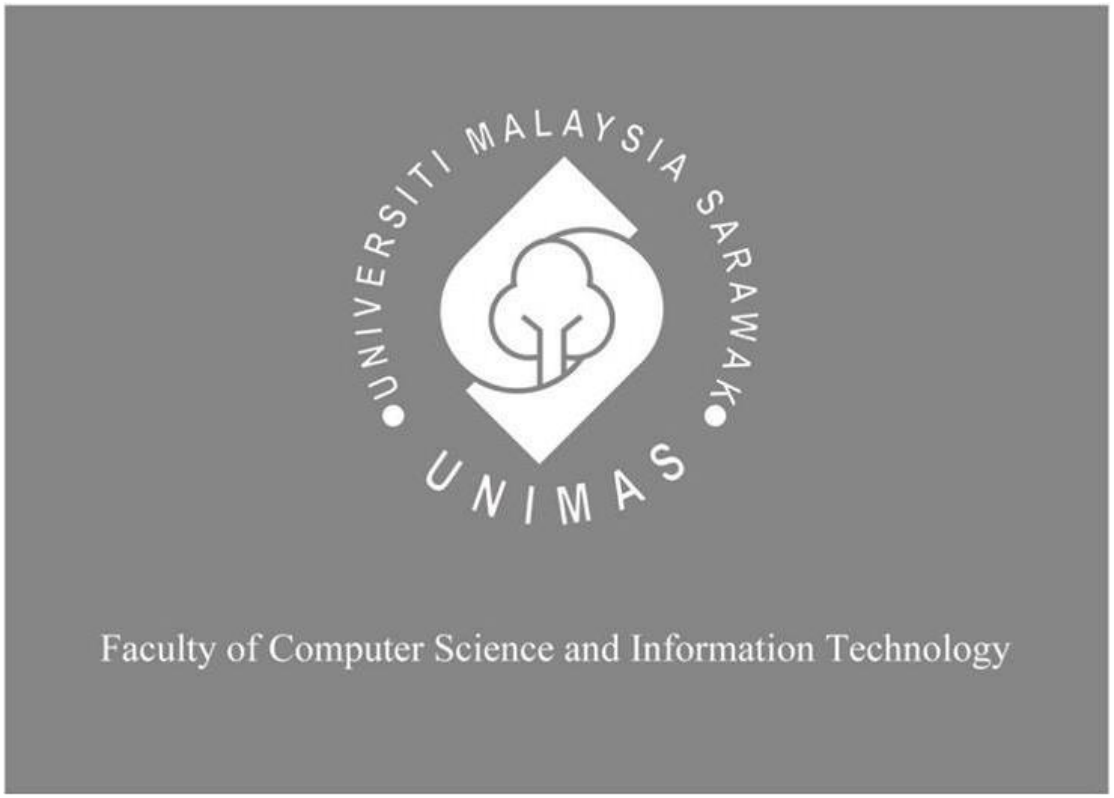

IMAGE-BASED PARKING SECURITY SYSTEM

VINCENT SAJEM

Bachelor of Computer Science with Honours

(Software Engineering)

2020

IMAGE-BASED PARKING SECURITY SYSTEM

VINCENT SAJEM

This project is submitted in partial fulfilment of the

Requirements for the degree of

Bachelor of Computer Science with Honours

Faculty of Computer Science and Information Technology

UNIVERSITI MALAYSIA SARAWAK

2020

SISTEM KESELAMATAN TEMPAT LETAK KENDERAAN BERASASKAN IMEJ

VINCENT SAJEM

Projek ini merupakan salah satu keperluan untuk

Ijazah Sarjana Muda Sains Komputer dengan Kepujian

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DECLARATION

I hereby declare that the work entitled Image-based Parking Security System submitted to the Faculty of Computer Science and Information Technology (FCSIT) is my original work under the guidance of my supervisor, Dr. Adnan Shahid Khan.

