IOT Based Power Meter

Nimisha A[1] Steffi Raffi[2] Niya Joy[3]
[1,2]U G Student [3]Assistant Professor
[1,2,3]Department of Electronics and Communication Engineering
[1,2,3]Matha College of Technology

Abstract— The IOT Based Power Meter comprises of a two way communication where electricity and information are exchanged by the consumer and utility to maximize efficiency. The main objective of present work is to design a smart energy meter using AtMEGA32 which can be controlled and monitored by the Raspberry pi via the internet of things (IOT).

Key words: ATmega32, Raspberry Pi, Opto-coupler, MAX232, LCD display

I. INTRODUCTION

The smart grid is an advanced platform to the way we receive electricity today. Since the demand for electricity has tremendously increased, a redesign of the current grid system is much needed. The system will feature a two way dialog where electricity and information can be exchanged between the consumer and utility. This can increaseor decrease the amount of energy a consumer needs by analyzing the feedback of the two-way dialog. In this system a smart energy meter is installed in every consumer unit and a server is maintained at the service provider side, both the meter side and the server which facilitates communication between the two ends.

The ATMEGA gets the units data from the energy meter and sends the acquired data to the server (Raspberry Pi). The server in the transmission system is connected to the cloud, through this we can able to monitor and control the EB lines of every consumer through Internet. This system, also serves to shut off the consumer‘s particular product which consumes more units. This system also helps the consumers to monitor their daily usage of electricity through the Internet. The transfer of electricity and information between consumer and utility would increase efficiency, reliability and security

II. LITERATURE SURVEY

This Review focus on the design and implementation of IoT based smart electricity energy meter. This design can be eliminate the man power involvement to maintain the electricity. The consumers of electricity need to pay as per the utilization of electricity on schedule, somehow consumers fail to pay, the transmission of electricity can be turned off from the distant server automatically. Energy meter provides provision to the consumers that they can monitor the energy consumption in units by using web page providing device IP address.

III. RELATED WORK

A. Design and Implementation of IoT based Digital Energy Meter for Remote Monitoring.

Digital signal processor or high performance microprocessors are used in digital electric meters. Once it converts analog signals to digital samples, voltage and current samples are multiplied and integrated by digital circuits to measure the energy consumed. There are many methods of error correction in digital electricity meters which are usually based on the known methods of A/D converters error correction. Send the total energy consumption in the form of sms from the remote location directly to the consumer and electricity board via modem. And create a separate web page and upload the meter readings to the page.

B. Raspberry pi based automatic meter reading

These are more accurate measuring device than the conventional electromechanical meter reading system. This paper presents an implementation methodology for a wireless automatic meter reading system (WAMRS) incorporating the widely used GSM network. Processing flow is as camera capture the image, captured image is pre-processed to get display plate and characters are recognized by processor Raspberry pi.

IV. EXISTING SYSTEM

Existing Electricity Energy Metering method:-As we know in our country the electricity energy billing duration is either end of one month or end of two months. During the month electricity consumer cannot know how much power is consumed, they can know at the end of one or two months when the bill issue. The major drawback of this method is user cannot manage the power consumption.

A. Disadvantages

- The other advanced techniques are costlier to implement and are more complex.
- No protection from tampering of energy meter.
- In most of the cases, the errors can be identified only at the end of the month.

V. PROPOSED SYSTEM

The IOT Based Power Meter comprises of a two way communication where electricity and information are exchanged by the consumer and utility to maximize efficiency. Advancement in technologies has made homes more convenient, efficient and even more secure. Introducing the Raspberry pi to the world of home automation provides numerous customizations to turn a regular home in to a smart home. Raspberry pi provides customizations to turn a regular home in to a smart home. Raspberry pi provides a low cost platform for interconnecting electrical/electronic devices and various devices in a home via internet.

A. Advantages

- It provides LCD display energy consumption.
- It provides telemetering service and eliminate the man power requirement for metering.
- It makes easy to access information of energy consumption from energy meter through IoT.

1) Description

2) Raspberry Pi

The raspberry pi is a series of credit card sized single board computers developed in the United Kingdom. The raspberry pi hardware has evolved through several versions that feature variations in memory capacity and peripheral device support.

