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Implementation of IOT for Energy Management

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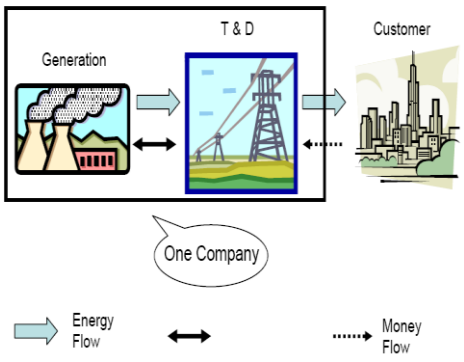
Abstract:
Rural areas are suffering from heavy power cut due to generation problems. This kind of generation problems is satisfied only to some extent. Due to the mismatch in power consumption the villages are facing power cut problems. To solve this problem, we propose a system that uses smart meters on the premises of customers embedded in Internet of Things. Advantages of the proposed approach are- Smart meters are flexible with smart capabilities to satisfy consumer demand, monitor and communicate electrical use in real time, Facilitates remote monitoring in real time,Consumers obtain real-time pricing and evaluate the consumption information that is the technological data to be sent to the grid. The whole system works on Internet of Things.

Keywords*: Demand side management, Internet Of Things (IOT), smart meter, Independent System Operator (ISO)*

I. INTRODUCTION

The smart meter is the smart grid part closer to home and the one that consumers communicate with.Based on their different energy needs, residential, commercial and industrial customers get the advantage, maximize energy consumption and local production, and participate actively in demand-response policies.Nontechnical customers need a clear way of controlling energy consumption and production and sharing power consumption data with energy providers or distributors at the correct level of granularity.This ranges from increasing energy efficiency by using better materials, smart energy tariffs with rewards for certain consumption patterns, and sophisticated monitoring of distributed energy resources in real time. [1].

There was a proposal for the concept of a local smart meter system, looking at the current European Union and international legislation, the technological solutions available on the market and those introduced in different countries and, finally, proposing specific architectures for the proper implementation of a smart meter network for consumers [5].The smart meter is only one aspect of the broader concept of smart home and smart buildings from the point of view of consumer adoption and penetration.There are four power transfer rates-GENCOS, TRANSCOS, DISCOS and CONSUMERS.



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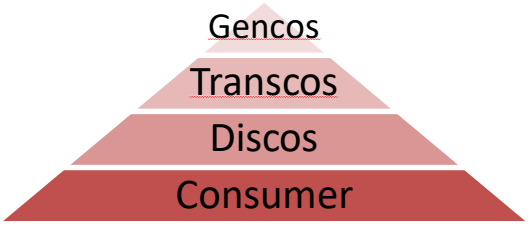

FIG.1. STRUCTURE OF REGULATED POWER SUPPLY

This implies the structure of regulated industry.In this system the low power consumers are also suffering from heavy power shut down due to rapid utilization of energy by high power consumers. In the existing system Load Dispatch Centre(LDC) distributes power according to the demand.The substation(SS) schedules the amount of power to be consumed for a particular period of time per day. If the consumer consumes beyond the supplied power within the scheduled time, then there will be a shutdown for the entire area which is a major problem the rural areas arefacing.A brief overview of the power consumption is also limited to current meters.

II.PROPSED SYSTEM

In proposed system the smart meter measures and monitors the power consumed by individual users. When the consumer is about to consume more than the scheduled power the buzzer circuit alerts the consumer. In case exceeded then power cut occurs to that particular residence by tripping the relay circuit. On the other hand the low power consumer will not be suffering from power shut down as their consumption is less.

In deregulated Industry Independent System Operator plays an important role. This sets controls and tracks the operation of the electrical power network in the areas where an ISO is set up.

The low power consumers can sign a contract with the ISO stating that he can face the shut down for few hours. By doing this he will get low tariffs and incentives.

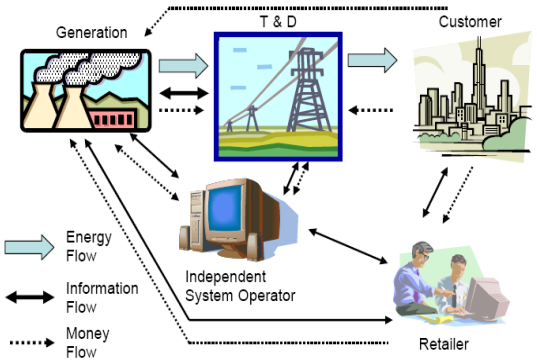

FIG.2. STRUCTURE OF DEREGULATED INDUSTRY

ISO will satisfy the power demand for high power consumers by intelligent load scheduling system.

