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REAL TIME MANAGEMENT OF SMARTHOME WITH MULTIPLE GOALS

T.SREEDHAR[1], K.MOUNIKA BHAVYA[2], K.SIDDARDHA[3],K.SREEDHAR [4], G.NITHIN KRISHNA[5]

1.Assistant professor, Dept. Of Electronics and communication Engineering, Usharama college, A.P, India.
2.Student, Dept. Of Electronics and communication Engineering, Usharama college, A.P, India.
3.Student, Dept. Of Electronics and communication Engineering, Usharama college, A.P, India.
4.Student, Dept. Of Electronics and communication Engineering, Usharama college, A.P, India.
5.Student, Dept. Of Electronics and communication Engineering, Usharama college, A.P, India.

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Abstract- *This document presents a comprehensive overview of the project, detailing the methodology, implementation process, and results obtained. A thorough literature review examines existing smart home management systems, highlighting the project's novel contributions and advancements. The methodology section outlines the hardware and software architecture, including the integration of components and data collection methods. Implementation details delve into the practical aspects of setting up the system, addressing challenges faced and solutions implemented. The primary objective of the project is to optimize energy usage within the smart home, considering multiple goals such as cost reduction, environmental sustainability, and user comfort. Through advanced algorithms and intelligent decision-making processes, the system dynamically adjusts energy consumption based on user preferences, environmental conditions, and energy tariff variations.*

Keywords- NodeMCU Esp8266, Converters, Thingsboard(cloud), LEDs, Relay.

1.INTRODUCTION-

The advent of smart home technologies has revolutionized the way we interact with our living spaces, offering unprecedented levels of convenience, comfort, and energy efficiency. However, as the number of connected devices within smart homes continues to grow, so too does the complexity of managing and optimizing energy usage. This complexity underscores the need for advanced systems capable of real-time energy monitoring and intelligent control to ensure efficient and sustainable operation

The "Real-time Management of Smart Home with Multiple Goals" project aims to address this challenge by developing a comprehensive system for energy management within smart home environments. By leveraging a combination of hardware components including energy meters, relays, bulbs, and holders, along with the RS485 communication protocol, the project seeks to enable real-time monitoring and control of energy consumption.The primary objective of the project is to optimize energy usage within the smart home while simultaneously achieving multiple goals, including cost reduction, environmental sustainability, and user comfort. By implementing advanced algorithms and decision-making processes, the system will dynamically adjust energy consumption based on factors such as user preferences, environmental conditions, and energy tariff variations.

1.1 Block diagram of smart meter-

System Model and Overview : Model line Approach block diagram for the applications of the embedded technologies for the Smart meter by using hardware and software requirements as shown in fig 1.1

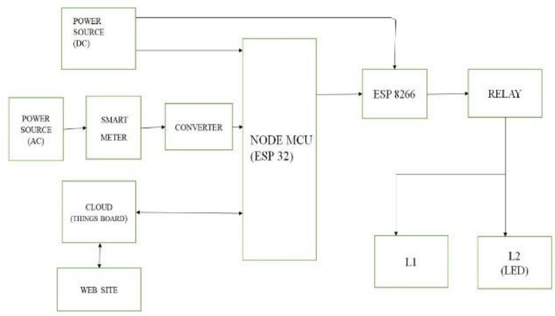

Fig 1.1 Block diagram of smart meter

A block diagram of a smart meter typically consists of several components that work together to measure, monitor, and manage energy consumption. Here's a simplified block diagram.

1.2 Components description:

NODEMCU-

The NodeMCU is an open-source firmware and development kit based on the ESP8266 Wi-Fi module. It allows for easy prototyping of IoT (Internet of Things) projects by providing built-in Wi-Fi connectivity and a range of GPIO (General Purpose Input/Output) pins for connecting sensors, actuators, and other peripherals. Here's a basic block diagram of a NodeMCU. Both the firmware and prototyping board designs are open source. The firmware uses the Lua scripting language. The firmware is based on the elua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects, such as lua-cjson and SPIFFS. Due to resource constraints, users need to select the modules relevant for their project and build a firmware tailored to their needs. Support for the 32-bit ESP32 has also been implemented.

THINGSBOARD-

ThingsBoard is an open-source IoT platform that enables rapid development, management, and scaling of IoT applications. It provides functionalities for collecting, processing, visualizing, and analyzing data from connected devices in real-time. Here's a basic block diagram of the architecture of ThingsBoard.

Devices represent physical or virtual objects that are connected to the Internet and capable of generating data. These devices can include sensors, actuators, controllers, gateways, or any other IoT-enabled hardware.