Vincent Sajem 31/7/2020

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ABSTRACT

This project proposes a smart solution or protocol that is generic to overcome vehicle theft issues, which can be implemented at any parking areas especially that are located outdoors. This proposed solution is known as Image-based Parking Security System. The problem of vehicle theft can occur at any location, but this project specifically focuses on vehicles that are parked in outdoor parking spaces. Vehicle theft in such location occurs as a result of a manually operated monitoring system, which requires someone to guard the entrance and exit gates. It also can occur due to no security protocol for vehicle theft being implemented at all. The smart solution this project proposes is considered smart because it solely depends on a machine to do the monitoring management at the entrance and exit gates of a parking place. This proposed system will utilize deep learning technology. This technology is chosen to create a system that could detect and recognise the license plate of the vehicle.

ABSTRAK

Projek ini mencadangkan sebuah penyelesaian atau protokol yang pintar dan juga generic untuk mengatasi masalah pencurian kenderaan, yang mana boleh dilaksanakan di mana-mana kawasan tempat letak kenderaan terutamanya kawasan tem pat letak kenderaan yang terletak di luar. Penyelesaian yang dicadangkan ini dikenali sebagai Sistem Keselamatan Parkir berasaskan Imej. Masalah kecurian kenderaan boleh berlaku di mana-mana lokasi, tetapi projek ini khusus memberi tumpuan kepada kenderaan yang diletakkan di ruang parkir luar. Kes kecurian kenderaan di lokasi tersebut berlaku akibat pengurusan pemantauan yang dijalankan secara manual, iaitu mengharapkan seseorang untuk berjaga di pagar masuk dan keluar. Ia juga boleh berlaku akibat tiada protokol keselamatan untuk kecurian kenderaan dilaksanakan sama sekali. Penyelesaian pintar yang dicadangkan oleh projek ini dianggap pintar kerana system yang dicadang hanya bergantung pada mesin untuk melakukan pengurusan pemantauan di pagar masuk dan keluar sebuah kawasan tempat letak kenderaan. Sistem yang dicadangkan ini akan menggunakan teknologi deep learning. Teknologi ini dipilih untuk menhasilkan sebuah sistem yang dapat mengesan dan mengenali plat lesen kenderaan.

CHAPTER 1: INTRODUCTION

1.1 Project Title

Image-based Parking Security System

1.2 Introduction

Vehicle theft is a problem that is not alien to todays' world as it still is happening now and then. This can be caused by no parking security management protocol being implemented or the implemented protocol is manually done by someone. Letting a person in charge of the entry and exit of a vehicle into and out of a location may be ideal for monitoring uninvited guest into an area but it is not ideal for suspecting possible vehicle theft. The Image-based Parking Security system can be the best answer for this situation as it is a smart access control system that utilizes deep learning technology to recognize the license plate of the parked vehicles.

1.3 Problem Statement

Manually managing the entrance and exit of vehicles into and from a venue can get a bit time consuming.

In addition, manually monitoring the entrance and exit of vehicles into and from a venue cannot suspect vehicle theft.

1.4 Objectives

i. To automate the process of managing the entrance and exit of vehicles into and from a venue.
ii. To develop a system that can detect and recognise the license plate number of a vehicle.

1.5 Brief Methodology

The methodology model used for this project is Waterfall. Waterfall model consist of five phases which are requirements, design, implementation, verification and maintenance. This model has several advantages which include easy to keep track of the project, suitable for small projects and overall project risk decreases.

