UNIVERSITI TEKNIKAL MALAYSIA MELAKA

AUTOMATIC VENDING PARKING SYSTEM (CYLINDRICAL DESIGN)

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the BACHELOR OF ELECTRICAL ENGINEERING TECHNOLOGY (INDUSTRIAL POWER) with Honours.

by

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APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Electrical Engineering Technology (Industrial Power) with Honours. The member of the supervisory is as follow:

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ABSTRACT

Human population keeps increasing in numbers which cause small country like Malaysia to be crowded especially in a big city like the capital city of Malaysia, Kuala Lumpur. This cause an increased number of vehicle on the road, which contributes to a problem lack of public parking area. This project aims to introduce automatic parking system to overcome such problem. The prototype to develop a multi-storey automatic parking system by using circular shape design which will reduce the amount of land used for the traditional parking area. The prototype will use linear elevator type of mechanism which using rack and pinion to drive the elevator system which used to deliver and receive the vehicles automatically which control by graphical programming written using LabVIEW software that uploads inside Arduino Mega 2560 board microcontroller. In this project, a comparison between automated and manual parking system based on cost, land requirement, safety and time-saving also will be conducted with analysis to determine and prove that automated parking system provide more benefit and cost-effective to be used. As the system operated automatically, human error could be reduced, which improve the security in public parking area.

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ABSTRAK

Bilangan manusia semakin meningkat dalam jumlah yang menyebabkan negara kecil seperti Malaysia menjadi ramai terutama di bandar besar seperti ibu kota Malaysia, Kuala Lumpur. Ini menyebabkan peningkatan jumlah kenderaan di jalan raya, yang menyumbang kepada masalah kekurangan ruang letak kereta awam. Projek ini bertujuan memperkenalkan sistem letak kereta automatik untuk mengatasi masalah tersebut. Prototaip untuk membangunkan sistem parkir automatik berbilang tingkat dengan menggunakan reka bentuk bulat yang akan mengurangkan jumlah tanah yang digunakan berbanding dengan kawasan letak kereta tradisional. Prototaip ini akan menggunakan mekanisme lif linear yang menggunakan rak dan pinion untuk memacu sistem lif yang digunakan untuk menyampaikan dan menerima kenderaan secara automatik yang dikawal oleh pengaturcaraan grafik ditulis menggunakan perisian LabVIEW yang dimuat naik di dalam mikrokontroler papan Arduino Mega 2560. Dalam projek ini, perbandingan antara sistem letak kereta automatik dan manual berdasarkan kos, keperluan tanah, keselamatan dan penjimatan masa juga akan dilakukan dengan analisis untuk menentukan dan membuktikan bahawa sistem letak kereta automatik menyediakan lebih banyak faedah dan kos lebih efektif untuk digunakan. Oleh kerana sistem beroperasi secara automatik, kesilapan manusia dapat dikurangkan, yang meningkatkan keselamatan di tempat letak kereta awam.

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DEDICATION

To my beloved parents, I give a lot of thank for keep motivate and provide support for completing this research. I also want to give thank to all my roommate and colleague, that help to provide solution and overcome challenges through all the process of completing this project. Lastly, I would like to give thank to my supervisor that help guide and assists me until the end of this project.

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TABLE OF CONTENT

Abstract v

Abstrak vi

Table of content viii

List of tables xiii

List of figures xiv

Chapter 1: Introduction

1.1 Background of the project 1

1.2 Statement of the problem 3

1.3 Objective 4

1.4 Scope 5

1.5 Organization 6

Chapter 2: Literature review

2.1 Automated parking system 8

2.2 Automated parking system design

2.2.1 Semi-circular design 9

2.2.2 Vertical design 11

2.2.3 Rectangular design 12

2.2.4 Rotary design 12

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2.2.5 Circular design 13

2.3 Storage configuration

2.3.1 Crane system 14

2.3.2 Tower system 15

2.3.3 Silo system 16

2.4 Type of arrangement

2.4.1 Tower-rotary type 17

2.4.2 Step-stacker type 18

2.4.3 stacker type 19

2.5 Component and material

2.5.1 Arduino Mega 2560 20

2.5.2 DC motor

2.5.2.1 Stepper motor 21

2.5.2.2 DC motor gear 23

2.5.3 Sensor

2.5.1 IR sensor 23

2.5.2 Ultrasonic 25

2.5.4 Mechanical part

2.5.4.1 Rack and pinion 26

2.5.4.2 Hydraulic 28

2.5.5 Motor driver

2.5.5.1 L298N motor driver 29

2.5.5.2 Relay 30

2.5.5.3 Power MOSFET 31

2.6 Preparation of project

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2.6.1 Comparison between traditional parking
system and automatic parking system 32
2.7 Summary of literature review 34

