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Implementation of Smart Energy Management System Using Low Power Arduino and IOT

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A B S T R A C T

The present traditional system brings many issues in calculation of readings and billing manually. It became a critical task in handling and maintaining the power consumption. Also maintenance of the power consumption is also an important task when the technician goes to consumer's end and obtaining the bill as per the meter reading. In case of due to consumer not availability, then the entire power consumption measurement and billing process will be pending also technical officer from electricity again need to revisit the same house. The availability of wireless communication system the exchange of information will be fast, secured and reliable. In the proposed system, we introduced system which can collects the energy information automatically through wireless communication from residential, commercial and industrial zones and send the information directly to the central server for further billing process.

Keywords: Smart Energy Metering System, Internet of Things, Bluetooth, Wireless Communication, GSM Gateway.

1. Introduction

Now a days in Government Electricity Board, automation system planned to implement due to the rapidly advancing mobile communication technology and the decrease in costs. With the rapid developments in the Wireless communication technology by the use of microcontrollers, there are many improvements in automating various industrial aspects for reducing manual efforts. The traditional manual Meter Reading was not suitable for longer operating purposes as it spends much human and material resource.

2. Existing System

In existing system for collection of energy consumption data is that the representatives of Government Electricity Board monthly comes and visit every residential , take the snap shot. This collected data is recorded on a piece of paper along with a snap shot of the meter and finally submitted to the local Government Electricity Board office. There after the official's read the snap shot and meter readings and then gives it to the local software for bill calculations and generation of bill.

3. Proposed System

In Proposed System, If an area suffered by Power shut down problem means each and every unit get an alert SMS by using GSM. If the user fails to make a payment for usage of Current rate within a deadline means automatically power supply goes on particular home will be OFF Mode after make a payment only the power supply will be ON.

If we supposed to fix default unit to separate units, for an example each unit fixed with 2500Watts means while reached 2000Watts it gets an alert SMS. And then, automatically the flow of power will be terminated.

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4. Hardware Implementation

The internet of things (IoT) is the internetworking of physical devices, vehicles, buildings and other items—embedded with electronics, software, sensors, actuators, and network connectivity that enable these objects to collect and exchange data.[1] In 2013 the Global Standards Initiative on Internet of Things (IoT-GSI) defined the IoT as "the infrastructure of the information society." The IoT allows objects to be sensed and/or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit.

When IoT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical systems, which also encompasses technologies such as smart grids, smart homes, intelligent transportation and smart cities. Each thing is uniquely identifiable through its embedded computing system but is able to interoperate within the existing Internet infrastructure. Experts estimate that the IoT will consist of almost 50 billion objects by 2020.

British entrepreneur Kevin Ashton coined the term in 1999 while working at Auto-ID Labs (originally called Auto-ID centers, referring to a global network of objects connected toradio-frequency identification, or RFID). Typically, IoT is expected to offer advanced connectivity of devices, systems, and services that goes beyond machine-to-machine(M2M) communications and covers a variety of protocols, domains, and applications.

As well as the expansion of Internet-connected automation into a plethora of new application areas, IoT is also expected to generate large amounts of data from diverse locations, with the consequent necessity for quick aggregation of the data, and an increase in the need to index, store, and process such data more effectively. The Allegro® ACS712 provides economical and precise solutions for AC or DC current sensing in industrial, commercial, and communications systems. The device package allows for easy implementation by the customer. The device is not intended for automotive applications. The device consists of a precise, low-offset, linear Hall circuit with a copper conduction path located near the surface of the die. Applied current flowing through this copper conduction path generates a magnetic field which the Hall IC converts into a proportional voltage. Device accuracy is optimized through the close proximity of the magnetic signal to the Hall transducer. A precise, proportional voltage is provided by the low-offset, chopper-stabilized BiCMOS Hall IC, which is programmed for accuracy after packaging. The output of the device has a positive slope (>VIOUT(Q)) when an increasing current flows through the primary copper conduction path (from pins 1 and 2, to pins 3 and 4), which is the path used for current sampling. The internal resistance of this conductive path is 1.2 mΩ typical, providing low power loss.

