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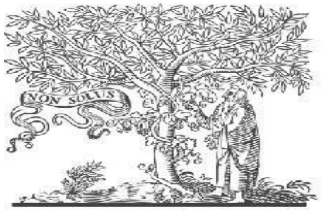

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IOT BASED ENERGY METER READING SYSTEM WITH AUTOMATIC BILLING

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ABSTRACT: The project proposes and analyzes a system which is used for energy meter billing and monitoring. The system is fully Internet of Things (IOT) based and highly desirable in field of energy. In this system consumer can do power management by knowing energy usage time to time. The customer needs to pay the bill on schedule; if couldn't, the electric power connectivity can be turned off autonomously from the distant host. ◦ The project explains the modelling and working of different units of the system and also discussed the basic components and their functions such that IOT and its working, Relay and LCD display and its interfacing with microcontroller.

Keywords *– ARMS (Automatic Meter Reading System), IOT (Wi-Fi) as communication, Real Time Clock (RTC), Arudino IDE.*

1. INTRODUCTION

Energy crisis is one of the major problems that the world faces today. The energy crisis can be reduced to a certain extent by properly monitoring our energy consumption and avoiding energy wastage. Nowadays people face many problems like power theft. Power theft may be a measure crime and it also directly affects the economy of our country. This system will find energy theft easily and send the notification to the user. The energy meters are connected to the PIC Microcontroller through an optocoupler. The optocoupler sensor gives an interrupt each time the meter LED ashes to the programmed microcontroller and microcontroller process this data to the ESP8266 WI-FI module then WI-FI module send this data to the blynk app. This system monitors the kWh readings and billing on LCD and also send this data into the blynk app. This design eliminates the human involvement in electricity maintenance. In this system, a microcontroller is interfaced with an energy metering circuit, current sensing circuit, WI-FI communication and a contactor to make or break power line. In this project we are connecting loads through relay and CT. User can check the energy meter readings into the blynkapp using mobile and isolate the power supply through electromagnetic relay. Here relay works as switch to on/off the power supply which is

connected to the load. The main controlling device of the project is PIC Microcontroller which is programmed by Embedded C language.

An embedded system is a combination of software and hardware to perform a dedicated task. Some of the main devices used in embedded products are Microprocessors and Microcontrollers. Microprocessors are commonly referred to as general purpose processors as they simply accept the inputs, process it and give the output. In contrast, a microcontroller not only accepts the data as inputs but also manipulates it, interfaces the data with various devices, controls the data and thus finally gives the result. The project "IOT Based Energy Meter Reading System with Automatic Billing" using PIC16F76 microcontroller is an exclusive project which is used to monitor and control the energy consumption (KWH READING), billing data into the blynk app and LCD display. This design eliminates the human involvement in electricity maintenance

2. LITERATURE REVIEW

ARM based energy management system using smart meter and web server:

In this paper a low cost real-time ARM-based energy management system is proposed. It is conceived as part of a distributed system that measures the main power system quantities and give the possibility to manage the whole power plant. An integrated Web Server allow to collect the statistics of power consumptions, power quality and is able to interface devices for load displacement. The device is characterized by easy access to the information and the combination of a smart meter and data communication capability allow local and remote access. In this way it is possible to manage the power consumption of the power system leading to an overall reduction in consumption and costs.

IoT Based Electricity Energy Meter Reading, Theft Detection and Disconnection using PLC modem and Power optimization:

This is a PIC16F877A micro controller based design and implementation of energy meter using IoT (Internet of Things) concept. This design eliminates the human involvement in electricity maintenance. The energy meters are connected to the PIC micro controller through an interfacing circuit. The optocoupler sensor gives an interrupt each time the meter LED ashes to the programmed PIC micro controller. The readings of the main energy meter and sub energy meters are compared so as to identify the theft status. Whenever there is discrepancy in the two values, a message that theft has occurred will be displayed in the LCD display as well as in the web page. We can access the web page from anywhere on the globe at any time using the consumer number provided by the supply authorities. So the consumers can easily track their energy usage so that effective monitoring of power consumption is possible. The hardware interface circuit consists of PIC16F877A micro controller, MAX232, LCD display, and optocoupler.

