

IoT Based Smart Energy Meter

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Abstract— This paper includes the idea of making an ordinary electric energy meter smart using an Arduino and some other basic components. Here we are using Arduino Uno because it is faster than other microcontrollers and is more efficient if we compare it with other controllers. In this paper, we have discussed that the pre-installed energy meter in our homes are not going to be replaced but they can be modified by making some changes in the configuration so that they work in a smart manner. The use of Arduino Uno has enable us to use this energy meter more efficiently. One can easily access the readings of meter through a third-party application.

Indexed Terms— Arduino Uno, Energy Meter, Wifi, LED

I. INTRODUCTION

This review paper is mainly focused on the IoT based smart meter, this meter involves the basic working principle of combination of hardware and software both commonly known as embedded system. The following review paper involves the comparison of Arduino Uno at mega 328 with other microcontrollers, and the application of a Wi-Fi modules to enable 'Smart' features. By utilizing this smart energy meter the consumer will get his data of electricity usage and the amount to be paid in terms of rupees with every unit cost. Also, with the help of Wi-Fi module the utilizer can regularly check his readings in the form of units. All this is made possible by the usage of arduino uno at mega 328 that regularly check the meter readings and store the number of units consumed in its memory location and user can see it on a third party IoT based app.

- Here we are using arduino uno atmega 328 as a primary controller, which regularly records meter readings.
- The Arduino uno will record the per unit consumption of energy whenever the LED light blink.

- An iot based third party app is used to display the meter readings with per unit cost.

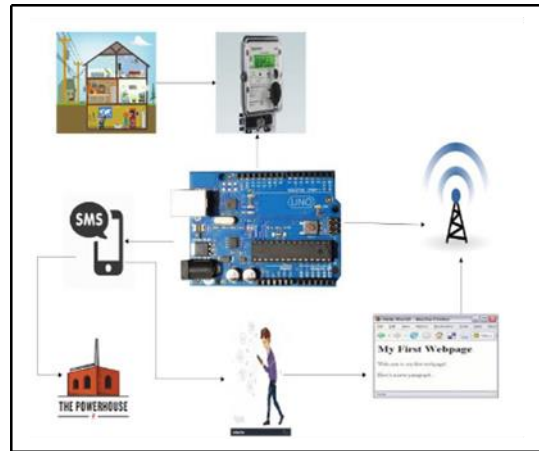


Fig.1. Architecture of IoT Smart Meter

II. MAJOR COMPONENTS USED

2.1. Smart Energy Meter

An electrical device which is used to measure the amount of electrical energy consumed is commonly called as energy meter. In our state UPPCL is responsible for installing these types of electric energy measuring meters, at places like factories, hospitals, malls, shops, private organisations and houses of every individual and all type of electrical equipment that consume electrical energy. Smart energy meter allows one to record their voltage and current readings and then also provide the consumption. This consumption of electricity is then measured, which provides the right amount of energy units consumed by the user.

2.2. Arduino UNO (Atmega 328)

In our project the Arduino Atmega 328 provens to be the heart of overall performance of this system as entire functioning depends on the arduino . Arduino replicates to the 5V supply sent by the opto-coupler and thus regularly counts the supply and then observed

the power consumed and also the cost. The consumed energy reading can be viewed on third party app.

2.3. *Wi-Fi Module (ESP8266)*

Wireless Fidelity commonly abbreviated as Wi-Fi. In our project the Wi-Fi proves to be one of the main components of this system. By using Wi-Fi, the readings of every unit along with its cost are displayed on third party app regularly. The user can regulate the functioning of smart meter and Arduino uno through Wi-Fi.

2.4. *MAX 232*

Serial communication is here done with the help of max 232 with the other modules like GSM and Wi-Fi. TTL is provided by MAX 232 to other components according to their need. Most of the Wi-Fi module does not require additional TTL as it is already installed in it while some may require TTL according to their needs. It is totally based on the requirement of WIFI module.

2.5. *GSM Module (SIM900):*

Global System for Mobile communication commonly abbreviated as GSM. It is one of the most severely used communication throughout the whole world in the field of networking. GSM is widely employed cellular technology that is used for transmitting mobile voice and data services. Maximum available data rate is from 64kbps to 120kbps. In our project it is used to send the information regarding the energy consumption with their unit and cost to the consumer.

2.6. *Signal Conditioner (P817)*

In our project signal conditioning block is the opto-coupler which performs the basic functionalities of the opto-coupling. In our project the blinking of LED shows the unit count consumption of energy. As LED blinks it produces only 0.7v which cannot be detected by aduino uno board, so to remove this error we are using the signal conditioning block. Now as soon as LED blinks the 5v supply will be provided to Arduino board. The signal conditioning block is here used to modify i.e. to increase the amplitude of voltage.

III. CALCULATIONS

As we know that types of meter consist of types of unit.

Here we have assumed that 1600 blink of LED will be equals to 1 unit. Assumption we made in our system, 1 unit of power consumed = 1 unit
Here,

LED blinks are denoted by A

Units of electricity are denoted by B

Consumption cost is denoted by C

Basically,

$$\text{No. of units (B)} = (A/1600) \tag{1}$$

$$B = (A/1) \tag{2}$$

Let cost of 1 unit = 5rs.

$$C = B * 5rs \tag{3}$$

Again, the consumer can monitor the energy consumption through an app which also provide the cost of energy consumed.

IV. WORKING

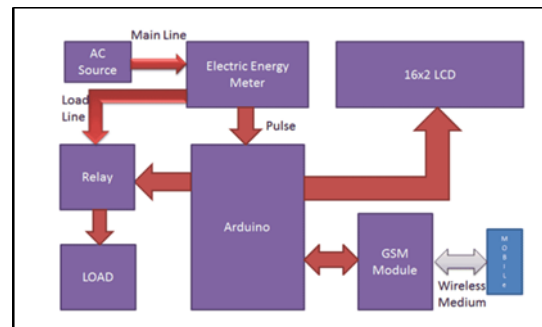


Fig.2. Functional Block Diagram

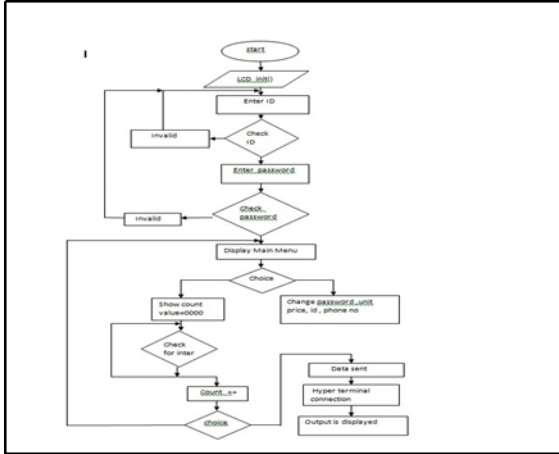


Fig.3. Flow Chart

V. RESULTS AND DISCUSSION

Give 5V Power supply and connect the pc with serial connector to DB9 connector

- Now ON the circuit.
- We can see on the LCD display “WELCOME RMCE” “SMART ENERGY METER” and press enter (E) in keypad.