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# Smart Energy Meter using IoT

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**Abstract:** *A smart energy meter is an advanced device developed to monitor and manage the energy consumption and other parameters efficiently with the help of Internet of Things (IoT). It provides an effective way to transfer the information of energy consumer wirelessly as well as it provides to track of the usage of the electricity the main intention of this project is measure electricity consumption in home appliances and generates the bill automatically using IoT. The smart energy meter will be able to do real time monitoring, generating accurate bills, reducing the losses and unnecessary errors due to human interference. This improves efficiency of the system and also of the smart grid effectively.*

**Keywords:** Smart Energy Meter, Internet of Things, Smart Grid, Accurate bills

## I. INTRODUCTION

The energy consumption can be monitored by using an electric device called energy meter. The cost and the regular usage of Energy consumption are informed to the user after the high bill usage. The Energy meter shows the amount of units consumed and transfers the data to both the customer and to the utility company (MSEB) so this helps in reducing man-power. The user can check their Power usage/ Energy consumption from anywhere and at any time. The IoT is used to Turn on/off the household appliances using relay and Arduino interfacing. The objective of this system is to monitor the amount of electricity consumed. The distributer and the consumer both will be benefitted by eventually reducing the total power consumption.

## II. LITERATURE SURVEY

We identified this topic through research papers of smart grid system through which we realised that energy meter is also an essential part of the system. Future energy grid needs to be implemented in a distributed topology that can dynamically absorb different energy sources. IoT can be utilized for various applications of the smart grid consisting power consumption, smart meter, electric power demand side management and various area of energy production. In this way, we got our project topic “Smart energy meter using IoT” about IoT, internet of things as an emerging field and IoT based devices have created a revolution in electronics and IT in Electrical devices. The main objective of this project is to create awareness about energy consumption and. efficient use of home appliances for energy savings. Due to manual work, existing electricity billing system has major drawbacks. This system will give the information on meter reading, power cut when power consumption exceeds beyond the specified limit using IoT.

The Arduino ESP 32 micro-controller is programmed toper form the objectives with the help of Wifi module. It is proposed to overcome all the disadvantages in the already existing energy meter. All the details are sent to the consumer’s mobile through the IoT and the Wifi module and it is also displayed in the LCD. It is a time savings and it helps to eliminate the human interference using IoT. “Smart Energy Meter Using IoT” that energy Consumption is the very important and challenging issue. Automatic Electrical Energy meter is used in large electric energy distribution system. The integration of the Arduino WIFI and SMS provides the system as Smart Power Monitoring system. Smart energy meter provides data for optimization and less power consumption. IoT can be utilized for various applications of the smart grid consisting power consumption, smart meter, electric power demand side management and various areas of energy production.

In this paper, the Smart Energy Metering (SEM) is explained as the main purpose of SEM is necessary for collecting information on energy consumption of household appliances and monitor the environmental parameters and provide the required services to home users. We demonstrated “Arduino based smart energy meter” that removes human intervention in meter readings and bill generation thereby reducing the error that usually causes in India. The system consists the provision of sending an SMS to user for update on energy consumption along with final bill generation

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along with the freedom of reload via SMS. The disconnection of power supply on demand or due to pending dues was implemented using a relay. The system employs GSM for bidirectional communication. Aboli [1] proposed "smart meter using IoT" on efficient energy utilization plays a very vital role for the development of smart grid in power system. Hence proper monitoring and controlling of power consumption is a main priority of the smart grid. The energy meter has many problems associated to it and one of the key problems is there is no full duplex communication to solve this problem, a smart energy meter is proposed based on Internet of Things. The smart energy meter controls and calculate the consumption of energy using ESP 32, a Wi-Fi module and send it to the cloud from where the consumer or customer can observe the reading. Therefore, energy examine has been by the consumer becomes much easier and controllable. This system also helps in detecting energy loss. Thus, this smart meter helps in home automation using IoT.

