PARKING SYSTEM USING LABVIEW WITH SMS APPLICATION

LEE LIU HUI

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Dedicated to my beloved family especially my father and mother, lecturer,

and friends

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ABSTRACT

This project is about designing a PC-based monitoring parking system that can be applied at parking area such as at shopping complex and offices. This project focuses on the development of front panel using National Instrument's LabVIEW software, Personal Computer (PC), GSM Modem and Data Acquisition (DAQ) card. The conventional car park system does not have display panel to show the vacancy of parking lot, while the current project only functions to display the availability of parking lot to users. Thus, one of the objectives in this project is to develop two front panels for both users and company. It will ease the company to access the information about parking lot in detail which might include total vehicles in and out daily or even monthly, total income gained by the company and so on. Besides that, the current project will be upgraded so that it's more power-saving as the sensor of consecutive levels of parking area will only be activated after the previous level is full-parking. Next, the system is more user-friendly after adding an "ASSISTANCE" button to it. Other than that, this project will create the virtual sensor operation system by developing 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 which acts as interface between hardware and software. When the "ASSISTANCE" button at the entrance is pressed by those who encounter problem such as system error, SMS will be sent to the operator in charge through interfacing between the PC and mobile phone by GMS modem. AT commands is used for controlling the functionality of modem. In this project, two front panels are 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 boleh diaplikasikan di kawasan meletak kenderaan seperti yang di kompleks membeli-belah dan pejabat-pejabat. Projek ini tertumpu kepada pembangunan sistem kawalan dengan menggunakan perisian *National Instrument's LabVIEW*, komputer peribadi (*PC*), modem *GSM* dan pemerolehan data (*DAQ*). Tempat meletak kereta yang biasa tidak mempunyai skrin paparan untuk menunjukkan bilangan tempat kosong manakala projek yang sebelum ini cuma dapat berfungsi untuk menyelesaikan masalah ini sahaja. Oleh sebab itu, salah satu objektif projek ini ialah untuk menghasilkan dua skrin paparan untuk pengguna dan kegunaan syarikat. Ini akan menyenangkan pemilik untuk mengekseskan data tentang tempat meletak kereta yang terperinci seperti jumlah kereta masuk dan keluar setiap hari ataupun bulan, jumlah pendapatan dan sebagainya. Selain itu, projek yang sedia ada akan diubahsuaikan supaya lebih menjimatkan pengunaan tenaga elektrik kerana pengesan kereta pada tingkat seterusnya cuma akan diaktifkan apabila tingkat sebelumnya penuh dengan kereta. Di samping itu, sistem ini menjadi lebih mesra pengguna selepas butang "BANTUAN" ditambah. Projek ini melibatkan sistem pengesan kereta melalui penggunaan panel paparan berkomputer. Apabila butang "BANTUAN" di laluan masuk ditekan oleh mereka yang menghadapi masalah seperti kesalahan system, *SMS* akan dihantar kepada pengawal bertugas melalui perhubungan antara computer peribadi dengan telefon bimbit oleh modem *GMS*. Perintah AT digunakan untuk mengawal fungsi modem. Dalam projek ini, dua skrin paparan telah berjaya dihasilkan dan diperincikan melalui model fizikal meletak kenderaan yang lengkap dengan operasi pengesan kenderaan. Kaedah sistem kawalan berkomputer seperti ini boleh diaplikasikan kepada pelbagai industri seperti sistem keselamatan bangunan dan automasi industri.

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LIST OF ABBREVIATION

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

USB   –   Universal Serial Bus

VI   –   Virtual Instrument

CHAPTER I

INTRODUCTION

In this chapter, the main concept and explanation on the objectives of this project will be introduced. The problem statement explains the project significant and gives the idea on real-time application. The main elements of this project are discussed in the scopes of work and the common structure of this project will be explained as well.

1.1. Introduction of Project

The conventional car park system does not have display panel and thus the vacancy of parking lot can not be shown. User has to gamble to seek whether there has any vacancy or not. By applying the existing parking system done by senior, availability of the parking space can be displayed in helping the users to park their vehicles. However, it needs to be further improved to turn it into a more user-friendly and multi-features system.