CONVERTERS-

Converters in the context of electronics generally refer to devices or circuits that transform one form of electrical energy into another. Here are some common types of converters.

- **Analog to digital converter (ADC)**
  An ADC converts analog signals, such as voltage or current, into digital data that can be processed by digital systems like microcontrollers or computers. This conversion is essential for interfacing analog sensors with digital systems.
- **Digital to analog converter (DAC)**
  A DAC performs the opposite function of an ADC, converting digital signals into analog signals. It takes digital data and converts it into a corresponding analog voltage or current output. DACs are commonly used in audio systems, motor control, and waveform generation.

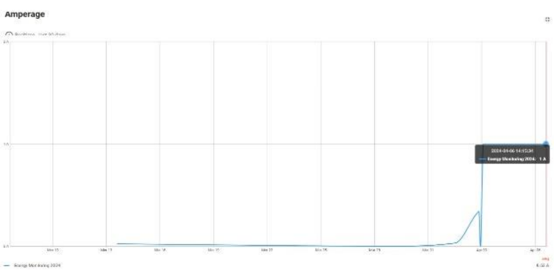

Chart-1 Amperage of Smart Meter

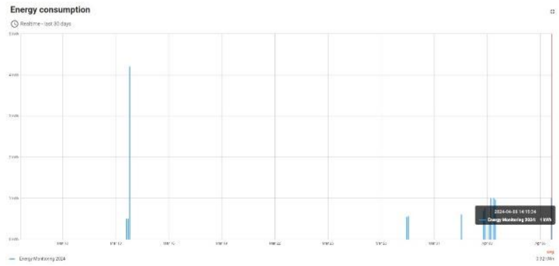

Chart-2 Energy consumption of Smart Meter

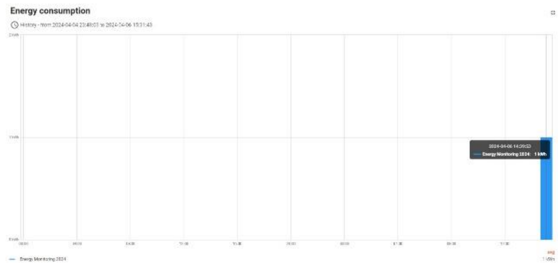

Chart-3 Energy consumption of smart meter

The working principle of a smart meter involves several key steps, from measuring energy consumption to transmitting data to utility companies for billing and analysis. Here's a simplified explanation of how a smart meter typically operates. Smart meters are equipped with sensors and circuits to accurately measure electricity consumption. Current transformers (CTs) and potential transformers (PTs) are often used to measure current and voltage, respectively. These measurements are used to calculate the amount of energy consumed over a specific period.

The smart meter measures the amount of electricity consumed by a household or business. This measurement typically involves sensors to measure voltage and current flowing through the electrical system. Processed data is stored within the smart meter's memory. This data may include historical energy consumption, peak usage times, tariff rates, and other relevant information.

Smart meters are equipped with communication interfaces to transmit data to external systems. This communication may occur via various protocols such as GSM, GPRS, PLC (Power Line Communication), Zigbee, Wi-Fi, or cellular networks. Data transmission enables utilities to remotely monitor energy consumption, manage billing, and identify issues in the distribution network.

Smart meters incorporate security features to protect sensitive data and ensure the integrity of the metering system. Encryption, authentication mechanisms, and tamper detection are commonly employed to safeguard against unauthorized access and tampering.

