

**INTELLIGENT ROBOTIC PARKING SYSTEM (IRPS)**

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**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

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JUDUL: INTELLIGENT ROBOTIC PARKING SYSTEM (IRPS)

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# **INTELLIGENT ROBOTIC PARKING SYSTEM (IRPS)**

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This report is submitted in partial fulfilment of the requirements for the  
Bachelor of Computer Science (Artificial Intelligence)

**FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY**

**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**2011**

## DECLARATION

I hereby declare that this project report entitled

### INTELLIGENT ROBOTIC PARKING SYSTEM (IRPS)

is written by me and is my own effort and that no part has been  
plagiarized without citation.

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## **DEDICATION**

To my beloved parents, Samiran bin Judi and Paimah binti Sodali,

And also my siblings for their loves and supports.

To my kind and supportive supervisor, Dr. Abd. Samad Hasan Basari

for making it worthwhile.

To all my lecturers and friends for their helps and supports.

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Next, I would also like to thank my university, Faculty of Information and Communication Technology lecturers that have taught me. With all the knowledge, I manage to complete the project. A special thanks to PSM (Projek Sarjana Muda) committee members for their kindness organizing briefing, seminar and talk to student who took this subject.

Then, I would also like to thank my classmates and course mates for making this study an unforgotten memory. Besides that, I would like to thank my friends that have given me sincere comments.

Last but not least, I would like to thanks to my beloved parents who have given me full support along completing this project.

## **ABSTRACT**

Parking spaces are limited and hard to find nowadays due to rapid development. Furthermore, parking process can take more time and harden the driver due to the complexity of the parking area and the lack of experience. Intelligent Robotic Parking System (IRPS) is a parking system that implemented with robotic function. This robot was programmed to act intelligently and require performing a specific task. The task is to move a car from delivery bay to empty parking space and to return it back. The robot will park the car into the nearest parking space and according to the criteria of the car. This system was adapted to be installed in building parking lot such as shopping complex and apartment. With this system, we can easier the parking process, save many users time and we can get more parking spaces because of the optimization of the parking space in this system. In future, we can solve the lack of parking spaces problem with this system.

## ABSTRAK

Tempat letak kereta sangat terhad dan susah untuk dicari disebabkan pembangunan yang pesat. Tambahan lagi, proses meletakkan kereta boleh mengambil masa yang lama dan menyusahkan si pemandu oleh kerana tempat letak kereta yang rumit dan kurangnya pengalaman pemandu. Intelligent Robotic Parking System (IRPS) adalah sistem tempat letak kereta yang dilaksanakan dengan fungsi robot. Robot ini telah diprogramkan untuk bertindak bijak untuk melaksanakan tugas tertentu. Tugasnya adalah untuk memindahkan kereta dari kawasan penghantaran ke ruang letak kereta yang kosong dan kembali semula. Robot akan meletakkan kereta ke dalam ruang letak kereta yang paling hampir dan mengikut kriteria kereta. Sistem ini telah disesuaikan dan akan dipasang di bangunan tempat letak kereta seperti kompleks membeli-belah dan bangunan pangsapuri. Dengan sistem ini, kita boleh memudahkan proses meletak kereta, menjimatkan masa banyak pengguna dan kita boleh mendapatkan lebih banyak tempat letak kereta kerana ruang letak kereta dalam sistem ini telah dimaksimakan. Pada masa hadapan, kita boleh menyelesaikan masalah kekurangan ruang tempat kereta dengan system ini.



## TABLE OF CONTENTS

<b>CHAPTER</b>	<b>SUBJECT</b>	<b>PAGE</b>
	<b>PROJECT TITLE</b>	<b>i</b>
	<b>DECLARATION</b>	<b>ii</b>
	<b>DEDICATION</b>	<b>iii</b>
	<b>ACKNOWLEDGEMENTS</b>	<b>iv</b>
	<b>ABSTRACT</b>	<b>v</b>
	<b>TABLE OF CONTENTS</b>	<b>vii</b>
	<b>LIST OF TABLES</b>	<b>xi</b>
	<b>LIST OF FIGURES</b>	<b>xii</b>
	<b>LIST OF ABBREVIATIONS</b>	<b>xiii</b>
	<b>LIST OF ATTACHMENTS</b>	<b>xiv</b>
<b>CHAPTER 1</b>	<b>INTRODUCTION</b>	
	1.1 Project Background	1
	1.2 Problem Statement	3
	1.3 Objectives	3
	1.4 Project Scopes	4
	1.5 Project Significance	4
	1.6 Expected Output	5
	1.7 Conclusion	5

