International Journal of Economic, Technology and Social Sciences
e-ISSN 2775-2976
International Journal of Economic, Technology and Social Sciences
url: https://jurnal.ceredindonesia.or.id/index.php/injects
Volume 4 Number 2 page 247- 253

Increased Smart Lamps Efficiency with Renewable Energy

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ABSTRACT
Technological developments are currently very rapid. Effectiveness in achieving convenience is required to be further advanced. Therefore, an example is the activity of turning on or off the lights. In general, these activities work by being controlled manually. However, sometimes homeowners are bothered to turn on and forget to turn off the lights when they leave the house. The lights will continue to be on, resulting in excessive use of electrical energy and incurring very high electricity bills. One of the technologies currently developing is the Smart lamps with an IoT-based solar energy source. This technology uses sunlight as a resource so that it can minimize electricity bills. Light control can work automatically via sensors or manually using a cellphone. So users don't need to bother and worry when they forget to turn off the lights, because with this sensor the lights will automatically turn on or off by themselves. In addition, controllers and other monitoring can be done via the blynk application on the cellphone after going through the programming process

Keywords **:** ***Internet of Things, Monitoring***

INTRODUCTION

The development of Electronic Technology to date is very rapid, one of which is smart lights. Where the lighting that originally used torches, petromax, incandescent lamps, gas lamps, until now to LED lamps (Light Emitting Diode). All of these lights are made to help humans in carrying out activities at night. Until now it has developed again with the existence of smart lights. Smart lights (smart LED) are LED lights that can be arranged in such a way through a smartphone. With uses, for example, forgetting to turn off the lights can turn it off through a smartphone so that it saves more energy. Smart lights can also improve efficiency, comfort and safety by using technology automatically. Technology designed for smart lights aims to make it easier for homeowners to monitor the condition of electronic equipment connected from gadgets owned. (Hardianto & Kusuma, 2019).

Based on these problems, this study will design a prototype of a lamp control system that aims to save electricity and make it easier for room occupants to use lights. Where this control device can control a lamp remotely using only a smartphone. This prototype was made as material for testing and research in making the system. Later on the lamp control device there will be features including brightness level control, detection of human presence, turning on or off, automatic set of lights, and monitoring. This research will use nodeMCU or microcontroller as the brain of the prototype or tool to be used. Microcontroller users themselves can be integrated with the Internet (Internet of Things). By making the microcontroller as a web server, the device can be accessed via the HTTP protocol, which makes the microcontroller can be controlled remotely (Nurmuslimah *et al*, 2023).

The sun is a source of energy for the earth. Earth has a layer of atmosphere that is hundreds of kilometers thick above the surface of the earth. Consisting of five layers, namely the troposphere, stratosphere, mesosphere, thermosphere and exosphere, this layer acts as a filter for solar radiation with various wavelengths. Living things in the troposphere

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(biosphere), where ecosystems are closely intertwined with each other and are continuous cycles that form the basis for life. However, the availability of driving power is a problem, especially for areas that have not been reached by the State Electricity Company (PLN) network, to overcome this problem, a solution is needed, one of which is to use solar power technology. (Dwi Chintya Dian Pratiwi and Habibullah, 2022).

The development of IoT technology that can be applied to the home and make it a Smart Home by referring to several Journal studies that make us interested in raising the title of Smart Lamps with renewable energy that can turn on lights automatically using LDR sensors and manual (On / Off) on Blynk IoT Apps and Blynk IoT Web Servers. This research was conducted by Supri Ananda et al who can implement the Internet of Things in their control system using NodeMCU esp 8266 by using Apps Blynk as control and monitoring. With this system, it is expected to make it easier for users to control the lights at home when users are outside the home

METHODS

The research method used in this study consists of literature studies and descriptive studies. In the development of Smart Lamp research with renewable energy, it aims to reduce the occurrence of ineffective electrical power consumption by using a light sensor (LDR) as a parameter in supporting the use of a load (lamp). The stages carried out include analysis of the work system in implementing Smart Lamp in everyday life using the Waterfall Method. The Waterfall method is a method that provides a sequential approach to software lifeflow." (Yana Iqbal Maulana, 2017).

Stages in the waterfall method (Rosa, Saladin, 2015: 28):

There are 5 stages of the waterfall method, namely requirement analyst, design, implementation, testing and maintenance.

