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Design Tools to Audit Electricity

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A B S T R A C T

Until now, energy has had a very important role in the life of human civilization. One of the problems that arise in the use of energy is that there is still a lot of use of fossil energy, even though this energy is very limited on Earth. Therefore, the need for efficiency in energy use in all areas of life, including in government, private, and community institutions. But doing so, of course, requires a measuring instrument that is practically inexpensive and highly efficient. The application system is the right answer to solving this problem, so the authors conduct research by making measuring instruments that can record digitally in memory and with the Internet of Things system so that analysis will be faster and more accurate, and by not using cables as data distribution.

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INTRODUCTION

Hospitals are capital-intensive and labour-intensive (resource-intensive) as well as technology-intensive industries. In hospitals, the fundamental element of the service process is human resources. Hospitals offer a variety of goods and services, including externalities (vaccinations), public goods (parking, front desk, cleaning services, housekeeping, laundry), and private goods (doctors' services, pharmacy nursing, nutrition). The aim of the hospital is to produce products, services or health services that really touch the needs and expectations of patients from various aspects, which are related to medicine and the information needed. (Definition of Hospital and Hospital Purpose, S. Supriyanto and Ernawati, 2010).

Installation for Maintenance of Hospital Facilities and Infrastructure (IPSRS), this installation as a support for facility management which carries out its duties as a facility manager consisting of facilities, infrastructure and equipment both medical and non-medical, has main tasks and functions and roles in realizing the vision and mission of the hospital.

IPSRS in the hospital organizational system is a support line so that it has a very important role to support hospital service activities. The services referred to non-medical services, medical equipment, Electrical Systems, Communications and Medical Gas, Water and Steam, Environmental Buildings and Infrastructure, as well as Administration-Logistics and Finance. Service support functions to increase customer satisfaction both internal and external to the hospital.

Electrical energy used in hospitals has a very vital and sustainable function. So, it is necessary to carry out appropriate supervision, maintenance and efficiency so that services are not disrupt-ed, and costs incurred are in accordance with needs. Energy audit is the right step to answer this need.

Hospitals in Indonesia are included in a public service activity that continues to grow. In carrying out its activities, hospitals require a large and sustainable source of energy, the need for which is increasing along with meeting the needs for both diagnostic and therapeutic services. The energy used in the hospital includes electrical energy and fuel energy sources. According to the first law of thermodynamics, energy can neither be created nor destroyed. But energy can be converted from one form of energy into another form of energy (Astu and Djati, 2006).

Higher energy use has an impact on the depletion of fossil energy reserves. The effort that can be done is by conserving energy. Energy conservation is using energy efficiently and rationally without reducing the energy that is really needed (Perpres, 2006). This energy conservation step compared to other steps; the implementation process is considered the easiest with the lowest cost (David, 2015). While the Energy Audit is a process of evaluating energy utilization and identifying energy saving opportunities as well as recommendations for increasing efficiency in the framework of energy conservation (Permen ESDM, 2012). The implementation of an audit depends on the size and type of facility to be examined and the objectives to be achieved (Cor-nelia, 2013).

Utilization of IoT (Internet of Things) technology can be used to monitor the use of electric power at home in real time. The reading of electric power values can use current, voltage, temperature and humidity sensors and grounding which are controlled by a microcontroller. The data obtained by the microcontroller is sent to the database using the internet network to receive and provide information. Monitoring the use of electric power can be done via an Android connected to the internet.

The author will create this tool in order to be able to implement the monitoring tool for the usage of electrical energy. Electronic components that are needed for electrical power monitoring instruments includes the ZMPT101B voltage sensor, the sct-013-0100 current sensor, the LCD 20x4, the ESP8266, the Arduino mega, and the DHT 22. The primary components will consist of a device that can track the consumption of electrical energy by analysing data on current and voltage as well as incoming temperature and humidity to determine the amount of power released. This visible power will be calculated at a cost per kWh so that it can be estimated how much it will cost to use these electronic devices. The creation of this tool is expected to make it easier for electrical energy users to find out how much electrical energy is used from the electronic devices used. So that users of electrical energy can save its use. The purpose of this study is to monitor the use of electrical energy based on the cost of using electronic devices, so that these costs will affect users to save electricity consumption.

LITERATURE REVIEW

Electrical Engineering Monitoring

Several studies related to electrical energy monitoring have been carried out, including monitoring electrical energy using IoT (Ali Hussien et al., 2021; Lasso-Lopez et al., 2020; Mudaliar & Sivakumar, 2020; Sowmya et al., n.d.). Lopez et al, designed a prototype of monitoring electrical energy in the laboratory (Lasso-Lopez et al., 2020). Lopez et al, display the data through an android app and web server to make it easier for users to monitor energy usage. Mudaliar et al, use Raspberry Pi to control and monitor energy in the switch gear industry (Mudaliar & Sivakumar, 2020). Mudaliar et al. display energy monitoring data through the Grafana application. Sowmya et al, monitoring the energy consumption of gadgets at home. Sowmya, uses Ubidots.com to display monitoring results and provide warnings when usage is excessive (Sowmya et al., n.d.). Hussien et al, conducted energy monitoring at Wasit University building. Hussien et al. used ESP32 and a web portal on the monitoring system created (Ali Hussien et al., 2021).

