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# Application Control and Monitoring of Light Usage in Smart Home Environment

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**Abstract**—In addition to the development of science, human activity in the modern era is also increasing. Busyness is seen by many who leave home for work or other business. Usually, homeowners will turn on the lights of his house when it leaves his house for long periods or even if the house left empty so that in a long time to waste of energy. Even if the owner does not turn on the lights, then at night the state of the house lights off. This could lead to theft in empty houses. Based on this, this application can help everyone to control and monitor the use of home lights remotely only by using a smart phone connected to the internet. This application uses the help of a microcontroller as a tool that can control the electrical switch that is connected to a mini server connected to the network. The method used in this research is the experimental research method with stages, study literature, hardware design, software design, testing and evaluation and conclusion.

**Keywords**— *Lights Controlling, Microcontroller, Smart Home*

## I. INTRODUCTION

The development of science is very rapid at this time. We can see with new thoughts that are useful to help human work and tackle certain problems. This is indicated by the advance of science and technology that is characterized by the emergence of tools that use digital and automatic. One of the technology knowledge is micro controller. A micro controller is a system containing input / output, memory, and processor used in products such as washing machines, video players, cars, and telephones. In principle, a micro controller is a small computer that can be used to take decisions, do repetitive things, and can interact with external devices, such as ultrasonic sensors, GPS receivers, light sensors and more. One type of micro controller is arduino. Arduino is a type of board (board) that contains a microcontroller [1].

In addition to the development of science, human activity in the modern era is also increasing. Busyness such as going to leave home for work or other business. Usually, homeowners will turn on the porch lights of his house. When will leave his house for long periods or even if the house left empty. So that in a long time become energy wastage. Even if the owner does not turn on the lights, then at night the state of the house lights off. This can invite potential theft by the thief because of the darkness of the house for not turning on the house lights.

This problem attracts researchers to conduct research on control applications and monitoring the use of lights in smart home environment. The goal is to use this application everyone can control and monitor the use of home lights remotely only by using a smart phone connected to the Internet. This application uses the help of a micro controller as a tool that can control the electrical switch that is

connected to a mini server connected to the network. The existence of this application is expected to be a human tool to keep the house from the trigger of theft against a house that does not turn on the lights at night, and can be an effective daylight-light controller to save energy.

## II. LITERATURE REVIEW

### A. Related Research

In a study conducted by Iyuditya [2], they designed a room light control system automatically using a pc based arduino uno microcontroller. Researchers managed to control the room lights for on and off through arduino uno microcontroller facility that allows residents to control the lights. Then Susanto [3] create remote control application on home based android light. The application is able to control the appliances - home appliances remotely by utilizing internet technology of every where. Furthermore, in research conducted by Giyartono [4] utilize android application as a home light controller based on atmega328 microcontroller. The open source operating system on android phones can be utilized to create home lighting control applications using Arduino UNO (Microcontroller ATmega328) and relays instead of switches. Furthermore, Alamsyah [5], et al designed and implemented a web-based remote control system for electronic equipment. This research builds a mini plant to model buildings and home furnishings consisting of electronic equipment, such as fans, TVs, air conditioners, and electric lights. This web-based remote control system is designed wirelessly by using internet technology. Then last, Kadir, et al [6] proposed a home monitoring system based on object sensor and cloud computing to keep the information before forward to owner. House monitoring system used cloud computing technology using Webcam motion detection used for the detection system and Raspberry Pi 3 as processor to store data as buffer before send to cloud, as well as webcam and motion movement.

Based on the research, the research will be designed next will use internet connected mobile application so that can be accessed anywhere. In this application there are some features of lamp controller which would be different from the above research. The various features of light controller available on this application are as follows:

1. Features on / off of each lamp.
2. Features on / off of all lights.
3. Timer feature that can set the time of life and death of each lamp.
4. Features monitoring daily and monthly light usage.

- c. Microchip Technology: PIC;
- d. Silicon Laboratories: 8051.

