

A Smart Home Energy Meter System Using Internet of Things (Iot)

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ABSTRACT: Now a days with the assistance of internet, not only the tactic to send and receive knowledge between individuals, conjointly among the devices while not management (i.e) automatic. this is often called net of Things (IoTs) thought that is employed to use to solve the growing issue of power or energy management. This helps to beat the human errors, labour and reduces the price that provides a lot of potency for the management system of power systems that chiefly focuses on IoT's energy observance. Here, the proposed system is to implement a efficient energy meter system to check energy status through Webpage. It's used to calculate energy meter values and also calculating total amount of energy using per month. Server ends message to user every month bill value and energy status also. This system is fixed amount of unit using per day. This fixing unit level is reached threshold value it will intimate to user.

KEYWORDS: energy meter, sensors, cloud storage, internet of things

I. INTRODUCTION

Enhancement of technology makes the human daily life easier with the help of newly developed smart systems. Due to the rapid development of internet of things technology and smart embedded systems. people are more interested to involve in using the internet of control and observe different types of devices. Internet of things creates an innovative of the technology world with a new era of mature intelligence computing. IoT can be defined as the connection between many kinds of devices like smartphone, personal computer, and tablets to the internet, which brings in the very new kind of communication between things and people and also between things. The key goal of IoT is to control any kind of electric objects or devices around us in a more easy, evocative and smooth manner. IoT helps to improve the prominence of electric devices by confirming cost-effective living with protection, safety, and entertainment. IoT technology is used to come in with a pioneering idea and great growth for smart homes to improve the living standards of life. There is lots of research going on home automation involving IoT. Developed a smart home system high security and low implementation cost using IoT. Proposed an IoT-based home automation using low-cost Android phones in the Indian context.

Developed a system using IoT for power utilization and conservation in smart homes. In this system, they used an image processing system to recognize human activities. N. David. Designed a home automation system that can control different household devices with the help of Wi-Fi and GSM technology. Though there are other researchers are going on, still, there is the scope to improve this home automation system using IoT. In this paper is home automation and energy monitoring system and it is updating energy status to cloud. The Arduino Uno is used to collect energy values from current sensor and voltage sensor. The current value is calculating unit of watts by controller and its update to cloud every one hour using esp8266. Server is calculating total energy value per month and these details is send to users.

II. RELATED WORK

This paper is designed at detailing the structure of internet of things along with the way of its functions. The process of collecting the information from the energy meters with the assistance of sensors and storing them at a central server is termed Automatic Meter Reading (AMR). Raspberry Pi counts the range of pulses detected by lightweight sensing element module. The sensing element is placed on the energy meter. The Raspberry Pi counts the quantity of pulses to calculate the energy consumption in kWh in keeping with the conversion mentioned on the energy meter [1] This technique is employed so as to scale back the burden of the individuals. However, any error or purposeful mistake within the reading will cause vast loss to the ability corporations. Automatic Energy Meter will give an inexpensive and effective answer to the present downside. This additionally prevents the toil getting used for asking. [2] Thus usage of

ARM processor increases the speed and accuracy of the system. In this way the combination of such a smart meter with an appropriate communication infrastructure has provided remote access and feasibility.[3] It's a sensible energy meter for associate automatic and superior metering and billing system. The integration of the Arduino and GSM Short Message Service (SMS) give the meter reading system with some automatic functions that are predefined.[5] It is a terribly high dependability digital energy meter with terribly low value, and it will be observation just like standard energy meter. this technique may also be achieved with fewer complications steps with ESP8266 WLAN module embedded into the meter with the TCP/IP protocol for facultative communications between the meter and net application. the block diagram is contain transmission line, current sensor, relay switch, load, Esp8266, arduinouno and power supply unit. Current sensor is used to calculate current value from transmission line and it is given to Arduino Uno microcontroller. This current values and voltage values are sending to webpage by using esp8266. Every month of billing values are sending to user from server. The power supply unit is used to provide power to microcontroller.

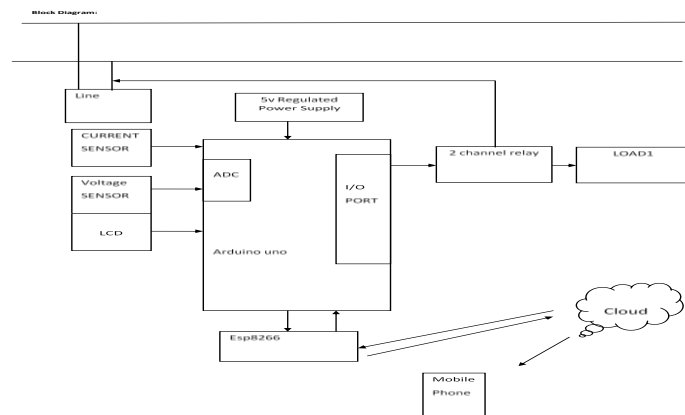


Fig1.architecture diagram

III.HARDWARE COMPONENTS

- Arduino Uno
- relay
- Current sensor
- Voltage sensor
- LCD 16x2

1.Arduino Uno:

The Arduino Uno R3 FrontArduino Uno R3 Back Arduino Uno R2 FrontArduino Uno SMDArduino Uno FrontArduino Uno BackOverview the Arduino Uno is a microcontroller board based on the ATmega328(datasheet). It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2(Atmega8U2up to version R2) programmed as a USB-to-serial converter.

