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Internet of Things (IoT) Based Smart meter

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ABSTRACT

The smart meter of this paper is basically used in monitoring and control of power consumption in a house by providing the user full awareness and control of the total load consumption. Here we have used a current transformer as the part of measurement by keeping the voltage as a constant. We have used Raspberry Pi module for making our system an IoT. We used relays for controlling the connected loads. The relays were controlled by using a Pic microcontroller which also performs the action of ADC. We have interfaced the Pi and Pic to form a closed loop. The Pi will send the power readouts to the custom built web page and the user can view each load and shut down or switch ON the loads accordingly.

Keywords: *IoT, Database, Current transformer, PIC, Pi.*

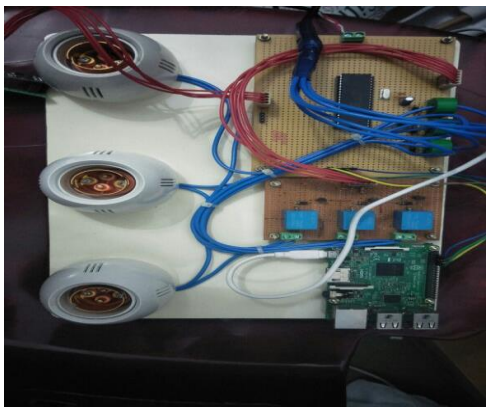
1. INTRODUCTION

A smart meter is an electronic device that records consumption of electrical energy in intervals of an hour or less and communicates that information at least daily back to the utility for monitoring and billing. Smart meters enable two-way communications between the meter and the central system. The smart grid manages and distributes electricity in a more efficient, economical and secure way and it integrates many different technologies, products, services to electric user side appliances with sensing, communication and control technologies from generation, transmission, and distribution. According to smart energy, there are several benefits to smart meter .the major advantage is the more accurate bills. The other advantage is to understand the power usage and innovative energy tariff.

2. EASE OF USE

A. Our Work

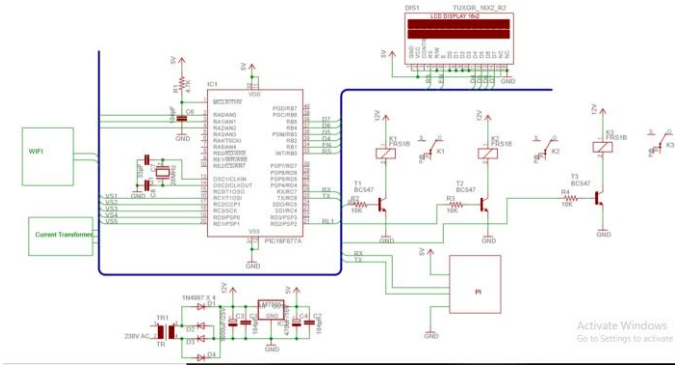
Our smart meter offers consumer to read the real-time data which give the idea of power consumption, real-time and pricing information. The other objective is used to optimize home energy usage and help home energy cost saving. Time Of Use (TOU) pricing is calculated in PC side software system processed and stores the data of power measurement, time and date, the price of electricity. The new approach to our design is to make use of relay which gives the advantage of protection against over voltages. The smart meter offers potential benefits to householders. Presently we are monitoring only three loads using three CT's and controlling those devices using three relays. These include an end to estimated bills which are a major source of complaints to many customers, tool to help consumers better manage their energy purchases. Stating that smart meters with a display outside their homes to provide up to date information on electricity consumption and in doing so help people to manage their energy use and hence reduce their energy bills.



B. The scope of the project

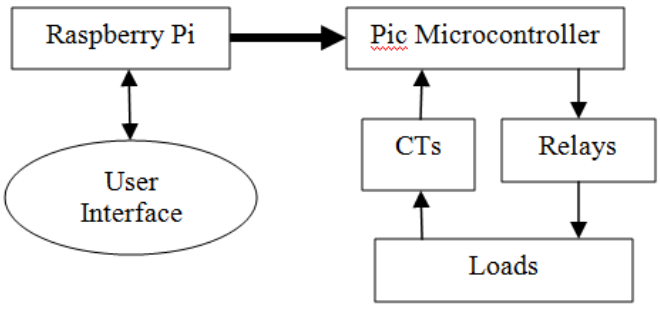
The objective of our project is to implement an IoT based smart meter. With the invent of smart meters in each home, the problems related to the power theft can be removed. Our smart meter provides correct power usage and transmits data to LCD display unit or to our mobile phones through a user interface. Here the user can monitor the power information and remotely control the system. With this, each device used in the building and homes can be scheduled, remotely controlled and monitored. As the demand for electricity is increasing day by day, we hope that our system will be a better solution to detect the misuse of power and hence saving our nation from power shortage. To clarify the doubts regarding the billing is one of the major advantages of the proposed system. The scope of the project is that the proposed project will be a solution to the false billing of Tariff. By implementing this system a common household can establish an efficient working of its electrical appliances. And there will be less power consumption in the long run. The smart meter continuously monitors the power consumption of the given load and the user will be able to monitor the power consumption continuously through his /her phone. This is monitored in the phone via a user interface. And by the implementation of the smart meter, we can avoid power theft to a larger extent.