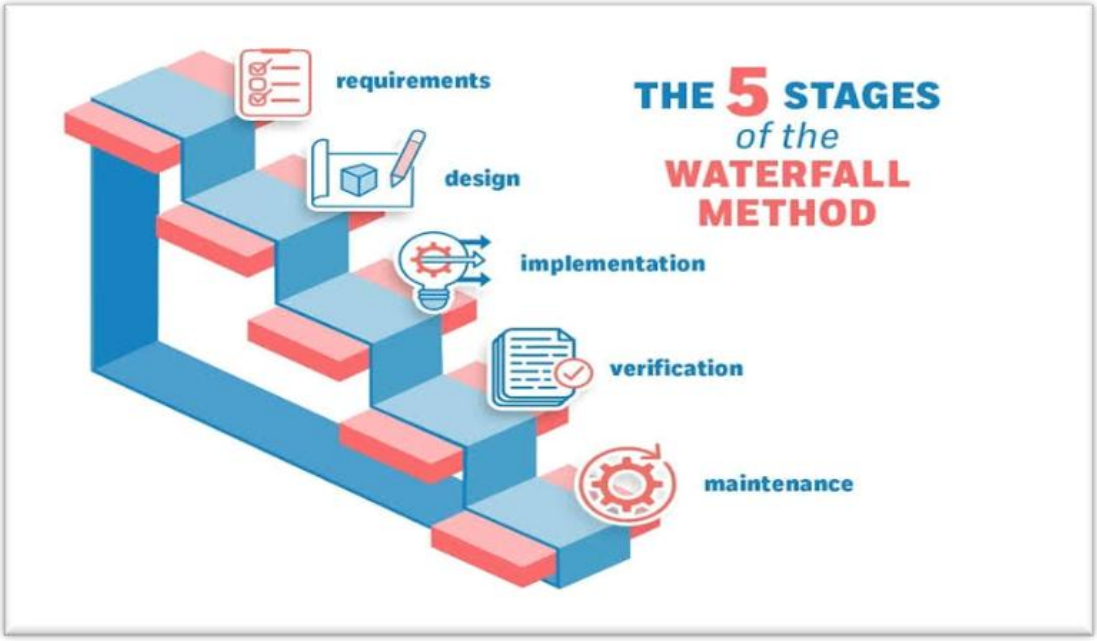

Figure 1. Stages of the Waterfall Method

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The stages of waterfall method development are:

a. Analysis and definition of service requirements, limitations, and system objectives are determined in consultation with the user.
b. Design- This process translates requirements into predictable software design prior to codingImplementation and unit testing Software design is realized as a series of programs with C language to be readable by computers
c. System verification and testing The program unit is integrated or tested as a complete system to ensure that the system requirements have been met and can work properly.

RESULTS AND DISCUSSION

Stages of Manufacture :

1. Needs Analysis
   Based on the analysis of the design of the smart lamp system with renewable energy is to reduce costs in using electricity via PLN so as to reduce existing costs in the long run**.**
2. System Analysis
   The design of the Smart Lamps System with renewable energy uses an IoT system as monitoring the condition of the lights to get optimal results. Internet of things (IoT) is a concept that aims to expand the benefits of continuously connected internet connectivity. Internet of things (IoT) can be used in Industry and Home to control and monitor existing electronic equipment such as room lights that can be operated remotely through computer networks & Mobile phones. (Yoyon Efendi, 2018).
3. Analysis of the required materials
   Some of the materials and software needed to design Smart Lamps with renewable energy include the following:
   - NodeMCU microcontroller ESP8266
   - Sollar Cell
   - Sollar Charger Controller
   - Battery
   - LDR sensor
   - 220 Ohm, 1K Ohm Resistors
   - Cable Socket
   - Cable Connetor USB to NodeMCU ESP 8266
   - Miniature House
   - Software Arduino IDE
   - Software Blynk
4. Design (Flowchart)
   A flowchart is a chart that shows the flow or flow in a program or system procedure logically. A flowchart is an illustration in the form of a flow chart of the algorithms in a program, which states the direction of flow of the program.

