TOWARDS SMART HOME: CONTROL ELECTRICAL DEVICES ONLINE

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Abstract

The rapid growth of the World Wide Web, has made the web is not just use for delivering information. Currently, Web is used to carry information in a borderless way since one of its features is stateless. The extension of the technology has discovered a web also could delivered signals. Since the introduction to the smart home concept, a web plays an important roles to control almost every electrical devices connected to internet that enable the user can control it every where. This paper presents on development of web-based controller for control electrical device. The prototype developed using Microsoft Visual Studio. NET and Circuit design. The methodology used in this project consists of three main phases which are Analysis, Design and Implementation. For future advancement, the prototype intends to include SMS module so that controlling can be done through SMS.

Keywords: *Smart Home, Visual Studio, Controller, Web*

1. Introduction

An explosive growth of the development in computer and network technology, the use of the Internet has been expanding exponentially. The Web is now extensively used as a reference tool for personal, educational, commercial, and industrial use. Due to rapid development of new technologies, the Internet has also started to serve as a medium that allows the monitoring, control, and interaction with machine and devices.

Electrical device control system is an integration of the current hardware and software technologies and the development can be categories into three categories [7]:-

- **Information appliance**
  Information appliance is dedicated to performing a function and has the ability to share information with others
- **Home control network**
  A home control network is designed to control all electronic appliance and Information appliance in the home environment. The main function of home control network is to make all the electronic appliance can be controlled and can share information with one another.
- **Software architecture**
  Despite that the development of software architecture is not prize as much as the development of hardware currently, it is believed that the software architecture must be an important issue for establishing the Home Automation architecture.

This paper aims to develop an electrical device control system using Web (Online). Using Internet access, home owners can remotely monitor and control almost any appliance at home. Local control is also offered in our design. Some security is imposed when logging into the system using Active Server Pages.

The Internet can be used in home automation which provides many features ranging from efficient use of energy to increased comfort, greater safety and security. Even over large distances the user can monitor and control his/her home gate, oven, refrigerator and water the garden without human invention [1], despite the benefit from this system, the high cost and complexity causes the home automation has not yet receive broad acceptance and attention.

Al-Ali and Al-Rousan [1] presented a design and implementation of a Java-based automation system that can monitor and control home appliance via the World Wide Web, where the design is based on a stand alone embedded system board integrated into a PC-based server at home and it does not cover if the network or server down. Liang et. al. [7] proposed home automation system is based on a dedicated network and has never been tested on the Internet. They founded that current home automation system is not equipped with efficient integration mechanism and it cannot fully manifest the worth of these developments. However, the proposed architecture focus on the software development perspectives and no hardware architecture proposed.

Srikanth [6] proposed an automation system that can control home appliances from PC using Bluetooth technology. However, the system cannot be controlled remotely through the Internet. Another approach to home automation using Bluetooth was discussed by Shepered [13] but no implementations were proposed.

Tongkaw [5] intelligent home automation control system by utilizing intelligent agent and fuzzy logic which control system will track the number of people in a given room of the house. Based on the amount of people present in the room, lights, fan, and air conditioner will be turned on and adjusted to an appropriate level as configured by the user. The water sprinkler system will function based on the humidity detected by a probe buried in soil. However the system only use stand alone configuration not using the Web for

The studies that have been presented [9-12] have enriched the field of Web-based real time applications. The system discussed above able to control, monitor, and interact with real devices used in universities laboratories. Real experiments have been conducted through the Internet. However, the system can be easily migrated towards home automation, the use of ready made software packages and proprietary hardware tools make the system more expensive.

2. Methodology

In order to design the system, the methodology presented below is used (see Fig. 1).

