raf
TJ223.P76 .K45 2009.
0000065845
PC based controller for a new aquarium system / Khairul Akmal Abdul Rahman.

PC BASED CONTROLLER FOR A NEW AQUARIUM SYSTEM

KHAIRUL AKMAL BIN ABDUL RAHMAN

This Report Is Submitted In Partial Fulfillment of Requirements for Degree of Bachelor in Electrical Engineering (Control, Instrumentation and Automation)

Fakulti Kejuruteraan Elektrik
Universiti Teknikal Kebangsaan Malaysia

KHAIRUL AKMAL BIN ABDUL RAHMAN
4 BEKC 1

APRIL 2009

© Universiti Teknikal Malaysia Melaka

"I hereby declared that I have read through this report and found that it has comply the partial fulfillment for awarding the degree of Bachelor of Electrical Engineering (Control, Instrumentation and Automation)"

Signature : .....

Supervisor's Name : Mr. Hyreil Anuar Bin Kasdirin

Date : 12 / 5 / 2009

© Universiti Teknikal Malaysia Melaka

"I hereby declared that this report is a result of my own work except for the excerpts that have been cited clearly in the references."

Signature : .....

Name : Khairul Akmal Bin Abdul Rahman

Date : 12 / 5 / 2009

© Universiti Teknikal Malaysia Melaka

For my beloved father and mother

Abdul Rahman Bin Chik and Sharifah Binti Kassim

In appreciation of supported and understanding

© Universiti Teknikal Malaysia Melaka

ACKNOWLEDGEMENTS

In the name of Allah, The Most Gracious, The Most Merciful. Peace be upon the Messenger of Allah, Prophet Muhammad s.a.w, his companions (r.a) and followers until the end of day. Thanks to Allah, with His blessing, this final project is successfully delivered.

First of all, I want to thanks my beloved mom and dad, whom keep prays for me, gives me freedom and show understanding to me as a student because their loves keep me moving forward.

Secondly, I want to thanks my supervisor for this final project, Mr Hyreil Annuar Bin Kasdirin whom shares knowledge and idea so that I will keep on the right track which leads to this project successful. I also want to thanks all technicians and FKE staff who lend me a hand through out this project.

Last but not least, to all my friends, thank you for making my life happens.

Wassalam

© Universiti Teknikal Malaysia Melaka

ABSTRACT

This project is about "PC Based Controller for a New Aquarium System". A new aquarium system consists of the development control for lighting and fish feeder system and also using radio frequency as a communication system. PC based controller is described as a controller that can be interfaced with PC to transmit or receive data to control automation system. Radio frequency is one of the wireless communications that transfers information over a distance without the use of electrical wires. In this project, it focuses on developing software and hardware. For the hardware part, there are 2 main circuit board will be developed which are interface circuit and water level changer circuit. The interface board that had been developed in this project will be divided into three parts which are parallel port as a communication interface, relay and transistor are used as a switch and remote control car as a wireless communication. The remote control car has two parts which are transmitter circuit and receiver circuit. The transmitter circuit will be connected with interface board to communicate with PC and send signal to receiver circuit at aquarium whereas the receiver circuit will be used to control fish food feeder and lightning bulb. For the software part, Microsoft Visual Basic 6.0 is used as a main timer to control the fish food feeder and lighting system.

© Universiti Teknikal Malaysia Melaka

ABSTRAK

Tajuk projek ini adalah "Membina sebuah litar pengawal berdasarkan komputer untuk Sistem Akuarium ".Sistem akuarium ini dibina untuk mengawal sistem lampu dan pemberi makanan ikan dan juga menggunakan radio frekuensi sebagai sistem perhubungan. Litar pengawal berdasarkan komputer adalah sebuah litar pengawal yang berhubung dengan komputer untuk menghantar atau menerima data untuk mengawal sistem automasi. Radio frekuensi adalah salah satu sistem perhubungan tanpa wayar yang menghantar maklumat pada jarak tertentu tanpa menggunakan wayar elektrik.Projek ini tertumpu kepada 2 perkara iaitu pembinaan perkakasan dan perisian.Untuk bahagian perkakasan, terdapat 2 litar utama iaitu litar kawalan dan litar penukar air baru. Litar kawalan yang perlu dibina bagi projek ini akan dibahagikan kepada 3 iaitu parallel port sebagai perhubungan kawalan, geganti dan transistor dibina sebagai alat pemutus elektrik dan alat kawalan jauh pula akan digunakan sebagai sistem perhubungan tanpa wayar.Alat kawalan jauh terdiri kepada 2 bahagian iatiu litar penghantar dan penerima maklumat. Litar penghantar maklumat ini akan disambungkan dengan litar kawalan supaya ia dapat berhubung dengan komputer dan ia juga akan menghantar data kepada litar penerima dimana litar penerima di akuarium ini digunakan untuk mengawal lampu dan alat pemberi makanan ikan. Bagi pembinaan sistem perisian, Microsoft Visual Basic 6.0 akan digunakan sebagai pengawal waktu utama untuk mengawal alat pemberi makanan dan sistem lampu .

