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Web Based Controlling System for Computer Technology Laboratory

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Abstract: Recently there are many existing applications in our daily life through the use of the internet. These applications had contributed to human in many aspects of life especially to those who rely mostly onto internet in completing their daily tasks. Knowing this, an application using web-based to control the electrical appliances such as lamps and fans in the FKEE Computer Technology Laboratory were proposed. By providing a function to switch on/off lamps and fans using the web without the exact existence of the user in the laboratory as it also has been designed to be more user-friendly help management to save the power consumption usage in laboratory. Apart from that, this project also has the capability to monitor the condition of the laboratory by using IP Based Camera that is connected to the internet and functions as the CCTV for the web users. Moreover, as the safety precaution, this application has been designed to have a restriction to only authorized user whom can login, in order for the user to have full control over the system. This can avoid from any unwanted circumstances and also increase the maximum level of handling the system properly for the user and university.

Keywords: web-based system, electrical appliances

1. Introduction

In today's world where time become shorter, we sometimes do not even have sufficient time to properly monitor or ensure that electrical devices in our work place left in such a safe condition. The situation is similar if we want certain devices to be turned on or off while we are away from our place. All these can be realized with the development of On-Line Monitoring and Controlling System.

As we know, there are many types of equipments and devices are placed in the Computer Technology Laboratory. The authorized persons who have to in-charge the laboratory can monitor and control the laboratory appliances such as lamps and fans although they are far from the laboratory by using web based environment. This can allow full control of the laboratory's condition while the person is away from the laboratory. Moreover, they can monitor the laboratory by using IP based camera that acts like a CCTV system.

This project is divided into three major modules which are the embedded system of PC relay driver board, the web based development and the configuration of IP based camera. The information of the authorized users is stored in the database while for the user interface is designed in Macromedia Dreamweaver Environment. The users can control the appliances such as lamps and fans in the laboratory by using the PC relay driver board. The users also can view or monitor the condition of the laboratory at anytime and anywhere by using IP based camera.

The main objectives of this project are to design and develop a laboratory controlling system and to provide user remote controlling purpose for their laboratory environment in a user-friendly environment. Apart from that, a server is required to be configured for controlling the laboratory and user friendly web-based system is developed for monitoring and controlling laboratory appliances. Figure 1 illustrates the system architecture or more accurate it demonstrates the process on how the system operates.

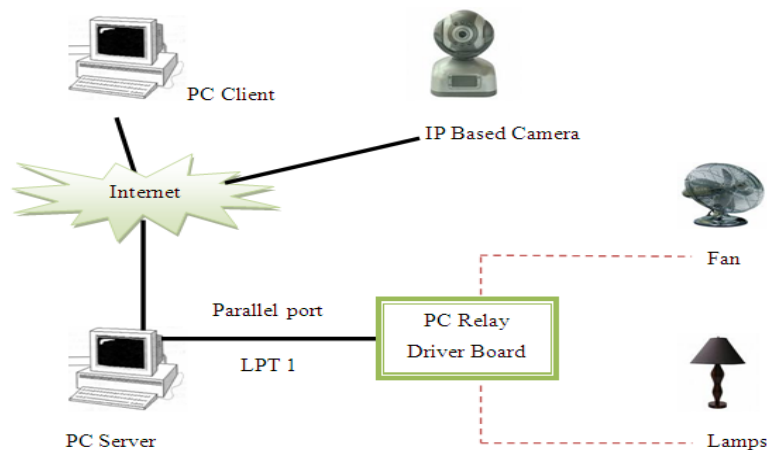


Figure 1: System Architecture

2. Related Works

Recent study regarding web based monitoring system has gained a lot of attention. Azman Abdul Latif (2005) had developed a supervisory control hardware consisting of an infrared transmitter, infrared receiver and a small power of home appliances such as table lamp and table fan to be controlled by using wireless internet. The programming of microcontroller chip that had been used is MPLAB IDE and C++ language while the Dreamweaver and Visual Basic had been used to implement the website that interfaced the hardware.

