Analysis of JTR Voltage Drop Improvement Using Simulation-Based Insert Transformer and Cable Uprating Method

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Abstract

The electrical system in Kenari Hamlet is supplied by the PR 072 distribution transformer through PU.08 feeders. The PR 072 transformer is located on Jalan Melati, Desa Melati II with a capacity of 160 kVA which is used to supply electricity to the Dusun Nangka area. Based on the results of the measurements that have been made, it is found that the low voltage value in the Dusun Nangka area is 170 volts against the one-phase source voltage to neutral (226 V) and occurs during peak loads or in other words the voltage drop. According to SPLN 1: 1995, the service line voltage tolerance (SP) is + 5% of the standard low voltage stress at the base side and -10% at the end side. At 19.00 when there is a peak load, consumers cannot make electronic devices such as water pumps, refrigerators, air conditioners and others. With such conditions, it is necessary to simulate ETAP 12.6.0 to make improvements, namely the construction of an in-line transformer and uprating the HUTR 3x35mm2 + 1x25mm2 to 3x70mm2 + 1x50mm2 in that area. For this reason, several assumptions are made, namely direct measurement calculations and simulations so that the low voltage value in the area is 219 Volts.

Keywords: *Voltage Drop, Etap 12.6.0, Network Repair*

Introduction

Flood is a natural disaster that occurs when excessive water flows submerge land. Flooding is caused by the volume of water in a body of water such as a river or lake that overflows or overflows from a dam so that water comes out of the river[1]. To minimize the impact of this disaster, an early warning system is needed that is able to provide information quickly and accurately to the community before floods occur[2]. One of the solutions that can be applied is a water level detection tool that works automatically, by utilizing renewable energy, namely solar energy. Solar energy is an unlimited source of energy and will never run out of availability and this energy can also be used as an alternative energy that will be converted into electrical energy, using solar cells [3]. Flood detection or warning systems can be done by detecting water levels, which can be done using Doppler radar, but this requires complex hardware design and considerable cost[4]. By using solar energy, this tool can work independently without dependence on conventional power grids, making it very suitable for use in flood-prone areas. As an early warning system, the tool is equipped with LED indicators and buzzers. The LED indicator functions to provide direct visualization of the water level level, while the buzzer acts as a water warning alarm when it reaches a dangerous level. This combination is expected to be able to provide quick information so that preventive measures can be taken early.

Research Methodology

The research method carried out in this study is experimental research, because it designs the tool and tests it directly. The tool is made in the form of a prototype. For the stages, namely a literature study, collecting data and information from books and journals related to solar panel-based water level detection devices. Designing tools, namely creating flowcharts and circuit diagrams and determining the components to be used. Assembly and installation, i.e. assemble all components. Tool testing, which is to find out if the tool is working properly and normally. Data collection and processing, which is the process of collecting data during the series trial.

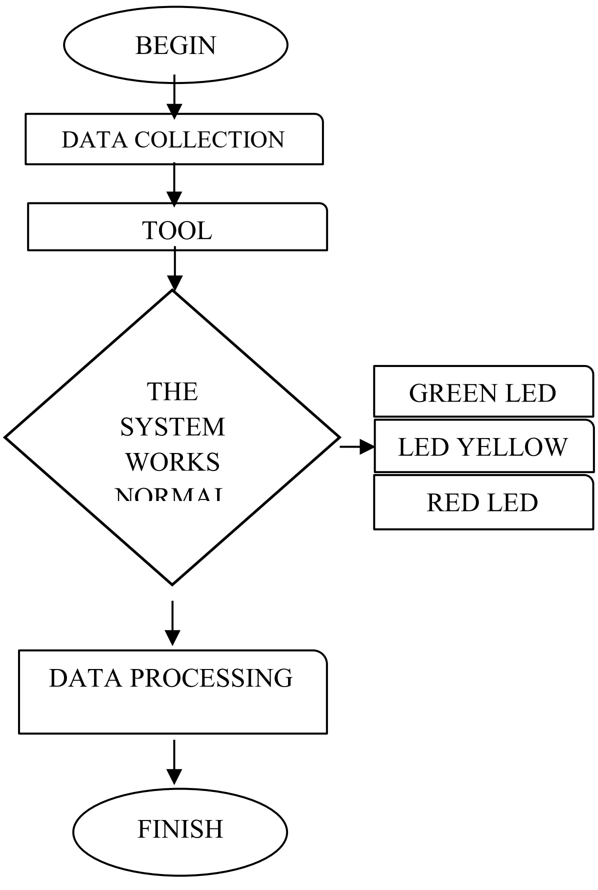

Figure 1. Flowchart Diagram

After the flowchart is completed, the next step is to create a series diagram.

