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IoT-Based Socket Control System

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Abstract: The project aims to develop an IoT-based socket control system for controlling the use of electrical appliances. The socket control system developed able to save on excessive use of electrical appliances and reduce the cost of electricity bills. NodeMCU and smartphones are used to control the overall effectiveness of the project. NodeMCU is connected to Wi-Fi, the socket is controlled using a smartphone connected to the internet. Users can turn the electrical appliance on and off using the Blynk application on a smartphone. Current charge readings and electricity consumption are taken with the addition of current sensors.

Keywords: socket, electrical appliance, IoT, Blynk,

1. Introduction

1.1 Background

Smart home technology generally refers to any network of devices, appliances, or systems connected to a public network that can be operated remotely. When your home technology works together in one system, this technology can also be referred to as a connected house [1]. Smart home automation allows users to take advantage of high-tech functions and luxuries that were impossible in the past. As technological advances continue to evolve, so does the automation of homes making life more easier.

Most smart home systems are operated by smartphones and microcontrollers. Smartphone applications are used to control and monitor home functions using wireless communication techniques. The concept of smart home is the integration between IoT and cloud services, sending data to sensors and actuators, the captured data is sent to cloud storage to access data more easily in different locations [2].

1.2 Problem Statement

The use of sockets is still used manually, life nowadays has become easier with the advancement of automation technology, manual systems have been replaced with automated systems aimed to saving the use of manpower and electricity. In addition, uncontrolled use of electrical appliances causes an increase in the cost of electricity bills, this causes losses to consumers.

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Wireless communication provides users with remote controls to control various home appliances using IoT technology. Iot-based socket control system control the use of socket using Blynk application where user can on and off electrical appliance simply by using smartphone.

1.3 Objectives

1. Develop an S-IoT system capable of controlling the use of electrical sockets for electrical appliances
2. Control the entire system using smartphone
3. Test and evaluate the effectiveness of a system that can be controlled using internet

1.4 Scope of Project

The scope of the project is:

- S-IoT system controlled by smartphone, NodeMCU, Blynk (IoT), Wi-Fi
- Effectiveness of controlling sockets using smartphones over the internet
- Electrical sockets controlled by S-IoT for the use of electrical appliances

2. Materials and Methods

The materials and methods section, otherwise known as methodology, describes all the necessary information that is required to obtain the results of the study.

2.1 Materials

The purpose of preparation is to ensure the efficient operation of the project as desired. First, by referring to the flow chart below, for this project, which is a context project, a better understanding and basic knowledge is required. Including the main objective of the project.

The first flow chart which relates to the phases in the development of the project. Figure 2.1 shows the main flow chart for this project.

Figure 1: Flowchart of project

In order to develop this project, there are several main components needed to achieve the objective.

i. ESP8266 NodeMCU

NodeMCU ESP8266 is a Wi-Fi chip built-in module. The construction of this product system is completely dependent on the chip with an integrated TCP / IP protocol arrangement that can send microcontroller information signals to Wi-Fi networks. Pre-programmed with instructions, the ESP8266 firmware module is set up so that it allows Arduino devices to connect to Wi-Fi. Its use is still limited for Wi-Fi purposes only. Esp8266 performs Wi-Fi processing and activity but with low power consumption. The data captured by the sensor is sent to the ESP8266 which can then be analyzed and processed by the ESP8266 on its own microcontroller board with the help of firmware loaded into its flash memory. The ESP8266 chip connects to a Wi-Fi router as a station node and can push the sensor data directly to the Ubidots. The ESP8266 contains its own calibrated RF allowing it to function under all operating conditions, and does not require external RF. ESP8266 offers a complete Wi-Fi network solution and allows it to host applications or load all the functions of a Wi-Fi network from processing other applications [3].

ii. Blynk Application

Blynk is a platform with iOS and Android applications to control the Arduino, Raspberry Pi via the internet. This app is a digital dashboard where you can build a graphical interface for your project by simply dragging and dropping widgets. It is easy to set everything up and can play in less than 5 minutes. Blynk is not tied to certain boards or shields. Instead, it supports hardware of your choice whether the Arduino or Raspberry Pi is connected to the internet via Wi-Fi, Ethernet or ESP8266 chips and is ready for Internet of Things (IoT). This software can control electrical or electronic hardware remotely, it can display data information from sensors, can store data, visualize it and do many other things and is easy to apply by users [4].

iii. Current Sensor ACS712

ACS712 current sensor is a sensor that can be used to measure and calculate the amount of current used on electrical equipment without affecting the performance of electrical equipment. ACS712 has a voltage isolation of RMS 2.1kV. Current sensors detect current in wires or electrical equipment and produce a proportional current-detected signal either in the form of analog voltage or digital output. Current detection is done in two ways namely direct detection and indirect detection. The ACS712 current sensor uses the direct detection method to calculate the current. The low-offset Hall sensor range is used in the ACS712, this sensor is located on its surface on a copper conductor strip. When current flows through this copper conduction band, it produces a magnetic field that is felt by the Hall effect sensor. The voltage is proportional to the magnetic field felt produced by the Hall sensor, which is used to measure current [5].

