

SMART PARKING SYSTEM USING LABVIEW

MUHAMMAD NAZIR BIN MAT ISA

This report is submitted in partial fulfillment of the requirements for the award of
Bachelor of Electronic Engineering (Industrial Electronics) With Honours

Faculty of Electronic and Computer Engineering
Universiti Teknikal Malaysia Melaka

April 2009



UNIVERSITI TEKNIKAL MALAYSIA MELAKA
FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER

BORANG PENGESAHAN STATUS LAPORAN
PROJEK SARJANA MUDA II

Tajuk Projek : **Smart Parking System Using LabVIEW**
Sesi Pengajian : **2008/2009**

Saya **MUHAMMAD NAZIR BIN MAT ISA**

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)

Alamat Tetap: 1097, JALAN 18/45,
 TAMAN SRI SERDANG,
 43300, SERI KEMBANGAN,
 SELANGOR D.E.

Tarikh: 30 APRIL 2009

Tarikh: 30 APRIL 2009

“I hereby declare that this report is the result of my own work except for quotes as cited in the references.”

Signature :

Author : MUHAMMAD NAZIR BIN MAT ISA

Date : 30-APRIL-2009

“I hereby declare that I have read this report and in my opinion this report is sufficient in terms of the scope and quality for the award of Bachelor of Electronic Engineering (Industrial Electronics) With Honours.”

Signature :

Supervisor Name: YUSMARNITA BT YUSOP

Date : 30-APRIL-2009

Dedicated to my beloved family especially my parent, lecturers, and all my friends

ACKNOWLEDGEMENT

First of all, I am greatly indebted to Allah SWT on His blessing to make this project successful and completely done in proper I would like to gratitude and express my appreciation to all organizations and individuals who have kindheartedly contributed to my final year project in Universiti Teknikal Malaysia Melaka (UTeM). With the cooperation from all parties, the objectives of the project were achieved precisely to the expected outcome. Additionally, I would like to give a honored thanks to Mrs.Yusmarnita bt. Yusop for supervise me with the proper guidance and full cooperation in any phase of the project especially in solving the problems that occurs from first to last of my final year project. Furthermore, I would like to thanks to my parents and family who have support me for all this years with their love and caring in term of moral, financial and advice through this project. Lastly, my appreciation goes to my fellow links in UTeM, especially from FKEKK Industrial Electronics department and all beloved friends. Their compliance in giving suggestions and technical support are valued while doing upon completion of my final year project. This project has achieved all the objectives and successfully done.

ABSTRACT

This project is about designing a PC-based monitoring parking system that can be applied at parking area such as at the shopping complex and offices. This project focuses on the development of front panel using National Instrument's LabVIEW software, Personal Computer (PC) and Data Acquisition (DAQ) card. The conventional car park system does not have display panel and it cannot show the vacancy of parking lot. The user has to gamble to seek any vacancy and have to wait for the other car to exit from the parking lot. By improving the conventional parking system, it will make the parking lot become well organized and user friendly. This project will create a car detecting system by develop a PC-based front panel of car park operation data. The system will convert the output from sensor to the programmable language to the PC-based display panel. The purpose of display panel is to show the status and parking lot vacancy. The DAQ is used to provide interfacing between hardware and software. By using LabVIEW, the simulation of the physical system can be developed to monitor the quantities to be measured and status of the equipment in the plant from remote point without accessing the inaccessible areas of the plant. Through improving the conventional parking system using LabVIEW, the front panel is successfully developed and explained by designing a physical model of parking lot with car detector operation. This PC-based monitoring systems can be applied in various industrial applications such as building security system and factory automation.

