

Energy Monitoring and Consumption Using IOT

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ABSTRACT:Energy monitoring and consumption device implements a low power energy consumption, monitoring and control system using IOT technology with Real-Time Analytics. The proposed GSM Module based system integrates energy meters installed at consumer unit with an electric supply companies to monitor, profile and control energy flow with the help of Graphical User Interface. These smart IOT devices allow for the usage of energy data from each unit to be collected and stored, TCP protocol used for sending bits of data over the Internet to a CloudBased database that can be analyzed and reported for energy conservation and analysis. The database from the Cloud system updates information to the application like Voltage, Current, Units and billing rate or sudden power cut to the energy supplier company and is displayed on GUI of the Energy Monitoring application. This system can also send an alert to the energy supplier in case of any power theft at the consumer side.

KEYWORDS: Arduino MEGA 2560, Smart Energy Meter, Current Sensors, Computer, GSM Module.

I.INTRODUCTION

In smart metering system as proposed in research with the ability to communicate wirelessly, commands are sent to the meter replies with the relevant energy consumption readings via GSM Module. In this way it allows both the power supply companies and the user to have a better monitoring of the energy consumed by the load. How to make energy use more efficient and effective is very critical for future social and economic developments due to limited availability of non-renewable energies.

Smart Energy Meter has been proposed as an innovative solution aimed at facilitating affordability and reducing the cost of utilities. The existing energy meter has mechanical with various tiresome and insecure energy meter reading methods. The problem with this system is that it requires man power, time consuming and causes error. In addition the online approach generates alerts about consumptions of energy as and when required according to a predefined pricing structure through a call/email/short text message.

A smart meter is well equipped digitally to provide better power theft-detection. Smart meters having capabilities based on different internet protocol to communication reliably for performing real-time operations like billing, quality assurance, load notifications. They are smart energy meters that offer two-way communication, allowing for more interactivity between the consumer and utility.

II.RELATED WORK

The Analysis of the Meter reading techniques which are existing currently is done. According to the research done, the existing component is an electronic or electromechanical energy meter which is present in the premise to measure the usage. The energy meter that are currently used, record the energy consumption in kWh and these units are still recorded by a person from the service provider every month, on foot. The Energy meter reading company or the internet service provider process the recorded data. The processing of the meter reading is done by first linking each recorded power usage data to an account holder and then determining the amount of that consumer through the specific tariff in use, which is a very tiresome job. The proposed system built on various platforms all over the world for reading meter automatically, known as Automatic Meter Reading

(AMR). The AMR are classified in two types, Wireless and Wired. The energy meters with closeness, bluetooth energy meters were designed which communicated wirelessly with master PC which were basically for low power consumption. This technique wasn't efficient as it operated within a short range. The wired system, the Power Line Carrier (PLC) and the Telephone Line Network are the AMR systems available. To transmit the data every month remotely to the central office, tele watt meters were used. This was done with the help of dedicated telephone lines and a pair of modems. A command was send to the remote meters by the master PC at the control centre to get the data using Power Line Communication technique, which was mainly implemented in the areas with fixed telephone net

III.PROPOSED SYSTEM

In the Proposed system the manual work is replaced with automatic meter reading with GSM ,which simplifies the meter reading and minimizes the chances of energy theft allowing the utility to control the theft effectively. The Electricity Consumption with various Analytics & Insights is feeded to a cloud based Analytical Dashboard where the user experiences at Real-Time. The Users get to know where, why and for what they have spent most of their electricity.This method improves both building's energy efficiency and economic efficiency by measuring data which turns into actionable insights. These insights can help the building operators to identify their energy costs and minimize the electricity consumptions which reduce the operational costs of the buildings. The proposed design that can be implemented in both single phase power and three phase power. The Energy meter is also make it smart enough to detect any theft and to communicate with energy supplier and user wirelessly via GSM technology. The smart digital energy meter is the upgraded version of the typical digital energy meters with extra features, i.e. a wirelessly controlled system using GSM technology that enables the user and supplier to communicate with the meter via application of user profile and with a power theft detection, scheduled load shedding and monitoring capability.