Table 1. Comparison between Literature review

Research Study	Description
[2]	The system uses the web, timer feature applies to all lights and can not switch on / off lights at different times
[3]	The system used android, it can turn on / off each lamp.
[4]	The system uses android connected to bluetooth, and also can turn on / off each lamp
[5]	The system uses the web, and it can turn on / off each lamp.
development focused	<ul style="list-style-type: none"> <li>• The system uses internet-connected mobile applications that can be used remotely.</li> <li>• The system can turn on / off each and all lights.</li> <li>• Timer feature can be used on each lamp and can turn on / off lights at different times.</li> <li>• The system can monitor the use of daily and monthly lights.</li> </ul>

### B. Smart Home

Smart Home is a home equipped with high technology that can allow systems and devices to communicate with each other. Smart Home is developed to implement some activities that are done in everyday life automatically to get a more comfortable and easier living environment. This house has an automatic system for lighting, temperature control, safety, equipment and many other functions. Signal codes can be sent over wires or wirelessly to be able to operate or monitor devices in every part of the house [7].

### C. Microcontroller

Micro controller or sometimes called embedded controller is a system containing input/output, memory, and processor, which is used in products such as washing machine, video player, car, and telephone. In principle, a micro controller is a small computer that can be used to take decisions, do repetitive things, and can interact with external devices, such as ultrasonic sensors to measure distances to an object, a GPS receiver to obtain content position data earth from satellites, and motors to control movement on robots. As small computers, suitable microcontrollers are applied to small objects, for example, as controllers on QuadCopter or robots [8].

Companies that are well known as a micro controller maker include Atmel, Cypress Semiconductor, Microchip Technology, and Silicon Laboratories. Examples of names of microcontrollers for each vendor are as follows:

- a. Atmel: AVR (8 bit), AVR32 (32 bit), AT91SAM (32 bit);
- b. Cypress Semiconductor: M8C Core;

## III. RESEARCH METHODOLOGY

The methodology used in this study is experimental which is divided into five stages namely [9]:

### 1. Study of literature

This method is used to search for and obtain relevant sources of study, supporting theoretical basis, data, or information as a reference in the planning, design, manufacture, experimentation, and preparation of research reports.

### 2. Hardware Design

This method is intended to produce a series of controlling and monitoring tools for the use of lamps in intelligent home environments so as to obtain design results that are suitable for the purpose of the study.

### 3. Software Design

This stage is the design of the stages of the monitoring system and home lighting controls from context diagrams, hierarchy charts, data flow diagrams and database design.

### 4. Testing

This method is done to adjust between the planning and the results that have been achieved so that the expected absence of unwanted deviations (errors), so it will be in accordance with what has been planned.

### 5. Taking Conclusions

This method is done in the planning, manufacture, and testing of work tools so that the components and designs that the prototype is correct and good. Generally the research methodology can be seen in figure 1 below

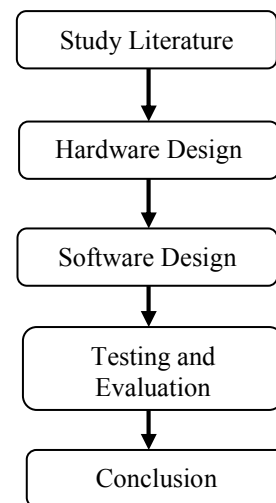


Fig 1. Research Method

### A. Hardware Design

The design of the device from the application controller and monitoring the use of lights in the Smart Home environment that will be developed on the current system is like in figure 2.

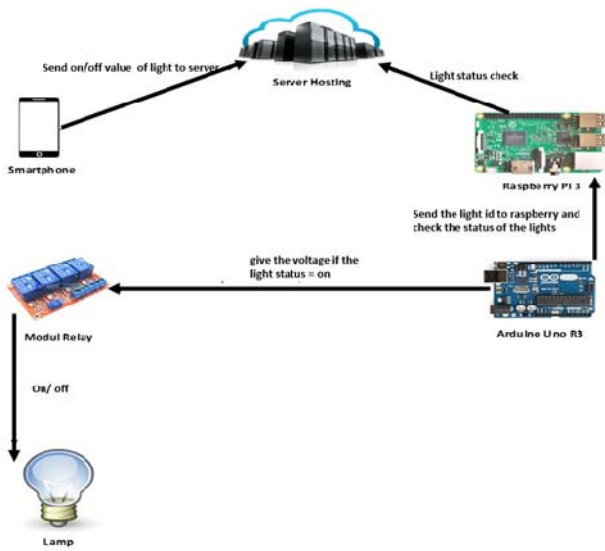


Fig 2. Hardware design

### B. Software Design

This built application can control our home lights through mobile applications that are connected to the Internet. This app can control and monitor the use of home lights, and can turn on and off the lights at home. The design of the context diagram can be seen clearly in figure 3.