2.2 Methods

This part is very important part where the progress can be done step by step smoothly. The references and information obtained reviewed so that the information obtained is the most current and appropriate source for project implementation. Furthermore, the process of identifying sources of reference and project related information is also crucial in determining the quality of a project.

In order for the project to run smoothly, the methodology should have a flowchart on how S-IoT system works. First, the Blynk application checks the internet or Wi-Fi connection on NodeMCU ESP8266 and smart phone. Then, the socket can be controlled using the Blynk application on a smartphone by pressing the ON / OFF button to turn the socket on and off. The socket is connected to a 24V power supply and current sensor to obtain current charge readings and electrical power consumption on electrical appliances. The following Figure 2 illustrates the flowchart of S-IoT system.

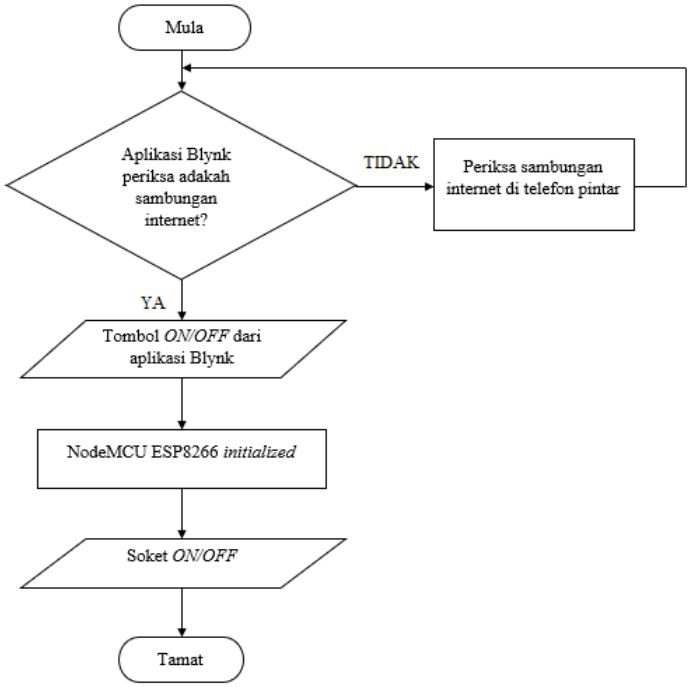

Figure 2: Flowchart S-IoT system

3. Results and Discussion

The results and discussion section presents data and analysis of the study. The testing of the design made was very critical since it involved money and required much accuracy and time for testing. The results show if the system had been successful in its objectives. Electrical appliances such as table fans, table lamps and kettles are used for testing and data collection.

3.1 Results

3.1.1 Test Conducted for Electrical Appliance

The purpose of this test is to collect the data for current charge used and electricity consumption for electrical appliance. The result in table 3.1, 3.2 and 3.3 shows the data collected from different electrical appliance. Voltage is calculated to prove the current and electricity consumption used.

Table 1: Test on table fan

Testing	Time Taken	Current Reading Ampere (A)	Energy used Watt (W)	Voltage Calculation (V) (V = P / I)
1	1 hour	0.22	50.531	230
2	1 hour	0.215	49.661	230
3	1 hour	0.213	49.011	230
Average		0.214	49.401	

Table 2: Test on table lamp

Testing	Time Taken	Current Reading Ampere (A)	Energy used Watt (W)	Voltage Calculation (V) (V = P / I)
1	1 hour	0.072	16.624	230
2	1 hour	0.070	16.178	230
3	1 hour	0.068	15.956	230
Average		0.07	16.252	

Table 3: Test on kettle

Testing	Time Taken	Current Reading Ampere (A)	Energy used Watt (W)	Voltage Calculation (V) (V = P/ I)
1	10 minutes 54 seconds	10.487	2412.011	230
2	10 minutes 16 seconds	10.438	2400.783	230
3	10 minutes 19 seconds	10.476	2409.554	230
	Average	10.467	2407.449	

3.1.2 Test Conducted for ESP8266 NodeMCU

ESP8266 NodeMCU is used to enable data transmission to turn on sockets transmitted online. Users can turn on the socket through the predefined Blynk application via ESP8266 NodeMCU. NodeMCU functionality can be seen by turning the socket on and off after the button is pressed on the Blynk application. Figure 3 and 4 show the condition when ESP8266 NodeMCU connected or not connected to Wi-Fi in Blynk application on smartphone.

