PARKING MONITORING SYSTEM USING LABVIEW

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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 to parking lots such as at shopping complexes, offices and buildings. The main focus on this project is the development of front panel using the LabVIEW software by National Instrument. Conventional car park system does not have display panel to show the vacancies of parking lot while current existing project only own the function to display the availability of vacancies but not the actual position to users. Thus, 1 of the main objectives in this project is to develop 2 front panels for both users and owner. This will not only ease the users but also bring benefits to the owner as information of the parking lots can be retrieved from this system. The information includes total vehicles in and out daily, monthly, total income gained and so on. In addition, the project is also being upgraded so as to become more power saving by allowing the sensor of consecutive levels of parking lot to be activated only after the previous levels are fully parked. On the other hand, the system is also more user friendly after a "HELP" button is added at the entrance of the parking lot. Besides that, this project will create virtual sensor operation system by developing 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 "HELP" button at the entrance is pressed by users, SMS will be sent to the operator in charge through the interface between PC and mobile phone using GSM modem. AT commands is used to control the functionality of modem. In this project, 2 front panels are successfully developed and explained by designing a physical model of parking lot with car detection operation. This PC based monitoring system can be applied in various industrial applications such as building security system and factory automation.

ABSTRAK

Projek ini merangkumi reka cipta 1 sistem tempat meletak kereta berkomputer yang boleh diaplikasikan di kawasan tempat letak kereta seperti di kompleks membeli-belah, pejabat-pejabat dan bangunan-bangunan. Projek ini menumpu kepada penciptaan panel depan system parkir dengan menggunakan perisian National Instrument‟s LabVIEW. Tempat letak kereta yang biasa tidak mempunyai skrin paparan untuk menunjukkan bilangan tempat kosong manakala projek yang sebelum ini cuma dapat mempamerkan bilangan tempat kosong, bukan kedudukan sebenar. Oleh sebab itu, salah satu objektif utama projek ini adalah menghasilkan dua skrin paparan untuk pengguna dan kegunaan syarikat. Ini akan menyenangkan pemilik untuk mengekseskan data terperinci tentang tempat letak kereta seperti jumlah kereta masuk dan keluar setiap hari ataupun bulan, jumlah pendapatan dan sebagainya, malah memudahkan pengguna. Selain itu, projek ini juga akan diubahsuaikan supaya lebih menjimat 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 pada pintu masuk. 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 komputer peribadi dengan telefon bimbit oleh modem *GSM*. Perintah AT digunakan untuk mengawal fungsi modem. Dalam projek ini, dua skrin paparan telah berjaya dihasilkan dan diperincikan melalui model fizikal letak kenderaan yang lengkap dengan operasi pengesan kenderaan. Kaedah sistem kawalan berkomputer seperti ini boleh diaplikasikan di pelbagai industri seperti sistem keselamatan bangunan dan automasi industri.

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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 objectives of the project will be discussed. Besides that, the problem statement explains the project significant and provides idea on real-time application. The main elements of the project are discussed in the scopes of work. The common structure of this project will also be explained thoroughly.

1.1 Introduction of Project

The conventional car park system which is not user friendly and systematic does not have display panel and the vacancies of parking lot is not shown. Users need to gamble from level to level to seek for vacancies and it is quite irritating. By applying the existing parking system done by senior, the availability of the parking space is displayed in assisting users to seek for parking space. However, it needs to be further improved on its system and usage of power.

The smart parking system is an electronic application that improves on the conventional parking system by using sensors and display panels developed using the Graphical Programming Language software.

The aim of this project is to design a more advanced and multi-features PC-based monitoring parking system to be applied at parking lots. The car park

monitoring system of this project will be upgraded so that it will be more power saving and also provides assistance to users through SMS application by using GSM modem. Furthermore, reservation and log-in features are added in this upgraded system. Improvement done on the conventional and existing parking system will make the parking lot become more systematic and user-friendly. This project will create 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 DAQ interfacing device. The concept of this project is illustrated in Figure 1.1 as below.

