International Journal of Education, Information Technology and Others (IJEIT), August 2023, 6 (3), 292-305
DOI: https://doi.org/10.5281/zenodo.8297814
p-ISSN: 2654-2528 e-ISSN: 2623-2324
Accredited by Directorate General of Strengthening for Research and Development
Available online at https://jurnal.peneliti.net/index.php/IJEIT

Automatic Switch Design with Specified Time Using Wemos D1 Mini Esp 8266 Based on IOT to Save Energy

Moch.Fachruddin Arrazaq[1], Fendi Achmad[2]

[1,2] Program Studi S1 Teknik Elektro, Fakultas Teknik, Universitas Negeri Surabaya.

Received: 5 Juni 2022
Revised: 10 Juni 2022
Accepted: 13 Juni 2022

Abstract

Excessive use of electronic devices often goes unnoticed. The result of excessive use of electronics is an increase in electricity bills. For that we need a tool that can reduce or limit the use of electricity. The problem that arises in this case is how a tool can operate according to the time needed so that it can limit and save electricity the tool runs as long as needed so that it can limit and save power according to usage Aiming to reduce excessive use of electrical energy, a design tool is designed automatic switch uses IoT-based time, which can turn on and off the switch automatically at a predetermined time, with the aim of saving energy and maximizing cellphones as a means of automatic switching off and Wemos D1 functions as a microcontroller that functions as a wifi reception and its relay. used as a trigger to control the opening and closing of switches and ams modules. 117 as a voltage reducer. The purpose of this tool is to help everyday life by using the tool to reduce electricity bills, thereby reducing the worries of homeowners in the future if the house is left for a very long time.

Keywords: Automatic time switch, Microcontroller, Wemos D1, Module Ams 117, Relay

(*) Corresponding Author: moch.fachruddin.18079@mhs.unesa.ac.id, fendiachmad@unesa.ac.id[2]

How to Cite: Arrazaq, M., & Achmad, F. (2023). Automatic Switch Design with Specified Time Using Wemos D1 Mini Esp 8266 Based on IOT to Save Energy. *International Journal of Education, Information Technology, and Others, 6*(3), 292-305. https://doi.org/10.5281/zenodo.8297814

INTRODUCTION

In everyday life humans always need electricity in the household sector, factories, and the tourism sector, electrical energy is a very important factor for mankind because in modern times many pieces of equipments, especially household appliances, use electrical energy. So in this case, humans play an important role in maintaining the use of electrical energy, because electrical energy is very important for daily use and electrical energy is limited.

Therefore, humans need electricity enough to carry out activities efficiently and as well as possible with relative time and at the required time (Sihombing, et al, 2018).

With the rapid development of technology, it also has an impact on increasing electricity demand due to the latest technology such as air conditioners, cellphones and others, although it can also be due to excessive energy use so that it becomes wasteful (Desy, Dwei astutik, 2017). control the use of electrical energy.

Electronics is one of the technologies that is very helpful for humans to make human life younger and more effective, one of which is a form of electronic control system that is widely developed is a remote control system, with this it is very possible for humans to control on-off on switches at a distance, of course, it is very easy for humans to support modern life (Andriyanto, 2015).

With this, the author innovatively designs smart switch technology that can be controlled remotely using IOT which uses a predetermined timer. The tool is designed to be able to turn on and turn off outlets, lights and other electronic devices in an automatic way.

The design made on the tool using the Wemos D1 eps 8266 microcontroller device that can be connected to wifi is used as an IOT device then the Relay Module as a replacement for the switch where the relay module becomes the igniter so that it turns on and off the equipment with a predetermined time for the automatic time switch to become a regulator that every minute turns off and turns on the lights, and the author came up with the idea to make "Designing an Automatic Switch with a Determined Time Based on IOT".

RESEARCH METHOD

The research carried out has the aim of retrieving data, where primary data is data that can be directly obtained from the observed source, this data is taken from the research subject carried out by the author using direct data recovery equipment about the object to be used as data to be sought. In that case, the data will be obtained in the form of automatic timing transformation to help utilize electric power savings.