Mohamad Khairul Baharom (2006) proposed the PC based system for monitoring the elements in the clean room. This system was developed to keep temperature and vibrations are under control in the cleanroom. Temperature and vibration circuit was constructed to detect and measure these elements. Visual Basic had been chosen as programming language to interface this circuit to PC via communication port. Users are able to view and monitor the data via online system that can be accessed using web browser using Internet Protocol (IP) address in the campus.

According to Nor Azarina *et al.* (2006), has developed an infrared remote control using web. The work presented the use of internet to control the remote from the web thus the remote automatically act to send signal to the appliance. The main limitation of the work is the use of infrared which is required a straight line of sight.

However, Malik Sikandar *et al.* (2009) and Mohd Helmy Abd Wahab *et al.* (2010) presented a new way of controlling the home appliance by utilizing Short Message Services. The uses of SMS as one of the medium for control are getting concern nowadays as the people are moving and always away from home. This allows SMS to be sent to the device connected to GSM modem and the control board translates and changes the protocol from SMS-based text messages into command control.

One application of controlling the electrical appliances was developed by Noraini Abdul Samat (2005) that gave better facility for the users in controlling lamps and fan especially for older people and people with disabilities. This project used RS232 devices, computer and controlling system as hardware and RS 232 Interface with Visual Basic 6.0 as software to develop this project. In addition, Mohd Rosli Mat Isa (2006) had designed and constructed a control system using microcontroller and sensors which built a comfortable home environment. This system had designed and built on and off unit for electrical facilities with the main component like triac, optocoupler and also used temperature sensor and light level sensor and microcontroller to control light and fan regarding to the atmosphere. This system would operate when the temperature of the atmosphere and the light level from the sun are changing. Therefore, we do not have to go to the exact switches to switch on the lamp when it is dark and on the fan when there is hot. Basically it was be an automatic system to on and off the lamp and fan for the comfortable environment in the house.

Nguyen (2008) presented the used of infrared ray and power line communication integration in home appliances control system that supports the ubiquitous access control mechanism which enables users to check their appliances' statuses and control them remotely through their cellular phone or Internet.

3. Design and Development

In order to control and monitor the laboratory, the server and central control unit are programmed by using web based programming language which is PHP. The MySQL is used for the database management while the client webpage is created for user's authentication. The embedded system is designed and developed based on PC Relay Driver Board as the core engine of the system and has been programmed using Visual Basic (VB).

The web-based needs user authorization to control the laboratory appliances such as lamps and fans and also the authorized users can view the condition of the laboratory in the webpage through IP based camera that acts like a CCTV system in the laboratory.

3.1 Hardware Specifications

The hardware is divided into two main modules which are embedded system of PC relay driver board and the configuration of IP based camera. Table 1 lists the minimum justification of hardware that has been analyzed to use in this project.

Table 1: Hardware Justification

HARDWARE	REQUIREMENT
Personal computer	<ol style="list-style-type: none"> 1. Operating system – Windows 98 or later 2. Hard disk – 5GB or greater 3. RAM – 64MB or greater 4. Processor – 600MHz or greater
IP Based Camera	<ul style="list-style-type: none"> • Pentium III 1 GHz processor or above • Windows 2000/XP/Linux • 128 MB RAM/800 x 600 16-bit display • Internet Explorer 5.0 Web browser or above that supports ActiveX • Web browser that supports Java Applet such as FireFox 1.5 • CompactFlash card • Router or Gateway • 10Base-T/100BaseTX Ethernet • Available power outlet
Parallel Port	<ul style="list-style-type: none"> • AWM STYLE2464 24AWG 80DEGR. C 300V VW-1
PC Relay Driver Board	<ul style="list-style-type: none"> • Rated 300V / 10A. • Connect 12VDC center positive to power the board. • DB25 connector to the parallel port of a PC. A straight-through 25 pin cable (DB25 male at one end, female at the other cable from the PC to connect to the board).