In this research, IoT-based electrical energy monitoring tool is developed using ESP8266 as a microcontroller and blynk application for voltage, current, and ground data display. In addition, information about the estimated cost consumed is also provided.

Conceptual Framework

Figure 1. Conceptual Framework

METHODOLOGY

In applying research on Electrical Parameter Measurement Based on SNI 03-6196-2000 calculating the amount of Energy Consumption Intensity (IKE) of a building can be done by:

a) Details of building area and total building area (m2).
b) Energy consumption of buildings per year (kWh/year).
c) Energy Consumption Intensity (IKE) of buildings per year (kWh/m2.year).
d) Building energy costs (Rp/kWh).

RESULTS AND DISCUSSION

In this section, we will discuss the results of our research about electrical power monitoring tools. The tools will monitor the use of electrical energy and display the amount of power re-leased by processing current data, voltage data, and incoming temperature and humidity. The creation of this tool is expected to make it easier for electrical energy users to find out how much electrical energy is used from the electronic devices used. So, the users of electrical energy can save their use for the design of this electricity monitoring system Figure 1 gives information about the flow diagram of the electricity monitoring system.

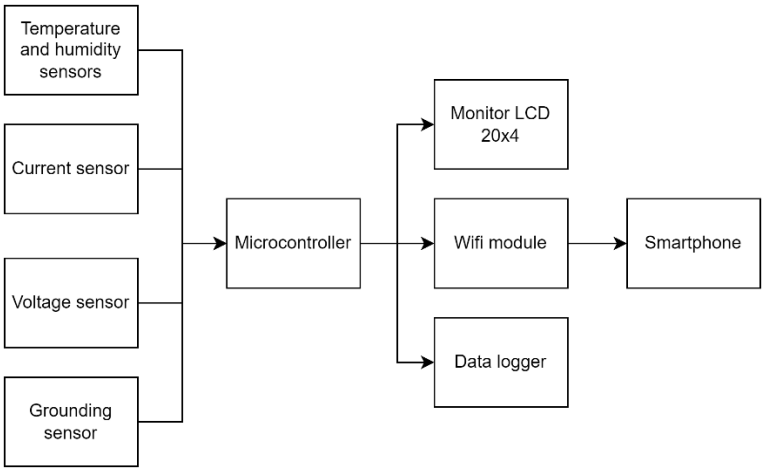

Figure 2. Flow diagram of the electricity monitoring system

The system's work process simplifies determining the system's working procedure in an out-line. The voltage sensor and current sensor collect data from the mounted load to begin this system's operation. The data from the readings is then processed by the Arduino Mega microcontroller. Using a 20x4 LCD, the output of the Arduino Mega microcontroller operation will be dis-

played. Furthermore, using the ESP8266, the outcomes of the Arduino Mega microcontroller operation will be displayed on a server via the internet network. The temperature and humidity sensors will read the condition of the room by displaying temperature data around the electricity monitoring room. After the system works, the data will be stored using the data logger module as storage 1 and will be sent to the blnyk server. The monitored data will be real according to the time and date of the month because the RTC module is used.

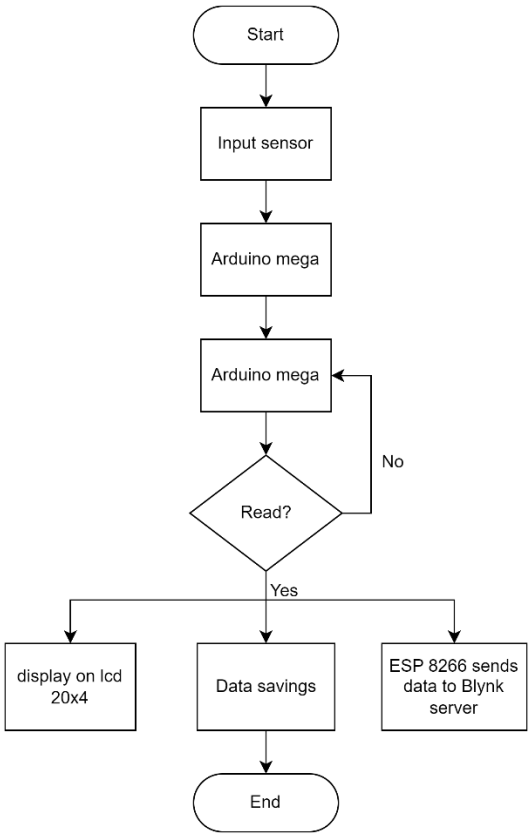

Figure 3. Flow diagram for system processing

Figure 4. Board system minimum

Figure 5. Blynk Dash Board

Figure 6. Panel Indicator Mode

CONCLUSION

In this study, the visible power will be calculated at the cost per kWh to find out how much electrical energy is used from the electronic devices used. The

data obtained by the microcontroller is sent to the database using the internet network to receive and provide information. Monitoring the use of electric power can be done via an Android connected to the internet.

The results of measuring with the tool show the difference in power from the three-phase system. From the results obtained, it is proven that the tool can function properly, hopefully it will bring benefits, especially colleagues, Indonesian electromedical engineering.

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