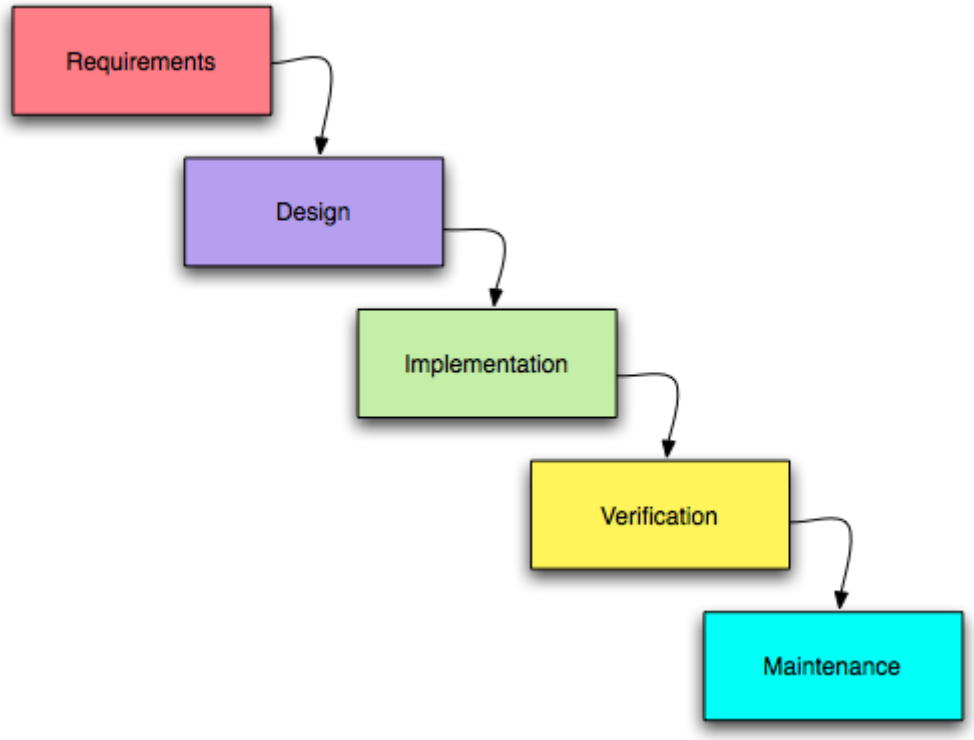

Figure 1.1: Traditional Waterfall Model Approach

1.6 Project Scope

This project is targeted towards local venue owners that provide parking spaces especially outdoors. The proposed system will focus on detecting and recognizing the license plate of vehicles using a deep learning based object recognition algorithm as well as detecting and recognizing characters on the license plate with optical character recognition (OCR) network.

1.7 Significance of Project

This project can be an example for local business owners that run business such as tourist attractions to further promote their business by easing their visitors from worrying about their parked vehicles.

1.8 Project Schedule

Task \ Weeks	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Identify Project Title	■														
Brief Proposal	■	■	■												
Full Proposal				■	■	■									
Chapter 1: Introduction							■								
Chapter 2: Literature							■	■	■	■					
Chapter 3: Requirements Analysis and Design										■	■	■	■		
FYP 1 Final Report													■	■	
FYP Symposium															■

Table 1.1: FYP 1 Schedule

Task	Duration	Start	Finish
Identify Project Title	1 day	10 Sept 2019	10 Sept 2019
Brief Proposal	19 days	11 Sept 2019	29 Sept 2019
Full Proposal	20 days	30 Sept 2019	19 Oct 2019
Chapter 1: Introduction	7 days	20 Oct 2019	26 Oct 2019
Chapter 2: Literature Review	21 days	27 Oct 2019	16 Nov 2019
Chapter 3: Requirements Analysis and Design	19 days	17 Nov 2019	5 Dec 2019
FYP 1 Final Report	7 days	6 Dec 2019	12 Dec 2019
FYP Symposium	2 days	17 Dec 2019	18 Dec 2019

Table 1.2: FYP 1 Duration Table

Task \ Weeks	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Chapter 4: Implementation and Testing	■	■	■	■	■	■	■							
Chapter 5: Conclusion and Future Work								■	■					
FYP 2 First Draft Report and Paper									■	■	■			
FYP 2 Final Report and Paper												■	■	
FYP Symposium														■

