

INTELLIGENT CAR PARK SYSTEM

LIM SIN NI

**This Report is Submitted in Partial Fulfillment of Requirements for the Bachelor
Degree of Electronic Engineering (Computer Engineering)**

**Fakulti Kejuruteraan Elektronik dan Kejuruteraan Komputer
Universiti Teknikal Malaysia Melaka**

June 2012



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER

BORANG PENGESAHAN STATUS LAPORAN

PROJEK SARJANA MUDA II

Tajuk Projek :

Sesi Pengajian :

1	1	/	1	2
---	---	---	---	---

Saya

(HURUF BESAR)

mengaku membenarkan Laporan Projek Sarjana Muda ini disimpan di Perpustakaan dengan syarat-syarat kegunaan seperti berikut:

1. Laporan adalah hakmilik Universiti Teknikal Malaysia Melaka.
2. Perpustakaan dibenarkan membuat salinan untuk tujuan pengajian sahaja.
3. Perpustakaan dibenarkan membuat salinan laporan ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. Sila tandakan () :

SULIT*

*(Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia seperti yang termaktub di dalam AKTA RAHSIA RASMI 1972)

TERHAD**

** (Mengandungi maklumat terhad yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan)

TIDAK TERHAD

Disahkan oleh:

(TANDATANGAN PENULIS)

(COP DAN TANDATANGAN PENYELIA)

“Saya akui laporan ini adalah hasil kerja saya sendiri kecuali ringkasan dan petikan yang tiap-tiap satunya telah saya jelaskan sumbernya.”

Tandatangan :

Nama Penulis : LIM SIN NI

Tarikh :

“Saya/kami akui bahawa saya telah membaca karya ini pada pandangan saya/kami karya ini adalah memadai dari skop dan kualiti untuk tujuan penganugerahan Ijazah Sarjana Muda Kejuruteraan Elektronik (Kejuruteraan Komputer).”

Tandatangan :

Nama Penyelia :

Tarikh :

ACKNOWLEDGEMENT

First, I would like to thank Yusmarnita Binti Yusop who was giving me a chance to be a final year project student of her; guiding me within the whole flow of my final year project; and sharing knowledge those are very useful for helping me to solve the problems faced within period of doing the project. The experiences and knowledge gained will also be a very useful references and tools in my future studies or work. I really appreciate all the things that I had learnt in this whole year on my final year project, the writing skills practiced on writing thesis of project and experiences gained by doing lots of surveys and problem solving with my project.

Also, I would like to thank Universiti Teknikal Malaysia Melaka (UTeM) that giving me a chance to study in with the course Bachelor of Electronic Engineering (major in Computer Engineering), and also a chance to choose on this project, Intelligent Car Park System, under guidance from Yusmarnita Binti Yusop. It is the best time to understand the advantages of use PLC with using the CX-Programming to program and using touch screen panel with using CX-Designer to design the User Interface as a good lesson before further study or work in future. I really appreciate all the efforts done by UTeM on designing learning techniques for courses, observing and examining students for future generation. Thank you.

ABSTRACT

The purpose of this project is to improve existing car park system with *Programmable Logic Controller (PLC)*. This project is an intelligent system to display empty slots on the touch screen and also guiding driver to the selected empty car park slot. There will be a screen panel which is located outside the car park building in order to display the available car park slots in the building. The driver can select their favorite empty car park slots on the screen panel. Then the driver should follow the direction arrow on the display board in the car park building to find out their selected empty car park space without make detour to find an available parking slot. In this project the *CX-Designer* software is use to display the available car park slots on the screen in the same time it also use to choose the empty car slots by the driver. Other than that, PLC also plays as main control processing unit to point the way toward the selected vacant slot for the driver. Furthermore, there are three types of sensors, which are photoelectric sensor, capacitor sensor, and inductive sensor use to sense the vehicle location status. These kinds of sensors are parts of input to PLC. Light Emitting Diode (LED) light are use to show the direction of the selected car park slot, which are the output from PLC. By applying this intelligent car park system, the car park user can save more time and reduce fuel consumption for searching an available car parking slot. These systems reduce traffic congestion at parking area as well during peak time. Furthermore, the drivers also capable seek out their selected car park slot in a very short time.

