IoT Based Energy Meter

Mercy George[1], Anumol Joseph[2], Jesbin Jaleel[3], Varghese Issac George[4]

Assistant Professor, Dept. of ECE, MBITS, Kothamangalam, Kerala, India[1]

UG Student, Dept. of ECE, MBITS, Kothamangalam, Kerala, India[2]

UG Student, Dept. of ECE, MBITS, Kothamangalam, Kerala, India[3]

UG Student, Dept. of ECE, MBITS, Kothamangalam, Kerala, India[4]

ABSTRACT: This proposed system describes implementation of energy meter using IoT concept along with an Arduino. The proposed system design eliminates the human involvement in electricity maintenance. The buyer need to pay for the usage of electricity on schedule, in case that he couldn't pay, the electricity transmission can be turned off autonomously from the distance server. The user can monitor the energy consumption in units from a web page that will be updated according to the electricity consumption. Theft detection unit connected to energy meter will notify when power theft event was occurred in energy meter and the supply will be turned off by KSEB.

KEYWORDS: Electricity maintenance, Web page, Power theft.

I. INTRODUCTION

Today the world is facing such an environment data that offers challenges. Energy crisis is the main problem faced by our society. A relevant system to control and monitor the power usage is one of the solutions for this problem. One approach through which today's energy crisis can be addressed is through the reduction of power usage in household. The consumers are increasing rapidly and also burden on electricity offering divisions is sharply increasing. The consumers must be facilitated by giving them an ideal solution: - i.e. the concept of IoT (Internet of Things) meters and on the other hand service provider end can also be informed about electricity thefts using theft detection unit.

This proposed system describe and implementation of energy meter using IoT concept along with an Arduino. The proposed system will eliminates human involvement in finding out any theft that may be caused by the consumer. The theft will be detected by the theft detection unit connected to the energy meter and notifies the KSEB and the supply can be turned off from a distant server. Also our system will help to turn off the power supply while failed to pay the bill. The user can monitor the consumption in units and cost of the consumption by login to a webpage that will updated automatically according to the usage.

IoT based energy meter reading consists of three parts: Controller, Theft detection and Network part. Controller plays a major role in the system. All the information can send through this controller to the other part of the system and it also stores information in it. Network part performs IoT operation in accordance with the Arduino and node MCU [1]. The energy meter connected with theft detection part will send information to the KSEB if any theft happens and automatically turn off the power supply.

II. BLOCK DIAGRAM

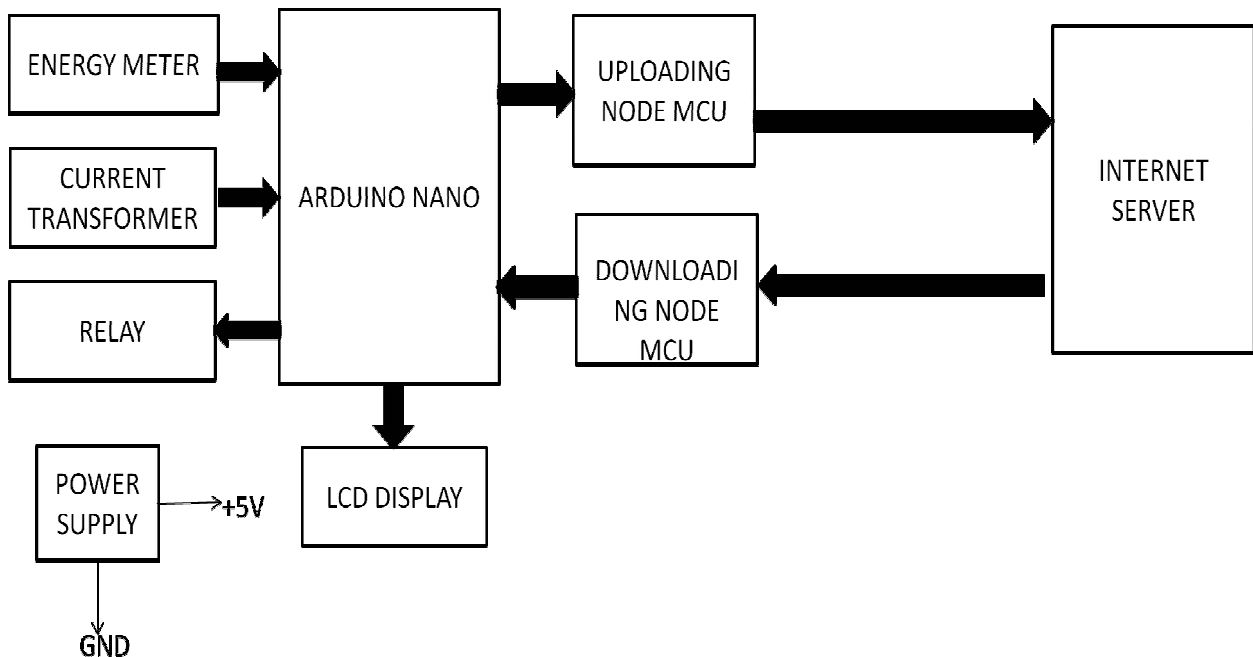The basic block diagram of the proposed system is shown below:

