

The Implementation of NodeMCU ESP8266 for Smart Lamp in the Cilacap State Polytechnic Campus Area

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Abstract— Lamps are household electrical devices. In general, the lights are controlled through switches which require the user to move towards the switch to turn the lights on/off. To save time, lights can be controlled via the internet of things using the NodeMcu ESP8266. The purpose of making a smart lamp using the NodeMCU ESP8266 is to make it easier to turn it on and off with a smartphone without the need to look for a switch. This smart lamp can be controlled via a virtual button on the Blynk application or based on a set clock. The results obtained from the design of this tool are that the smart lamp will turn on at 8.00 AM and will turn off automatically at 3.00 PM, or by pressing the virtual button on Blynk. There is a slight delay when the lights will turn on or off, this is caused by the strength of the internet from the wifi connected to the ESP8266.

Keywords— Internet of Things, NodeMCU ESP8266, Smart Lamp, Arduino IDE, Blynk App.

I. INTRODUCTION

The internet in today's digital era is very closely related to everyday life. Starting from young people to adults, the majority use the internet as a medium to assist in carrying out and connecting various human activities effectively, accurately, and efficiently. Technological developments that can be utilized from this internet connection are being able to access equipment with the electronic Internet of Things (IoT) based NodeMCU module, one of which is light control [1]. Previous research related to smart lights has been carried out by several researchers such as [2-5]. The difference between this research and similar research is the use of NodeMCU ESP8266 and the Blynk application as an interface to control and show conditions at the smart lamp. some study also shows that the use of smart lamp also can reduce energy consumption [6-7].

Based on development needs tools and previous studies, this article describes the implementation of a Smart Lamp with the NodeMCU ESP8266 module based on the Internet of Things (IoT) to control the lamp without having to look for a switch. This research aims to prove that smart lamps work well to replace the switch function by turning on or off the lights. This smart lamp can be used in various places on campus, for example in the practicum room, bathroom, courtyard, parking lot, and others as the application of IoT in real life [8]. The smart lamp control application used is Blynk, which can be downloaded by lecturers, students, or security. Users can use the application to control the smart lamp when learning is carried out or after learning is complete.

A. Arduino IDE

Arduino IDE (Integrated Development Environment) is software used to program various microcontrollers such as

Arduino and NodeMCU ESP8266. Arduino IDE can run on all OS. Arduino IDE uses the C/C++ programming language and uses a compiler (Avr-g++). Arduino program code is usually called a sketch and is made using the C programming language. Programs or sketches that have been written in the Arduino IDE can be directly compiled and uploaded to the Arduino Board. In simple terms, Arduino sketches are grouped into 3 blocks, namely the header, setup, and loop. [9]

B. Blynk App

Blynk is a server service that is used to support Internet of Things projects. This server service has a mobile user environment, both Android and iOS. Blynk Application as IoT support can be downloaded via google play. Blynk supports a wide range of hardware that can be used for Internet of Things projects. Blynk is a digital dashboard with a graphical interface for project creation. Adding components to Blynk Apps using Drag and Drop, makes it easier to add input/output components without the need for Android or iOS programming skills. Blynk was created to control and monitor hardware remotely using internet or intranet data communications (LAN network). The ability to store data and display data visually using numbers, colors, or graphics makes it easier to create projects in the Internet of Things field [10].

C. NodeMCU ESP 8266

NodeMCU ESP 8266 is a hardware-based open-source IoT platform that is equipped with WiFi features and uses Lua as a programming language or you can use Arduino IDE sketches to create IoT prototypes, the purpose of NodeMCU being created is to make microcontroller circuits and programming easier to use or learned by new people [11].

The ESP8266 family of ESP-12 IoT (Internet of Things) platform modules includes the NodeMCU ESP8266 development derivative module. Functionally, this module is almost identical to the Arduino platform module; however, it differs in that it is focused on being "Connected to the Internet" [12].

The NodeMCU ESP8266 development board comes with the ESP-12E module containing the ESP8266 chip having Tensilica Xtensa 32-bit LX106 RISC microprocessor. This microprocessor supports RTOS and operates at 80MHz to 160 MHz adjustable clock frequency. NodeMCU has 128 KB RAM and 4MB of Flash memory to store data and programs. Its high processing power with in-built Wi-Fi/ Bluetooth and Deep Sleep Operating features make it ideal for IoT projects [13].



Figure 1. NodeMCU ESP8266

D. 5V Relay Module

The 5V Relay Module is a magnetic switch, which functions to disconnect and connect electric current. These relays are electrically operated which makes it possible to turn a circuit on or off using a remote voltage or current.

