CERTIFICATION OF APPROVAL

Wireless Room Control

By

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(Mr. Khairul Shafee Kalid)

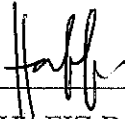UNIVERSITI TEKNOLOGI PETRONAS
TRONOH, PERAK
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CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

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ABSTRACT

University Technology PETRONAS has a big campus compound. Moving from a room to the lecture theatre is sometimes tiring due to the distance from one end to another end. The purpose of this project entitled "Wireless Room Control" is to create an application and a system whereby each and every student in University Of Technology PETRONAS can have control over their room at far distance. The main ability of the system is that the students have the power to switch on and off to all possible electrical appliances. This wireless technology is the best suited for UTP environment. It gives the student an ability to control their room at any point in UTP as long as at that particular point is equipped with wireless communication facilities. In the methodology, the phases include problem definition, analysis, outline design, detailed design and implementation. Finally, by having this applied research and system development project, hopefully it can create a new network environment in University Technology PETRONAS – wireless environment.

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ABBREVIATIONS AND NOMENCLATURES

UTP – University Of Technology PETRONAS

CISCO APs – CISCO Access Point

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

1.1.1 Wireless communication

The study in wireless communication gives a closer look at how wireless networking is deployed in a practical manner. Basically, like cordless telephones, wireless LAN use electromagnetic radio waves to communicate information form one location (your notebook, for instance) to another (an access point), without having to use any physical medium to transfer the massage.
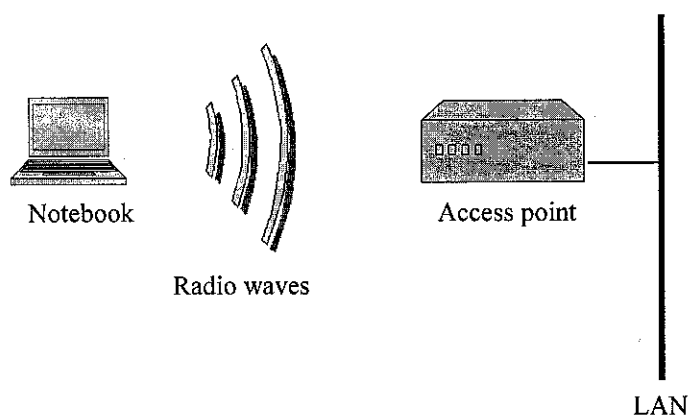

Notebook   Access point

Radio waves

LAN

Figure 1: WLANs communicate information.

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Once data is added onto the radio carrier, the radio signal spills over, occupying more that a single frequency. This happens because frequency-or bit rate- of the modulating data adds to the carriers. In a WLAN, the device that physically connects to the wired LAN is a transceiver and is commonly called an access point. The access point receives, buffers and transmit data between the WLAN and the wired network.

In this project, wireless LANs can be as simple as two computer talking or as complex as hundreds of computers in one location connecting to computers in a building miles away. There are three basic architectures to build wireless network which are peer-to-peer, in-building and building to building. Peer-to-peer is the simplest architecture and extremely easy to setup and operate because no access point is required. They just connect two PC which equipped with wireless adapter card and ideal for home networking or small business for spontaneous networking.

Much like a conventionally wired network, in-building WLAN equipment consists of a PC card, Personal Computer Interface (PCI), and Industry-Standard Architecture (ISA) client adapters as well as access points. The ultimate achievement in wireless networking comes when networks are extended between buildings in different cities. By using wireless bridge, networks located in buildings dozens of miles away from each other can be connected into a single network

1.1.2 Controlling electrical appliances using parallel port

To apply the controlling system over the electrical appliances, the parallel port is the most commonly used port for interfacing the output signal to the dedicated devices. It serves up to 12 bits of the output at any one given time. The port is composed of 4 control lines, 5 status lines and 8 data lines on the back of the PC and also known as a D-Type 25 pin female connector. The parallel port adapter is specifically designed to attach printers with a parallel port interface, but it can be used as a general input/output port or any device or application that matches its input/output

capabilities. It has 12 TTL-buffer output points, which are latched and can be written and read under program control using the processor In or Out instruction. The adapter also has five steady-state input points that may be read using the processor's In instruction.

In addition, one input can also be used to create a processor interrupt. This interrupt can be enabled and disabled under program control. Reset from the power-on circuit is also ORed with a program output point, allowing a device to receive a power-on reset when the processor in reset.

The input/output signals are made available at the back of the adapter through a right-angled, PCB-mounted, 25 pin, D-type female connector. This connector protrudes through the rear panel of the system, where cable may be attached. When this adapter is used to attach a printer, data or printer commands are loaded into an 8-bit, latched output port and the strobe line is activated, writing data to the printer. The program then may read the input ports for printer status indicating when the next character can be written, or it may use the interrupt to indicate "not busy" to the software. The output ports may also be read at the card's interface for diagnostic loop functions. This allows faults to be isolated between the adapter and the attached device.

1.1.3 Application development architecture

To have such system, a developed application must have the client server architecture that is to allow data moving from client application to server. Most of the client server architecture will place a single PC at a dedicated place as a server and the client is dispersed everywhere. The server will basically does function like verifying the incoming client which is attempted to enter the server, communicate with the database through DBMS (Database Management System) such as Oracle9i and access. It is important, to have a well-secured server because most of the important operation, data will be running in the server.

1.2 PROBLEM STATEMENT

1.2.1 Problem identification

The lack of wireless communication environment in UTP is due to the limited usage of such facility. On that point onwards, it was encouraged student to further research on wireless technology application. So this research topic creates a pilot project regarding controlling switched electrical appliances remotely via wireless communication medium for a convenience living environment in UTP. There are a number of important factors that make wireless networking a useful productive technology. The mobility feature in WLAN gives student real-time access to their LAN from virtually anywhere. This ability comes without having to be hardwired into the network. This mobility gives student the freedom to access the network from anywhere at any time.

The major problem occur when the student tend to forget to switch off fan or lamp once they leave their room. This is a bad behavior and wasting electric resources. UTP needs to spend thousand of ringgit settling the bill. By having such system (Wireless Room Control) it might reduce the billing cost of electricity resource besides having UTP owns power generator. Even though start-up costs for WLAN hardware are more that the cost of a traditional LAN, when the complete, lifecycle expenses are considered, WLAN expenses can be considerably lower. The greatest long-term cost benefits are seen in dynamic environments where there are frequent moves and changes. WLAN also can be easily configured in a number of networking topologies to meet the needs of specific application and installations. Configurations are highly flexible, can easily be changed, and range from simple peer-to-peer networks that are ideal for a new users to full infrastructure networks of thousands of users that enable roaming across a broad area.

The most popular LAN technology in the world is Ethernet. It is defined by the Institute of Electrical and Electronic Engineers (IEEE) with the 802.3 standard. The first wireless LAN (WLAN) technologies were not as speedy as Ethernet at the time.

They operated in the 900 MHz band and only clocked in at about 2 Mbps, max. The coming year, WLAN developers began developing products that operated in the unlicensed 2.4 GHz frequency band. In June 1997 the technology that serves as the core standard for the WLANs we know today was developed. The IEEE released the 802.11 standard for wireless local area networking. The standard supports data transmission in infrared light and two types of radio transmission within the unlicensed 2.4 GHz frequency band which is Frequency Hopping Spread Spectrum (FHSS) and Direct Sequence Spread Spectrum (DSSS).

1.2.1 Significant of the project

This project could solve the stated problem by enabling certain switched-electrical appliances to be in on and off condition. It is very flexible system because WLAN are not restricted by the physical barriers that constrain wired LANs and by having wireless connection networks it could provide network access to those users and workstations where connecting to a LAN. It is also easy to install and simple. Before wireless technology, connecting computers to a LAN required stringing and plugging in a mess of wires. The task could be further complicated if the wiring needed to be strung through walls or between different floors. Adaptation of wireless technology in this system simplifies and speeds up the installation process. The system which is in wireless environment also gives the comparable transmission speed to wired-networks. Users can access information at 11 Mbps, which is on par with conventional wire speeds. Though not yet touching the 100 Mbps and 1 Gbps that are possible in wired networks, wireless has a respectable, functional speed.