Chapter 3: Methodology
3.1 Research design 36
3.11 Flowchart 38
3.2 Selection of material
3.2.1 Arduino Mega 2560 40
3.3.2 Stepper motor 40
3.3.3 IR sensor 41
3.3.4 Rack and pinion 41
3.3.5 L298N motor driver 42
3.3.6 Relay 42
3.4 Preparation of project 43
3.4.1 Schematic circuit 44
3.4.2 Software
3.4.2.1 Arduino IDE software 46
3.4.2.2 LabVIEW 47
3.4.2.3 Solidwork 48

Chapter 4: Results & discussion
4.0 Introduction 49
4.1 Analysis on time for LabView to communicate with Arduino Mega 2560
to perform its tasks 49
4.1.1 Time taken for sorting process of vehicles at parking lot 1,2 & 3 50

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4.1.1.1 Time taken for sorting process of vehicles at parking lot 1 50
4.1.1.2 Time taken for sorting process of vehicles at parking lot 2 52
4.1.1.3 Time taken for sorting process of vehicles at parking lot 3 54
4.1.1.4 Comparison time taken for sorting process of vehicles at parking lot 1, 2, & 3 54
4.1.2 Time taken for sorting process of vehicles at parking lot 1,2 & 3 57
4.1.2.1 Time taken for sorting process of vehicles at parking lot 1 57
4.1.2.2 Time taken for sorting process of vehicles at parking lot 2 59
4.1.2.3 Time taken for sorting process of vehicles at parking lot 3 61
4.1.2.4 Comparison time taken for retrieve process of vehicles at parking lot 1, 2, & 3 63
4.1.3 Comparison time taken for sorting & retrieve process 64
4.2 Analysis on energy consumption of the system 65
4.3 Analysis on the time management for each process for prediction on real scale of development of this project 68

Chapter 5: Conclusion & future work

5.0 Introduction 73
5.1 Conclusion 73

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5.2 Future work 75

Reference 77

Appendix A 80

Appendix B 82

Appendix C 95

Appendix D 100

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LIST OF TABLES

Table 2.1: Specification of Arduino microcontroller board 21

Table 2.2: L298N motor driver dual H-bridge specification 30

Table 2.3: Comparison between automatic and traditional parking 33

Table 2.4: Analysis data between automatic and traditional parking 34

Table 3.1: Requirement I/O of Arduino Mega 2560 40

Table 4.1: Power consumption when sorting or retrieval process occur at parking lot 1 66

Table 4.2: Power consumption when sorting or retrieval process occur at parking lot 2 66

Table 4.3: Power consumption when sorting or retrieval process occur at parking lot 3 66

Table 4.1: Average time management for each process 69

Table 4.5: Comparison of time management between traditional car parking and automatic car parking system 71

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LIST OF FIGURES

Figure 1.1 Garage Rue de Ponthieu in Paris 2

Figure 1.2 unprofessional parking 4

Figure 1.3 Flow chart of frame work 7

Figure 2.1 Automated parking system (a) Design (b) Storage configuration (c) Type of arrangement 9

Figure 2.2 Design of semi-circular automatic parking system 10

Figure 2.3 Design of semi-circular automatic parking system with separated block building 10

Figure 2.4 Design of vertical automatic parking system 11

Figure 2.5 Design of rectangular automated parking system 12

Figure 2.6 Design of rotary vertical automated parking system 13

Figure 2.7 Design of circular automatic parking system produced by Volkswagen in Germany 14

Figure 2.8 Crane system of automated parking system 15

Figure 2.9 Tower system of automated parking system 16

Figure 2.10 Silo system of automated parking system 16

Figure 2.11 Tower-rotary arrangement type 17

Figure 2.12 Step-stacker arrangement type 18

Figure 2.13 Stacker arrangement type (a) horizontal design (b) cylindrical design 19

Figure 2.14 Arduino Mega 2560 21

Table 2.1 Specification of Arduino microcontroller board 21

Figure 2.15 Bipolar NEMA 17 stepper motor 22

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Figure 2.16 DC motor gear 23

Figure 2.17 IR sensor-based obstacle detection schematic circuit 24

Figure 2.18 Working principle of IR sensor 25

Figure 2.19 Comparison IR sensor and Ultrasonic sensor in distance measurement with different materials. 26

Figure 2.20 Rack and pinion arrangement 27

Figure 2.21 Rack and pinion (a) straight teeth (b) helical teeth (c) roller pinion 28