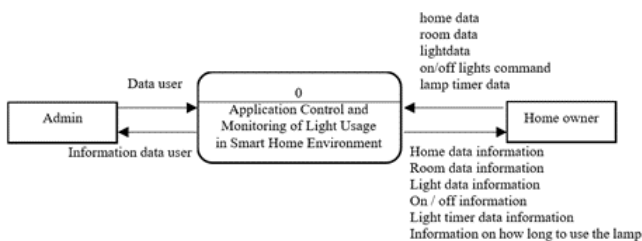


Fig. 3 context diagram

In Figure 3 is a diagram context design that describes the process of data flow that occurs in the system outline. In this system involved 2 entities ie the owner of the application / admin and homeowners. The admin entity is tasked with performing user data processing to the system. The system will provide user data information that can be processed again if there is a change. The homeowner's entity is tasked with performing data processing of the house, room and lamps in the house as well as providing on/off commands and light timer data to the system. The system will provide information on smart home environment data, room and home lamp that can be reprocessed if there are changes as well as provide on/off information and data timer lamps and the long use of lights in the house. The design of the software process is further described in the hierarchy chart as in figure 4.

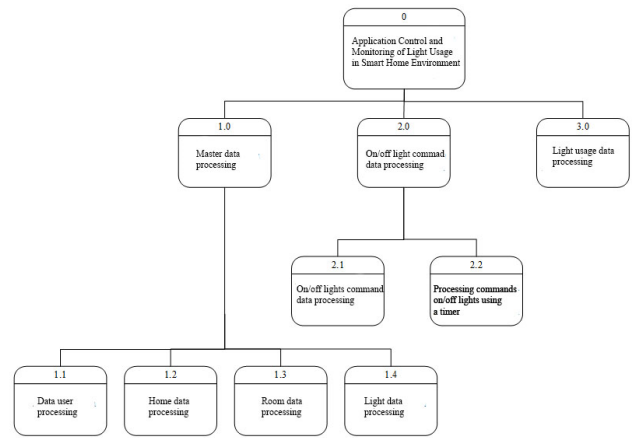


Fig 4. Hierarchy chart process

In Figure 4 above consists of 3 (three) processes depicted in the hierarchy chart. The process on the first level is, master data processing, command processing of on/off lights and processing of lamp usage. Data processed in the process of master data processing is the user data processing, home, room and lights. The data processed on the command processing on / off lights is processing on/ off commands lights manual and processing command on / off lights using timer.

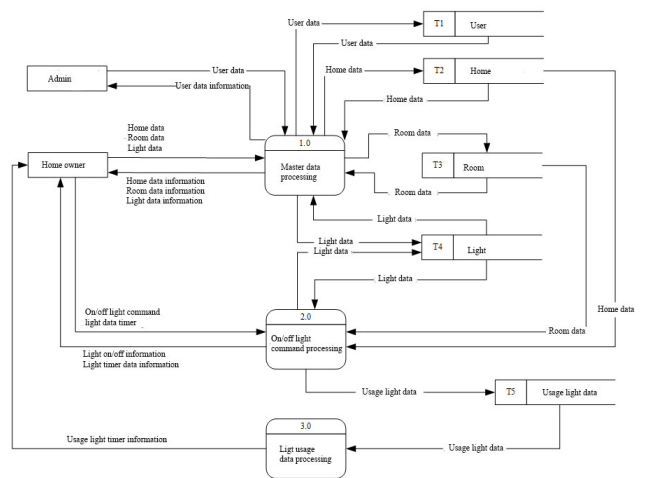


Fig 5. Data flow diagram

In Figure 5 the entity involved is the owner of the app / admin and the home owner. The app / admin entity is responsible for entering user data into the stored system into the user table. The system will provide user data information to the owner of the application/ admin in order to be in if back if there are changes. The homeowner's entity is tasked with entering the house, room and lamp data into the stored system into the home, room and lamp tables. The system will provide home data, room and lamp information to the home owner so that it can be back if there is a change. The homeowner entity is also tasked to provide on/off commands and timer data on the lights into the system stored into the lamp table and usage. Then the system will provide on/off information, timer data and lamp usage time to the home owner.