## **CHAPTER 2 LITERATURE REVIEW AND PROJECT METHODOLOGY**

2.1 Introduction	6
2.2 Facts and Finding	6
2.2.1 Domain	7
2.2.2 Existing System	7
2.2.3 Technique	7
2.3 Project Methodology	8
2.3.1 Waterfall Methodology	8
2.3.1.1 Planning Phase	9
2.3.1.2 Analysis Phase	9
2.3.1.3 Design Phase	9
2.3.1.4 Testing Phase	9
2.4 Project Requirement	10
2.4.1 Software Requirement	10
2.4.2 Hardware Requirement	11
2.5 Project Schedule and Milestone	11
2.6 Conclusion	13

## **CHAPTER 3 ANALYSIS**

3.1 Introduction	14
3.2 Problem Analysis	14
3.2.1 Proposed System	15
3.3 Requirement Analysis	16
3.3.1 Data Requirement	16
3.3.2 Functional Requirement	16
3.3.3 Non-functional Requirement	17
3.4 Conclusion	17

## CHAPTER 4 DESIGN

4.1 Introduction	18
4.2 High-level Design	18
4.2.1 System Architecture for Robotic and Automation	19
4.2.2 User Interface Design for Robotic and Automation	21
4.2.2.1 Navigation Design	22
4.2.2.2 Input Design for Robotic and Automation	26
4.2.2.3 Technical Design	27
4.2.2.4 Output Design	27
4.3 Detailed Design	27
4.3.1 Software Design	28
4.4 Conclusion	31

## CHAPTER 5 IMPLEMENTATION

5.1 Introduction	32
5.2 Software or Hardware Development Setup	32
5.3 Software or Hardware Configuration Setup	33
5.3.1 Configuration Environment Setup	33
5.3.1.1 Software Configuration Setup	33
5.3.1.2 Hardware Configuration Setup	36
5.3.2 Version Control Procedure	39
5.4 Implementation Status	40
5.5 Conclusion	49

## CHAPTER 6 TESTING

6.1 Introduction	41
6.2 Test Plan	41
6.2.1 Test Organization	42
6.2.2 Test Environment	42
6.2.3 Test Schedule	44
6.3 Test Strategy	44

6.3.1 Classes of Test	45
6.4 Test Implementation	45
6.4.1 Test Description	46
6.4.2 Test Data	46
6.5 Test Results and Analysis	47
6.6 Conclusion	47

## **CHAPTER 7 PROJECT CONCLUSION**

7.1 Observation on Weaknesses and Strengths	48
7.1.1 System Weaknesses	48
7.1.2 System Strengths	49
7.2 Propositions for Improvements	50
7.3 Contribution	50
7.4 Conclusion	51

<b>REFERENCES</b>	52
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<b>APPENDICES</b>	53
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**LISTS OF TABLES**

<b>TABLE</b>	<b>TITLE</b>	<b>PAGE</b>
2.1	<b>Project Schedule</b>	<b>11</b>
5.1	<b>List of Version of the System</b>	<b>39</b>
5.2	<b>List of Modules and Implementation</b>	<b>40</b>
6.1	<b>Test Schedule</b>	<b>44</b>
6.2	<b>Test Description</b>	<b>46</b>
6.3	<b>Test Data</b>	<b>46</b>

## LIST OF FIGURES

DIAGRAM	TITLE	PAGE
2.1	Waterfall model	9
4.1(a)	System Design and Architecture	20
4.1(b)	System Design and Architecture	21
4.2(a)	Flow of the System	22
4.2(b)	Flow of the System	23
4.2(c)	Flow of the System	24
4.2(d)	Flow of the System	25
4.3	Top view of the whole system	26
4.4	Bricx Command Center window	28
4.5(a)	master.nqc program files	29
4.5(b)	slave.nqc program files	30
5.1	Robolab Main Menu	34
5.2	Robolab Administrator Menu	34
5.3	Message to download firmware	35
5.4	The Connection between RCX and Computer	36
5.5	Robolab Main Menu	37
5.6	Robolab Administrator Menu	37
5.7	Select Port Message	38
5.8	BricxCC Starting Window for Setting the Port, Brick and Firmware	38
6.1	Test Environment	43

## LIST OF ABBREVIATIONS

BricxCC	–	Bricx Command Center
IDE	–	Integrated Development Environment
IR	–	Infra-red
IRPS	–	Intelligent Robotic Parking System
NQC	–	Not Quite C
RAM	–	Random Access Memory
RCX	–	A LEGO Mindstorms controller device
USB	–	Universal Serial Bus

**LIST OF ATTACHMENTS**

	<b>TITLE</b>	<b>PAGE</b>
<b>Appendix A</b>	<b>Coding for master robot</b>	<b>53</b>
<b>Appendix B</b>	<b>Coding for slave robot</b>	<b>54</b>
<b>Appendix C</b>	<b>Project Proposal</b>	<b>59</b>



## **Chapter I**

### **Introduction**

#### **1.1 Project Background**

Parking does not need more space, it just need a more intelligent solution. While parking process does not need more human power, it can be done by machine or robot. Traffic congestion today and tomorrow represents an exceptional challenge. According to a research, more than 50% of drivers in the centre of major cities are searching for a place to park their vehicle. More and more cars are sharing a limited volume of available parking space.