© Universiti Teknikal Malaysia Melaka

LIST OF CONTENT

CHAPTER	TITLE		PAGE
	TITLE PAGE		i
	CONFESSION		ii
	DEDICATION		iii
	ACKNOWLEDGEMENT		iv
	ABSTRCT		v
	ABSTRAK		vi
	LIST OF CONTENT		viii
	LIST OF TABLE		xi
	LIST OF FIGURE		xii
	LIST OF ABBREVIATION		xv
	LIST OF APPENDIX		xvi
I	INTRODUCTION		
	1.1	Background Project	1
	1.2	Project Statement	2
	1.3	Problem Objective	2
	1.4	Project Scopes	2
	1.5	Expected Results	3

© Universiti Teknikal Malaysia Melaka

II	THEORY AND LITERATURE REVIEW		
	2.1	Overview	4
	2.2	Microsoft Visual Basic 6.0	4
	2.3	Parallel port	8
	2.4	Transistor	11
	2.5	Remote Aquarium Monitor and Control System	14
III	METHODOLOGY		
	3.1	Overview	18
	3.2	Work Plan	18
	3.3	Project Development	21
	3.3.1	Hardware Development	21
	3.3.1.1	Schematic design process of interface board	22
	3.3.1.2	Modification of transmitter circuit (Tx)	23
	3.3.1.3	Arrangement process of interface board	24
	3.3.1.4	Schematic process of receiver circuit board	25
	3.3.1.5	Modification of receiver circuit (Rx) and fish food feeder device	26
	3.3.1.6	Schematic design of water changer circuit	27
	3.3	Software development	29
IV	RESULTS		
	4.1	Overview	35
	4.2	Flowchart	36
	4.3	Analysis	39

© Universiti Teknikal Malaysia Melaka

4.3.1	Software Analysis	39
4.3.2	Hardware Analysis and Result	41
4.3.2.1	Interface board	41
4.3.2.2	Receiver board	46
4.3.2.3	Choosing a suitable transistor and resistor	49
4.3.3	Firmware analysis	51

V DISCUSSION AND CONCLUSION

5.1	Discussion	55
5.2	Suggestion	55
5.3	Conclusion	56

REFERENCES	57
APPENDIX	58

© Universiti Teknikal Malaysia Melaka

LIST OF TABLE

NO	TITLE	PAGE
2.0	Visual Basic Naming Conversion	7
2.1	The information about parallel port pins	10
2.2	Command and status in graphical user interface	13
2.3	Help Documentation	14
3.1	Water condition	29
3.2	Real timer user interface condition	31
4.0	Pin 4 in high logic level	39
4.1	Conversion 0010(binary number) to 4(decimal number)	39
4.2	Pin 2 and pin 4 in high logic level	40
4.3	Conversion 0101(binary number) to 6(decimal number)	40
4.4	Pin 3 in high logic level	41
4.5	Conversion 0010(binary number) to 2(decimal number)	41
4.6	Pin 2,3,4,5 in low logic level	42
4.7	Conversion 0000(binary number) to 0(decimal number)	42
4.8	Rotation degree and rotation period of food container	49

© Universiti Teknikal Malaysia Melaka

LIST OF FIGURE

NO	TITLE	PAGE
2.0	Form object	5
2.1	Tool box	6
2.2	Properties window	6
2.3	Code written in Visual Basic	6
2.4	A typical parallel port on the back of computer	8
2.5	The D type 25 pins female connector and the Centronics 36 pins male	8
2.6	System Hardware	11
2.7	Graphical User Interface	12
3.0	Project planning	16
3.1	Project overall methodology	17
3.2	Proteus Professional 6 software	18
3.3	A schematic of interface circuit board	19
3.4	Parallel port male connector	19
3.5	Transmitter circuit (front view)	20
3.6	Receiver circuit (rear view)	21
3.7	Interface circuit board	21
3.8	A schematic of receiver circuit board	22
3.9	Remote control car body	23
3.10	Receiver circuit (Rx) (front view)	23
3.11	Fish food feeder device (front view)	24
3.12	Fish food feeder device (rear view)	24
3.13	Electric diagram of fish food feeder system	25