ABSTRAK

Projek ini membincangkan reka cipta sebuah sistem tempat meletak kereta berkomputer yang akan digunakan pada kawasan meletak kenderaan seperti di kompleks membeli-belah dan pejabat-pejabat. Projek ini tertumpu kepada pembangunan sistem kawalan dengan menggunakan perisian National Instrument's LabVIEW, komputer peribadi (PC) dan Pemerolehan Data(DAQ). Sistem letak kereta yang biasa digunakan tidak mempunyai panel paparan dan tidak boleh menyatakan kekosongan tempat meletak kereta. Para pengguna perlu mencuba sama ada terdapat kekosongan tempat meletak kereta atau tidak dan perlu menunggu kereta yang lain untuk keluar dari tempat tersebut. Dengan membuat penambahbaikan kepada sistem asal boleh mejadikan sistem meletak kenderaan ini lebih teratur dan mesra pengguna. Projek ini melibatkan sistem pengesan kereta melalui penggunaan panel paparan berkomputer. Panel paparan direka untuk menayangkan status dan kekosongan lot tempat letak kenderaan. DAQ digunakan untuk menghubungkan antara peralatan dengan perisian. Melalui perisian LabVIEW, simulasi untuk sistem fizikal boleh dicipta untuk mengawal kuantiti sesuatu ukuran dan status peralatan tanpa perlu memasuki tempat kawalan tersebut. Dengan penambahbaikan kepada sistem meletak kenderaan secara perisian LabVIEW ini, panel paparan telah berjaya dihasilkan dan diperincikan melalui model fizikal parkir kenderaan yang lengkap dengan operasi pengesan kenderaan. Kaedah sistem kawalan berkomputer seperti ini boleh diaplikasikan kepada pelbagai industri seperti sistem sekuriti bangunan dan automasi industri.

TABLE OF CONTENTS

CHAPTER	CONTENTS	PAGE
	PROJECT TITLE	i
	VERIFICATION FORM	ii
	DECLARATION	iii
	ACKNOWLEDGEMENT	vi
	ABSTRACT	vii
	ABSTRAK	viii
	TABLE OF CONTENTS	ix
	LIST OF FIGURES	xiv
	LIST OF ABBREVIATIONS	xv
I	INTRODUCTION	1
	1.1 Project Background	1
	1.2 Objectives of Project	3
	1.3 Problem Statement	3
	1.4 Scope of Project	4
	1.5 Thesis Outline	6
II	RESEARCH BACKGROUND	7
	2.1 Study on Parking Lot Occupancy Tracking System	7

2.2	Study on PC-Based Automated Systems Using National Instrument's LabVIEW Software Package and Data Acquisition (DAQ) Card	9
2.3	Study on Sunway Pyramid Shopping Complex Parking	11
2.4	Study on DAQ	13
2.5	NI USB-6008	15
2.6	Metal Detector	17
III	METHODOLOGY	18
3.1	Project Methodology	18
3.2	Operation Flow Diagram	20
IV	RESULT AND DISCUSSION	21
4.1	First Stage Result: Development of LabVIEW's VI Front Panel	21
4.2.1	Discussion	26
4.2	DAQ Interface Setup	26
4.2.1	Analyze Analog Output	28
4.3	Car Park Model	31
4.3.1	Metal Detector Circuit	32
4.4.2	Light Indicator Circuit	34
4.4	Second Stage Result: Development Of Display Panel and Hardware	36
4.4.1	Discussion on Block Diagram Description	42

V	CONCLUSION AND RECOMMENDATION	44
	5.1 Conclusion	44
	5.2 Recommendation	45
	REFERENCES	47
	APPENDIX A	48
	APPENDIX B	49
	APPENDIX C	50
	APPENDIX D	51
	APPENDIX E	52
	APPENDIX F	53

LIST OF FIGURES

NO	TITLE	PAGE
1.1	Real Implementation Concept Diagram	2
2.1	Parking Vacant Diagram Using GUI Interface	8
2.2	Concept Diagram of Automatic Car Parking System	9
2.3	Data Flow Diagram of Automatic Car Parking System	10
2.4	Car Detector and Light Indicator Implemented in Sunway Pyramid Shopping Complex Parking	11
2.5	Light Indicator Turned On When Car Entered the Parking Lot	12
2.6	Position of Light Indicator and Car Detector in Parking Box	12
2.7	6534 I/O Connector, 68-Pin Assignments	13
2.8	Example of DAQ System Block Diagram	14
2.9	the NI USB-6008 DAQ	15
2.10	Example of Metal Detector Circuit	17
3.1	Project Flowchart Diagram	19
3.2	The Operation Flow Diagram for Parking System Block Diagram	20
4.1	LabVIEW Front Panel Display	21
4.2	The Front Panel before the Data is Transferred.	23
4.3	Executed Front Panel	24
4.4	VI block Diagram	25