A Review on IOT Based Smart Electricity Energy Meter:

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Diagnosis This Review focus on the design and implementation of IoT based smart electricity energy meter. This design can be eliminate the man power involvement to maintain the electricity. The consumers of electricity need to pay as per the utilization of electricity on schedule, somehow consumers fail to pay, the transmission of electricity can be turned off from the distant server automatically. Energy meter provides provision to the consumers that they can monitor the energy consumption in units by using web page providing device IP address. Energy meter consists theft detection unit will notify company side in the event of meter tempering or theft practice occur in energy meter and also it will send information regarding theft detection by using PLC modem and the theft detected will be displayed on the terminal screen or window of the company side. IoT operation can be performed by Wi-Fi device which sending energy meter data to the web page through the IP address. This smart electricity energy meter consists Microcontroller, LCD display, theft detection unit, MAX232, Triac switch circuit, temperature sensor, PLC modem and Wi-Fi module.

IOT Based Energy Meter Reading:

Due to rapid increase in human population and the human‘s dependency towards electrical energy, the demand for electricity has increased many folds, causing deficit of electrical energy during peak hours. In order to cope up with the energy challenges, it is necessary to modernize the electrical system. Internet of Things (IoT) technology can be employed to energy consumption and distribution in different scenarios. This paper mainly focuses on automatic billing, power card facility, theft detection, power optimization and providing the relevant energy consumption information to user. IOT based smart energy meter system basically consists of three major components namely controller, Wi-Fi and Theft detection device. Whenever there is any theft or fault, the theft detector sensor detects the error and responds accordingly. The controller plays a vital role in keeping all the components in working state. In this system energy meters are connected to the internet i.e., using IoT concept, eliminates the human intervention in electricity maintenance. In the proposed work, IoT based meter reading system is designed to continuously monitor the meter reading and service provider can disconnect the power source whenever the consumer does not pay the monthly bill and also it eliminates the human intervention, delivers effective meter reading, prevent the billing mistakes.

Iof Things (IOT) Based Energy Meter:

We can see a person standing in front of our house from electricity board, whose duty isto read the energy meter and handover the billsto the owner ofthat house everymonth. This is nothing but meter reading. According to that reading we have to pay the bills. The main drawback of this system is that person has to go area by area and he has to read the meter of every house and handover the bills.Many times errors like extra bill amount or notification from electric board even though the bills are paid are common errors. To overcome this drawback we have come up with an idea which will eliminate the third party

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between the consumer and service provider, even the errors will be overcome. In this paper the idea of smart energy meter using IOT and embedded system have been introduced. In this method we are using PIC16f886microcontroller because it is energy efficient i.e. it consume less power, it is fastest and has two UARTS. In this paper, energy meters which are already installed at our houses are not replaced, but a small modification on the already installed meters can change the existing meters into smart meters. The use of GSM module provides a feature of notification through SMS. One can easily access the meter working through web page that we designed. Current reading with cost can be seen on web page. Automatic ON & OFF of meter is possible. Threshold value setting and sending of notification is the additional task that we are performing).

3. METHODOLOGY

The project aim design a smart energy meter monitoring and controlling system using iot based app.

By using this system user can monitor the energy meter kwh readings into the iot based application and calculate the bill accordingly.

Also user can disconnect the power source when they want using blynk APP.

The status of the project will display on LCD module.

This design eliminates the human involvement in electricity maintenance.

OBJECTIVES:

The best remedy for this is not the increase in energy production, but the effective use of available energy. By properly monitoring our energy consumption and avoiding energy wastage, energy crisis can be reduced to a certain extent.

Consumer can monitor their energy consumption, billing into the blynkapp so user can access this data from anywhere on the world.

Energy meter controlling.

Relay can isolate the circuit.

Visible alerts using LCD display.

To turn on and off the load using relay switch.

To achieve this task using PIC microcontroller.

In the proposed technique the customer can deal with their vitality utilization by knowing their vitality use time to time. The strategy not just gives two path interchanges amongst utility and purchaser yet in addition gives different capacities that are if the customer neglects to pay the power charge the vitality supply would be chopped down from the utility side and once the bill is paid the vitality supply is reconnected. In addition with the existing system innovative to include an alert message to the user energy consumed for 15 days once, constant alert message with payments details and power usage until the payment is done.. If there is a fault in e-meter it also sends a notification to the user.

