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DESAIN POWER MONITORING SYSTEM USING WIRELESS TECHNOLOGY

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ABSTRACT

Energy is one of the most interesting topics from various aspects. The issue of energy saving is one of the most interesting researched topics. Energy management is one way to save energy. In energy management, it is necessary to monitor the power of electrical equipment to find out when and where electrical energy is being spent. Power monitoring system is designed to monitor electrical parameters such as power, current, and voltage of several household appliances. Electrical parameters on household appliances could be detected by using them. electrical parameters on household appliances and a Bylink application that can connect sensor data with android applications. By using aplication, user could monitor electrical parameters can make it easier for users to monitor electrical parameters. This prototype system, has been made, has tested and compared with the electrical parameters that exist in the specifications of household appliances. The error that occurs in this tool is 0.80% for the voltage parameter and 1.49% for the current parameter.

Keywords: NodeMCU, monitoring, current, and voltage

1. Introduction

Automation and digitization are two things that many people echo. Both are considered very interesting because both are the spearheads of industry 4.0. Where human work will be more efficient because there is assistance from artificial intelligence technology.

Energy is one issue that has attracted a lot of attention. Both in terms of energy generation and in terms of energy savings. The issue of energy saving has been extensively researched. ViridiScope can easily monitor the power consumption of equipment with multiple equipment active simultaneously as well as power consumption. ViridiScope is a step towards an energy efficient home, because measurement is one of the most important components[1]. Users can manage electric household appliances and monitor the power consumption status of electric household appliances remotely by using a remote Web browser. Remote Web browser with GUI allows users to easily control/monitor the power status of home appliances[2]. Microcontrollers are used to build household electricity utility metering and monitoring to effectively track real time power consumption[3]. A low-cost, flexible and real-time smart power management system that is easily integrated with household electrical monitoring systems using the Wireless Sensor Network[4]. Whereas in research [5] monitoring of power, temperature, and irradiance in PVcells was made using MCU nodes

In this study, power system monitoring can be done through an application on a cell phone, making it easier for users to monitor power usage. With this method, energy management can be applied.

2. Research Methods

The electrical parameter monitoring system is designed to measure current, voltage and power on household appliances, which are assumed to be electrical equipment on ships. The monitoring system is composed of several elements as shown Figure 1.

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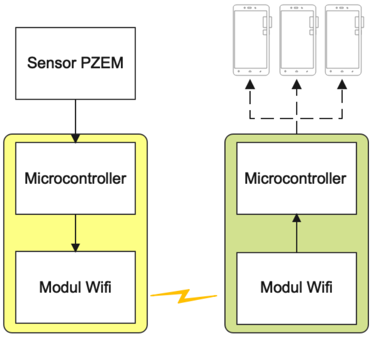


Figure 1. Power monitoring prototype block diagram

The sensor is connected to the CT split core and load/electrical equipment. The input data is obtained by the PZEM-004T sensor, which is in the form of current data, voltage data. The data will be processed by the MCU node and then sent by the ESP 3866 module.

While on the receiving side, the ESP module will receive data from the transmitter. The data is processed by the microcontroller. The output from the microcontroller is in the form of voltage and current data displayed in the application. The data will be displayed in the Bylink application. As for power data obtained from the results of mathematical operations between voltages and currents.

$$P=I\times V \quad (1)$$

Theoretically, power is obtained by multiplying the voltage and current. Based on this theory, the power value for each load is obtained.

Users can monitor electrical parameters, so users can control energy use. From the monitoring results, users can calculate electricity bills so that electricity savings can be made at certain times.

3. Results and Discussion

The prototype tool can be seen in the picture. In testing the prototype amonitoring day, it was tested on several household appliances, namely fans, electric shocks, lights, hand drills and speakers. Data measurement results can be seen in the table. Voltage and current testing is carried out using an amperage meter and a power monitoring prototype. This measurement aims to test the validation of the prototype. Based on the test results, the average difference in test values was 0.80% for voltage measurements and 1.49% for current measurements.

