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Smart Electric Energy Meter Based on IoT

Padmwar Prachi[1], Rahinj Shilpa[2], Shendage Snehal[3], Prof. P.R Yawle[4]
[1, 2, 3, 4]*Dept. of E&TC, BVCOEW, Pune, India*

Abstract: ***Now a day, smart electric energy meter is one of the widely used technologies. Electric energy meter undergoes the number of rapid changes and advancements and there is increased in demand for more reliable and efficient metering system. An accurate and timely analysis is critical due to a large number of meters, yet it has a huge demand in the market. In the existing system, in any apartments or large buildings number of meters ate installed. For calculation of energy consumption representative of MSEB office come and takes individual readings of each meter. This is a very hectic process and human resources get wasted. To solve this problem, we propose architecture and an implementation of a smart energy meter using an internet-of-things (IoT) platform. In this system, we use a wireless technology and collect the readings and data of the number of energy meter at a time and also display it on the webpage which is developed by us. The webpage provides the information of meter id, consumed unit and status of the meter to the user. This analysis will be useful in the world which is faster, user-friendly and less time to consume.***

Keywords: Electric energy meter, Microcontroller LPC2148, GSM, IoT, Web page.

I. INTRODUCTION

The Internet of Things (IoT's) term can be used as connecting everyday objects like a Smartphone, Internet TVs, sensors and actuators to the internet where the devices are intelligently linked together enabling new forms of communications between things and peoples and between themselves. This is a low cost and flexible monitoring & controlling system using a microcontroller. Internet of Things is a network of many electronic devices and sensors which are connected together to exchange some information over the web. The devices based on IoT are similar to talking and sharing data with each other. Smart Meter is one of the applications of IoT. It records the consumption of bill and sends the readings to the local MSEB office on regular basis for monitoring and billing. For a long time, traditional electromechanical meters have been used. Meter readings were noted down on the monthly basis. But now with the evolution of smart electricity meters, things are changing. Aiming at reducing time consumption, we designed an IoT based smart electric energy meter, in which consumption each meter. For larger building, lower the obtained detail. Ideally, spreading hundreds in a large building, implementing sub-metering techniques, can lead to a very well detailed report that can actually help to reduce energy consumption. In this project, we are designing the IOT-based SMART Energy Meter. In which we are connecting the entire meter in the society to one micro-controller. The data is sent to the MSCB with the help of GSM system. And the data is available on the website. It is useful to obtain meter reading when we required so that meter reader doesn't need to visit each customer for the consumed data collection and to distribute the bill slips. In case the customer can't pay the bill there is no need to send a person to cut-off the connection. It is done only by the Relay Mechanism.

II. SYSTEM ARCHITECTURE

The block diagram of the given system is shown in Fig.1. The proposed system gives you a detailed idea about various connection establishments between the microcontroller and other components for proper functionality.

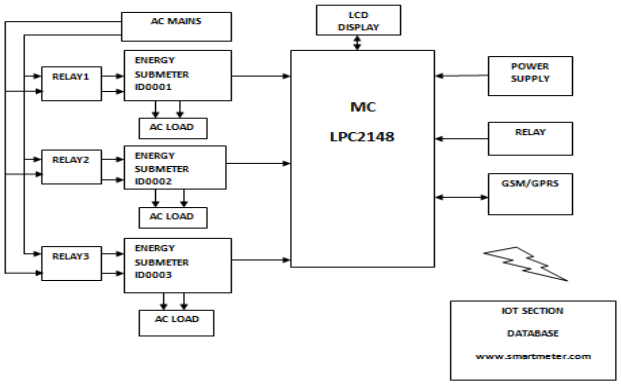

Fig 1: Block diagram of the proposed system.

A. Hardware

In given system number of energy meters are connected to the microcontroller LPC2148 through connecting wires, for energy meters we use IC ADE7761.Each ac load is connected to the every energy meters for calculation of consumption of data. The relay is also connected to every energy submeter for turn ON and OFF the energy meters when a consumer is unable to pay the bills.16x2 LCD display is interfaced with the microcontroller which shows the meter ID and consuming unit. The power supply is given to the microcontroller to ON the microcontroller.GSM/GPRS is interfaced with the microcontroller. We also developed a webpage which shows the status of energy meter such as meter ID, the number of the unit, billing, a status of energy meter i.e live or dead and status of payment. The web page can be accessed by consumer anywhere in the world by proper authentication.

