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# Smart Electrical Panel Installation

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**Abstract**—The aim of this research is to design a web based electrical installation control system using smartphone for apartment, that includes hardware and software design. The hardware consists of microcontroller of ATmega16, relay driver and power supply. The controller software for client and server is design based on NetBeans IDE and Eclipse Juno. The computer network system will be achieved and it is connected to Virtual Private Network (VPN) connection system. The controlled electrical appliances are water heater, lights, and air conditioning (AC). Each controlled appliances on a different time obtain the same response time of less than one second. The results show that the response time is not depend on the distance of controlling system, but depends on the speed of data transfer.

## I. INTRODUCTION

Nowadays, most people choose to live in apartments because of the convenience environment and a high privacy level. Effectiveness and mobility are the major things, but sometimes the occupant overlook about a simple issue that has a huge impact to them selves and other people. Forgetting to switch off the electricity is one of the most occasional incident.

The needs of enjoying all the practical and comfortable living, with automatic facilities and easily to control from distance without brought many additional equipment such as remote control, is one of the most craving wish for those with high mobility. For instance is switching the air conditioner, the water heater or refrigerator on a few minutes earlier before approaching the apartment, so they will feel comfort as soon as they arrived.

The electric appliances control system using the personal computer (PC) is proposed in Ref. [1]. The aim of their research is to assists users who are disable in home and workplaces to control the home appliances using voice commands. They present the design of the interface box to control the PC and use Visual basic programming language. Also, an integrated system that uses speech as a natural input modality to provide user-friendly access to information and entertainment devices is implemented in Ref. [2]. The system integrated a linear microphone array to supply spatial sound selectivity, adaptive noise cancellation to deal with appliances that emit noise with the same statistical behavior as the desired speech signal, a word spotter that provides a robust gate to the far-end speaker recognition system, a speaker recognition

module that allows interaction of only registered users and finally a speech recognition system.

Another electrical control system is proposed in Ref.[3]. The paper introduced the SMS-based home appliances control system that uses GSM technology thus providing ubiquitous access. The system is wireless therefore more adaptable and cost-effective. Electrical control system is part of Energy Management System (EMS) that is presented in Ref.[5] for efficient load management. That research used human machine interface (HMI) that consists of PIC18f4520 of microchip family and zig bee transceiver of MC12311. The microcontroller interface with the zig bee transceiver is on standard RS232 interface.

Nowadays, remote control system is highly developed research due to very wide applications, such as control system for electrical installation. The used transmission medium for control is also quite diverse, i.e. infrared, Bluetooth, telephone network and internet. By using the internet network, distance is not a barrier. In addition, internet access is not restricted by time and place due to be accessed through smartphones. Therefore, this research proposed a web-based control of electrical installation using smartphone.

The objectives of this research are designing a long distant control system of electrical installation, designing the interface and android application to control the web based electrical installation system as smart electrical installation and evaluating the distant effect to controlling time using server and client application.

## II. THE PROPOSED HARDWARE DESIGN

The hardware design consists of microcontroller of ATmega16, relay driver and power supply.

### A. Microcontroller of ATmega16

This microcontroller type has complete facility, fast instruction process and it is supported by Code Vision AVR Evaluation software for simulation and compiler [6]. The schema diagram of microcontroller ATmega16 is shown in Fig. 1. The microcontroller circuit is designed to control the overall system design and clock system. The used frequency of crystal oscillator is 12 MHz The power source with dc voltage of  $\pm 5$  Volt is required.

**B. Relay Driver**

Relay is an electronic switch that is driven by an electric current. In this research, relay is controlled by the microcontroller. The schematic diagram of the relay driver is shown in Fig. 2. The simplest relay is an electromechanical relays which provide mechanical movement while getting electrical energy.

**C. Power Supply**

Power supply is designed to produce a DC voltage for microcontroller circuit of 5V and relay driver circuit of 12 Vdc. The schematic diagram of power supply is shown in Fig. 3.

