

WIRELESS IoT ENABLED ARDUINO SYSTEM FOR REAL TIME ENERGY MONITORING AND REMOTE CONTROL

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ABSTRACT

The project aims at developing a system which helps in monitoring the readings from an energy meter and controlling the switching of energy meter. In the proposed system IoT modem, Relay, LCD, tamper switch and energy meter are interfaced to Microcontroller. The microcontroller is programmed such that it sends the energy readings to the authorities by sending information to IoT server as well as The readings are displayed on LCD. The Microcontroller is loaded with intelligent program written using Embedded 'C' language. The modules in the project are: IoT modem for establishing communication between system at house and electricity department, Energy meter which continuously gives usage details, LCD to display current reading of meter, Relay to disconnect the power in case of nonpayment of bill. Excessive energy usage in today's world presents a range of drawbacks. excessive energy use results in elevated utility bills, impacting household budgets and reducing overall financial savings. The IoT Remote Control and Monitoring System is an innovative solution designed to reduce energy usage, enhance user convenience. This system leverages smart technologies to remotely control and monitor various home appliances and devices.

Keywords: Energy Meter, Arduino System, Relay, LCD, Tamper Switch, IoT Modem, Microcontroller

1. INTRODUCTION

Monitoring and keeping tracking of your electricity consumption for verification is a tedious task today since you need to go to meter reading room and take down readings. Well it is important to know if you are charged accordingly so the need is quite certain. Well we automate the system by allowing users to monitor energy meter readings over the internet. Our proposed system uses energy meter with microcontroller system to monitor energy usage using a meter. The meter is used to monitor units consumed and transmit the units as well as cost charged over the internet using wifi connection. This allows user to easily check the energy usage along with the cost charged online using a simple web application. Thus the energy meter monitoring system allows user to effectively monitor electricity meter readings and check the billing online with ease. 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.

2. LITERATURE SURVEY

A practical model of IoT Based Smart Energy Meter. The proposed model is used to calculate the energy consumption of the household, and even make the energy unit reading to be handy. It reduces the wastage of energy and bring awareness among all. A system was developed to solve many problems such as over usage of electricity, large amount of manpower transparency of usage and wastage of money and resources etc. This technology allows

verified customers to check status of electricity usage by using Device identification number and password in real time. This can be done from web application using Internet are designed the system to resort to a local server and database, upon resumption of internet connection, all information are synchronized with the web server. The billing is handled locally by the web server and has not been interfaced with any online payment platform are explained the framework and how it will be beneficial in detecting an unauthorized use of electricity[1]

The relative advantages of the proposed system over conventional systems have also been outlined in the paper provide some enhancement in the conventional Metering system by smart metering[2]

The term Smart Meter is an advanced energy meter that measures consumption of electrical energy providing additional information compared to a conventional energy meter introduced a tamper detect feature for a GSM solution for prepaid energy meter, however this work didnt provide an interactive interface for real-monitoring, access control as well as a robust database[3]

The proposed power monitoring of the consumed energy is one of the main concepts. Once the power is monitored it is sent to the consumer through SMS and a feedback control is taken from the SMS to the microcontroller for the relay control[4]

The presented old meter is made as new smart meter that has an Electronic Meter Automation Device that sends the output data to the webpage and smart app for the real-time monitor of the power consumed. And the feedback control is connected in between webpage and microcontroller for the control of Electronic Meter[5]

The proposed system consists of the digital billing and power consumption on lcd display presented the paper the load is monitored in the web database through the IoT. And the energy management in a demand side is clearly mentioned what are the necessary things needs to be followed[6]

On switching of the on load or off load is made simple. , using Multi-appliance power disaggregation technology implementers implemented the linear detection algorithm to determine which appliances are active in their power contributions. Problems are robust to errors in this database[7]

The cloud computing technology found the solution for efficiency calculation of individual equipment. Using three feedback system, monitored the energy in residential Real-Time. It is critical to the continuing engagement and use of the device to save energy. Residences to determine the feedback provided by real-time energy monitors results in lower residential consumption rates during the 30 days after installation[8]

Using GREEN technology is the smallest Zigbee-compatible node in existence. This technology will possible in every place sensing of a different data types, from energy metering to environmental monitoring[9]

GSM technology implemented automatic power will be reading[10]

Using wifi technology application can develop for Apple and BlackBerry 10 OS, thus providing multiple platform users support[11]

Using IoT technology Photovoltaic cell has been designed in order to optimize and to manage energy flow also works as a home automated device[12]

Through a brief review of the published literature and previously done work, we can say that the researches have done a severe work on the plc power line communication and Internet of Things (IoT). It is concluded from the ken study of their work that in today`s world PLC & IoT based meter could improve the overall efficiency of the existing or present system and could help in examining the unnecessary losses of power in different areas[13]

A real time smart system which enhances the energy conservation and serves as home automation system as well[14]

3. PROPOSED SYSTEM

In the proposed method, the consumer can manage their energy consumption by knowing their energy usage time to time. This method not only provides two way communications between utility and consumer but also provides other functions that are if the consumer fails to pay the electricity bill the energy supply would be cut down from the utility side and once the bill is paid the energy supply is reconnected. Another huge advantage of this system is that it notifies the consumer & utility at the event of the meter tampering. By this information the consumer & utility can control the tampering are reduce energy crises.