1) *Power Supply:* A power supply is an electronic device that supplies electric energy to a load. The primary function of a power supply is to convert one form of electrical energy into other and as a result power supply is sometimes referred to as electric power converters. This project uses regulated 3.3V 500mA power supply. A 7805 three terminal voltage regulator is used for voltage regulation. Bridge type full wave rectifier is used to rectify the ac output of secondary of the 230/12V step-down transformer.

2) *LPC2148::* The main purpose of the microcontroller is to accept input from different input devices and accordingly drive the output. Hence, there will be different devices connected to a microcontroller at a time. Also, there are many internal components in a microcontroller like a clock, timers, and counters etc. that require the attention of the processor.The LPC2141/42/44/46/48 microcontrollers are based on a 16-bit/32-bit ARM7 TDMI-CPU with real-time emulation and embedded trace support, that combine the microcontroller with embedded high-speed flash memory ranging from 32kB to 512kB and 8kB to 40kB static memory.A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at the maximum clock rate. The 16-bit Thumb mode reduces the code by more than 30% with a minimal performance penalty, for critical code size applications.

3) *LCD:* A 16x2 LCD has 16 columns and 2 rows.. It can display 16 characters for each line and there are such 2 lines. In this LCD each character is made of in the 5x7 pixel matrix. The LCD has two registers that is Command and Data to display meaningful data onto our LCD screen.

Fig 2: LCD module

4) *GSM:* The GSM Modem can accept any GSM network operating SIM card and act like a mobile phone with its own unique identification number. Using this modem you can develop embedded applications like data transfer, SMS Control, remote control, and logging can be developed very easily. GSM modem can be connected directly to the PC serial port or through MAX232 to any microcontroller. It can be used to send and receive SMS or make and receive voice calls. It can also be used in GPRS modem to connect to the internet and do many applications such as data logging and control. In GPRS mode you can also connect to any remote FTP server and upload any files for data logging and control.. GSM modem is a highly flexible plug and plays quad-band SIM800A GSM modem for direct and easy integration to RS232 applications.

Fig 3: GSM Module

5) *Relay:* A relay is an electrically as well as mechanically operated switch. Relays consist of an electromagnet and contacts. The switching mechanism is carried out with the help of the electromagnet. They are used for the purpose of connecting and disconnect.

B. Software

1) *Keil:* Keil is the complete software development environment for a wide range of tools like ANSI C compiler, macro assemblers, debuggers and simulators, linkers, IDE, real-time operating system and evolution boards for 8051, ARM and XC16x families. Keil µ5vision is free software that enables programming in the language that understood by the system. They are easy to learn and use. It is powerful enough for the most demanding embedded applications. In the Keil, we compile the C code.

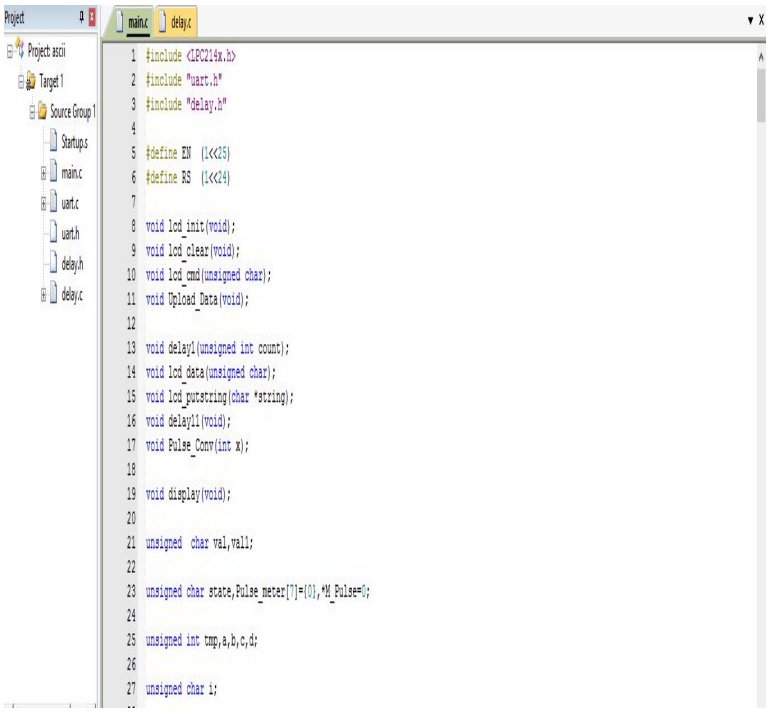

Fig 4: Code

2) *Proteus 8:* Proteus 8 is software with we can generate the schematic captures, develop PCB and stimulate microprocessor. We can design different electronic circuits with necessary components such as signal generator, power supply, and microcontroller. We used Proteus 8 software for simulation of interfacing of energy meter with the microcontroller and also interfacing of GSM with the microcontroller.