1.3 OBJECTIVE AND SCOPE OF STUDY

The project is proposed to develop such a remote system that uses the wireless technology. The scopes are limited to UTP lecture areas (building 2 – information system), student who only has notebook, wireless devices and network facilities.

The study is only controlling the switched-electrical appliances and the time for completion is limited to 3 months development only.

1.3.1 Roaming radius

Roaming with a wireless device means moving from one cell to another cell. One access point at 100-mW transmit power with dipole antenna at 2.2dBi is only capable to roam indoor range 130ft (39.6m) at 11Mbps and 350ft (107m) at 1Mbps. To roam outdoor, it only capable to reach range 800ft (244m) at 11Mbps and 2000ft (610m) at 1Mbps. When it comes down to actually connecting to an access point or another computer, there are two methods that are used. The first involves a station joining an existing cell and the second involves the process of moving form one cell to another. There are three different times when a wireless device will try to access an existing access point or another wireless device; when the device is powered up, after existing sleep mode, or when it enters new area. With each situation, the device needs to obtain synchronization information. The device will locate another device to sync with via either active or passive scanning. Active scanning is a type of scanning that requires the device to attempt to locate an access point that can receive synchronization information from that device. This is accomplished by transmitting probe request frames and waiting for a probe response packet, which is transmitted by an access point. However the passive scanning is when devices can listen for a beacon frame that is periodically transmitted from each access point. The beacon frame contains synchronization information, so a device can use this for synchronization.

1.3.2 Limited to student who has wireless devices and network facilities

The first thing is students that want to deploy this application, he or she needs to have a notebook and wireless network card then only the services is directed to them. It is a big pleasure if UTP can setup one stop terminal for wireless application.

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1.3.3 The scope is to control switched-electrical appliances

As mentioned before, the research and system is only meant for switched-electrical appliances in a single room. The appliances could be lamp, fan and others. Perhaps it sounds that the system is not valuable for market oriented because it is limited to that appliances, which has switching capability. It is true; this is not a profit oriented type of research but actually by having these two appliances as a trial version automatically it could be implemented to the rest of the appliances as they apply the same concept.

CHAPTER 2

LITERATURE REVIEW

The following discussion is a reviewed literature, which is used as a guideline to drive to the completion of this project. Most of the literature gives a gross idea regarding the architecture of the project and it is very critical to understand thus it is the most important literature that needs to be further studied and discussed. The study introduces at first the necessity of wired environment and their expansion technology brought to the wireless environment. When we look a glance at our home, we will notice that there are no electrical appliances without a long tangle brownish rope-liked string which we called coppered-wire. We use them to give contact of electric pulses to that particular electrical application whether to switch them on or off.

According to B Webster Smith (2000)

"The ubiquity of the copper metals and their contribution to every civilization since Sumerian and Pre-Dynastic Egypt gives them a unique position in the history of technology".

Since the beginning of the electrical age, copper has been recognized for its unique and beneficial qualities in electrical applications. In building construction accounts for more than 40% of all copper use while residential construction is about two-thirds of the building construction market. Cooper is the most superior wired technology ever exists.

Then wireless technology comes into play. Wireless technology is relatively young and it is hard to gain public acceptance. It is just when digital phoning captivating analog cell phone. Those days, this story is like a modern fiction but went along the time it has been the most important stuff in life.

According to Kathleen S.Carr (March 2002)

> The next generation of wireless technology may sound like science fiction, but it is not. It is just not now.

However the question remains, how wireless technology is getting to do with the on and off function over electrical appliances? First when we look at the architecture of LAN connection you will find that it is still using physical wire (e.g. CAT5) to connect two or more computer systems in a communication pipeline. The networking environment is nothing new with wired technology environment. The only different is it enabling communication at far distances and in different category. When the communication is a wired-base medium, so it is a possibility to control electrical appliances through networking environment. Finally, when there is an interconnection between wired LAN and wireless LAN, so there is also possibility to control electrical appliances through network environment enhanced by wireless technology. It makes sense right.

2.1 ARCHITECTURE OF CONTROLLING ELECTRICAL APPLIANCES USING WIRED TECHNOLOGY.

The architecture controlling electrical appliances using wired technology is quite simple perhaps. We just have to place the interface circuit in between parallel printer port and the electrical device itself. The architecture discussed the PC printer port as an inexpensive and yet powerful platform for implementing projects dealing with the control of real world peripheral, Peter H. Anderson, (2001).
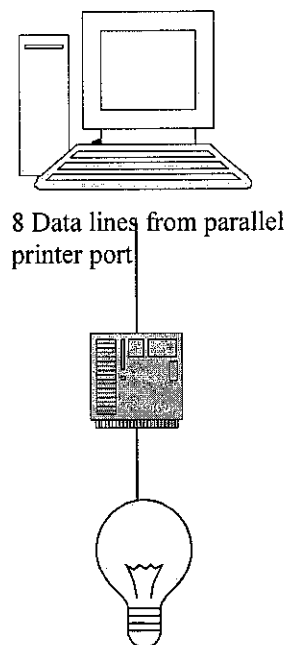

8 Data lines from parallel printer port

Figure 1: Architecture of wired control system.

Our parallel port has 8 output pins, which can be accessed via Data Port (D0-D8). Five input pins (one inverted) accessed via Status Port, 4 output pins (three inverted) accessed via the Control Port and the remaining 8 pins are grounded, Craig Peacock's (2001). Any bits come out from any of the eight data lines can be fed into the parallel port interface. This interface is necessary in order to direct the digital pulse voltage +5v (logic 1) to the relay circuitry and finally to the device itself, (K

Printer port provides eight TTL outputs, five inputs and four bi-directional leads and it provides a very simple means to use the PC interrupt, Peter H. Anderson, (2001). Each printer port consists of three port addresses, which are data, status and control port. These addresses are in sequential order. That is, if the data port is at address

0x0378 (hexadecimal representation), the corresponding status port is at 0x0379 and the control port is at 0x037a. They are in sequence right, starting from address0x0378, followed by 0x0379, which is the following base address and finally 0x037a meant for control port base address.
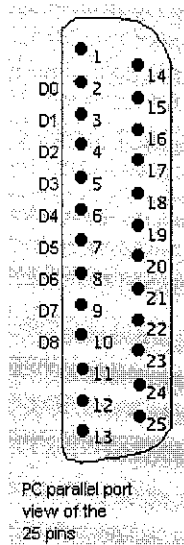

Figure 2: The power source supply from printer port.

The pin assignments are discussed in details throughout the article. It is important to know which pins are outputting bits value and which pins are used to receive responses from outside. In this project, output pin assignments are the studied area. Figure 1 illustrates the pin assignments on the 25-pin connector and the bit assignments on the three ports.

Note that there are eight outputs on the Data Port (Data 7 (Most Significant Bit) to Data 0) and four additional on the low nibble of the Control Port. All outputs on the Data Port are true logic. That is writing logic one to a bit causes the corresponding output to go high. However the /SELECT_IN, /AUTOFEED and /STROBE outputs on the control port have inverted logic. That is, outputting logic one causes logic zero on the corresponding output.

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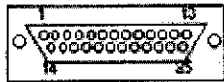
View is looking at
Connector side of
DB-25 Male Connector.

Pin	Description	
1	Strobe	PC Output
2	Data 0	PC Output
3	Data 1	PC Output
4	Data 2	PC Output
5	Data 3	PC Output
6	Data 4	PC Output
7	Data 5	PC Output
8	Data 6	PC Output
9	Data 7	PC Output
10	ACK	PC Input
11	Busy	PC Input
12	Paper Empty	PC Input
13	Select	PC Input
14	Auto Feed	PC Output
15	Error	PC Input
16	Initialize Printer	PC Output
17	Select Input	PC Output

Pin Assignments

Note: 8 Data Outputs
4 Misc Other Outputs

5 Data Inputs

Note: Pins 18-25 are
Ground

Figure 4: Pin assignments.

