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.

1. 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]
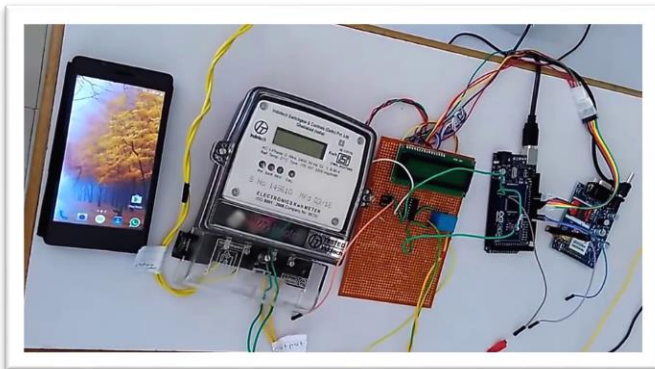

Figure 2. Proposed Iot based Smart Electric Meter

These features are implemented using the Arduino micro controller and a GSM module [1]. Esp8266 chip is the Wi-Fi module which helps in transferring the data through the internet. In case, if internet does not work, a GSM is used for backup purposes.
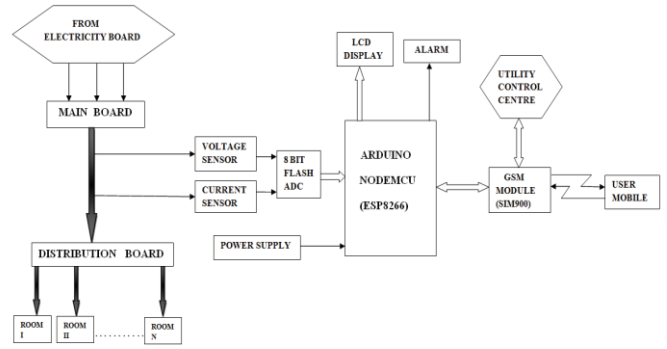

Figure.3. Functional block diagram of the Hardware module

2. RELATED WORK

Author S. Visalatchi ET. all in year 2017 published A new concept of electric meter will be discussed, where maximum demand of energy of a consumer will be indicated in the meter used by the consumer.[4]After exceeding the maximum demand, the meter and hence the connection will automatically be disconnected by an embedded system inserted in the meter itself.

Author P.V. Santhosh Roja, et.all. in year 2013 GSM MODULE SIM 300 is used to produce communication between load circuit and utility side[6]. We actually have used max232 along with DB9 connector to interface it.

Author Gobhinath.S,.et. all in year 2016 presented The system consists of the electricity meter which measures the electricity bill and informs the consumer about the number of units consumed and associated costs with it.[3] The microcontroller coordinates the whole system with the help of its different components connected to it. The design of Smart Energy meter using GSM technology can make the users to pay for the electricity before its consumption.

3. PROBLEM STATEMENT

In India, the current electricity billing system is completely manual. The electric meters are situated in the houses, offices and factories etc.

The energy meter reading is collected by meter readers on their fortnightly or monthly visits to the premises.

This system has disadvantage of appointing meter reader to take the meter reading, effects consumer privacy etc.

In this direction this project undertakes the meter reading without human intervention.

4. PROPOSED SYSTEM

4.1 Flow Chart of Proposed System

The existing model is a time-consuming process and it needs a lot of labour. The proposed system eliminates the need of labour and it is a cost efficient and a time saving process
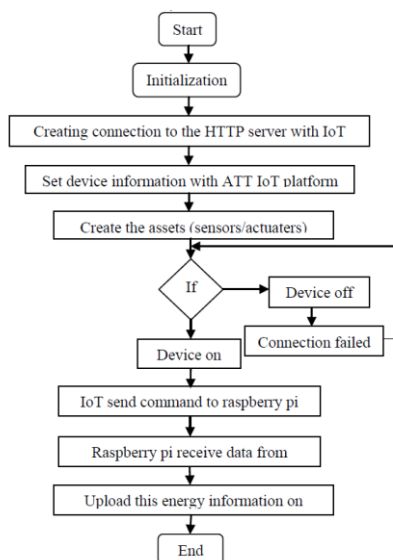

Figure 4. flow chart of proposed system

The proposed system gives the information about the energy consumption on daily basis, billing and payment through IoT, pre-intimation of shut down details, alert systems when the energy consumption

exceeds beyond the critical limit and the disconnection of power through a message when the residential are out of station to prevent the wastage of energy.