Let's take an example, when you go for shopping at shopping complex during weekend, it is hard to find parking place. You need to go around the parking area or maybe search in all level of parking lot to find an empty parking space. More worst if after the searching of parking space, there is no empty parking lot anymore. This will lead to the wasting of time, wasting of human power and the worst is wasting of the energy (fuel or petrol) in same time contribute to air pollution at the parking area.

When the parking area was full, there is a problem when parking in a fit place. A good skill is needed and a little bit of effort to park our car safely without bump or touching with neighbourhood cars. Unfortunately, not all drivers are well-trained to do like that. Any single mistake can lead to accident whether small or big. Then, the parking result, sometimes the car is

not properly parked in the parking box. Maybe it more to the right space in same time consumes the space for right parking box.

Remembering the parking lot is another problem. Can you imagine in multilevel car park, there are hundreds or maybe thousands of vehicles? Can you remember where you park your car? At which side, which level? The same environment of parking lot and the changes of the neighbourhood cars can make us more confused. Furthermore, walking to the car alone can be dangerous especially for ladies. It can attract strangers or maybe theft or pervert.

Conventional parking must have extra space to easier the parking process. Whether the parking lots are built in 45° angle or not, there must be small unused space that is spaces for the driver and passengers to go out from the car.

The proposed system - Intelligent Robotic Parking System (IRPS) is a fully autonomous multilevel parking system controlled by robot. This system will be installed in the building that has potential to receive many cars every day such as shopping complex. How it works? The driver just needs to park the car at the delivery bay. Then the driver needs to key in the car plate number at the machine there and receive the ticket. After that the drivers can leave. Meanwhile, the system (robot) will take place in removing user's car to the nearest parking lot. The placement of the cars depends on the type of the car which is measure from size and weight of the car.

To get back the car back, the driver just needs to insert the previous ticket and pay the fees at the kiosk then wait for the system to transfer the car to receiving bay. After that the driver can drive out safely. This means that the driver no needs to park in and park out their car into empty parking space. Just need to pass the parking, placement and storing matter of the car to the system.

In this project, I will develop a model based on this system by using LEGO Mindstorms model RCX1.0. I will show the automation process from the process car arrive at the toll gate until the process of take out the car complete. In this model, there are only 2 parking lots will be used as demonstration which one is delivery/receiving bay and the other one is the empty parking lot. The detail of the model will be explained in other chapter.

## 1.2 Problem Statement

Based on the project background above, the main problem of the whole scenario is parking process can take much times and it a waste of plenty time. Then, parking process can be a difficult task depends on situation. Furthermore, empty parking lots are limited and so hard to find nowadays.

## 1.3 Objectives

This system is developed to fulfil the objectives, which are:

1. To saving drivers' time during parking process.
  - No more searching around the parking area to find an empty parking.
  - No more walking to the car, just wait at the receiving bay that close to the entrance of the building.
2. To easier the drivers' park process.
  - No need human effort to park the car perfectly.
  - No more remembering parking site. Just wait the car at the receiving bay.
  - During parking process, the driver only need to park the car at receiving bay and later the robot will park it for you.
3. To increase the space revenue up to 50% compared to conventional parking lot.
  - The cars will be placed together as close as possible.
  - There will be no extra parking space. The parking box will be made to fit perfectly with size of the car. Also, there will be no unused driveway.

## 1.4 Project Scopes

Intelligent Robotic Parking System (IRPS) will be installed in a building such as shopping complex, apartment, hospital and other potential places. The parking area can be underground or on the ground. Actually, Intelligent Robotic Parking System (IRPS) already exists in America, Dubai, and Japan but in Malaysia, not yet. This system can be categorized in automobile industry and vehicle lift industry. In Malaysia, there are only have Mechanical Parking System which the system is not automated and need a human power as operator. Yet it still can save the parking area up to 30% because of multilevel characteristic. There are many things need to be improved. First, make the system autonomous. Human error can occur anytime, but machine error is hard to occur if the system was trained sufficiently. Next, the time taken need to be improved in transfer a vehicle from terminal to parking area. After that, the usage of parking space can be optimised by placing the cars closer together, both side-to-side and bumper-to-bumper. This can maximize space normally lost in driving lanes and behind columns.

