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Energy meter monitoring system using IoT

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ABSTRACT
We can monitor the energy consumption of the energy meter using the Blynk application through our smartphone. In addition, Battery was used as a backup power supply, and as an optional feature, we can receive notification if there was an overconsumption of energy. This cutting-edge technology, in conjunction with the Internet of Things (IoT), can also be used to apply Artificial Intelligence (AI) to a manual system. Adaption of an automatic systemsuch as a smart energy meter that helps to manage energy efficiently as a new impression. Thissystem uses ESP3266 as a microcontroller within a built Wi-Fi module to communicate with anIOT platform like the Blynk application. This sample design uses a smartphone application interface with Blynk to track daily, weekly, and monthly energy consumption and deliver notifications to the smartphone, promoting energy conservation.

KEYWORDS- Energy meter, Blynk application, Backup power supply, Internet of Things (IoT).

INTRODUCTION-
It is possible to monitor power consumption with Power Meter. Users are informed about how to avoid high bill expenditures and power consumption. They will show the amount of units used and communicate the data to both the electricity board and the consumers in order to eliminate manpower meter usage. Individual users can monitor their power consumption at any time and from any location. We can monitor information even on non-android mobile phones [7]. Interaction between android phone and meter is done using GSM [1]. Home appliances can be switched on/off through the Internet of thinking using relay and Node MCU interfacing. The mobile phone can cut on/off power from anywhere. The major goal of this system is to keep track of the total amount of electricity consumed and the amount of money that must be paid. Both the distributor and the consumer will gain if total power usage is reduced. [2].

PROPOSED SYSTEM-

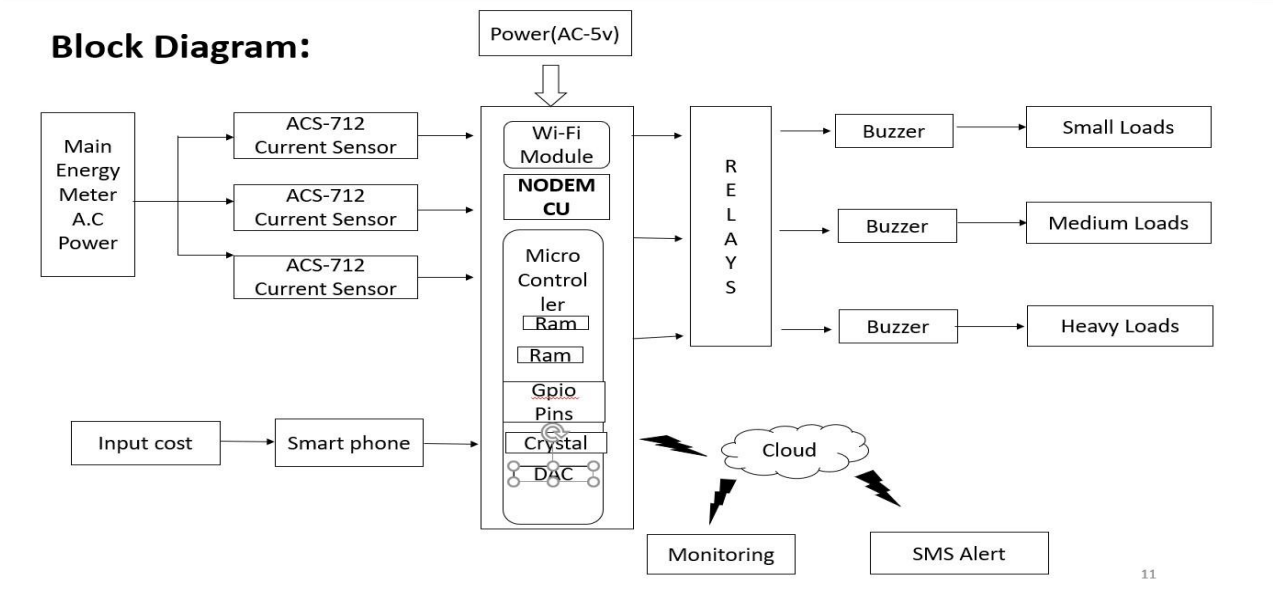

Figure.1. Block diagram of smart energy meter

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- Electric power consumption in each residence can be monitored using a single-phase Electrical power meter. In this paper, the hardware and schemed circuit diagram is shownin fig below [3].
- Components used are Nodemcu (esp8266) as microcontroller board with inbuilt Wi-Fi modules, Nodemcu Base Board,2 channel Relay Modules, ACS-712(10Amp) Current sensors, Buzzers, 230/12v DC Adaptors, Connecting Wires, Electrical Gang Box.