© Universiti Teknikal Malaysia Melaka

LIST OF FIGURE

NO	TITLE	PAGE
3.14	Gear 1 and mechanical switch of fish food feeder	25
3.15	Relay replace mechanical switch of food feeder	26
3.16	A schematic of water changer circuit	27
3.17	Microsoft Visual Basic 6.0	29
3.18	Real Time User Interface (GUI)	30
4.0	The overall project block diagram	33
4.1	Transmitter (Tx) operation flow chart	34
4.2	Receiver (Rx) operation flow chart	35
4.3	Application error message box	36
4.4	The function of Inpout32.dll	37
4.6	Waveform shows that pin 4 deliver 5 volt	39
4.7	Waveform shows that pin 3 and pin 4 deliver 5 volt	40
4.8	Waveform shows that pin 3 deliver 5 volt	41
4.9	Waveform shows that pin all pin deliver 0 volt	42
4.10	Waveform shows that 3 volt input activate relay 1 to turn on food Feeder	43
4.11	Graphical user interface shows that first and second feeder is on	43
4.12	Waveform shows that 3 volt input activate relay 2 to turn on lighting system	44
4.13	Graphical user interface shows that lighting system is on	44
4.14	Waveform shows that there is 0 volt input that de-energized relay 2	45
4.15	Graphical user interface shows that lighting system is off	45
4.16	Transistor as a switch that is implemented in interface board	46

© Universiti Teknikal Malaysia Melaka

LIST OF FIGURE

NO	TITLE	PAGE
4.17	Food container at its home position	48
4.18	Food container rotates in clockwise	48
4.19	Graph of rotation degree (°) versus rotation period (sec)	49
4.20	Timer properties	50

© Universiti Teknikal Malaysia Melaka

LIST OF ABBREVIATION

GUI	- Graphical User Interface
PC	- Personal Computer
IDE	- Integrated Development Environment
COM	- Component Object Model
UTeM	- Universiti Teknikal Malaysia Melaka
OLE	- Object Linking and Embedding
PCB	- Printed Color Board
bin	- binary
dec	- decimal

© Universiti Teknikal Malaysia Melaka

LIST OF APPENDIX

NO	TITLE	PAGE
1	Coding to form real timer user interface in Microsoft Visual Basic 6.0	54
2	Gantt chart	61
3	Transistor specification sheet	62

© Universiti Teknikal Malaysia Melaka

CHAPTER 1

INTRODUCTION

1.1 Background project

An aquarium is a specially designed device to keep fish and other plant species in the water .Proper care of fish and maintenance of aquarium are needed to the health of fish and the appearance of aquarium. Generally human error when monitoring and keeping fish can weaken or even kill fish especially when feed fish. So why leave fish's health to chance? PC Based Controller for a New Aquarium System ensures that fish are fed on a regular schedule. The aim of this project is to let the user decide the desire time to feed fish and turn on lighting system under computer control. The other purpose of this project is to let the user at home to keep their fish easier because changing the aquarium water is not an easy task. The hardware that will be developed in this project is an interface board and aquarium with water changer circuit. PC will communicate with interface board and send the signal to the fish food feeder and lightning system at aquarium via wireless communication. Furthermore, the aquarium will be included with water changer circuit to make a cleaning process of aquarium easier. In software part, the real time of graphical user interface (GUI) need to be designed to let the user control the operation time for fish food feeder and lighting system at aquarium.

© Universiti Teknikal Malaysia Melaka

1.2 Problem Statement

Generally, human error when monitoring fish can weaken or even kill fish especially when the user left home. Moreover, contaminated water at aquarium also kill fish if an aquarium is not changed with new water. Generally, user is unable to change clean water for aquarium because it is not an easy task especially when changing water for the big size of aquarium. So, this project was designed to solve those problems to keep fish easier.

1.3 Project Objective

This project was designed for user who wishes to keep fish easier by using PC to control fish food feeder device and lightning bulb via wireless communication. Another objective is to let the user at home make a cleaning of aquarium process easier. The main purpose of using wireless communication is to enhance the existing functional of remote controller which is using the radio frequency communication application. The other advantage of using radio frequency communication is the user can control fish food feeder and lightning bulb at a certain distance which is 10 meter range. For the cleaning part, the water changer circuit is designed and put on the aquarium to ease the maintenance of aquarium when changing the water.

In software part, the project coverage also includes the programming knowledge of Microsoft Visual Basic 6.0.A graphical user interface in the form of real timer in Microsoft Visual Basic 6.0 will be designed to let the user control hardware.

