

Electricity Energy Meter using IoT

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Abstract - Demand for electricity usage increasing. Manual distribution and maintenance of electricity requires more human resources, which leads to fault and delay in every stage. To provide consumer needs, computerization of distribution and billing required. In the manual billing process, the consumer should stay for a minimum of one month. Sometimes incorrect reading is also noted because of individual faults. To focus on the raised issues, we have evolved an IOT based energy meter. Electricity energy meters installed in consumer's house or offices to measure electricity consumption. At the end of every month, many of the people get worried about the enormous electricity bill and they have to read at the electricity meter once in a moment. But what if anybody can monitor electricity used from anywhere in the province and take an SMS/E-mail when electricity consumption shows a threshold value? We have developed an IOT based project of the Energy Meter. In this energy meter using ESP8266 Wi-Fi module which cannot only sends an SMS/E-mail of electricity bill but still can observe the power uses anytime and from anywhere by utilizing an application. IOT based energy meter gives Intimation after completion of one month about the bill amount, and still it will give a website for the user in processing the bill. If any delay in payment by the user, the power will get off after the given fixed time duration.

1. INTRODUCTION

This approach is one of the rising fields for the paid service providers. The concept becomes so attractive. Because it takes so many interests. The works like electricity, gas, water, telephone etc., are nowadays privatized. We cannot restore these service items from the customer, so the approach of electricity meter reduces the risk and enhance profitability. Also, the bill collection infrastructure is unnecessary, which intern improves the efficiency of the service providing companies? Initial energy meter appears in the manual form by receiving advance deposits but now because of the revolution of IT and electronics industry the manual recharging process replaces with automatic recharging. Recharging methods can be wire based like telephone line and also by using wireless technology like radio and blue tooth communication. The Energy meter is designed with a smart technology using Node MCU and the recharging by some method of communication. It is depends on IOT concept, Node MCU collect the readings from the energy meter and this data will be saved in temporary variable, whenever the days going on incremented from zero to specific date

i.e., 25th day information or units will sent to the cloud then from the cloud user get data in android app. Some action repeated in 28th day and also when the month is completed automatically power is off and information will be renewed in the operation at the same time user can get text message notification.

2. LITERATURE SURVEY

Wireless Automatic Meter Reading System:

The wide proliferation of wireless communication propose and explore new possibilities for the next generation .Automatic Meter Reading (AMR) whose goal is to help collect the meter measurement automatically and possibly send commands to the meters. Automation ranges from Connecting to a meter through an RS-232 interface for transmitting the meter measurements all the way from the meter to the utility company via GSM network.

Electricity Online Bill Payment:

The system automates the conventional process of paying electricity bill by visiting the place. The system would be having two logins admin and user login. Admin can view user account details and can even add or updates things in their account. Admin has to feed the system with electricity usage data into respective users account. The system then calculates the electricity bill for every user and updates the information into their account every month. User can then view their electricity bill and pay on the spot before month end. If user is incapable of paying the bill before month end, it then calculates fine for each subsequent day.

Mobile Based Electricity Billing System:

From the beginning of the day, a mobile phone with a route map called Walk Order Map which has the route of houses that he has to cover within a day, will be in use. Whenever a meter is read, the particular meter is indicated with the red color confirming that the reading is already captured. This leaves no room for 'missed' readings especially for novice Meter Readers. Meter readers are not required to do the calculation manually. All that needs to be done is to get the meter reading and send it to the system as bulk. Then the system does the calculation and proceed bills are sent to the relevant consumers via SMS. Importantly, the Meter reader can make complaints then and there whenever a fault is spotted. In such a case, an image of that particular meter can be sent. This option is also provided through the system.

Smart Meters:

The smart meters were introduced in order to avoid manual readings. This process is done by using gsm module. Here a threshold value is set and it is designed in such a way that a notification is sent when the power limit exceeds. Similarly a SMS is sent to the mobile indicating that you have crossed the threshold value. But in this project people can't monitor their electricity bill every time they want, they can only come to know that they have crossed the limit.