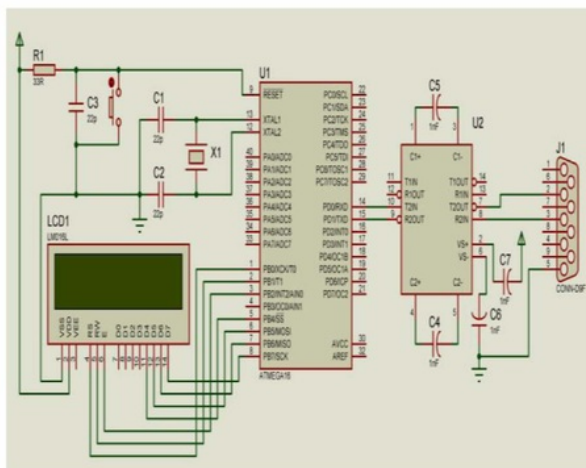


Figure 1. Schematic diagram of Microcontroller and LCD

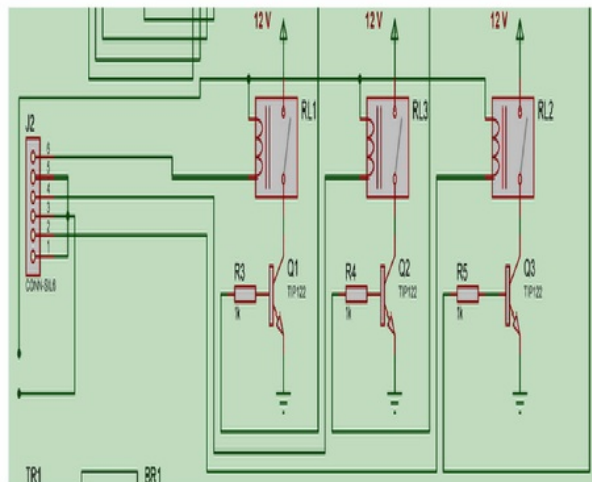


Figure 2. Schematic diagram of Driver Relay

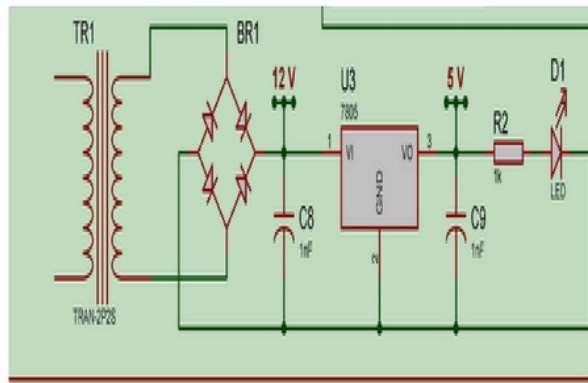


Figure 3. Schematic Diagram of Power supply

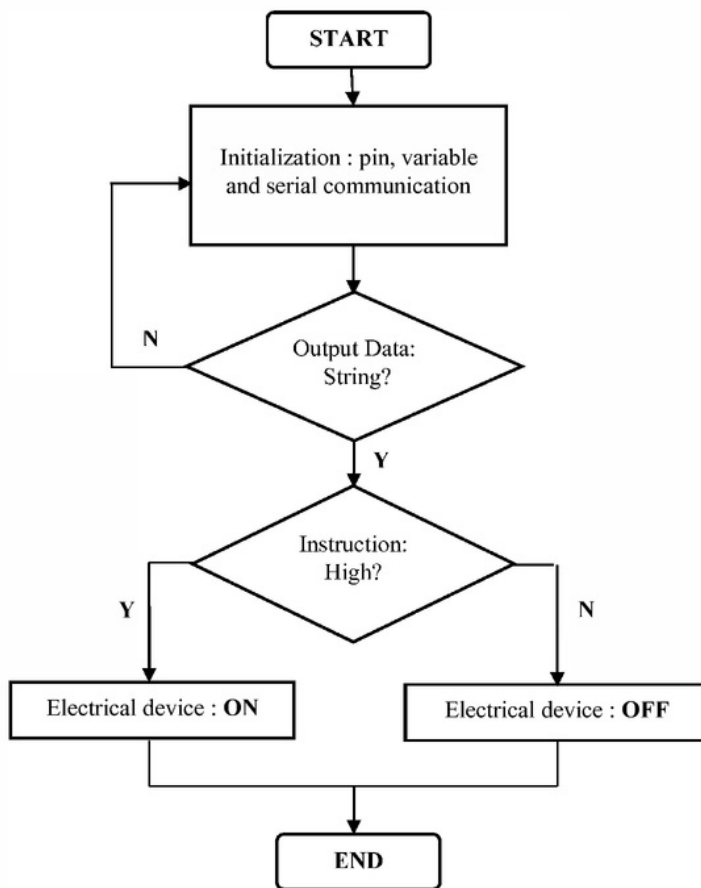


Figure 4. Flowchart of Microcontroller

### III. THE PROPOSED SOFTWARE DESIGN

The software design consists of desktop program, cellular application program, flowchart and listing program, compiling and loading program to Microcontroller ATMeg<sup>36</sup> [7]. The flowchart of Microcontroller is shown in Fig. 4. The desktop application is created with NETBeans Program IDE 7.2, which function as an application for server of computer and it is directly connected with switching hardware. Meanwhile, android application is builded using Eclipse Juno program, which function as an application for client and it is directly installed on the handphone/tablet with Android Operating System version 2.3.

### IV. RESULTS AND DISCUSSIONS

The Hardware and software is integrated as an electrical installation control system in apartment that is shown in Fig. 5. The prototype of Electrical Installation Controller Hardware and circuit panel for apartment are shown in Fig. 6 and Fig. 7, respectively. In this research, the controlled electrical appliances are water heater, lights, and air conditioning (AC).

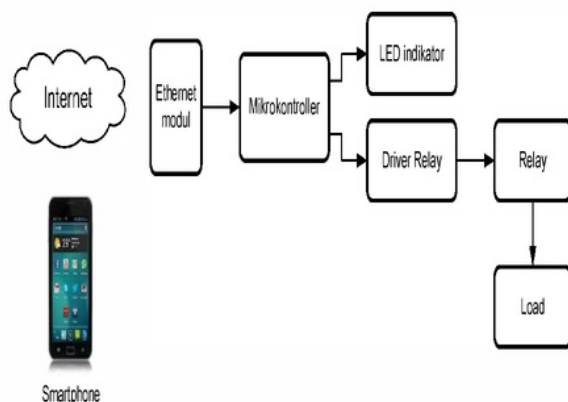


Figure 5. The diagram of electrical installation control system in apartment



Figure 6. Prototype of Electrical Installation for Apartment

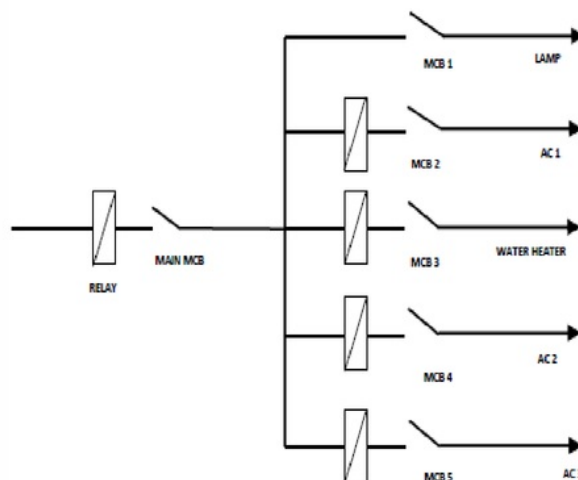


