IoT Based Power Consumption Monitoring And Controlling System

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ABSTRACT: Despite many efforts, energy crisis is the present-day problem and it is getting worse day by day. To overcome this situation people are finding various energy efficient resources among them power is the main concern which needs to be monitored and controlled. With the rise in power consumption in every part of the world there is a subsequent rise in power theft and over usage of power. This is a serious problem which is being faced by the power utilities. In this project, a model is designed which aims to control and monitor power consumption of a particular area or sector. The designed model monitors the power consumption of the end users and cut off the power supply when it exceeds the set limit. The device sends the power consumption data to the suppliers blink server using internet of things (IoT) technology. The designed model can be placed before the transmission of the load in each house of that particular area. with the help of the internet accessibility, communication will be possible between end user and supplier. The supplier can monitor and control the power consumption pf the end user from a remote place. Along with that the device sends the notification to the supplier about the status of power consumed and data sheet will be generated.

KEYWORDS: Energy crisis, IoT, WI-FI, monitor and Control, Power consumption.

I. INTRODUCTION

Due to fraud of electricity consumers power utilities lose large amount of money every year. Electricity fraud can be define as a dishonest or illegal use of electricity equipment or service with the intention to avoid billing charge. It is difficult to distinguish between honest and fraudulent customers. Realistically, electric utilities will never be able to eliminate fraud. It is possible, however to take measures to detect, prevent and reduce fraud. Investigations are undertaken by electric utility companies to assess the impact of technical losses in generation,
transmission and distribution networks, and the overall performance of power networks. Every year 20-30 % average line loses according to WAPDA Company's loss more than RS.125 billion. At the time of purchasing the meter according to the requirement of customer the limit of meter will be set; in the same way the limit of transformer is also set according to the consumer requirement of the particular area. If the consumer uses the power beyond the limit of the meter in that case they have to pay the penalty. As many of the consumer's uses the high amount of power which crosses the limit of the transformer at that time the probability of busting of transformer increases. So in this project we proposed a method to overcome above problem this project mainly
focusing on monitoring and controlling of power in the range of limit of the meter. The IoT has recently become universal to highlight the vision of a global structure of interconnected physical objects.

II. SYSTEM ANALYSIS

The main objective of this study is to design and develop a fully functional "Automated Energy Metering and Monitoring System" having innovative capabilities like remote metering, theft detection and controlling the electricity supply to the consumer. The research is about to handle all the information of the consumer regarding energy consumption using a software system. Electricity is one of the essential necessities of human being for their life. It is a non-renewable energy source therefore we must use it judiciously for its sustainable utilization. Data analytics is the process of inspecting big datasets to draw inference about the content of the data. A data analytic platform was used to monitor the data sent by the energy meter so as to calculate the bill and detect the electricity theft. The IoT Data Analytic was used to visualize the status of the meter on the Internet. The infrared sensor senses when the meter has been tampered with, sends signal to the controller and network interface units. The

network module connects the meter to the Internet by first connecting to an Internet-ready WiFi network and subsequently uploads the status of the meter to the Internet. An energy providing company may have several energy meters to be watched and may not be able to effectively monitor the meters at the same time but with the use of a data analytic several meters can be monitored at the same time effectively.

III. PROPOSED SYSTEM

The device sends the power consumption data to the supplier's blink server using Internet of Things (IoT) technology. With the help of internet accessibility, communication will be possible between end-user and the supplier. The supplier can monitor and control the power consumption of the end user from a remote place.
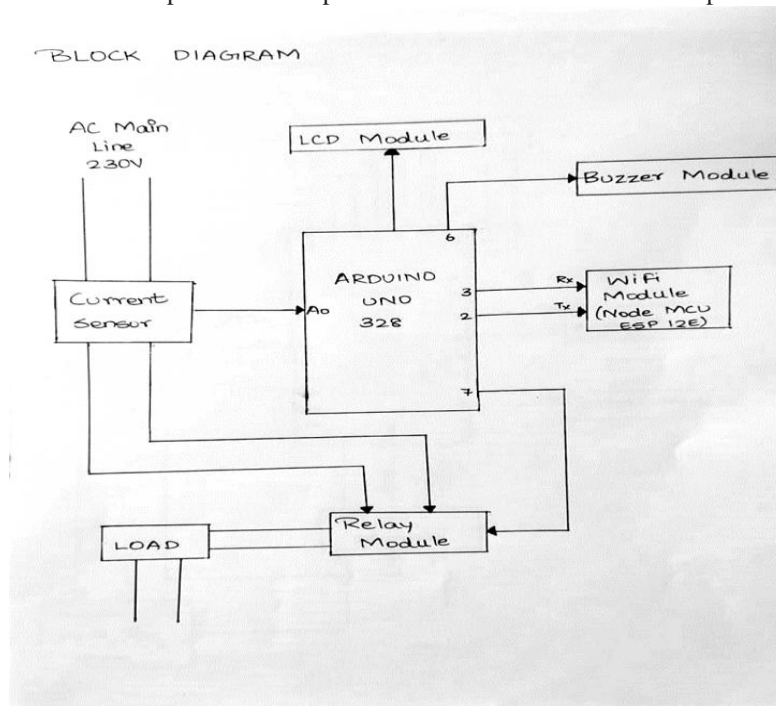