2.2 ARCHITECTURE OF CONTROLLING ELECTRICAL APPLIANCES USING WIRELESS TECHNOLOGY

The basic connection to contact the digital pulses to the relay circuitry and finally to the devise has been mentioned before. This time, we just expand a bit on the architecture where we have wireless connection architecture with client-server application system, Francis J. Deck's (2000)
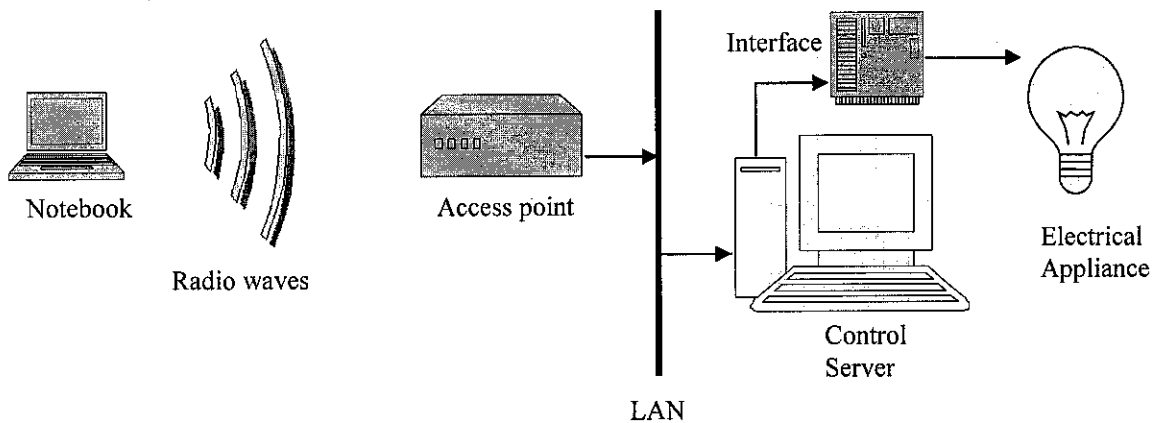
Interface

Notebook

Radio waves

Access point

Control
Server

Electrical
Appliance

LAN

Figure 1: Wireless architecture to control electrical appliances.

2.1.1 Example of application that uses same architecture

This project is similar to the PC anywhere concept which apply a wireless communication access. The product allows the screen of a PC to be broadcast securely over the Internet or a phone line so that it appears on monitor of another PC. Ones can sit at home, log on to their PC at work and work away as if they were physically in work, Symantec (2004).

Anyone viewing the screen at work will see documents open and shut, email being received and lots more. This tool perhaps was the first product to truly match the needs of growing section of wireless remote access. This software needs to be installed on both client and server PC. The server requires the host version of PC Anywhere whilst the client requires the client version of PC Anywhere.

Until recently Pc Anywhere was considered to be the industry standard remote access solution; however there is a new product worth considering called GoToMyPC. GoToMyPc allows a user to access their PC through a web page. The screen of ones PC appears in the web page; they can run programs, download email and view documents as if they were beside their PC. This means that it is possible to use any PC to log on to your computer at work or home.

2.3 STANDARD USED

We know that 802.11 is the standard protocol used in wireless communication. But, there are two types of 802.11 standard that we might want to take into consideration because both type a and b give a very different solution and outcome. The study below shows the differences between these two, Mitch Tulloch (2001).

The most common types of wireless LANs today support the 802.11b standard. Also called Wi-Fi, 802.11b operates at 2.4 GHz with maximum transmission rate of 11M bit/sec at the access point (AP). Meanwhile, 802.11a operates on the less-crowded 5 GHz band and runs at up to 54M bit/sec. Although the 802.11a and 802.11b specs are incompatible, vendors offer so-called dual-mode APs that support both. A future standard, 802.11 g, may offer 802.11a speeds and backward compatibility to 802.11b.

The 802.11a standard offers more non-overlapping channels per AP that clients can use: eight vs. three for 802.11b. Since it operates at a higher frequency, though, 802.11a has a shorter range and requires more APs for a given coverage area. That makes 802.11a more expensive for applications such as warehouse data entry that don't need extra bandwidth. And while 802.11b is available in Europe, 802.11a is not. For higher bandwidth, network designers will need to investigate the European HiperLAN2 standard.

CHAPTER 3

METHODOLOGY

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┌─────────────────────────┐
│   Problem Definition    │
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┌─────────────────────────┐
│        Analysis         │
└─────────────────────────┘
            │
            ▼
┌─────────────────────────┐
│      Outline design     │
└─────────────────────────┘
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            ▼
┌─────────────────────────┐
│      Detail design      │
└─────────────────────────┘
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            ▼
┌─────────────────────────────┐
│ Testing and Implementation  │
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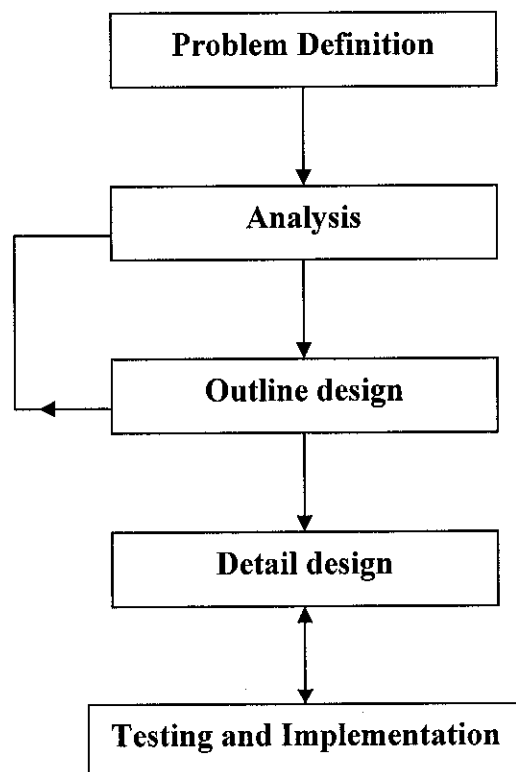
Figure 5: The chosen development cycle

3.1 PROBLEM DEFINITION

It must be considered as the most important phases in any project. Here, the entire possible problem will automatically affect the decision making on what scope and study that needs to be concentrated. In this project, problem definition is divided into two main tasks which are problem identification and observation.

3.1.1 Observation

This phase will be in a very economical approach. Observing what causes the problem and the solution that can cater the problem is the method applied. The observation will be done at Village 4. It is meant to observe on how frequent student spend their time at room and at what time. In each time how many rooms are left in "mislead" positions (electrical appliances are left on) and why it is happened.

As mentioned before, there was no hard effort allocated to come out with the study of distance affects onto UTP's student life pattern. Ideas from several IT professional comprehend with the problem observed finally come out with the topic so-called wireless room control.

3.2 ANALYSIS

Analysis is the phase to define what constitutes a solution to the problem. This is just a logical model solution. From the defined problem, we know that we have to find a way which enables student to switch off (or with some intention to switch on) the electrical appliances which is being left on (or with some intention to switch off). The method use in analysis is to find some literature regarding wireless technology, how to control electrical appliances through a stand-alone PC, how is the wireless client-server connection.

3.2.1 Literature review

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One of the method to gain many logical concept and solution regarding the problem mentioned before is by reading a lot of white papers and research journal. The information is also needed to study a lot of fields that is very new in order to give a comprehensive picture on the subject matter. The source of the literature review will be the internet and library. The journal and other literature could help to bring good idea and point of view thus as a bottom line to come out with a good solution.

3.3 OUTLINE DESIGN

3.3.1 Study interface circuit design (concept)

In this phase, it is just an effort to gain as many as possible the example of circuitry design on interfacing CPU and outside world. The chosen circuit could be the easiest to implement and draws a few devices and components. It is always advisable to review the analysis phase to avoid any misinterpretation concept while dealing with the design issue.

3.3.2 Study relay circuit design

While having the parallel port interface circuit, we also need to find examples of circuitry design on implementing relay and transformer to boost up the digital voltage. The digital voltage is somehow too small to drive electrical appliances. 5 V power is not able to turn own a lamp that need a standard 240 V for room appliances. Study the circuit and choose the easiest way to implement.

3.3.3 Matched circuit design

After choosing the most compatible circuitry design for relay and parallel port interface, it comes to match both designs into a complete logical hardware application. Logical hardware application does mean that both circuit (relay and

parallel port interface) need to be drawn onto a piece of map working paper. It is always advisable to test the circuit using any testing circuit software to avoid any harmful operation that may cause a severe accident while dealing with the high voltage electrical supply. Next, the estimated prices for the electrical components are drawn in this phase also.

