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Monitoring the Use of Electrical Energy and Water in Homes Based on IoT

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ABSTRACT

Increased awareness of energy efficiency and sustainable resource management has encouraged the development of intelligent electrical energy and water usage monitoring systems. In this context, the Internet of Things (IoT) has become a promising solution for connecting household devices to the internet, enabling users to monitor and control electricity and water consumption in real-time. This research aims to design and implement an IoT-based monitoring system for electrical energy and water usage in homes. This system uses a powerful Arduino ESP32 microcontroller and can connect to the internet via WiFi. This microcontroller acts as a control center that collects data from sensors installed in the house. Based on these problems, this research was carried out, with the aim of creating a prototype to record electrical power loads and display the amount of electricity consumption in rupiah levels to monitor the use of electrical power loads and convert them into rupiah. To conduct this research, the author used observational research methodology or field study and literature study. In this research, it is necessary to pay attention to understanding how to think and how to carry out the results of thinking according to scientific steps

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1. INTRODUCTION

Electricity is one of the essential needs in daily human activities. The only one in Indonesia, there is the State Electricity Company (Persero) which is an effort that the state claims is responsible for being the first electricity producer to take over the entire territory of Indonesia. This researcher discusses the use of electrical energy monitoring technology via cellphone devices using a WiFi connection[1][2][3]. This researcher is concerned with the use of the NodeMCU microcontroller, LCD screen, and Pzem-004t sensor. The instrument system created has advantages such as using minimal modules, making it more efficient. However, one of the shortcomings of this tool system is the absence of a recording feature for test tool data[4][5][6].

As a difference, there is another research that discusses a prototype for monitoring energy and electricity costs for each room using Telegram based on the Atmega2560

microcontroller in residential homes[7][8]. Water is a substance that is very important for humans. Humans need water in various aspects of life, including for drinking, washing, bathing, and more[9]. Hopes that clean water will continue to increase along with the increase in population. There are several ways to provide clean water, such as using wells, Drinking Water Companies (PAM), and Regional Drinking Water Companies (PDAM)[10][11].

Even though PDAM and PAM provide drinking water services, there are significant differences between them in providing practical drinking water and guaranteed quality[12].

PDAM or PAM customers in urban areas are not only limited to ordinary households, but also include residential homes[13]. PDAM/PAM fees vary, with an average rate ranging from IDR 10,500 to IDR 19,000 for 1 cubic meter. However, PDAM/PAM lines face several problems, such as leak monitoring which requires direct supervision and meter calculations which are still done manually[14][15].

2. METHOD

The initial stage in this research method includes a literature review, which involves extracting information through books, journals,articles or theses.can be related to the elements used for this research. This information was obtained from the results of discussions and consultations with lecturers and several experts who can be considered competent in this field. The following literature is studied : The home electrical energy control and monitoring system uses RTC (Real Time Clock) ESP32, The Water PDAM design uses ESP32-based TELEGRAM APK in the house.

2.1 System Block Concept

In this system block is an initial concept in the process of making a PDAM Water Design prototype using Telegram Apk based on ESP32 at home. The concept from the beginning in making this prototype can be seen in the picture below

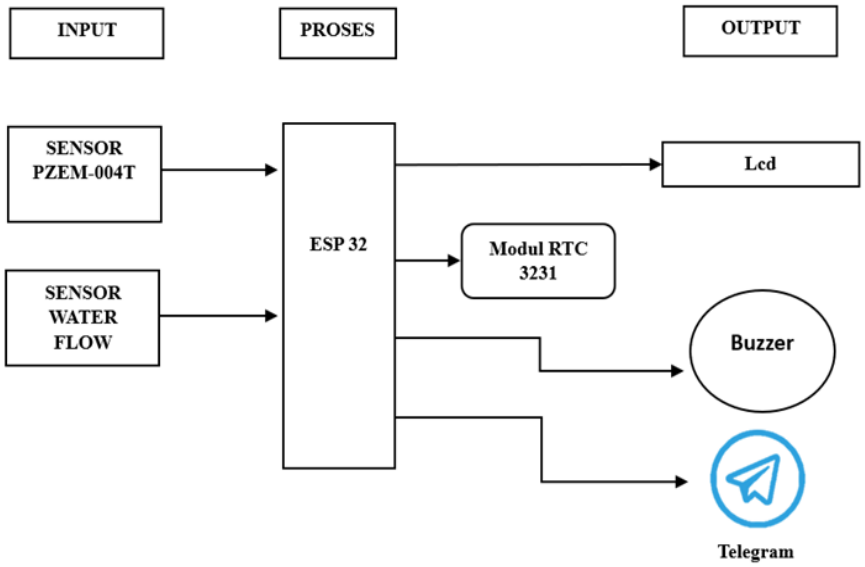

Figure 1. System Block Concept

The sensor reads the current and voltage and then displays it on the Lcd display and Telegram BOT. Rtc functions to prevent the program from being reset when there is no electricity. The buzzer is a notification to the user if the device experiences a water leak.