#### IV. RESULT AND DISCUSSION

Application verification is used to evaluate that application whether the application can work properly as expected or not. The appearance of the hardware design of the application to be in control is like the figure 6.

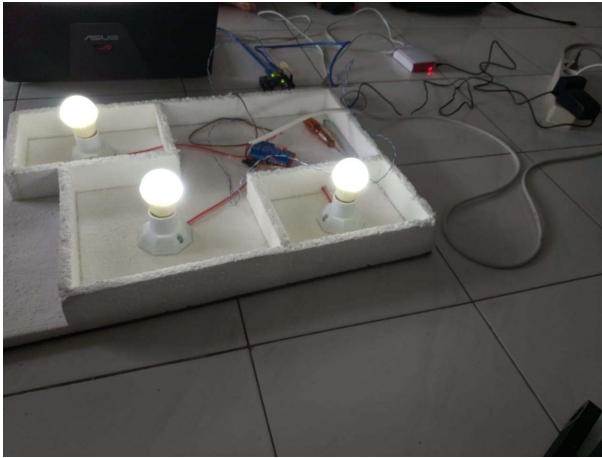


Fig 6. Prototype Hardware

Testing the application is done by running the application controller and monitoring the use of lights in smart home environment, by using a smartphone connected to the internet. This system uses the help of a microcontroller as a tool that can control the electrical switch that is connected to a mini server connected to the network. The existence of this application can be a human tool to keep the house from the trigger of theft against a house that does not turn on the light at night, and can be an effective daylight-light controller to save energy. Then this application can also perform on/off action and set timer on the lights that can be seen in figure 7.

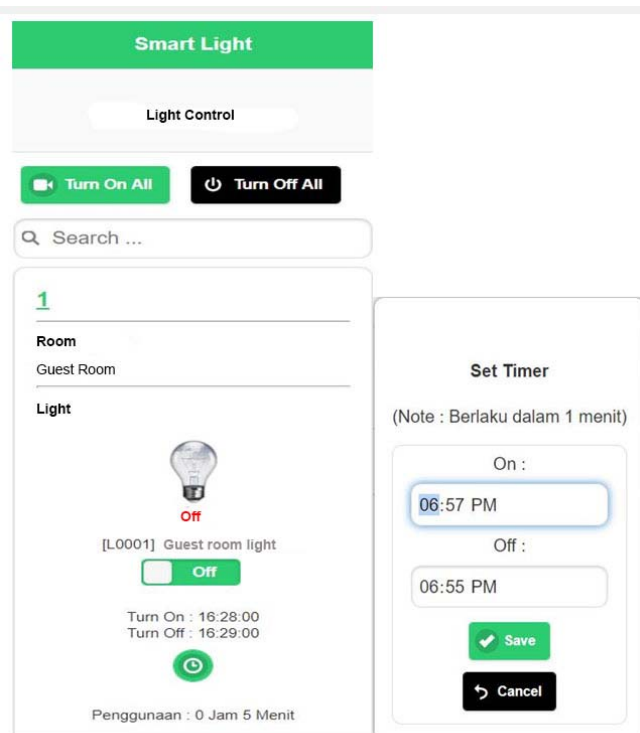


Fig 7. Smart light application view

Based on testing done by turning on and off via smart phone connected to the internet, the prototype and application is able to work well in controlling and monitoring the lights in smart home environment.conclusion

From the research conducted and after analyzing and overcoming the problem, it can be concluded as follows:

1. This application serves to control on/off lights at home from remote network.
2. With this application allows homeowners to monitor the conditions on/off light at home via remote network.
3. Provide information about how long the usage of a light in the smart home environment.

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# CERTIFICATE OF APPRECIATION

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**Apri Siswanto**

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