3.2 Software Specifications

PHP and MySQL had been chosen for creating the web server and the dynamic website. Furthermore, the basic system requirement to ensure the system can work properly are Windows XP Professional / Windows server 2003 including the web server software WAMP 5.1, and MySQL Database Server for managing the database and its structure. The SQLYog 5.01 is used for database development while Dreamweaver MX/ 8 as a web editor.

C. Hardware Design

A PC Server is required to integrate PC with the relay. This PC Server is connected to the PC Relay Driver Board via Parallel Port (LPT1). Since PC Relay Driver Board has eight relays on this it, so it has an ability to turn on and off of the eight devices consist of lamps and fans which are connected to the output port of the board. Figure 2 illustrates the prototype design of Computer Technology Laboratory. The users can control the electrical appliances via internet by sending the instructions (ON or OFF) which act as the digital input for the board. IP Based Camera is connected to the network so that it can be functioning as a device to monitor the laboratory through Internet protocol. Table 2 shows 8 data pins of Parallel Port (DB25). The relay at the PC relay driver board would act as a switch as when it receives input 1 from the

user, then the LED is turned ON. The circuit would be completed when we connect to power supply. When we send 0 to that same pin, the LED turned OFF.

Table 2: Pin in Parallel Port (DB25)

No. Pin In	Address Pin with Visual Basic
2	0x378, 0x01
3	0x378, 0x02
4	0x378, 0x03
5	0x378, 0x04
6	0x378, 0x05
7	0x378, 0x06
8	0x378, 0x07
9	0x378, 0x08



Figure 2: Prototype of the Computer Technology Laboratory ,FKEE

3.3 System Design

The system design is focused on the designing the system interfaces and divided into two parts; hardware interfacing (embedded system) and web based programming. The hardware interfacing which was written using Visual Basic particularly to enable the timer and to allow data sending and control the hardware(appliances) through parallel port.

While the second part, is the web interface which is written in PHP. This is web-enabled interface needs users' authentication before they can browse to view or monitor laboratory appliances through the web and control them as they wish. For authentication and security purposes, authorized users are required to create user name and password and save in the provided MYSQL database. These two data are needed to log in to the web based system and moreover to differentiate the identity between authorized user with unauthorized user. Both of these Visual Basic program and PHP-written web pages are referring to the same MySQL database.

Basically, the system will be begun to operate by the process of password verification at the login page. If the information such as login name and password are correct, users will be able to link to next page which is main page. From the page, the user has the options either to control the laboratory by switch on or off the lamps and fans or monitoring the laboratory by using the IP Based Camera. The request for viewing the laboratory condition can also be done by clicking the video button which also included in this particular webpage.

4. Results

4.1 Embedded System (Visual Basic)

User is presented with the main interface for embedded system which is shown in Figure 3 below. The user needs to authenticate with the correct username and password before accessing to the next interface. There will be a pop up message display 'User Identified' if the users are success to log in.



Figure 3: System Login Success

If authentication failed, the popup error message that shows 'Did Your Forget Your Password; Be Sure To Use The Correct Uppercase And Lowercase Letters'. So, the users need to re login until the characters of the username and password are correct. This is one of the security features for this system that allows only the authorized user to access the system.

Figure 4 below illustrates the condition of each device that consists of the six lamps and two fans in the laboratory. When the window is popped up, the devices which are already switched on according to database are displayed as "On" with green indication. Otherwise, the status is displayed as "Off" with red indication. Users can change this condition whether to switch on or off the devices based on their needs. There is a command button; "From Database" which can be pressed to show binary bits after being read from the database and assigned to set of array variables.