Diagram Blok

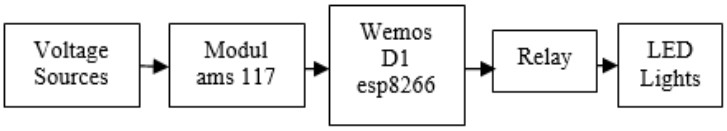

Figure 1. Blok Diagram

The first step before making this tool is to start by designing the workflow of this tool, so that the research can run as desired, in addition to making a functional diagram, we will find it easier to connect one tool with another, here is a block diagram of this research.

Image description:

a. Voltage source
   This voltage source comes from an adapter that is connected to a power outlet so as to produce a voltage source, from the voltage source then the current is transferred to the AMS Module 117.
b. AMS 117 Module
   Where the module functions for a voltage reducer, and after the voltage is reduced through the AMS 117 Module the voltage continues to the Wemos D1 Esp 8266
c. Wemos D1 Esp 8266
   Where the Wemos D1 mini functions as a wifi network connector so that it can be used as an Internet Of Things (IOT) device, after passing through the Wemos D1 mini current through the relay
d. Relay
   Where this Relay functions as turning on and off the light switch
e. LED Lights
   After passing through the Relay then the current to the lamp, where the lamp as an automatic switch output uses time

Flowchart Design sistem

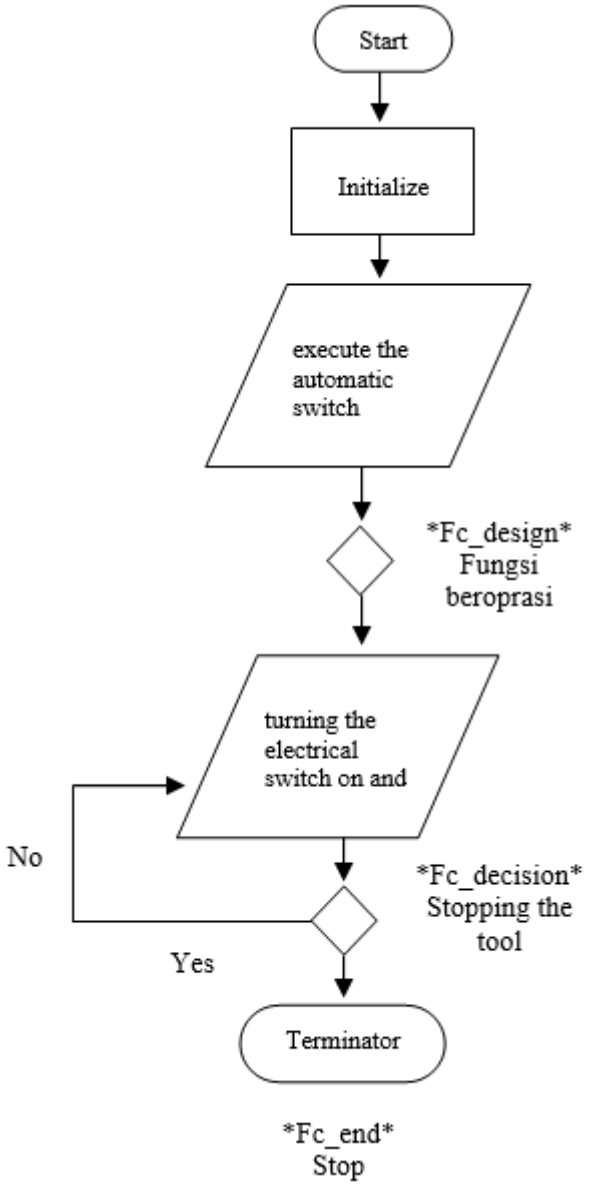

Figure 2. ***Flowchart***
(Source: Personal Doc, 2022)

A flowchart is a way to represent an algorithm.

Description:

1. Start
2. Planning process before starting the program
3. Execute the time switch function that has been programmed in the system that will be sent to the relay module
4. The function is received by the relay module and starts executing
5. The relay module performs the function of turning on and off the electrical switch with a predetermined time repeatedly
6. Stop

Workflows

This tool has a very simple way of working, namely, where from the adapter that is connected to the outlet and produces voltage on the adapter, then the voltage obtained by the 9 volt adapter is transferred to the Ams 117 module to reduce the voltage to 5 volts so that later the tool functions properly, from the Ams 117 module the voltage is flowed to the Wemos D1 and relay, after from the Ams module the voltage is transferred to the Wemos D1 so that later the Wemos gets a wifi signal then from the Wemos D1 the function has been received by the relay, operating the automatic time switch function that has been programmed on the system and has been sent to the relay module. The function has been received by the relay module, turning on and turning off the electricity switch according to the time specified repeatedly in the Blynk application.