Higher than NodeMCU can handle. There is no connection between the low voltage circuit operated by the NodeMCU and the high power circuit [14].



Figure 2. 5V Relay Module

E. 5V DC Adaptor

The adapter is used as a voltage source to activate the ESP8266, the required voltage for the ESP8266 is 5-12V DC. Adapter input is connected to 220VAC mains voltage and output is connected to ESP8266.

F. Internet of Things

Internet of Things (IoT) is a concept or scenario where an object can send/transfer data over a network directly without any human intervention. speed is too high or tire pressure is too low, farm animals with transponder biochips and someone with a heart implant monitor. wearables category, and IoT can provide benefits in almost all aspects of life [15].



Figure 3. Adaptor 5V

II. METHOD

The method that will be used in this activity is to create flowcharts, block diagrams, and electronic circuits. Where the flowchart will explain how the smart lamp works, the block diagram will explain the order of the control system on the smart lamp, and the electronic circuit explains the schematic circuit of the smart lamp.

The flow or work sequence of this smart lamp uses an open-loop system, where from the Blynk application as input it gives a command to the ESP8266 (controller) to be processed and produces an output. When the ON button in the Blynk application is pressed, the ESP8266 will turn on the relay and the lights will turn on, for more details, see the following block diagram.

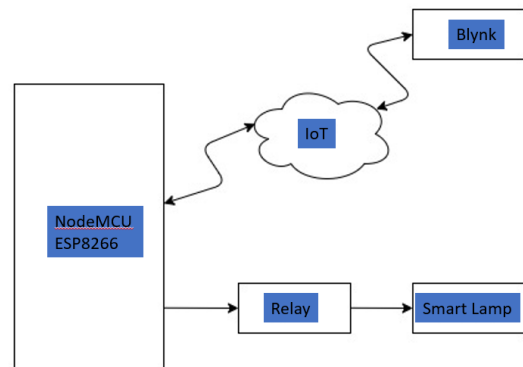


Figure 4. Block diagram

The way these smart lamp works is that we first connect the smart lamp with the Blynk application, once connected we can turn the lights on and off with the application. The initial condition of the lamp after it is connected there is a choice whether to use the button or not, if not, the lamp will turn on and off automatically based on the specified time. If so, it will use the button found on Blynk, the initial condition of the button is OFF or off as shown in the flowchart below. When we press the button, the button will turn ON and turn on the relay connected to the lamp so that the light turns on. To turn it off we just press the button again so that the button becomes OFF.



Figure 5. Flowchart system

The schematic circuit of the smart lamp can be seen in the image below. The input for the ESP8266 comes from the charger module with a micro-USB cable. Then the relay is connected to the ESP8266 digital pin, you can freely use any number of digital pins. The relay source is connected to the VCC and GND pins of the ESP8266. Then COM on the relay is connected to the AC from the lamp holder, and NO on the relay is connected to the lamp. Neutral on the lamp holder directly connected to the lamp.

III. RESULTS AND DISCUSSION

The test is carried out to find out whether the system designed for smart lights has been achieved or not. testing is carried out in two ways, namely testing against time as a system response and testing based on virtual button responses.

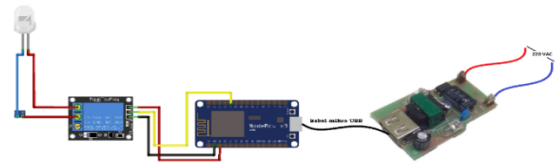


Figure 6. Electrical Circuit

A. Tests turning on and off the lights based on the specified hour/time

Testing is done by setting the time when the lights turn on and off. Setting time using the general time provided by RTC. This test will work immediately when the smart lamp is connected to Wifi and will work automatically by the number of pages the smart lamp turns on and off periodically.

TABLE I
TEST RESULTS OF LAMP CONTROL WITH SPECIFIED TIMES

Time (WIB)	Lamp Condition	Notification
08.00	ON	Turning On
15.00	OFF	Turning Off

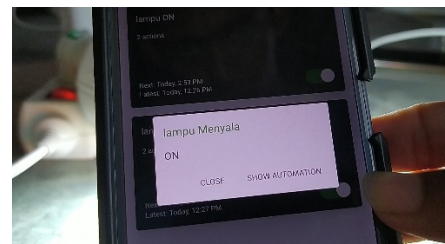


Figure 7. notification when the light is on

Notifications received on the Blynk application are feedback from the ESP8266 so that the user knows that the light is on. The notification "Lights On" will be received at 08.00 WIB.

