PROTOTYPE OF FAULT DETECTION AND LEAKAGE CURRENT MONITORING ON FL2XCY CABLE BASED ON INTERNET OF THINGS

FARID PERDANA PUTERA SISWANTO*, KUSTORI, DWIYANTO

Politeknik Penerbangan Surabaya, Jemur Andayani I/73 Wonocolo Surabaya, Jawa Timur, Indonesia, 60236
**Corresponding Author. Email: farid.perdana.putera@gmail.com*

ABSTRACT
Airfield lighting system (ALS) is a visual landing aid that serves to assist and serve aircraft that take off, land and taxi in order to move efficiently and safely. This facility consists of special lights, which provide visual cues and information to pilots, especially when pilots are about to land or take off. The occurrence of interference with the airport lighting system caused by damage to the FL2XCY cable causes the pilot's vision to be less efficient when landing, takeoff and movement on the air side which can later endanger the flight. Therefore, a tool is needed that can detect the location of the disturbance and monitor the current on the cable by using the internet of things (IoT) as a device that transmits output data from sensor readings to the website. In this research, a prototype design will be made that can detect the location of the disturbance and monitor the current on the cable so that it makes it easier to find where the problem and disturbance are located on the cable because the FL2XCY cable is in the ground.

Keywords: *Airfield lighting system, FL2XCY cable, internet of things, prototype, current*

1. INTRODUCTION

Every airport is inseparable from visual aids or airfield lighting system (ALS). The airfield lighting system is one of the aviation safety standards that must be in place at all airports. This visual landing aid installation includes signal lights that provide visual information to pilots, especially during pilot landing, takeoff and movement on the air side. In general, when landing or takingoff, pilots rely more on visuals outside the aircraft rather than using the instrument landing system located in the cockpit of the aircraft.

A ground cable is one or more insulated, mechanically protected and externally sheathed conductor sections whose use is buried in the ground. Therefore, cable components must be able to operate continuously because they have special insulation requirements to protect them from all forms of moisture and other influences in the soil. Installation of cables in the ground can be done by direct planting or through protective channels. Installation with direct planting, namely by laying the cable directly without using a protective sheath (duct or pipe).

The internal factor that affects cable line damage is the age factor which along with the age of the cable can affect the quality of the cable, meaning that the older the age of the cable the more the quality of the cable used decreases. With the age of the cable, it will reduce the quality of the pvc sheath, the pvc sheath will shrink and cause air and water to enter, if water has entered the pvc sheath on the cable, over time the water will enter the outer semi- conductor to become a link between the core cable and the ground which causes heat so that it can cause back contact. After back contact occurs, over time it causes the XLPE insulation to melt causing the cable insulation resistance to decrease, so that it will cause an open circuit on the cable.

External factors that affect cable line damage are weather conditions and soil contours. Caused by weather conditions due to rain / heat causing the soil to become damp. If there is moisture in the soil, it will damage the cable insulation resistance, causing a decrease in insulation resistance. While the contours of the land are

caused by heavy equipment for example a lawn mower tractor that weighs 4382 kg, as a result of the activities of the lawn mower tractor over time the soil will decrease. So that it will cause a shift in the position of the cable and decrease the cable insulation resistance which can cause an open circuit.

In the FL2XCY cable installation on the runway the circuit used is a series circuit, to find the point of damage by mapping or engineering starting from MPH to engineering in the field by dividing the two parts of the circuit, namely the right and left. Then the transformer is jumped with the FL2XCY cable that has been provided with a length of approximately 120 m and connected from point to point. Checking is done by unplugging the transformer primary line output and then connecting it to the FL2XCY cable whose end is also connected to the transformer primary line output. The mapping process from MPH to point to point to identify the location of the fault is what takes a long time.

For this reason, a tool is needed that can detect the location of the disturbance and monitor the current on the cable by utilizing internet developments in today's modern era. So that in this case it can make it easier to find where the problems and disturbances are located on the cable because the FL2XCY cable is in the ground. With the above problems, in this study a final project design was made with the title "PROTOTOTIPE DETECTING THE LOCATION OF DISTURBANCE AND MONITORING THE FLOOD ON THE INTERNET OF THINGS-BASED FL2XCY CABLE".