Table 1.3: FYP 2 Schedule

Task	Duration	Start	Finish
Chapter 4: Implementation and Testing	67 days	15 Jan 2020	21 Mar 2020
Chapter 5: Conclusion and Future Work	10 days	9 Jun 2020	18 Jun 2020
FYP 2 First Draft Report and Paper	17 days	19 Jun 2020	5 July 2020
FYP 2 Final Report and Paper	10 days	6 July 2020	15 July 2020
FYP Symposium	3 days	22 July 2020	24 July 2020

Table 1.4: FYP 2 Duration Table

1.9 Expected Outcome

This project focuses on recognizing the license plate of vehicles. The recognition should be done twice to simulate the entrance to and exit from the tourism place. The results obtained at entrance must match with the results obtained at exit.

1.10 Project Report Outline

1.10.1 Chapter 1: Introduction

This chapter focuses on the background of this project. This part comprises problem statement, project objectives, brief summary of methodology used, project scope, significance of project, project schedule and the expected outcome of this project.

1.10.2 Chapter 2: Literature Review

This chapter discusses about any existing or related systems from the official website, related journal and articles. In addition, it also focuses on the limitation of these existing systems and how it can be improved by this proposed system. Finally, it discusses about the details of implementation of project such as software and programming language used.

1.10.3 Chapter 3: Requirement Analysis and Design

This chapter discusses the methodology that chosen to apply on requirement analysis and design of the system. The methodology model chosen for this project is Waterfall.

1.10.4 Chapter 4: Implementation and Testing

This chapter discusses about the implementation and testing of this proposed system.

1.10.5 Chapter 5: Conclusion and Future Work

This chapter is about the summary of the project and discussion about any future work of the proposed system.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

In this chapter, background study of similar parking access control system will be demonstrated. The main purpose for doing these background studies is to capture the need for the proposed system and understand briefly on the required software technologies and hardware to demonstrate the proposed system. Some of the information that can be obtained from this background study may include reviews of existing smart parking access control systems and the technology used in those methods as well as their strength and weaknesses.

In this project, the Image-based parking security system is targeted towards any local industry to manage and log vehicle access activity. It is used to automatically grant access to vehicles entering the location after recognising the vehicle's plate number. It will also automatically allow access for the vehicle to exit the location if it recognises the matching between the vehicle's license plates.

2.2 Reviews of similar parking access control systems

Image-based Parking Security System is compared to the GAO RFID Parking Control System and Sunway Smart Parking system.

2.2.1 GAO RFID Parking Control System

RFID stands for radio-frequency identification. The GAO RFID Parking Control System is developed by a leading RFID company called GAO RFID. According to GAO RFID, the system is powered by three key components which are GAO Parking Control Software, GAO RFID Vehicle Tags (hang tags and windshield tags) and GAO RFID Readers. The system only allows access to authorized vehicles that are assigned with the GAO RFID tags. These

tags will be read by the GAO RFID reader which are installed near the entrance and exit gates of the parking facility of the tourism location.

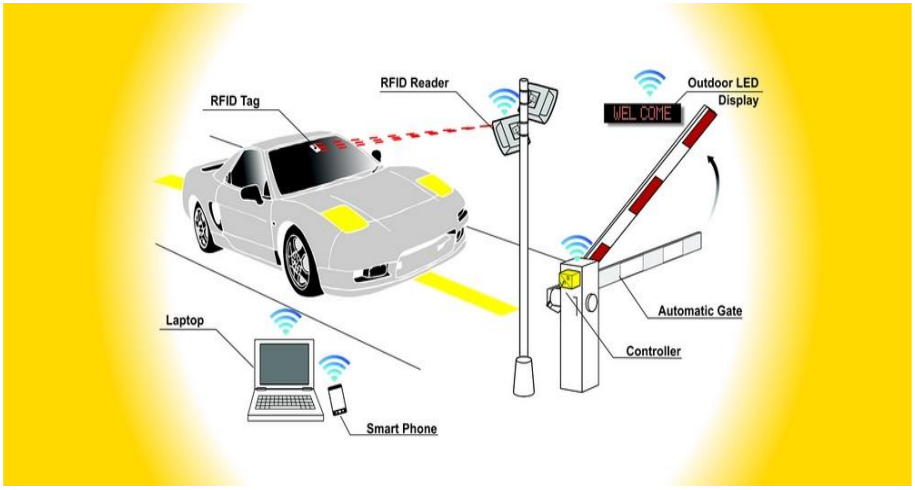

Figure 2.1. RFID Parking Control Set Up

Strength and weaknesses of system.