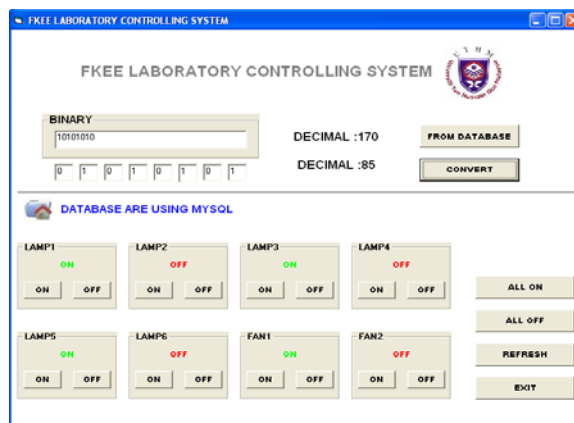


Figure 4: Status of the System

Then the previous separated binary bits are merged together and assigned into one new variable. The merged binary bits will then be converted into decimal value, before it is being sent as hexadecimal to hardware through parallel port that used the base address of LPT which is 0x378 for typical personal computer (PC). Those data pins are TTL (transistor-transistor logic) level output pins. This means that they put out ideally 0V when they are in low logic level (0) and +5V when they are in high logic level (1). In real world the voltages can be something different from ideal when the circuit is loaded. The output current capacity of the parallel port is limited to only few milliamperes (mA).

4.1 Web Based Application Interface (PHP)

WAMP Server is used to activate the Apache Server and to ensure that the web server is running. Figure 5 illustrates the main pages for the web based system. In this page, user needs to log in as a valid user by providing correct Login and Password.

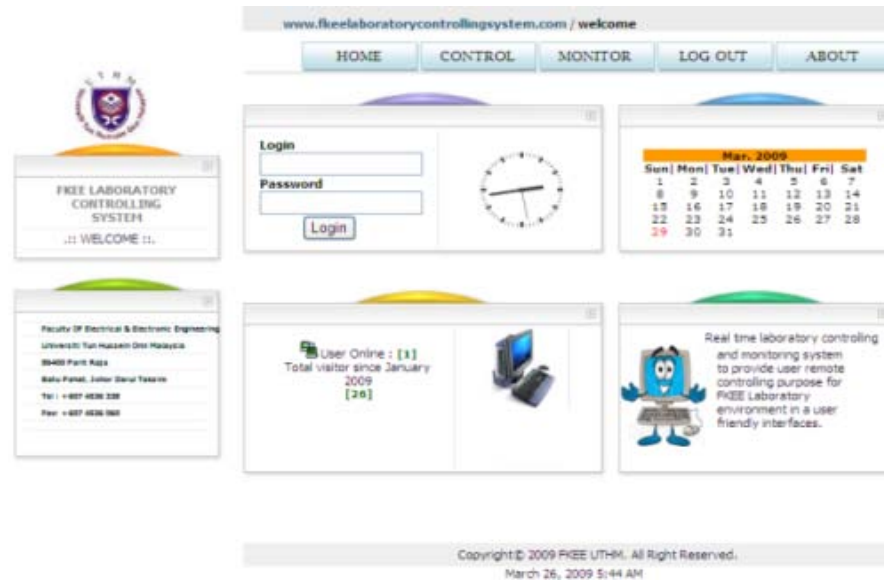


Figure 5: Main page for the system

This main page is also provides online users and total visitors function for the administrator to monitor the website from time to time.

Figure 6 below depicts the page for the operation of the system. This page allows users to turn on or off the lamps and fans, which situated in eight rooms. Green color radio button shows that the devices in on status while the red radio buttons shows it is off. Every activity of pressing the On or Of button will send the data to the database which represents in binary digits, zero or one. One represents that the device is on whereas zero represents that the device is off. The status of bit 1 or bit 0 in the database is updated depending on the user's activity. If the 'On' button is pressed, the data in the database will change to 1 while if the 'Off' button is pressed, the data will change to 0.