Figure 1 Block diagram

In this project, to reduce the excessive power consumption through IoT based power monitoring system. This system consists of Arduino, Current Sensor, LCD Module, Buzzer Module, Wi-Fi Module, Relay Module, Load. Firstly the power flows through the SMPS circuit. The 230V AC supply is converted to 230V DC with the help of an rectifier. The 230V DC is then stepped down to 48V dc by an step down transformer. Then the IC DK112 step down the 48V DC to 12 DC. IC DK112 is used since it is easy to operate and filters the noise completely.

The power flows through the SMPS and Current sensor to the relay. The incoming current is sensed and the output is given to the Arduino and the relay module.

The RX and TX terminal of the WIFI module is connected with Arduino. A certain limit would be set in the Arduino; if the current exceeds the limit an alert notification will be displayed on the LCD panel with a buzzer making an alert sound. Then the relay module helps in shut downing the power supply of a particular house if the power exceeds the certain set limit.
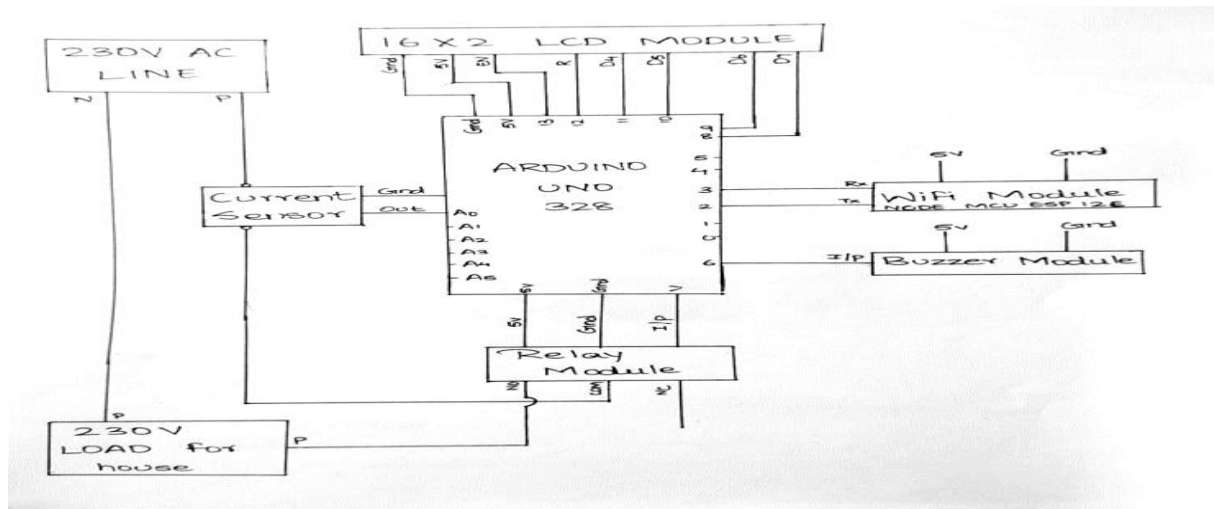
Figure 2 Circuit diagram

IV. WORKING OF PROPOSED SYSTEM

This IOT smart energy meter is directly coupled with 230V ac supply in series with the consumer load and two grid stations. Because this smart meter mostly consists of electronic components therefore 230V AC voltages are stepped down to 6 or 9V ac with the help of step down transformer. After that, these ac voltages are converted into dc through bridge rectifier and then these are regulated to 5V dc though voltage regulator. Microcontroller and LCD display are powered up with this voltage regulator. Microcontroller is the main controller of this IOT smart energy meter. It is programmed in c language with the help of mikro/c software and is interfaced with current sensor, IOT device and LCD display. For the demonstration purpose we have connected two bulbs at output of IOT smart energy meter and this meter relates to two different grid stations.