ABSTRAK

Tujuan projek ini adalah untuk memperbaiki system tempat letak kereta yang sedia ada dengan menggunakan *Programmable Logical Controller (PLC)*. Projek ini merupakan satu sistem pintar untuk memaparkan kekosongan slot pada skrin sentuh dan membimbing pemandu kepada slot tempat letak kereta yang dipilih oleh mereka. Panel skrin yang terletak di luar bangunan tempat letak kereta untuk memaparkan slot tempat letak kereta yang sedia ada dalam bangunan. Pemandu boleh memilih slot tempat letak kereta kegemaran mereka pada panel skrin. Kemudian pemandu perlu mengikut arah anak panah yang dipapan dalam papan paparan di tempat letak bangunan untuk mencari tempat letak kereta ruang kosong yang dipilih oleh mereka tanpa membuat lencongan untuk mencari slot tempat meletak kenderaan tersedia. Dalam projek ini, perisian *CX-Designer* digunakan untuk memaparkan slot tempat letak kereta yang terdapat pada skrin, dalam masa yang sama juga digunakan untuk memilih slot kereta yang kosong oleh pemandu. Selain daripada itu, PLC juga memainkan peranan dalam kawalan unit pemprosesan untuk menunjukkan jalan ke arah slot kosong untuk pemandu yang dipilih. Di samping itu, terdapat tiga jenis sensor seperti sensor fotoelektrik, sensor kapasitor, dan induktif mengguna kesan status lokasi kenderaan. Sensor merupakan bahagian input kepada PLC. LED digunakan untuk menunjukkan arah slot tempat letak kereta yang dipilih, sebagai output dari PLC. Dengan menggunakan sistem ini, pemandu boleh menjimat lebih banyak

masa dan mengurangkan kegunaan bahan api untuk mencari slot tempat letak kereta. Sistem ini boleh mengurangkan kesesakan lalu lintas di kawasan letak kereta terutamanya pada waktu puncak. Tambahan lagi, pemandu berupaya dalam masa yang singkat mendapatkan tempat meletakkan kereta.

TABLE OF CONTENTS

CHAPTER	TITLE	PAGE
	ABSTRACT	iv
	TABLE OF CONTENTS	ix
	LIST OF TABLES	xii
	LIST OF FIGURES	xiii
1	INTRODUCTION	1
	1.1 Introduction of the Project	1
	1.2 Problem Statements	2
	1.3 Project Objectives	3
	1.4 Project Scope	3
	1.5 Thesis Layout	4
2	LITERATURE REVIEW	6
	2.1 Overview	7

CHAPTER	TITLE	PAGE
2.2	Wireless Mobile-based Shopping Mall Car Parking System	7
2.3	An Intelligent Car Park Management System	10
2.4	Smart Parking Reservation System using Short Message Services	13
2.5	Dupline Car Park Guidance Systems	16
2.6	Comparison between ICPS and Other Car Park System	18
2.7	Programmable Logic Controller	19
2.7.1	Structure of PLC	20
2.7.2	Elements of Ladder Logic	21
2.7.3	Advantages of PLC Controller	22
2.7.4	Comparison between PLC & PIC	22
2.8	Sensors	23
2.8.1	Inductive Proximity Sensor	24
2.8.2	Photoelectric Sensor	25
2.8.2.1	Through Beam	26
2.8.2.2	Retro-reflective Scan	26
2.8.3	Ultrasonic Sensor	27
2.8.3.1	Open Structure Type	27
2.8.3.2	Enclosed Type	28
2.8.3.3	High Frequency	29
2.9	Graphical User Interface	29
2.9.1	Characteristic GUI	29
2.10	CX-Designer	30

CHAPTER	TITLE	PAGE
3	PROJECT METHODOLOGY	32
3.1	Flow Chart Methodology of the Project	33
3.2	Project Implementation	36
3.2.1	Touch Screen Panel	36
3.2.2	Omron PLC	37
3.2.3	Photoelectric Sensor	37
3.2.4	Capacitive Sensor	38
3.2.5	LED Display	39
3.2.6	Relay	39
4	RESULT AND DISCUSSION	41
4.1	The Design of Prototype Car Park Area	42
4.2	Intelligent Car Park Operation Flow Chart	44
4.3	CX-Programmer	45
4.4	CX-Designer	51
4.5	Prototype of Intelligent Car Park System	53
5	CONCLUSION AND RECOMMENDATION	55
5.1	Conclusion of the Project	56
5.2	Recommendation	57
	REFERENCE	59
	APPENDIX	60