The Smart Parking System is an electronic application that improves the conventional parking system by using sensors and display panel developed through Graphical Programming Language software. Wired-sensor based technology is used in this car park guidance system.

Mobile Phone	GSM Modem	DAQ Device
PC Front Panel (LabVIEW)		Electronic Circuit
For operator	For users	
Operator-in-charge	User	Car park
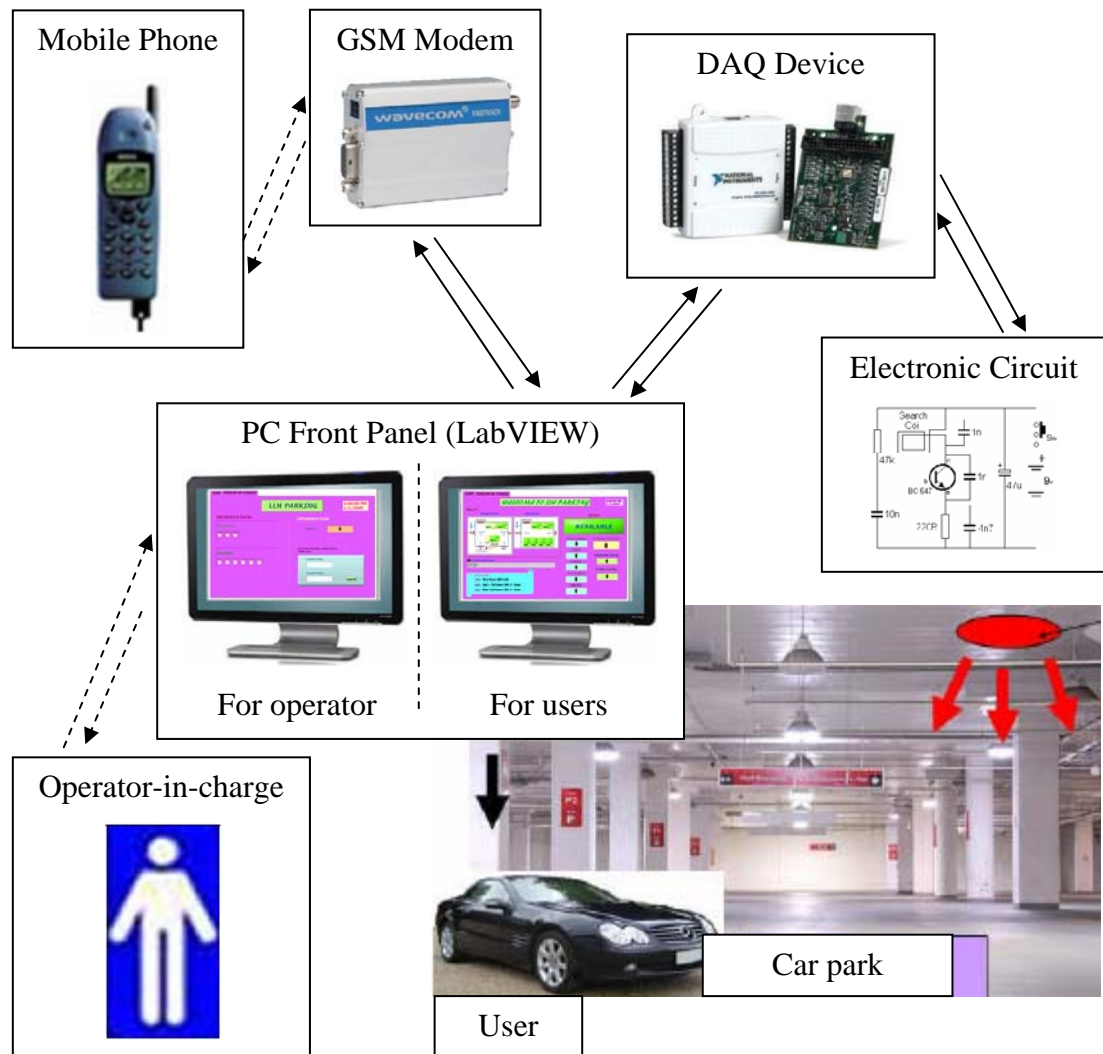
Figure 1.1: Real Implementation Concept Diagram

The goal of this project is to design a more advanced and multi-features PC-based monitoring parking system to be applied at any conventional car park. Car park monitoring system of this project will be upgraded so that it is more power saving and provides assistance to the users though SMS application by using GSM modem. Besides that, reservation feature for users and log-in features for the owner of car park with the additional display panel are added too in this upgraded system.