A user-friendly GUI is designed for the power supply stations that enable them to monitor and control the meter through computers. Once the application is started, a dialog box appears asking for the "com port" at which the GSM is connected. Then the application is connected to the meter and data is received from the meter all the time and is updated on the application. There is an indicator which is used to show the theft for the meter. In case of any meter tampering, an indicator will alert service provider. For sending a turn on/off signal and to get energy consumption updates instantly, separate buttons are provided on the screen. The user can communicate with the meter via SMS using this window.

IV.BLOCK DIAGRAM

TRANSMITTER SIDE:

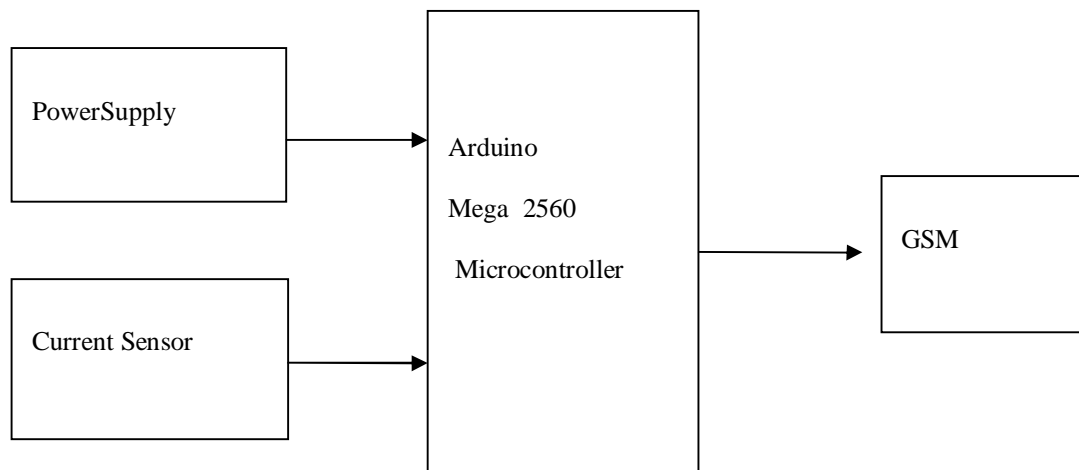


Fig.1.Transmitter side

RECEIVER SIDE:

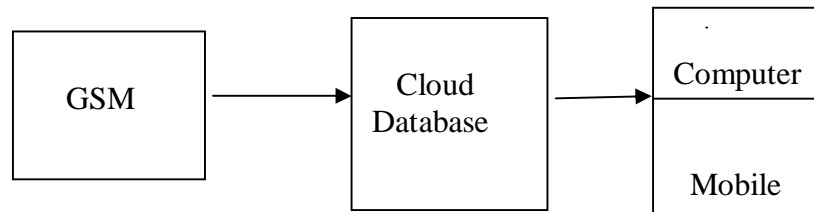


Fig.2.Reciever side

V. WORKING PRINCIPLE

A power offer is employed to scale back the most electric power at 240V AC to 5V DC for the method. The buildings ought to be equipped with increasing variety of current sensors, these sensors detect or control the actions for driving the efficient use of energy. Even though the sensors produce some efficiency but more number of sensors has to be equipped throughout the building which makes deployment costs very high and installation process complex. ArduinoATMega2560 is used in this work along with other required hardware like power supply required for GSM with the capability to perform multiple tasks at a very high conversion rate. It contains everything needed to support the microcontroller. GSM stands for Global System for Mobile communication. SIM900 GSM Module supports communication in 900MHz band. It is used mobile communication modem system in world wide. This module is used to communicate between the meter and utility and consumer. The ways of connecting GSM module to Arduino by the Transmitter pin of GSM module to Receiver pin of Arduino and Receiver pin of GSM module to Transmitter pin of Arduino. The consumption of the power and details from the energy meter move to Microcontroller it measures the voltages, current and stores the datas and move to the GSM module. The communication between GSM and cloud server via Internet protocol TCP (Transmission Control Protocol), it is updated to the cloud database and the data are retrieved from the cloud server which display in the dashboard of the user profile. The database from the Cloud system updates information to the external application like Voltage, Current, Units and billing rate are displayed on GUI of the Energy Monitoring application of the user profile.

VI. EXPERIMENTAL RESULTS

A GSM Module sends the data of the Energy Meter via an application, the details of the data of the energy meter in the clouds are extracted by using an external application which display in the profile of the user in the system via dashboard. The database gets updated in the dashboard of the user profile.

