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IOT Based Smart Electric Meter

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ABSTRACT

Electricity plays a cardinal role in day to day life. The electrical energy consumption in India is the third biggest after China and USA with 5.5% global share in 2016. Due to manual work, our existing electricity billing system has major drawbacks. This system gives the information on meter reading, power cut and the alert systems for producing an alarm when energy consumption exceeds beyond the specified limit using IoT.This idea is being implemented to reduce the human dependency to collect the monthly reading and minimize the technical problems regarding billing process. From the electricity board section, the information regarding the bill amount, payment and the pre-planned power shut down details are communicated to the consumer. If the customer does not pay the bill in time, the user is informed through a message. In the already existing smart energy meter, it shows the energy consumed by the appliances from the date of installation of the energy meter and its corresponding rupees. In this proposed energy meter, the meter gives the energy consumed on daily basis, its corresponding rupees, billing details and payment using IoT. This system not only reduces the power cut issues and the labor cost for noticing the residential energy consumption in regular intervals but also increases the energy conservation with the help of alarm systems and the energy meter accuracy by reducing the billing error and the cost of maintenance.

Keywords—Arduino, GSM, IoT, energy consumption, human dependency, shut down, alert message, payment details, daily basis, alarm systems.

I. INTRODUCTION

Monitoring and keeping tracking of electricity consumption for verification is a tedious task today since manual meter reading and recording is in vogue. It is important to know from the customer view point that if one is charged fairly and according to the need. [2]

Automation of the system will allow users to monitor energy meter readings over the internet in the real-time. [2]

Figure 1. Traditional Meter

As shown in fig1.In apartments, the energy meter is far away from the residents. An LCD display is placed in each residential house in the apartment to inform about the messages regarding the power cut, energy consumption on daily basis, billing details and an alarm for the critical limit indication.[4]

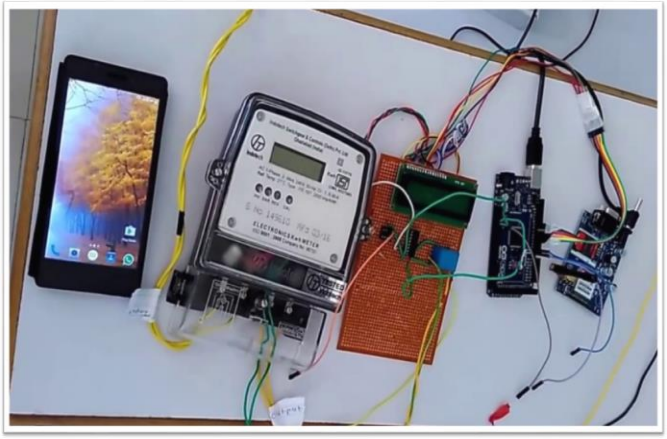

Figure 2. Proposed Iot based Smart Electric Meter

II. METHODS AND MATERIAL

In this section we'll be discussing about Mathematical Model, System Architecture and Data Flow Diagram of this project.

A. MATHEMATICAL MODEL

Let S be the list of modules or the functionalities of the system.

Thus, S is a set: S= {power supply, reading the sensor output, output}.

MODEL 1

Algorithm for power supply

F1: To take input power supply

- Input: providing power supply to voltmeter
- Output: display the current and voltage reading

MODEL 2

F2: calculating electricity consumption and theft detection

- Input: reading from sensor
- Output: consumption of power and theft detection

Steps:

1) Take the reading from sensor
2) compute the bill for current billing cycle
3) calculate difference od home input and power supply.

MODEL 3

F3: sending the detected reading and consumption to consumer

- Input: calculated value of units and theft detection
- Output: sending the computed values to user

Steps:

1) readings are obtained of electricity consumption and difference of meter input and home input
2) if difference meter consumption, then there is electric theft
3) Send the consumption units computed bill and warming if a theft is detected.

