Electricity Tariff Analysis And Prediction System Using The Arima Algorithm Based On The Internet Of Things (IoT)

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ABSTRACT

The problem of monthly electricity bills in Indonesia is often a hot topic among the public. Some of the problems with electricity bills that are often complained about by the public include: The increase in basic electricity rates by the government or PLN (State Electricity Company) is often the main complaint. This increase can have a significant impact on people's monthly expenses. Many customers feel that their electricity bills do not match their actual usage. This can be caused by uncontrolled electricity usage or devices that consume more electricity than expected. There are cases where errors in electricity meter readings occur, either due to human error or damage to the meter. This error can result in electricity bills that are higher or lower than actual usage. Some customers feel they do not get clear information about the details of their bills. This lack of transparency can lead to distrust of PLN. Several additional costs such as administration fees, late payment fees, and other costs can add to the burden on monthly electricity bills. Based on the above problems, we built a Smart Precision Electric platform system based on IoT and Artificial Intelligence as a Predictive Model for Electricity Bills. The system we built is able to predict next month's electricity bill and identify the electronic devices that contribute the most to that cost using the integration of the Internet of Things Platform and Artificial Intelligence.

Keywords: *Predictif Model, Internet of Things (IoT), Smart Precision Electric, Arima Algorithm*

1. INTRODUCTION

The problem of monthly electricity bills in Indonesia is often a hot topic among the public. Some of the problems with electricity bills that are often complained about by the public include: The increase in basic electricity rates by the government or PLN (State Electricity Company) is often the main complaint. This increase can have a significant impact on people's monthly expenses. Many customers feel that their electricity bills do not match their actual usage. This can be caused by uncontrolled electricity usage or devices that consume more electricity than expected. There are cases where errors in electricity meter readings occur, either due to human error or damage to the meter. This error can result in electricity bills that are higher or lower than actual usage. Some customers feel they do not get clear information about the details of their bills. This lack of transparency can lead to distrust of PLN. Several additional costs such as administration fees, late payment fees, and other costs can add to the burden on monthly electricity bills. Based on the above problems, we built a Smart Precision Electric platform system based on the Internet of Things and Artificial Intelligence as a Predictive Model for Electricity Bills. We developed a prediction and analysis system using ARIMA machine learning. Our system is capable of predicting next month's electricity bill and identifying the electronic devices that contribute the most to that cost, using an integrated Internet of Things platform and Artificial Intelligence.

2. METHOD

1) Description of the Approach Used

The development approach for this predictive analysis platform utilizes Research and Development (R&D). Research is a method used to develop a specific product. To produce a specific product, research is needed, including needs analysis and testing the product's effectiveness to ensure its functionality in the wider community.

2) Method of collecting data

The approach used in developing this platform is a quantitative research method, which processes statistical data in the form of numbers. The application of quantitative methods to obtain data in this platform's development can be done objectively by building an Internet of Things platform to obtain measurable data on electricity usage.

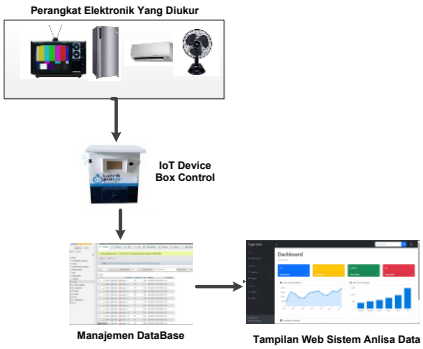

Figure 1. Internet of Things (IoT) Based Data Collection Method

In platform development, we created a dataset from sensors installed on electronic devices and integrated it into our Internet of Things platform. The dataset obtained from sensor readings was then processed into a dataset and visualized on a database management platform. At this stage, a predictive model was developed using machine learning and the ARIMA algorithm to estimate the monthly electricity bill and remaining balance, and to determine its contribution to costs.

3) Data Analysis Techniques

In developing this platform we use the ARIMA (Autoregressive Integrated Moving Average) data analysis method, a method based on historical variable value data which is then used to determine historical patterns in the data to extrapolate those patterns into the future. The ARIMA method we use is a combination of the Autoregressive Model (AR) and the Moving Average Model (MA) developed by Gwilym Jenkins and George Box.