Energy Meter Reading Using Bluetooth Technology:

In this project the energy meter will send the meter reading to the Bluetooth device via the microcontroller. The Bluetooth thus transmits the data and sends it to the receiving side which will be indicated on the computer screen. The reading can be sent back after sufficient calculation to the energy meter display via Bluetooth devices. A mobile van or motorbike can be used by the staff to visit a street and it is required to enter only the building code to access all the meter readings of the building. The proposed design involves a microcontroller block that read up to 16 energy meters per building. Then the bill of the individual meter will be generated and displayed on the LCD screen of the microcontroller at the consumer end. This system will provide the readings of each and every meter in a building even if the staff is unable to enter the building.

Gsm Based Energy Meter Billing Using Aurdino Mega 2560:

The main objective of the project is to develop a wireless energy meter. The arduino takes the pulse from the energy meter, calculate units and displays the reading on the LCD. The reading is store in built in EEPROM so at the power failure it continues the calculating reading. The reading of the energy meter is also sent to the cell phone of the user by a message through GSM modem. A relay and relay drive is also used so that if arduino fails or stop working , it automatically discontinued power supply to user and we get the information about it.

Manual Reading using Digital Meters:

The conventional method of this electricity billing involves a person from the distribution unit reading the number of units of electricity consumed in the energy meter, conveying this information to the distribution unit and then preparing the bill according to the units consumed for a fixed amount of time. It involves various tasks like reading, then preparing the bill. Still accuracy cannot be guaranteed as there can be errors in human reading.

3. Proposed Work

Objectives of Project

The objectives of the project are

1. To avoid traditional method of monitoring (manual readings)
- 2 To monitor the power consumption continuously and accurately.
3. Reduces the wastage of power and they can also know about the amount for their consumed power .

Block Diagram

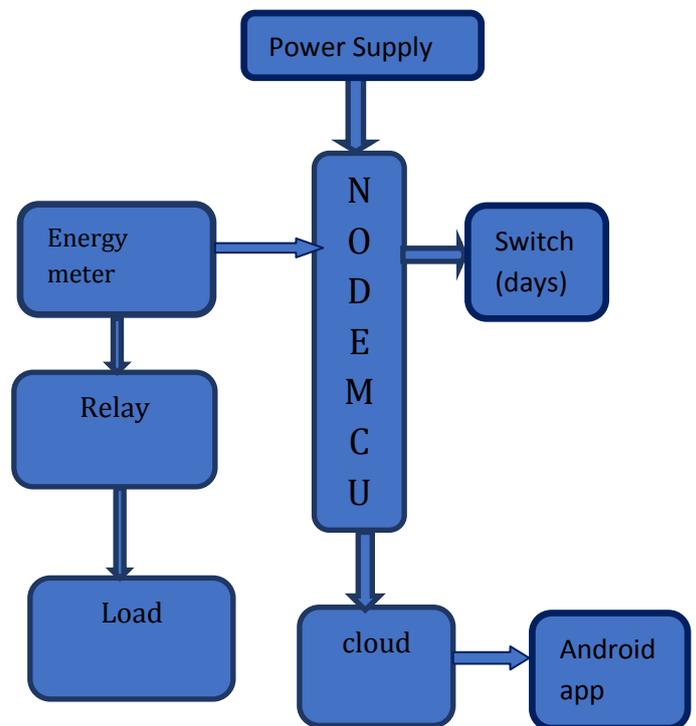


Fig: 1 Block Diagram of Electricity Energy Meter

Energy Meter:

Energy meter is an apparatus that measures the volume of electrical energy absorbed by the load. Energy meters, the direct revenue interface between utilities and consumers, have encountered several advances in the finished decade. Typical mechanical meters are being taken over from with electronic meters to enhance the efficiency in meter reading. The most popular system of measure on the electricity meter is the Kilo Watt Hour [kWh], which is matched to the value of energy spent by a load of one kilo watt over one hour.