4.5	Signal Label Application Diagram	27
4.6	Connection Diagram for DAQ	28
4.7	DAQ Assistant Configurations	29
4.8	Connections for DAQ	30
4.9	Car Park Model	31
4.10	Metal Detector Schematic Diagram	33
4.11	Metal Detector Circuit	34
4.12	Light Indicator Circuit	35
4.13	Initial Condition of Front Panel	37
4.14	Initial Condition of Parking Lot Model	37
4.15	Front Panel Display after 2 Cars Entered and 2 Reserved Parking	38
4.16	Parking Lot Model after 2 Cars Entered the Parking Lot	39
4.17	Front Panel Display after All Parking Lots Are Entered	39
4.18	VI Block Diagram of Parking System	40
4.19	VI Block Diagram of Single Parking Lot System	41
4.20	VI Block Diagram of Status Display	41

LIST OF TABLES

NO	TITLE	PAGE
4.1	Analog Terminal Assignments	27
4.2	The Connection of DAQ Terminals	30

LIST OF ABBREVIATIONS

DAQ	Data Acquisition
EMF	Electromotive Force
GUI	Graphical User Interface
GPS	Global Positioning System
HMI	Human to Machine Interfaces
LabVIEW	Laboratory Virtual Instrumentation Engineering Workbench
LED	Light Emitted Diode
NI	National Instrument
PC	Personal Computer
RFID	Radio Frequency Identification
USB	Universal Serial Bus
VI	Virtual Instrument

CHAPTER I

INTRODUCTION

In this chapter will introduce the main concept and explanation on the objectives of the project. The problem statement explains the project significant and gives the idea on real time application. The main element of the project is discussed in scope of work and showed the common structure of this project.

1.1 Project Background

The conventional car park system does not have display panel and it cannot show the vacancy of parking lot. User has to gamble to seek either there are any vacancy or not. By developing a parking system that includes a vacancy display can help the user to park their vehicle.

The Smart Parking system is electronic applications that improve the conventional parking system by using sensor and display panel using Graphical Programming Language software.

The goal of this project is to design a PC-based monitoring parking system for applied on parking lot. The improvement of the conventional parking system will make the parking lot become well organized and user friendly. This project will create the virtual sensor operation system by develop the LabVIEW front panel of car park operation data. The system will convert the output from sensor to the programmable language to the PC-based display panel by using the DAQ that can interface between hardware and software. The concept of this project illustrated in Figure 1.1.