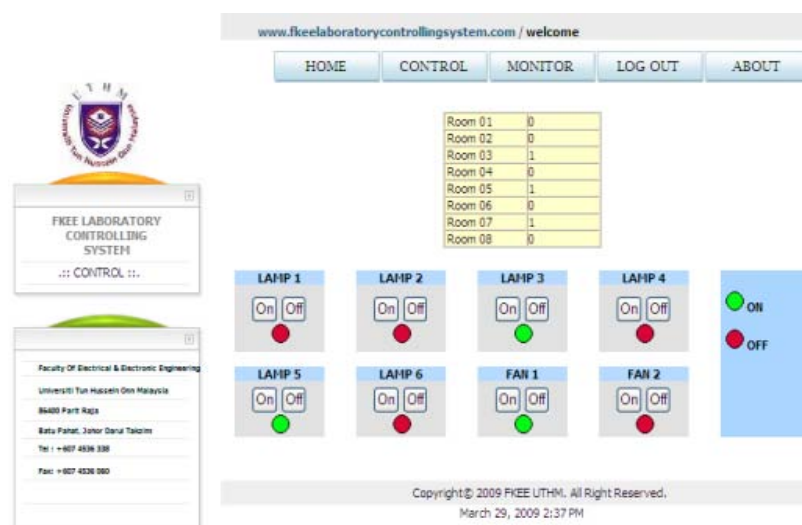


Figure 6: System Operation

The above page also provides Monitor command button which allow the authorized user to access to the IP Camera that acts as a CCTV in this system. The user can view the condition of the laboratory through the webpage. IP-based camera connects directly to IP networks, record at higher frame rates, and generally has better resolution than webcams. Since this system is IP-based, we can monitor, store, and do the archive video, audio and associated application data over the internet or across private data networks. The video can be carried anywhere the IP network extends, as opposed to closed-circuit television (CCTV) systems that require proprietary equipment and dedicated coaxial cabling. Anyone with the proper security clearance and a standard browser can monitor video, and control and configure the cameras on the network.

The log out menu, will guide the user to the main page again, and user cannot access back to operation page menu. User need to re-login in main page system due to the system security.

4.3 Database Management (MySQL)

MySQL database is used for this system because it is compatible database for both Visual Basic and PHP. Visual Basic needs to communicate with this database to send the instruction from the web browser to the parallel port for activity of on or off the devices. Whereas for the web browser, which is written in PHP scripts need to communicate with the MySQL in order to ensure the system is functioning for monitoring and controlling the devices via internet.

In order to connect the PHP Script with MySQL, the Open Database Connection (ODBC) must be configured to open a database with a remote data control. Table 3 below shows the MySQL database for Table room and lists up the status of the devices that can be controlled. This table consists of two columns. First column is room_id and this attribute is set as a primary key. Id represents of a room number for this system. Whereas for the second column; status represents a binary number, either in 0 or 1 to show the status of device in on or off condition respectively.

Table 3: Table room

	room_id	status
<input type="checkbox"/>	1	0
<input type="checkbox"/>	2	0
<input type="checkbox"/>	3	1
<input type="checkbox"/>	4	0
<input type="checkbox"/>	5	1
<input type="checkbox"/>	6	0
<input type="checkbox"/>	7	1
<input type="checkbox"/>	8	0

Table 4 describes user login that stores the information of username and password of the authorized user whom can access to this system. This is apart of securities for this system that give only the authorized users have the ability to login the system so that they control and monitor the laboratory.

Table 4: Table user_login Database

	id	username	password
<input type="checkbox"/>	1	azrisaidin	1234
<input type="checkbox"/>	2	aisahsudin	1234
<input type="checkbox"/>	3	mohamad	1234
*			

There is a special feature in this system that can detect the total visitors that have been visited to this system. This system has a capability to count how many users that have been visited to the web pages.

Moreover, this system also can detect how many users are online through this webpage at one time. So, the administrator of the system can monitor their web pages if there is any unauthorized user accessed to this system. Table in_live is used in database to store the information about the online user based on the IP address and time that the users enter the web pages.

5. Conclusion

The system prototype that has been developed in this project seems to be very useful in nowadays life that provides high technology and low cost web based system since the system has gives the users to control their devices from outside the laboratory effectively if they forgot to turn on or off before leaving the laboratory, or other circumstances. It is also made possible for the user to access their devices from the worldwide web through web browser

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