3.3.4 Study the client-server architecture

This phase discusses the designation and development of client-server applications for various field solutions. Learning the fundamentals of GUI (Graphical User Interface) design by using Visual Basic's event driven programming concepts and techniques to create several small GUI for the windows environment is something that need to be emphasized in this phase.

3.4 DETAILED DESIGN

3.4.1 Build circuit

After matching the design, it comes then to build the physical hardware application. Implementing a prototype circuit with "Pro-ject" board (GL no.12) is the cheapest way. This is because the board is easy to hard-wired the lines and the components and the components can be put and taken off back at any time when necessary. When testing the prototype and it works, later the circuit can be permanently fixed onto the PCB board using soldering iron.

3.4.2 Program software

Visual Basic will be used to design, layout, and implement screen, controls, menus, buttons, forms and other GUI devices. Programming techniques such as logic flow, input validation, data management and integration data also will be discussed in this phase. There are two applications that need to be developed, one is the client room

control application and another one is server room control application. Client room control will have a text box field to locate the address of the server side application, user login module which is used to verify the user password and user input module. Whilst, server room control will have two modules which are user registration, and control hardware module. *vbOut* function in Visual Basic will be the important function chosen to program the hardware module. Window socket or family known as WinSock is the most reliable components to construct client server application in Visual Basic.

3.4.3 Test program with designed circuit

In any program and system, testing is very important. It gives professional quality assurance on the SDLC that used to perform competence system validation. In this phase, the designated circuit and the programmed software will be matched into one complete system. Before constructing a test for the whole system, it is advisable to test the program and examine any failure in a unit testing module. The testing should include the coding testing using debugger and trigger pointer, circuit testing using multimeter to examine any open, short or changed value circuit and finally the sub integration testing which include testing in a single stand alone system.

3.5 TESTING AND IMPLEMENTATION

This phase is where the integration system tested. During this phase of testing, every time there is a change in code inside the software program as well as in interface circuit, it must turn back to the previous phase and test everything all over again to make sure that what was just repaired did not break something else. Integration testing must be based on a written system specification

When testing critical systems for example the circuit and network connection, a detailed specification of each software component and electrical component is used to drive the tests. However in most other cases, testing is more spontaneous process

as there is not time to write detailed specifications of every part of a software system.

3.5.1 Test via physical/wired LAN

Lastly, the tested program that consists of the tested circuit and application program will be tested via physical LAN. Here is the most critical path where the skills to configure server and clients application is needed. It is advisable to have a fix server IP instead of dynamic IP to avoid conflicts and illegal operation. Set the host IP as automatic setting.

This phase is where full integrated system is tested. During this phase of testing, every time there is a change in code in the software, it must turn back to the previous phase and test everything all over again to make sure that what was just repaired did not break something else.

To start the testing, install the server application at one end and alert with the IP listened. Install the client application at the other on of the network and try to dial the server IP and examine whether the connection is established upon dialing or not.

3.5.2 Test via wireless LAN

After successful configure it via physical LAN, it will finally be tested via wireless LAN. The wireless LAN will be set using CISCO wireless networking. Cisco provides the most prevalent line of wireless equipment. This line of equipment includes hardware to link individual laptop and PC with the wired network Further the equipment can be used to extend the range of wireless network within a building, to communicate between buildings on a campus or-with the correct antenna- to communicate between cities.

To start the testing, basic wireless equipments must be prepared like Aironet 350 Bridge, client adapters, access point and antenna. Aironet 350 Bridge gives the most prevalent line of is used to extend network into a hybrid of a WAN and a LAN. Though the wireless network can be connected and configured like a LAN, bridges can be up to 25 miles apart, depending on what kind of antenna you install. Configuration and management options include direct console or remote configuration via Telnet, File Transfer Protocol (FTP), Simple Network Management Protocol (SNMP) or Browser graphical user interface (GUI). The bridge's main improvements over microwave technology are that no licensing is required, low cost and it's reasonably easy to install.

PC card client adapters is a PCMCIA card radio module that plugs into any device equipped with a PCMCIA type II or type III slot. Because of their compactness, they can be used on a number of different machines, including desktop computers, notebook computers, personal digital assistants and pen-based computers.

The Access Point is also important equipment in order to do the testing via wireless connection. It is a piece of hardware that is connected to your wired network, allowing wireless devices to access the network through it. Access points perform functions similar to a hub in a wired network. Additionally, they add the performance benefits of security, management features and mobility services. For example, access points enable users equipped with wireless client adapters to freely move throughout a facility while maintaining uninterrupted access to the network. Access point's range is 100 feet indoors and 400 feet outdoors (at 11 Mbps), and 300 feet indoors and 1500 feet outdoors (at 1 Mbps). Access points can also be used as repeater to extend the range of your WLAN. For instance, if there are a couple of remote terminals in an isolated part of your building, situating an access point or two between the terminals and the access point connected to the wired LAN can improve speed and performance.

CHAPTER 4

RESULT AND DISCUSSION

The project manages to drag out some really market-oriented type of product. The idea was to create such an environment that student could get access to their room while being outside or having an outstation trip. They can access via wireless LAN and perhaps through Internet and mobile IP.

4.1 OBSERVATION RESULTS

Venue : Village 4 E
Date : 20 Jan 2004
Purpose: Observe the tendency of the electrical appliances in each room is being left on.
Time : 10:00 am – 3:00 pm

Level 3 : consists of 4 houses
Room counts : 4 houses x 7 student's rooms and toilet = 28 rooms
"Opened" room : 21 rooms
Percentage : 75% of rooms are left opened

Note: Opened room is the room that electrical appliances are left on

Level 2 : consists of 4 houses
Room counts : 4 houses x 7 student's rooms and toilet = 28 rooms
"Opened" room : 19 rooms
Percentage : 68% of rooms are left opened

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```
Level ground    : consists of houses
Room counts     : 4 houses x 7 student's rooms and toilet = 28 rooms
"Opened" room   : 20 rooms
Percentage      : 71% of rooms are left opened
```

Figure 6: Observation results

The results show that each room has possibilities almost 76% with opened condition. This is very critical because the percentage is very high. It is suggested that only 5% of each block will have the room with opened condition.

4.2 CLIENT-SERVER APPLICATION

To enable communication between student and the desired electrical appliances client-server application is being developed using WinSock component in Visual Basic programming language.

The following function is the sample of the written program using Visual Basic. Before we can use the program, we need to copy a .DLL file into system directory or window directory. The file name is Win95io.dll, and this file must be declared in any module in the program.

```
Declare Sub vbOut Lib "WIN95IO.DLL" (ByVal nPort As Integer, ByVal nData As
Int)
Declare Sub vbOutw Lib "WIN95IO.DLL" (ByVal nPort As Integer, ByVal nData
As Int) Declare Function vbInp Lib "WIN95IO.DLL" (ByVal nPort As Integer)As
Integer
Declare Function vbInpw Lib "WIN95IO.DLL" (ByVal nPort As Integer)As
Integer
```

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CHAPTER 4

RESULT AND DISCUSSION

The project manages to drag out some really market-oriented type of product. The idea was to create such an environment that student could get access to their room while being outside or having an outstation trip. They can access via wireless LAN and perhaps through Internet and mobile IP.

4.1 OBSERVATION RESULTS

Venue : Village 4 E
Date : 20 Jan 2004
Purpose: Observe the tendency of the electrical appliances in each room is being left on.
Time : 10:00 am – 3:00 pm

Level 3 : consists of 4 houses
Room counts : 4 houses x 7 student's rooms and toilet = 28 rooms
"Opened" room : 21 rooms
Percentage : 75% of rooms are left opened

Note: Opened room is the room that electrical appliances are left on

Level 2 : consists of 4 houses
Room counts : 4 houses x 7 student's rooms and toilet = 28 rooms
"Opened" room : 19 rooms
Percentage : 68% of rooms are left opened

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Level ground : consists of houses
Room counts : 4 houses x 7 student's rooms and toilet = 28 rooms
"Opened" room : 20 rooms
Percentage : 71% of rooms are left opened

Figure 6: Observation results

The results show that each room has possibilities almost 76% with opened condition. This is very critical because the percentage is very high. It is suggested that only 5% of each block will have the room with opened condition.

4.2 CLIENT-SERVER APPLICATION

To enable communication between student and the desired electrical appliances client-server application is being developed using WinSock component in Visual Basic programming language.

The following function is the sample of the written program using Visual Basic. Before we can use the program, we need to copy a .DLL file into system directory or window directory. The file name is Win95io.dll, and this file must be declared in any module in the program.