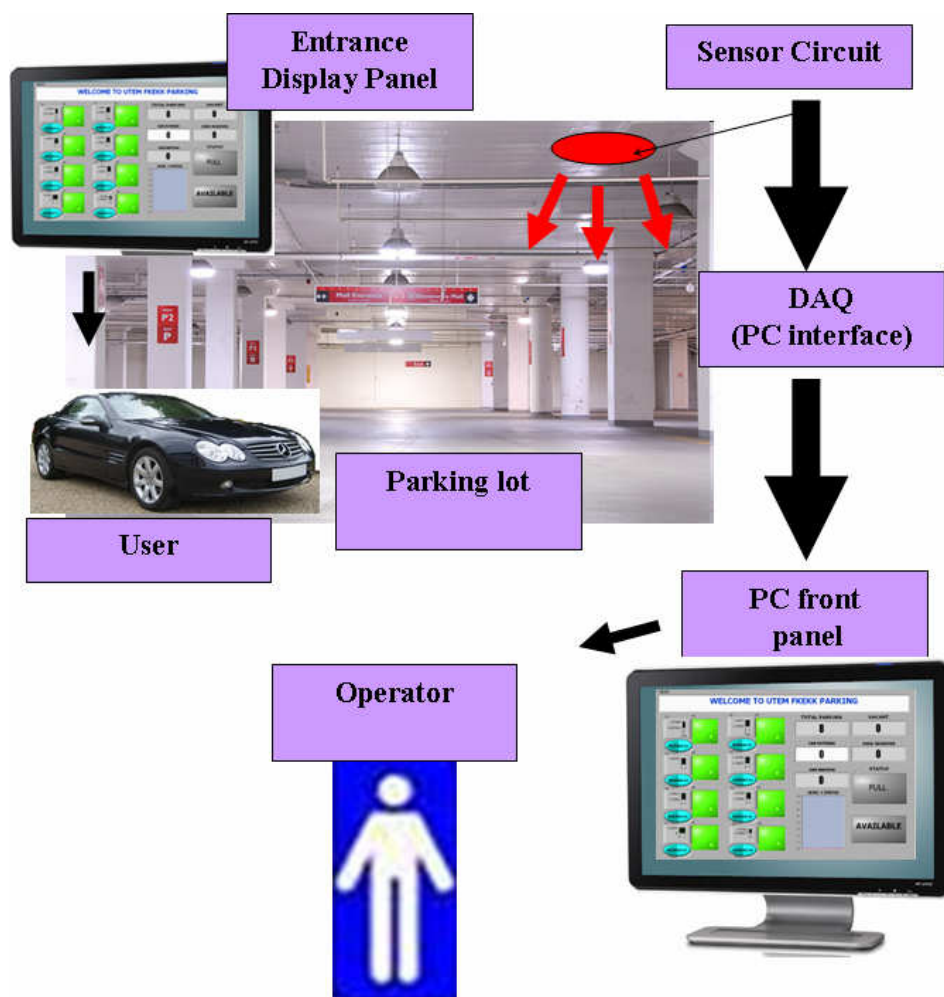


Figure 1.1 Real Implementation Concept Diagram

1.2 Objectives of Project

The aims of doing this project are stated below;

- (a) To assemble a circuit that using metal detector to detect object (car).
- (b) To develop front panel using National Instrument's LabVIEW software
- (c) To design a model of car park system that includes electronic circuit, DAQ, and Front panel monitoring system.

1.3 Problem Statement

The conventional car park system does not have display panel and it cannot show the vacancy of parking lot. User has to gamble to seek any vacancy or not. To ease the user, this project proposed a parking system that able to display the availability of parking lot by display a front panel using LabVIEW software. By using this system, the user can analyze the status of total car entered and the details of parking lot vacancy. Furthermore, this project can assist the company by monitoring the parking lot system from control room so that it improves the security level and ease the guard duties

The car park status can be shown on the LabVIEW front panel simultaneously after the detection of metal detector circuit. The vacancy of parking lots can be shown in front panel accurately with the actual car quantity and display total car quantity, vacant, status, and used parking lot quantity. This operation detail will be explained in the chapter of Results and Discussions.

1.4 Scopes of Project

This part discuss about the elements that involved in this project. In this project, the scope is based on five main parts. They are:

(a) **LabVIEW Graphical Programming Software**

LabVIEW is selected to create the interactive of the Virtual Output which is called Front Panel. The Front Panel will display the status and vacancy of parking lot. This PC based automated systems can be applied in various industrial applications such as, high-rise building security system, automatic car parking system and factory automation.

(b) **Data Acquisition (DAQ)**

DAQ device is used to interface the signal from the Electronic Circuit and link it to the PC. Data is interfaced with LabVIEW's front panel and then viewed on the computer screen. The operation of DAQ consist of interface the signal to PC operation .The electrical signals either analogue or digital forms are then applied to the PC through DAQ card. The PC will then do the necessary processing and send the output signals to the protective devices or related equipment/machinery through the same DAQ card. A computer program is required to develop to receive the signals from the transducers through the DAQ card, process the signals and send the output signals to the protective devices or equipment/machineries to be controlled.

The typical factory floor is a mix of sensors, actuators, relays, motors, wires, and controllers working together as an interdependent system. Running an efficient plant involves promptly troubleshooting malfunctions and constantly evaluating plant efficiency by monitoring machine vibrations, capturing digital events, and trending temperature and pressure data. Along with 24 V digital signal levels, 4 to 20 mA analog signal levels, and galvanic isolation for safety, industrial applications require a

measurement system with high-speed, accurate analog input; fast data logging; and analysis capabilities. They also need a permanently installed efficiency monitoring system and a portable diagnostic system for troubleshooting.