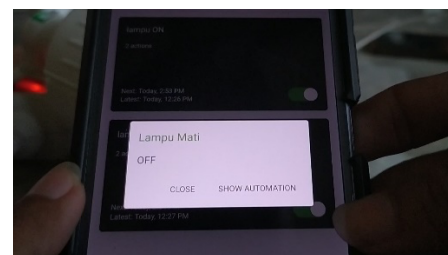


Figure 8. notification light is off

When the light is off, the Blynk application sends notifications received from the ESP8266 so that the user knows the notification "Lights Off" will be received at 15.00 WIB.

B. Tests turning on and off lights with virtual buttons

This test is needed whether there is an error that occurs in the virtual button in the application that has been designed.

This test is done by pressing the button on the Blynk application that is already connected to the smart lamp.

TABLE II
TEST RESULTS OF LAMP CONTROL WITH VIRTUAL BUTTONS

Switch Condition	Notification	Delay time (s)
ON	ON	0
OFF	OFF	0

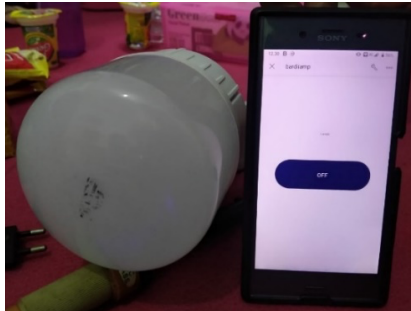


Figure 9. Condition of the lamp when the switch is off

The picture above is the initial condition when controlling the smart lamp. The initial condition is OFF and the button is black, the light is off.

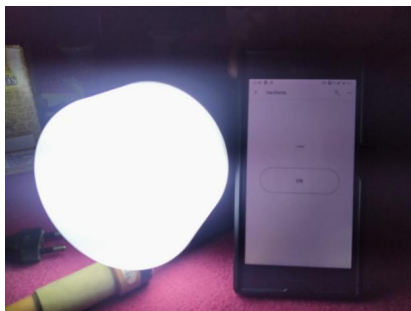


Figure 10. Condition of the lamp when the switch is on

The picture above shows the condition after the button is pressed, the button will change from OFF to ON and the button color becomes white, and the light is on.

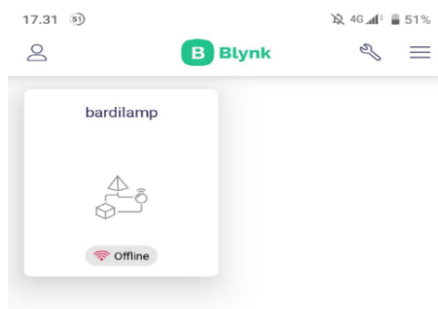


Figure 11. Dashboard smart lamp

The picture above shows the initial view when opening the Blynk IoT application, a connected device will appear.

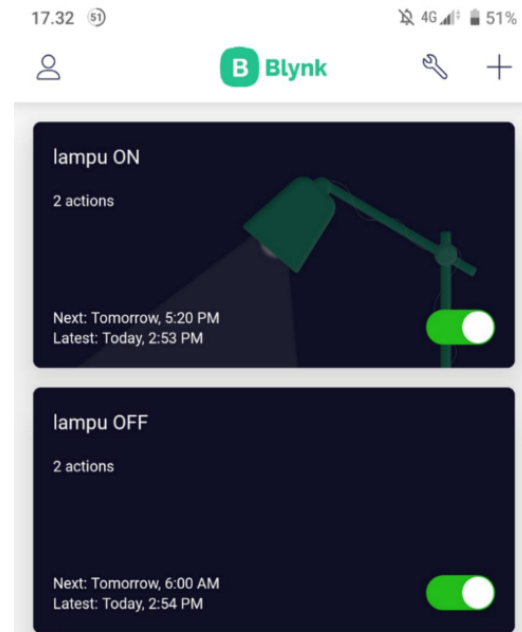


Figure 12. Dashboard smart lamp

The picture above shows that the smart lighting control can be set on the owner's smartphone dashboard and users can create the automation menu looks as they wish. the owner can set when the lights will turn on and off as long as they are connected to the wifi network so they don't have to press the switch from home and are expected to be more energy efficient because they can reduce energy use in lights that are turned on during the day

IV. CONCLUSION

Based on the results of the analysis, design, and implementation that have been carried out and based on the results of the experiments that have been carried out the implementation IoT-based light switch control device using the NodeMCU ESP8266 works well to replace the switch function turning on or off the lights. The automatic system of time-based lights works well, but there is a slight delay when pressing the button and the lights turn on, due to the internet's strength from wifi.