Schematic of the Entire Circuit

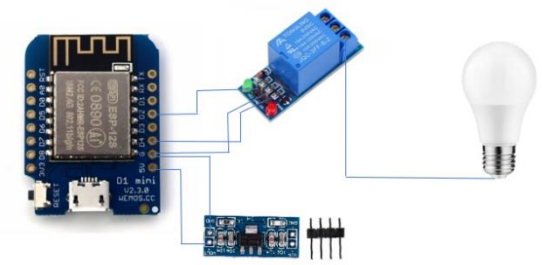

Figure 3. Automatic switch circuit

(Source: Personal Doc, 2022)

This schematic explains everything of a prototype designed by the author. shows the Wemos D1, Ams 117 Module, and 1 Relay module. Relay modules that are interconnected. Arduino Uno as the controller The entire network is responsible for receiving and processing data. When using the 1channel 5V relay module itself as a trip device to turn the electricity on and off. The designed circuit scheme is as follows:

1. Arduino
2. Modul AMS 117
3. Modul Relay
4. Light

To write a program on the Arduino board, need Software *Arduino Integrated Development Environment (IDE)* can be downloaded for free from http://arduino.cc/en/Main/Software which is the official website of Arduino. The download is one arduino-1.8.5-windows.exe file and then run the application by double-clicking on the arduino.exe file. Write the program in C/C++ or Java language and adjust it to Arduino, whether this means machine language or the program used, pure C language. (Eko ihsanto, Muhammad Faitul Rifky, 2015)

In order for the Arduino board and computer to be connected or connected, a standard AB USB cable is required. Then open the Arduino IDE software and connect the cable to the Arduino board, then the computer will read each port on the Arduino, so that it can facilitate use in developing IOT microcontrollers, because the entire circuit has been put together on the board.

Software *Design*

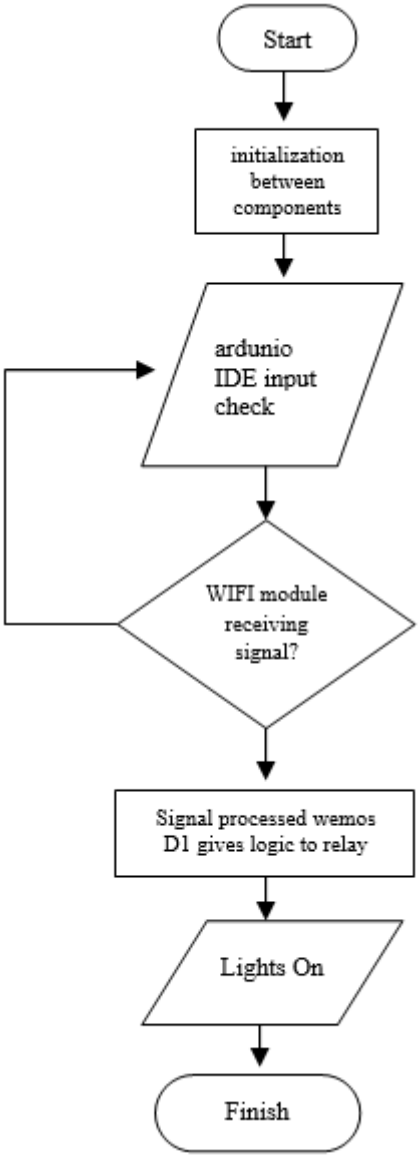

Figure 4. software design flowchart
(Source: Personal Doc, 2022)

Hardware Design

In its design, this automatic switch design uses wemos D1 as an important component, wemos D1 for its basic brain, the formation of this hardware is carried out to realize the creation of IOT (Internet Of Things) which is simple and can be operated through the Blynk application.).

