



Smart Energy Meter Monitoring using IOT

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ABSTRACT:

IOT based smart energy meter (SEM) is a monitoring system that can detect the Automatic Meter Reading (AMR) continuously and is sent via internet to the electrical power companies for calculating the bills as well as to the consumers. These readings are transferred over a communication channel through which consumers and electricity board officials both can see the readings on to the server. By adding these features to the energy meter, it can be termed as Smart energy meter

Introduction:

As is well known, in the current situation, an electrical system bills and monitors itself using a digital energy metre that is manually operated. Additionally, creating a bill by hand takes a lot of time and human labour, and it requires constant monitoring. The goal of this project is to use IoT to construct a smart energy metre. This system uses IoT to display the current energy use to customers' mobile devices. Additionally, the microprocessor of this smart electricity metre receives the current reading from a current sensor. In order to configure the system, we must establish an SMS connection between our cell phones and the system. Information will be disseminated on the set number in the event of an emergency. Each unit has to have a cost, and there are four buttons for that. We are able to specify pricing for the unit with the use of buttons. The IOT panel displays reading as soon as the machine is turned on. The way that you read will alter throughout time. If energy is stolen, it will be detected and shown on the IOT screen. Even the information will be sent to the specified phone via SMS. To prevent theft, the operator can use IOT to turn off the system after receiving the alarm.

Additionally, it reveals how to disable the system's message on a mobile device.

This system offers four primary functionalities.

1. Distance switching, or using a mobile IoT device to turn on and off the power supply from any location.
2. Continuous observation.
3. Automated invoicing.

This solution allows us to do away with manual procedures, save labour costs because no human is required, and operate remotely, which makes it extremely time-efficient. Energy gauge In the near future, many other nations will be implementing communication technology for electrical metres; however, there are still a lot of questions about how best to apply it in India. Nonetheless, there are a lot of reasons to put in place a system like that, which might have a big influence on the metering problems we face today.

Since the inception of the Ferraris wheel electromechanical energy metre, Indian electrical metering utilities have endeavoured to incorporate characteristics that are less prevalent in other global regions.

Objectives:

The objectives for the Prepaid Energy Meter System can be summarized as follows:

- To apply to get the concept of “*First Pay First Serve*”.
- To save time using an energy meter by only reload prepaid.
- To assembling a remote home robotization structure constrained by gadget associated with the web.
- Integrate the contraption to the controller: The overwhelming need that must be recollected when developing a Smart Home is that it must be savvy. The contraption controller must be humbly organized with the machines in the house with a foundation.

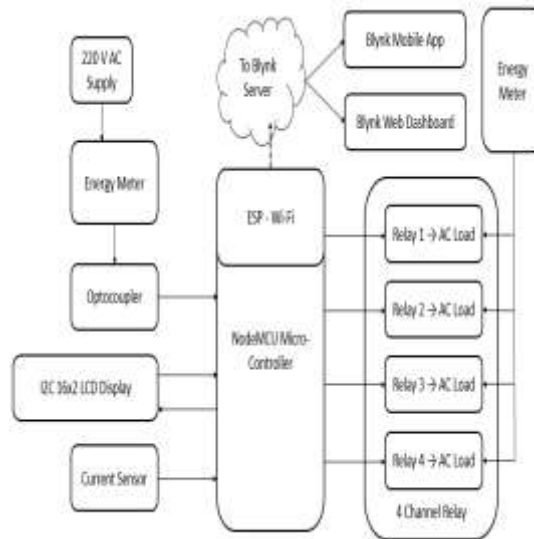
- Test the set up and analyse the data: After the system is set-up, with the help of a mobile phone and a controller, tests are driven while data is recorded and inspected.
- To arrangement and execute monetarily adroit home robotization structure yet a capable one.
- To plan an easy to use and a guaranteed structure to control home machines particularly planned to support the more prepared individuals and weakened.

Post-paid vs Prepaid system

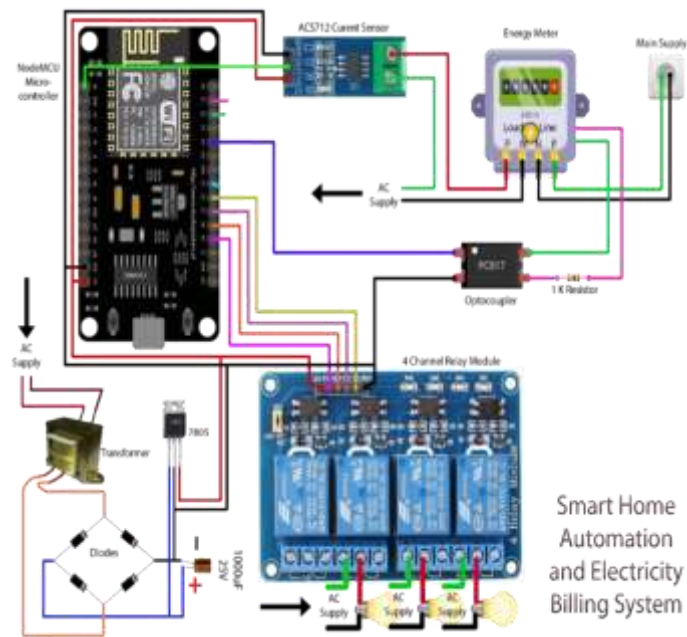
Prepaid and post-paid are two forms of payment that may be involved in many types of services [5]. Refer to the Latin language, Post means after, Pre means before, so a post-paid means paying after used while prepaid means pay before use [6]. Prepaid make it easier to budget as know in advance on how many KW/h that must use. Companies that offer these services like to brag that there are no annual contracts that must pay and no surprises at the end of the month. **Table 1:** Post-paid Metering System vs Prepaid Metering System:

Post-paid Metering System	Prepaid Metering System
Make a payment after use.	Make a payment before use.
The process is under office management, which have invoicing, feedback and response and consumer monitoring.	The process is self-administered which already cut down the worker costs.
To end up payments, staff in charge will come to read the meter reading.	To end up payments, no need staff to read the meter reading.
There have lots of time loss and resources for clients and distributor due to connection disconnection of the system.	There are use concept of self-connection and self-disconnection of the system which save money and there no customer complaints.
Low-income households which use low energy consumption need to pay the same rates of maintenance and management costs every month.	Just only once off installation, maintenance, and management costs.

Block Diagram



Circuit Diagram



Software Requirements

Arduino IDE

The ATmega328p microcontroller IC with Arduino bootloader makes a lot of work easier in this project as Arduino code is written in C++ with an addition of special methods and functions. The Arduino Integrated Development Environment (IDE) is the main text editing program used for Arduino programming. It is where you'll be typing up your code before uploading it to the board you want to program. Arduino code is referred to as sketches.



Figure 1: Arduino IDE

Blynk IoT: Android/Web App

.Blynk is an IoT (Internet of Things) stage utilizing which you can without much of a stretch and distantly control equipment. Furthermore, you can likewise see sensor information, store the information, picture the information and so on everywhere.



Figure 2: Blynk IoT Mobile App

Arduino Libraries

ESP8266

The Wi-Fi library for ESP8266 has been developed based on ESP8266 SDK, using the naming conventions and overall functionality philosophy of the Arduino Wi-Fi library.

Blynk

Blynk Library is an extension that runs on top of your hardware application. It handles all the connection routines and data exchange between your hardware, Blynk Cloud, and your app project.

HARDWARE COMPONENTS

NodeMCU ESP8266

The NodeMCU ESP8266 development board comes with the ESP-12E module containing NodeMCU has 128 KB RAM and 4MB of Flash memory to store data and programs. Its high processing power with in-built Wi-Fi / Bluetooth and Deep Sleep Operating features make it ideal for IoT projects.

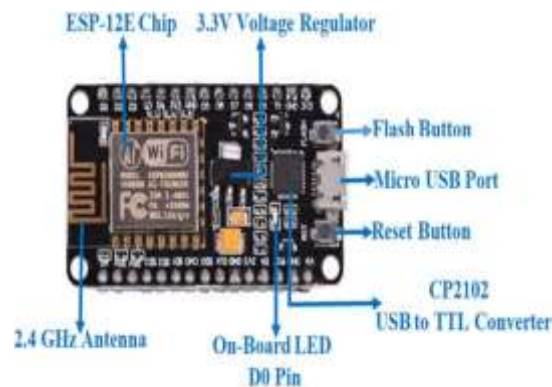


Figure 3: Nodemcu ESP8266

Advantages

- prevent any external energy theft
- online monitoring due to IOT
- SMS notification.
- Accuracy in meter reading.

- Improved security.
- Helps in successfully controlling energy use.
- Wastage of energy is avoided.
- Meter reading can be accessed from anywhere on the globe at anytime.
- Customer pay bill monthly

Applications

- Accessing information is easy for customer from energy meter through IoT.
- Theft detection at consumer end in existent time.
- Energy consumption units and temperature is display on LCD.
- By using remote server disconnection of service.

Conclusion

The Internet of Things-based Smart Energy Metre assists with online energy monitoring, giving us access to real-time power usage data and enabling us to continuously monitor our consumption. We receive precise readings and reasonable electricity bills because it removes the possibility of human error, processing delays, and electricity theft. IOT enables the direct data exchange between the metre and the utilities, turning it into an automated system that provides better service quality and faster response times while requiring less manual labour. This lowers labour costs and gives us additional financial advantages.

Future Scope:

This project can be further improved to increase the performance in the future. The improvements needed to be included are:

- Show the meter reading of the energy usage for every appliance that being used at the time.
- By the production of the hardware design will clearly shows the complete function of the system. Therefore, the code used must be more efficient, properly modified and the development of the hardware-based prototype must be suitable for the system.
- With current technologies, it is not impossible to do mobile banking service for Prepaid Electricity Meter System. This service will help a user who tends to make their life routine easily. In addition, make the system send the SMS to the user via mobile when the amount of the electricity in critical balance (80% used).

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