A Power Sensor Tag with Interference Reduction for Electricity Monitoring Of Two-Wire Household Appliances

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Abstract - Wasting electricity is caused by leaving things on when they are not being used. This means leaving on lights when we're not in the room, or leaving the TV on or plugged into the mains when we are not in the house. Any outlet plugged into the main socket will draw electricity, so it is the best interest of the household to leave electronics turned off, or unplugged, until it needs to be used. With most chargeable battery items, such as phones, gaming devices and cameras, the battery length will deteriorate if left charging for too long, leading to a shorter battery life with each use. Therefore, once the device is fully charged, it should be removed, and the charger removed from the socket, to stop further waste of electricity. Even leaving an entire house's lights on when only using one room can waste five times as much energy than if you're using all the sockets in only one room. As well as needing to be replaced three times as much as any other electric component, lights use more than twice as much energy to run daily. To keep the same amount of light entering a room without using energy, one could try keeping the curtains open in certain rooms, to allow natural light to enter the house. This is both free, and is better for your eyes, reducing the strain on the iris to focus on things in low-light conditions.

Keywords - Sensor, Tag, Interface, Electricity, Light.

I. INTRODUCTION

Electrical Energy wastage is being done by the following ways. These systems are some of the biggest culprits when it comes to wasting of energy Power plants typically only turn about 30% of the energy input into usable electricity. We are losing up to 75 % of the energy in the fuel at the start of the process. Energy companies could do much better – combining power and heat production can lift efficiency to over 70%.But power producers insist on working to old models – the production of large quantities of energy in one plant far from where people live. Many of the new plants that are proposed now will remain below 40% efficiency – but power producers still try to persuade us that this is good. Is wasting 60% really what we want? These systems are some of the biggest culprits when it comes to wasting energy. How often have you seen the windows open in a house that was overheated? The equivalent exists in the tropics where people cool their places down to 20°C and then open the windows because they are freezing. Construction can help in a big way – near-to-zero energy homes and offices are possible at an economic scale. But it is also personal habit. Even simple things like choosing to wear a sweater rather than turning up the heating can help. It is Municipal corporation should also wake up and introduce automatic photo switches so that the huge wastage of electricity from street lights may be saved. We must remember One unit of electricity saved is equal to avoiding nearly two units of electricity generation. This equals a saving of 1.6 KG of coal – a non-renewable fossil fuel. Naturally, there are large environmental benefits. Fellow consumers that may suffer load shedding due to power shortage stand to gain not to mention that the efficiency improvement reduces the need for load shedding.

II. ENERGY METER USING GSM TECHNOLOGY

Induction type energy meters are most commonly form of an A. c. KWh meter used to measure the energy consumed in any ac. circuit in a prescribed period when supply voltage and frequency are constant, in day today life & in industrial installation. Energy meter is an integrating instrument which measure the total quantity of electrical energy supplied to the circuit in a given period. These meters measure electrical energy in Kilowatt hours.

A. Principle

The Basic principle of induction type energy meter is electromagnetic induction. When an alternating current flows through two suitably located coils (Current coil & Potential Coil) produces rotating magnetic field which is cut by the metallic disc Suspended near to the coils, thus, an e.m.f. is induced in the thin Aluminum disc which circulates eddy currents in it. By the interaction of Rotating magnetic field & eddy currents, torque is developed & causes the disc to rotate. This is the same principle which is applied in the single-phase induction motors.

III. WORKING OF ENERGY METER

When the energy meter is connected in the circuit, the current coil carries the load current and the pressure coil carries the current proportional to the supply voltage. The magnetic field produced by the SERIES magnet (series coil) is in phase with the line current & the magnetic field produced by the shunt magnet (pressure coil) is in quadrature with the

applied voltage (since the coil is highly inductive). Thus, a phase difference exists between the fluxes produced by the two coils. This sets up a rotating field which interacts with the disc and produces a driving torque and, thus, disc starts rotating. The number of revolutions made by the disc depends upon the energy passing through the meter. The spindle is geared to the recording mechanism so that electrical energy consumed in the circuit is directly registered in KWh. The speed of the disc is adjusted by adjusting the position of the breaking magnet. For example, if the energy meter registers less energy than the energy actually consumed in the circuit, then the speed of disc has to be increased which is obtained by shifting the magnet nearer to the centre of the Disc and vice-versa. At constant angular speed the power $VICos\varphi$ is proportional to the angular speed in r.p.s. We calibrate w and energy meter by time test. Let K be the meter constant of energy meter, which is the number of revolution per KWh energy consumption. When connected to measure energy, if disc makes R number of revolution in t seconds. Then the reading of energy meter is:

$Et = R/K$,Let KW= Power in Kilowatt from wattmeter reading.