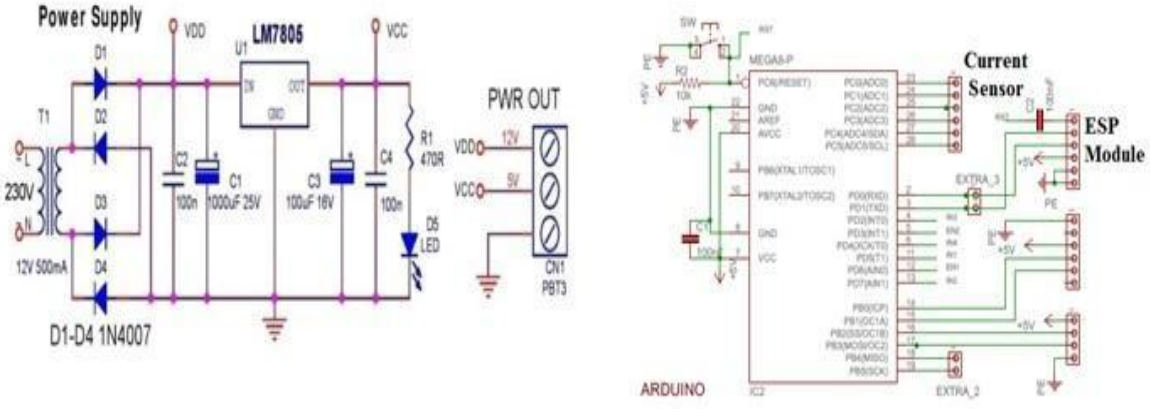

Fig.1. Circuit Diagram for Energy metering system

5. Working principle

The Internet of Things provides access to a broad range of embedded devices and web services. ThingSpeak is an open data platform and API for the IoT that enables you to collect, store, analyze, visualize, and act on data from sensors or actuators, such as Arduino, BeagleBone Black, and other hardware. For example, with ThingSpeak you can create sensor-logging applications, location-tracking applications, and a social network of things with status updates, so that you could have your home thermostat control itself based on your current location. The primary element of ThingSpeak activity is the channel, which contains data fields, location fields, and a status field. After ThingSpeak channel is created, you can write data to the channel, process and

view the data with MATLAB® code, and react to the data with tweets and other alerts. The typical ThingSpeak workflow is Create a Channel and collect data and Analyze and visualize the data.

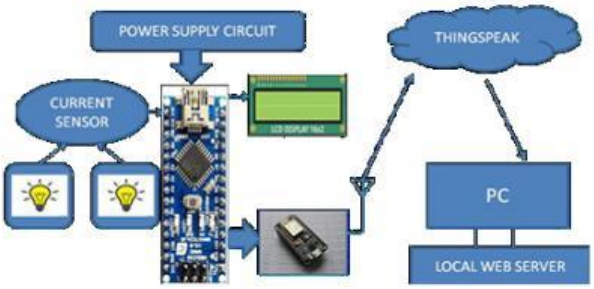

Fig.2. Block Diagram for Energy metering system

6. Result

Firstly we have to switch on the mains. Current sensor senses the power utilized by the load. Which gives output in analog form. The output of the sensor is supplied as input to the analog input part in the Arduino Nano Board. Arduino board has inbuilt analog to digital convertor which converts analog input of power to digital output. This digital output is displayed on LCD display in form of Watts as shown in Image -1 below. There is a set point value; when the power utilized by the load exceeds the set point value LCD displays "Theft detected" as shown in the Image -2 below. The Node MCU is used to connect internet with the monitoring hardware system. The power utilized by the load is displayed in the cloud viz, ThingSpeak cloud in graphical format as shown in the Chart -1 and Chart -2 below. It shows time to time power utilization of the load/loads connected to the system.

Fig.3.Energy Metering System Hardware prototype

7. Conclusion

Energy Monitoring using IOT techniques is an innovative model which is developed to control home appliances remotely over the cloud from anywhere in the world. In this proposed system, the current sensor is used to sense the current and also can view the values on internet using IoT. The proposed system will provide the updated energy values in every 1 to 3 seconds on the internet using customised public cloud. In the present system, energy consumption is accessed using Wi-Fi, hence the system will help to the consumers to secure from unwanted use of electricity. IoT system where a user can monitor and view their energy consumption and pay the bill in Online mode. Also, a system where a user can receive SMS, when he/she crosses threshold of electricity usage slab can be equipped. We can make a system which can send SMS to the concerned meter reading man of that area when theft is detected at consumer end. Also using cloud analytics we can predict future energy consumptions.

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