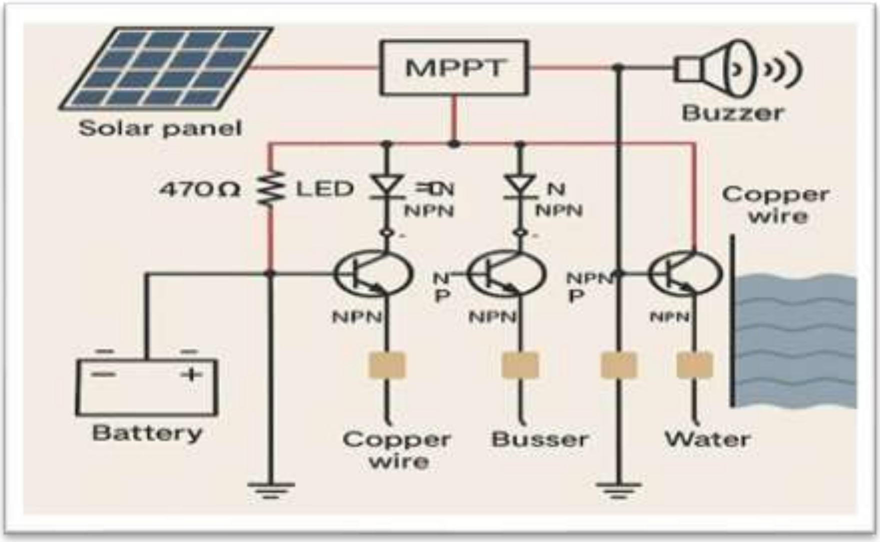

Figure 2. Network Schema

In the process of making this water level detection tool, of course, tools and materials are needed in accordance with what is needed. After making the design and series, the next stage is to design a water level detection device with the tools and materials that have been provided. Here are the tools and materials

Table 1. Tool List

TOOL	SUM
Solder	1
Scissors	1
Tin	1

Table 2. List of Materials

MATERIAL	SUM
Talent hose	1
Tin	1
PCB Board	1
Cable battery	1
Yellow yellow red green LED light	1
Buzzer	1
Transistor	1
Resistor	1
Suyra Panel	1
Battery	1

Results And Discussion

Before we get into the results and discussion, let's discuss this tool first. So the prototype of this detection device was made as an early warning of water level. To design this tool is quite easy and practical. The main point is the use of solar panels as the main source of the network. When the solar panel receives sunlight, it will go directly into the Solar Charge Chontroller first, which serves as a current connection to the battery to keep it safe. Then the positive side of the battery is connected to the positive LED. While the negative side of the battery is first connected to a 560ohm resistor, then connected to the foot of the npn base transistor colector, made as a connector to turn on the LED lights and buzzers with different levels as seen in figure

Figure 3. Prototype of Water Level Detection Device

For how the prototype of this water level detection device works, namely,

1. When the water rises and touches the foot of the highest emitter base,
2. then it will turn on the green LED light which means the water level is still safe
3. When the water rises and touches the feet of the medium-sized emitter base, it will turn on a yellow LED light which means that the water level is already alert
4. When the water rises and touches the shortest foot of the emitter base, it will turn on the red LED light and the buzzer will sound automatically which means that the water level is in danger.

4.1 Testing Process 1

After the assembly process is complete, the next stage is the testing process. This testing process is carried out to find out if the prototype of this detection tool can work properly. For the test, I immediately did it indoors, without having to use sunlight, because the components here already use batteries

Figure 4. Water Level Detection Device Prototype Testing Process

From the results of the tests that have been carried out as shown in figure 4. , data obtained

Table 3. Tool Test Results Data

WATER LEVEL	EMITTER WIRE LEGS	LED ILLUMINATED	BUZZER
LOW	LEVEL 1 AND (+)	GREEN	DIE
MIDLE	LEVEL 2 AND (+)	YELLOW	DIE
HIGHT	LEVEL 3 AND (+)	RED	LIVE

After the data from the test results of the tool has been obtained, it can be explained that:

1. When the water level is low, then the light that will be on is a green LED, and the buzzer does not sound
2. When the water level is midle, then the green and yellow LED lights are on, the buzzer is silent
3. When the water level is hight, then the green, yellow and red LED lights will come on, and the buzzer will sound

4.2 Testing Process 2

In this 2nd test process, we will calculate the battery charging system and test the current usage of this set of water level detection devices, whether it works normally or not. In the next process, here we will do a test on the solar panel. This research was conducted at home for 6 hours, from 10.20 to 15.20. Here are the results of the input test of the solar panel.