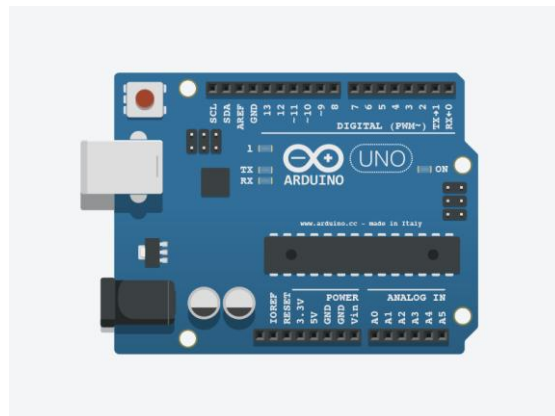


Fig3.1.1 Arduino Uno

2.Relay:

relay is an electromagnetic device which is used to isolate two circuits electrically and connect them magnetically. They are very useful devices and allow one circuit to switch another one while they are completely separate. They are often used to interface an electronic circuit (working at a low voltage) to an electrical circuit which works at very high voltage. For example, a relay can make a 5V DC battery circuit to switch a 230V AC mains circuit. Thus, a small sensor circuit can drive, say, a fan or an electric bulb.



Fig3.2.1 relay

3.Current Sensor:

A **current sensor** is a device that detects electric current in a wire, and generates a signal proportional to that current. The generated signal could be Analog voltage or current or even a digital output. The generated signal can be then used to display the measured current in an ammeter, or can be stored for further analysis in a data acquisition system, or can be used for the purpose of control.

The sensed current and the output signal can be:

- Alternating current input,
 - Analog output, which duplicates the wave shape of the sensed current.
 - Bipolar output, which duplicates the wave shape of the sensed current.
 - Unipolar output, which is proportional to the average or RMS value of the sensed current.
- Direct current input,
 - unipolar, with a unipolar output, which duplicates the wave shape of the sensed current
 - digital output, which switches when the sensed current exceeds a certain threshold
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4.Voltage Sensor:

The Voltage detector block represents a perfect voltage detector, that is, a tool that converts voltage measured between 2 points of an electric circuit into a physical signal proportional to the voltage. Connections + and – square measure electrical preserving ports through that the detector is connected to the circuit. association V may be a physical signal port that outputs the activity result.

5.LCD 16*2:

A **16x2 LCD** means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD.

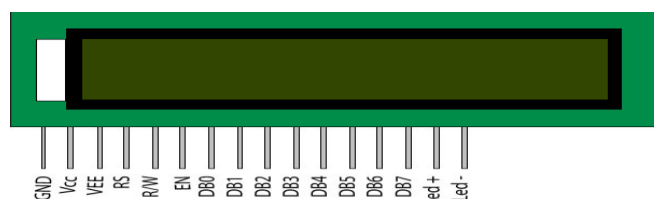


Fig3.5.1 led display

IV. OTHER REQUIREMENTS

1. Cloud Storage:

Firebase is a mobile and web app development platform that provides developers with a plethora of tools and services to help them develop high-quality apps, grow their user base, and earn more Profit. The Firebase Realtime Database is a cloud-hosted NoSQL database that lets you store and sync between your users in Realtime. The Realtime Database is really just one big JSON object that the developers can manage in Realtime. **Realtime Database => A Tree of Values** With just a single API, the Firebase database provides your app with both the current value of the data and any updates to that data. Authentication provides backend services, easy to use SDKs, and



Fig4.1.1 firebase

ready-made UI libraries to authenticate users to your app. Normally, it would take you months to set up your own authentication system. And even after that, you would need to keep a dedicated team to maintain that system. But if you use Firebase, you can set up the entire system in under 10 lines of code that will handle everything for you, including complex operations like account merging. Firestore database can consist of multiple collections that can contain documents pointing towards sub-collections. These sub-collections can again contain documents that point to other sub-collections, and so on. Cloud Firestore is a NoSQL document database that lets you easily store, sync and query data for your mobile and web apps at a global scale. through this may sound like something similar to the realtime database , firestore brings many things to the platform completely different.