Figure 3: ESP8266 NodeMCU connected to Wi-Fi

Figure 4: ESP8266 NodeMCU not connected to Wi-Fi

3.1.2 Mobile Interface Using Blynk Application

This system is process middleware to display an output data from pin-A0 ESP8266 NodeMCU. This Blynk is used to implement the technology of Internet of Things (IoT) for nowadays engineering. In this Blynk application, there is no need any coding or programming, it just has to setup the button that we need to display and press. For this project, it used button, gauge, labeled value, slider and menu which is active to display the output data from ESP8266 NodeMCU. Figure 5 shows the Blynk configuration in Blynk Application. Figure 6 shows the reading of current charge and energy consumption in Arduino IDE platform. Figure 7 shows product prototype.

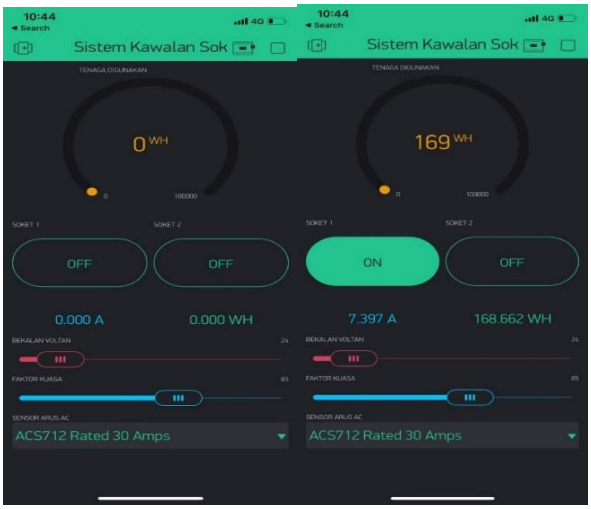

Figure 5: Blynk setup and condition when the button pressed shows the measurement of current charge and energy consumption.

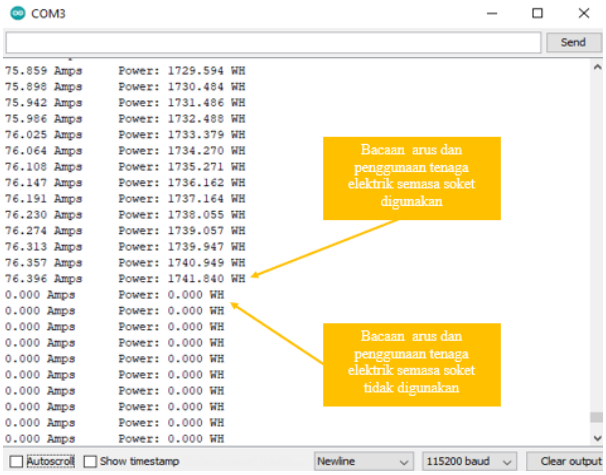

Figure 6: Current charge and electricity measurement in Arduino IDE Serial Monitor

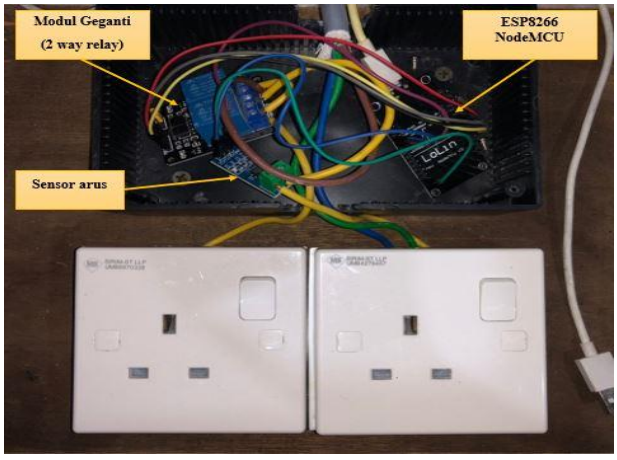

Figure 7: Product prototype

3.2 Discussions

As the results showed, S-IoT system can measure the use of current charge and electricity consumption used by electrical appliances. Furthermore, ESP8266 NodeMCU can communicate with

Blynk application using Wi-Fi and the socket control system can be controlled using smartphone connected to internet. Hence, the wastage of electricity consumption can be reduced.

4. Conclusion

In conclusion, the prototype of this IoT-based socket control system (S-IoT) has worked well. The use of IoT systems in this project can also be used without the need for extensive wiring from the control system to the socket, it also allows the socket to be controlled remotely without using wires instead, using the Blynk application on smartphones. The use of sockets manually is still used, with this S-IoT system the user does not have to turn on and off an electrical appliance manually the socket can be controlled using smartphone and Blynk application and current readings and electricity consumption for electrical equipment connected to the socket can be measure. The production of projects using IoT is in line with current technology.

Acknowledgement

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