

Automatic Energy Meter Reading using Raspberry PI and IOT

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Abstract

The Existing domestic energy meter reading systems universally have many problems, such as difficulty in construction, too narrow bandwidth, too low rate, poor real time, not two-way communication quickly etc. To solve the above problems, this paper uses the wireless technology for Automatic Meter Reading system. We are introducing a new way of communication between the EB section and the consumer using IOT technology for transmitting the customer's electricity consumption and bill information that is calculated using RASPBERRY PI microcontroller. The power fluctuations are monitored using the voltage sensor and current sensor and fed to the microcontroller which indicates it to the Electricity Board. Depending on the power generation, the house hold devices are controlled automatically. From EB section the information regarding the bill amount and payment are communicated to the consumer via Internet. This facilitates the consumer so that he can request for the bill information any time by seeing the unique AMR server.

Keywords - Automatic meter reading, smart metering

I.INTRODUCTION

The AMR system consists of Digital Power meters installed in every consumer unit and an Electricity e-Billing system at the energy provider side.. At the power provider side an e-billing system is used to manage all received information of meter reading, compute the billing cost, update the database, and to publish billing notification to its respective consumer through internet.

Traditional meter reading for electricity consumption and billing is done by human operator from houses to houses and building to building. This requires huge number of labor and long working hours to achieve complete area data reading and billing. Labor billing job is sometime also restricted and is slowed down by bad weather condition.

With the advent of digital technology analogue electro-mechanical meter is continuously replaced by digital electronic meter. Digital energy meter offer greater convenience to implement and establish automatic meter readings systems electronically. Efficiency and reliability of retrieving meter reading in the AMR system was a major challenge. Various AMR methods and technologies using power line carrier(PLC) communications, supervisory control and data acquisition (SCADA) , telephone modem , internet , 19organize, embedded RF module , Wi-Fi, blue tooth and were established and developed to provide and demonstrate the solution of efficiency reliability and effectiveness of AMR .

Human error and common error are explained[1]. Design and requirements needed for applying smart meters

to micro grid [2]. The challenges of a novel method for securing the readings of smart electricity meters against tampering or malfunctioning [4]. Technical challenges faced by the IoT in the smart building arena [5]. Cloud computing client-server architecture [6]. The ability to use smart meter voltage data effectively [7]. The Raspberry Pi is an uncased, credit-card sized computer [8]. Development and deployment of smart energy meters [9]. IoT devices enable large-scale data collection and sharing for a wide range of applications [10].

In order to achieve efficient meter reading, reduce billing error and operation costs, automatic meter reading (AMR) system play an important role to address the above mentioned problems.

AMR is an effective mean of data collection that allow substantial saving through the reduction of meter re-read , greater data accuracy, improved billing and customer service , more timely energy profiles and consumption trends updates, and better deployment and human resources were proposed in this paper.

II.MICROCONTROLLER

The **Raspberry Pi** is a Microcontroller and it is a series of small single-board computers developed in the United Kingdom by the Raspberry Pi Foundation to promote teaching of basic computer science in schools and in developing countries. It does not include peripherals (such as keyboards and mice) and cases. However, some accessories have been included in several official and unofficial bundles.

The organization behind the Raspberry Pi consists of two arms. The first two models were developed by the Raspberry Pi Foundation. After the Pi Model B was released, the Foundation set up Raspberry Pi Trading, with Upton as CEO, to develop the third model, the B+. Raspberry Pi Trading is responsible for developing the technology while the Foundation is an educational charity to promote the teaching of basic computer science in schools and in developing countries.

III. ENERGY METER BILLING

In the Existing work, the front end is user friendly and one can work on this software with minimum knowledge of computers and can read the meter by sitting in the office. This is useful for billing purpose in electricity board authority. A GSM modem is connected to the energy meter. Each modem will be

having its own sim (usual mobile phone sim). A PC is connected to other modem, which contains the data base. The module is designed such that user can have the complete usage details about the energy meter. Just like postpaid mobile connections, one can know our due bill instantly and can even pay for it.

The SIM card used is implemented in energy meter and it sends a message to the user about the due bill. A LCD is used in the hardware module for the user interface. The LCD displays the current usage and units consumed. After the usage of each unit the amount and total units will be incremented whenever user wants to know his/her bill he/she can message a given code to sim card attached to the meter and can know his/her present bill. The user can pay the amount just by knowing the given code which is fed in the meter.

But in the Proposed system, the energy meter billing can be done without using the energy meter, and the communication is also done by using the IOT technology.