LIST OF TABLES

TABLE	TITLE	PAGE
2.6.1	Comparison between ICPS and Others Car Park System	18
2.7.1	Main units of PLC	20
2.7.3	Comparison between PIC and PLC	22
2.8.1	Advantages & Disadvantages of Inductive Proximity	25
2.9.1	Advantages and Disadvantages of Graphical User Interface	30
4.3.1	The comment of the address	50

LIST OF FIGURES

FIGURE	TITLE	PAGE
2.2.1	Overview of WMCPS	7
2.2.2	Simulation Model (First Floor)	8
2.2.3	Simulation Model (Second Floor)	9
2.2.4	Shortest Path Routes from Simulation	9
2.3.1	Layer Framework of WSN-Based System	10
2.3.2	Software Structure	11
2.3.3	Flow Chart for Enter and Exit from Car Park System	12
2.4.1	Flow Chart of Parking Reservation System	13
2.4.2	Parking Layout	15
2.5.1	Ultrasonic Sensor Used To detect a car	16
2.5.2	Display Board	17
2.5.3	The Layout for Dupline Car Park Guidance Systems	17
2.7.1	Schematic of a PLC (Vernon, 2004)	20
2.7.2	Basic Components of Ladder Logic Program	21
2.8.1	Inductive Proximity Sensor	24
2.8.2	Concept of Through Beam Sensor	26
2.8.3	Concept of Retro-reflective Scan or Reflective	26
2.8.4	Open Structure Type Ultrasonic Sensor Structure	27

2.8.5	Enclosed Type Ultrasonic Sensor Structure	28
2.8.6	High Frequency Ultrasonic Sensor Structure	29
2.10.1	CX-Designer Logo	31
3.1.1	Flow Chart of Methodology	35
3.2.1	Touch Screen Panel (OMRON ns5-sq00b-ecv2)	36
3.2.2	Omron PLC (Omron SYSMAC CJ1G)	37
3.2.3	Photoelectric Sensor (PA18CSD04PASA)	38
3.2.4	Capacitive Sensor (CA18CLF08PA)	38
3.2.5	LED IDEC Pilot Light (APW199-D-G-24V)	39
3.2.6	Relay (MY2J 24VDC Solid State Relay)	40
4.1.1	The Design of Prototype	42
4.1.2	The Layout of Prototype	43
4.2.1	Flow Chart of the ICPS	44
4.3.1	Main Design of the Ladder Diagram	47
4.3.2	Area B Design of the Ladder Diagram	49
4.4.1	Touch Screen Panel Layout for Front Page	51
4.4.2	Touch Screen Panel Layout for Level 1	52
4.4.3	Touch Screen Panel Layout (When user press the button)	53
4.5.1	Prototype Car Park System Output	54
4.5.2	Prototype Car Park System Input	54

CHAPTER I

INTRODUCTION

This chapter will give reader a basic introduction of how the idea of the project generated. In this chapter will show the introduction, objectives, problems statements, scopes of work, methodology and simple brief for the report structure.

1.1 Introduction of the Project

Nowadays, most of car parks system is designed without assisting the drivers to locate their vehicle the vacant parking slots. This occurrence can cause the drivers

facing problem in searching park slot, while there is limited place to parking vehicle or almost full park conditions. In addition, it also causes traffic congestion in the car park building. Other than that, the driver is wasting their valuable time and fuel consumption to find a suitable parking slot. Intelligent Car Park System (ICPS) plays the important role to provide a good parking system to the public. The ICPS which is the system that can let the driver select their favorite vacant car park slot in car park building. At the same time it is guiding the driver to the car park slot which they selected at the car park area as well. Most of car park systems are designed without assisting the drivers to locate their vehicle the vacant parking slots. Therefore, a well organized car park system is needed to avoid the driver compete with other car park user for an available car park slot. ICPS is purposely implemented to solve those problems. ICPS focus on design a system that can allow the driver to select their parking slots and guide them to the car park place they select. It will reduce time spending and fuel consumption for searching a car park slot.