Figure 2.22 Hydraulic system 29

Figure 2.23 L298N motor driver 29

Figure 2.24 Relay module 1 channel SPDT 31

Figure 2.25 Power MOSFET H-bridge connection 32

Figure 3.1 Control process of the automatic parking system. 38

Figure 3.2: Flowchart of (a) emergency status (b) storage command (c) retrieval command. 38

Figure 3.3 Process flow of the methodology 39

Figure 3.4 Two stepper motor connected with the L298N motor driver 42

Figure 3.5 SPDT Relay connected as H-bridge with Motor gear. 43

Figure 3.6 Block diagram of the automatic parking system 44

Figure 3.7 Full schematic circuit of the automatic parking system 45

Figure 3.8 Arduino IDE software workplace 46

Figure 3.9 Function and control pallete 47

Figure 3.10 Design of the automatic parking system (a) front view (b) top view (c) cross-view 48

Figures 4.1 Graph analysis of time taken for sorting process at parking lot 1 51

Figures 4.2 Graph analysis of time taken for sorting process at parking lot 2 53

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Figures 4.3 Graph analysis of time taken for sorting process at parking lot 3 55

Figures 4.4 Graph analysis of time taken for retrieve process at parking lot 1 58

Figures 4.5 Graph analysis of time taken for retrieve process at parking lot 2 60

Figures 4.6 Graph analysis of time taken for retrieve process at parking lot 3 62

Figures 4.7 Example of timing belt attached to pulley with used in parallel Conveyor 64

Figure 4.8 Graph analysis of power consumption when perform tasks at parking lot 1 67

Figure 4.8 Graph analysis of power consumption when perform tasks at parking lot 2 67

Figure 4.8 Graph analysis of power consumption when perform tasks at parking lot 3 68

Figure 4.11 Flow of automatic car parking process 69

Figure 4.12 Front panel control of LabView for Automatic parking system for one part of single lifting platform 71

Figure 4.13 Dual lifting platform of automatic car parking system 72

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CHAPTER 1

INTRODUCTION

1.0 Introduction

In this chapter, it provides an information regarding automatic parking system evolution from the first design in the year 1905 in Paris until now. It's have been long topic debate by researchers to improve the system which evolves from semi-automatic follow by fully automatic, until recently which become an intelligent system or robotic. The outcome objective and scope of this project will benefit the citizen which made living in a crowded city such as Kuala Lumpur, Malaysia. This project is expected to solve the problem including the requirement of land spaces, time-saving, and parking issues such as unprofessional parking, small accident, etc. Furthermore, it will convert the traditional parking system into more reliable and efficient system while providing better cost-effective to invest, at the same time will boost the economics of the surrounding area.

1.1 Background of the project

The automatic parking system is new technology to replace existing traditional parking system that will solve numerous problem includes less land requirement, user-

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friendly and more parking spaces provided. As the global technology is growing year by year to more advanced level, it not possible for the technology that exists nowadays to be used for developing automatic parking system to improve the system redundancy of existing traditional parking system. Furthermore, a research predicted that total income that comes from automated parking system will generate up to $356.5 million or RM1386.81 million yearly by 2020 globally according to(Jog, Sajeev, Vidwans, & Mallick, 2015). Thus, it will benefit the country due to able give high income with huge profit simultaneously solve the lack of public parking issues.

Automatic parking system or automatic garage not generally new idea or concept but already been first introduced. Garage Rue de Ponthieu situated in Paris develop by architect Auguste Perret was the long establish mechanical parking system that has been acknowledging which build in the year 1905 for storage vehicles at first or second floor according to the book, Mechanical Parking Guide was written by Hamelink (2011). Although the first build garage was semi-automated which required the worker to park manual and have lifting system in the centre to lift the vehicles to the upper level, it resembles most of the existing automatic parking system concept nowadays.

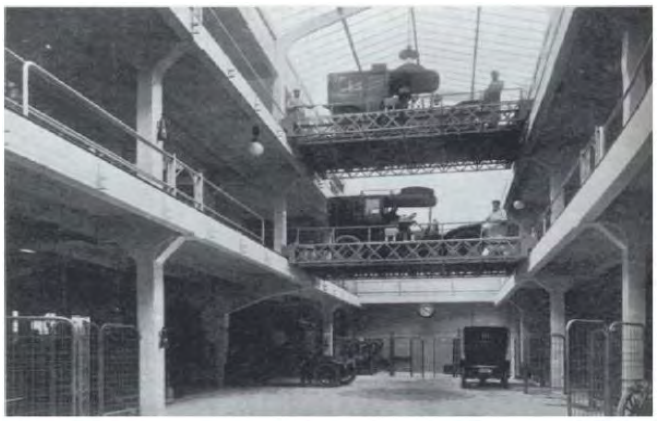

Figure 1.1: Garage Rue de Ponthieu in Paris (Hamelink, 2011)

