Energy Monitoring System Using IOT

[1]Abhishek Bhokare, [2]Neha Chalke, [3]Kajal Ambavale, [4]Ms. Swati Nadkarni, [5]Dr.V.C. Kotak

[1, 2, 3] Student, [4]Associate Professor, [5]Professor

Shah & Anchor Kutchhi Engineering College, Mumbai, India

Abstract: The vitality review may go from a straight forward stroll through overview at one outrageous to one that may traverse a few stages. These stages incorporate a straightforward stroll through study, trailed by checking of vitality use in the business administrations, and after that demonstrate examination utilizing PC recreation of industry activity. The multifaceted nature of the review is along these lines legitimately identified with the stages or level of modernity of the vitality the board program and the expense of the review work out. Remote observing and control alludes to a field of mechanical mechanization that is entering another period with the improvement of remote detecting gadgets. Remote checking of various ventures sensors, apparatuses, vitality or the power boards are the most requesting items and numerous associations are dealing with it. Keeping both the important points in consideration proposed has been designed to implement the remote energy parameter monitoring system for energy audit and analysis. The proposed hardware modules are device with inbuilt functionality to work as a web client to communicate directly with web services. Providing microcontroller web functionality through GPRS protocol and reading meter parameter over MODBUS protocol is most challenging part of the system.

Index Terms - *Internet of things, Cloud service, Energy-conserving opportunities, Monitoring and control, Remote Monitoring System, Energy Management System.*

I. INTRODUCTION

The vitality review in a structure is plausibility contemplate. For it not just serves to recognize vitality use among the different administrations and to distinguish open doors for vitality preservation, however it is likewise an urgent initial phase in building up a vitality the board program. The review will create the information on which such a program is based. The investigation ought to uncover to the proprietor, supervisor, or supervisory crew of the business the choices accessible for lessening vitality squander, the costs included, and the advantages feasible from actualizing those vitality monitoring openings (ECOs).

The vitality the board program is a methodical on-going methodology for controlling a structure's vitality utilization design. It is to lessen misuse of vitality and cash to the base allowed by the atmosphere the business is found, its capacities, inhabitance plans, and different components. It sets up and keeps up an effective harmony between a structure's yearly useful vitality necessities and its yearly genuine vitality utilization.

Observing of electrical parameters is a key component in any Energy approach. Execution of checking gear is the initial step of this sort of methodology, as it makes an appraisal of the genuine circumstance conceivable, before assurance of the most pertinent arrangements. Because of observing it is conceivable to evaluate the Energy Efficiency improvement activities.
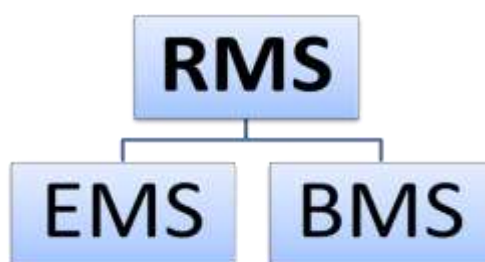

Fig:1: Classification of RMS

II. OBJECTIVES

The objective of the thesis is to provide brief idea regarding following points:
- To design a microcontroller-based internet enabled remote data acquisition system for energy parameter monitoring.
- To implement centralized data gathering and management application.
- To develop a web service for interaction between web application and microcontroller.
- To develop internet enabled graphical data analysis tool.

III. LITERATURE SURVEY

1]   Wireless Energy Management System for Residential Area.
Authors: Hong-Chan Chang and Cheng-Chien Kuo.

The vitality the executive's framework proposed in this paper utilizes the correspondence stage of ZigBee remote sensor organize in blend with the vitality parameters estimation and the control elements of security insurance and screen, so as to accomplish the targets of vitality sparing, carbon decrease and safe power use. The framework structure is comprised of the insightful outlet module, remote transmission module and focal screen and control module. Consolidating with the vitality screen and security insurance programming, the framework can accomplish seven noteworthy capacities, which are vitality utilization screen, vitality use control, backup control the board, circuit circle vitality screen and assurance control, outlet overheat security, electric spillage security and unbiased line over-voltage insurance. The framework cannot just lessen vitality misfortunes and improve security insurance, yet in addition advantage for stifling carbon emanation and relieving the impacts of worldwide cautioning procedure and environmental change [1].

2]   Energy Monitoring System using PLC's and SCADA's.
Authors: P.Thamarai, R.Amudhevalli

This paper talks about power shutdown is a noteworthy issue now-a-days and it happens on the grounds that a ton of intensity is squandered in enterprises. The ENERGY MONITORING SYSTEM manages this issue in a basic and viable manner by inspecting the vitality use in enterprises. It checks control shut downs by knowing the huge measure of vitality squandered in businesses. This in a mechanized procedure. In ENERGY MONITORING SYSTEM, Energy Meters, PLC's and PC's are utilized for playing out its activities. Various vitality meters with a solitary PLC which thus associates with a PC. VB - sequential correspondence is utilized to encourage the correspondence between the PLC and PC. A few PLC's in a system can likewise be utilized. The system is clearly associated utilizing RS-485 links, which give all-inclusiveness. In any case, PC's are just perfect with RS-232. Consequently, we interface a converter (that changes over RS-485 to Ethernet) between the system of PLC's and the PC. SCADA-Supervisory Control and Data Acquisition of modern procedures utilized for sequential correspondence to encourage correspondence between the programmable intelligent controllers and PC [2].