Revati [2] proposed AMR approach for energy saving in Smart Grids using Smart Meter and partial Power Line Communication" on the raising demand of energy. Smart meters are one of the proposed solutions for the Smart Grid. In this article, an AMR solution which gives detailed end-to-end application. It is based on an energy meter with low-power microcontrollerMSP430FE423A and the Power Line Communication standards. The microcontroller includes an energy metering module ESP430CEl. Revati., [2] presented "ARM-based Energy management system using smart meter and Web server about a low-cost real-time ARM-based energy management system. An integrated Web Server helps to collect the statistics of energy consumptions, power quality and is to interface devices for load displacement. The device is used to access the information.

In this way it is possible to manage the power consumption of the power system leading to a consumption of power. Aboli.,

[1] explained "Design and implementation of Bluetooth energy meter" described around the year 2004, digital meter has started to replace the electromechanical meters in Singapore. A wireless digital power meter would offer greater convenience to the meter reading task. Bluetooth technology is a possible wireless solution to this issue. The power reader can collect the power consumption reading from the energy meter wirelessly based on Bluetooth. Two methods that can retrieve the meter reading with little human intervention, are added and implemented in the targeted applications, they are Automatic meter reading (AMR) and the Automatic polling mechanism (APM). Some commercial applications are applied for the Bluetooth-enabled energy meter.

## III. PROPOSED METHODOLOGY

The smart energy meter monitoring system is shown in figure 1. The block diagram consists of Dual channel Relay, Arduino (Energy Meter), Current sensor, Voltage sensor, Voltage regulator, WIFI module, and IoT.

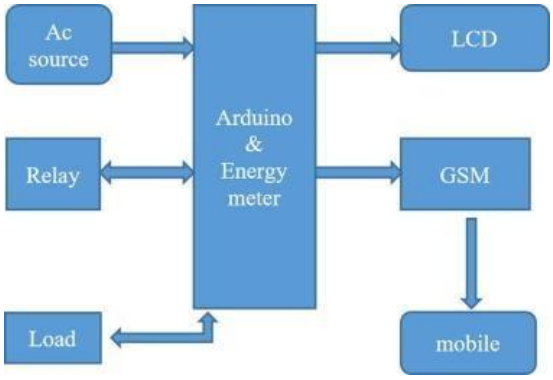


Fig.1: Block Diagram Of Smart Energy Meter Fig.1 Smart energy meter Energy meter used here is clamp. Microcontroller reads these parameters and send it to the cloud. Node MCU is a Wi-Fi device which has a microcontroller in it. This connects the local router through IoT.

The status of these parameters can be obtained through mobile or laptop. WIFI is used for data communication. WIFI is configured with Arduino.

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The Data from the Energy meter is sent to Arduino and to WIFI module and it reaches the user's mobile phone.
In this system the user can switch on/off the mains or home appliances from their Android smart phone app. The WIFI module trans and receives the data from cloud and sends to Arduino and the Arduino controls the relay to switch on and off the circuit of the home [8-9].

*Dual channel Relay*

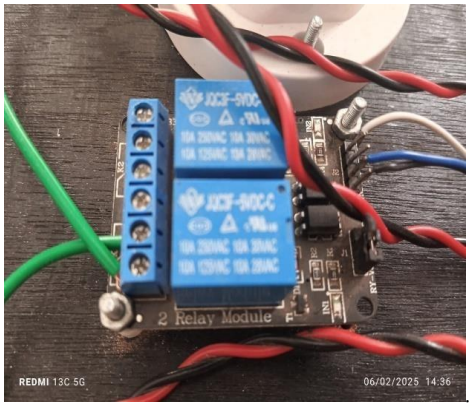


*Fig.2: Dual Channel Relay*

Relay is the three terminal high voltage (NC, C and NO) devices which connect to control. Relay also has three pins with low voltage (ground Vcc and signal) which connect to the Arduino. Relay is a 120-240 switches are connected inside to an electro magnet. must not be used. Other font types may be used if needed for special purposes.

*Arduino (Energy meter)*

Arduino (Energy meter) is used for measuring the energy utilized by electric load. The energy is the total power consumed and utilized by the load at a particular interval of time. It will measure all the parameters like Voltage, Current, Power, Power Factor.