RESULTS AND DISCUSSION

Manufacture of automatic switch design

In the process of making the automatic switch the required hardware is Wemos D1, Module AMS 117, Module Relay 5v, and components include jumper cables, and breadboards.

Where all hardware and components are made into one unit, after assembling the hardware after that programming where this programming uses the software used in building the system is Wemos D1.

AMS 117 Module Circuit

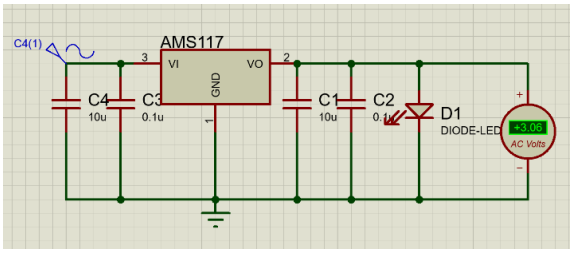

Figure 5. Wiring diagram of AMS 117 module

(Source: Personal Doc, 2022)

The AMS 117 module functions as a voltage regulator, adjusting or controlling the voltage of any electronic circuit.

That is, it takes any input and converts it into a higher voltage or lower voltage according to electronic needs.The AMS 117 module functions as a voltage regulator, adjusting or controlling the voltage of any electronic circuit.

That is, it takes any input and converts it into a higher voltage or lower voltage according to electronic needs.

Figure 6. AMS 117 circuit

(Source: Personal Doc, 2022)

Wemos D1 Circuit

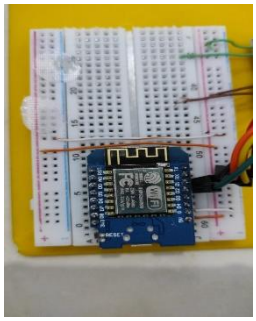

Figure 7. wemos D1

(Source: Personal Doc, 2022)

Wemos D1 functions as a wifi network connector so that it can be used as an Internet Of Things (IOT) device, after passing the wemos D1 mini current through the relay

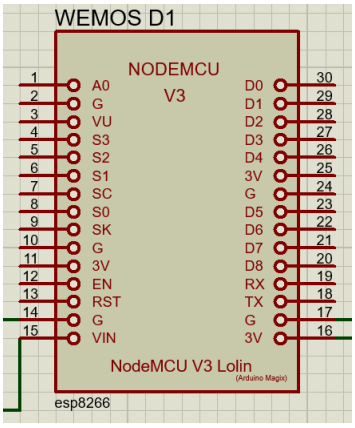

Figure 8. Wiring Diagram wemos D1
(Source: Personal Doc, 2022)

Relay circuit 5v

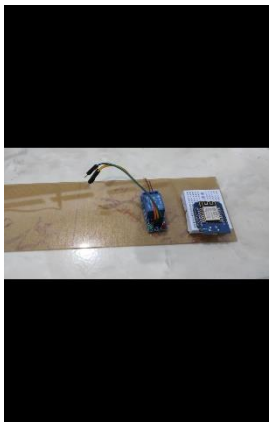

Figure 9. Relay Circuit
(Source: Personal Doc, 2022)

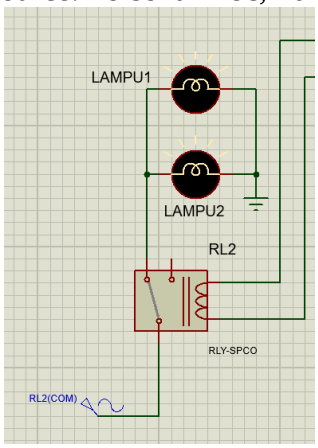

Figure 10. Wiring Diagram Relay
(Source: Personal Doc, 2022)
This relay functions as turning the light switch on and off.

The Entire Circuit

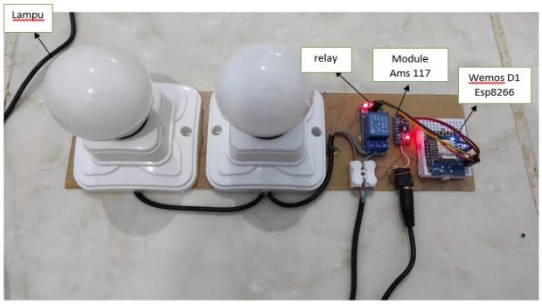

Figure 11. The Entire Circuit
(Source: Personal Doc, 2022)

From the number of module circuits above, they are then assembled into a single unit that forms a systematic system, where the circuits have their respective functions from the AMS 117 Module to the relay module.