Fig : 2 Energy Meter

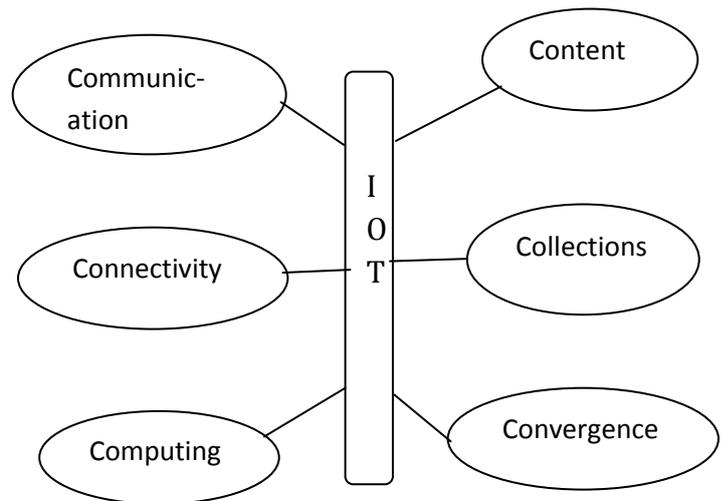


Fig: 3 Services of Internet Of Things

Relay Driver:

Relay is an driven switch. It subsists a set of input terminals for a single or multiple control signals and a series of performing contact terminals. We use relays where it is vital to regulate a circuit by an independent low power signal, or we must govern several circuits by one signal.

The relay section is constructed to operate and drive the relays. The NODEMCU cannot afford much of the current. In routine process, it is preferable to get 60 to 600 micro ampere current from the NODEMCU, as the output to load current is very large and a transistor driver is taken. We construct this driver circuit with an integrated Darlington pair of transistors.

IOT:

The Internet of Things (IoT) is a process concerned to computing machines, automatic systems, digital systems, designs, creatures or humans that over with special identifiers and the capability to move data over a system with no order in human to human or human to computer communication. Internet of things becomes grown owing to various technologies, real time analytics, Machine Learning and Embedded systems.

NODEMCU:

NODEMCU is a low cost open source IOT platform. It initially included firmware which runs on the ESP8266 Wifi module, and hardware which was based on the ESP-12 module. Later, support for the ESP 32-bit MCU was added. NODEMCU is an open source firmware for which open source prototyping board designs are available. The name "NODEMCU" combines "node" and "MCU" (micro controller unit).



Fig: 4 Node MCU ESP8266

Cloud Computing:

Cloud computing is the data repository and computing authority with no setting of operating supervision. It is to express data centres workable for many buyers over the Internet. Enormous clouds have many functions dispersed over many areas from key servers. If the link to the buyer is tight, we may define it as an edge server. Clouds may be restricted to a particular organisation or to many organizations.