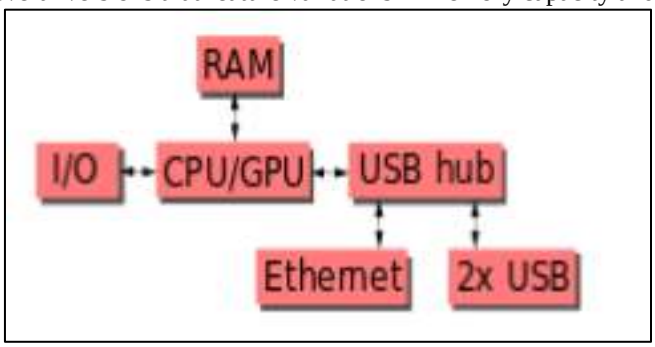

Fig. 1: Raspberry Pi

This block diagram depicts models a, b, a+ and b+. Model a, a+ and the pi zero lack the Ethernet and USB hub components.

B. Processor

Fig. 2: Processor

The raspberry pi 2 uses a 32- bit 900 MHz quad-core ARM cortex-A7 processor.

C. ATMEGA32

The AtMEGA series contains:

- 4-256 kb program memory
- 28-100 pin package
- Extended instruction set
- Extensive peripheral set

AtMEGA32 has 32 kb program memory and has 40 pin package. It has 8 ADC channels, 3 internal timers, two 8 bit and one 16 bit timers. It can process one million instruction in one second. It has 4 ports PORTA, PORTB, PORTC and PORTD. All ports are 8 bits. It has 32 general purpose registers.

D. OPTO COUPLER

In electronics an opto-isolator also called an optocoupler, photocoupler, or optical isolator, is a component that transfers electrical signals between two isolated circuits by using light. This prevents high voltages from affecting the system receiving the signal. Commercially available optocouplers withstand input-output voltage up to 10 kV and voltage transients with speeds up to 10 kV/micro sec.

An opto-isolator consists of an LED and a photo transistor in the same opaque package. Other type of source –sensor combinations include LEDphotodiode, LED-LASCR and lamp-photoresistor pairs. Usually opto-isolators transfer digital (onoff) signals but some techniques allow them to be used with analog signals.

E. TCP/IP

TCP/IP (transmission control protocol/internet protocol) is the basic communication language or protocol of the internet. It can also be used as a communication protocol in a private network (intranet or extranet). When set up with direct access to the internet, the computer is provided with a copy of the TCP/IP program.

F. RELAY

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch. But other operating principles are also used such as solid-state relays. Relays are used where it is necessary to control a circuit by a separate low power signal or where several circuits must be controlled by one signal.

G. Relay Driver

Relay drivers are used to drive relays. There are numerous ways to drive relays. They are high side toggle switch driver, low side toggle switch driver, bipolar NPN transistor driver, Darlington transistor driver, N-channel MOSFET driver and ULN2003 driver.

H. LCD DISPLAY

A liquid crystal display (LCD) is a flat panel display or other electronic visual display that uses the light modulating properties of liquid crystals.

I. Power Supply

A power supply is a device that supplies electric power to an electrical load. A regulated power supply is one that controls the output voltage or current to a specific value. Power supply is implemented in 5 stages. The essential stage is to step down the 230V AC to 12V AC and is done using a step down transformer (230/12-0-12). The output of the transformer is a 12V peak to peak supply Vmax=12V (peak of one half cycle). This output is given to a bridge rectifier which gives a pulsating DC supply. This supply is then given to the next stage which is a regulated IC 7805 which gives a constant DC supply regulated at 5V.

J. INTERNET-OF-THINGS

Whenever an Embedded System plays a role in updating data onto a remote location or device through an Internet IP address using WAN, it‘s nothing but IoT. Here in our project, we are uploading and retrieving data from Cloud or any particular Internet IP address using the Internet facility provided default by the hardware in our system (Raspberry Pi 2) at Smart Grid EB Side.
All the data say the Power Unit Monitored at Grid Side, the data received from Consumer Side, Comparison between both Units and Exceeded Units, etc... etc... are possible through this IoT concepts using WAN facility. Updating this kind of Embedded Systems data‘s are possible in many ways like TCP/IP, UDP/IP, Web-based Apps or Scripts or particular Webpage.

VI. WORKING

The KSEB as well as consumer can monitor the consumed data through internet. The consumer side is equipped with an energy meter, relay unit, optocoupler, atmega32 and raspberry pi. The raspberry pi is continuously monitors the energy meter reading and calculate the amount till the last usage. These details can be viewed on the monitor and also it will be sent to the KSEB by the IoT. The LCD is provided for the attention of the consumer in case of exceeding normal usage.