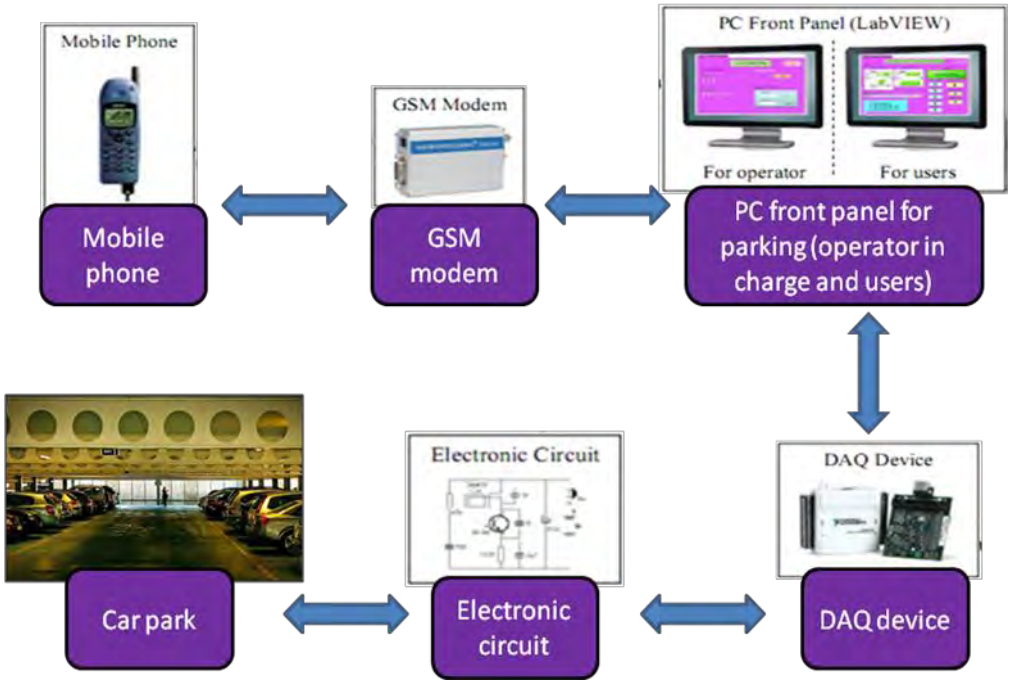

Figure 1.1 Real Implementation Concept Diagram

The difference of this project from other existing systems and projects is that it is created using LabVIEW software rather than conventional programming software. LabVIEW software is more user-friendly and its development is closer to user‟s idea. Majority of the existing car park only show users the availability of parking space through built-up signboard at the entrance of the car park. It only shows the number of vacancies and arrow of direction to the desired place.

1.2 Objectives of Project

The objectives of this project are stated as below:

(a) To develop front panel for owner and users of the car park using LabVIEW software

(b) To interface the PC-based system with mobile phone and electronic circuit

(c) To upgrade the current model of car park system and the electronic circuit in order to save power consumed

1.3 Problem Statement

The existing project done by senior has only 1 front panel which displays the availability of parking lot to users but no other detail information of the parking lot can be retrieved by the owner. Therefore, another front panel will be developed specially for the owner to access information such as the total car in and out of the parking area daily, weekly or even monthly, total income gained and so on. Besides providing convenience to the owner, it also assists in monitoring the parking lot from the control room as to improve the security level.

Besides that, the previous project does not provide any facility in case system error occurred or when the user needs some guidance or assistance while there is no operator around. Thus, a "HELP" button will be added at the entrance of the parking where user can request for help when needed. After the button is pressed, a SMS will be sent to the operator in charge through the interface between PC and mobile phone using GSM modem. A reply message will be send by the operator in charge to user as confirmation of the message received. The system is more user friendly due to this added feature.

Last but not least, for the existing project, all parking level sensors are always light on and this is power consuming. In this project, the sensors of

consecutive levels of parking lot will only be activated after the previous level is fully parked. Compared with the existing project, this seems more power saving.

1.4 Scope of works

This part discusses the elements involved in this project. The scope is based on 6 main parts which are:

(a) **LabVIEW software** is used to create front panel of virtual instrument. 2 front panels are developed in this project where 1 of them is for user which displays the status and vacancies of the parking lot and 1 is for owner to retrieve useful information such as the total amount of car entering and leaving the car park, total income and so on. Reservation of parking space can also be made by the operator in charge.

(b) **DAQ** device is a data acquisition unit that is used as an interface between hardware and software. The DAQ will transfer the output signal from electronic circuit to the PC through DAQ card and vice versa. The results can then be 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 the user encounters any difficulties after user pressed the "HELP" button at the entrance of the car park. AT commands is used to control the functionality of modem.

(d) **Mobile phone** is used to send or receive message by operator to users who encounter problem. This function is achieved by pressing the "HELP" button at the entrance of the car park.

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

(f) **Electronic circuit** consists of sensors that detect car at the entrance and exit of the parking lot and also each parking space. Indicators for

reservation and car parked will be shown. Green is for available while red is for occupied. Reed switch can detect the metal that has in each car such as magnet. Relay is used to trigger the circuit from one condition to another condition. In this project, sensors at consecutive levels will only be activated after the previous level is fully parked.