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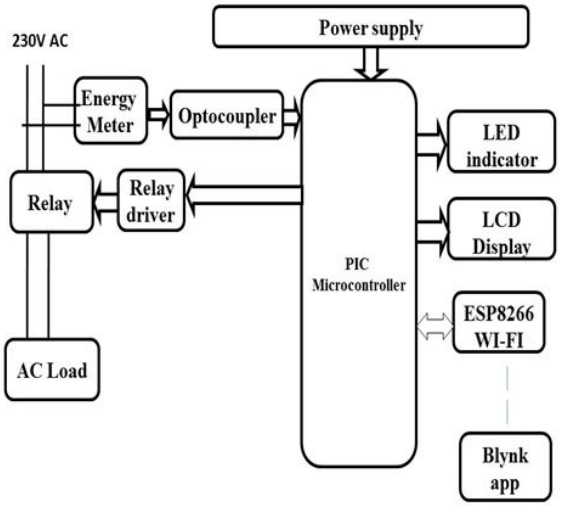

Fig.2: Block diagram

In the above block diagram, the hardware connections of the proposed system are shown. Where PIC microcontroller works as the central microcontroller board .It is a 8 bit microcontroller which consists of an inbuilt crystal oscillator which is used to produce frequency for the timer and a power on reset and brown out reset buttons,. It has 22 input output pins. The regulated power supply board receives 230v input, which is split into three stages—rectification, filtering, and regulation. Through an optocoupler, a 5v regulated power source is sent directly to the pic microcontroller. All of the other hardware parts, including the relay, LCD display, and Wi-Fi module, receive power from this microcontroller.The esp 8266 Wi-Fi module is used to link the microcontroller board to a hotspot-enabled device in order to control, track, and bill the units.

Advantages:

- Energy conservation can be monitored on LCD display.
- Prevent any external energy theft.
- Online monitoring due to IOT.
- Blynk app notification.
- Efficient and low cost design.
- Low power consumption.
- Fast and accurate result.
- The proposed system eliminates the human involvement in electricity maintenance.
- The users can also monitor their energy meter reading online from anywhere on the globe 24*7.

POWER SUPPLY

Power supply is a supply of electrical power. A device or system that supplies electrical or other types of energy to an output load or group of loads is called a **power** supply unit or PSU. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others

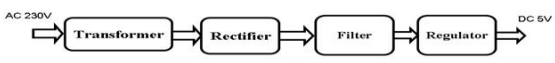

Fig.1: Power supply

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A power supply may include a power distribution system as well as primary or secondary sources of energy such as

- Conversion of one form of electrical power to another desired form and voltage, typically involving converting AC line voltage to a well-regulated lower-voltage DC for electronic devices. Low voltage, low power DC power supply units are commonly integrated with the devices they supply, such as computers and household electronics.
- Batteries.
- Chemical fuel cells and other forms of energy storage systems.
- Solar power.
- Generators or alternators.

Transformers:

A transformer is a device that transfers electrical energy from one circuit to another through inductively coupled conductors without changing its frequency. A varying current in the first or primary winding creates a varying magnetic flux in the transformer's core, and thus a varying magnetic field through the secondary winding. This varying magnetic field induces a varying electromotive force (EMF) or "voltage" in the secondary winding. This effect is called mutual induction.

Rectifiers:

A rectifier is an electrical device that converts alternating current (AC) to direct current (DC), a process known as rectification. Rectifiers have many uses including as components of power supplies and as detectors of radio signals. Rectifiers may be made of solid-state diodes, vacuum tube diodes, mercury arc valves, and other components.

Voltage Regulator:

A voltage regulator (also called a 'regulator') with only three terminals appears to be a simple device, but it is in fact a very complex integrated circuit. It converts a varying input voltage into a constant 'regulated' output voltage. Voltage Regulators are available in a variety of outputs like 5V, 6V, 9V, 12V and 15V. The LM78XX series of voltage regulators are designed for positive input. For applications requiring negative input, the LM79XX series is used. Using a pair of 'voltage-divider' resistors can increase the output voltage of a regulator circuit.