R= No. of revolution made by disc in't' Sec.

$$K = \frac{revolution}{KWh}$$

Energy recorded by meter under test $(Et) = \frac{R}{K} KWh$

Let the wattmeter reading be Kw watts of energy calculated from the wattmeter & stop watch is given by

Energy consumed by wattmeter (Es) = $\frac{Kw \times t}{3600}$

Percentage Error = $\left[\frac{\frac{R}{K} - \times \frac{Kw*t}{3600}}{\frac{Kw \times t}{3600}}\right] \times 100$

= $\left[\frac{Et-Es}{Es}\right] \times 100$

Fig. 1. Energy meter

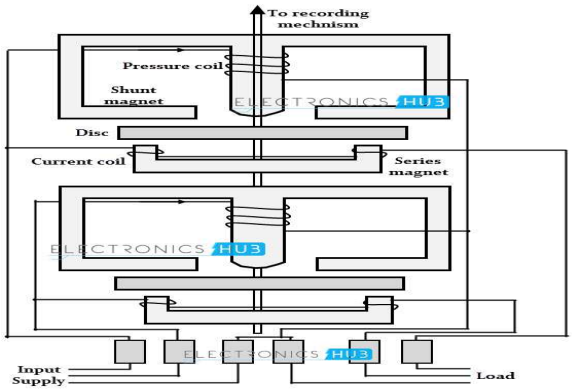

Fig. 2. Working of Energy Meter

IV. PREPAID ENERGY METER WITH GSM TECHNOLOGY

A. Proposed System

The present power usage reading is made manually by moving to the consumer locations. This requires large number of labour operators and long working hours to accomplish the task. Manual billing is sometimes restricted and delayed by bad weather conditions. The printed billing also has the tendency of getting lost. Over the last few years, Smart (Prepaid) Energy Meter has been proposed as an innovative solution aimed at facilitating affordability and reducing the cost of utilities. This mechanism, essentially, requires the users to pay for the electricity before its consumption. In this way, consumers hold credit and then use the electricity until the credit is exhausted. If the available credit is exhausted then the electricity supply is cut-off by a relay. Readings made by human operators are prone to errors. This project addresses the above mentioned problems. The development of GSM infrastructure in past two decades made meter reading system wireless. The GSM infrastructure, which has national wide coverage, can be used to request and retrieve power consumption notification over individual houses and flats. Apart from making readings using GSM communication, billing system is needed to be made prepaid to avoid unnecessary usage of power. The use of Prepaid Energy meter is still controversial. On the one hand, those that support the diffusion of prepaid meters claim that they
Benefit both consumers and utilities because they help users to consume more efficiently and to improve the management of their budget, while allowing firms to reduce financial costs.

B. Working

The proposed model has the PIC microcontroller as Central Processing Unit. The whole system is interfaced with PIC microcontroller. The GSM modem is serially connected with the controller which is the major communication module between User and provider. The GSM uses its own network for the transfer of information. Special coding in embedded c is

used for programming PIC microcontroller using programmer Hardware along with MP-LAB IDE software. The relay acts as switching device to cut off and restore power supply. The LCD is interfaced to microcontroller using parallel port connection. In this project the Microcontroller based system continuously records the readings and the live meter reading can be sent to the Electricity department on request. These systems also can be used to disconnect the power supply to the house in case of non-payment of electricity bills. A dedicated GSM modem with SIM card is required for each energy meter. The microcontroller pulls the SMS received by phone, decodes it, recognizes the Mobile no. and then switches on the relays attached to its port to control the appliances. After successful operation, controller sends back the acknowledgement to the user's mobile through SMS. The coding emphasis the fact that it reduces human labor but increases the efficiency in calculation of bills for used electricity .the user will have an universal number and they can recharge outlets of electricity board .the acknowledgement of recharged coupon detail will come to notice of the consumer and also will get displayed in LCD module. So this process will bring solution of creating awareness on unnecessary wastage of power and will tend to reduce wastage of power. This module will reduce the burden of energy providing bye stabilizing the connection easily and no theft of power will takes place. The LCD display will display the used amount and balance amount that can be used.

