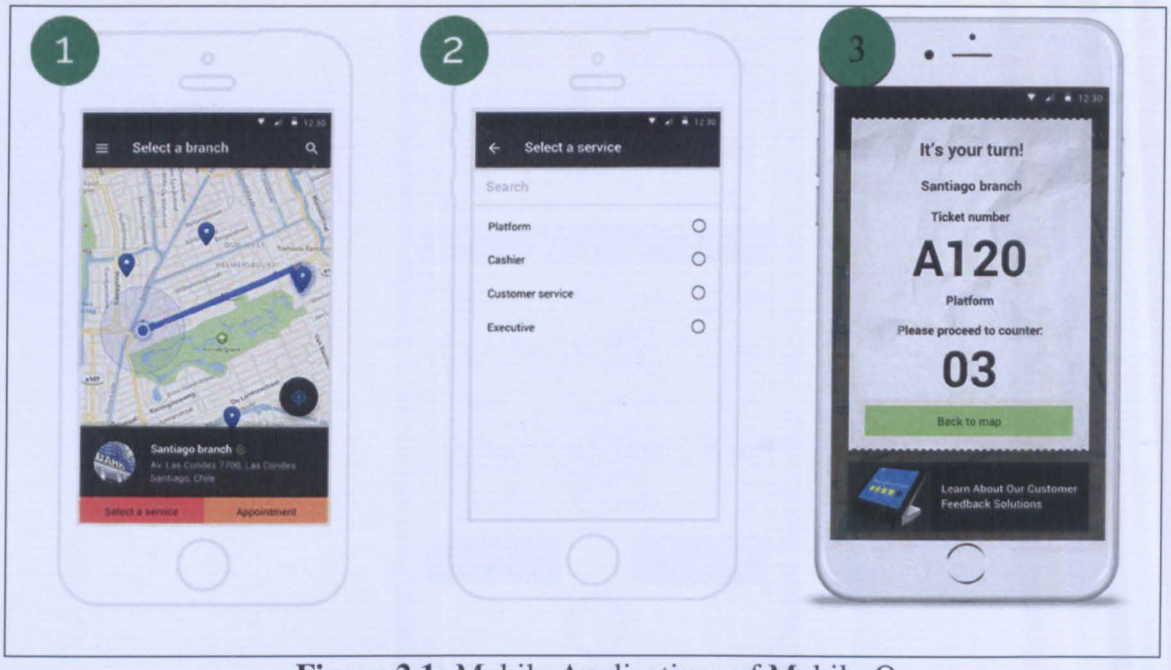


**Figure 2.1:** Mobile Applications of Mobile-Q

Wavetec from Dubai had propelled a mobile queuing platform named "Mobile-Q" in 2015. Mobile-Q allows clients to line up in fictitious mode [12]. Figure 2.1 shows the mobile applications of Mobile-Q. It is Android and iOS-based application which aims to reduce the waiting time by only few clicks on hand. Mobile-Q invented to manage customer traffic, send targeted posts and deals to client, gather client comment about provision experiences as well as offer actual-time queuing data to clients. The associations provided in Mobile-Q are clinics, banks, cafeterias and Movie Theater to systematize data more effectively. There are three steps to book an appointment which is select the nearest branch according to the real-time location provided, enter the service required and check present status consequently. Nevertheless, smartphone and mobile data is required to access this application.