There has been a lot of previous study in the subject of smart energy management devices and smart meters. Users may check their electricity usage using this smart meter. Using the IoT platform via a smartphone application provides a comprehensive energy billing system that runs on autopilot, saving time and money. [4-5]. Smart meters, on the other hand, are not yet available in India. In otherstates, the system is fully operational, allowing researchers to conduct research and propose a smart meter based on a completely dependable method. For optimal energy management, it is both efficient and safe to use.

Previous research recommended using a Blynk application on a smartphone to operate a wirelessly linked appliance and monitor power use [8]. The Blynk application's energy monitoring mechanism, as a microcontroller, the system combined with a Nodemcu, conduct real-time visualization of electricity data.

A bill measurement that allows a person to look at their own energy usage using a smartphone. The wireless technology has been presented by another researcher. Nodemcu is used to measure and operate smart home meters. Created for wireless data reading and transmission Nodemcu technology is used in the network, and the internet is accessed via the computer. Nodemcu is a microcontroller. This document provides an overview of a little word on the easiest way to control the light by using the smartphone [6].

Based on previous research, another smart meter approach is to use the Blynk application to display data using a smartphone as a monitoring device for electricity usage, a way to calculate the electricity cost using the Indian currency tariff [9]. The system was constructed using an ESP8266 NodeMCU. The application, as well as the current sensor that was used to measure thecurrent flow of current to the power meter Its system has been modified. It was created as a new technique for tracking data. Use of electricity via a web server, as a result, data on electricity usage may be accessed. As previously stated, the smartphone. Proposed smart meter for energy monitoring system a more effective energy management system. As a result, this paper was written to demonstrate a smart meter that is based on a system that allows the user to use a smartphone, they may keep track of their daily electricity usage program and warn them when their energy usage is excessive.

METHODOLOGY-

In this paper, the Hardware prototype connection and circuit diagram are shown in Fig below. Esp8266 is a microcontroller board with an inbuilt wi-fi module, ACS-712 current sensors, 230/12v DC Adaptor, Buzzers, Connecting wires, Electrical Gang Box, and Nodemcu Base Board.

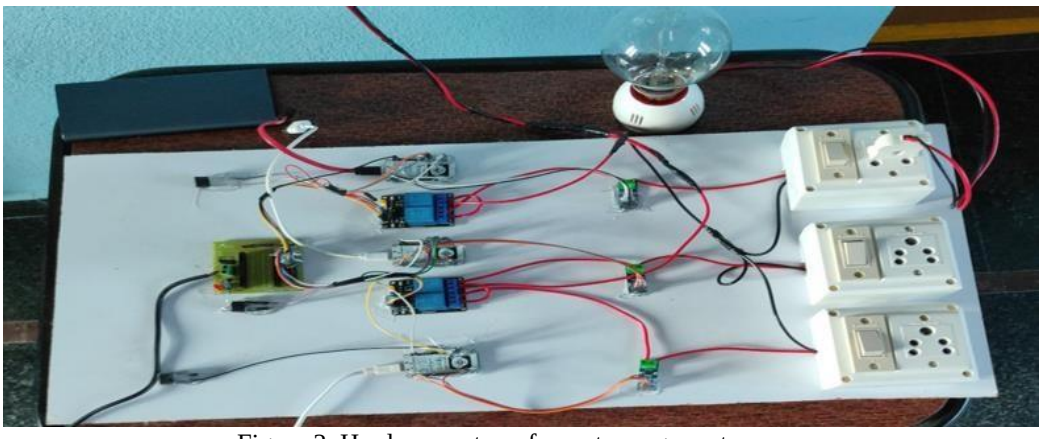

Figure.2. Hardware setup of smart energy meter

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With the help of Arduino software(IDE) nodemcu (esp8266) microcontroller board is programmed. Nodemcu board is connected to AC and voltage sensor to recognize voltage and current. Two-wires connections phase and neutral wires are connected to the single-phase homepower supply with 240V AC to the distribution board.

Whenever the residual current circuit breaker (RCCB) detects the current is not balanced it acts as a switch that is connected to the load it trips or disconnects the connection. With RCCB main

distribution board (MCB) plug points on the nodemcu distribution board are connected which act as a main operating switch for the connected load to the main electric supply.