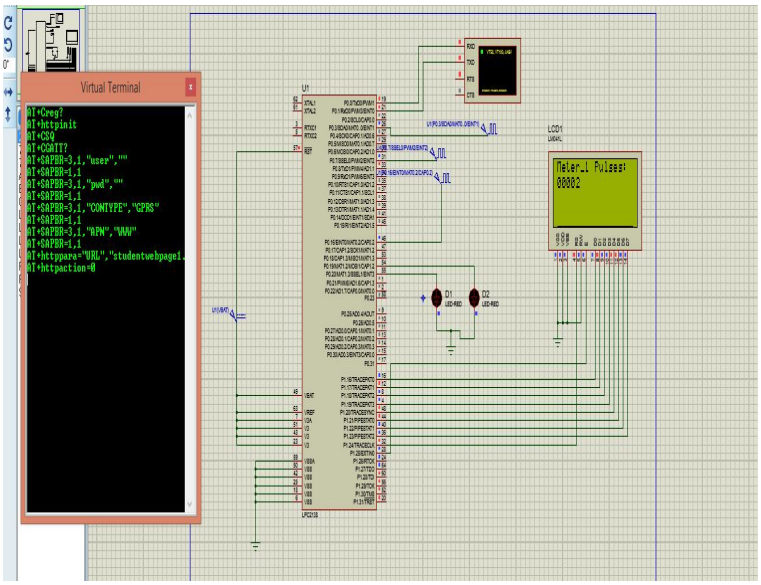

Fig 5: Simulation

3) *Webpage:* The web page is a document that is suitable for the World Wide Web and web browser. It is written in Hyper Text Markup Language (HTML) which is accessible through the internet or other network using internet browser. It is accessed by entering specific URL address. HTML code can be created using an HTML editor. It includes many different elements such as CSS, PHP, JavaScript and much more. We can style the HTML templates using CSS. Using CSS we set the colors, font, heights, width, margins, padding. CSS function includes transform functions, colour functions and shape functions etc. It includes different animated properties such as background colors, border widths, element position, padding margin. JavaScript is used to program the behavior of the webpage.

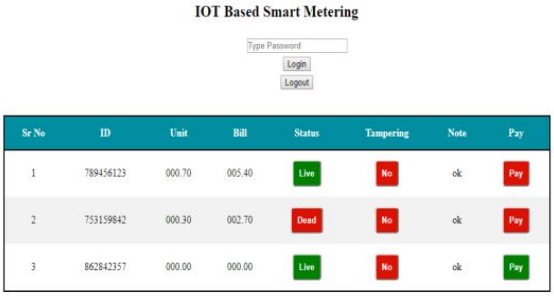

Fig 4: Web page

III. SYSTEM FUNCTIONALITY

A power supply of 3.3v is given to the microcontroller.ac mains is supplied to energy meter.inside the energy meter, there is LED which blinks 3600times per minute and it is considered as one unit in general meter.in our project, 10 pulses are considered as 0.1 unit. Energy meter generates the pulses which are given to the microcontroller and microcontroller counts the pulses. LCD is interfaced with the microcontroller which displays the meter ID and number of unit one by one. GSM is interfaced with microcontroller used to transmit the overall data of energy meter to the webpage. We developed the webpage which is accessible to both consumers and MSEB office.

The web page displays the meter ID, consumed unit, billing, status of the meter and pay option.

IV. ADVANTAGES

A. The user can be aware of electricity consumption

B. The human work of collecting readings by visiting at every home at the end of every month can be avoided by generating electricity bills automatically

C. Accurate measurements of electricity use while eliminating the need for estimated monthly bills or home visits from meter reading

D. Enable consumers to adjust their habits in order to lower electricity bills.

V. CONCLUSIONS

This proposed method is robust and effective to perform the task of gathering the separated data consumption of every meter in buildings and apartments simultaneously to a server which shows the overall consumption one by one on LCD display and also provides some other useful services such as meter id, number of units, bill, meter status i.e live or dead and status of payment. On the webpage, a consumer can able to see the status of energy consumption which can be accessed anywhere in the world.