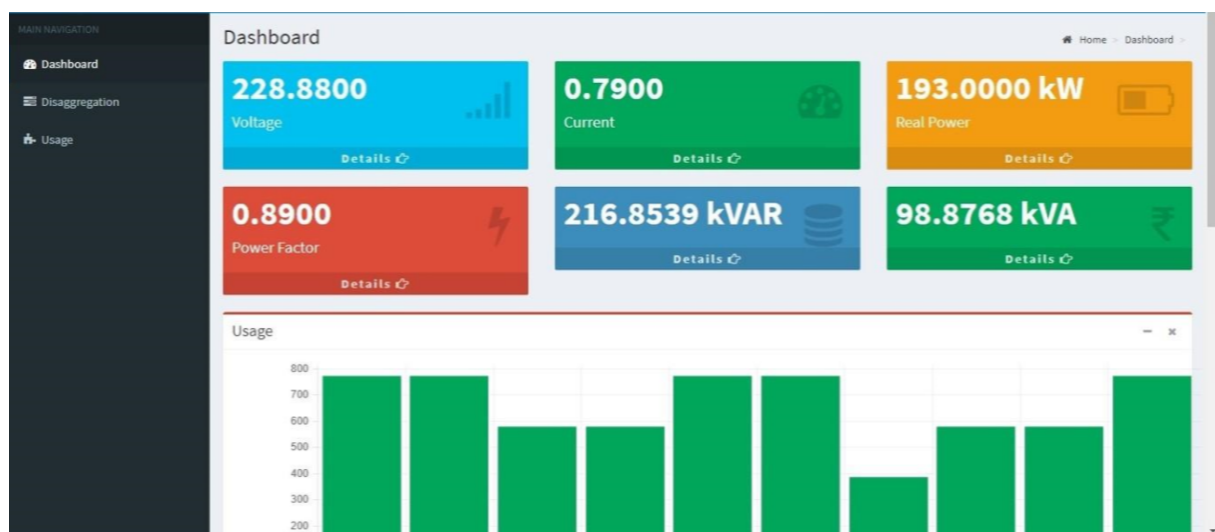


Fig.3. Graphical User Interface of the Proposed method

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These are the power distribution architectures and their specification of the loads consumption of the energy in the buildings.

Module	Building type	Supply	Wiring/ main route	Floors	Floor area	Total area	Power required	Transformer module	Generator	UPS
1	Low-rise building	1 supply section	Cable	≤4	2,500 m ²	10,000 m ²	1,000 – 2,000 kW	2 × 630 kVA, u _{kr} = 6%, I _k ≤ 30 kA	400 kVA (30%)	200 kVA (15%)
2	Low-rise building	2 supply sections	Busbar	≤4	2,500 m ²	2 × 10,000 m ²	> 2,000 kW	2 × 800 kVA, u _{kr} = 6%, I _k ≤ 60 kA	730 kVA (30%)	400 kVA (15%)
3	High-rise building	1 supply section, central	Busbar	≤10	1,000 m ²	10,000 m ²	≤ 1,800 kW	2 × 630 kVA, u _{kr} = 6%, I _k ≤ 30 kA	400 kVA (30%)	200 kVA (15%)
4	High-rise building	1 supply section, transformers at remote location	Cable	10 – 20	1,000 m ²	20,000 m ²	≤ 1,500 kW	2 (2 + 1) × 630 kVA, u _{kr} = 6%, I _k ≤ 45 kA	800 kVA (30%)	400 kVA (15%)
5	High-rise building	Distributed supply	Busbar	>20	1,000 m ²	20,000 m ²	≥ 2,000 kW	2 × 3 × 800 kVA, u _{kr} = 6%, I _k ≤ 60 kA	2 × 630 kVA (30%)	2 × 300 kVA (15%)

Fig.4. Power Distribution Architectures and their Specification

The unit consumed by the load per day is stored and updated in the dashboard of the user profile.



Fig.5. Insights Delivered in the Analytic Dashboard

VII. CONCLUSION AND FUTURE ENHANCEMENT

The proposed system, Smart Energy Meter using IOT is designed. This project was to bring improvement in the current power systems of the country by introducing a new smart metering system. The results discussed, and observations made in this research concluded that smart metering system with GSM communication capabilities

will make the current power management better and efficient in many ways. In future the paying of bill can be implemented in the user profile.

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