Improvement done to the conventional and existing parking system will make the parking lot become well-organized and more user-friendly. This project will create the virtual sensor operation system by developing the LabVIEW front panel of car park operation data. The system will convert the output from sensors to the

programmable language to the PC-based display panel by using DAQ interfacing device. The concept of this project is illustrated in Figure 1.1.

Different from other existing systems and projects, it is created by using LabVIEW software, which is a graphical programming software rather than conventional programming software. It is more user-friendly and its development is close to user's idea. Besides that, most of the existing car park shows users the availability of parking space through built-up signboard at the entrance of the car park. It only shows the number of vacancy and arrow to the direction desired. First-time viewing to the layout of a car park is not provided.

1.2 Objectives of Project

The objectives of this project are stated as below:

(a) To develop front panels for users and company using National Instrument's LabVIEW software.

(b) To interface the electronic circuit with the PC-based system through DAQ device.

(c) To interface PC-based system with mobile phone through GSM modem to provide assistance for users by using SMS notification.

(d) To upgrade the current model of car park system and the electronic circuits in order to save power consumed.

1.3 Problem Statement

There is only one front panel in the existing project done by senior, which displays the availability of parking lot to users but does not show or provide other information in details to the owner of car park. Thus, another front panel will be created specially for owner to access the information such as total of car in and out of the parking area daily, weekly or even monthly, total income gained and so on in this project. This can not only provide convenience to the owner, but also can assist to

monitor the parking lot system from control room so that it improves the security level.

Next, the current project does not provide any facility in case of system error occurred or the users need some guides or assistance when there is no operator around. Hence, an "ASSISTANCE" button will be added at the entrance of the parking area in this project where the user can press it when need. After the button is pressed, a SMS will be sent to the operator in charge through the interfacing between PC and mobile phone by GSM modem. After that, a reply message will be send back by the operator where the content of the SMS will be shown at the display panel for user as a reply of confirmation of receiving the message. Because of this feature, this system is more user-friendly.

Lastly, the non-parking (green) indicators of all parking levels in the existing project are always light on. In this project, these sensors of consecutive levels of parking area will only be activated after the previous level is full-parking. Compared to the current project, it is more power-saving.

1.4   Scope of Works

This part discusses about the elements involved in this project. In this project, the scope is based on six main parts. The scopes of work in this project are:

(a)   **LabVIEW software** is used to create the front panel of virtual instrument. Two front panels will be created in this project where one of them will display the status and vacancy of parking lot for user while another one will show some useful information such as total amount of car entering, total income and so on to the owner of the car park. The second display panel will be used by operator in charge to make reservation of parking space for users who require.

(b)   **DAQ** is a data acquisition unit that used as an interface between hardware and software. In this project, DAQ will be used to transfer the output signal from electronic circuit to PC using DAQ card. The results are then viewed on the computer screen.

(c)   **GSM modem** is used to interface the PC with mobile phone. SMS will be sent to the operator in charge in case users encounter problem about the system. This function is achieved by pressing an "ASSISTANCE" button at the entrance of the car park. AT commands is used to control the functionality of modem.

(d)   **Mobile phone** is used by operator of the car park to receive SMS which informs that problem encountered by user. Besides that, it is used by the operator too to send out a SMS to the display panel for user as a reply of confirmation of receiving the message.

(e)   **Car park model** shows the real operation of the system by making simulating operation using car model. It consists of several levels of parking, has metal detector circuit, car model, parking level building and display panels.

(f)   **Electronic circuit** consists of sensor that detects car at the entrance and exit of a car park as well as at each parking space. Indicators with different colors are used to show the status of a parking lot – green for available and red for unavailable. EMF (electromotive force) sensor can detect the EMF that has in every car such as metal detector. Relay is used to trigger the circuit from one condition to another condition. In this project, the non-parking sensors of consecutive levels will only be activated after the previous level is full-parking.