Table 1. Result

Tools	Voltage (V)			Current (A)		
	ref	meas	error	ref	meas	error
Iron	227	228	0,44 %	1,61	1,57	2,48 %
Electric fan	233	235	0,86 %	0,2	0,2	0,00 %
Drill machine	236	236	0,00 %	0,28	0,29	3,57 %
speaker	238	235	1,26 %	0,07	0,07	0,00 %
lamp	232	236	1,72 %	0,04	0,04	0,00 %
Iron + lamp	229	226	1,31 %	1,71	1,68	1,75 %
Electric fan 2	220	220	0,00 %	0,38	0,37	2,63 %

Table 2. Power calculation

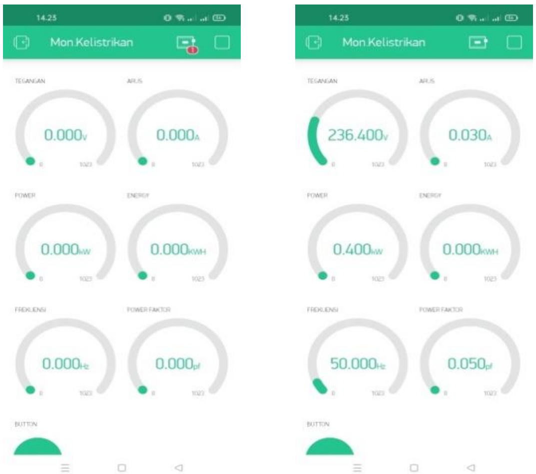
Tools	Voltage (V)	Current (A)	Power (VA)
Iron	228	1,57	357,96
Electric fan	235	0,2	47
bor tangan	236	0,29	68,44
speker	235	0,07	16,45
lamp	236	0,04	9,44
Iron + lamp	226	1,68	379,68
Electric fan 2	220	0,37	81,4

Based on the calculation results, the power value for each electrical equipment is obtained. This value is the required power. To change the power value to the kWh value, this value must be multiplied by the duration of use in hours and then divided by 1000. In table 3, the conversion value data is presented in kWh form assuming the use of each tool is 3 hours.

Table 3. Simulation of calculating kWh per 3 hours of use

Tools	Power (VA)	kWh (3 hours)
Iron	357,96	1,07388
Electric fan	47	0,141
bor tangan	68,44	0,20532
speker	16,45	0,04935
lamp	9,44	0,02832
Iron + lamp	379,68	1,13904
Electric fan 2	81,4	0,2442

While in application testing, display testing and connectivity testing are carried out based on distance. In Figure 2, you can see the difference when the application is not connected to the internet and is already connected to the internet. In the initial conditions, all parameters have a value of 0, but when the application is connected to the internet, the voltage and current indicators show an increase in value according to the value of the voltage and current at the load.



(a) (b)

Figure 2. (a) the display of the application when it is not connected; (b) App display when connected

The second test was carried out to determine the connectivity status of the application based on distance. Tests were carried out up to a distance of 20 Km with 2 Km intervals. The test results are shown in table 4. Up to a distance of 20 Km the application can monitor current and voltage values, but with the condition that both devices are connected to the internet. This makes it easier for users to monitor load power.

Table 4. Connectivity testing of applications with monitoring devices

Distance (KM)	Status
2	Connect
4	Connect
6	Connect
8	Connect
10	Connect
12	Connect
14	Connect
16	Connect
18	Connect
20	Connect

4. Conclusion

The prototype power monitoring tool can monitor current and voltage in real time, provided that there is an internet network on the user's side as well as a monitoring prototype. This prototype can measure the voltage and current at the load with an error rate of 0.8% and 1.49%.
In the future, this prototype can be developed by adding leakage current, temperature, and power factor sensors and a controller can be added to turn off / on the device remotely.

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