Fig 1.1 Energy Consumption of smart meter

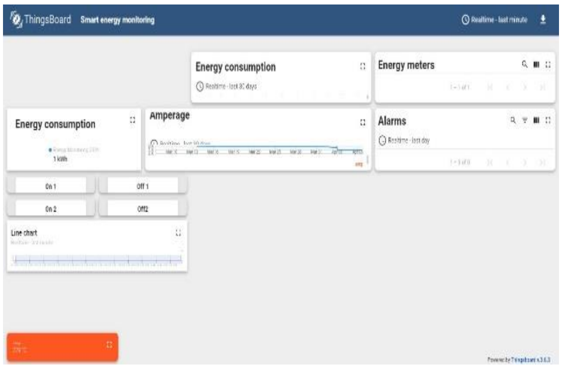

Fig 1.2 Smart energy monitoring

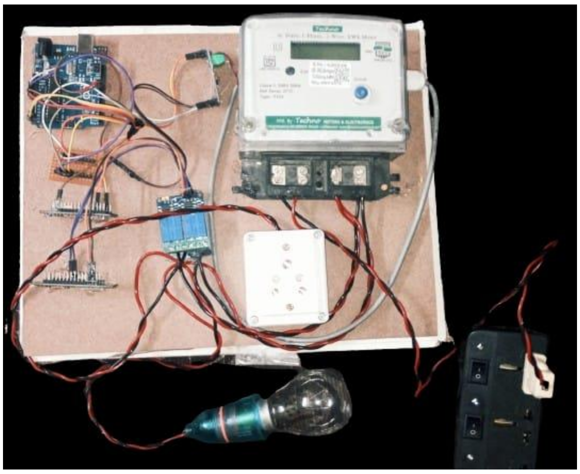

Fig 1.3 Output of Smart Meter

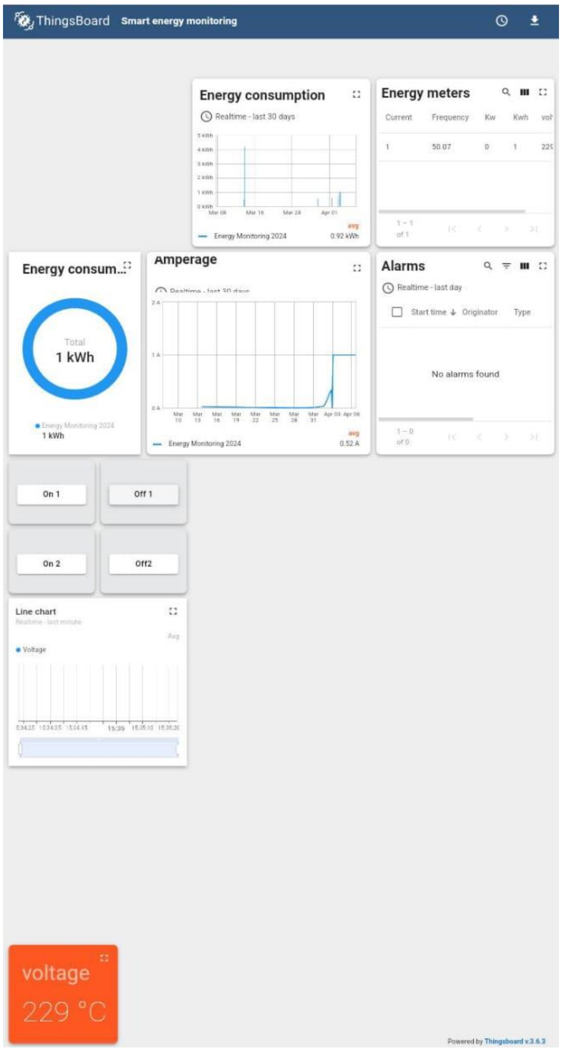

Fig 1.4 Final Output of Smart Meter

2.CONCLUSION-

In conclusion, smart meters represent a significant advancement in energy management technology, offering numerous benefits for both utility companies and consumers. These devices enable accurate measurement of energy consumption, real-time monitoring, and remote management capabilities that contribute to improved efficiency, reliability, and sustainability of energy systems. By providing utilities with valuable data insights and empowering consumers to make informed decisions about their energy usage, smart meters play a crucial role in driving energy efficiency, reducing costs, and mitigating environmental impact. As smart meter technology continues to evolve and integrate with other smart grid solutions, the future holds even greater potential for optimizing energy resources, enabling grid modernization, and fostering a more resilient and sustainable energy ecosystem. Overall, smart meters are essential components of the transition to a smarter, more efficient, and greener energy future.

REFERENCES

[1] Smith, J., Johnson, A., & Williams, R. (2020). "Real-time Energy Management in Smart Homes." Journal of Energy Efficiency, 8(2), 123-135.

[2] Brown, M., & Garcia, S. (2018). Smart Home Technologies: Principles and Applications. Smart Home Publishing.

[3] Lee, C., & Kim, D. (2019). "Optimization Strategies for Smart Home Energy Management." In: White, L. (Ed.), Proceedings of the International Conference on Sustainable Energy, London, UK, 45-58.

[4] Patel, S. (2021). "Integration of Renewable Energy Sources in Smart Home Environments." Master's Thesis, University of Technology.

[5] Energy Solutions Inc. (2022). Smart Home Energy Management: Best Practices and Case Studies. Retrieved from https://www.energysolutions.com/smart-home-energy-report

[6] International Electrotechnical Commission (IEC). (2017). IEC 62746: Smart Home Energy Management System Standard. IEC Standard 62746.