2. METHOD

In the process of designing a prototype of an IoT- based FL2XCY cable fault detection and leakage current monitoring device, it refers to the research and development method. The research and development method is a research method for creating products by perfecting products according to the references and criteria of the products being produced, in order to create new products through various different stages and then validation or testing. The research method used includes planning hardware, software and the working system of the tool.

The operation of this internet of things-based FL2XCY cable fault detection and leakage current monitoring prototype equipment using a 5 VDC voltage power supply, will activate the NodeMCU ESP 8266 as a microcontroller and will activate the connected components. The ACS 712 sensor will monitor the current which is then displayed on a 16 x 2 LCD screen. When there is a cable fault, this tool will send a message via telegram and can also monitor the current on the web. If this tool does not send notifications and data to the telegram or web, this tool will also continue to display the location of the cable fault on the LCD screen so that it can still be monitored.

3. RESULT

This tool will be able to work by displaying the amount of current and when there is a disturbance in the cable it will be able to provide notification where the location of the disturbance occurs. Making it easier to find out the disturbance on the cable. If this tool does not send notifications and data to telegrams or the web, this tool will also continue to display the location of the cable fault on the LCD screen sothat it can still be monitored.

This tool uses NodeMCU ESP 8266 as a microcontroller. The hardware used includes NodeMCU ESP 8266, ACS 712 sensor, buzzer, LCD, buck converter. And also using Arduino IDE software, telegram and web.

The following will explain the data from the test results using measuring instruments and using visuals on several components as well as testing the system that has been integrated as a whole related to what is mentioned above and the discussion of the test results.

2.1. Power Supply Testing

The power supply used is a power supply that has an output voltage of 12 volts DC, which gets a voltage input from PLN of 220 volts AC. Testing the power supply is done to ensure that the voltage issued is in accordance with the required voltage. In this test using a multimeter as a voltage meter.

Table 1 Power Supply Testing

Percobaan	Tegangan Input	Tegangan Output	Keterangan
1	231 VAC	11.97 VDC	Normal
2	230 VAC	11.96 VDC	Normal
3	231 VAC	11.97 VDC	Normal

After testing in the form of measurements on the input and output voltage of the power supply using a multimeter in accordance with the data table above, it can be seen that the power supply can work properly as a voltage reducer and converter from 220 VAC to 12 VAC.

2.2. DC to DC Converter Testing

In testing the DC to DC Converter component which is useful as a voltage reducer from a 12 VDC power supply to 5 VDC, this test is carried out to determine whether the component can work optimally. This test measures the voltage using a multimeter.

Table 2 DC to DC Converter Testing

Percobaan	Tegangan input	Tegangan output	Keterangan
1	11.97 VDC	5 VDC	Normal
2	11.96 VDC	5 VDC	Normal
3	11.97 VDC	5 VDC	Normal

From the component testing above, it can be seen that the DC To DC Converter can work well in reducing the voltage coming from the power supply from 12 VDC to 5 VDC. This shows that this component works well and is suitable.

2.3. NodeMCU ESP 8266 Testing

In this test, we will test the microcontroller whether the port of the microcontroller is functioning properly or not, where this component functions as a controller in this tool.

In the picture below the power source enters VCC and Ground on the NodeMCU ESP 8266 pin which is indicated by the voltage read on the multimeter of 4.9 VDC. So that the arduino works well.

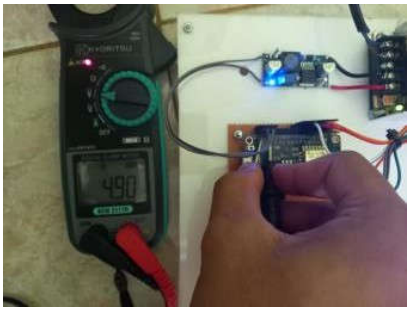

Figure 1 NodeMCU ESP 8266 Testing

2.4. ACS 712 Sensor Testing

The ACS712 sensor is the sensor used to measure DC current in this tool. This sensor module is a module capable of measuring currents up to 5 amperes. Testing the ACS712 sensor is by comparing the current read by the sensor with the results measured by a multimeter.