The 240/12V DC adaptor is connected between the main supply and microcontroller. That converts the 240 V single-phase AC power supply to 12v DC output to the microcontroller. First,it will convert 240V AC to 5V DC then there will be an internal step-up DC-DC converter whichwill convert 5V DC to 12V DC. The resultant output voltage of 12V DC is given to the microcontroller.

Conversion of the energy into cost-

To obtain the power average, multiply the RMS current by the RMS voltage value from that thepower average formula is

$P_{AV} = I_{RMS} * V_{RMS}$

In kilowatt-hours, the energy measurement used to compute electricity bills is equal to power. Pin watts (W) multiplied by the number of hours used in hours divided by 1000 in kilowatts

$E_{kwh} = P_{watt} * t_{hours}/1000$

Cost is calculated by the energy consumed multiplied by the tariff value.

Blynk Application Features-
By double-clicking the app's icon on the smartphone, the Blynk app is launched. The Blynk app has a number of tools that help users keep track of their electricity usage. It includes value display and labelled value widgets for data visualization from data sensors., as well as a notification widgetwhere users can be notified via notification when their electricity consumption exceeds the energy consumption limit, Through the Super Chart widget, you can also see a graph of average energy consumption over time. One button notifies you of excessive energy consumption, while the other notifies you of battery backup usage. The Super Chart widget was used to depict the graph of average energy use over time, which is located at the bottom of the main interface.

Figure.3. Power monitoring system monitoring in smartphone

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Aside from analyzing power statistics on a smartphone, the recommended solution also includes a Blynk notice, which sends users a notification to remind them to conserve electricity. A flow chart depicts two conditionals for Blynk notification.

Total 3 conditions were used one for sending a notification, one for the buzzer, and the other forbreaking the circuit. When power consumption crossed 100watthour then there will be a notification for our smartphone and if it crosses 150watthour we can hear a buzzer sound and a text message that we crossed the limit. When we reached the limit 450watthour the circuit will break and the system will reset.

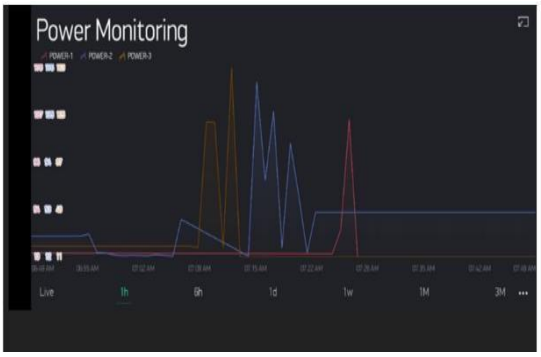
RESULTS

Figure.4. Smartphone notifications

Furthermore, if there is a power outage, users will receive a Blynk message. In this event, the battery will be used to provide backup power, and a notification will be sent to the users' smartphones informing them that the battery backup has been used. The Fig below shows an example of Blynk notice when energy surpasses the energy threshold level and consumption level, as well as the utilization of the battery as a backup power supply.

CONCLUSION

From the perspective of the end-user, the Internet may be a mode of communication that is both readily available and affordable. Android phones and Android apps have already become a part of everyday life. As a result, combining those technologies will make life easier to understand and quantify. Combining technologies like cloud computing, which aren't new to the industry, with the Internet of Things (IoT) can boost the system's potential to a greater level. It's the house or domestic activity automation.



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The planning, implementation, and functional validation of an upgraded Smart Energy meter with IoT-based support for integration in smart settings such as Smart Homes and Smart Cities were discussed in this study. This suggested system uses a concentrator-type architecture to interface with an internet server to report on the events that have been recorded. The system includes a Web-based interface for monitoring the network of operational devices, as well as real-time event notification, a siren, and circuit termination when the power exceeds the defined limit.

Smart meters help you figure out when you're using the most energy and how much it's costing you. They eliminate the volatility of anticipated invoicing, guaranteeing that you only purchase exactly what you need. Installing Smart meters has resulted in cost savings for a few smaller families.

We are aware of this. Smart meters have only been around for a short period, and only about 35% of UK houses have one installed. A smart meter provides automatic meter readings to your supplier as well as displaying on an in-home display how much energy you're using, where, and when. This assists you in managing your energy consumption as well as paying anticipated costs. These systems will be used in this manner. Installing it in our country will cut power usage and save resources for the future.

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