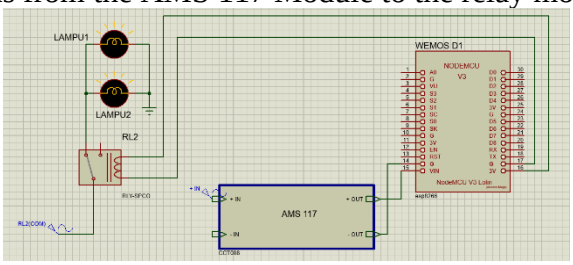

Figure 12. Wiring Diagram Of The Entire Circuit
(Source: Personal Doc, 2022)

Functional Tests

This functional test is used to carry out system tests on the tool whether the system functions as expected and runs normally, such as testing each module in the system.

Table 1. Functional Tests

Input	Function	Output	Experiment
Initialization	Turning on the device	The device turns on	Successfully
Connecting to the voltage source	Connecting lights and relays via adapters to 220volt current	The lights turn on when the relay as a switch connects the electric current to keep the lights on.	Successfully

Tool Timekeeping Test

This test is to find out how the tool works how exactly the tool functions if the load is installed.

Table 2. Tool Accuracy Testing

Time on-off (tools)	Time on-off (loads)	Delay (seconds)
16.00-16.10	16.00-16.10	0
16.15-16.20	16.15-16.20	0
16.25-16.30	16.25-16.30	0

Hardware Testing

The hardware that is tested has the aim of carrying out testing the level of suitability to users. Therefore, a questionnaire is needed which will be filled in during the software testing stage with the appropriate answers. This hardware testing is done objectively, what is tested directly to the user to see the user's response and comments on the system that has been built.

This test was carried out consisting of 7 things that were asked and determined 5 categories of answers, namely strongly disagree, disagree, enough, agree, and strongly agree. The results of the assessment on the tool:

1. Can automatic switches save energy?

Table 3. Beta Test Result Number One

Categories of answers	Answer	Total Person
Strongly Agreed	4 Person	10 Person
Agree	3 Person	10 Person
Enough	3 Person	10 Person
Disagree	0 Person	10 Person
Strongly Disagree	0 Person	10 Person

From the results of beta testing on tool number two, it can be concluded that 4 out of 10 people strongly agree, 3 out of 10 people agree, and 3 other people are quite good.

1. Is the automatic light switch easy to use?

Table 4. Beta test result number two

Categories of answers	Answer	Total Person
Strongly Agreed	7 Person	10
Agree	3 Person	10 Person
Enough	0 Person	10 Person
Disagree	0 Person	10 Person
Strongly Disagree	0 Person	10 Person

From the results of beta testing on the tool for number two, it can be concluded that 7 out of 10 people strongly agree, and 3 out of 10 people agree.

2. Does the tool function according to the specified time?

Table 5. Beta test result number three

Categories of answers	Answer	
Strongly Agreed	7 Person	10 Person
Agree	3 Person	10 Person
Enough	0 Person	10 Person
Disagree	0 Person	10 Person
Strongly Disagree	0 Person	10 Person

From the results of beta testing on the tool for number three, it can be concluded that 7 out of 10 people strongly agree, and 3 out of 10 people agree.

3. Is the automatic switch function more efficient than the general switch function?

Table 6. Beta test result number four

Categories of answers	Answer	Total Person
Strongly Agreed	9 Person	10 Person
Agree	1 Person	10 Person
Enough	0 Person	10 Person
Disagree	0 Person	10 Person
Strongly Disagree	0 Person	10 Person

From the results of beta testing on the tool for number four, it can be concluded that 9 out of 10 people strongly agree, and 1 out of 10 people agree.

4. Can automatic switches help with daily life?

Table 7. Beta testing result number five

Categories of answers	Answer	Total Person
Strongly Agreed	7 Person	10 Person
Agree	3 Person	10 Person
Enough	0 Person	10 Person
Disagree	0 Person	10 Person
Strongly Disagree	0 Person	10 Person

From the results of beta testing on the tool for number five, it can be concluded that 7 out of 10 people strongly agree, and 3 out of 10 people agree.