1.5 Brief Explanation of Methodology

First of all, this project is begun by having a discussion with supervisor about the general ideas and concepts that would be used in this project. Next, for literature review stage, the background of this project is studied and research is done by referring various sources such as reference book, I.E.E.E journals, website of National Instrument and data sheet. In the following stage, all the information related to components, DAQ, GSM modem information is searched where the most suitable would be selected to be used in this project. Next, the LabVIEW programming is studied; the front panel of virtual instrument is created and simulated. Hardware interfacing would be studied on the following stage. After that, the hardware for this project is built and assembled; and the system is ready for overall system testing. If the desired outputs of this system fulfill the project requirements and specification, this project is considered success. Otherwise, troubleshooting would need to be carried out until it reaches the project requirements.

1.6 Report Structure

This report is documentary delivering the ideas generated, concepts applied, activities done, and finally the product of project itself. It consists of five chapters. Followings are the chapter-by-chapter description of information in this report.

Chapter 1 gives readers a basic introduction on how the idea of this project is generated. This chapter consists of introduction, objective of the project, problem statement, scopes of work, brief methodology and the report structure.

Chapter 2 is a literature review on theoretical concepts applied in this project and some of the related conceptual information for project improvement. This chapter includes background study of several car parks in Malaysia, PC-based monitoring system and related specification of project. Other than that, introduction to the LabVIEW, DAQ device, GSM modem and application of others component as well as the reason of choosing them are explained too in this chapter.

Chapter 3 introduces the methodology of the project. The chapter contains the flow chart which explains the overall method taken along the development and implementation of this project. Besides that, software development of the project which is created by referring to the desired sequence in the designed state diagram will be introduced too.

Chapter 4 discusses about the outcome of this project. Besides the result obtained, discussions on the problems encountered throughout the designing process will be explained too.

Chapter 5 will be the conclusion of this PSM project where objectives of the project are answered according the results obtained. This chapter includes some recommendations that can be implemented for future project improvements too.

CHAPTER II

RESEARCH BACKGROUND

This chapter will review about existing projects and systems created to get an idea about the project design, conception and any information that related for improving the project. It is due to variety of creations and innovations of projects available with different concept and design done by other people. Researches related to this project are also covered in this chapter. Other than that, study on elements included in the scope of work is also done in this part.

2.1   Study on LabVIEW

LabVIEW stands for Laboratory Virtual Instrumentation Engineering Workbench. It is the standard for data acquisition, instrument control software and analysis software. [12] It is a graphical programming language, rather than a conventional programming language as software development environment. Besides that, it can be used to acquire, analyze, and present the data obtained from the input or output devices. Thus, it is suitable to be used in the development of front panel in this project.

National Instrument LabVIEW is the graphical development for creating flexible and scalable test, measurement, and control applications rapidly and at minimal cost. By using the LabVIEW, engineers and scientists interface with the real

world signals, analyze data for meaningful information, and share results and applications. The combination of LabVIEW graphical development environment with NI-DAQmx gives the tools that needed to easily construct application using counters to generate the PWM signals.

LabVIEW is the vital part of the Virtual Instrumentation which provides a user-friendly application development environment designed specifically with the needs of engineers and scientists in mind. LabVIEW offers powerful features that make it easy to connect to a wide variety of hardware other software. These features are graphical programming, connectivity and instrument control, reduce cost and preserve investment, analysis capabilities, multiple platforms, visualization capabilities, flexibility and scalability, research and design, development test and validation, manufacturing test and data acquisition.

2.1.1   State Diagram

The state machine is one of the fundamental architectures that NI LabVIEW developers frequently use to build applications quickly. Developers use state machines in applications where distinguishable states exist. Each state can lead to one or multiple states and can end the process flow. A state machine relies on user input or in-state calculation to determine which state to go to next. Many applications require an "initialize" state followed by a default state, where many different actions can be performed. These actions depend on previous and current inputs as well as states. A "shutdown" state can be used to perform cleanup actions.

In LabVIEW software, a basic state machine can be created with a while loop, a shift register, a case statement and some form of case selector. While loop is the main program loop which executes until the conditions for exiting the program are met. The while loop's main responsibility is to call the case selector and then execute the appropriate case. The shift register keeps track of which case should execute next. Finally, each case of the case statement contains the action for one specific use action. Often the default case is used as the place to check the case selector.