4. Implementation of work:

SCHEMATIC DIAGRAM

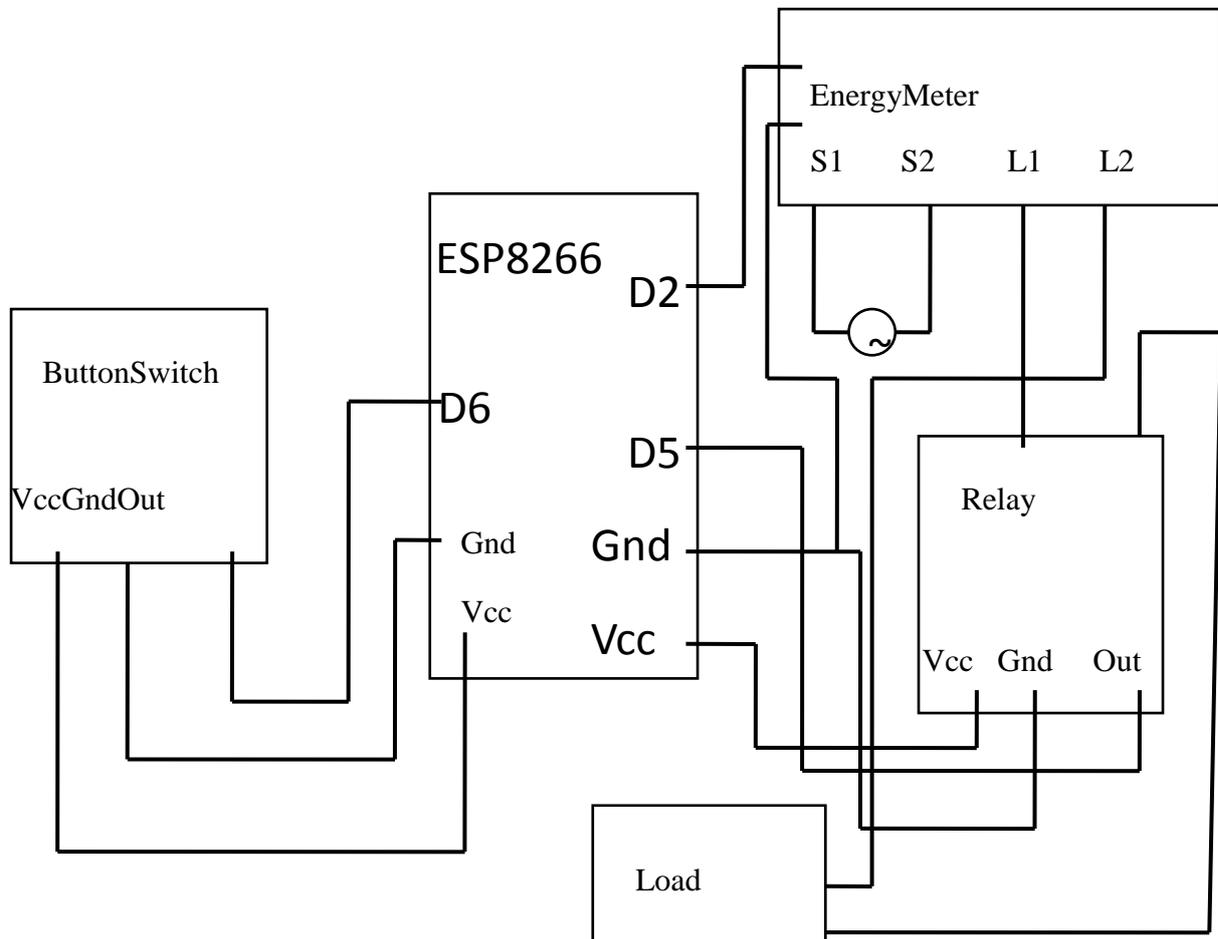


Fig: 5 Schematic Diagram

All the components are connected as per the schematic diagram. As a step of implementation power supply is given to the NODEMCU. When the load is connected, NODEMCU collect the readings from the energy meter continuously and this data will be stored in temporary variable, when ever the days going on incremented form zero to certain date i.e day=25 information or units will sent to the cloud then from the cloud user get data in android app. Its respective amount for units consumed is shown in the android app. Though the app the user get the notification about electricity bill payment. Same action repeated in day=28 also and when the month is completed automatically power is off and again information updated in application at the same time user can get text message notification.



Fig: 6 Prototype Of Electricity Energy Meter



Fig: 7 Energy Meter Android App Result

This android app also known as Energy Meter app. This app is used by the user where the number of units consumed and its respective amount is shown in the app. It also displays the number of days power consumed from day of previous bill payment. User can also know the status of power in home whether it is in ON State or OFF State. Along With this a website is also displayed where user can do online transaction.



Fig: 8 Power Station App Result

This app is known as Power Station app. This is used by distributor person. In this app the number of units consumed by the user and its corresponding amount is displayed along with the status of power.



Fig: 9 Notifications From The App

These are the notifications sent from the app about the payment of bill based on the days condition. This notification contains text information about the bill payment along with some link through which user can pay the bill.

6. Conclusion & Future scope:

This project is operating adequate serve in measuring the electricity. Electricity consumption is intimated at every instant of time and still notification is delivered to contact via SMS. The atmosphere of electricity is

observed from anywhere. The amount of Bill is affirmed every month at the slated date.

This project can be expanded in the following directions:

1. Remote recharging can be implemented through telephone line or wireless network.
2. The protection against the power theft and energy meter tampering can incorporate in this project.
3. A mini printer can be interfaced to get a printed bill or details of billing.
4. Software can be modified to view the balance on request.

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