B. SYSTEM ARCHITECTURE

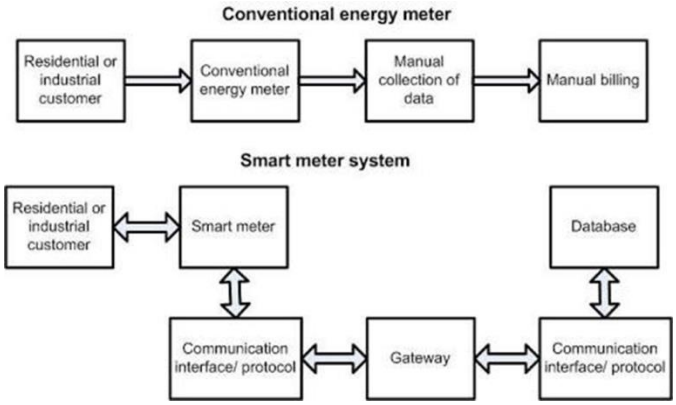

Figure 3. System Architecture

C. DATA FLOW DIAGRAM

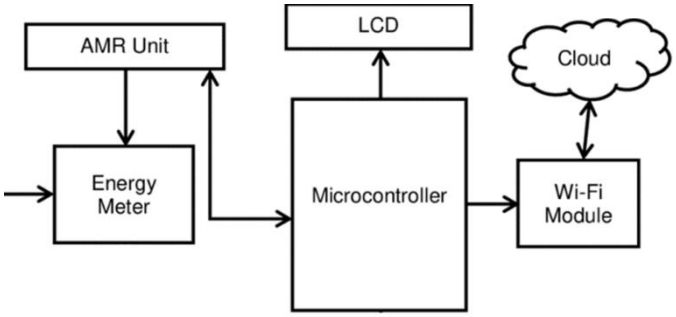

Figure.4 Data Flow Diagram

The goal of this proposed energy metering system improves the customer demand for higher energy as well as by utility. The block diagram consists of an Arduino Uno board, an energy meter, and IoT through Ethernet. This paper presents communication measurement, accuracy, and more timely data. The information of energy measurement can be used by the consumer through Ethernet to send data to the server. The simplified block diagram of the system is shown in Fig 3

III. RESULTS AND DISCUSSION

In this section we've discussed the functioning of the device and the outputs it provides

The experimental setup for the system is as shown in Figure. 2. The ACS 712 current sensor gives precise current measurement for both AC and DC signals. These are good sensors for metering and measuring overall power consumption of systems. The ACS712 current sensor measures up to 20A of AC current.

This project is efficient in reading consumption reading units from the meter and sending them to Arduino which eventually sends them to user.

A. Algorithm

Step 1 : Initialization

In this step module initialization takes place. The system detects the module and other parts which are Wi-Fi module, Electric Meter, Loads.

Step 2 : Inputs and Result Calculation

In this step Arduino device collects the energy meter readings and calculates the consumed power which would be sent to LCD screen and user.

Step 3 : Display of Reading Output

In this step output from Arduino after calculation is sent to display screen and user.

B. LCD Display Outputs

1) LCD Display Screen in idle state

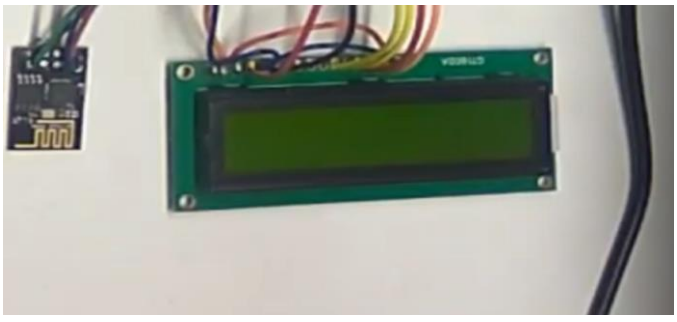

Figure.5 LCD Idle State

Shows the LCD screen in idle .This is connected to the meter and Arduino. This will display all the values of meter reading including current along with the Unit consumed and then bill amount will be displayed here.

2) LCD Display Screen after starting module

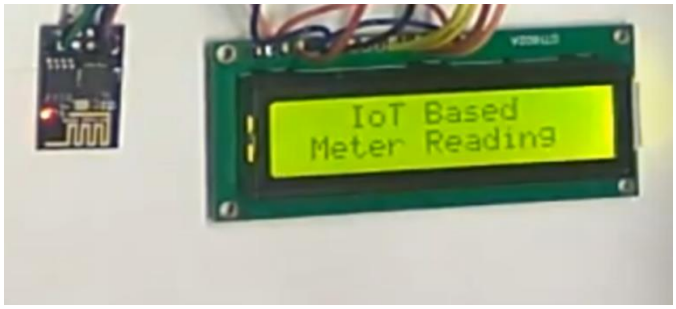

Figure. 6 Module Starting

Shows display on LCD after the module is started. Write now it is displaying the topic of our project and later will display all desired values as per requirements.