Programmable logic controllers (PLCs) traditionally used for plant control do not offer the high-speed I/O required for diagnosis and monitoring tasks. Instead, a USB-based measurement system with industrial I/O levels and high data throughput can make demanding measurements, including dynamic machine condition monitoring. The USB type can be used for short-term diagnostic systems that require quick and easy setup and also can permanently install USB data acquisition systems where industrial PCs or Human to Machine Interfaces (HMIs) with USB ports are available.

Since its release in 1996, USB has become the standard bus for connecting to computer peripherals, and today, it is readily available on industrial PCs, single-board computers, and touch panel HMIs. USB also offers a unique mix of ease of use, high performance, and reliability and security.

(c) **Electronic Circuits**

The electronic circuit consists of sensor that detects the car when it enters the parking lot. Relay will be used to delay the time for car to enter the parking lot for 4 second. It is because to make the conformation of the car to park at that parking lot. The type of sensor is EMF(electromotive force) sensor that can detect the EMF that have in every car such as metal detector.

(d) **Car Park Model**

The car park model shows the real operation of the system by making a simulation operation using car model. It consists of 2 level of parking. The model of parking lot has metal detector circuit, car model, parking level building, and display panel.

(e) **LabVIEW VI Front Panel**

The front panel is constructed by using LabVIEW 8.5 version provided by National Instrument. The vacancy of parking; lot represent as LED light in the VI block diagram. The DAQ will transfer the output signal from metal detector to pc using DAQ card. The system will be monitored by operator or person from control room for security precaution. The front panel will be displayed at the main entrance and in the shopping complex so that it can inform the user every time. The real implementation concept of this project is shown in Figure 1.2 below.

CHAPTER II

RESEARCH BACKGROUND

This chapter will review about existing project created to get an idea about the project design, conception and any information that related to improve the project. With different concept and design, there are other creations and innovations of projects done by other people. Researches related to this project also covered in this chapter. Other than that, the study on the scope of work is also done in this part such as study on the Data acquisition (DAQ) and sensor circuit.

2.1 Study on Parking Lot Occupancy Tracking System

For this project, it design a system that can be deployed in existing parking structures which would provide information about available parking spaces to drivers trying to access the facility. The system will include software, sensors and the networking components. The installation of permanent sensors in each parking space will provide lot owners with constant and accurate information on parking lot occupancy. This allows them to keep the lot at full capacity and serve customers need. In addition, a list of members provided to the system by the building owner will be used to grant or not access to the facility. The system will make use of electronic signs to give

drivers, information regarding parking availability before they enter the facility. Once inside, color coded LED displays will lead motorists to the vacant spaces. Parking spaces can be made unavailable by the building manager bypassing the sensors. This and other configuration options will be made available through a GUI interface. [6]

