Design of Energy Management and IoT-Based Smart Home Security System Improvement

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ABSTRACT

Energy Management System and home security are some of the exciting discussions to be developed. Many innovations have been made to control the use of electricity and make it easy for humans to monitor their homes even when they are not at home—one of them containing electronic devices in the house. Home security control devices are now integrated with smartphone devices. This study aims to design energy management and home security system (Smart Home), where homeowners can find out their daily electricity usage and make it easier to secure their home when they leave the house. This home security system can provide information when someone tries to enter the house. This home security system can monitor the house by turning on or off lights, electronic devices, door locks, and garage keys using an Android device as a controller using NodeMCU as a communication tool. The results of this study can show that an android application can help in securing a home. So using Prototype security and control of the electrical device through a smartphone-based microcontroller can make it easy for humans.

Keywords-- *NodeMCU, Smart Home, Energy Management System*

I. INTRODUCTION

Present the awareness of the people of Indonesia in saving electricity at home is still relatively minimal and inefficient. Examples include forgetting to turn off lights or other electronic devices when going out. A lot of electrical energy is wasted and causes wasteful use of electricity in the home, which causes high bill costs.

Then in this day and age, many families often leave the house, and the wife works, so the house is empty, this makes the house unattended, and the place is prone to theft and undesirable things such as fire.

IoT (Internet of Things) is a concept where internet connectivity can exchange information with objects around us, such as electronic devices inside the home that can be controlled, monitored, or accessed via the internet.

A Smart Home, also called a Smart Home, is a home that utilizes information equipment and home-based networks to connect household equipment and with the outside world[1]. The connection of household equipment to a network allows

homeowners to monitor and control electricity in the home. This thesis will design an electrical energy management system and security system improvement that can be monitored and controlled via a smartphone from the problems above. Electrical energy management can later use current sensors and track the house's state later using NodeMCU ESP8264 as the primary tool in this design.

Then in this final project will be made a prototype simulation house that has a security system. With the photodiode sensor later, if the sensor detects a buzzer or alarm movement will sound and will send a message to the application to be made.

II. LITERATURE REVIEW

There are many excellent studies on using NodeMCU for technology Internet of Things that can help humans for the activity to control home. In research, Smart Home design simulation-based on ATmega16 microcontroller. Smart Home monitoring & control system using the internal messaging infrastructure [2]. Prototype Security and Control of Home Lights Through an Android-Based Microcontroller [3]. Implementation and analysis of smart plug performance for Smart Home systems based on smartphone applications[4]. Prototype an automatic home control system Iot-based (internet of things) Using Arduino Uno [5]. Analysis and design of Smart Home prototype with the Android platform-based client server via communication Wireless[6]. Electronics on Android and Google Voice-based Smart Home applications to design and control [7]. Internet-based Smarthome Security and Control System Design of Things. [7] The design of monitoring and control system applications on security systems Android-based Smarthome. [8]The Smart Home automation system uses raspberry pi 3 Android-based through wireless communication.

In reviewing this system, the authors compare the models proposed by many researchers by directly observing the system of Smarthome. The benefits of preparing this thesis are that prototype Smart Home simulation can make it easier to control home appliances, especially electronics, remotely to save electricity usage and make homeowners feel comfortable with the security system installed at home.

III. SOLUTION ARCHITECT

Based on the interviews and observations that we have made to several families in controlling the house, which is still using the manual system by pressing the socket in place. Sometimes, families who travel frequently forget to wash doors, wash fences, and turn off electronics. The security system itself is still prone to theft because security is only on guard at night. In this case, of course, the electricity in the house will swell, and the owner of the house will always be vigilant when leaving the house, including families whose husband and wife work.

A. Proposed Model

Below are several electronic tools for creating Smart Home applications:

NodeMCU ESP8266 version 12E

NodeMCU is an IoT platform that is open source. It consists of hardware in the form of System On Chip ESP8266 from ESP8266 made by Esperessif System. NodeMCU can be analogized as an Arduino board connected with ESP8622. The NodeMCU is equipped with an ESP8266 package, which includes a microcontroller, wifi access, and a communication chip in the form of a USB to serial converter [9].