Fig.1: Block diagram

Every house under KSEB section is provided with an energy meter. The reading of an energy meter is based on the rate of blinking of the LCD. When the LED blinks 2300 times, 1 unit of energy is recorded as consumed.

In the proposed system, the energy meter reading is given to an Arduino and it is programmed to calculate the energy consumption and cost of the consumption. There is an LCD display provided in the home section to view the energy consumption in units and cost of the energy consumed. The consumer can also check the details by login to a web page that will be updated according to the usage [3]. If the consumer finds over consumption of electricity, he can control the gadgets working and can be reduce the energy consumption to a desired value.

Whenever an energy theft occurs by the user, the KSEB will get a notification about this. When KSEB receives the indication of theft, the authorities can disconnect the supply. Also the system provides a facility to disconnect the supply by KSEB from a distant server when the user failed to pay the electricity bill [4]. A relay is used for automatic switching. The system should be so programmed that the consumer should not able to control the gadgets once the supply is disconnected by KSEB due to failure in the payment of electricity bill or any theft that may be happen in the consumer side.
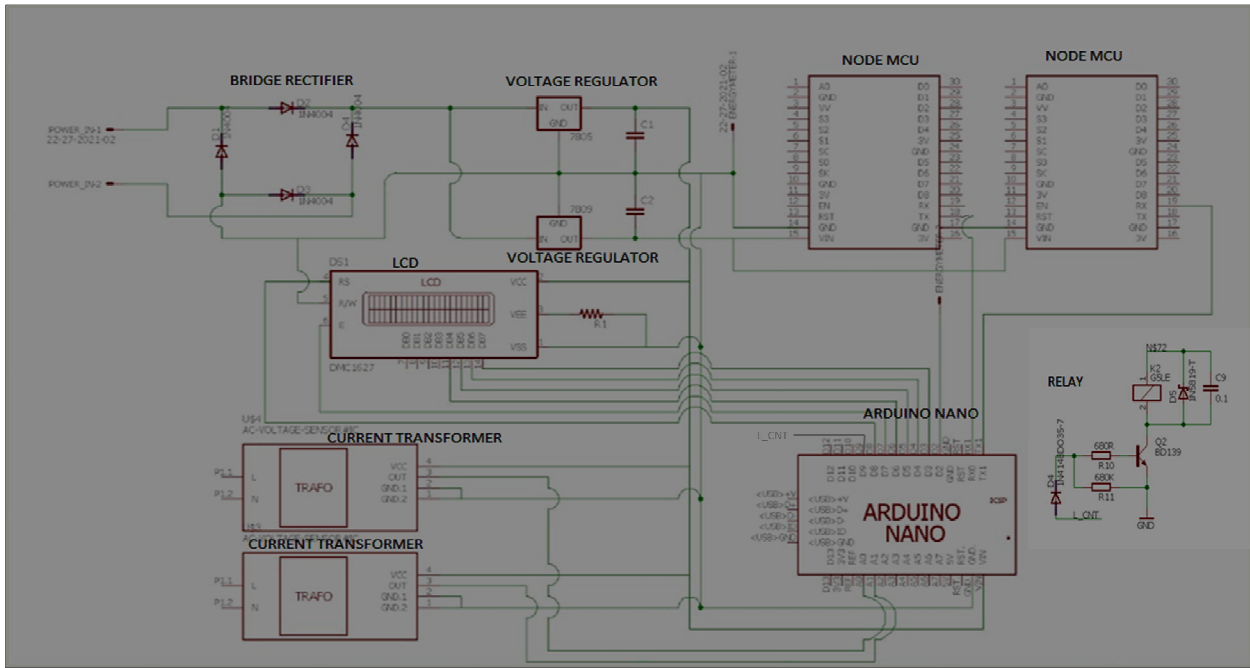
III. CIRCUIT DIAGRAM