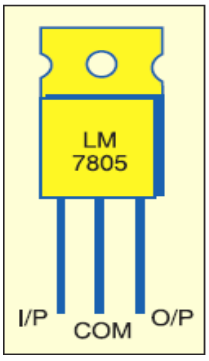

Fig.2: Voltage regulator

LED:

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A light-emitting diode (LED) is a semiconductor light source. LED's are used as indicator lamps in many devices, and are increasingly used for lighting. Introduced as a practical electronic component in 1962, early LED's emitted low-intensity red light, but modern versions are available across the visible, ultraviolet and infrared wavelengths, with very high brightness. The internal structure and parts of a led are shown in figures 3.4.1 and 3.4.2 respectively.

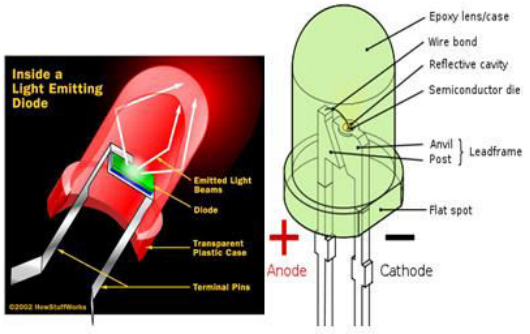

Fig.3: LED

ENERGY METER:

An electric meter or energy meter is a device that measures the amount of electricalenergy consumed by a residence, business, or an electrically-powered device. Electric meters are typically calibrated in billing units, the most common one being the kilowatt hour. Periodic readings of electric meters establish billing cycles and energy used during a cycle. In settings when energy savings during certain periods are desired, meters may measure demand, the maximum use of power in some interval. In some areas, the electric rates are higher during certain times of day, to encourage reduction in use. Also, in some areas meters have relays to turn off nonessential equipment.

Relay:

A relay is an electrically operated switch. Many relays use an electromagnet to operate a switching mechanism, but other operating principles are also used. Relays find applications where it is necessary to control a circuit by a low-power signal, or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits, repeating the signal coming in from one circuit and re-transmitting it to another. Relays found extensive use in telephone exchanges and early computers to perform logical operations. A type of relay that can handle the high power required to directly drive an electric motor is called a contactor. Solid-state relays control power circuits with no moving parts, instead using a semiconductor device triggered by light to perform switching. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called "protection relays".

5. EXPERIMENTAL RESULTS

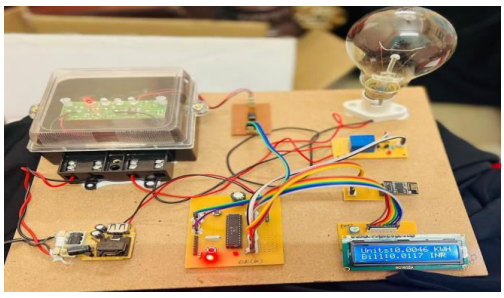

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Fig.4: Output

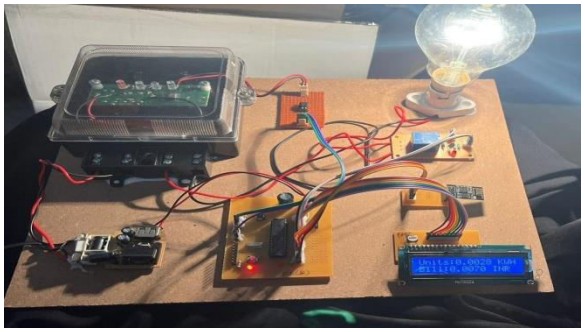

Fig.5: Output

6. CONCLUSION

Integrating features of all the hardware components used have been developed in it. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit. Secondly, using highly advanced IC's with the help of growing technology, the project has been successfully implemented. Thus the project has been successfully designed and tested.

7. FUTURE SCOPE

The performance of the system can be further enhanced by smart metering lie in the areas of data access, billing transparency, energy efficiency, performance and compliance. Analytics and technology unfold more exciting possibilities into the future.

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