Smart Energy Meter Using Lora Protocols & IOT Applications

[1]Krunalkumar Gandhi, [2]Dr. Vijay Patil, [3]Chetan D. Nile, [4]Abhishek S. Patil, [5]Dinesh V. Gosavi

[1]Assistant Professor, [2]Associate Professor, [3,4,5]Student,
RCPIT, Shirpur

***Abstract*- The world regularly uses old technology to measure power consumption. In today's technological and digital world, no system or device works without electricity. Therefore, everyone needs energy to work on a system or device. So, we are delivering such a system to know or to measure the power consumed by the system to do work. People are moving towards digitalisation and modernization, and energy requirements are increasing. It is an electrical era where the electrical sector is emerging. There are many misunderstandings between consumers and the electricity board. Vehicles are dependent on electricity. Due to the increment in EVs, electrical requirements and electricity optimization is also required. To power EVs, there is a need for charging stations. So, these are the main reasons behind load shedding. To continue the electricity dispatch, we must manage and control the electricity on the consumer side. Considering the above, we are designing a model/system that can measure the accurate meter reading without human involvement and generate bills. i.e., Smart Energy Meter Using LORA Protocols & IOT Applications [1].**

I.INTRODUCTION

In today's world, everything depends on electricity, even though vehicles also depend on electricity, i.e., Electric Vehicles. There are no devices or any machine which works without electricity. So due to modernization and digitalization, electricity is an essential requirement of society or human beings to survive and meet their daily needs. Hence due to the enormous requirement and need for electricity, there is a need for proper management and optimization of electricity. The system of electric meter reading currently used has many drawbacks, such as being more time-consuming, requiring manpower and electricity theft, and misunderstandings between the electricity board and consumer because of third-party participation in meter reading. There is no fixed date for taking meter readings because the current reading is taken manually with the help of employees. The bill will be generated after taking it home by home, and it is a more time-consuming process. Then after a few days, the generated bills will be distributed along with the meter numbers. It is a more time-consuming process due to which the electricity board gets losses. So, by considering this, the proposed system is much more helpful to consumers and the electricity board, i.e., the Smart Electric meter [1].

The system consists of an inbuilt WIFI module and PZEM-004T module, which senses the active variable voltage, current, frequency and power consumed by the load.

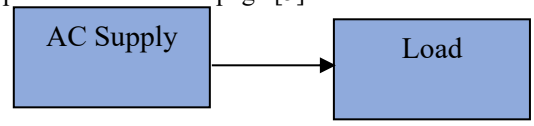
The PZEM-004T module is interfaced with NODEMCU ESP8266. The proposed system is using Wi-Fi which acts as a heart for IoT. In proposed system, the Wi-Fi module is connected to mobile. Through this Wi-Fi module, the reading will reach the users mobile. The data sensed by the PZEM-004T module will be sent to the Wi-Fi module NODEMCU ESP8266, and it will show on a web page with the help of coding and programming. The system will show the active voltage, active frequency, active current, and the power consumed by the consumer. So, there are no theft chances in meter readings. So, there is no chance of misunderstanding between the electricity board and the consumer. The smart meter system provides the user with real-time voltage, current, frequency and power. We can implement this system efficiently and at a low cost with higher efficiency. Once the system is installed, there is no need for Manpower to take meter readings. This system requires minimal installation space because it has minimum components; only one PZEM-004T module will give several readings, i.e., variable voltage, variable frequency, variable current and power consumed by the user [2].

II.LITERATURE REVIEW

This paper proposed that the energy consumption in household and industrial sectors, mainly in the developing areas gaining more and more losses due to Electricity theft and improper management of electricity. This paper proposes an intelligent energy metering system using IoT. This smart energy meter is not only designed to measure power consumption, but it can show the live voltage, current, and frequency so that we can manage the devices. No damage to the devices due to high voltage. It is designed with the help of an intelligent PZEM-004T sensor with inbuilt voltage, current, and frequency sensors to give accurate readings. This paper proposed an auto meter reading with perfection; it removes the manual help to get meter readings to minimize consumer fraud and misunderstandings. It reduces the cost of a meter reading person so that the charges can be minimized. It has the ability to optimize the use of electricity. This system can reduce the financial losses of electricity board and energy savings. Meter readings will be taken on date accurately so there is no chance of misunderstanding between an electricity provider and consumer [4].

III.PROPOSED SYSTEM

This system is designed with the help of PZEM-004T module and WIFI module NodeMCU ESP8266. The PZEM-004T sensor is interfaced with the WIFI module. The data sensed by the sensor will be passed to the ESP8266 module. We can see the output with the help of an HTML web page [5].