III. PROPOSED SYSTEM

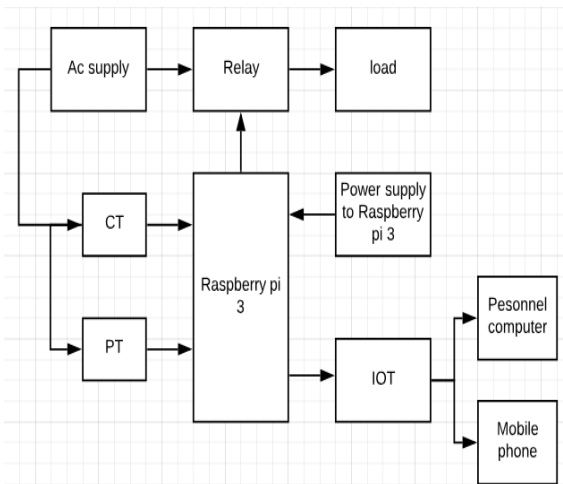


Figure 1 Block diagram of proposed system

The Figure 1 represented that the ac supply is given to the load through the relay circuit. With the help of the potential transformer and the current transformer, the readings are taken from the direct power supply. The consumer can choose either the pre-paid or post-paid billing method in their internet server. Power, current, voltage, and the tariff calculation are done by using the python program.

And later it is uploaded in the Raspberry pi 3 microcontroller. A 3.3v or 5.5v dc supply is applied to the raspberry pi through the external source. It can be done by using the voltage regulator circuit. After that the signal is taken from the current transformer and the potential transformer is given to the Analog to Digital converter.

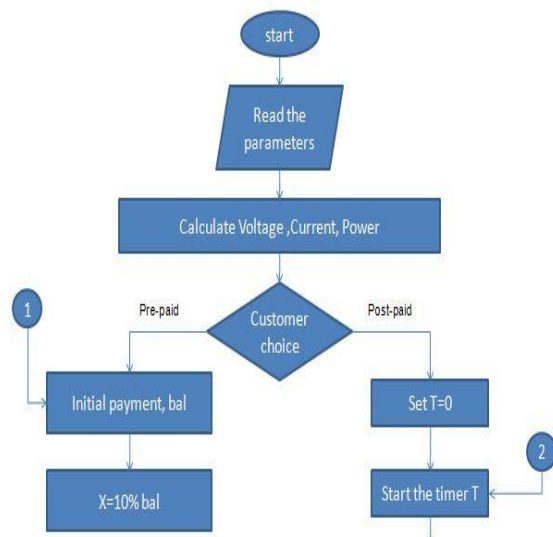
With the use of the ADC converter Raspberry pi takes as analog signal of the current and the voltage. Raspberry pi can be easily connected to the internet by using the Ethernet port. The usage of the IOT the unique server is created, to display the consumed energy day by day. It can be easily transmitted to the EB section.

IV. FLOW CHART

The Figure 2 shows that the flow chart of the python coding language. First of all the Raspberry pi takes the parameters from the Ac supply and calculate the voltage, current, and power readings. The customer allows choosing either pre-paid or post-paid method.

If the consumers choose the post-paid billing method, then the Raspberry pi calculate their consumed energy for the certain period, after that total amount for the consumed energy is displayed. Then it set the timer for some period to pay the required billing amount. If the total amount paid, then the microcontroller continues the next calculation. But, if the amount is not paid, the relay circuit trips the load from the supply.

If the consumers choose the pre-paid method, the Raspberry pi calculated the energy consumed and calculate the consumed amount, and then it displayed the consumed amount and is reduces the total amount to the consumed amount. Then it display the balance amount. The Raspberry pi is gives the intimation of “your balance is low”. If the amount is paid , the controller continues it calculation, but if the amount is not paid , the relay circuit trip the load from the supply.