The heart of the system, raspberry pi which receives the power consumed units from the consumer side and let the software program receive the values for further calculations and uploading that consumer data to cloud using IoT through ethernet or wifi. We are uploading and retrieving data from any particular IP address using the internet facility provided default by the hardware in our system. This system with Arduino-UNO micro controller unit does both the internal and external activities regarding the communication with energy meter and raspberry pi. Energy meter output is connected to the optocoupler to provide the LED blinking as trigger to the Atmega32

VII. FLOW CHART

A. Flow Chart for Trigger from Energy Meter

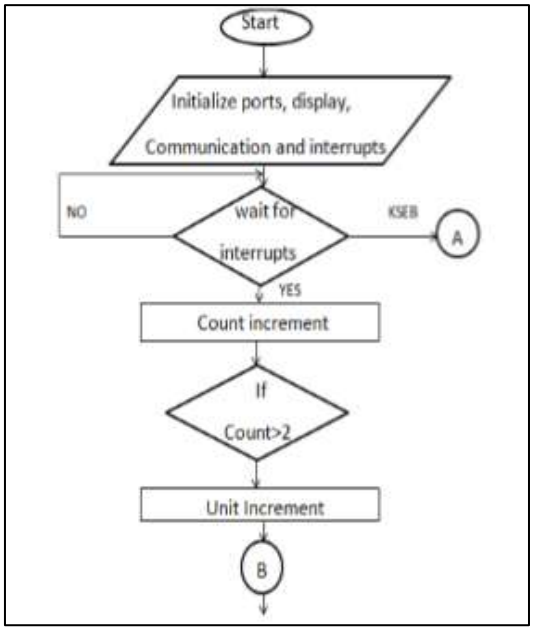

Fig. 3: Flow Chart for Trigger from Energy Meter

B. Flow Chart for Trigger from KSEB

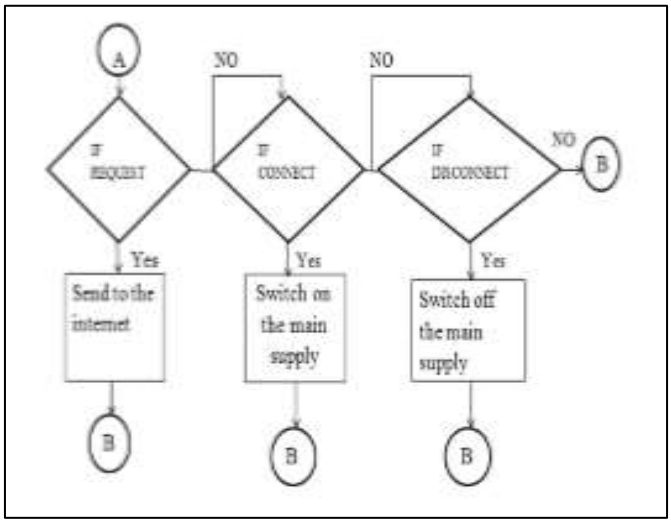

Fig. 4: Flow Chart for Trigger from KSEB

Basically there are two interrupts present in this system. First interrupt is from energy meter. whenever the meter has start to work with a load, the LED present in the meter starts to blink. An optocoupler connected with this LED converts this 230V to 5v, this is connected to interrupt pin ofAtmega32. The second interrupt is from KSEB section, may be of three types: connect, disconnect and generate.

VIII. OPEN SOURCE AND EXTENSIBLE SOFTWARE

The Arduino software is published as open source tools, available for extension by experienced programmers. The language can be expanded through C++ libraries and people wanting to know the technical details can make the leap from Arduino to the AVR C programming language on which it's based. Similarly, you can add AVR code directly into your Arduino programs if you want to.

IX. OPEN SOURCE AND EXTENSIBLE HARDWARE

The plans of the Arduino boards are published under a creative common license, so experienced circuit designers can make their own version of the module, extending it and improving. Even relatively inexperienced users can build the breadboard version of the module in order to understand how it works and save money.

X. PROGRAM REQUIRED

Python is used to program the interconnection section of web page and hardware. Php is used for web page design. Embedded C is used to program Atmega 32.

XI. ADVANTAGES

It eliminate the man power requirement

1) Easy to monitor energy consumption.
2) It provides remort disconnection of service.
3) It helps to save time and money.

XII. DISADVANTAGE

Implementation cost is high

XIII. EXPERIMENTAL RESULT

Fig. 5: Experimental Result

XIV. CONCLUSION

This paper presents the energy monitoring using IOT BASED POWER METER. It simplifies the work of electricity board. It ensures residential, commercial and industrial consumers in electricity management and even production.

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