```
Declare Sub vbOut Lib "WIN95IO.DLL" (ByVal nPort As Integer, ByVal nData As
Int)
Declare Sub vbOutw Lib "WIN95IO.DLL" (ByVal nPort As Integer, ByVal nData
As Int) Declare Function vbInp Lib "WIN95IO.DLL" (ByVal nPort As Integer)As
Integer
Declare Function vbInpw Lib "WIN95IO.DLL" (ByVal nPort As Integer)As
Integer
```

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Once the DLL file has been declared input these two new commands which are vbInp and vbOut can be used. But in this case only vbOut is needed to outputting a bit pulse to the parallel interface. Below is the sample of code using vbOut function.

```
'set port to 00000000
vbOut 888, 0
'set port to 10000000
vbout 888, 1
```

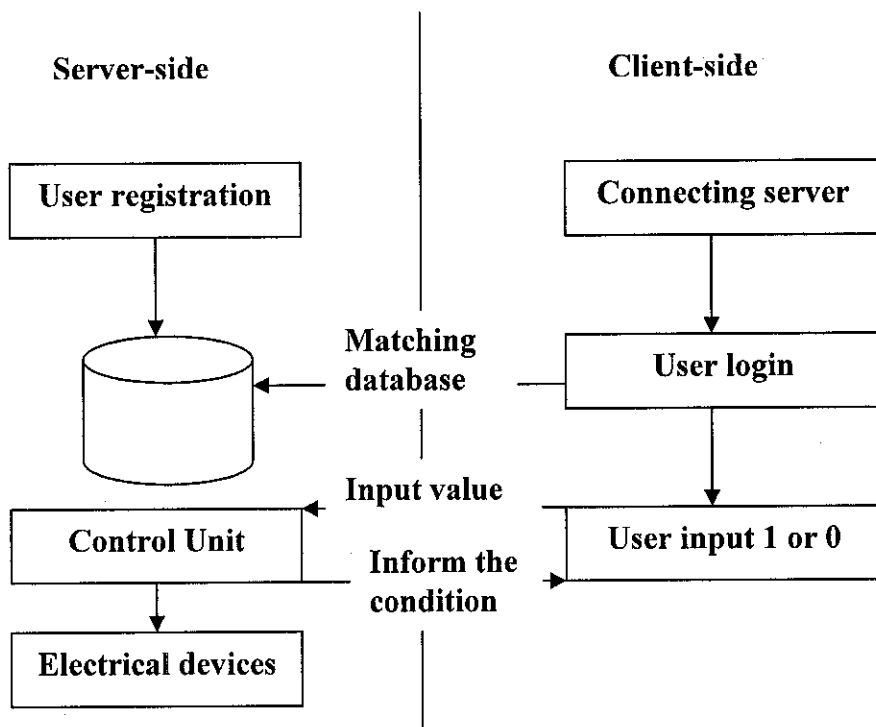### 4.2.1 Logic flow and box diagram of the program.
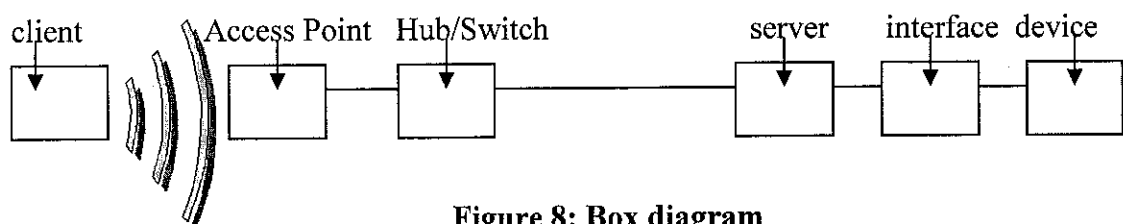

Figure 7: Logic flow

Figure 8: Box diagram

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The application starts from the user registration process, where user will key in all the details regarding them and it will be stored at the server-side database. User also will be given a password to enable them passing through the login window.

At client side, user will first try to get connect to the server side application. Then, they need to login in order to enable them to use the switch function. After successfully login, the user need to send value from "value 1 Or 0" textbox. The value is in logic digit where 1 indicates ON and 0 indicates OFF.

4.2.2 User interface design
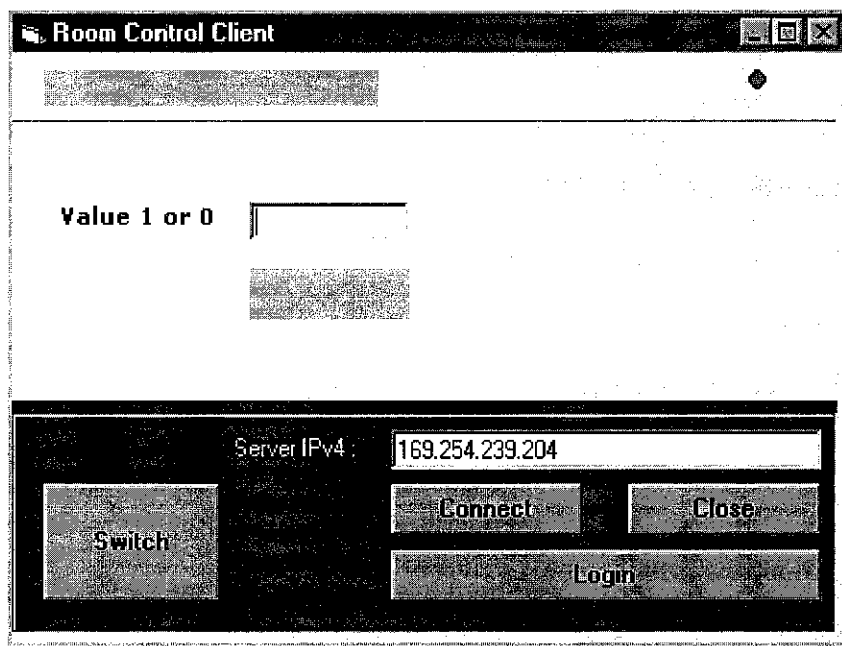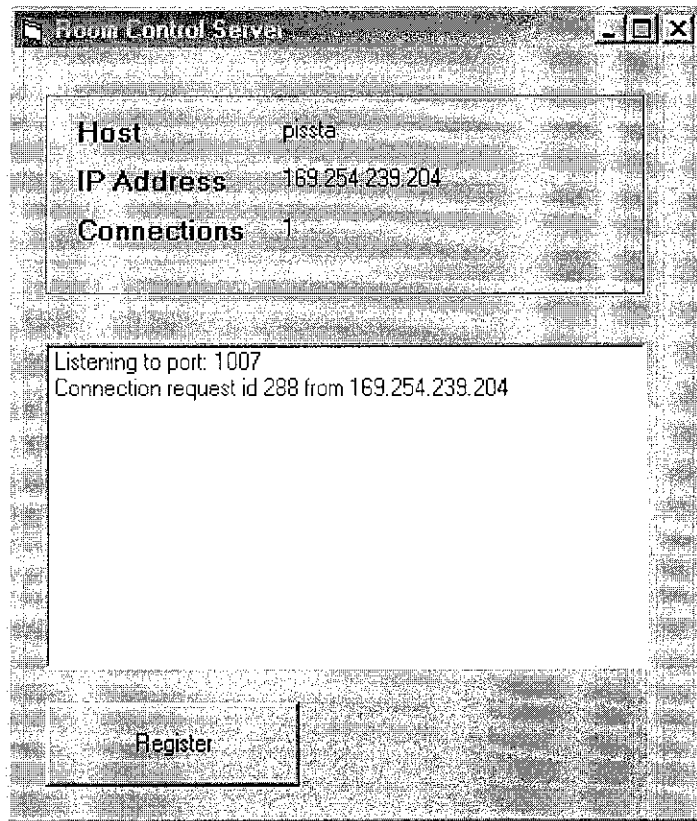

Figure 9: User enter the server's IP

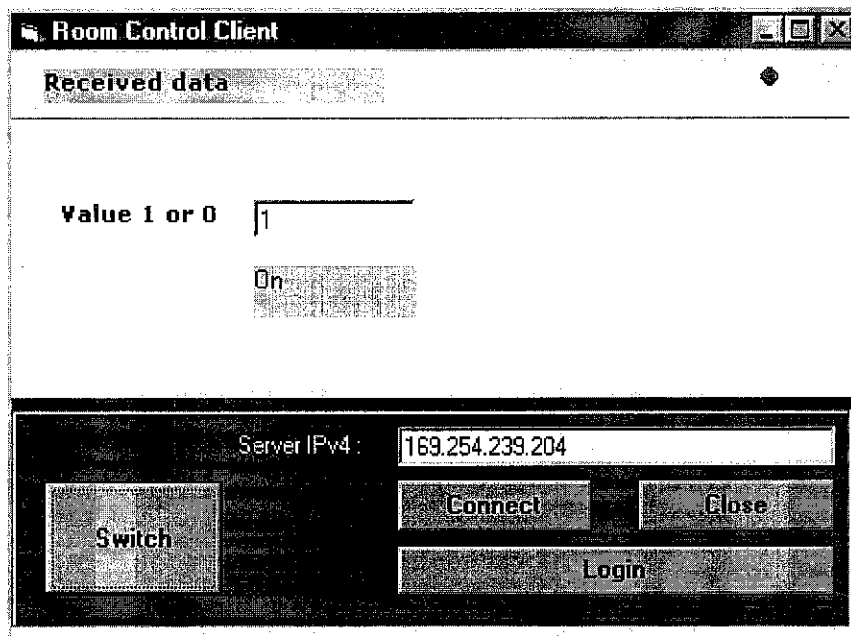Figure 10: Server listens to user's request connection.

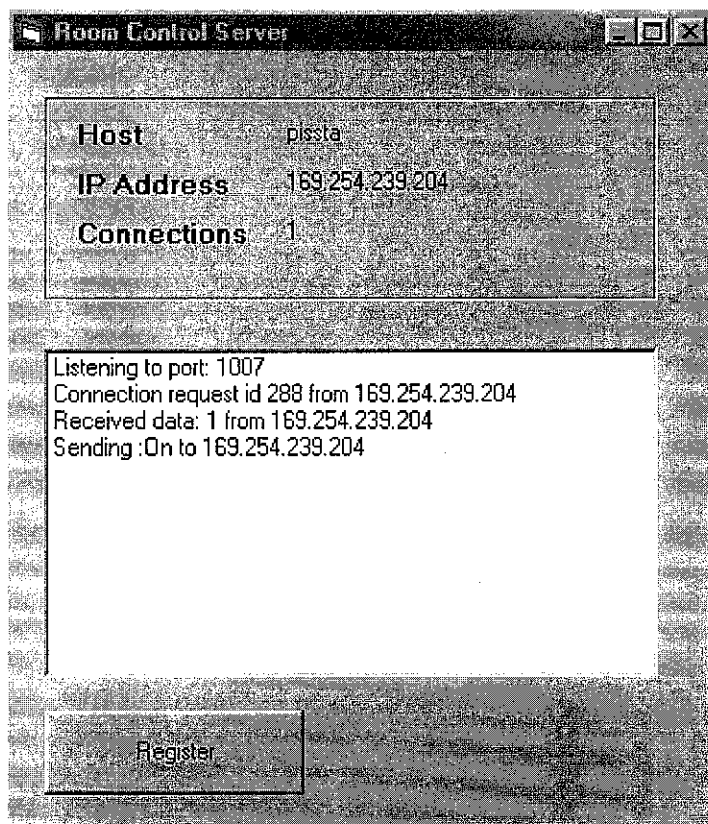Figure 11: User inputs 1 to switch ON the electrical appliances.

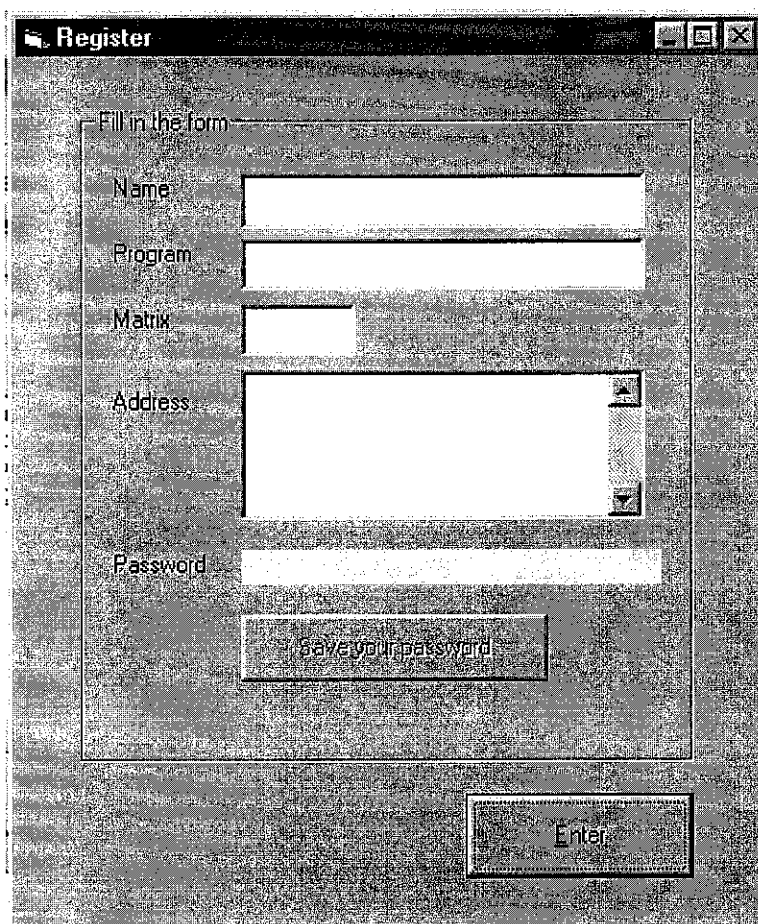**Figure 12: Server receives 1 and inform the condition to user.**
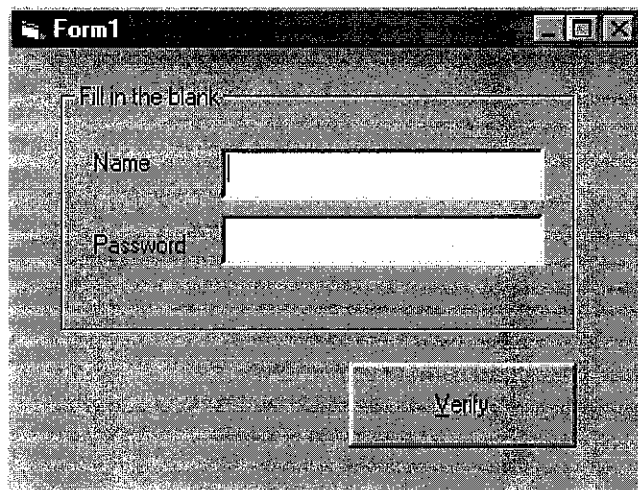
Figure 13: Registration form for first timer user

Figure 14: This login form will match the name and password in the database to allow only an authorized user to use this application.

4.3 INTERFACE CIRCUITRY

The first attempt to complete the circuit on interfacing parallel port together with electrical appliances is by examining the architecture of printer cable which is the color configuration and input output signal. There are 25 pins altogether and knows as DB-25 male printer port. The color formation is very important when the time to construct the interface from the parallel port to the outside world.

Figure 13 shows the circuit to interface parallel port (DB25 female). The data signals come from D0 to D8. Logic one (+5V) on data port causes the signal propagate through the 74367 Hex Buffer. After buffering the signal, the signal finally will go through 220 ohm resistor.
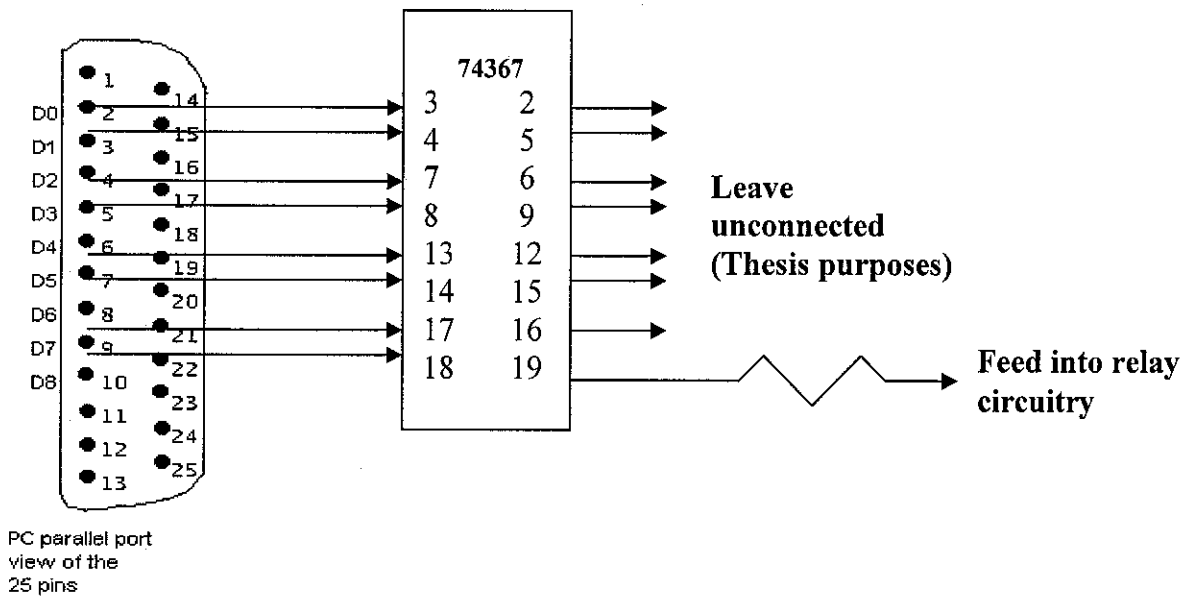
Figure 15: Parallel Interface circuitry diagram.
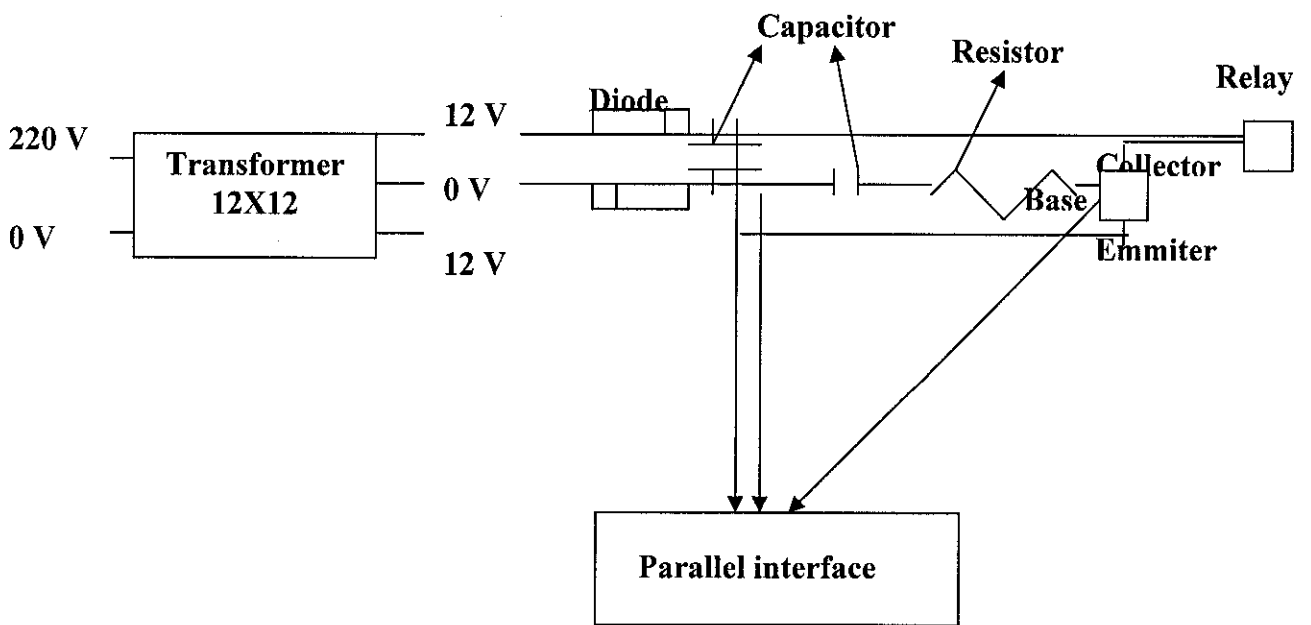

Figure 16: Relay circuitry diagram.

If the electrical devices need a supply current up to 240V so, the next diagram, which is figure 14, is needed. The following particulars are needed in the project to construct the above circuitry.

Part Description	Price	Quantity
1) 74367 Hex Buffer	RM3.00	3
2) DB25 Male Connector (1.2m)	RM3.00	1
3) 220 OHM resistors	RM0.20	12
4) PCB board	RM1.50	1
5) LED	RM30.00	30