3) LCD Display Screen Connecting WiFi

Figure.7 Module Connecting to Wi-Fi

Shows WiFi connectivity with the entire setup. Currently it is displaying ongoing WiFi connectivity with our system.Once it is done a message regarding connected will be displayed.

4) LCD Display Screen Operational state

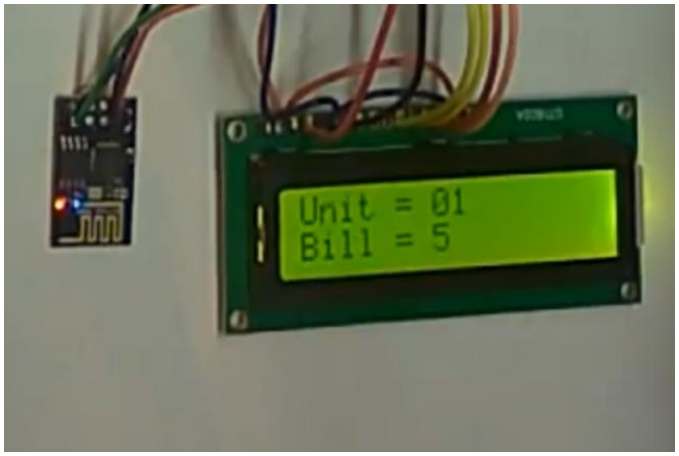

Figure. 8 Displaying Units Consumed

Shows unit consumption and bill amount. The current display is showing 1kWh unit where the bill amount displayed is in ₹. Currently it is showing the amount for 1kWh is 5₹.

Final Completed Project

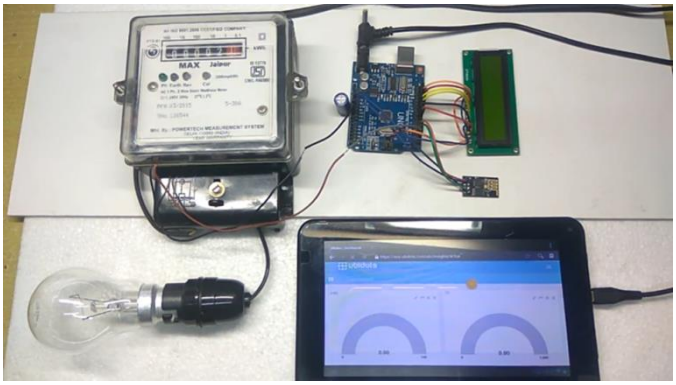

Figure. 9 End Product

Final setup of the project.

IV. CONCLUSION

Arduino and Wi-Fi based Smart Electric Meter for advanced metering and billing system is built which is able to read and send data via wireless protocol using Wi-Fi technology through Wi-Fi modem, capable of managing the meter as well as the line connection.

However, this project needs more modification for more reliable and higher degree of satisfaction and safety.

The goal of this project work was designed for the two-way communication of energy consumed in the home can send to the web server by using Ethernet communication (IoT). By using the Ethernet communication the customer and utility receive the real status of energy consumption with less cost as compared to other communication protocols. This proposed system is cheap as compared to other communication protocols. The collected data about energy consumption is monitored by consumer and supplier at anytime, anywhere from any part of the world. Improvements can be achieved in the

controlling and monitoring of energy online from any edge of the world

V. REFERENCES

[1]. Himshekhar Das and L.C. Saikia, "GSM enabled smart energy meter and automation of home appliances", Institute of Electrical and Electronics Engineers (IEEE), 2015.

[2]. V.Preethi and G. Harish, "Design and implementation of smart energy meter", Institute of Electrical and Electronics Engineers (IEEE), 2016. 188International Conference on Power, Energy, Control and Transmission Systems (ICPECTS). Authorized licensed use limited to: Middlesex University. Downloaded on September 04,2020 at 01:45:08 UTC from IEEE Xplore. Restrictions apply.