Strength:

- Remote management
- Enhanced facility security because only vehicles with RFID tags are allowed to enter and exit location.
- 24 hour unmanned operation

Weakness:

- The windshield tags are not applicable for all vehicle windshield. Which means hang tags are most likely the option.
- The RFID tags can be stolen as they are hang tags. Since the system only recognizes the tags, it is still possible for a vehicle theft situation especially if the user is careless.

- RFID tags can be damaged.

2.2.2 Sunway Smart Parking System

Sunway Smart Parking System is a License Plate Recognizing (LPR) system that is scheduled to launch on 2020 in Malaysia. This system aims for a cashless and ticketless experience when visiting Sunway Pyramid, a shopping mall located in Bandar Sunway. This system allows visitors to register their plate number through their website or app prior reaching to Sunway, then once they have arrived in front of the entrance gate, the gate would automatically give access if the system successfully recognizes the license plate.

The main element of this system is the LPR system uses technology provided by JIESHUN, a company in China with 6 years of experience in automated carpark management. A representative from the company states that the recognition rate is 95%, compared to 99.7% in China. The recognition rate can be improved over time as more samples are obtained for the database although in time, the level of enforcement regarding number plates should also be more stringent. On the issue of security, the Smart Parking system has a LOCK feature to prevent a vehicle thief from just drive the vehicle out if all that is required is for the number plate to be verified. The owner of the vehicle have to manually activate this when required and the vehicle will not be allowed to exit.

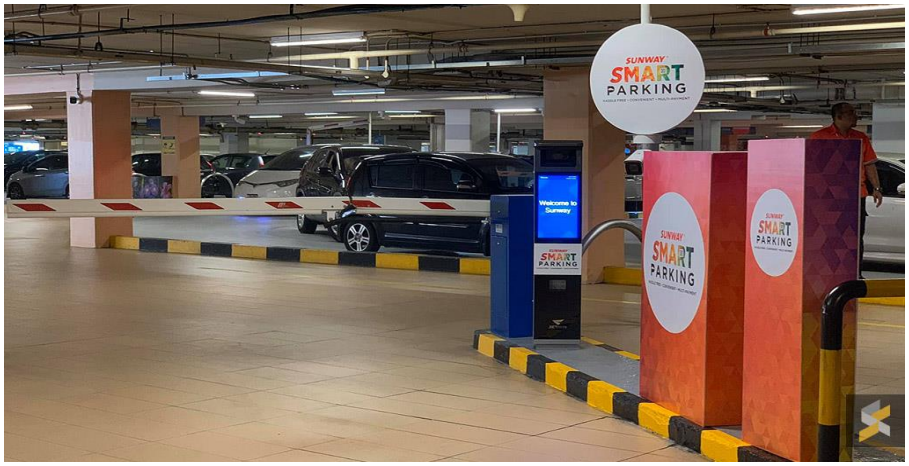

Figure 2.2. Sunway Smart Parking Entrance

Strength and weaknesses of system.

Strength:

- Convenient because no physical ticket is required when visiting the location.
- Hassle free because the need to go to a physical counter to pay for entrance fee is unnecessary.
- Enhanced facility security because only registered license plate are allowed to enter and exit location.

Weakness:

- The enhanced facility security is not automatic. Visitors need to register license plate prior entry to enter the secured parking space.
- The LOCK feature has to be set manually by the visitor. This means that the vehicle is not automatically secured even when parking in the facility.