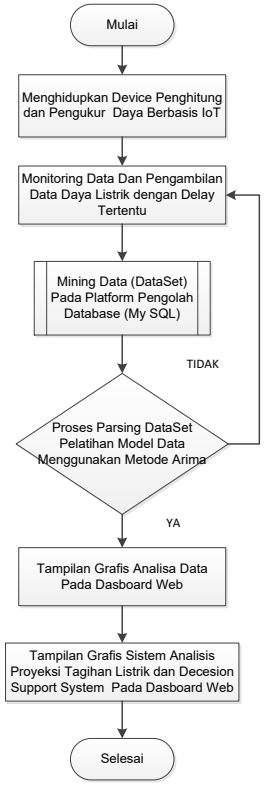

Figure 2 Data Analysis Flowchart

The stages above are the steps taken to produce the desired and maximum prediction and analysis system.

4) Decision Making System

A decision-making system is a series of processes and methodologies used to make the best choice among various available alternatives. The decision-making system in our electricity bill analysis prediction system helps in distribution planning and control of various electrical equipment activities. Our decision-making system functions in applications related to operational decisions regarding the use of electrical equipment in daily operations.

3. RESULT AND DISCUSSION

a) Design System

Figure 3 IoT Design System

The working principle of this research development is to create a data collection from sensors installed on electronic devices and integrated into the Internet of Things platform on the control box we built. The data collection obtained from sensor readings is then continued to the dataset process and data visualization on the database management platform. At this stage, the development is then carried out by parsing the data using a predictive model with machine learning modeling using the ARIMA algorithm to estimate the bill and remaining electricity bill for that month and contribute to the cost.

2) Power Sensor Device

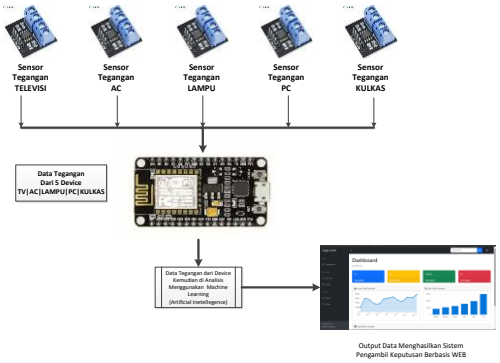

Figure 4 Sensor Device Circuit

This system utilizes real-time sensor data collected from various household appliances. This system generally aims to identify the power on certain electronic devices, for example TV, AC, Lights, PC, Refrigerator.

3) **Data Preparation**

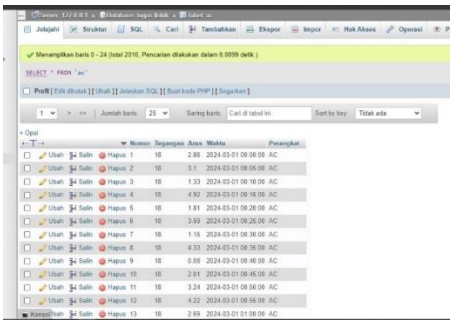

Figure 5 Data Preparation System

Explore data sets provided by Internet of Things (IoT) platforms and perform necessary data preprocessing steps to handle missing values or outliers.

4) **Model Design**

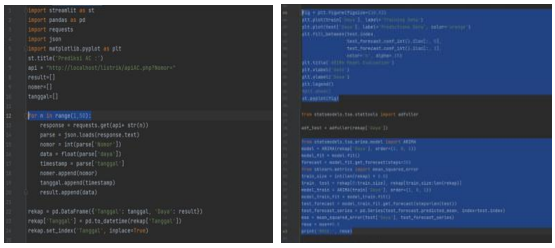

Figure 6 Design Using ARIMA Algorithm

Create a machine learning model based on the ARIMA algorithm to estimate the remaining electricity bill for the month and identify the device's contribution to the cost.Using an appropriate algorithm with detailed prediction and analysis capabilities, in this case, the ARIMA Algorithm Method.

5) **Model Evaluation and Training**

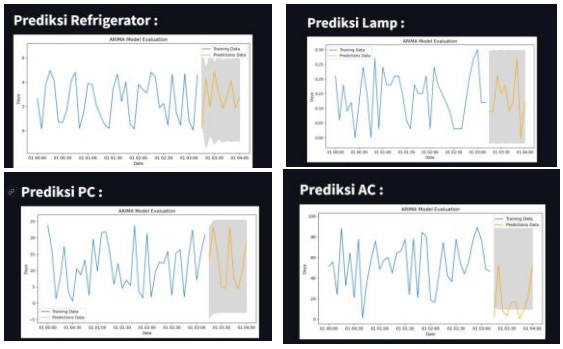

Figure 7 Model Evaluation and Training

Train the model based on historical data and evaluate its performance using relevant metrics. This stage involves identifying and converting ARIMA algorithm calculations using the Python programming language.

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