REFERENCES

- [1] Ginting, Dicky Ardianta, Wahmisari Priharti, And Rizki Ardianto. "Desain Penerapan Lampu Pintar Berbasis Internet Of Things." E-proceedings Of Engineering 8.5 (2021).
- [2] Artiyasa, Marina, And Ilman Himawan Kusumah. "Studi Perbandingan Platform Internet Of Things (Iot) Untuk Smart Home Kontrol Lampu Menggunakan Nodemcu Dengan Aplikasi Web Thingspeak Dan Blynk." Fidelity: Jurnal Teknik Elektro 2.1 (2020): 59-78.
- [3] Destiarini, Dan Pius Widya Kamara. "Robot Line Follower Berbasis Mikrokontroler Arduinouno

- ATMEGA328”, Jurnal Informanika, Vol 5 , No.1 (2019) Hal 23-24.
- [4] Marina Artiyasa, Aidah Nita Rostini, Edwinanto, Dan Anggi Pradifita Junfithrana. “ Aplikasi Smart Hone Node MCU Iot Untuk Blink.” Jurnal Teknologi Nusa Putra. Vol 7. N0 1. September(2020) Hal:2.
- [5] Deni Ahmad Jakaria, Dan Muhamad Rifki Fauzi. “Aplikasi Smarphone Dengan Perintah Suara Untuk Mengendalikan Saklar Listrik Menggunakan Arduino.” JUTEKIN Vol 8 No 1(2020) Hal:22.
- [6] R. Ramdhoni, S. Supriyadi, and N. Nugraha, “Rancang Bangun Sistem Kontrol Dan Monitoring Lampu Otomatis Menggunakan Arduino Dengan Metode Fuzzy Logic Berbasis Android (Studi Kasus Koridor Lantai 1 dan 2 Fakultas Ilmu Komputer),” J. Nuansa Inform., vol. 12, no. 1, pp. 44–52, 2018.
- [7] S. A. E. Mohamed, “Smart Street Lighting Control and Monitoring System for Electrical Power Saving by Using VANET,” Int. J. Commun. Netw. Syst. Sci., vol. 06, no. 08, pp.351–360, 2013.
- [8] N. Febrianto, W. Sunanda, and R. F. Gusa, “Penerangan Jalan Umum Tenaga Surya: Studi Kasus di Kota Pangkalpinang,” J. Presipitasi, vol. 16, no. 2, pp. 33–39, 2019.
- [9] A. Adriansyah, S. Budiyanto, J. Andika, A. Romadlan, and N. Nurdin, “Public street lighting control and monitoring system using the internet of things,” in AIP Conference Proceedings 2217, 030103, 2020.
- [10] E. Ihsanto and M. Dawud, “Sistem Monitoring Lampu Penerangan Jalan Umum Menggunakan Mikrokontroler Arduino dan Sensor LDR dengan Notifikasi SMS,” J. Teknol. Elektro, vol. 7, no. 2, May 2016.
- [11] P. V. A. Wibawa, O. S. Komang, and A. A. N. Amrita, “Rancang Bangun Sistem Monitoring Lampu Penerangan Jalan Umum Berbasis Web,” J. Spektrum, vol. 6, no. 4, pp. 51–57, 2019.
- [12] Dewi, N.H.L., Rohmah, M. F., dan Zahara, S, “Prototype Smart Home dengan Modul Nodemcu ESP8266 Berbasis Internet of Things (IOT)”, Bachelor thesis, The University Institutional Repository of Majapahit Islamic University, Mojokerto, April. 2019.
- [13] (2022). utmel homepage. [Online]. Available: https://www.utmel.com/components/nodemcu-esp8266-video-faq-esp32-vs-esp8266?id=2036&gclid=CjwKCAjw5NqVBhAjEiwAeCa97UERrKO5Uyr1gShqsrV26oV1610qh7BNR1mp9FuYJdVO5OLaUELSXxoCPvYQAvD_BwE
- [14] D. P. Buwana, S. Setiawidayat, and M. Mukhsin, “Sistem Pengendalian Lampu Penerangan Jalan Umum (PJU) Melalui Jaringan Internet Berbasis Android,” JOINTECS (Journal Inf. Technol. Comput. Sci., vol. 3, no. 3, pp. 287–292, Dec.2018.
- [15] Muhammad, Ardhi Anzala, Rendy Munadi, And Ratna Mayasari. "Perancangan Lampu Lalu Lintas Pintar Untuk Smart City Menggunakan Wireless Sensor Network." Eproceedings Of Engineering 6.1 (2019).