*Current sensor (ACS712)*

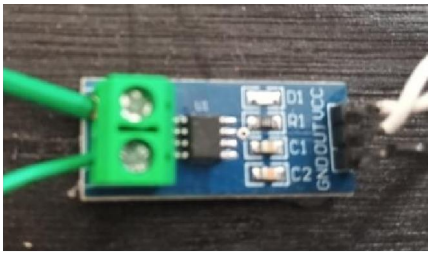


*Fig.3: Current Sensor*

Current sensor is used for measuring the current utilized by the electric load

*Voltage sensor (ZMPT 101)*

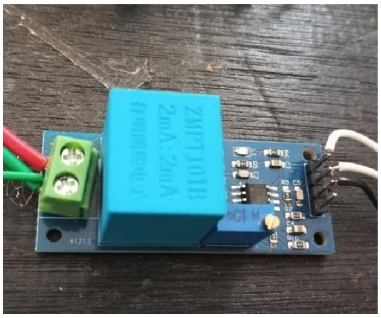

*Fig.4: Voltage sensor*

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Voltage sensor is used for measuring the voltage utilized by the electric load.

*WIFI module*

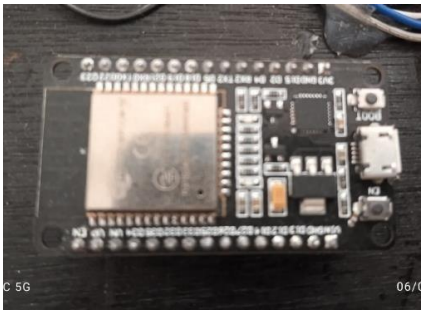

*Fig.5: WiFi Module*

Wi-Fi module delivers highly integrated WI-FI solution to meet users for continuous demand of efficient power usage.

*Internet of Things (IoT).*

Internet of Things (IoT) links anything from anywhere in the universe. It communicates with almost everything around the world. The communication can be a control signal or identified data from this world. It is a common internet data communication and is communicated in different ways. The Internet of Things (IoT) collects the data of automated objects and helps the machine learn where it needs. The data is stored in cloud and sends to the energy meter to switch on/off objects.

*Final Hardware*

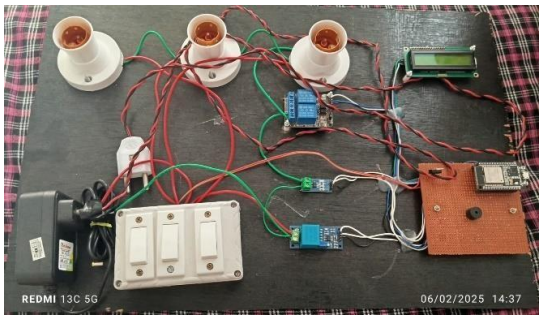


*Fig.6: Project*

The PIR sensor used in this hardware setup senses the human motion and Arduino information. It sends signal to relay and relay will cut of the power. The system operated through software application which consists of API read, read will interact with the user. Thing Speak is an open source application and API to store and retrieve the data.

## IV. DIFFERENCE BETWEEN SMART ENRGY METER & CONVENTIONAL ENERGY METER

| Feature | Smart Energy Meter | Conventional Energy Meter |
|---|---|---|
| Reading Method | Sends readings automatically to the electricity company. | A person must visit and take the reading manually. |
| Billing | Allows real-time billing and prepaid options. | Bill is generated based on manual readings. |
| Monitoring | Shows real-time electricity usage on a mobile app or display. | Only shows total electricity used over time. |
| Control | Electricity company can turn power on/off remotely. | Needs a worker to visit for connection or disconnection. |
| Power Saving | Helps manage and reduce electricity waste. | Does not help In power saving. |
| Cost | Costs more initially but saves money in the long run. | Cheaper to install but lacks advanced features. |
| Smart Features | Works with smart grids and home automation. | Cannot connect to smart systems. |

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## V. CONCLUSION

"A Smart Energy meter is like a smartphone which updates us with the all information related to our energy consumption, billing and about every minor detail which is necessary to know about."

## REFERENCES

**[1].** "Smart Energy Meter By Using and Monitoring System and using IoT' By Naziya Sulthana, Prakyathi N Y, Rashmi N.

**[2].** "A smart home energy consumption monitoring system integrated with internet connection" by Ganta N., M. Srujana.