Evolution in Electrical and Electronic Engineering Vol. 4 No. 1 (2023) 539-544
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EEEE

Homepage: http://publisher.uthm.edu.my/periodicals/index.php/eeee
e-ISSN : 2756-8458

Electric Load Management Control for Residential Using Internet of Things

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DOI: https://doi.org/10.30880/eeee.2023.04.01.064
Received 16 January 2023; Accepted 06 February 2023; Available online 30 April 2023

Abstract: The internet of things (IoT) is a cutting-edge technology that have the potential to perform admirably. When it comes to making a decision and doing an evaluation, it is quite helpful to use a tool that was designed for control and observation specifically for monitoring in order to perform monitoring and control work for electrical employees. The objective of this paper is to build a monitoring tool for power systems that can be accessible quickly through an IoT platform and can take input signals from the NodeMCU through the use of a relay that functions as a switch. After that, a check will be made to determine whether there is a power source that can accommodate the load that is being used. Then, signals from the Blynk cloud will be provided via the ESP8266 development board, which will be the primary component of the project. In the online system, there is a switch associated with each connected load that controls the input of power supply to that load. In addition to being updated in the online system, each piece of linked equipment can be controlled by physical switches, which serves the goal of monitoring power supply system. An indication is also included with each component that is connected to this system.

Keywords: Smart Home, Load control, Internet of Things (IoT).

1. Introduction

Load management is vital in optimizing the performance of generating plants [1]. This is accomplished by effectively managing the energy generated. Using technology tools that people use, such as applications that are connected to the internet of things, has a lot of advantages. This was especially true during the age in which control was exercised. The planned control system has the potential to create indirect cost savings, which will ultimately simplify the experience for the user. The use of internet of things (IoT) in load management makes the device smart, which can be accomplished by paying less amount. It assists utilities in reducing peak energy demand (peak shaving), lowering costs by eliminating the need for power plants to produce peak power. Because peaking plants and backup generators are frequently dirtier and less reliable than base load power plants, poor management can assist us in minimizing hazardous missions. Electrical energy cannot be stored effectively in

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massive quantities. When the load on the grid exceeds the full generating capacity, network operators should introduce additional energy supplies or methods to reduce the load [2].

The term "electrical grid" refers to a consolidated network that is designed to supply power to consumers [3]. It consists of electricity-producing generating stations and transmission lines that transmit electricity from distant sources to demand distribution center links that connect individual customers. The Smart System, which uses two-way communications and distributed intelligent devices, will be an advance over the electrical grid of the twentieth century. The energy grid generates electricity and distributes it over great distances to end customers.

The IoT refers to a network of interconnected physical objects that can be accessed via the internet [4]. IP addresses have been assigned to objects. Embedded technology in objects enables them to interact with internal states or the external environment, which influences their decisions. Energy savings can be achieved by turning off lights and appliances when they are not in use. These powerful IoT platforms can specify exactly which data is required and which data can be safely discarded. This data can be used to identify patterns, make recommendations, and identify potential problems before they occur. The data collected by connected devices enables users to make informed decisions about which components to stock up on based on real-time data, thereby saving time and money.

2. Methodology

This section discusses the methodology used to achieve the paper’s goal. The goal of this paper is to build a model of smart load management control using IoT. This study’s methodology is to examine the circuit proposed to the system can be control using the Blynk application by only using clouds on the internet. The Proteus 8 Professional programmed is used to simulate the circuit model before in can be built as the hardware model.

2.2 Research Framework

Research framework in Figure 1 depicts the flowchart for the entire project planning process. This research begins with a review of the literature to gather relevant information about previous load management control. The project's planning and execution will then begin. When preparing the project's flow, including the timeline, types of equipment required, and the software that will be used to perform the simulation, and so on.