6) Relay 9V in 240V out	RM18.00	1
7) Transistor C945	RM1.00	1
8) 12-0-12 transformer	RM8.00	1
9) Diode	RM0.50	2

4.3.1 Test the output signal using a LED

For thesis purposes LED was being used to be a prototype device (replacing electrical appliances) before applying to the real electrical appliances. The cathode leg is connected to the ground (GND) and anode to the resistor. It was being told that the use of regulator is necessary to stabilize the input voltage at 5V and an adapter as the power supply.

A telephone charger is used as an adapter, which stated at the head plug AC/DC adapter with 4.5V voltage supply. The other end of the adapter had to be cut off to pull out the wire only. When the output voltage is tested using multimeter, the range went up until 10V so as advised, the use of regulator (LM7805) is needed.

4.3.2 Apply the output signal to a lamp

After successfully turn the LED on, direct the signal to drive a 100-Watt lamp. Figure 14 (relay circuitry) is discussing more or less about how to get the lamp on. From the 240 V power supply point, drive that voltage into a 12-0-12 transformer. The transformer will down grade the voltage to 12 V. Tab over 12 V and 0 V pin outs and drive them into diode and bind the other end of the diode with a capacitor. One of the output will be directed into the parallel port interface and another output source will be directed into the transistor and relay.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

Parallel port interfacing circuitry and its architecture is the most significant findings in relation to the objective of the project entitled "Wireless Room Control". It is often desirable to interface a personal computer to a digital system that performs some special task (for example, control of an attached machine, data acquisition et cetera). Most of the findings are very helpful in providing information about the synchronous sequential circuit that interfaces to the printer port of a PC and drives up to 24 data outputs and also in providing information regarding the architecture of the parallel printer port which includes the informative literature regarding pins out configuration, data port, control port et cetera.

As part of these findings, they did help in learning about the details of the printer port interface and how synchronous designs can be used to communicate with such an interface. Basically there are two ways to accomplish this (parallel port interface): (1) Use a parallel interface card that plugs in to the PC's internal bus or (2) Use the PC's printer port.

Using an interface card has the advantages of flexibility and speed; since data can be written to the outputs very quickly and off-the-shelf interface cards are available that

5.2.3 Application with surveillance cameras

In the future enhancement, perhaps the clients can have an application that shows the current situation at their home at the far distance. They can place the camera at strategic spot and can check the condition of that particular spot remotely. There are functions in the server application that can stream the video and send the picture every five seconds to the client application. This might use the status port over the parallel port which can read input data (using *vbInp* in Visual Basic) .

provides a large number of outputs. However, in some cases a card slot may not be available for this purpose. Moreover, for portable devices, a user may not wish to take the time required to open the PC and install the card.