2.2 System Work Process

At this stage, it will be explained as follows, there is a system flow of how the tool works which has been depicted in the image below

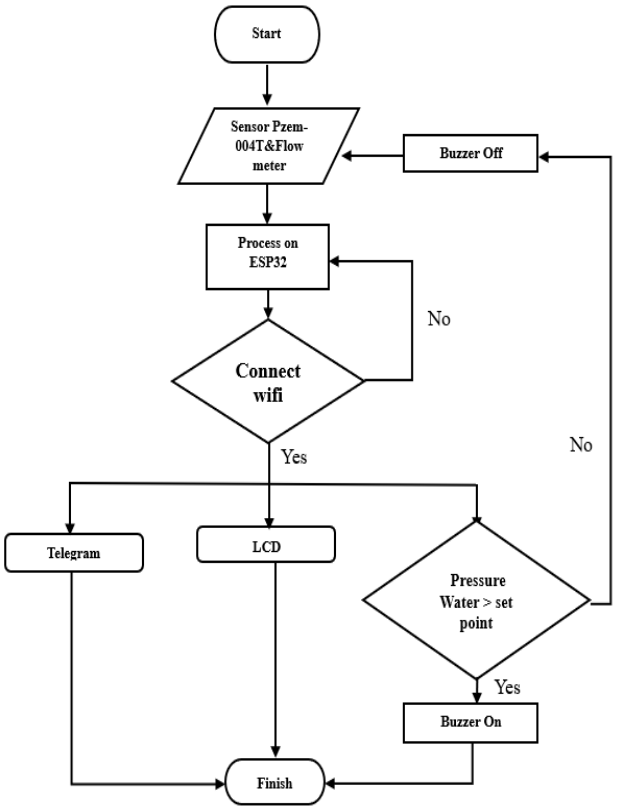

Figure 2. System Work Process

The working steps of the flowchat system above have the following process: the power is turned on, the pzem-004t sensor will detect PLN tariff power consumption, the flow meter sensor will detect water pressure for PDAM water tariff power consumption and water leaks, esp32 will process data from both sensors, connect wifi, the results will be displayed in real time on the LCD and telegram, the buzzer will turn on if the water pressure exceeds the set point (the tap water has a leak), the buzzer will turn off if the water pressure does not exceed the set point.

3. RESULTS AND DISCUSSION

The chapter below discusses the results of the system that has been created and designed. To find from a system that meets the author's desired standards

3.1 PLANNING FOR COLLECTING AND ANALYSIS ELECTRICAL USAGE DATA

The test results of data collection from the pzem-004t sensor from different times are in the table below.

Test Data	Freq	Cost	watt	Kwh
1.	50.0 Hz	4.060	20.0	0.03
2.	50.0 Hz	7.650	25.5	0.02
3.	50.0 Hz	9.354	35.2	00.3
4.	50.0 Hz	21.63	95.1	0.02

Table 1. electrical energy usage test results

Based on the table above, data on electrical energy usage at home can reach 21,000 daily and can reach 95.1 watts.

Figure 3. tool for test results using electrical energy

3.2 PLANNING FOR COLLECTING AND ANALYSIS WATER CONSUMPTION DATA

The test results for collecting flow meter sensor data from different times are in the table below

Day	Result Liters	Cubik meter result	Cost
1	72.43 L	0.07	72
2	137.69 L	0.14	137
3	34.76 L	0.03	34

Table 2. PDAM water usage test results

the result of water use in the house can reach 137.69 liters or more and the total cost can reach 34,000 in one day

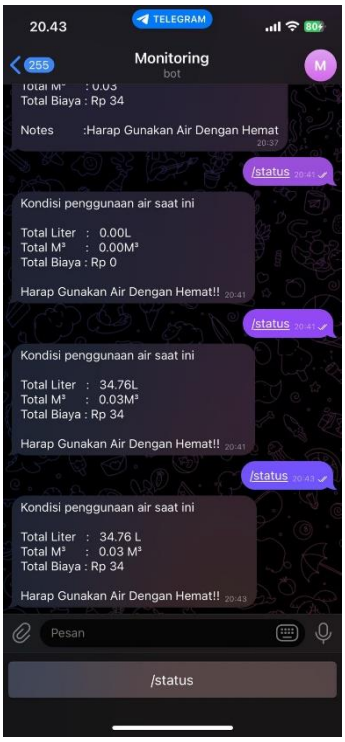

Figure 4. results of using tap water via telegram bot

4. CONCULUSION

Managing the use of electrical energy and air at home wisely can not only reduce monthly bill costs, but also contribute to environmental conservation. Choosing efficient equipment, fixing leaks, and changing daily habits are simple but effective steps to achieve that goal.

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