5. Is the automatic switch function more effective than the general switch function?

Table 8. Beta testing result number six

Categories of answers	Answer	Total Person
Strongly Agreed	7 Person	10 Person
Agree	3 Person	10 Person
Enough	0 Person	10 Person
Disagree	0 Person	10 Person
Strongly Disagree	0 Person	10 Person

From the results of beta testing on the tool for number five, it can be concluded that 7 out of 10 people strongly agree, and 3 out of 10 people agree.

6. Can automatic switches be applied to all electrical equipment that requires switches?

Table 9. Beta testing result number six

Categories of answers	Answer	Total Person
Strongly Agreed	7 Person	10 Person
Agree	3 Person	10 Person
Enough	0 Person	10 Person
Disagree	0 Person	10 Person
Strongly Disagree	0 Person	10 Person

From the results of beta testing on the tool for number five, it can be concluded that 7 out of 10 people strongly agree, and 3 out of 10 people agree.

Data Collection

In this data collection, 5 loads are added where the loads are.

Table 10. Datta Collection

Loads	Time	status
Light	6 hours	On
Fan		On
Laptop Charger		On
Charger Hp		On
Ironware		On

Data obtained by adding 5 loads at once with 2 loads of lamps each 5 watts, 35 watt fan, laptop charger with 65 watts of power, Hp charger with 7 watts of power, and a 350 watt iron.

With this if all loads operate the power obtained is 467 watts.

And in the simulation data collection using an automatic switch design which is turned on at 17.00 -23.00 which means that the total electrical device is on 7 hours out of 24 hours.

After the test is carried out, the following data can be presented.

Table 11. data collection using automatic switch design

Hour	Voltage	Power	Description
06.00-16.00	0	0	Off
17.00	220	467	On
18.00	220	467	On
19.00	220	467	On
20.00	220	467	On
21.00	220	467	On
22.00	220	467	On
23.00	220	467	On
00.00	0	0	Off
01.00	0	0	Off
02.00	0	0	Off
03.00	0	0	Off
04.00	0	0	Off
05.00	0	0	Off

To find out the results of power usage per hour, it needs to be calculated using the international unit formula, namely:

$$W = \frac{P}{1000} \times t$$

$$W = \frac{467}{1000} \times 1 \text{ jam}$$

W =0,467KWh

Based on the previous calculation, the result is multiplied by the use of electrical energy, which is for 7 hours per day.

W/day = 0,467 × 7h

W/day = 3,629KWh/day

Based on the previous calculation, the result is multiplied by the use of electrical energy, which is for 7 hours per day.

W/ day = 3,269 × 30

W/month = 98,07KWh/month

And to convert monthly power usage into rupiah is the result of monthly power multiplied by Rp1,444.70 per KWh.

R1= 1300watt

1300watt= Rp1.444,70 × 98,07KWh

1 month = Rp.142.000,00/month

So by using the automatic switch design, the power generated per month is 98.07KWh and Rp.142,000.00/month.

Table 12. Automatic switchless design

Time	Voltage(w)	Power (v)	Description
00.00 – 23.59	220	467	On

To find out the hourly power consumption without using an automatic switch with international units, namely:

$$W = \frac{P}{1000} \times t$$

$$W = \frac{467}{1000} \times 1hour$$

W=0,467KWh

Based on the previous calculation, the result is multiplied by the use of electrical energy, namely for 24 hours per day.

W/day= 0,467 × 24h

W/day=11,208KWh/day

To find out the monthly power usage, the results of the calculation per day are multiplied by the use of electrical energy for 30 days.

W/day = 11,208 × 30

W/month = 336,24KWh/ month

And to convert monthly power usage into rupiah is the result of monthly power multiplied by Rp1,444.70 per KWh.

R1 = 1300watt

1300watt= Rp1.444,70 × 336,24KWh

1month = Rp.486.000,00/ month

Without using the automatic switch design, the power generated per month is 336.24KWh and Rp.486,000.00/month.

From the testing and data generated, a comparison is made between the automatic switch design and conventional switches in general.