This system reduces the human interference and also save the time consumption. In future, it will be used in large number in many infrastructures for easy access of energy consumption.

VI. ACKNOWLEDGMENT

It is a great pleasure for us to present a project on “Smart Electric Energy Meter based IoT” where guidance plays an invaluable key and provides the concrete platform for completion of the project. The hard work and perseverance of our mentor will always be embedded in our memory. Project execution would not have been possible for us without the continued assistance of certain people. We take this opportunity to express our deepest gratitude for all the heartfelt assistance rendered. We thank our project guide Prof. P. R. Yawle who was responsible for coordinating us all efforts and sincerely very grateful to her for helping to achieve this successful performance.

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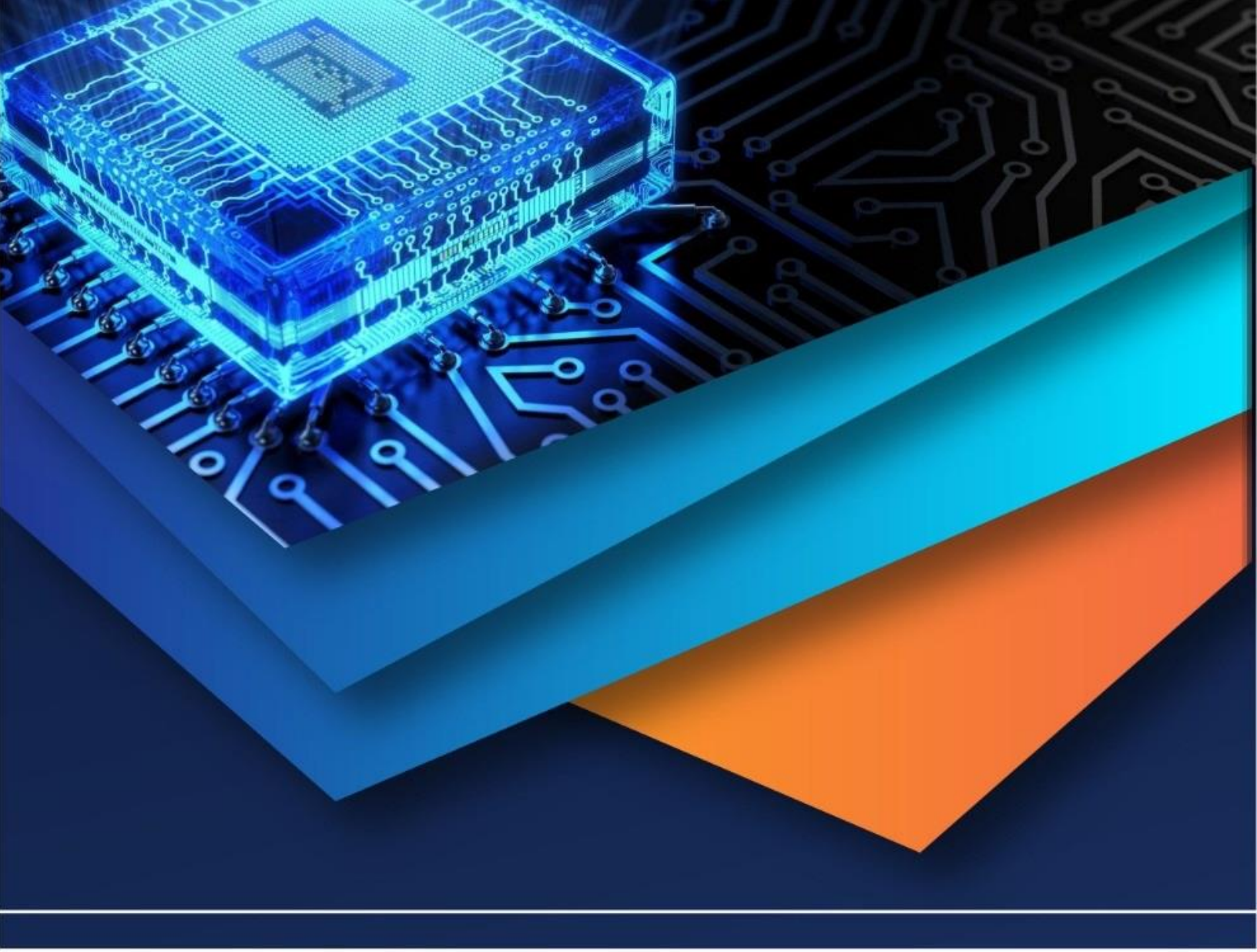

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