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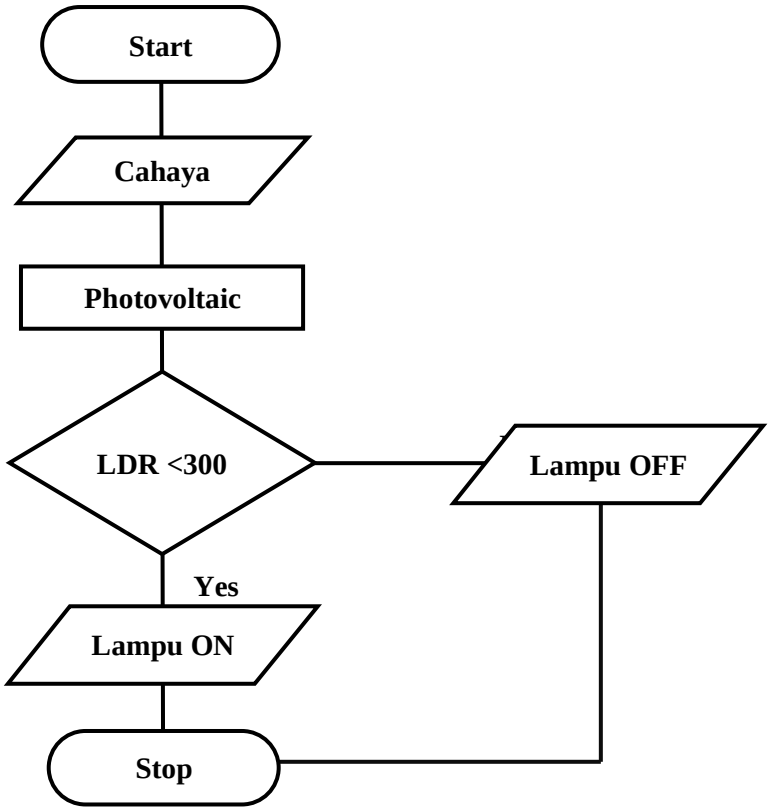

Figure 2.
Flowchart of Smart Lamp control and monitoring system from renewable energy

Here is the working system of each process on the Flowchart, including:

1. Light is the input that is the main power source in the system.
2. Photovoltaic is a working principle that converts photon energy (electromagnetic producing light particles) from the sunlight radiation it receives into electrical energy.
3. LDR < 300 is the Max parameter of the LDR sensor which is set to detect dark conditions.
4. After the LDR is selected according to the parameters, < 300 for the ON lamp and > 300 for the OFF lamp.
5. Hardware Design.
   Assembling every material component needed so that they are interconnected and can function properly is a function of hardware design. The stages include the following:
   - First Step, Pairing NodeMCU bas ver 1.0 as a Peripheral device to ESP 8266 in order to connect and connect to the Internet.
   - The second step, the 3V3 PIN is connected to the LDR input and the out of the LDR is connected parallel to the resistor input and to the A0 PIN on the NodeMCU Esp8266 and the out on the 1k resistor is connected to the GND PIN.