© Universiti Teknikal Malaysia Melaka

1.4 Project Scope

The hardware that will be used in this project are PC, interface board, transmitter and receiver of remote controller, aquarium, fish food feeder, lightning bulb, and water changer circuit while for the software part is using Microsoft Visual Basic 6.0 software.

PC is used as a main controller and communicates with interface board through parallel port. In this project, Microsoft Visual Basic 6.0 software will be used on PC to control hardware. Graphical user interface (GUI) in Microsoft Visual Basic 6.0 software will be designed to let the user decide the exact time for fish food feeder and lightning bulb at aquarium to turn on. Parallel port is used as a medium communication between interface board and PC. Interface board that contains transistor and relay is used as a switching part whereas transmitter circuit is utilized as a wireless communication to send signal to receiver at aquarium.

For the aquarium part, it has receiver circuit, fish food feeder, lightning bulb, and water changer circuit. The receiver circuit is used to receive signal from the transmitter circuit and control the fish food feed and also lightning bulb to turn on automatically. Besides, the water changer circuit in aquarium has two water sensor and water pump. Water sensor has two parts which detects high and low level of water. These water sensors control water pump to make up water and drains the water out from aquarium.

1.5 Expected Result

The final results that are being expected are the fish food feeder and lightning bulb are operating at the time controlled by PC. The Graphical User Interface (GUI) that will be designed will let the user control and set the time for fish food feeder and the lightning bulb turn on. For the water changer circuit part, it will change the clean water in aquarium by using the water motor pump to dispense water and let the water flow in.

© Universiti Teknikal Malaysia Melaka

CHAPTER 2

THEORY AND LITERATURE REVIEW

2.1 Overview

In this literature review, it is containing all the information related to the project such as types of Microsoft Visual Basic 6.0, parallel port and the example of previous Remote Aquarium Monitor and Control System project.

2.2 Microsoft Visual Basic 6.0

Visual Basic (VB) is the third-generation event-driven programming language and Integrated Development Environment (IDE) from Microsoft for its Component Object Model (COM). VB is also considered a relatively easy to learn and use programming language, because of its graphical development features and BASIC programming software heritage. The Microsoft Visual Basic 6.0 is the most popular choice to create the Window GUI (Graphical User Interface).In Visual Basic; new windows created are called form. Elements as text boxes and button that placed in the form are called control. The visual basic allows event-driven programming where the user actions cause events, and such event in turn triggers a procedure that is associated with it. Like the BASIC programming language, Visual Basic was designed to be easy to learn and use. The language not only allows programmers to create simple GUI applications, but can also develop complex applications. [9]

© Universiti Teknikal Malaysia Melaka

Significant language features

Visual Basic is not only a programming language, but also a complete graphical development environment. This environment allows users with little programming experience to quickly develop useful Microsoft Windows applications which have the ability to use OLE (Object Linking and Embedding) objects, such as an Excel spreadsheet. [9]

Visual Basic's main special feature is the ease with which it allows the user to create nice looking, graphical programs with little coding by the programmer, unlike many other languages that may take hundreds of lines of programmer keyed code. As the programmer works in the graphical environment, much of the program code is automatically generated by the Visual Basic program. [9] In order to understand how this works, it is necessary to understand the major concepts, objects and tools used by Visual Basic. The main object in Visual Basic is called a form. When user opens a new project, it will start with a clear form that looks similar to this:

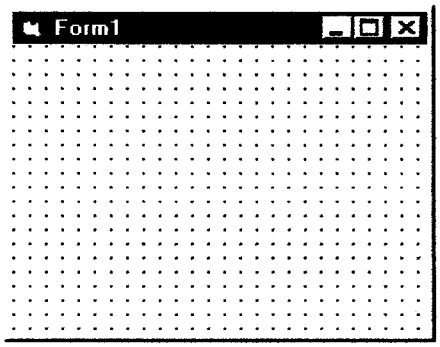

Figure 2.0: Form object

This form will eventually be incorporated into program as a window. After create this form we can add controls on it. Controls are things like text boxes, check boxes and command buttons. Controls are added to form by choosing them from the Visual Basic "tool box" with the mouse and inserting them in the form. The basic Visual Basic Tool Box looks like figure 2.1:

© Universiti Teknikal Malaysia Melaka

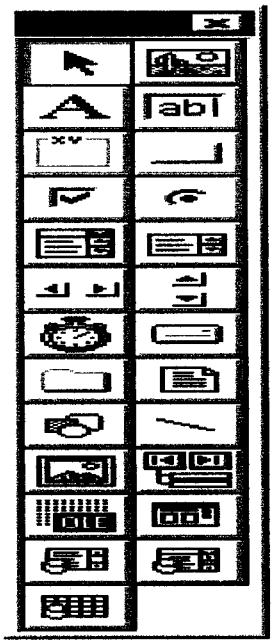

Figure 2.1: Tool box

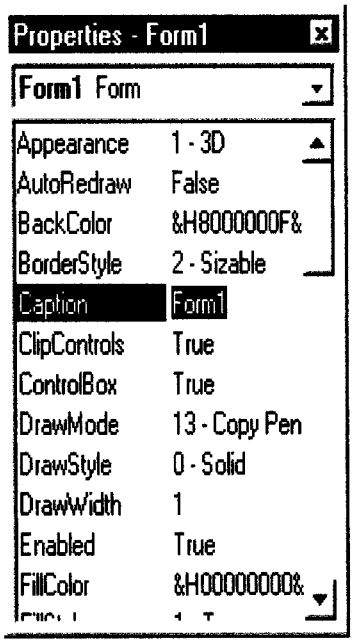

Figure 2.2: Properties window

Once forms/controls are created, user can change the properties (appearance, structure etc.) related to those objects in that particular objects properties window. From this window, user can choose the property from the list and change its corresponding setting. An example of a properties window like figure 2.2.Finally, user can add events to controls. Events are responses to actions performed on controls. For example, in the "Hello world" program sample on this page, when user click on the command button on form, the event that is triggered is the output of the message "Hello world" to the screen. Code must be written to create an event.

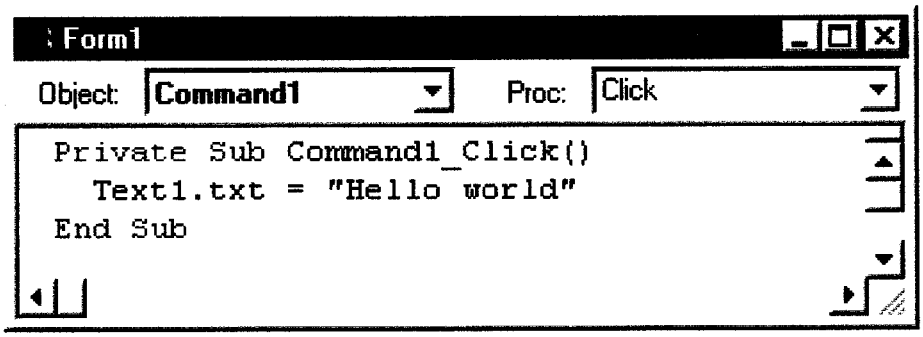

Figure 2.3: Code written in Visual Basic

© Universiti Teknikal Malaysia Melaka

Table 2.0: Visual Basic naming conversion

Object	**Prefix**
Form	firm
Command Button	cmd
Text Box	txt
Label	lbl
Option Button	opt
CheckBox	chk
Frame	fra
Horizontal Scrollbar	hsb
Vertical Scrollbar	vsb
Image	img
Picture Box	pic
Combo Box	cbo

© Universiti Teknikal Malaysia Melaka

2.3 Parallel Ports

Figure 2.4: A typical parallel port on the back of computer

Parallel ports were originally developed by IBM as a way to connect a printer to PC .The parallel port is the most commonly used port for interfacing printer, and other parallel devices. Parallel ports have 2 different connectors for use. The first one, 1284 Type A is the D-Type 25 connector found on the back of most computers. The 2nd is the 1284 Type B which is the 36 pin Centronics Connector found on most printers This port will allow the input of up to 9 bits or the output of 12 bits at any one given time, thus requiring minimal external circuitry to implement many simpler tasks. The port is composed of 4 control lines, 5 status lines and 8 data lines. [4]

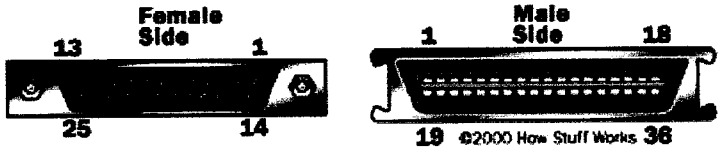

Figure 2.5: The D type 25 pins female connector and the Centronics 36 pins male

How it operates?

When a PC sends data to a printer or other device using a parallel port, it sends 8 bits of data (1 byte) at a time. These 8 bits are transmitted parallel to each other, as opposed to the same eight bits being transmitted serially (all in a single row) through a serial port.[4] The standard parallel port is capable of sending 50 to 100 kilobytes of data per second.

© Universiti Teknikal Malaysia Melaka