Table 3 Pengujian Sensor ACS 712

Percobaan	Data Arus (A)		Keterangan
	ACS 712	Multimeter	
1	7,3 A	0 A	Ketika mengalami gangguan
2	7,8 A	1 A	Normal

From the above tests it can be concluded that there is a comparison between the ACS 712 sensor and the multimeter, as evidenced by the readings from the multimeter which differ in value.

2.5. Testing on Arduino IDE Software

In the design of this tool using a microcontroller that is often used, namely NodeMCU ESP 8266, so that in making this tool program requires an application to perform a command in accordance with the work system that has been set up using the Arduino IDE. The program that has been made is compiled in the Arduino IDE software. Then the program is downloaded into the microcontroller.

Testing is done by looking at the function of each port. Testing is needed because it greatly affects all existing components, both electronic, mechanical, and software components on the computer. If the settings that have been determined are not appropriate, then the microcontroller and other devices are not synchronized. This test is also carried out to ensure that the coding used does not experience errors.

After testing, the results show that the application has run well because the script program in Aduino IDE has successfully entered the NodeMCU ESP 8266 board without error, and the program is able to manage the NodeMCU ESP 8266 work properly.

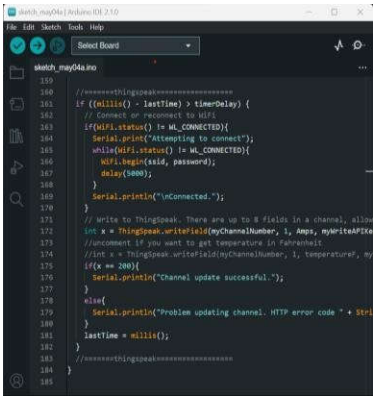

Figure 2 Testing on Arduino IDE Software

2.6. Testing on the Web Display

On the website display contains readings from the current sensor. If the device has been run and connected to a wifi signal, the current value read will be sent and displayed in the form of a graph on the website. The graph shows the presence of current when there is no interference, while the graph below shows the absence of current when there is interference. So that it can facilitate the monitoring process remotely.

Figure 3 Testing on the Web Display

2.7. Testing on Telegram

Testing on the telegram aims to find out that when there is a disturbance in the device it will send a notification to the telegram. This test is done by giving a simulation of interference and seeing whether the tool will send a notification or not. From these tests it can be concluded that the telegram application can provide notification notifications and run well.

Figure 4 Testing on Telegram

4. CONCLUSION

Based on the prototype produced, this tool is designed to simplify and save time in field repair management. The design of this tool uses Website and Telegram on smartphones and laptops, which sends data from NodeMCU to Website and Telegram which requires internet. The components in this tool work well by displaying the fault position and current sensor readings on the LCD. The application of this tool is intended in airports that do not have current leak detection equipment.

REFERENCES

[1] Abrianto, H. H., Sari, K., & Irmayani, I. (2021). Sistem Monitoring Dan Pengendalian Data Suhu Ruang Navigasi Jarak Jauh Menggunakan WEMOS D1 Mini. *Jurnal Nasional Komputasi dan Teknologi Informasi, 4*(1), 38-49.

[2] Agusalim, F. (2018). Pengertian Taxiway, Konfigurasi Taxiway, dan Perkembangan Taxiway. Ilmu Komputer Vol 1 (hal. 1251-1259).

[3] Indah, A., Hulukati, S. A., & Malago, Y. (2022). Rancang Bangun Sistem Monitoring Arus Bocor Isolator. *Electrician: Jurnal Rekayasa dan Teknologi Elektro, 16*(1), 110-115

[4] Kholil, M. (2021). Simulasi Rancang Bangun Smart Home Menggunakan Wemos D1 R2 ESP8266 Berbasis Internet Of Things. *Journal of Computer Science and Visual Communication Design, 6*(1), 1-9.

[5] Ma'ruf, A., Purnama, R., & Susilo, K. E. (2021). Rancang bangun alat monitoring tegangan, arus, daya, dan faktor daya berbasis iot. Jurnal SISKOM-KB *(Sistem Komputer dan Kecerdasan Buatan), 5*(1), 81-86.

[6] Wahyudi, W. P., Hidayat, A., & Fakhri, M. M. (2022). Penerapan Machine Learning Pada Mikrokontroler Arduino Mega PRO MINI ATmega2560- 16AU.