Design and Implementation of Smart Energy Meter

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Abstract—**This paper proposes a new method of streamlining Energy Monitoring and Utility Payment Procedures with a Smart Energy Meter. The features of the aforementioned device consist of being able to pre-load a certain amount of currency for timely payments, the ability to monitor real time energy consumption, set a limit on consumption in conjunction with funds allocated and a method to notify when said limit is reached allowing for smart payment methods for hassle free transactions.**

The meter was conceived using a Raspberry Pi board scripted in Python connecting to a cloud interface for the automation and maintenance of the tasks described. The physical prototype manufactured is functioning as expected and is well within our expectations and margin of error.

Index Terms—**Energy Meter, Internet of things, Raspberry Pi**

I. INTRODUCTION

Akin to recharge a mobile phone, the consumer buys a recharge card and gets some energy units in return, proportional to the balance amount. The balance amount will keep reducing for every unit of energy consumed and once zero, the power supply would be automatically cut off. The amount deducted for every unit of energy consumed can be controlled by the distribution unit according to the peak hours. It is highly accurate as the whole idea of reading the units and then billing manually or any other means is eliminated. Consumer cannot escape from paying the electricity bill and the State Electricity Board gets free from debts. On the consumer front, the tedious task of paying the bill and waiting anxiously for the bill is eliminated. Wastage of energy is diminished as now only the required energy will be consumed as allotted. The power grid can monitor the overall energy consumption and any tampering attempts are actually of no use and can be detected if still prevalent.

II. NEED FOR THIS SYSTEM

The conventional method of electricity billing involves a person from the distribution unit reading the number of units of electricity consumed in the energy meter, conveying this information to the distribution unit and then preparing the bill according to the units consumed for a fixed amount of time. This can prove quite tedious as it involves various tasks like reading, then preparing the bill. Still accuracy cannot be guaranteed as there can be errors in human reading. Even though digital meters are being replacing conventional electromechanical meters and provide much accurate readings, still the problem of deliberately falsifying readings exists for various reasons beyond the scope of this paper.

Despite this, the task of billing for every consumer is a time-consuming job for the distribution grid. Also, the consumer can deliberately consume more amount of power than required and still refrain from paying the bill and nothing can be done to severe the electric power supply.

To eliminate all these problems, the most convenient method is making the whole system prepaid similar to a mobile phone recharge or a DTH recharge.

III. SYSTEM DETAILS

1) Energy meter:

Energy meter is an electrical instrument which is used to measure the electrical energy utilized by the consumer.
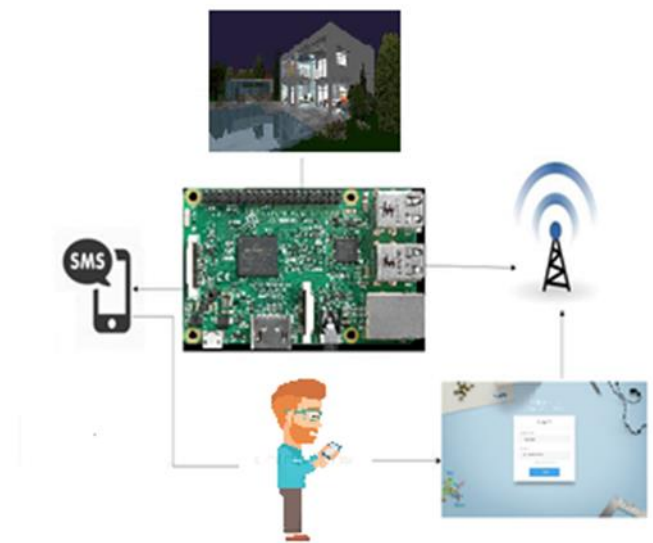

Fig. 1. Overview of implementation of smart energy meter

It is used in many departments like home, offices, industries, organisations etc. to charge the electricity consumed by the electrical devices. This is used to measure the total power consumed by the loads after certain time period.

- *Signal conditioning device:*

Signal conditioning device in energy meter is used to convert the non-linear signal to linear signal. Signal conditioning devices basically manipulate the signal in such a way that signal is prepared for the next step in the operation.

In smart energy meter, signal conditioning is used to convert the input signal into linear signal for the controller in the system to activate and respond accordingly.

- *Relay drivers:*

Relay drivers in a circuit is used for switching the circuit open or close electromechanically or electronically. In smart energy meter relay drivers are used to switch the circuit on or off depending on the signal from the controller of the
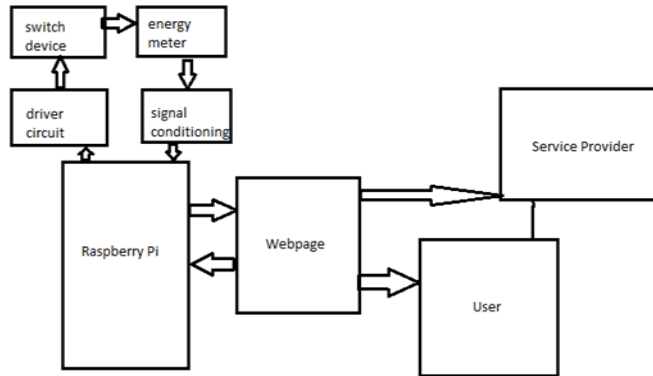

Fig. 1. Block diagram of implementation of smart energy meter

2) Raspberry pi:

Raspberry pi plays the major role as whole system functions based on it. Raspberry pi has many ports in it. It takes Python programming language for the operations in smart energy meter. Raspberry pi responds to the electrical supply given to energy meter and calculates the power consumed. It automatically updates the information to the webpage for real time tracking.

Raspberry pi by default has a wi-fi module unlike other board. With the help of this feature in raspberry pi, using internet, sends the updated information about consumption of electricity by the user. The particular user can check the webpage for the information about electricity usage.

Raspberry pi automatically updates the customer as it reaches the particular value. Raspberry pi prevents the power supply to the consumer whenever it reaches the limit. It updates to the distribution system regarding the recharges and consumption of the user.

3) Web page:

Webpage is designed using HTML, CSS and Javascript. This webpage is designed for user to track the power consumption and recharge accordingly to get services without any interruptions. In the webpage the user has to enter the

details of his/her smart energy meter to login where the user can check the details of consumption of electricity.

4) Overview on Internet of Things:

Internet of Things is a network where the exchange of data is done between vehicles, home appliances and also between the electronics, sensors and software's in which each device is identified within the internet infrastructure.

The connection between different types of devices in IoT is used for collection of data and automatic flow of data. Many systems are designed with the help of IoT for the easy flow of data and to reduce the human effort on it. Our project is also designed with the idea of using IoT.

IV. CONCLUSION

Made an attempt in designing the practical model of the project "Smart energy meter using IoT". This project is used for reducing human intervention and to check the electricity consumed by the particular user anytime which is updated time to time. This project is mainly used for the control of energy wasted by the people all over. This is easy to maintain by the distribution system or the provider without any human effort. A conclusion section is not required. Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions.

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