On the other hand, the interface for the printer port is simple, and a circuit to implement this interface is easy to design and inexpensive to build. Such an interface doesn't require a slot as an interface card does, and doesn't require opening the PC to install the card. However, this approach also has disadvantages. First, only eight bits of data can be written through the printer port. Second, the printer port interface is slower that that used by an interface card. Third, the printer port may also be in use. However, if we want a "quick and dirty" interface to a PC, the printer port gives us an easy way to accomplish this.

Printer ports provide TTL-level signal which can be used for data output (and in bidirectional ports, data input). The capabilities of printer ports vary, but the minimum function is to provide eight data outputs along with a set of control outputs and status inputs. Printer port output signal basically come from pin 1 to 9 and 16 to 17. Pin 18 to 25 are grounded and the rest are the input pin.

The simplest interface to the printer port connects data signals directly to the inputs of the attached logic circuit. The attached circuit must have its own power supply and operate without harming the printer port. In environments with a lot of electrical noise (e.g. factory automation) or where the attached circuit may use high voltages, some form of isolation is needed between the PC and the interface that this might be accomplished by a device call an opto-isolator.

5.2 RECOMMENDATION (for future enhancement)

Currently student can only control their rooms that have connection inside UTP network clouds. From any point at building 2 (Information System) which has established a wireless connection that is up at data communication lab, student can

have their client room control application ready to be used. When the student insert the server's IP it will be detected by the CISCO antenna and link that IP to Aironet 350 Bridge. Next, the IP will be propagated through Data Communication Lab switch to the UTP network cloud which is connecting to various sub networks inside UTP. One of the sub networks is Village 4E building which is the building that locating the control room server application. The server will listen to the IP that had been sent. From UTP networks cloud, the client IP will propagate through Village 4E switch and broadcast the IP throughout the subnet. The server that listens to the incoming IP (which had been broadcasting) will open the PC port and the connection is established. The client send a value and the control module inside the server application will direct that value to the parallel interface and finally to the particular electrical appliances.

5.2.1 Control the electrical appliances at house.

The previous connection is only allowing the usage within the UTP networks. With just a simple configuration, this method can be applied to control any appliances at home from UTP. Ones need to establish an internet connection at their house using fixed IP (streamyx) line from JARING. It is not recommended to use DHCP (Dynamic Host Configuration Protocol) which will set your IP dynamically. Meaning that it the IP will change each time you establish the dial-up connection.