III.BLOCK DIAGRAM:

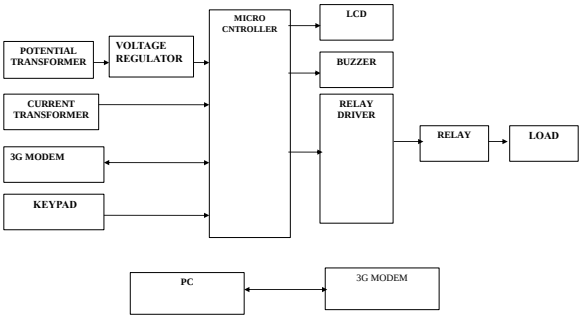

FIG.3. BLOCK DIAGRAM OF SMART METER

Here the potential transformer and current transformer are used to monitor and measure power.

When the consumer is about to consume more than the scheduled power the buzzer circuit alerts the consumer.

In case exceeded then power cut occurs to that particular residence by tripping the relay circuit.

LCD is used for display purpose.

The entire system works on IOT platform and hence we require a 3G modem.

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IV. CIRCUIT DIAGRAM:

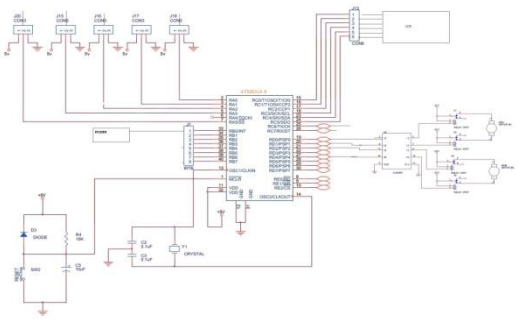

FIG.4. CIRCUIT DIAGRAM OF SMART METER

DESCRIPTION:

1. MICROCONTROLLER:

The ATmega8 is an AVR RISC-based low-power CMOS 8-bit microcontroller.The ATmega8 achieves throughputs of approximately 1MIPS per MHz by executing powerful instructions in a single clock cycle, allowing the system designer to maximize power consumption versus processing speed.

2. CURRENT TRANSFORMER:

Current transformer (CT) is an electrical device that generates, in its secondary, an alternating current (AC) equal to the main AC.Current transformers are known as instrument transformers, along with voltage transformers (VTs) or potential transformers (PTs) that are intended for measurement.

If a current is too high to calculate directly or the circuit voltage is too high, a current transformer can be used in its secondary to provide an independent lower current equal to the primary circuit current.The secondary induced current is then appropriate in electronic equipment for measuring instruments or processing.There is also no influence of current transformers on the primary circuit. Also, the important characteristic of electronic equipment is the distinction between the primary and secondary circuits.Current transformers are commonly used for metering and are used in electronic equipment.

3. POTENTIAL TRANSFORMER:

In the electrical power network, potential transformer or voltage transformer is used to decrease the voltage of the system to a safe value that can be fed to low meter ratings and relays. Commercially available relays and meters are designed for low voltage safety and metering.

A theory of voltage transformer or potential transformer theory is just like a step down transformer theory of general purpose. This transformer's primary contact is between the phase and ground Like the transformer used for the purpose of stepping down, possible transformer, i.e. PT's secondary has lower turns winding

4. RELAY:

A relay is a device that is operated electrically. Most relays use an electromagnet to mechanically control a switching mechanism, but other concepts of operation are also used. Relays are used where a low-power signal (with complete electrical separation between control and controlled circuits) is necessary to control a circuit, or where several circuits must be controlled by one signal.

5.BUZZER:

A Piezo buzzer consists of two conductors separated by the crystals of Piezo. We move on one conductor when a voltage is applied to these crystals and pull on the other. A sound wave is the product of this push and pull. For many items, these buzzers can be used, such as signalling when a period of time is up or making a sound while pressing a certain button.

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V. PLATFORM FOR THE INTERNET OF THINGS

We have built an IoT platform as a scalable distributed system that can accommodate a home smart grid and multiple concurrent remote monitoring and control applications seamlessly.This is shown below.

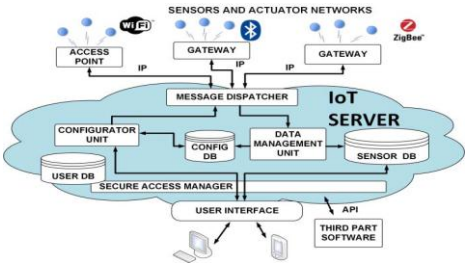

FIG.5. IOT PLATFORM

It consists of three main parts: the simulation and control sensor and actuator networks, the IoT application and user interfaces. Sensor nodes and actuators communicate with the IoT server in a secure bidirectional manner.The node-to-IoT server communication is based on the TCP / IP client-server model. Sensors send messages to the IoT server (if necessary via a gateway) in their native format via an encrypted connection.The IoT server transforms the raw payload, which contains information from heterogeneous nodes, into a standard format, containing object description, type of entity, unit of measurement, field of data, geographic position and timestamp.It allows data to be conveniently interpreted, manipulated and aggregated without taking into account the source's contact protocol.