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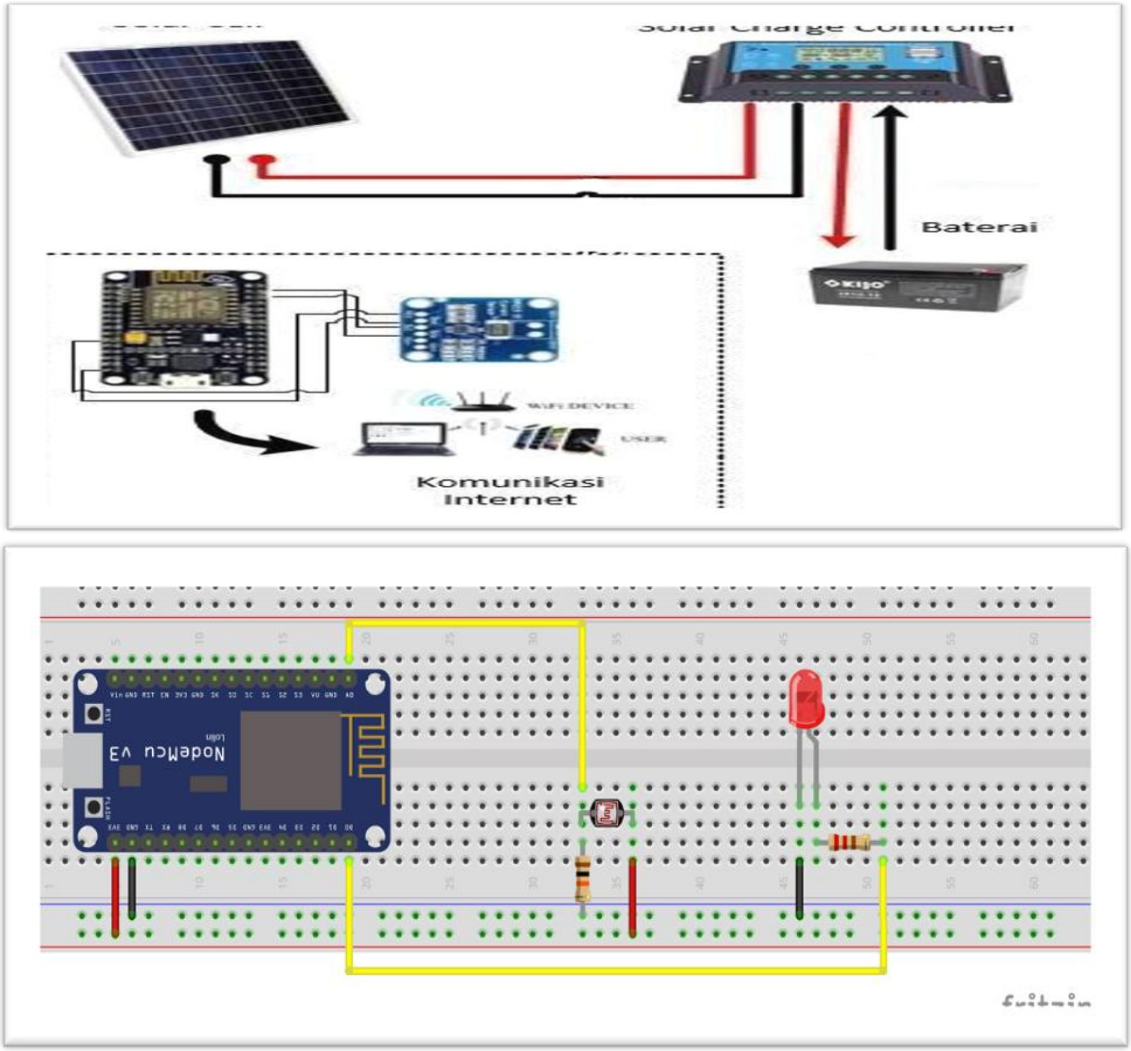
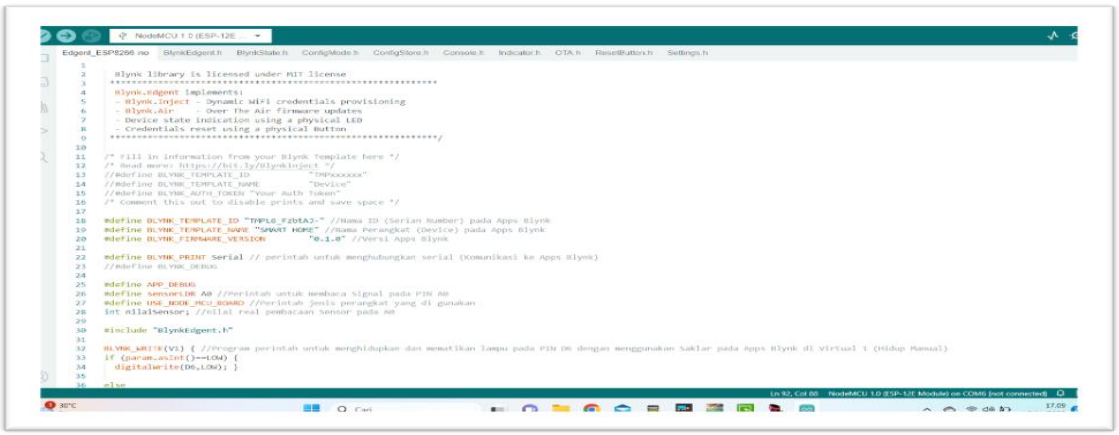