1.2 Problem Statement

Most of driver always facing problem in searching an empty car park slot, while there is limited place to parking vehicle or almost full park conditions. In fact, most the driver will drive at slow speed in the car park due to find out an available car parking slot. However, this will cause traffic congestion meantime indirectly waste valuable time and also reduce the fuel consumption to find a suitable parking slot. Without a well organized car park system driver may have to drive through the car park area and compete with other car park user for an available car park slot.

Moreover, when the driver moves around to find out vacant parking area in a crowded parking area, the possibility that happen accident is very high and fortunate it can give rise to injury and seriously may cause death.

As a matter of fact, the conventional car park system is inefficiency; therefore it is importance to have an effective and intelligent car park system, to save time and create a green environment.

1.3 Project Objectives

Project objective is mission, purpose that can be reasonably accomplished within the expected schedule. Intelligent Car Park System (ICPS) is implemented to achieve four objectives as below:

1. To design a user-friendly system that can allow the driver to find out their favorite parking slot in more convenient way.
2. To reduce the fuel consumption and time spending for searching an empty car park slot.
3. To indicate vacant car parking slot in the car park building on a touch screen panel through CX-Designer software.
4. To design and simulate Programmable Logic Control (PLC) which is main control processing unit in the intelligent car park system.

1.4 Project Scope

The project scope for this system is applicable in wide indoor car park area. Design and simulate an effective intelligent car park system by using Programmable Logic Control (PLC), CX-Programmer, CX-Designer, photoelectric sensor, capacitor sensor and Light Emitter Diode (LED). Beside that, this project will be made into the prototype to automate the system. The system that uses CX-Designer to design the

interface between PLC and touch screen panel. Other than that, there will be touch screen panel, in order to let the driver to select an available car park space.

1.5 Thesis Layout

This report is documentary delivering the ideas generated, concepts applied, activities done and the outcome of the project. It consists of five chapters. The description of this report as following:

Chapter I: Introduction

The first chapter is introduces the general overview of the project. In this chapter, it states the background, objectives, scope of work, importance, problem statement and methodology of this project.

Chapter II: Literature Review

This chapter discusses the research of study related to the project. The information of research is obtained from journal, book reference, lecturer notes and etc. This chapter is performed and document about the theoretical concept applied in completing this project.

Chapter III: Project Methodology

This chapter is identifies the materials, equipments or apparatus are used in this project. It also determines the method or procedures are implemented in this project. Flow chart and Gantt chart are used to design the flow of completing the project.

Chapter IV: Results and Discussion

It shows the current results or progress of the project. The results are explained with the aid of figures and tables.

References

The list of references is determined.

CHAPTER II

LITERATURE REVIEW

A literature review is a body of text that discusses the up-to-date background information and appropriate methodological on a certain area of study. Sometimes it includes suggestions about what needs to be done to improve the knowledge and understanding of a particular problem. Other than that, it might give a new study of old material or combine new concept with old study. In this section, it will be discussing about the theory and concept that had done by previous researchers related to this project. In addition, it will explain the methods that have been used of the component such as sensors to achieve the result. Through this section, it would provide with an idea about the current situation in terms of what has been done, and what should be known.

2.1 Overview

Literature review are based in information obtained from valid sources such as books, articles of relevance, publisher paper or any other source deemed appropriate.

2.2 Wireless Mobile-based Shopping Mall Car Parking System (WMCPS)

This study proposes Car Parking System based on Wireless Mobile-based Car Parking System by Breadth First Search (BFS) algorithm by finding the nearest parking space for drivers and using low cost SMS services.

In this system, the drivers enable to receive information inside the car park by using SMS service. The assignment of the parking space is based on the shortest path and used BFS algorithm, by taking into consider, so the driver can have a nearest entrance into car park.