Table 4. Solar Panel Testing

HOUR	VOLTAGE(V)	ARUS(A)	POWER(W)	WEATHER
10:20-11:20	12.2	0.10	1.2	BRIGHT
11:20-12:20	12.2	0.11	1.34	BRIGHT
12:20-13:20	12.2	0.12	1.46	BRIGHT
13:20-14:20	12.2	0.11	1.34	BRIGHT
14:20-15:20	12.2	0.12	1.46	BRIGHT
15:20-16.20	12.2	0.10	1.2	BRIGHT

From the table of test results on the solar panel, we can see that there is no significant increase in voltage, the highest current is obtained at 12:20 and 14:20, which is 0.12 A. Battery charging trial here uses a 12 v 1.5 w solar panel. Because it uses SCC, the lowest current usage is 10.6 v, the new solar panel will recharge to the battery, while the highest voltage is 13.7 v where the solar panel will stop supplying current when it reaches that figure.

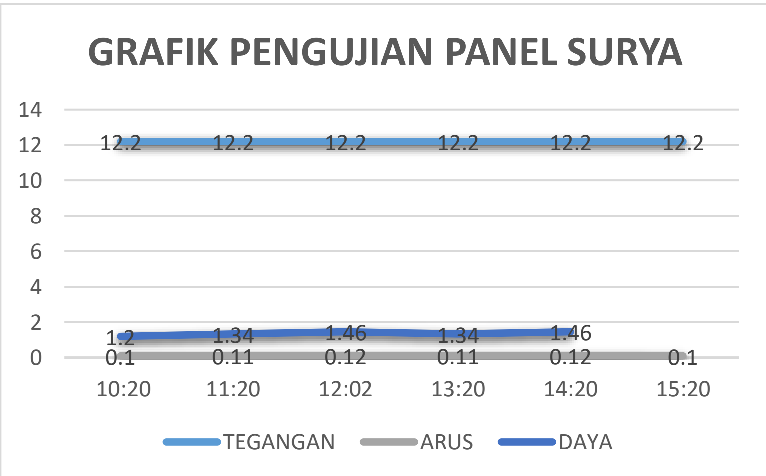

Figure 5. Solar Panel Testing Chart

Next is testing for the battery, how long it can turn on the LED lights and buzzers in a row. And here are the results of the battery test, which can be seen in table 5.

Table 5. Trial time 1 Battery

TIME	BATTERY
18:30 - 19:30	12.4 – 12.3 V
19:30 - 20:30	12.3 – 12.3 V
20:30 - 21:30	12.3 – 12.3 V
21:30 - 22:30	12.3 – 12. 2 V
22:30 - 23:30	12.0 – 12.2 V
23:30 - 00:30	12.2 – 12.2 V

In the first trial, it was carried out for 6 hours, with the LED light and buzzer working simultaneously. It can be seen in table 5, from the initial voltage of 12.4 volts and ending at 12.2 volts.in the first 6 hours of testing, only 0.2 volts were reduced

Table 6. Trial time of 2 Batteries

TIME	BATTERY
09:00 - 10:00	12.2 – 12.2 V
10:00 - 11:00	12.2 – 12.1 V
11:00 - 12:00	12.1 – 12.1 V
12:00 - 13:00	12.1 – 12.0 V
13:00 - 14:00	12.0 – 12.0 V
14:00 - 15:00	12.0 – 11.5 V
15:00 - 16:00	11.5 – 10.0 V
16:00 - 17:00	10.0 – 10.0 V
17:00 - 18:00	10.0 – 10.0 V

In the second battery test, it was carried out for 9 hours, with the LED light and buzzer working simultaneously. It can be seen in table 6, from the initial voltage of the battery to 12.2 volts and ending at 10.0 volts. On the second 9-hour test of the battery, the battery voltage was reduced by 2.2 volts

Table 7. Battery Trial Time

TIME	BATTERY
09:00 – 10:00	10.0 – 10.0 V
10:00 – 11:00	10.00 – 9.9 V
11:00 – 12:00	9.9 – 9.9 V
12:00 – 13:00	9.9 – 9.9 V
13:00 – 14:00	9.9 – 9.9 V
14:00 – 15:00	9.9 – 9.8 V
15:00 – 16:00	9.8 – 9.8 V
16:00 – 17:00	9.8 – 9.8 V

In the second battery test, it was carried out for 8 hours, with the LED light and buzzer working simultaneously. It can be seen in table 7, from the initial voltage of the battery to10.0 volts and ending at 9.8 volts. On the second 9-hour test of the battery, the battery voltage was reduced by 0.2 volts

Conclusion

After testing the battery, it can be concluded that the battery can turn on the LED light and buzzer at the same time for 23 hours.

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