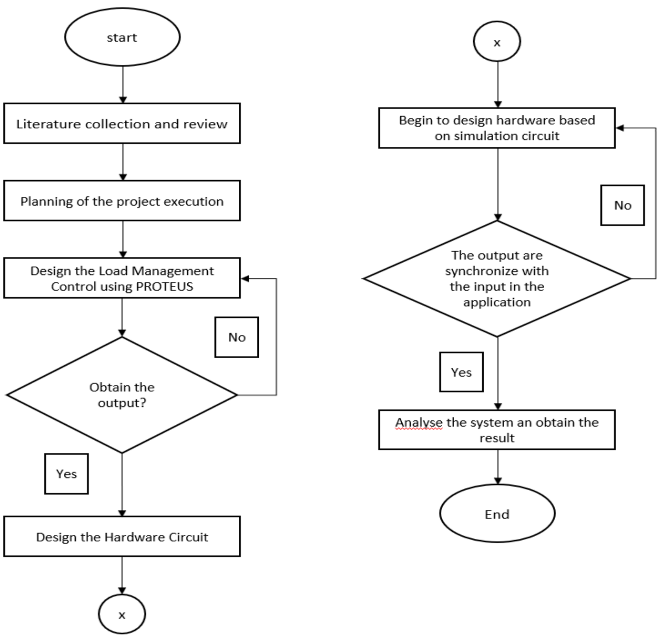

Figure 1: Research Framework

Begin with designing the model in the software Proteus to obtain a schematic diagram for the project. If the output gain is successful, developing the hardware circuit will be the next process. If there is no output gain or the output is not as intended, the process will be repeated with a redesigned circuit design. Back to constructing the hardware, it will be evaluated to see if the gain is the same as the previously successful simulation. If it is not a problem, it will proceed to study the report's results. The research block diagram is shown in Figure 2.

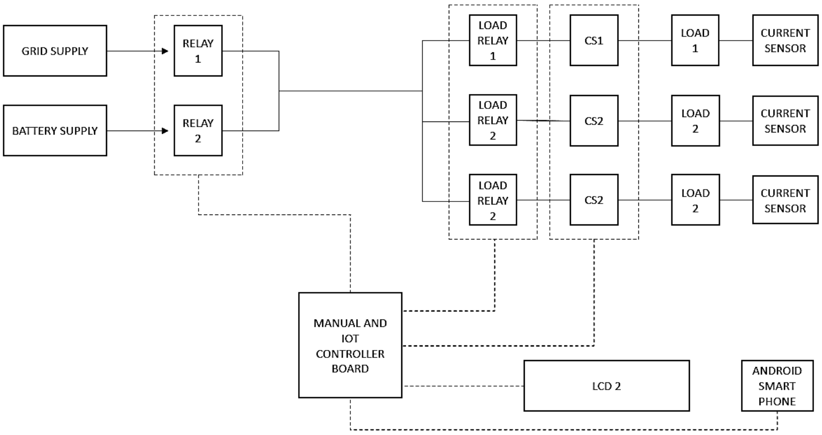

Figure 2: Research Block Diagram

2.3 Design Model

The arrangement of the circuit can be seen in Figure 3. The connection of the circuit can be made to make sure the outcome of the simulation not gaining any error at the end. The decisive step of the simulation was to run the simulation. Refer to the Figure 3, the simulation log will show the reason if the circuit made having some error.

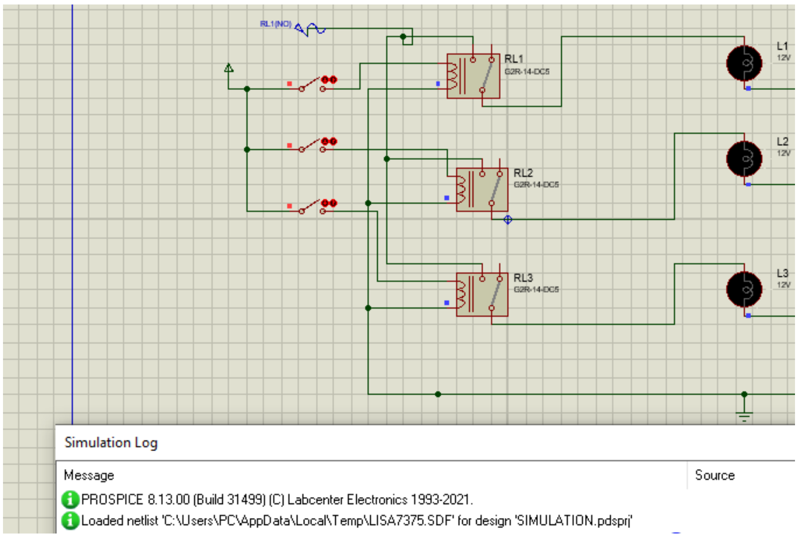

Figure 3: The simulation successfully run

2.4 Blynk Apllication Setup

Blynk can be used to create smartphone apps that allow you to interact with microcontrollers or even full computers like the Arduino Uno. The Blynk platform's primary goal is to make developing mobile phone applications as simple as possible. As will see throughout this project, creating a mobile app that can communicate with Arduino is as simple as dragging a widget and configuring a pin. With Blynk, user can control an LED or a motor from phone with no programming required. Create the template that will be used for the project on the Blynk software. The four switches were used to control the load in this simulation. Create a new template in the software to be used in the future.