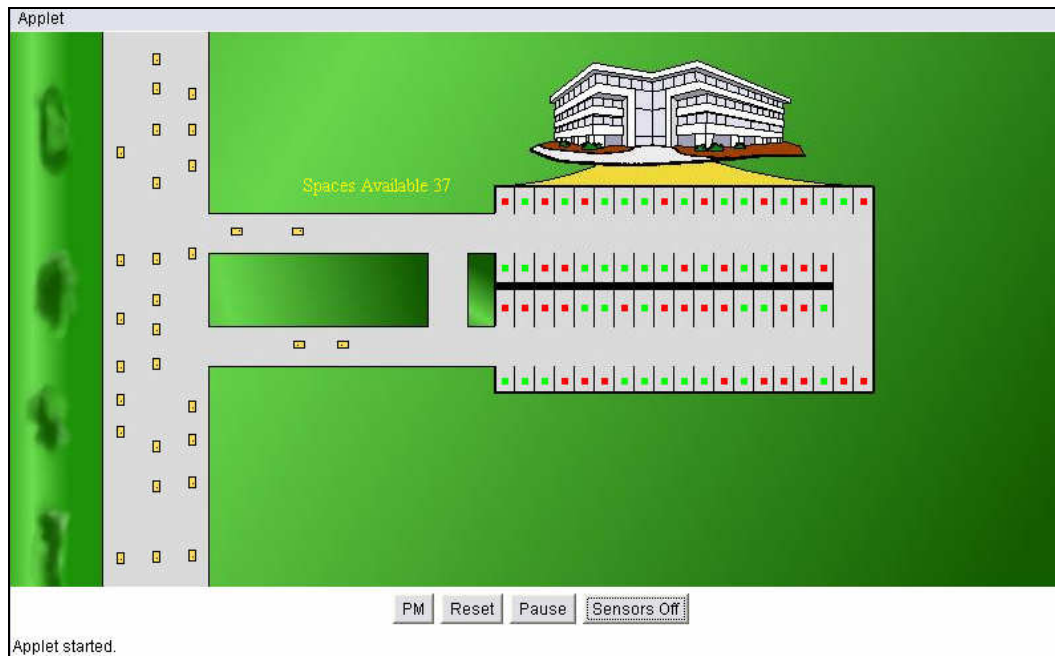


Figure 2.1 Parking Vacant Diagram Using GUI Interface [6]

This project is using GUI system, so it is totally different with proposed parking system. But the idea of using LED for the sign of vacancy is used in LabVIEW front panel. The idea of system operation is exactly the same, can display the vacancy through the display panel. This idea can be implemented to the level parking system such as at the shopping mall and office building.

2.2 Study on PC Based Automated Systems Using National Instrument's LabVIEW Software Package and Data Acquisition (DAQ) Card

In this thesis the author, R N. Roy has automated the system to make car parking completely automatic. Pressure sensors have been installed at the entry and exit gate to sense the car waiting for entry or exit and give input signals to the computer to count the number of vehicles entering and leaving the park respectively.

The number of cars available in the park will be the difference of the number of vehicles entering and the number of vehicles leaving. When a car approaches to the entry gate, computer will decide whether any space is available or not. If no space is available, the computer will then send signal to entry gate to keep the gate closed and also to the monitor to display the message "Car Park Full". If there is space in the park, the user will enter his car number in the keyboard located at entry gate and the entry gate will open to allow the car to enter the park. The computer will then store the number of the car and the time of entering into the park in the database. [7]

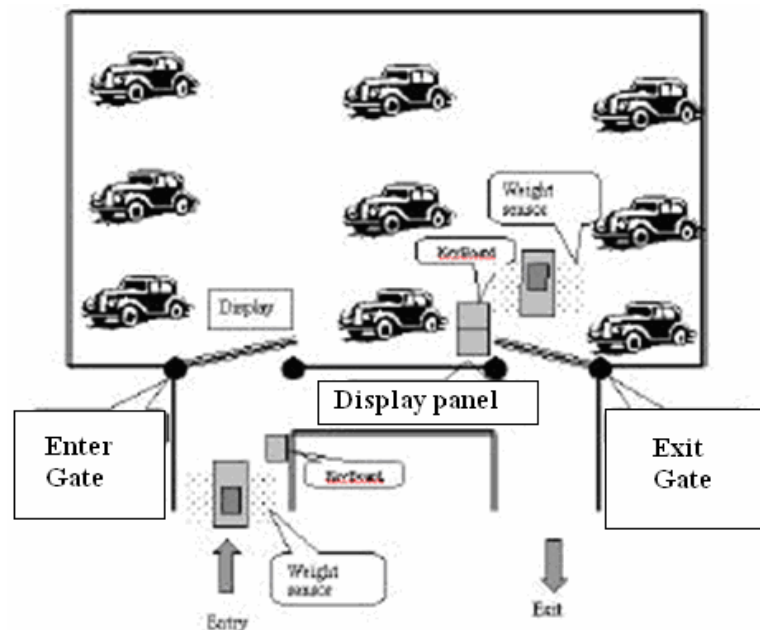


Figure 2.2 Concept Diagram of Automatic Car Parking System [7]