Fig.2: Circuit diagram

The circuit mainly consists of 3 sections:

1. Control section or Home section.
2. Theft circuit.
3. Serial communication.

Control section: The energy meter, loads, digital display and power supply constitute the control section. The theft circuit and serial communication end are arranged at the home end. However the main home section is assigned the task of counting the energy meter reading. The digital energy meter shows the blinking and records the reading. Usually the representative from the KSEB visits houses regularly and notes the reading. The current reading and previous reading are compared and the difference is noted as the usage for that specific period. Cost of energy or the electricity bill is calculated based on the tariff.

In the proposed system, energy meter reading is regularly sent to the controller which makes it available on the web page. In the prototype, 3 blinks make 1 unit. A fixed cost of Rs 20 is charged and for each unit used, Rs 1.5 should be paid. The energy meter reading is given to the Arduino and calculations are done by it based on the program. The consumption in units and cost are displayed on the digital display provided. If the consumer fails to pay the bill, the KSEB authorities can disconnect the supply from KSEB through the web page. Once the bill is paid, the supply is reconnected.

Theft circuit: The theft circuit consists of two current transformers [2]. One current transformer is kept near the main supply and another current transformer is kept after the energy meter. The CTs show the amount of current drawn from the distribution system and the current through the energy meter to the consumer's load. If an extra load is powered using the main supply by the consumer, then there will be difference between the current drawn from the distribution system and the current drawn by the consumer load [2]. This energy consumption will not be recorded in the energy meter. Under such a condition, when a change is noticed in the current, the home section load will be turned off. The display will show the indication of theft. Once the supply is disconnected, it cannot be reconnected from the

consumer's end. The reconnection can be done only from the KSEB end. In the web page also the theft will be indicated.