VI. HARDWARE MODEL

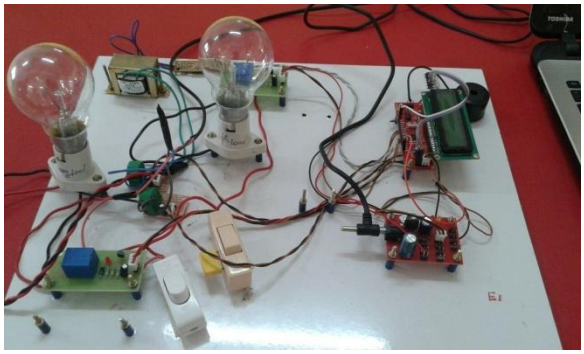

FIG.6

The above figure shows the hardware kit of smart meter.

STEP I:

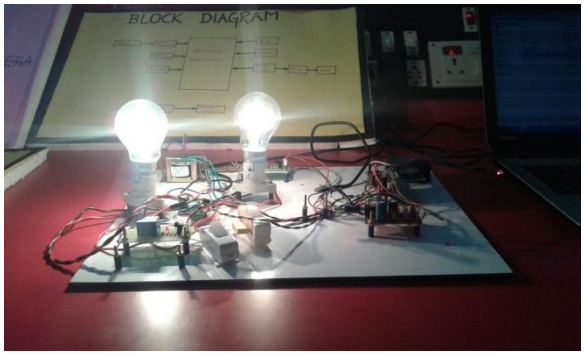

FIG.7

Both heavy and light loads are switched on. The corresponding voltage, power, current, power factor and units consumed are displayed in the smart meter.

STEP II:

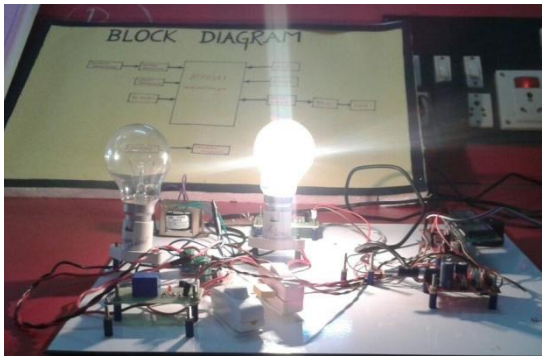

FIG.8

Once the consumer reaches the scheduled power the relay driver is activated to trip that

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particular user. The low power consumers will not face any difficulties.

STEP III:

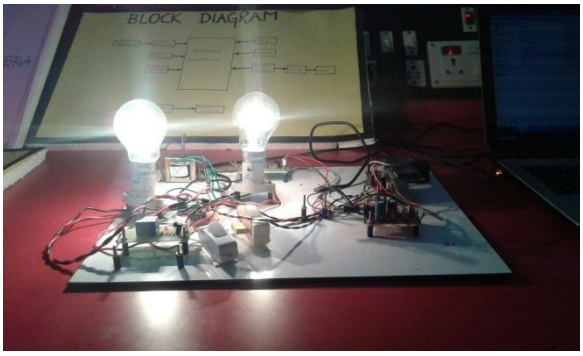

FIG.9

Consumers of low power have signed an ISO contract. The ISO will be able to distribute the power according to the need in the situation of demand, thereby satisfying the demand of the heavy power user which is illustrated in fig.

VII. SOFTWARE MODULE:

FIG.10

The software was designed using Visual Basic which will be used in the Substation side.

It keeps track of all the measured values.

VIII. RESULTS AND DISCUSSIONS

Our concept mainly focuses on managing the available power among the consumers. When there is a over usage of power then power is cut off only for the residence whose consumption exceeds the scheduled range.The ISO can supply power to the high power consumers on the basis of contract.

Less power users will be benefitted by incentives.

IX. CONCLUSION:

We have presented the system employing smart meter embedded in internet of things platform. Our proposal will manage power at the customer side through ISO. Since generation is a major problem now the power demand can be satisfied only in the customer side. Hence the smart meters can help in meeting the demand of the high power consumers. We assume that this is the secret to broad acceptance of the smart meter to be installed at home.

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