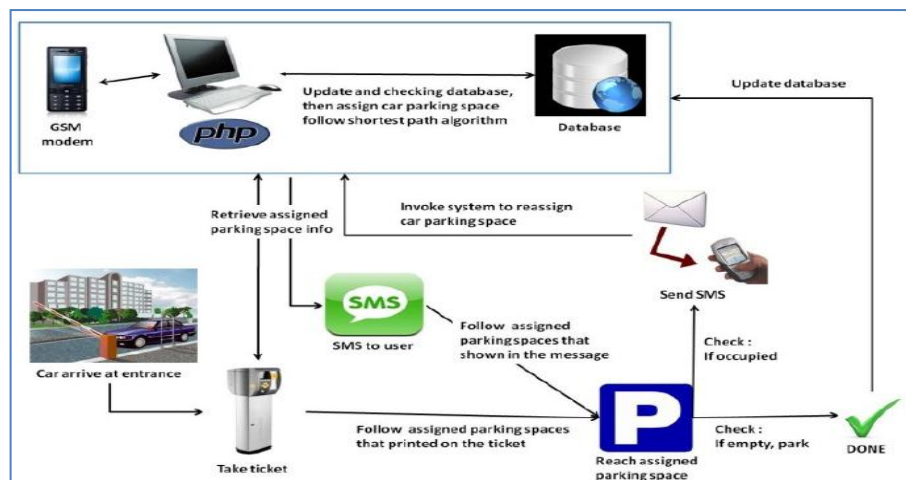


Figure 2.2.1: Overview of WMCPS

From the figure 2.2.1, the drivers reached the entrance and take a car park ticket. Then, the driver may follow the assigned parking spaces (with car parking lot ID) that had printed on the ticket and park their vehicle. When the driver assigned parking space and found out the driver arrive at the assigned parking space and the place is occupied by others, driver may resend SMS to WMPCS to get a new assigned parking slots. Within a short period, the driver will received another new ID parking slot.

The SMS service is the upgrade of GSM modem, SMS gateway and web server. OZEKI NG SMS Gateway (OZEKI) which is a software tool that uses to support the services of send and receive SMS. OZEKI allow the user to attach a mobile phone as GSM modem to the PC, and control the GSM modem with AT command to send or receive SMS.

PHP script on the Apache web server is designed to interface the system. The Apache can directly send the HTTP requests and communication with OZEKI. It will proceed with GSM modem after OZEKI get the request.





Figure 2.2.3: Simulation Model (Second Floor)

The figure 2.2.2 and 2.2.3 show the layout of the simulation model used for WMCPS. Each floor contains over 110 parking slots. There have two entrances and two exits.



Figure 2.2.4: Shortest Path Routes from Simulation

The Figure 2.2.4 shows the simulation model, which has several available parking slots; the system will find the shortest path from the available spaces and return the parking lot to the user. A function panel is designed to show the detail information of simulation result.

2.3 An intelligent Car Park Management System based on Wireless Sensor Networks

This paper propose WSN (wireless sensor networks)-based intelligent car park system. In system, low cost wireless sensors are developed into a car park field, with each parking lot equipped with one sensor node, which have function to detect and monitors the occupation of the parking lot. Sensor nodes can detect the status of the parking field is reported periodically to a database via the deployed wireless sensor network and its gateway. The database can be accessed by the upper layer management system to perform various management functions, such as finding vacant parking lots, auto-toll, security management, and statistic report.

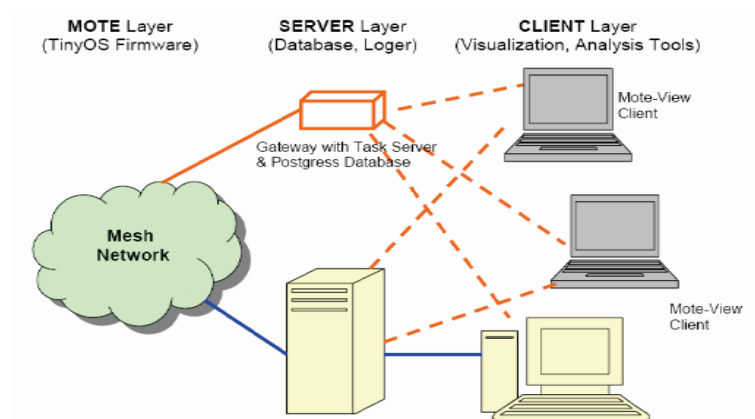


Figure 2.3.1 Layer Framework of WSN-Based System