When we switch on this smart energy meter then this meter switch on the one loads with one grid station. Similarly, when we switched off one grid then this smart energy meter connects the load with another grid station automatically without switching off the load. Means, this smart energy meter switch on the load continuously without any interruption. During this whole process this smart energy meter displays the status of the load on LCD display as well as with, sends the information or status on IOT webpage through WIFI module. Where authorize people can login and can the check status of their loads. Though this webpage authorize person can also set the cost of using energy. When he sets the cost then this meter converts this cost into units and then supply power to consumer against these units after that this meter switch off the power supply. This smart meter also sends the energy theft intimation message on dedicated webpage.

V. RESULTS AND RECORDED DATA

A permanent data is recorded in the excel sheet in the form of date, time and power consumption of the particular area. From this data the authorized person exactly determined the power consumption from the remote place and to analyse the power consumption of the whole area. When the user exceeds his limit of power consumption, the power will cut offautomatically. Sensor which is placed at the left side of the Arduino deducts the current usage. The ground of the current sensor is connected to the ground of the Arduino. The output pin of the current sensor is connected to A0 (Analog pin) of the Arduino. The sensed output of the current sensor is given as the input to both the Arduino and the relay module. The RX and TX terminal of the WIFI module is connected with Arduino. A certain limit would be set; if the current exceeds the limit an alert notification will be displayed on the LCD panel with a buzzer making an alert sound. With the help of WIFI module the supplier and the consumer will tend to know about the status of the power consumed. WIFI acts as a bridge between both the consumer as well as the supplier. The relay module helps in shut downing the power supply of a particular house if the power exceeds the certain set limit. The usage of every consumer in the region or sector is sent to the blink server. Supplier will be notified about the power consumption of

the entire region or sector. The supplier can monitor and control the power usage of the user as well as the entire region. The power consumption data sheet of the entire region is generated and analysed. If the generated data is provided to the customers, they can compare their usage with the data sheet. So this will help to identify the fraudulent user who is stealing the user's power by direct hooking method.

TABLE1 RECORDED DATA 1

WATT	UNIT	PRICE	DAYS	LogDate	LogTime
60.00	33.00	59.00	33.00	3/22/2021	3:35 PM
60.00	34.00	62.00	34.00	3/22/2021	3:35 PM
60.00	35.00	65.00	35.00	3/22/2021	3:36 PM
60.00	36.00	68.00	36.00	3/22/2021	3:36 PM
60.00	37.00	71.00	37.00	3/22/2021	3:36 PM
60.00	38.00	74.00	38.00	3/22/2021	3:36 PM
60.00	39.00	77.00	39.00	3/22/2021	3:36 PM
60.00	40.00	80.00	40.00	3/22/2021	3:36 PM
60.00	1.00	0.00	1.00	3/22/2021	3:44 PM
60.00	2.00	0.00	2.00	3/22/2021	3:44 PM

TABLE 2 RECORDED DATA 2

| WATT	UNIT	PRICE	DAYS	LogDate	LogTime
60.00	3.00	0.00	3.00	3/22/2021	3:45 PM
60.00	4.00	0.00	4.00	3/22/2021	3:45 PM
60.00	5.00	0.00	5.00	3/22/2021	3:45 PM
60.00	6.00	0.00	6.00	3/22/2021	3:45 PM
60.00	7.00	0.00	7.00	3/22/2021	3:45 PM

VI. ADVANTAGES

- It helps reduce the extra cost of monitoring and provides enhanced productivity at an advanced level.
- IoT is widely adopted in the energy industry due to its effective functioning and energy consumption.
- Accessible at anytime from anywhere which makes energy saving easier.
- Remotely switch OFF excess power usage.

VI. CONCLUSION

Energy monitoring through the internet is easy. It gives the real power consumption as well as accurate reading. Also, it requires fewer labour and less time to monitor the energy. It can transmit the data to the utilities and also can receive information from utilities. After two months electricity bill will be paid otherwise supply line will be disconnected through the internet. After two months validity for alert purpose buzzer will be ON. It is easy to know the two months validity. By making this thing the energy will be monitored. The future scope will be on PC side one