1.5 Brief Explanation of Methodology

First of all, this project is begun by having discussion with supervisor about the general ideas and concepts that would be used in this project. Next, for literature review, the background of this project is studied and research is done by referring to various sources such as reference books, I.E.E.E journals, website of National Instrument, internet and data sheets. Followed by, is the seeking of information related to the components, DAQ device, GSM modem and so on. The most suitable would be selected to be used in this project. Then, the LabVIEW programming is studied and the front panel of virtual instrument is developed and simulated. Hardware interfacing would be studied on the following stage. After the hardware for this project is built and assembled, the system is ready to be tested. Once the desired outputs of this system fulfill the project requirements and specification, this project is considered successful. Otherwise, troubleshooting would be needed until it reaches the desired result.

1.6 Report Structure

This report delivers the ideas generated, concepts applied, activities done and prototype of the project. It comprises 5 chapters.

Chapter 1 provides readers with the basic introduction of the project. This chapter includes the introduction, objectives, problem statements, scopes of work, methodology and report structure.

Chapter 2 is the literature review on theoretical concepts applied in this project. The chapter includes the background study of several car park systems existing, PC-based monitoring system and other related specifications. In addition, it also explains on how the PC-based monitoring with SMS notification works, introduction on LabVIEW, DAQ device, GSM modem and application of other components, as well as the reason of choosing the specific DAQ device, GSM modem and related components.

Chapter 3 introduces the methodology of the project. This chapter contains the flow chart which explains the overall method used along the implementation of this project. Besides that, this chapter also introduces the software development of the project using state diagram. Basically, the software development for this project consists of the VI front panel and VI block diagram.

Chapter 4 shows the result for the project outcome. It also includes the discussion of this project. This discussion includes the problems encountered throughout the designing process of the VI front panel and VI block diagram.

Chapter 5 will be the conclusion of the final year project. This chapter also includes some recommendations that can be implemented in the future.

CHAPTER II

LITERATURE REVIEW

This chapter will review on those existing projects and systems invented to obtain idea about the project design, concept and other related information to improve on this project. Besides that, other related elements are also included, such as the LabVIEW software, DAQ device, GSM modem and so on.

2.1 Studies on LabVIEW

LabVIEW (short for Laboratory Virtual Instrumentation Engineering Workbench) is a platform and development environment for a visual programming language from National Instruments. The graphical language is named "G", a dataflow programming language. LabVIEW is commonly used for data acquisition, instrument control, and industrial automation on a variety of platforms including Microsoft Windows, various flavours of UNIX, Linux, and Mac OS X.

It can interface with measurement and control hardware, analyze data, share results, and distribute systems through intuitive graphical programming. LabVIEW combines the flexibility of a programming language with the power of an advanced engineering tool so users can complete their projects regardless of their unique, custom requirements. Execution is determined by the structure of a graphical block diagram (the LV-source code) on which the programmer connects different function-nodes by drawing wires. These wires propagate variables and any node can execute as soon as all its input data become available.

It is used to develop sophisticated measurement, test, and control systems using intuitive graphical icons and wires that resemble a flowchart. It offers unrivaled integration with thousands of hardware devices and provides hundreds of built-in libraries for advanced analysis and data visualization – all for creating virtual instrumentation.

2.1.1 Graphical programming

LabVIEW ties the creation of user interfaces (front panels) into the development cycle. LabVIEW programs are called virtual instruments (VIs). Each VI has three components: a block diagram, a front panel, and a connector panel. The last is used to represent the VI in the block diagrams of other, calling VIs. Controls and indicators on the front panel allow an operator to input data into or extract data from a running virtual instrument. However, the front panel can also serve as a programmatic interface. Thus a virtual instrument can either be run as a program, with the front panel serving as a user interface, or, when dropped as a node onto the block diagram, the front panel defines the inputs and outputs for the given node through the connector pane. This implies each VI can be easily tested before being embedded as a subroutine into a larger program.

The graphical approach also allows non-programmers to build programs by dragging and dropping virtual representations of lab equipment with which they are already familiar. The LabVIEW programming environment, with the included examples and the documentation, makes it simple to create small applications. For complex algorithms or large-scale code, it is important that the programmer possess an extensive knowledge of the special LabVIEW syntax and the topology of its memory management. The most advanced LabVIEW development systems offer the possibility of building stand-alone applications. Furthermore, it is possible to create distributed applications, which communicate by a client/server scheme, and are therefore easier to implement due to the inherently parallel nature of *G*-code.