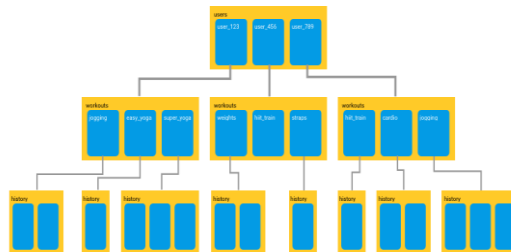


Fig4.1.2 firestore

You can build hierarchies to store related data and easily retrieve any data that you need using queries. All queries can scale with the size of your result set, so your app is ready to scale from its first day itself. By this, I mean to say that in Firestore, you can simply fetch any document that you want without having to fetch all of the data that is contained in any of its linked sub-collections. **Better Scalability** Though Firebase’s Realtime Database is capable of scaling, things will start to get crazy when you app becomes really popular or if your database becomes really massive. Cloud Firestore is based on Google’s Cloud infrastructure. This allows it to scale much more easily and to a greater capacity than the Realtime Database. **Multi-Region Database** in Firestore, your data is automatically copied to various regions. So if one data center goes offline due to some unforeseen reason, you can be sure that your app’s data is still safe somewhere else. Firestore’s multi-region database also provides strong consistency. Any changes to your data will be mirrored across every copy of your database. **Different Pricing Model** the Realtime Database charges its users based on the amount of data that you have stored in the database. Cloud Firestore also charges you for the same, but the cost is significantly lower than that of Realtime Database and instead of basing the cost on the amount of data stored, Firestore’s pricing is driven by the number of reads/writes that you perform. **Firebase Predictions**, Firebase now comes with machine learning, with it uses to analyse your app’s data and create dynamic user groups based on the user’s predicted behaviour. Firebase Predictions can work with Remote Config to increase conversions by providing a customized experience based on each of your user’s behavior. it can work with the Notifications composer to deliver the right message to the right user group. Firebase Predictions can also work hand-in-hand with A/B testing to evaluate the effectiveness of your prediction based strategies.

V.METHODOLOGY

Firestore Cloud Messaging (FCM) provides a reliable and battery-efficient connection between your server and devices that allows you to deliver and receive messages and notifications on iOS, Android, and the web at no cost. You can send notification messages (2KB limit) and data messages (4KB limit). Using FCM, you can easily target messages using predefined segments or create your own, using demographics and behaviour. You can send messages to a group of devices that are subscribed to specific topics, or you can get as granular as a single device. FCM can deliver messages instantly, or at a future time in the user's local time zone. You can send custom app data like setting priorities, sounds, and expiration dates, and also track custom conversion events.

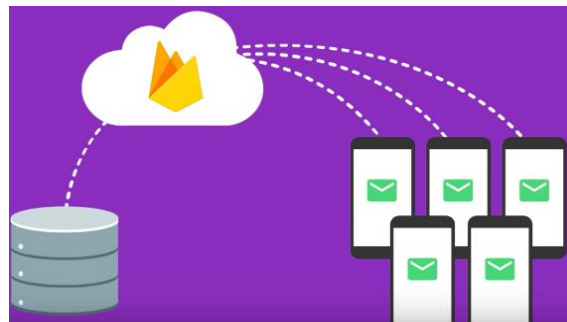


Fig5.1.1 FCM

VI.RESULTS

In this paper is IoT based home energy monitoring system and used to check energy status through webpage. We are calculating the voltage and current status and update to the cloud and Server sends message to user every month bill value and energy status also It will reduce human resource for government.

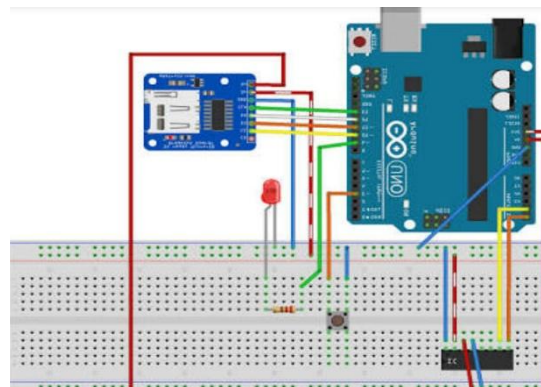


Fig6.1.Arduino Connection

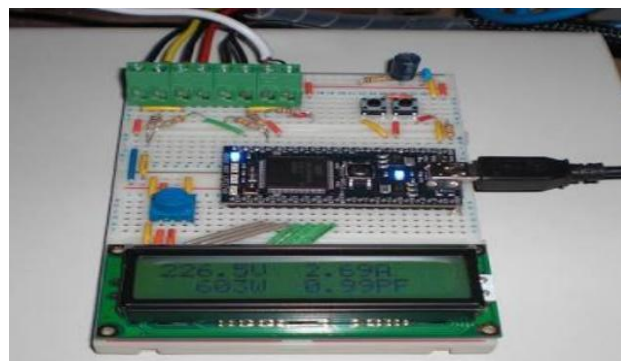


Fig6.2.Led display connections



Fig6.3.final result

VII.CONCLUSION

Using this Project we can reduce the manual efforts to take the reading from energy meter which is low cost effective solution. It reduces the man power and also it is user friendly and we can enhance this project in which an electricity department through the messages automatically sent to the user about the billing information.

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