3.1 BLOCK DIAGRAM

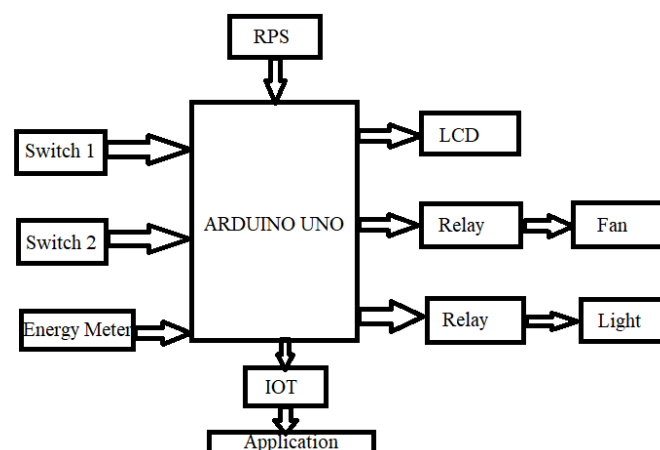


Figure 1: Block Diagram

3.2 WORKING

When the various appliances of the household consume energy the energy meter reads the reading continuously and this consumed load can be seen on meter. We can see that the LED on meter continuously blinks which counts the meter reading. Based on the blinking, the units are counted. Normally, 3200 blinks is one unit. In our project we are trying to develop, a system in which Arduino Uno act as main controller, which continuously monitor energy meter. As per the blinking of LED on energy meter the Arduino will measure the unit consumption. The measured reading with the calculation of the cost will be continuously displayed on web page that we have designed.

Threshold value can be set on webpage with the help of Wi-Fi, as per the consumer's requirement. When the consumers reading will be near about to the set threshold value it will send a notification value to the consumer. This threshold value notification will increase the awareness amongst the consumer about the energy. When the consumer gets the notification he can visit the webpage and change the threshold value. If the consumer is not aware with

the threshold notification, then the meter will automatically get OFF. Then the consumer has to visit the webpage again and increment the threshold value. By the incrementation, the meter will automatically get ON. Finally the overall monthly bill with cost will be sent to customer as well as service provider in the form of text at first day of every month.

The smart meter will monitor by using Arduino nano microcontroller that is ATMEGA328. It maintains 8bit data size, operating range will be 3.3v to 5v. Wi-Fi module (ESP8266) works under six AT commands. Interfacing the Wi-Fi module, liquid crystal display, and meter pulse by using C language on Arduino ID1.6.9. LCD is 2line 16 characters, here providing 5v to activate and then it displays the IP address which needs to connect the Wi-Fi module to send the data to processor. The crystal oscillator is used to convert the digital current signals to alternate current signal which requires maintaining the entire module of energy monitoring system. Load takes 5v power from the power transformer. Energy meter will read the pulse to calculate the amount of consumed power. Here meter pulse will be counted for calculating how much power is consumed by the consumer. One example to calculate the amount for consumed power.

4. CHARDWARE IMPLEMENTATION AND RESULT

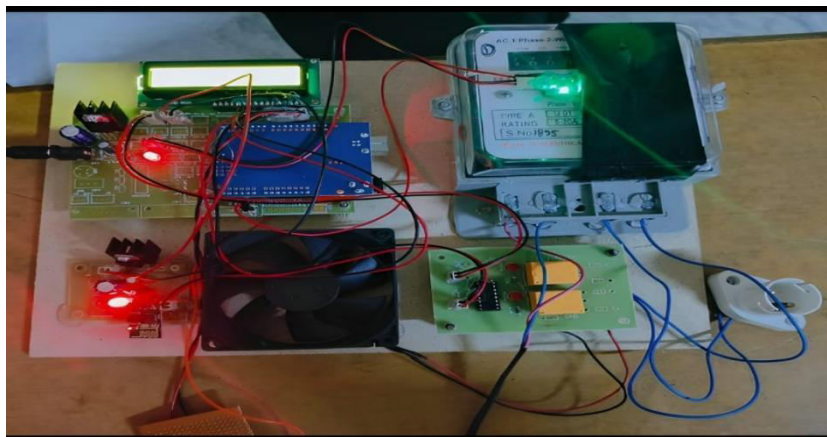


Figure: 2 Wireless IoT Enabled System

In Figure:2 all the components are interfaced to Arduino Microcontroller



Figure: 3 LCD Display

In Figure:3 Display of LCD with Energy units consumed and Amount along with the operation of Fan and Light