server software is required for automatic data collection. We proposed an idea for monitoring the consumption of electrical energy by household electrical devices and controlling the unnecessary loss of electrical energy by combining IoT and Block chain technologies. A smart meter which constantly monitors electricity consumption of devices is designed. An android application which is used by the user to set the limit value is developed. Using the android application, the consumer can also view the total amount of electrical energy currently consumed by the appliances. The consumer is also provided a notification alert when ninety percentage of the specified threshold value is reached. Using this information, the consumer may either extend the threshold value or takes precautions to control the electricity. The two reading from the android application and the smart energy meter is stored in a database using blockchain technology. These values are compared and if the energy consumption exceeds the limit set by the user, the device will be turned off or switched from normal mode to power saving mode. The main disadvantage of the proposed system is the need for Internet to provide communication among the electrical devices. The project was experimented by the use of a single electric bulb. In future the work is extended to monitor and control many electrical devices thus developing a fully-scaled IoT system containing number of IoT devices, whose energy consumption will be continuously monitored thereby conserving electricity for future generations.
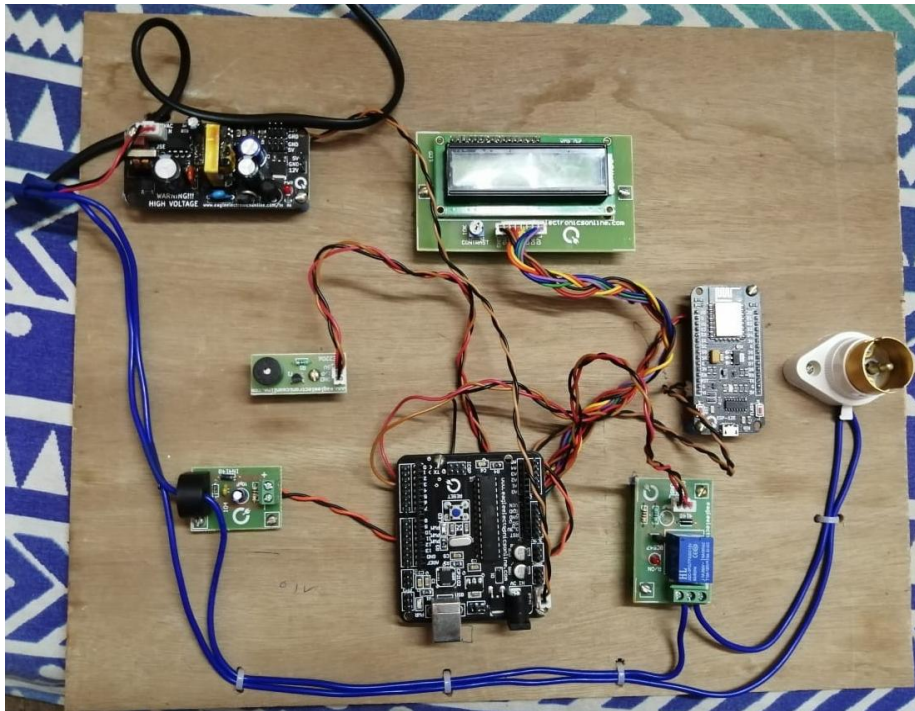
REFERENCES

[1] Ajeeba A A, Anna Thomas, Risa Rasheed, 2017, IOT Based Energy Meter Reading, Theft Detection and Disconnection, International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056 Volume: 04, Issue: 04, p-ISSN: 2395-0072.

[2] Arango, L.G., Deccache, E., Bonatto, B. D., Arango, H., Ribeiro, P.F., Silveira, P. M., 2016,Impact of Electricity Theft on Power Quality,IEEE 17th International conference on Harmonics and Quality of Power (ICHQP),electronic ISSN: 2164-0

[3] Ashna.k,Sudhish N George, 2013, GSM Based Automatic Energy Meter Reading System with Instant Billing, IEEE Automation, Computing, Communication, Control and Compressed Sensing (iMac4s), Electronic ISBN: 978-1-4673-5090-7.

[4] B.Saikiran, R.Hariharan, 2014, Review of methods of power theft in Power System, International Journal of Scientific & Engineering Research (IJSER), Volume 5, Issue 11, 276 ISSN 2229-5518.

[5] G. L. Prashanthi, K. V. Prasad, 2014, Wireless power meter monitoring with power theft detection and intimation system using GSM and Zigbee networks, IOSR Journal of Electronics and Communication Engineering (IOSR-JECE) e-ISSN: 2278-2834,p- ISSN: 2278-8735.Volume 9, Issue 6, Ver. I (Nov - Dec. 2014), PP 04-08.

[6] Harsha Khandel , Suchitra Pandey , D. Reynolds , 2017, A Review on IOT Based Power Theft Detection and Control Systems, International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering Vol. 5, Issue 9.