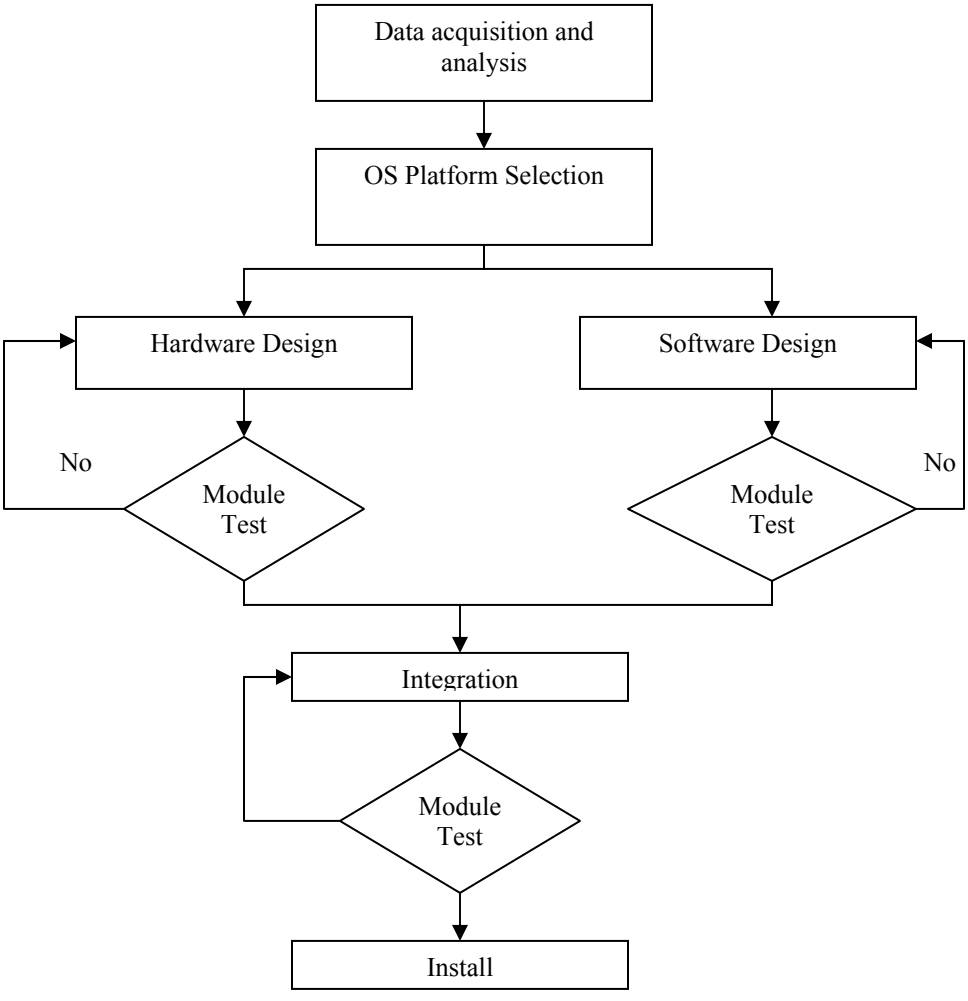

Figure 1: Development Methodology

3. Design and Implementation

This section discussed the design and implementation of electrical device control system which consider hardware and software design. However the design and implementation of the system is based on the block diagram as shown in Figure 2.