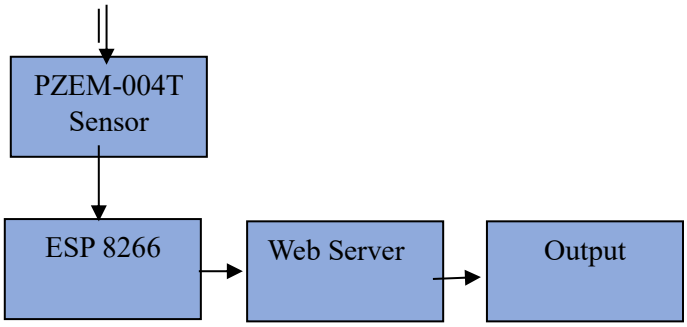


Fig.1: Proposed System Block Diagram

To assemble the system following components are required: -

1. PZEM – 004T Sensor
2. NodeMCU ESP8266
3. Load
4. Electrical Wires
5. Jumpers

PZEM – 004T Sensor

By using individual measuring elements, the complexity of the system increases. So, we have used the Electrical Variable Meter is named PZEM-004T sensor. (Ningbo Peace Fair Electronic Technology, Zhejiang, China). PZEM-004T Voltage, current, active power, power factor (PF), and system energy are measured and calculated by the sensor.

Fig.2: PZEM-004T sensor

Sensor has the Voltage measurement range from 80 to 260 VAC; current measurement ranges from 0 to 100 amps; active power measurements range from 0 to 23 KW; Power factor measurements range from 0 to 1; and frequency measurements range from 45 to 65 Hz, and 5V D.C. is the module working voltage.

NodeMCU ESP8266

System is using Wi-Fi which acts as a heart for IoT. The Wi-Fi module (ESP8266) is a circuit generally used to establish the connection for any internet-enabled devices. In our system, we connect the Wi-Fi module to our mobile. Through this Wi-Fi module, the reading will reach the users mobile. The Wi-Fi module has a range of 2.4GHz. It is also known as ESP32-DevKitC [5].

Fig.3: NodeMCU ESP8266 Wi-Fi module

This board has a 2.4GHz dual mode WIFI and wireless connection. The board has 21 pins for interface connection. Features: - Flash Memory is about 4MB Frequency – 2.4 GHz & Operating voltage is 3.7V or 5V.

IV.WORKING OF SYSTEM

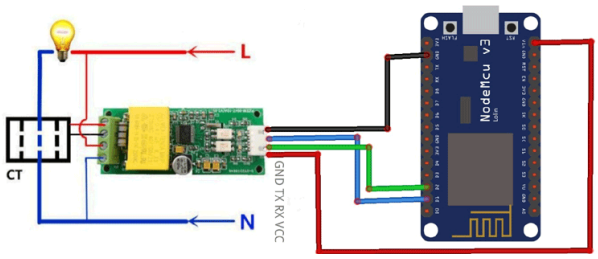


Fig.4: connection diagram of proposed system

A 230V passes through the ELCB and is divided by the MCB. The proposed system transfers energy from the ELCB to the MCB and then, via a relay, from the MCB to the load. Here, two PIR sensors are used to look for people inside the room. NodeMCU will receive Pzem-004T real-time data. The serial port and LCD can be used to display the extracted data. In the proposed system, closed relays are typically used. The HTTP protocol is used to push data from NodeMCU to the server [5].

The suggested approach makes use of Firebase as the desired server. The relay is controlled and configured by the user through Firebase. The web/Android application allows users to access real-time data from anywhere. As a result, users may monitor and control loads more effectively, lowering the cost of the bill. The Django framework for Python is used for web development. A third-party program, MIT app inventor, is a user interface between mobile and control devices. It is an open-source platform for developing applications. A visual programming language based on building blocks will piece together application behavior [5].

The design of the suggested system is built on components like the PZEM004T energy meter, NodeMCU, PIR sensor, Firebase server. A microcontroller, and the PZEM004T sensor are installed near the building's MCB. It has a Wi-Fi connection to the Firebase server. Comparing the electrical parameter data, such as voltage, current, and frequency, allows the user to determine the accuracy of the proposed system. The connected load may cause changes in power factor readings. Since the readings are acceptable and reliable, the proposed system is reliable [5].

V.RESULT

The primary motivation behind creating an IOT-based E-meter is to lower internal power usage. It forgoes human involvement, lowers expenses, and conserves human power. Both automatically and manually, it functions. Before the due date, this meter automatically sends billing to a mobile device without requiring human involvement [6]. The job costs are reduced by computerization, which also improves the framework's effectiveness and accuracy.

The system's primary target audience is public Wi-Fi hotspots in smart cities. The Internet of Things is the foundation of the project. It aims to replace the outdated implementation of energy meters with a more modern one. It can be used for automatic power reading, which reduces power waste by optimizing power usage. The meter readings are posted to Thingspeak.com, where the customer and service end can examine a channel with the energy usage for a specific energy meter [6].

VI.CONCLUSION

This research focuses on the networking aspect of IoT connectivity in the era of smart city development. This project uses an embedded system PIC16F*A MCU to create and perform an energy consumption computation based on counting calibration pulses. The proposed work uses an IoT and PLC-based meter reading system to track the readings. Whenever a client fails to pay the monthly fee, the service provider has the right to permanently cut off the power supply. Additionally, it does away with human intervention, provides persuasive meter readings, and guards against billing errors. The following goals of the project have been met.

- Consumers can easily access data from energy meters via IoT.
- Real-time theft detection at the consumer end.
- Service being cut off from a distant server. Future improvement: Wi-Fi access to IoT energy meters in the current system will assist consumers in preventing unauthorized electricity use.
- By integrating all electrical home appliances with IoT, the system's performance can be improved.

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