Set the home PC as server with internet connection through ADSL modem (modem for streamyx). The fixed IP propagate through the same route but this time when the IP is within UTP network cloud it will direct through UTP gateway. From there, it will go through the global internet connection which finally propagates through Telekom leased line (streamyx line) which has the direct connection to the particular house. It is more advisable to establish DNS address like www.wirelessroomcontrol.com or any relevant name to the application.

5.2.2 Addressing many output.

Currently, the addressable output is about eight to nine outputs, thus the possible appliances that manageable to control are on that range. It is always recommended that the numbers of the driven output can be increased to the possible number of electrical appliances at ones room or house.

Specifically, a synchronous sequential circuit can be designed using PAL22V10 which is normally known as "addressable register". The purpose of addressable register circuit is to expand the number of outputs that can be driven from a PC printer. This is done by treating two bits of the eight-bit output as *address* outputs which specify where data will be stored. The address bits are used to select one of up to four addressable registers connected to the port to store the remaining six outputs bits, allowing the printer port to control a total of 24 different outputs.

Figure 3 shows the schematic symbol for the addressable register circuit. The inputs to this circuit include a clock input CLK, an active-low request input (REQ), two address inputs A0-A1, two address configuration inputs CO-C1, and six data inputs DO-D5. The outputs include six data outputs Q0-Q5.
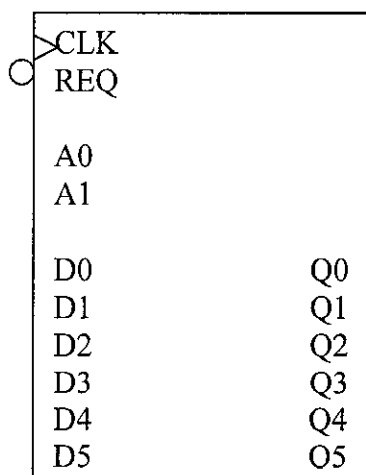

Figure 15: Addressable Register Schematic Symbol

The operation of the circuit is relatively simple. Specifically, when the address inputs A0-A1 are equal to the configuration inputs C0-C1 and the (REQ) signal is

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asserted low, the data inputs D0-D5 should be stored into data outputs (pooling) Q0-Q5 on the next rising edge of the clock. Otherwise, the data outputs Q0-Q5 should continue to be stored in the output flip-flops. Note that this circuit is *synchronous* because all activity occurs at each rising clock edge. Such an approach is more immune to noise and glitches than an asynchronous circuit where changes occur directly in response to inputs.

Up to four addressable registers can be combined to drive up to 24 outputs, as shown in figure 3. Each addressable register must have its configuration inputs C0-C1 set to a binary value "00", "01", "10" or "11". To write a value to all four addressable registers, the output port must write four separate outputs, each with the bits set for the appropriate register and outputs.
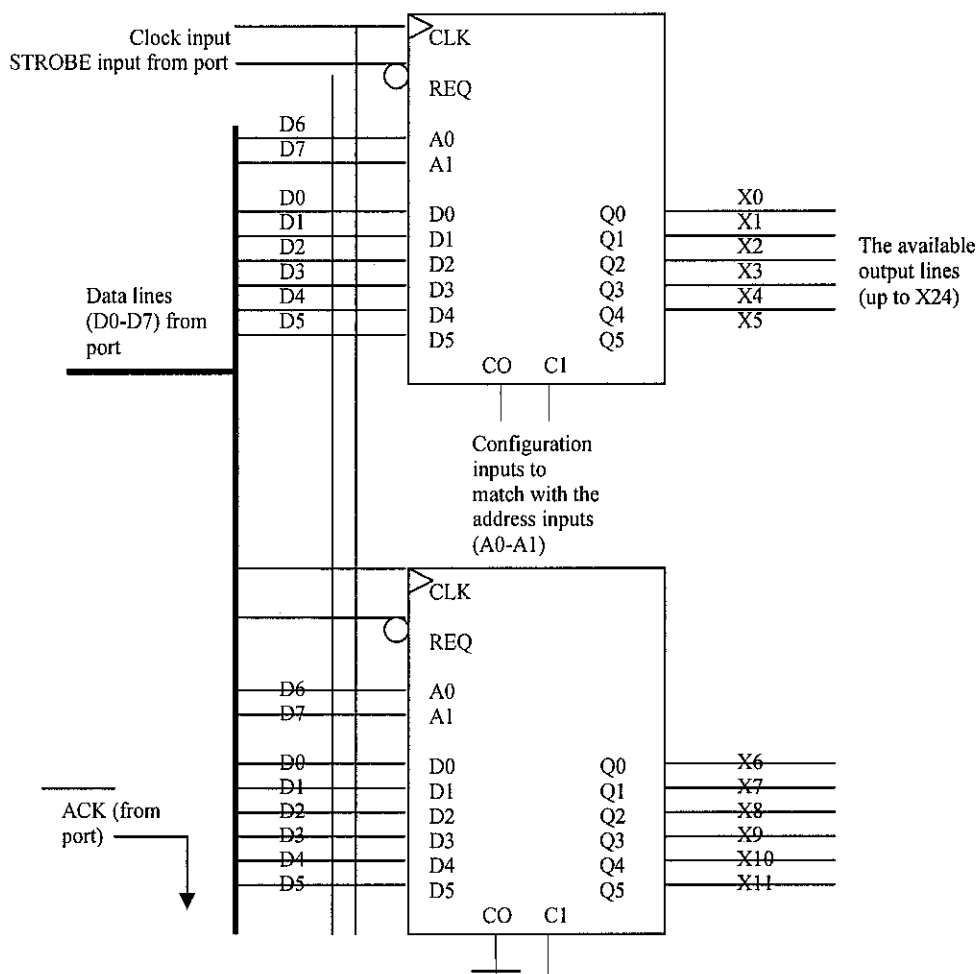

Figure 16: Interfacing Registers to Printer Port

5.2.3 Application with surveillance cameras

In the future enhancement, perhaps the clients can have an application that shows the current situation at their home at the far distance. They can place the camera at strategic spot and can check the condition of that particular spot remotely. There are functions in the server application that can stream the video and send the picture every five seconds to the client application. This might use the status port over the parallel port which can read input data (using *vbInp* in Visual Basic) .

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