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The prototype will consist of a mechanical system to store and retrieval of vehicles into or out of the parking spaces provided. It will have a centre lift to perform the task and automatically check for which parking spaces available after the driver leaves their vehicles at the base centre platform and store the vehicles. When the driver returns, the control system will command the centre lift to retrieve and return the vehicles back to the owner safely. As cylindrical or circular shape prototype is chosen, it will use silo type system for storage configuration which will use robotic arm or platform as lift mechanism. The rack and pinion will also integrate into the lifting mechanism for smooth and easier movement while at the same time able to carry the payload caused by the vehicles. Due to cylindrical shape is chosen, the centre lift will rotate for storage and retrieval process which make the automatic parking system more effective.

The safety features will add to increases its functionality and avoid unpredictable event to occur by using the PIR sensor to detect any living motion on the centre lift before the storage and retrieval process able to continue.

1.2 Statement of the problem

The automated parking system is a system which provides more spaces for parking and safety features to help improve the life of a citizen in a crowded city such as Kuala Lumpur, Malaysia. Its assists the citizen by fully automatic park their vehicle to available vacant parking slot, thus reduce time consumption to search for availability vacant parking spaces which the traditional parking building that mostly used this day as shown in **figure 1.2**.

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Figure 1.2: unprofessional parking

A lot of research has been made to improve this problem by switching this traditional parking to Automated parking system which more efficient and safe to be used for all citizen. According to book with the title “Mechanical Parking Guide” written by Leon Hamelink, the fully automatic parking system better than traditional, because it provides more benefit include flexibility in term of shape design, vehicles are more secure against damage, theft, and burglary. It helps the driver to park their vehicle effortless and reduce the incident that mostly occurs during parking which could damage their or another vehicle if not properly park in the parking slot.

1.3 Objective

The objective of the research project as stated below:

a) To design the multi-storey automatic parking system prototype that using cylindrical design with stacker type of arrangement.

b) To develop a prototype of multi-storey automatic parking system that storage configuration used the robotic arm as centre lifting mechanism.

c) To testing and analyse energy consumption and time management for automatic parking system.

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1.4 Scope

The scopes of this research include:

a) Design circular shape disc for each level of parking using prospect plexiglass plastics with an outer circle radius, 14cm and inner circle,7cm in Solidworks software.

b) Design the robotic arm with a platform for lifting mechanism situated at the centre of the prototype with a height of 31.77cm in Solidworks software.

c) Develop and assemble each part need for parking spaces which in circular shape disc and lifting mechanism into a complete single prototype using bolt and nut with a gap between each floor level are 7cm.

d) The prototype is testing and analyses to obtain data comparison between traditional parking and automatic parking system regarding land benefit on spaces, cost-effective and time-saving.

e) The entry and exits only through single lifting mechanism in silo system which used the single robotic arm to sort or retrieval process that will cause system redundancy to be high. Thus, the research will improve the lifting mechanism in silo system to reduce system redundancy.

f) The research will improve existing cylindrical or circular shape of automatic parking system to more cost-effective design, less land requirement and utilize more parking spaces each level.

g) The paper will compare between traditional parking and automatic parking system which will solve the problem of lack and inefficient parking building issues, thus help citizen to reduce their time for finding parking spaces, dealing with unprofessional parking ethic, etc.

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h) The automatic parking system will provide well-managed power consumption will help to reduce cost operation which better compares to traditional parking system that constantly needs lightning in each parking area either the floor parking area have vehicles or not.

1.5 Organization

This research organized into 5 main chapter which provide information regarding this project prototype. Chapter 1 is introduction that briefly explain about research background, problem statement, objectives and scope of this research include with rational research and summary of the methodology. Chapter 2 is the literature review that explain the related work done by previous researchers which include design of the automatic parking system, storage configuration and type of arrangement to utilize spaces as possible for parking. It helps to compare which design that more close to realize the objective and scope of this research. Chapter 3 will explain the methodology of this research in detail which include material used for building the prototype, simulation of the design in Solidwork software, schematic circuit, programming used to control the process, etc. Chapter 4 will give the results analysis and discussion of this research. The data collected from prototype will be analyse and compare with traditional parking to determine the research realize it objective. Lastly, Chapter 5 represent conclusion and recommendation where conclude the findings of this research and future improvement that can be done.

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