[3]. Md.Masudur Rahman, Noor-E-Jannat, Mohd. Ohidul Islam and Md. Serazus, "Arduino and GSM based smart energy meter for advanced metering and billing system", Institute of Electrical and Electronics Engineers (IEEE), 2015.

[4]. S. Visalatchi and K Kamal Sandeep, "Smart energy metering and power theft control using Arduino & GSM", Institute of Electrical and Electronics Engineers (IEEE), 2017.

[5]. Gobhinath.S, Gunasundari.N and Gowthami.P, "Internet of Things (IoT) Based Energy Meter", International Research Journal of Engineering and Technology (IRJET), 2016.

[6]. P.V. Santhosh Roja, B. Kiran Babu and V. Samson Deva Kumar, "Wireless Energy Meter and Billing via SMS", International Journal of Science and Research (IJSR), 2013.

[7]. Vanishree k Rao and Sri G N Madhu, "GSM based Energy Meter Reading and Billing", International Journal of Science and Research (IJSR), 2016.

[8]. Pritee Mahajan, Sneha Tatia and Prachi Jadhav, "Smart Meter: An IOT Based Meter for Live Electricity Monitoring and Bill Payment", International Journal of Electrical, Electronics and Computer Systems (IJEECS),2017

[9]. Q. M., Ashraf, M. I. M., Yusoff, A. A., Azman, N.M., NorN. A. A., Fuzi, M. S., Saharedan, & N. A. Omar, "Energymonitoring prototype for Internet of Things: Preliminaryresults", In 2015 IEEE 2nd World Forum on Internet ofThings (WF-IoT), IEEE, pp. 1-5, Dec. 2015.

[10]. S., Karthikeyan, & P. T. V., Bhuvaneswari, "IotBased real-time residential energy meter monitoring system", In 2017 Trends in IndustrialMeasurement and Automation(TIMA), IEEE, pp. 1-5, Jan. 2017.

[11]. N., Anggraini, A., Fiade, & M. Fauzan, "Flow measurement of charges and electricity costs monitoring system with android based Iot (case study: Boarding house Adelina)", In 2017 5th International Conference on Cyber and IT Service Management (CITSM), IEEE, pp. 1-5, August, 2017.

[12]. L.C.Saika, H. Das, N.B Dev Choudhry, T.Malakar, "GPRS enabled smart energy meter and automation of home appliances", IEEE Annual India Conference, pp. 1-5, Bangalore.

[13]. S. Male, P. Vethekar, K. Moore "A Smart Wireless Electronic Energy Meter Reading Using Embedded Technology", International Journal of Engineering Research and Application,Vol. 4, No.1, pp.145-147, January 2014.

[14]. M. Wei, S.H. hang, M. Alam, "An IoT-based energy management platform for industrial,purposes applied energy limited volume 164,pp.607_619, February 2016.

[15]. Shikha Kushwaha, Sahil Dhankhar, Shailendra Singh, Vishal Kisan Borate "IoT Based Smart electric meter using Ardiuno " International Journal of Scientific Research in Science and Technology (IJSRST), Vol 5, Issue 8, pp:80-84, Nov-Dec 2020

[16]. Handoko, M. Y. Nayan, M. Awan "Hybrid Automatic Meter Reading System", International Journal of Advanced Research in Computer Science and Software Engineering, Volume 2, No. 7, pp.361-365, Malaysia, July 2012.

[17]. K. Gill, S.H. Yang, F. Yao, and Xin Lu, "A ZigBeeBased Home Automation System," IEEE, Transactions on Consumer Electronics, Vol. 55, No. 2, May 2009, pp. 422-430.

[18]. Imran A. Zualkernan, A. R. Al-Ali, Mustafa A. Jabbar, Imad Zabalawi, and Ahmed Wasfy,"InfoPods: Zigbee-based remote information monitoring devices for smart-homes," IEEE Transactions on Consumer Electronics, Vol. 55, No. 3, August 2009, pp. 1221.

[19]. Maity, "Intelligent Online Measurement and Management of Energy Meter Data through Advanced Wireless Network," International Conference on Devices and Communications(ICDECOM), pp.1-4, Mesra, 25 Feb. 2011.

[20]. L.C.Saika, H. Das, N.B Dev Choudhry, T.Malakar, "GPRS enabled smart energy meter andautomation of home appliances", IEEE Annual India Conference, pp. 1-5, Bangalore,December 2016..