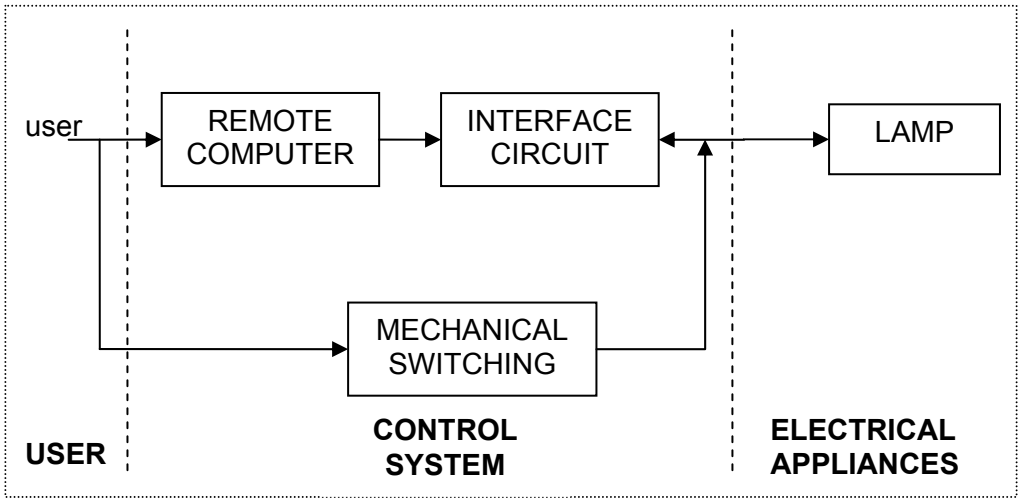

Figure 2: System Block Diagram

3.1 Parallel Port

The parallel port consists of 25 pins and normally it is situated at the back of the computer as illustrated in Figure 3. The port using IEEE standard 1284-1994 and can be functioned in both direction.

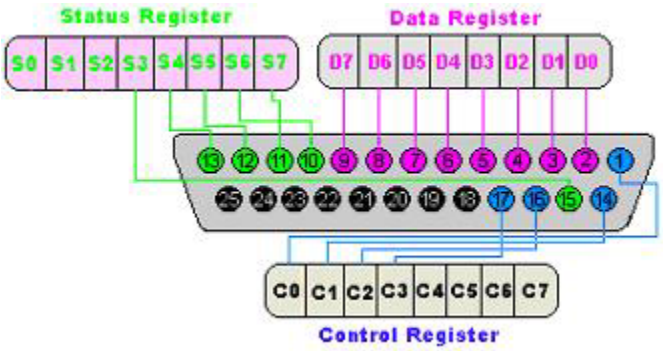

Figure 3: Pin Numbering System for Parallel Port

Not all 25 pin is used in one time but it can be easily used with 8 pin OUTPUT. The data is sent parallel at 8 bit each time. All pin are using OUTPIT at TTL level. It means at ideal situation, when volt is 0 shows that volt in LOW logic (0) and when volt is 5 shows that volt in HIGH logic (1). But in actual situation, the amount of the volt is different with the ideal when it is connect to the circuit.

3.2 Driver Installation

NTPORT.ocx is a driver file need to be installed before any communication can be made through the Port. NTPORT is distributed with application setup file. To install NTPORT simply run the setup file. It will place the DLPORTIO.DLL and NTPORT.OCX files into our system directory and will also register these files in the

Windows registry. Setup will also place the DLPORTIO.SYS file into our computers **system/drivers** or **system32/drivers** directory.

3.3 Interface Circuit

Interface circuit is designed to enable signal can be transmitted from server to hardware device. The circuit is constructed based on the circuit schematic and tested in the Digital Laboratory using IDL-800 Digital Lab as shown in Figure 4. Figure 5 illustrated a circuit that it used to test the control module circuit using application software. The circuit use 8 LED and 8 resistors 330 Ω.