Figure 7. Circuit panel for apartment

All the lighting on the apartment is straightly controlled by relay (R) through the smartphone and the main MCB that is shown in Figure 7. The rules of the circuit panel for apartment as follows.

- If the main MCB is ON and MCB 1, MCB 2, MCB 3 and MCB 4 are ON, then all the indicator lamp, water heater, AC 1, AC 2 and AC 3 are also ON.
- If MCB 1 is turned off then AC 2 in the bed room 1 will be shutted down (OFF).
- If MCB 2 is OFF, the water heater is also OFF.
- If MCB 3 is switched off, then AC 1 in the living room will be OFF.
- If MCB 4 is OFF, AC 3 in the bedroom 2 will automatically OFF.
- And if the main MCB is OFF then all the electricity will be disconnected and none of the equipment is ON.

Equipment response testing to distant controlling is conceived within less than 100 meters radius, due to the testing used local network. In this measurement, every controlled equipment on a different time has the same response time, less than 1 second. It shows that the response time is not depend on controlling system distance, but depend on data rate.

### V. CONCLUSIONS

The smart electrical installation for apartment was studied. Smartphone is used as a remote to control the electrical equipment in apartment and it uses internet connection to transfer data. The Electrical Installation Controlling System equipment has a good performace and its response time is independent from controlling system distant and reliant to the speed data transfer, which is linked to the internet connection speed.

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