To connect the device to the Blynk server, the program's code must define the "Blynk Template ID," "Blynk Device Name," and "Blynk Authentication Token," which can be obtained from the server's or template's Device Info. When the microcontroller is connected to the internet, this configuration is complete. The example of template ID used in this paper is shown in Figure 4.

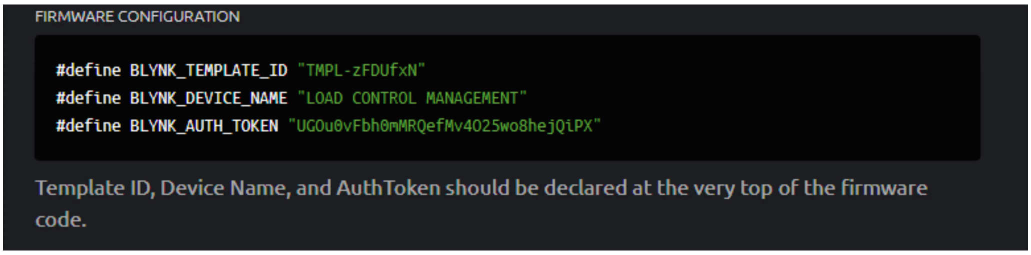

Figure 4: Template ID

3. Results and Discussion

The goal of this project is to use IoT to control the load and supply power to the switch when connected to the internet, and manual control when not connected to the internet. The four switches were defined as switch 1 to switch 4 based on the observation in Figure 5 and 6. The manual control for these switches will be the control load. When switch 1 is closed, it sends a signal to the microcontroller, which causes relay 1 to release power. This command causes the relay to return to the normally closed state that was connected from the supply to the load. This command from the manual control of switch 1 applies to all switches and loads in the system.

The virtual pin from V1 to V4 is virtualy connected with Relay 1 until Relay 4. These pins are linked to the Blynk server via the microcontroller NodeMCU or Arduino Uno (for simulation testing). According to the theory, if the V1 pin was clicked or set to high input, it would trigger the Relay 1 and turn on the Lamp 1 without any physical contact to the system, as the latch switches did. Table 1 shows the result when simulate the software to the Blynk 2.0. The result of virtual switch V1 set to LOW and HIGH is shown in Figure 5 and 6, respectively.