## 1.5 Project Significance

Intelligent Robotic Parking System (IRPS) will give many benefits to some party. But the most benefit is the user which is the driver. By having this system, it can help save drivers' time and energy (human power and car energy) in parking process because the park process is done by the robot. Next, this system will help the drivers' job in parking process. The robot will take place the role to park the car. During parking process, the driver only needs to park the car at receiving bay and later the robot will park it for you. Drivers' also do not have to worry about the security of their car because the garages are totally locked for outsider. The most important thing is the investor of the project can have more cars in their parking area which mean it will become more profits to them.

## **1.6 Expected Output**

I hope, with this system, it will reduce human power in parking process. By passing the job to the robot, the user can save much energy. Then this system can help to reduce time taken in the parking process. In same time can save much precious time of the user. After that this system can maximize the usage of parking lot by 50% compared to conventional parking system. This mean the parking garage can have more cars in same time increasing the productivity of the parking garage.

## **1.7 Conclusion**

As a conclusion, by all the brief explanation about the importance of the system development stated above, many benefits can be achieved. Through this system, it is an effective way to maximize the parking space, reduce the parking cost, saving drivers' time and facilitate the drivers' job. The next chapter will be discussed on literature review and project methodology.

## **Chapter II**

### **Literature Review and Project Methodology**

#### **2.1 Introduction**

In this chapter, the discussions are more on literature review and methodology of this project. The explanation of fact and finding, project domain, project methodology, project requirement, and milestones for this project will be included.

#### **2.2 Facts and Finding**

There are many types of robotic / automated parking system. To determine the basic information on what is needed and what to do for this project, the searching process of research and finding is done by collecting the information from the internet, journals and etc. This process is done to gather a useful technique and information as a contribution for the successful of this project.

### **2.2.1 Domain**

The domain of this project is actually fall in vehicle parking lift industry and automatic parking industry. But because of model that I built, this project can be considered in robotic and automation industry.

### **2.2.2 Existing System**

Car parking system has been around almost since the cars were invented. It was developed in the early 20th century in response to the need for storage space for vehicles. Nowadays, there are many company already developed this automatic parking system and commercialize their product.

### **2.2.3 Technique**

The technique that I will use in this project is automation technique. Automation is the use of control systems and information technologies to reduce the need for human work in the production of goods and services. In the scope of industrialization, automation is a step beyond mechanization. Whereas mechanization provided human operators with machinery to assist them with the muscular requirements of work, automation greatly decreases the need for human sensory and mental requirements as well. Automation plays an increasingly important role in the world economy and in daily experience.

Automation has had a notable impact in a wide range of industries beyond manufacturing (where it began). Once-ubiquitous telephone operators have been replaced largely by automated telephone switchboards and answering machines. Medical processes such as primary screening in electrocardiography or radiography and laboratory analysis of human genes, sera, cells, and tissues are carried out at much greater speed and accuracy by automated systems. Automated teller machines have reduced the need for bank visits to obtain cash and carry out transactions. In general, automation has been responsible for the shift in the world economy from industrial jobs to service jobs in the 20th and 21st centuries.

## 2.3 Project Methodology

In this project, the methodology used is frame work methodology of the overall process of developing information analysis through a multi-step process investigation of initial requirement through planning, analysis, design, and testing. There are many different model and methodologies, but each generally consists of a series of defines steps or stages.

### 2.3.1 Waterfall Methodology

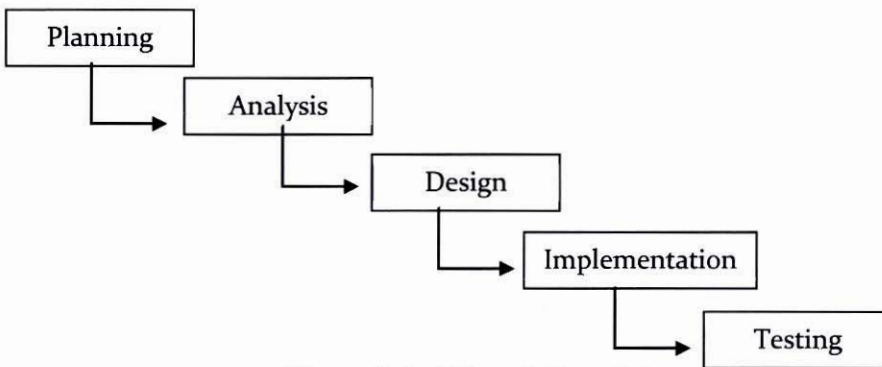


Figure 2.1 : Waterfall model