SMART ENERGY MANAGEMENT USING NODE-RED

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***Abstract*—Smart meter technologies are being installed to increase grid stability and energy efficiency while delivering better services to customers. To make it more user-friendly and technically dependable, we propose our smart energy meter, which can be extensively utilized for monitoring and analyzing energy usage in a household electrical system or solar PV plant utilizing Node-RED. It can measure Voltage, Current, Active Power, Active Energy, and Frequency in real time and upload the results to the cloud. They are perfect for use in a solar PV system since they are bi-directional meters. It can track the energy generated by the solar inverter as well as the energy imported from/exported to the grid. .**

Keywords- Smart Energy Meter, Renewable Energy, Node-Red, Power Saving

I. Introduction

Smart energy meters have revolutionized the way energy consumption is measured and monitored. These meters allow for real-time monitoring and analysis of energy usage, providing valuable insights into energy consumption patterns. The integration of smart energy meters with Node-RED, a visual programming platform, provides a powerful and flexible solution for energy management.

Node-RED enables the creation of applications through drag-and-drop interfaces, making it a user-friendly platform for energy management. The real-time data processing capabilities of Node-RED allow for the creation of custom rules and algorithms for energy management, providing a platform for optimizing energy usage and reducing energy waste.

Despite the potential benefits of smart energy meters using Node-RED, there is limited research in this area. This research paper aims to fill this gap by providing a comprehensive analysis of smart energy meters using Node-RED. The study will focus on the potential benefits of this technology, including real-time monitoring and analysis of energy consumption, the ability to detect unusual usage patterns, and the flexibility to customize the system to meet specific needs. Additionally, the study will highlight the importance of accuracy and reliability in energy measurement and the need for user-friendly and intuitive interfaces.

The results of this research will provide valuable insights into the potential of smart energy meters using Node-RED for energy management. This information will be useful for policymakers, energy companies, and consumers, as they look to implement effective and efficient energy management systems.

II. Literature Survey

A literature review of electrical energy meters is a comprehensive analysis of available research and development in the field of energy measurement. Energy meters, also known as electricity meters, are devices used to measure the amount of electrical energy consumed by a particular customer or premise. The literature review of electrical energy meters is a crucial step in understanding the current state of the field and identifying areas for further research and development.

In recent years, the demand for accurate and reliable energy meters has increased due to the growing demand for electricity, increased energy costs, and the need for efficient energy management. In response, the development of advanced electrical energy meters has been a focus of research in the field of electrical engineering. Some of the most significant advances in electrical energy meter technology include the development of smart meters, which allow for remote reading and monitoring of energy consumption, and the development

of advanced metering infrastructure (AMI), which provides real-time data on energy consumption and enables real-time energy management.

Another important development in electrical energy meter technology is the integration of renewable energy sources into the energy grid. The integration of renewable energy sources, such as solar and wind power, requires accurate energy meters to measure the amount of energy generated and consumed by these sources. This is critical for managing the energy grid and ensuring that renewable energy sources are effectively utilized.

The literature review of electrical energy meters also highlights the importance of accuracy and reliability in energy meters. Accurate energy meters are essential for billing purposes and for ensuring that customers are charged for the energy they consume. Inaccurate energy meters can result in overcharging or undercharging customers, which can have significant financial implications. Additionally, inaccurate energy meters can result in incorrect readings of energy consumption, which can impact the efficiency of energy management systems.

Finally, the literature review of electrical energy meters highlights the need for ongoing research and development in the field. The rapid advancement of technology and the growing demand for energy management require continuous innovation in energy meter technology. Research in the field should focus on developing energy meters that are accurate, reliable, and cost-effective, as well as exploring new technologies, such as machine learning and artificial intelligence, that can improve energy management systems.

A literature review on smart energy meters using Node-RED is a comprehensive analysis of available research and development in the field of energy measurement and management using this platform. Node-RED is a visual programming platform that allows for the creation of applications through drag-and-drop interfaces. The integration of smart energy meters with Node-RED provides a platform for visualizing and analyzing energy consumption data in real-time. This information can be used to optimize energy usage and reduce energy waste. The literature review on smart energy meters using Node-RED highlights the potential benefits of this technology, including real-time monitoring and analysis of energy consumption, the ability to detect unusual usage patterns, and the flexibility to customize the system to meet specific needs.