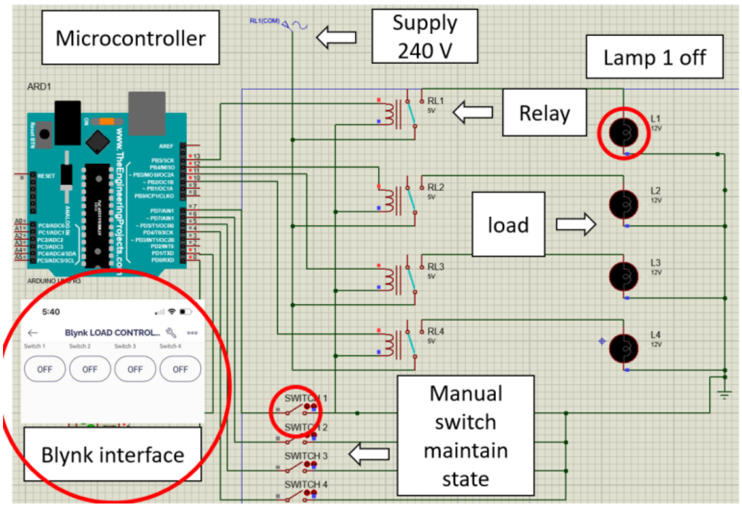

Figure 5: Result of Virtual switch V1 set to LOW -OFF state at Virtual Pin 1

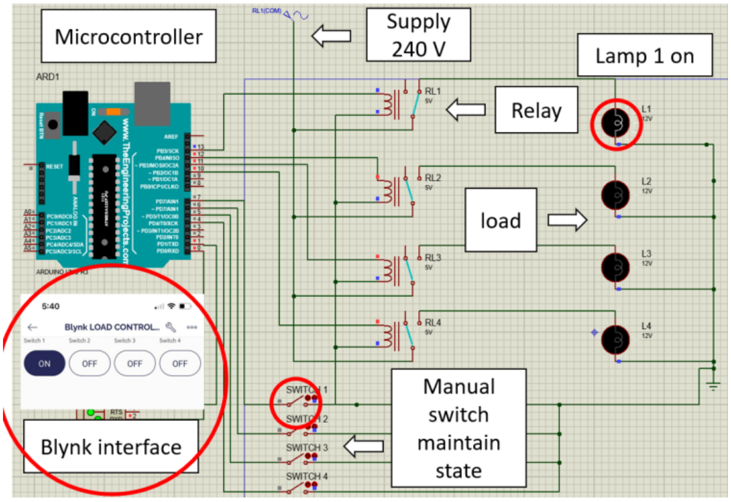

Figure 6: Result of Virtual switch V1 set to HIGH - ON state at Virtual Pin 1

3.3 Hardware Design of Load Management Control for Residential Using IoT

The design consists NodeMCU of ESP8266 as the microcontroller, four channel relay module, which will be switching the AC supply that connected to the load. The four latched switch was provided the manual control if not using the Blynk application. The four lamps represent the load that will connected to the relay module. The incoming 5v will connected to DC supply of NodeMCU ESP. The final design of the project is shown in Figure 7.

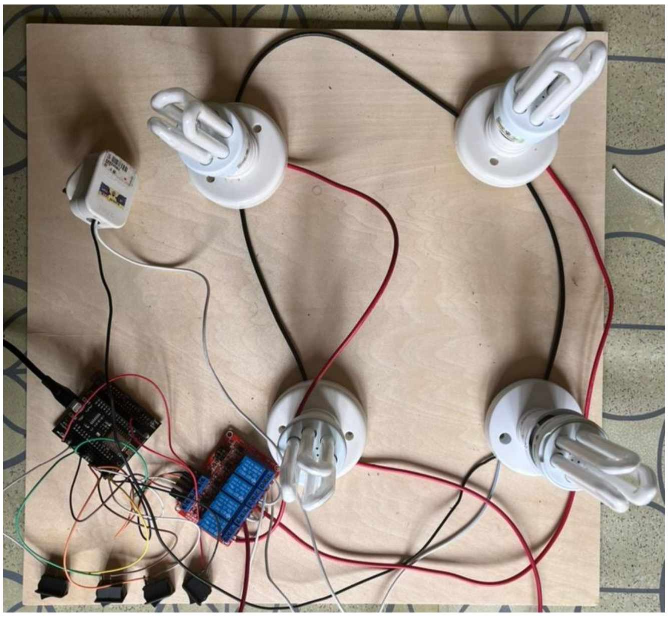

Figure 7: Final Design of the Project

4. Conclusion

As a direct consequence of this, it is possible to construct a household load management control system by utilising the Internet of Things (IoT). The prototype for a real-time electrical control and monitoring system was built, and the Blynk server, which can manage load through the IOT, was used to conduct an analysis of real-time power consumption. It should be possible to bring together new sectors by utilising this system, which is very simple to apply and has the ability to offer each user a very high impact simply by following the same approach if the concept that underpins this title can be expanded. Although though this project is centred on a domestic neighbourhood, the same idea and concept can be used to design a larger system that is capable of handling a greater load. Despite the fact that this project's focus is on a residential neighbourhood. On a daily basis, the results and outputs of this project can be used to control load for residential users, which is one of the project's potential uses. Before sending a signal to the relay module, the ESP8266 development board used the Blynk clouds strategy to manage the load by employing both virtual and real switches. While utilising the system with Blynk via the Wifi module on the ESP8266 chip, the Blynk application transforms into an interface for visualising the data value generated by the ESP8266 development board. This is possible while the system is connected to Blynk.

Acknowledgement

The authors would also like to thank the Faculty of Electrical and Electronic Engineering, Universiti Tun Hussein Onn Malaysia for its support

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