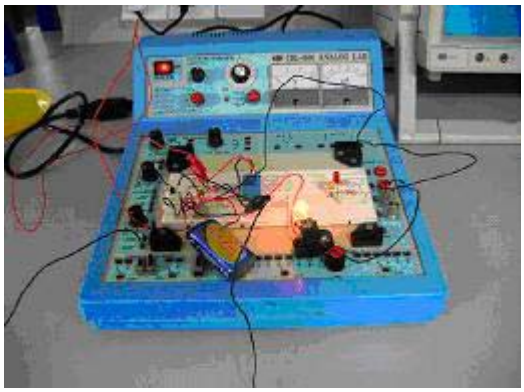

Figure 4: IDL-800 Digital Lab

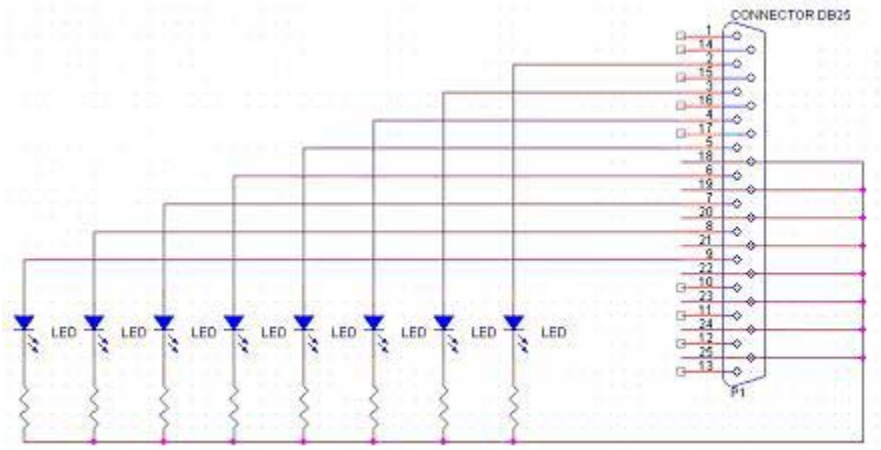

Figure 5: Circuit tester

LED connected to the eight pin data parallel port at pin 2 to 9. HIGH signal at this pin will enable LED to switch ON. Table 1 shows how the LED is switch on effect by application software. The BUTTON is click consecutive from above table to below where each BUTTON has its relationship to the pin at parallel port like table 2. The box that is black shows that the LED is switch ON.

Table 1: The result for a circuit test using application software

	LED 1	LED 2	LED 3	LED 4	LED 5	LED 6	LED 7	LED 8
BUTTON 1	■							
BUTTON 2		■						
BUTTON 3			■					
BUTTON 4				■				
BUTTON 5					■			

BUTTON 6								
BUTTON 7								
BUTTON 8								

Table 2: The relationship between BUTTON and PIN

BUTTON	PIN
1	2
2	3
3	4
4	5
5	6
6	7
7	8
8	9

3.4 Control Circuit

These circuits act as a switch which control using electrical signal and not using mechanical switch. Based on Figure 4, it supplies the signal +5V from parallel port to active the circuit. The volt 9V is used to active the relay so that it can be ON with HIGH input. **D1** used to block inverted current. Relay 9V is used because it has low barricade when it's ON compare to transistor. Figure 6 shows the circuit that when it is ON, relay will has barricade less than 1Ω.

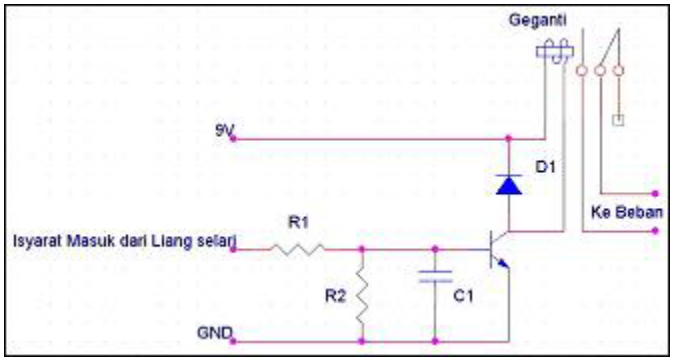

Figure 6: Control Circuit

3.5 The operation of control circuit

As we can see in schematic diagram (Fig. 7) is a combination from the circuit at figure 6. The circuit demonstrates that the device that we use with more volts. This circuit also designed for transistor and relay as a switch. General purpose NPN transistor (CS9013) is used to make it as switch to relay. It is because, the small value of the volt can disaturate V_{CE} for this transistor. When the transistor was disaturated, it will allow the collector current, **Ic** flow to ground and make an impermanent magnet at relay coil. When the impermanent magnet is exist, it will change the relay from normally open (NO) to normally close (NC). These changes will reflect the current can flow to ground and with that, the volt will supply to load.