In conclusion, the literature review of electrical energy meters highlights the significant advancements in energy meter technology and the ongoing need for research and development in the field. The ongoing advancement for smart energy meter Node-RED highlights the potential benefits of this technology for energy management and the importance of accuracy and reliability in energy measurement. The visual programming interface and real-time data processing capabilities of Node-RED make it a valuable tool for optimizing energy usage and reducing energy waste. Further research in this area will help to ensure the continued advancement of energy meter technology and improve the efficiency of energy management systems.

III. METHODOLOGY

Step 1 : Node-RED is used as the primary interface for collecting data from sensors and other sources. It provides a visual programming environment that allows users to easily connect and integrate different data sources, such as temperature sensors, light sensors, and energy meters. The data collected by Node-RED is then sent to ThingSpeak for storage and analysis.

Step 2 : ThingSpeak is a cloud-based IoT platform that provides a way to collect, analyze, and visualize data from IoT devices. The platform provides a RESTful API for data ingestion, which can be used to send data from Node-RED to ThingSpeak. Once the data is in ThingSpeak, it can be analyzed using MATLAB.

Step 3 : Matlab is used to compute the excel datasheet provided from user side also use to analyze data from ThingSpeak to identify patterns and trends in energy consumption.

Step 4 : Once the data has been analyzed using MATLAB, the results can be sent back to Node-RED and displayed on a dashboard. This allows users to monitor energy consumption in real-time and take action to optimize energy usage

IV. RESULT

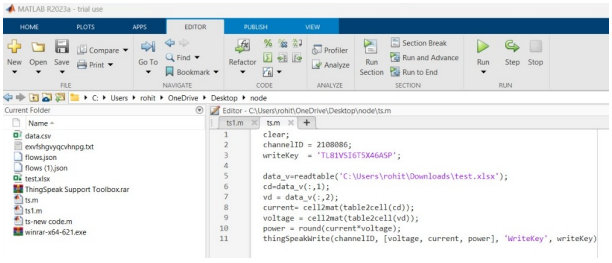

Fig. 1. MATLAB Code

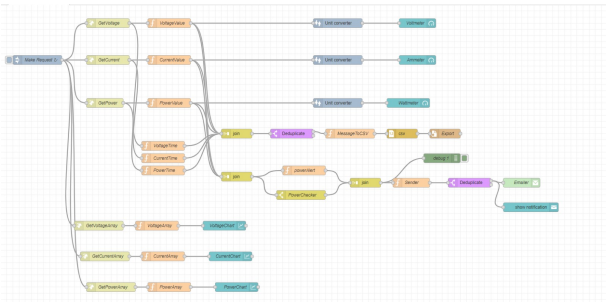

Fig. 2. Node-RED Flow

Fig. 3. Dashboard (Output)

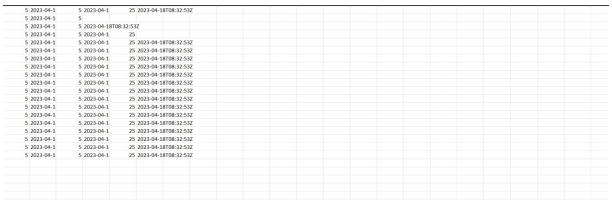

Fig. 4. Excel Sheet (Real Time Data)

V. Conclusion

In conclusion, the use of smart energy management systems has become increasingly important in today's world as we strive to reduce our carbon footprint and improve energy efficiency. This research paper explored the use of Node-RED, MATLAB, and ThingSpeak application for smart energy management. As discussed Matlab is responsible for fetching the data ie, current volatage from the user datasheet as proposed in the paper. The Node RED dashboard is responsible for displaying current, voltage, power, total power consumed by customer and the results have shown that this approach can be highly effective in managing energy consumption and reducing waste. By leveraging these technologies, we can create a more sustainable and efficient energy infrastructure that benefits both individuals and society as a whole. Overall, the research presented in this paper highlights the potential of smart energy management systems to create a more environmentally friendly and cost-effective approach to energy consumption. With the continued development and implementation of these technologies, we can work towards a future where energy is managed intelligently and sustainably, creating a more efficient and prosperous society.

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