Serial communication: It refers to the process of making the data available through node MCU on the web page [1]. The data from the hardware or the controller Arduino is sent to the node MCU via UART. The node MCU makes everything available on the web page. The relay connected to the Arduino will control the connection and disconnection of the circuit based on the program which is loaded in it. It constitutes the software part of the proposed system and is what makes the system IoT based.
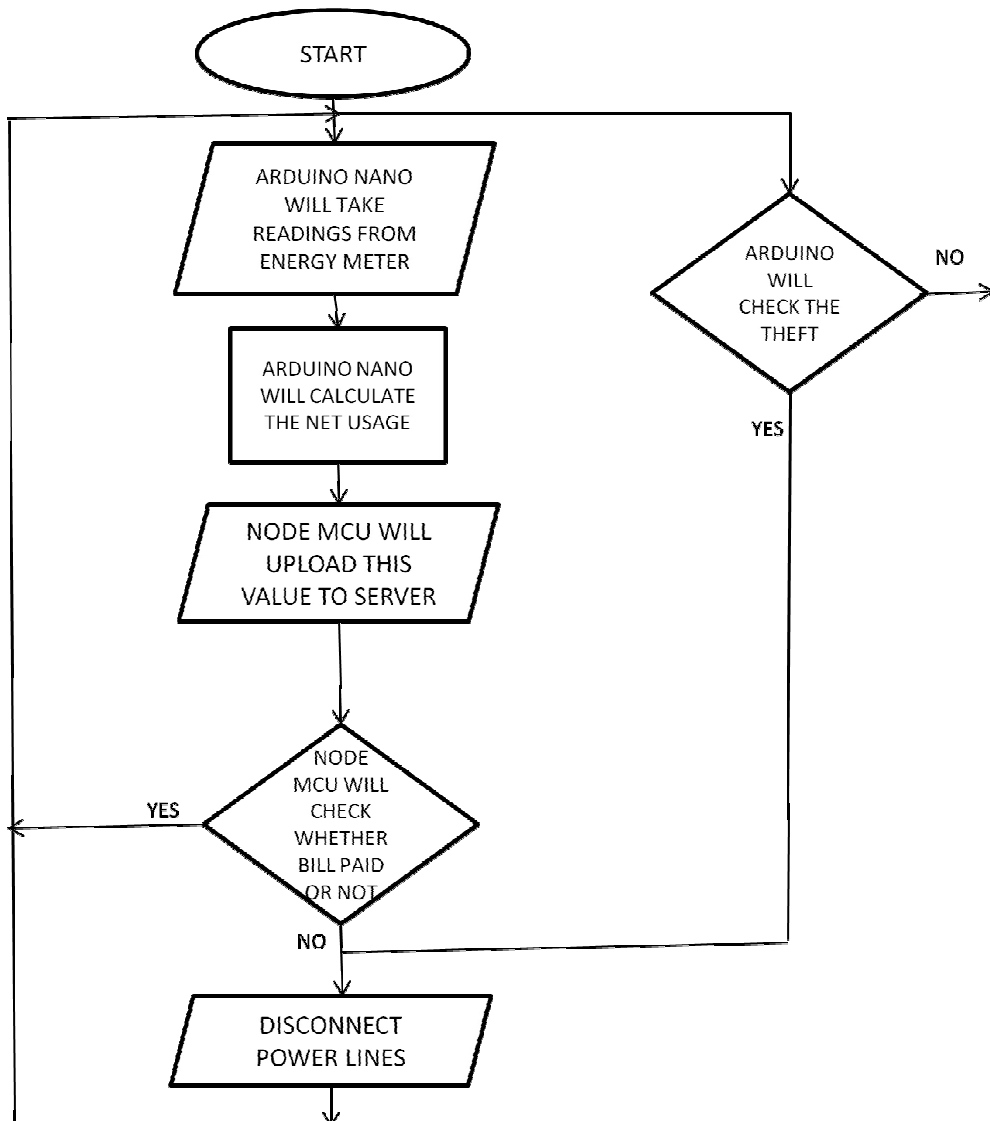
IV. FLOW CHART

Fig.3: Flow chart

The program started and the Arduino nano will take the readings in the form of interrupt. These values are calculated in units when and also calculates the cost of the consumption by the ISR program in the Arduino nano. The node MCU will upload these values to the webpage and it can be viewed by the consumer. In the web page another process happens. It will check that whether the bill paid or not and the node MCU will check continuously for yes or no response. If the bill is not paid, then the power supply will disconnect from KSEB using a relay which is connected to Arduino nano. Otherwise it will continue to take readings and the process repeats. At the same time the Arduino nano will check for any theft which is determined by comparing the outputs of current transformers within the Arduino nano [2]. If the outputs are not equal, then a theft is founded and the relay connected to Arduino nano will disconnect the power supply, otherwise the process is repeating.