Table 13. switch comparison

Switch type	Voltage (v)	Power (w)	Electric energy(KWh)	Rupiah (Rp)
Automatic switch	220	467	98,07	142.000,00
Conventional switch	220	467	336,24	486.000,00

From the results of this comparison it can be concluded that when using an automatic switch the electrical device is on for 6 hours, the energy used is only 98.07KWh and per month only Rp.142,000.00 and using a conventional switch the electrical device is used for 24 hours the energy used is 336.24KWh and per month Rp.486,000.00.

With this it can be concluded that the design of an automatic switch with a specified time is more energy efficient than conventional electrical switches in general.

CONCLUSION

Conclusions are drawn from the research results and test results in accordance with what is expected:

1. The automatic time switch with the IOT-based specified time runs very well on and off.
2. With this automatic switch can control the use of excess power
3. This automatic time switch can be used easily as a substitute for switches in general.

The author adds suggestions that can be used as innovations for future development, preferably using LCD to provide notifications to users.

BIBLIOGRAPHY

ADISENA, A.D., 2021. Rancang bangun sistem pengontrolan Lampu Berbasis IOT. Jurnal Online Mahasiswa (JOM) Bidang Teknik Elektro, 1(1).

Desy santi, dan Dwi astutik. 2017. Rancang bangun Lampu otomatis dengan sensor *passive infra red* (PIR) berbasis Raspbery. Jurnal Elektronik Sistem Informasi dan Komputer 3(2):48-58

Hasanat, R. T., Rahman, M. A., Mansoor, N., Mohammed, N., Rahman, M. S., & Rasheduzzaman, M. 2020. *An IoT based real-time data-centric monitoring system for vaccine cold chain*. In *2020 IEEE East-West Design & Test Symposium (EWDTS)*. pp. 1-5. IEEE

Ihsanto, E. dan Rifky, M.F., 2015. Rancang bangun kendali gordeng dengan saklar lampu otomatis berbasis smartphone Android. *Jurnal Teknologi Elektro*, *6*(1), p.143329.

Hendrawati, T.D. dan Lesmana, I., 2016. Rancang bangun saklar lampu otomatis dan monitoring suhu rumah menggunakan VB. Net dan Arduino. *J. Teknologi dan Rekayasa*, *1*(1), pp.67-72.

Iqbar, M.Y. dan Riyanti, K.P.K., 2020. Rancang bangun lampu portable otomatis menggunakan RTC berbasis arduino. *Antivirus: Jurnal Ilmiah Teknik Informatika*, *14*(1), pp.61-72.

Noviansyah, Y. dan Abdulrahman, E., 2022. Rancang bangun Inkubator Penetas telur otomatis menggunakan sensor suhu berbasis mikrokontroler berbasis wemos D1 ESP8266. *Jurnal Teknik Elektro Raflesia*, *2*(1), pp.21-29.

Rahman, A. dan Salim, A.N., 2022. Sistem Kendali pH dan Kekeruhan Air pada Aquascape menggunakan Wemos D1 Mini Esp8266 berbasis IoT. Jurnal Teknologi Terpadu, *8*(1), pp.22-30.

Saleh, M. dan Haryanti, M., 2017. Rancang bangun sistem keamanan rumah menggunakan relay. *Jurnal Teknologi Elektro*, *8*(2), pp.87-94.

Setiawan, A., Ramdhani, M. dan Ilhamsyah, I., 2015. Rancang Bangun Produk Pemutus Saklar Timer Otomatis berbasis mikrokontroler. *eProceedings of Applied Science*, *1*(3).

Sibagariang, M.O., 2020. Rancang Bangun Lampu Otomatis Berdasarkan Kebutuhan Manusia Dengan Sensor Secara IOT.

Siswanto, V. dan Edidas, E., 2021. Prototype Station Informasi Cuaca Berbasis IOT Wemos di ESP8266. *Voteteknika (Vocational Teknik Elektronika dan Informatika)*, *9*(2), pp.71-77.

Septiawan, F.D. dan Sudarmilah, E., 2019. Rancang Bangun Otomasi Penguncian Pintu Rumah dan Saklar Lampu dengan Android Berbasis Arduino Uno. Ainet: Jurnal Informatika, *1*(2), pp.59-67.