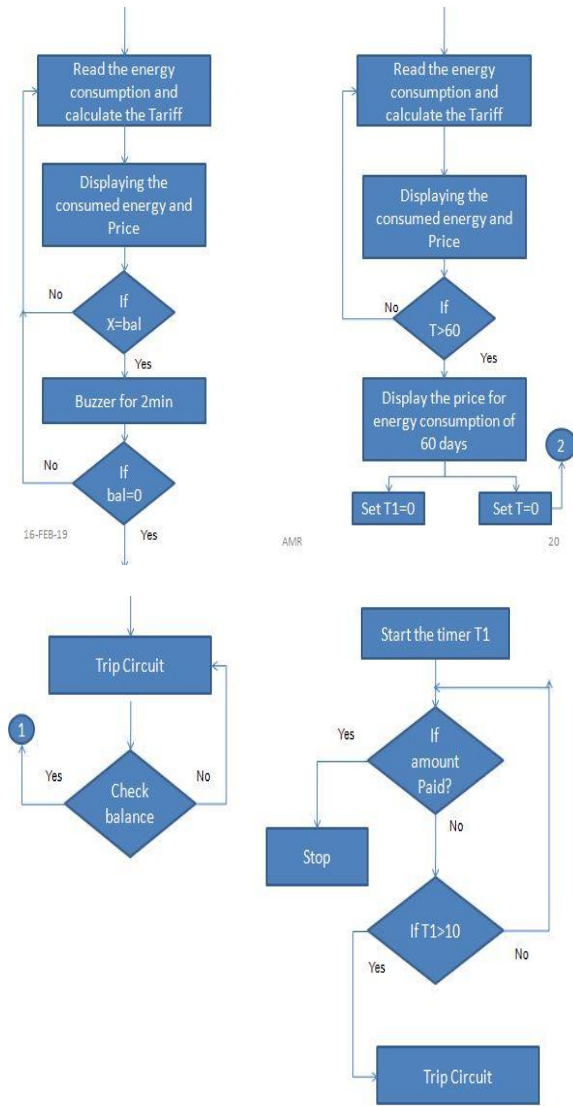


Figure 2 flow chart for python coding

V. OUTPUT

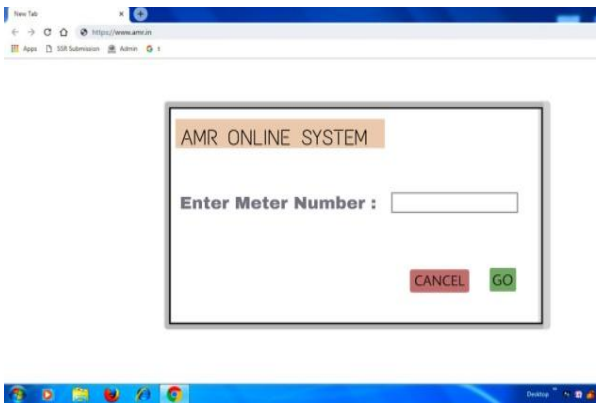


Figure 3

The Figure 3 shows that the first page of the server link. In this first page, the consumer must enter the energy meter number, and then it move on to the next page.

The Figure 4 shows the , if the consumer chose the pre-paid billing method , this page will open. In this page meter number, consumer name, amount consumed and amount reaming are displayed.

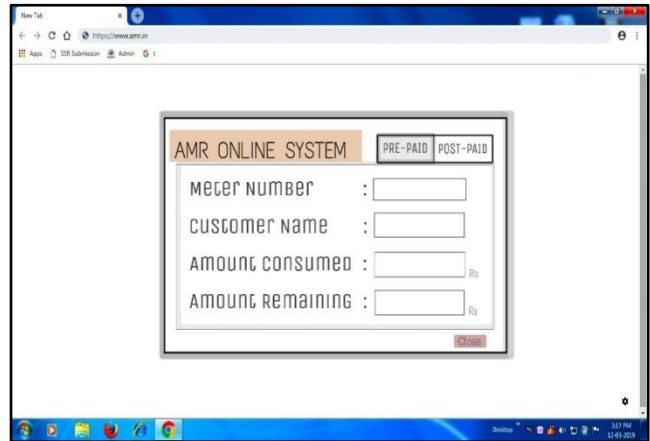


Figure 4

The Figure 5 shows the output, if consumer choose the post-paid billing method. Here also the meter number, consumer name, power consumed and total amount for the energy consumption are displayed.

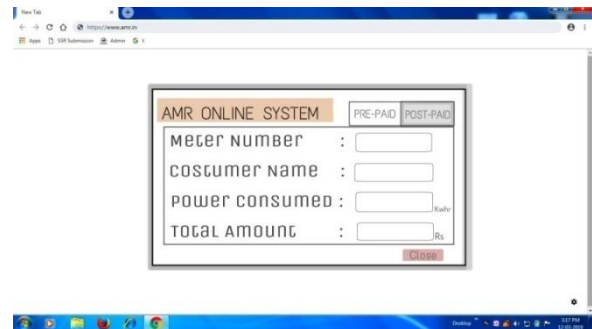


Figure 5

V. BENEFITS OF AMR

- Smart machine-controlled processes rather than manual labor work.
- It optimizes maintenance and investments as the machines send the accurate info.
- Rates and asking dates are customize.
- The investigations of the electric bills are highly streamlined.
- The change in state of energy meter can be detected.
- Accurate measure of transmission loss
- The performance of the network becomes more efficient and priced potency.
- The consumption of the electricity info is précised.

VI. CONCLUSIONS

Since automatic reading is all about "Reading a utility meter without the requirement for visual inspection of the meter". It is indeed an easy and fail-safe method for monitoring consumption details of customer. Automatic meter can detect meter tampering and illegal drawing of power (Hooking/power pilfering). AMR as a way of improving customer service while reducing the cost of reading meters. The AMR system enable us to save millions of Dollars every year in meter Reading costs and also provide our customers with better information about water use, more accurate billings, and keep rate us low as we can.

The Future scope of the AMR are, it just collects meter reading electronically and match them with the accounts. This can include events alarm such as tamper, leak detection, low battery or reverse flow. Many AMR device can also capture interval data, and log meter events.

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