3. CIRCUIT DIAGRAM



Above shown is the circuit diagram of our proposed system. Here the main components are a WiFi Module, Raspberry Pi, PIC Microcontroller, Relays, Current transformer etc. The wifi module and CT act as an external device and is connected to the PIC. The analog current value is converted to digital by means of an ADC in PIC. The crystal oscillator is used to provide clock pulses for the microcontroller to work. The rest of the connections are from PIC to Pi and relay. The data transfer pins from d0-d7 are connected to the relay. Here three relays are used for three devices respectively. The relay is driven by a driver circuit consisting of transistors. Here BC 547 is used. Relay consists of a coil and an on /off way. Both are given in the circuit. The pic in connected to Pi, which acts as a base station here. It sends and receives data from the user interface and PIC respectively.

4. SMART METER

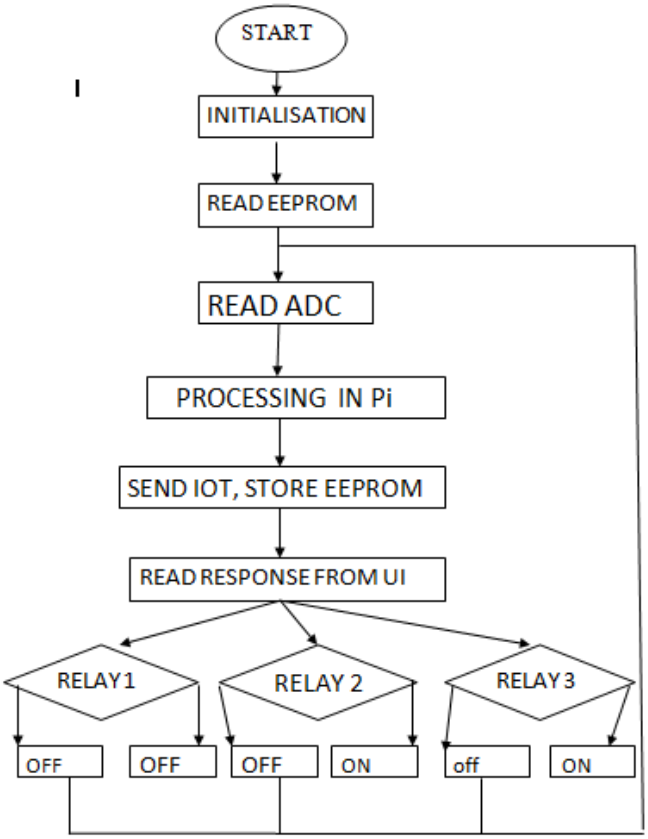


This is the basic block diagram of our smart meter.

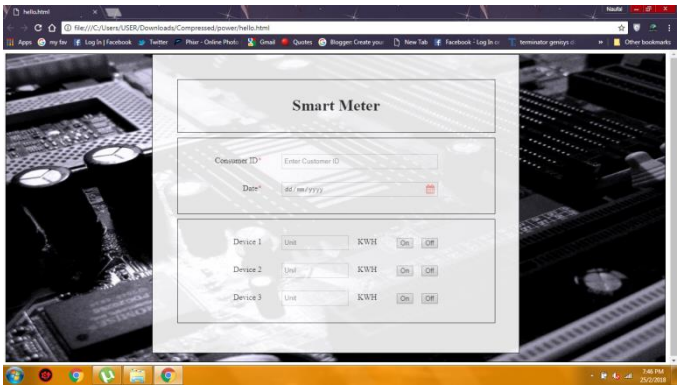
A. Working

In this setup, we have made the Raspberry Pi as our base station. The Pi performs the task of enabling IoT services to our meter. We have a Pic microcontroller for taking the readings from our current transformers (CTs) and for controlling the loads via the relays. The CT readings are sent over to the Pi and these readings are observed on the user side webpage. The user can monitor the live readings of individual readings of each load under different CTs. If the user wishes to switch off a particular load, a button is provided near to each load considered. When the user presses this button the command is sent over to the Pi which then signals the Pic microcontroller to trip that particular relay across the load which is to be switched off.

B. Flow Chart



Above shown is the flow chart of our system. The first step is to start the process by initializing all the variables requires in the system design. The next step is to create a memory space as a register in the form of EEPROM, which is erasable and programmable read-only memory. Then the current is measured suing CT and is in analog form. It has to be converted to digital form by the help of ADC. Then this value from PIC is sent to Pi where all the processing takes place. Here the Pi acts as a base station that is any data transfer can occur only via Raspberry Pi. Then the value of Pi is sent over to the user interface created via IOT. Here the value gets displayed on the webpage and the response from the user is taken aback from this. The user response is recorded as the button press. According to the user needs, the relay gets operated. If the button press is made once, then it will give a value of 1, that is the device gets on and respectively the other process also takes place. The whole process gets repeated. When the supply is tuned off, that is no load is connected to the system. Then the process gets stopped.



This is the sample UI webpage that we have created for the project. The webpage was able to communicate with the Pi.In the following working of the Pi, it was able to send and receive the data from the database simultaneously. Only a small delay was

occurring during our testing since the database has to access the data and the webpage has to be refreshed every time to get the present reading. The loads could be monitored and controlled via the webpage.

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