3]   Remote Energy Monitoring, Profiling and Control Through GSM Network.
Authors: Adnan Rashdi, Rafia Malik.

This paper presents plan and advancement of a worldwide framework for versatile correspondences (GSM)- based vitality observing, profiling and control framework. The proposed framework coordinates buyer's advanced vitality meter with vitality observing framework which is constrained by electric supply organization. Single stage or three stage advanced electric meters can be utilized with indigenously created extra module, which secures vitality use information at purchaser premises and after vital handling transmits it to the electric supply organization utilizing short message administration (SMS) and worldwide bundle radio administration (GPRS) through GSM arrange. At electric provider end, a vitality observing framework deals with all gotten meter readings, figures the charging cost, refreshes the database and keeps up a vitality utilization profile for every shopper. Framework controls all activities at the electric supply organization home office and creates different cautioning alarms on event of flaws in the framework. A working model of complete framework has been created utilizing advanced vitality meter made by MicroTech Industries, Pakistan, to show an effective and straightforward methods for programmed meter perusing, charging and warning utilizing existing wide spread GSM organize [3].

4]   Online and Remote Motor Energy Monitoring and Fault Diagnostics Using Wireless Sensor Networks.
Authors: Anbarasu, Rajendhiran.

This paper recognizes the cooperative energies between remote sensor systems (WSNs) and nonintrusive electrical flag based engine signature investigation and proposes a plan of applying WSNs in on the web and remote vitality checking and flaw diagnostics for mechanical engine frameworks. The principle extension is to give a framework review where the nonintrusive idea of the electrical-flag based engine signature investigation empowers its applications in WSN engineering. Uncommon contemplations in planning nonintrusive engine vitality checking and shortcoming symptomatic techniques in such frameworks are examined. This paper likewise gives definite examinations to address this present reality challenges in structuring and sending WSNs practically speaking, including remote connection quality elements, clamor and impedance, and natural effect on correspondence range and unwavering quality. The general framework practicality is examined through a progression of research center examinations and field tests. To begin with, the idea of a remote and online vitality observing and issue analytic framework is shown utilizing a rearranged star-type IEEE 802.15.4 agreeable WSN in the lab. Two settled nonintrusive engine analytic calculations are deliberately used to demonstrate the practicality. Next, the difficulties of applying the proposed WSN plot in genuine modern situations are investigated tentatively utilizing field test results [4].

IV. DESCRIPTION

In order to control and monitor the communicator system need to deal with series of software which will internally communicate with each other and all software must follow some standard formulations. The below figure will describe the series in detail.

Fig 2: Process Flow

1. Microcontroller program: This code specifically designed for AVR series microcontroller Atmega328P which will control overall working logic of the communicator. This module will handle following sub modules,

1. Communicate with meter over RS485 serial device using MODBUS protocol and read the incoming reading from energy meter.
2. Communicate with GSM/GPRS to establish the data link with web server using AT+ command set or protocols. This module will try to convert communicator in to web client for sending details to web server.

2. Web Service: This will be dedicated IP based central web service which will be accessed by communicator for different functionality. Web service will handle following task.

1. Method for getting reading from communicator over web request and save the record with timestamp in data table.
2. Check the communicator status in order to give different response like "Active" or "De-Active".
3. Parsing the incoming request if the data is coming from master meter and store the records along with every meter ID and time stamp.
4. Generating alerts if there is no data from any of the meter between defined time periods.
5. Generating graph table for data analysis purpose.

3. DBMS Manager: As the data will come from multiple communicators hence to inserting data records, reading data records on demand, defragmenting data space DBMS manager module needs to develop. This will be single point interface for any type of data manipulation.

4. Web Application: In order to managing the customers, sites and communicators system needs web application so that it can be managed from any locations. Scope of web application will be as follows,

1. Registering the Customers and managing their information.
2. Registering and managing the meter communicator along with the SIM card provided details and activating meter for first use.
3. Authenticating user through valid login process for monitoring user's site and meters statistics.
4. Customer profile and billing management.
5. Meter grid or individual meter monitoring.
6. Meter communicator configuration monitoring.
7. Reports, Statistics, graph generation.
8. Alerts for different event generation and sending mails or SMS in critical or pre-defined conditions

V. COMPONENTS DETAILS

The major components used in this project are as follow:

1. Current Transformer
2. Smart Meter
3. IOT Device
4. ASP .net

Current Transformer

A current transformer (CT) is a type of transformer that is used to measure alternating current (AC). Current transformers are the current-sensing units of the power system and are used at generating stations, electrical substations, and in industrial and commercial electric power distribution.

Smart Meter

Smart meter has bidirectional communication capability for remote control and tariff based operation. The customer has up-to-date price, load and cost info about gas-, water-, heat and electricity consumption. The smart meter is a basic end-user element of the smart grids, too.

IOT Device
The Arduino UNO is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits.

ASP .Net
Asp.NET is a free, cross-platform, open source developer platform for building many different types of applications. With Asp.NET, you can use multiple languages, editors, and libraries to build for web, mobile, desktop, gaming, and IoT.

VI. FUTURE SCOPE

This project can be used in future by adding new features such as SMS Notification. Over here we can set a limit of units if the meter goes above that unit then it will send a notification to the registered phone number. And secondly we can add one more feature of shutting the power from sending a SMS from mobile phone.

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