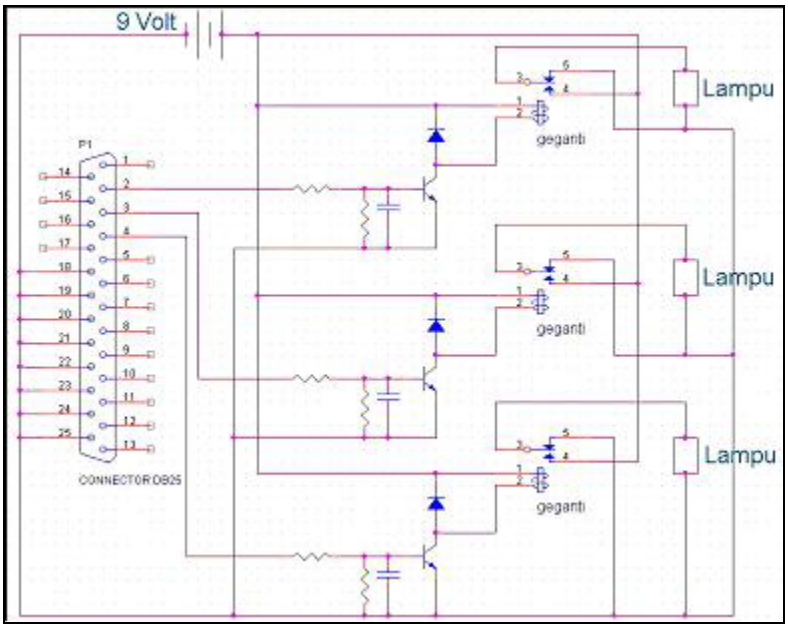

Figure 7: Project schematic circuit

3.6 Software Design

Software design has been implemented using Microsoft Visual Studio. NET and Active Server Pages (ASP) for Web Programming. ASP used to provide a user interface and will be display using Web browser. While Visual Studio.NET used to received signal from the Web Server to the hardware. User need to supply username and password to protect the hardware from unauthorized access. Figure 8 shows the interface for the system.

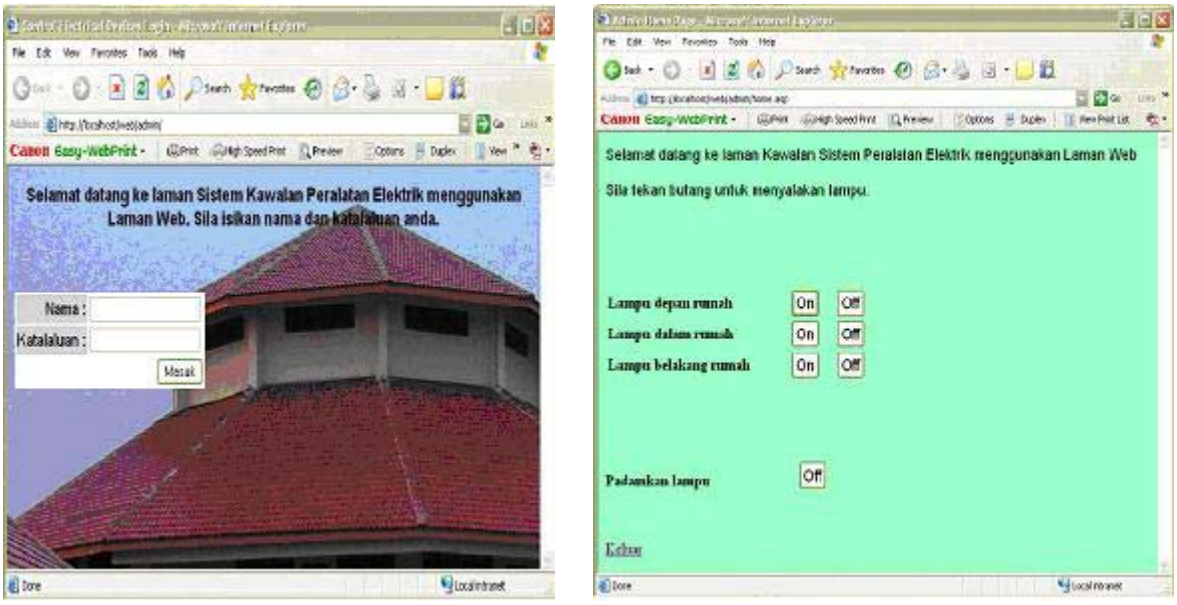

Figure 8: Web-based interface for electrical device control system

4. Conclusion

This is an on-going project to develop electrical device control system using Web. Since the prototype has been successfully control the lamp. The owner of the house can monitor and control the electrical device remotely. This will assist in energy safety, and security. For this prototype, we already set the server with auto restart if the server condition is currently down. However, the system will looking for advance features for accessing and controlling device using SMS due to usage of hand phone and smart phone is increasing rapidly.

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