Relay Module

Relay is an electrically operated Switch and is an Electromechanical component consisting of 2 main parts, namely Electromagnet (Coil) and Mechanical (a set of Contact Switches / Switches). Relays use the Electromagnetic Principle to move the Contact Switch so that a small electric current (low power) can conduct higher-voltage electricity. For example, with a Relay that uses 5V and 50 mA, Electromagnet can move the Armature Relay (which serves as a switch) to deliver 220V 2A electricity[10] .

DHT11

DHT11 sensor is a sensor with digital signal calibration that can provide temperature and humidity information. This sensor includes components with an excellent level of stability, especially coupled with the ability of the ATmega8 microcontroller[11].

ACS712 30A Hall Current Sensor Arus

A current sensor is a device or component or device to detect electric current in a cable and produces a signal proportional to the value of the current detected. The signal generated can be either an analogue voltage or a digital data voltage. This signal can be used as a current measuring device, and the amount currently stored in a storage area such as a server can be analyzed or used as a control tool [12].

Motor Servo

A Servo motor is a device that can convert electrical energy into mechanical energy. A DC motor drives a servo motor. Because the servo motor is caused by a DC motor, the type of current used is direct current. In addition to the DC motor components, there is also gears in the servo motor that function to reduce rotation and increase the torque produced by the DC motor [13].

Explanation of the proposed model

The system to be built is a Smart Home security system based on NodeMCU, which can be controlled and monitored through an android application. This system can monitor the state of the house, hold the door locks, fence locks, lights, other household appliances. Meanwhile, users can see the history of electrical usage and see motion sensors installed in smart homes[14].

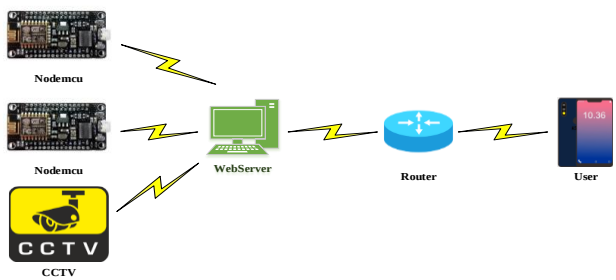

Figure 1 Proposed Model

Based on the system architecture built, NodeMCU acts as the primary tool to read the sensors used and as communication through the modules in NodeMCU, namely wifi ESP8266 connected to the router. This thesis uses 2 NodeMCU so that

the I / O pins are met. Then the data generated by the device will be retrieved by the web server and displayed on the user interface via a wireless network.

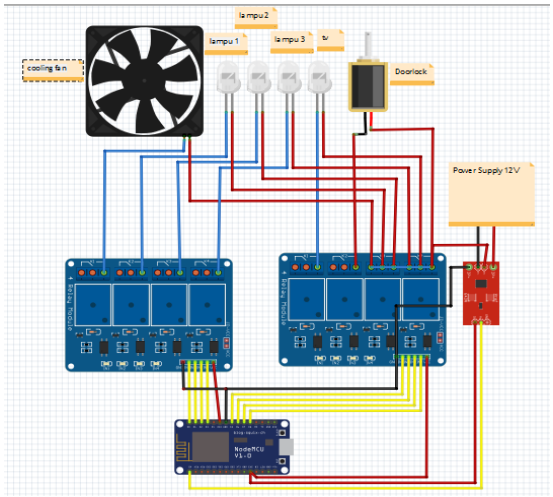

Figure 2 Electronic scheme for hardware design

Table 1

Explanation

Pin I/O	Alat Elektronika	Kegunaan
D0		
D1	Relay	Relay
D2	Relay	Relay
D3	Relay	Relay
D4		
D5	Relay	Pagar
D6	Relay	Relay
D7	Relay	Relay
D8		
A0		