V. RESULT AND DISCUSSION

The present system only provides feedback to the customer at the end of the month and how much power is consumed in the form of bill. The consumer has no way to track their energy usage on a more immediate basis. The consumers are growing and malpractices on energy consumption like theft, meter tampering is increasing. Also there is no provision to disconnect the supply from a distant point. In our system consumer can do power management by knowing energy usage time to time. The customer needs to pay the bill on schedule, if he couldn't, electric power connectivity can be turned off autonomously from distant host. Also if any theft is founded, the supply can be disconnected from a distant server. The user can monitor the energy consumption in units from a web page that will be updated automatically according to usage. The bill amount can be checked by the owner anywhere globally and this reduces the manual labour.
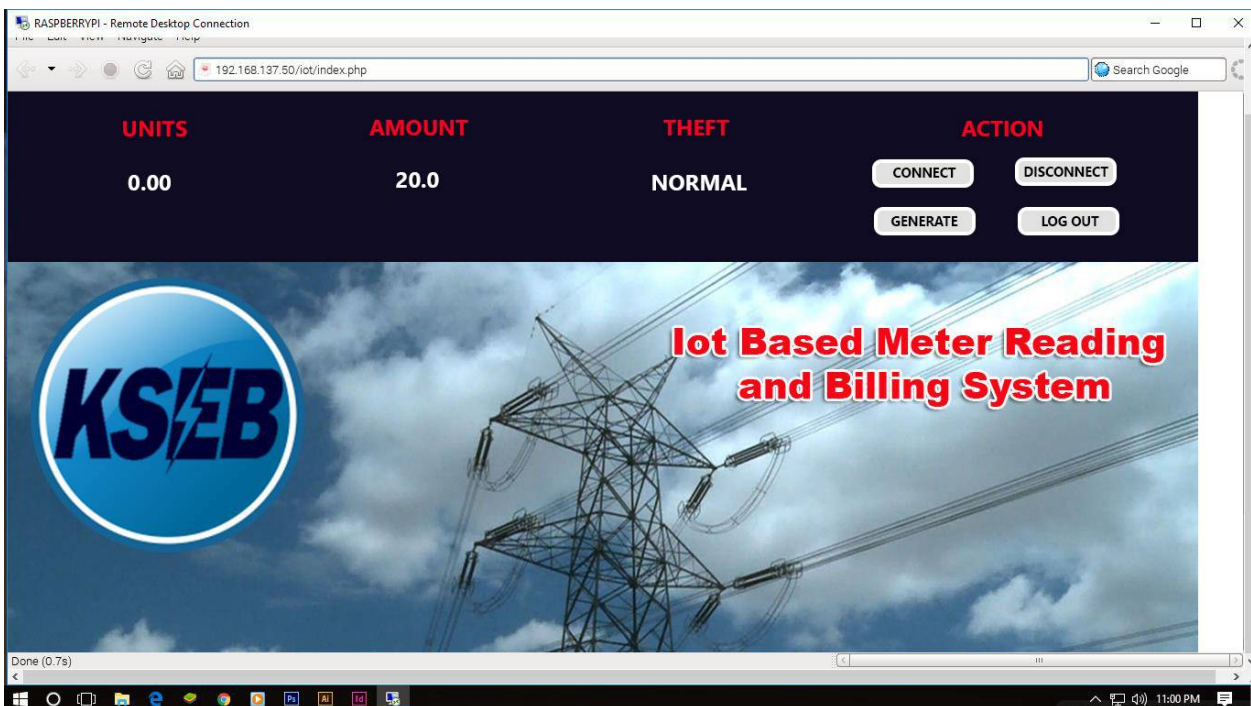
VI. CONCLUSION

The implemented system, IoT based energy meter is designed to continuously monitor the meter reading and service provider can disconnect the power source whenever the customer does not pay the monthly bill and also it eliminate the

human involvement, delivers effective meter reading, prevent the billing mistakes. The theft detection also considered in this system. The performance of the system can be enhanced by connecting all household electrical appliances to IoT.

Future scopes:

- We can make a system where a user can receive SMS, when he or she crosses threshold of electricity usage.
- A mobile application can be developed bringing everything related to consumption and billing into a nutshell.
- We can make an IoT system where a user can monitor energy consumption and pay the bill online.

REFERENCES

[1] Safa.H1, Sakthi Priyanka.N, Vikkashini Gokul Priya.S, Vishnupriya.S, Boobalan.T, "IOT based Theft Premption and Security System", International Journal of Innovative Research in Science, Engineering and Technology Vol. 5, Issue 3, March 2016.

[2] Shubhangi Kadam, Pooja Umarjikar, Anuja Padalikar and Leena Chaudhari, "IoT based automatic energy meter reading and theft detection", International Journal of Contemporary Research in Computer Science and Technology (IJCRCST), Volume2, Issue 3, March 2016.

[3] Pooja D Talwar, Prof. S B Kulkarni, "IoT based energy meter reading", International Journal of Recent Trends in Engineering & R, Volume 02, Issue 06, June 2016

[4] Darshan Iyer N, Dr. K A Radhakrishna Rao, "IoT Based Electricity Energy Meter Reading, Theft Detection and Disconnection using PLC modem and Power optimization", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol. 4, Issue 7, July 2015.