Figure 3. NodeMCU Wiring Scheme to LDR & LED Sensor

6. Implement Programs on Arduino Uno Software
   The programs for the application of Smart Lamp using LDR Sensors are:



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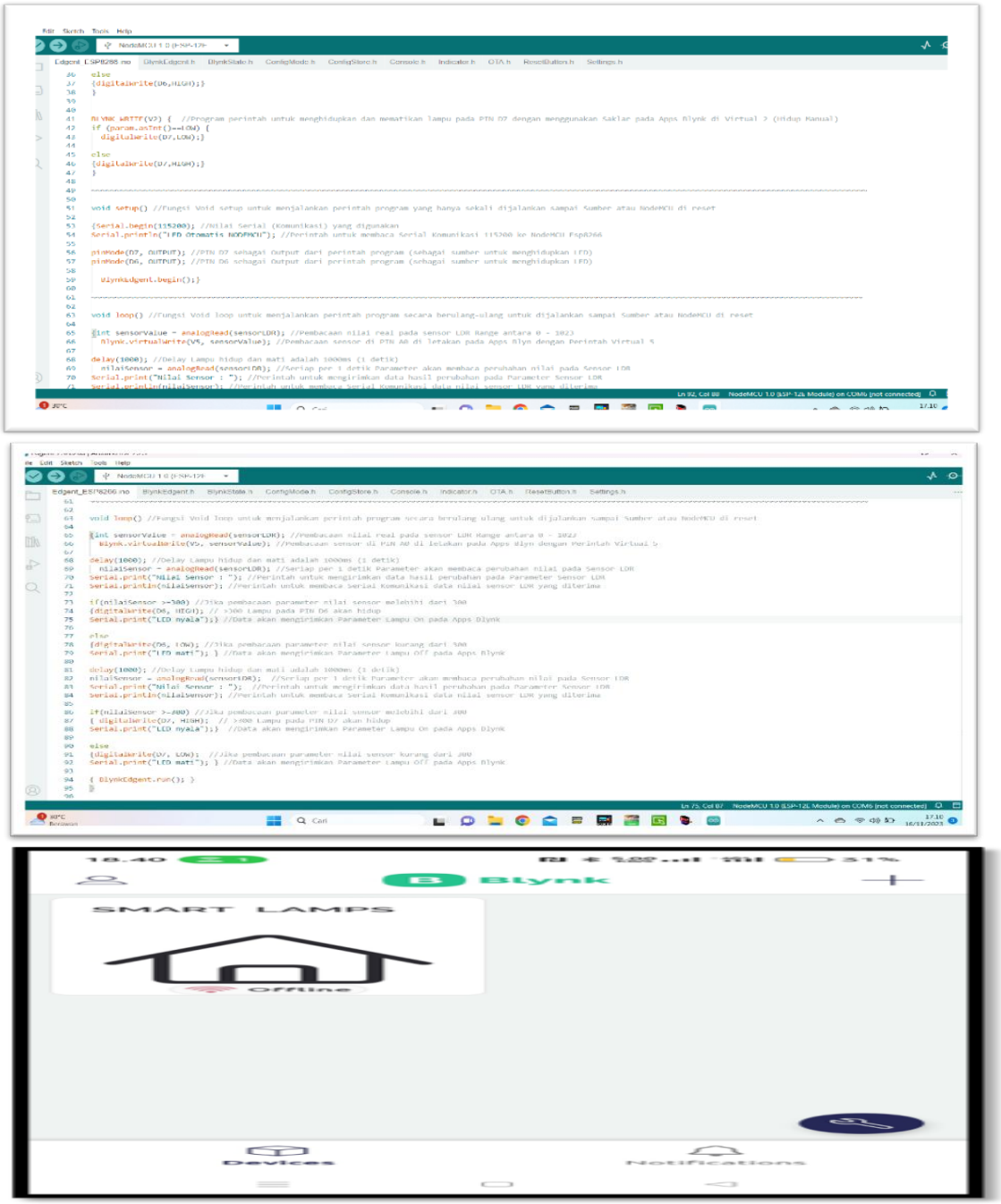

Figure 4. Display Smart Lamps on Smart Phone using Apps Blynk

7. Unit Testing and Observability
   - Circuit and Program Testing on Arduino uno using a ESP8266-based mycorocontroller as a Wifi module to support IoT-based data processing by using an LDR (light) sensor by making Value 300 as a benchmark for light for bright On-Off.
   - When bright light readings on the parameters show a range of 500 – 900

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- When the light is dark, the readings on the parameters show a range of 100-300

CONCLUSION

Based on the discussion above, it can be concluded that:

1. Solar cells and batteries are used as voltage-generating sources to power circuits and NodeMCU ESP8266
2. This Prototype design is used only to turn on and off lights manually using Apps Blynk on Smart Phone and automatically using LDR sensors
3. Application to IoT (Internet Of Things) systems that are useful for monitoring and controlling lights
4. There is a parameter reading to determine the Value given to the LDR Sensor which is used to measure the identity of light outdoors

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