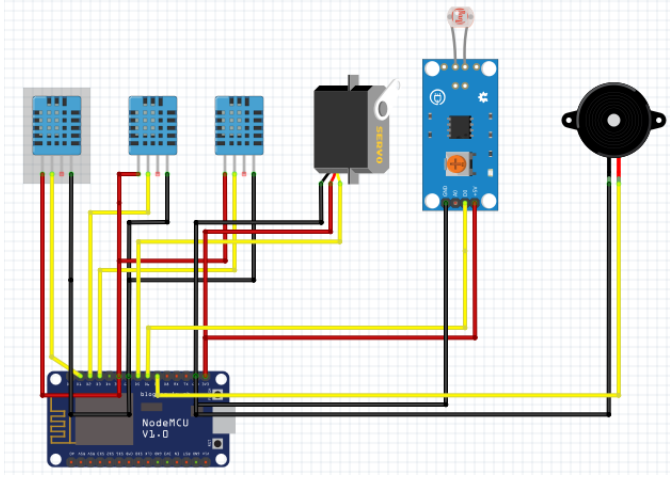

Figure 3 Electronic scheme for hardware design

Table 2

Explanation

Pin I/O	Alat Elektronika	Kegunaan
D0		
D1	DHT11	Sensor Suhu
D2	DHT12	Sensor Suhu
D3	DHT13	Sensor Suhu
D4		
D5	Motor Servo	Pagar
D6	Sensor LDR	Sensor Gerak
D7	Buzzer	sensor bunyi
D8		
A0		

B. Use Case Diagram

Use Case is a collection of diagrams and text that work together to document how actors interact with the system . The following is the Use Case Diagram of the Smarthome system proposed in this study:

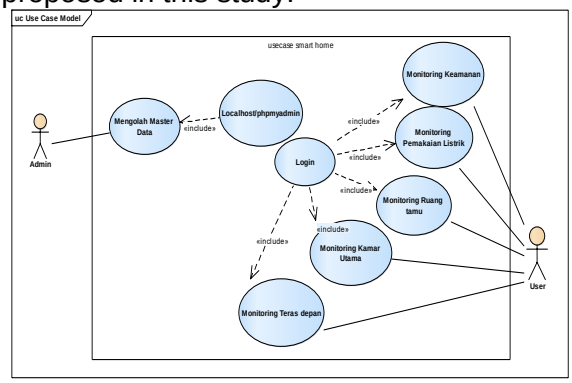

Figure 4 Use Case Diagram Sistem Baru

1. Admin
   Admin can add, edit and delete anyone who can use the Smarthome application. After that, the admin can change the appearance of the application
2. User
   Users can only use the Smarthome application and control the home by using the Smart Home application

IV IMPLEMENTATION

LOGIN

The first time to use the Smart Home application must log in first, using the username and password that the admin has provided.

Figure 5 Login

HOME

In the home view, there are several options for being able to monitor the room, and there is a CCTV display installed in front of the house

Figure 6 Dashboard

LIVING ROOM

The living room menu is for monitoring electronic devices in the guest room.

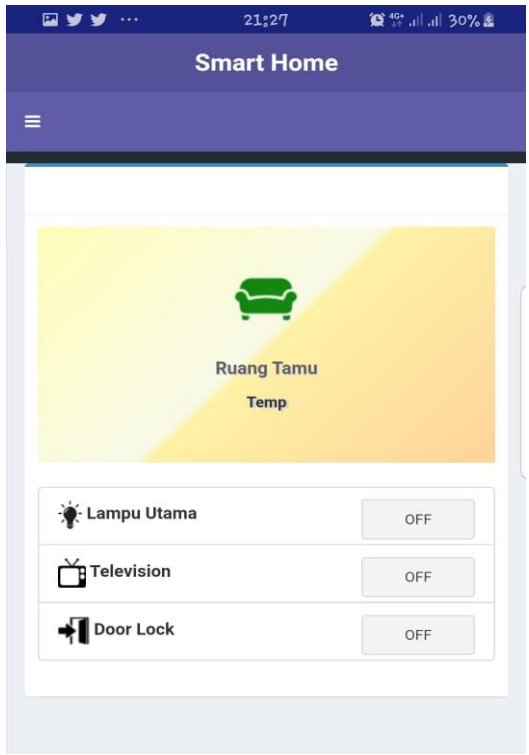

Figure 7 Menu Living Room

BEDROOM

The bedroom menu is for monitoring electronic equipment in the main room.