4.2 SYSTEM DESCRIPTION

In this system, a unique Id is given for each energy meter. This unique Id number is interlinked with the customer's unique mobile Id number. It constantly monitors the energy meter. The energy consumption from each house is sent to the control station through the web server and the billing and power cut details are sent from the control station to the residential energy meter.

4.2.1 Energy consumption on daily basis

In the existing electric meter, the meter shows the energy consumed from the date of installation. In this system, the daily energy consumed is calculated using the Arduino microcontroller and it is displayed in the LCD. It is also communicated to the consumer's mobile using IoT.

4.2.2 Billing and Payment through IoT

The billing detail for the energy consumed is communicated to the consumer monthly through the webserver using IoT and as a message through the GSM module.

The payment is also made through the web server. This helps in eliminating the manual dependency to collect the reading.

4.2.3 Alert Systems

Our electricity billing system has a format that when the energy is consumed beyond the certain limit, then it indicates that there might be a electricity theft and alerts the consumer to check it.
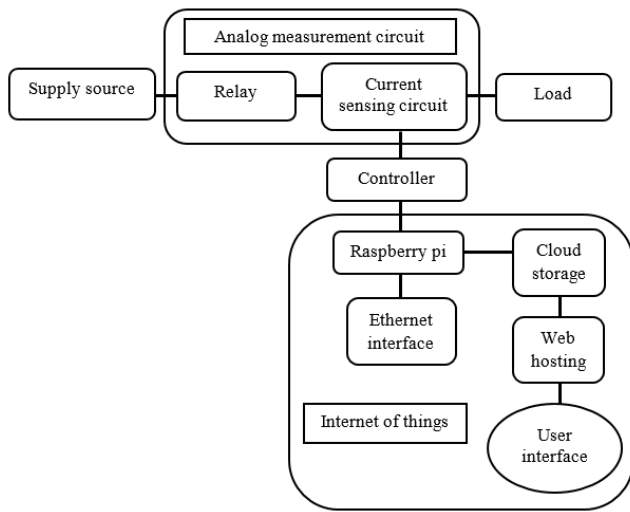
4.2.4 Proposed Block Diagram

Fig. 5. Proposed block diagram

Arduino uno microcontroller is used which is based on ATmegha328. After receiving measured current data and input voltage from analogy measurement circuit we have to calculate the power. The programming is done in Arduino software (IDE). This is the open source platform. This board also acts as network traffic controller. It receives the measured data from sensor and send calculated data to Arduino . The instantaneous output is provided to the current flowing through the terminals by ACS712.

4.2.5 Internet of things

Arduino is the key learning platform for IOT. Arduino is connected to the controller and the internet. Once the Ethernet connection is set then login to raspberry pi to start developing IoT platform. Python programming language is used. Raspberry pi send energy information to the internet connected server for monitoring energy use information of individual device. Cloud storage and web hosting is used for storing real-time energy data and allows other programs to access and monitor the data. The control signal sends to raspberry pi using same server

to turn on/off the device. These are the various steps to build IoT platform as shown in flow chart below.

5. RESUT ANALYSIS

The experimental setup for the system is as shown in fig. 3The 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.

- Project is focused on the government's plan to turn the major cities of the country into smart cities.
- The project can be further extended to detect the electricity meter tampering.
- A smart app can be designed to provide various alerts based on the readings from the device.
- A unified can be provided to the customers for both viewing the electricity usage and a platform to pay the bill online following the digital India initiative.
- In one case the service provider can evaluate the bills which are not paid and can disconnect the electricity connection remotely.

6. CONCLUSION

Arduino and GSM based Smart Electric Meter for advanced metering and billing system is built which is able to read and send data via wireless protocol using GSM technology through GSM 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.

For GSM module the network coverage of the SIM used is one might be bit complicated due to network strength issues.

7. REFERENCES

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