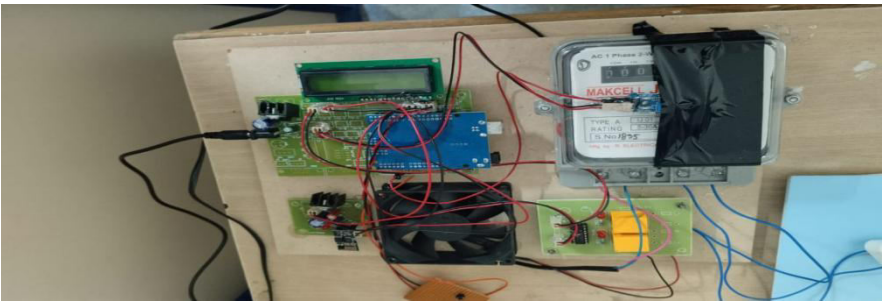


Figure:4 Arduino and Energy Meter

In Figure:4 Display of Fan, LCD, Energy Meter and Arduino in OFF state

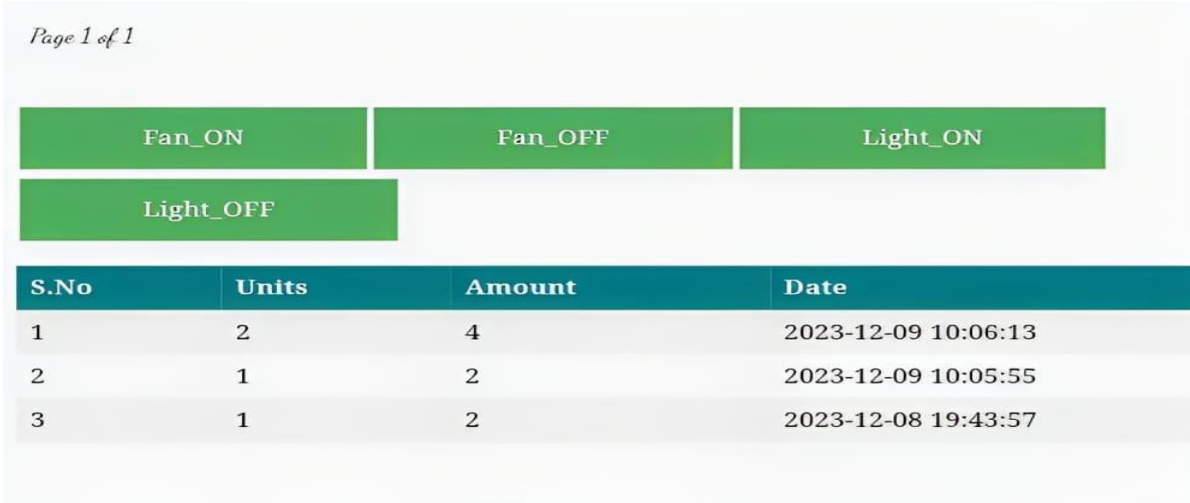


Figure:5 Project Factory Server

In Figure:5 Mobile Output Display of Project factory server through which units and amount is detected

The IoT based smart energy meter monitoring is shown from Fig 8.2 to Fig 8.5. Considering as 5seconds equals to 1day and 1pulses equals 0.1unit power consumption. By taking 4 Rs per unit power the bill for two months will be calculated. unless paying bill the supply line will be disconnected and the amount and units will be displayed.

5. CONCLUSION

We designed and implemented IoT smart prepaid energy meter using Arduino, esp8266 IoT module, LCD, Relay and Load. The proposed IoT based energy meter is easy to install and beneficial for both energy Provider and Customer. This reduces revenue cost and reduces the human errors and problems like over running of the meter etc. This leads to reduction of outstanding dues. The proposed system continuously monitors the meter reading and shut down the power supply remotely whenever the recharged units become zero. It avoids the human intervention, provides efficient meter reading, avoid the billing error and reduce the maintenance cost. In this system, electricity controlled prepaid energy monitoring bill payment system electricity controlled prepaid energy monitoring bill payment system is designed to continuously monitor the meter reading to be handy and transfer the data to a central server which can be accessed from anywhere on the remote place at any time by android app.

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