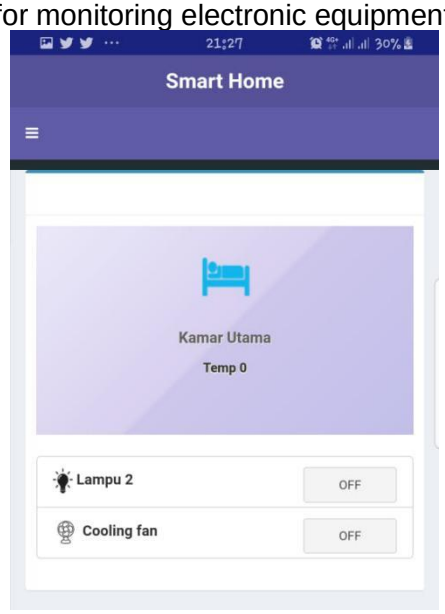

Figure 8 BEDROOM

HOME GARDEN

The garden menu is to monitor fences and headlights

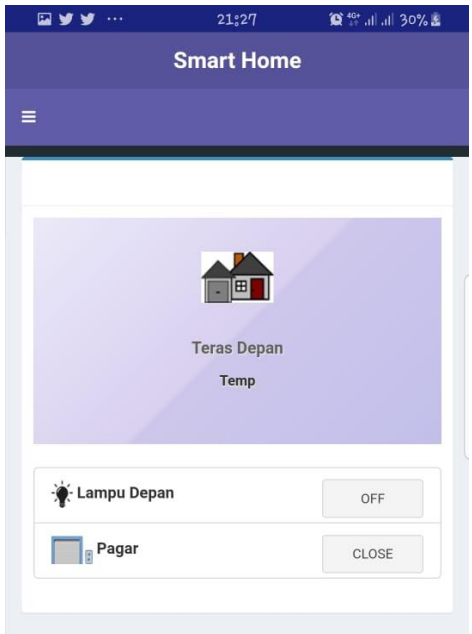

Figure 9 home garden

ELECTRICAL USE

This menu can see electricity consumption

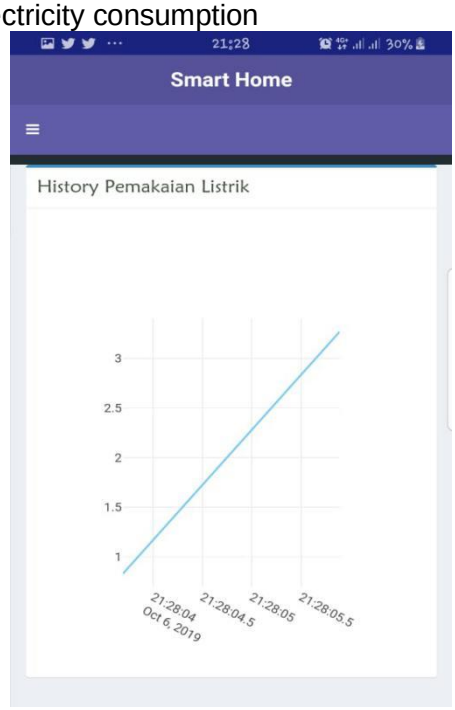

Figure 10 Electrical Use

V. CONCLUSION

The writer can describe the following conclusions based on analysis, design, testing systems that are built based on the theory used include:

1. Prototype of electricity usage monitoring system at home using NodeMCU can run well. The application can see what daily electricity consumption is used at home. Compared to the old system that can not see the use of electricity used at home.
2. The prototype Smarthome system in this study can monitor the state of the house and can regulate some lights and electronic devices properly.
3. Prototype on the security system in this study the Smart Home application can detect movement well. If something suspicious happens, the application can bring up an alarm, and an additional webcam feature assumed to be a CCTV camera.
4. Can make a prototype Smart Home simulation well using Nodemcu as the primary tool and can be monitored through the Smartphone application.

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