C. Design Approach

It contains block diagram of a power sensor tag with interference reduction for electricity monitoring of two-wire household appliances

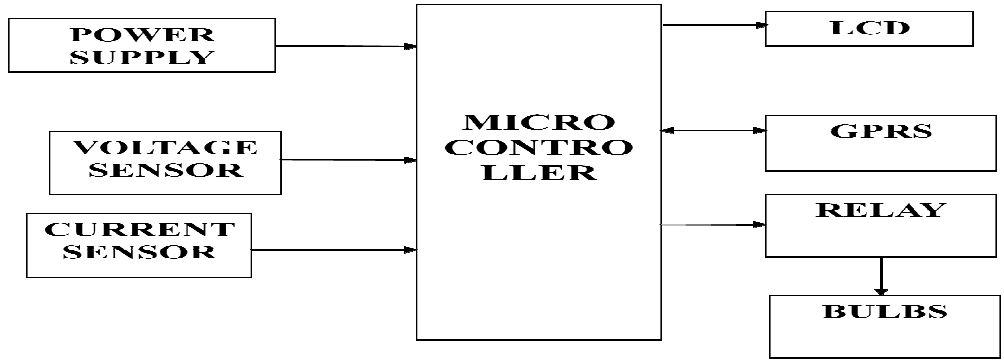

Fig. 3. Block Diagram Of Power Sensor Tag With Interference Reduction

D. Power Supply Section

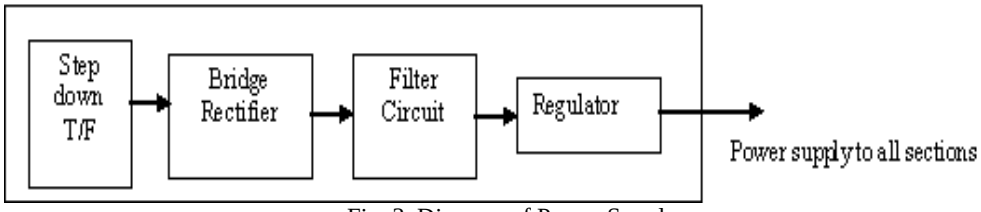

Fig. 3. Diagram of Power Supply

E. Description Of Block Diagram

The AC main Block is the power supply, which is of single-phase 230V ac. This should be give to step down transformer to reduce the 230V ac voltage to low voltage. i.e., to 6V or 12V ac this value depends on the transformer inner winding. The output of the transformer is give to the rectifier circuit. This rectifier converts ac voltage to dc voltage. Nevertheless, the voltage may consist of ripples or harmonics. To avoid these ripples the output of the rectifier is connect to filter. The filter thus removes the harmonics. This is the exact dc voltage of the given specification. However, the circuit operates at 5V dc voltage. Therefore, we need a regulator to reduce the voltage. 7805 regulator produces 5V dc voltage. The system uses reliably proven electronic technology to measure temperature and current, while using fiber-optic technology to energize the electronic circuitry and transmit the signals back via optical fibers. The data collected, together with the sag information, will provide support for the development of an algorithm for the estimation of conductor-sag values.

F. General Packet Radio Service (GPRS)

General packet radio service (GPRS) is a packet oriented mobile data service on the 2G and 3Gcellular communication system's global system or mobile communications(GSM). GPRS was originally standardized by European Telecommunications Standards Institute (ETSI) in response to the earlier CDPD and i-mode packet-switched cellular technologies. It is now maintained by the 3rd Generation Partnership Project (3GPP). GPRS usage is typically charged based on volume of data transferred, contrasting with circuit switched data, which is usually billed per minute of connection time. Usage above the bundle cap is charged per megabyte, speed limited, or disallowed. GPRS is a best-effort service,

implying variable throughput and latency that depend on the number of other users sharing the service concurrently, as opposed to circuit switching, where a certain quality of service (Quos) is guaranteed during the connection. In 2G systems, GPRS provides data rates of 56–114 Kbit/second.[3] 2G cellular technology combined with GPRS is sometimes described as *2.5G*, that is, a technology between the second (2G) and third (3G) generations of mobile telephony.[4] It provides moderate-speed data transfer, by using unused time division multiple access (TDMA) channels in, for example, the GSM system. GPRS is integrated into GSM Release 97 and newer releases.

V. RESULTS AND DISCUSSIONS

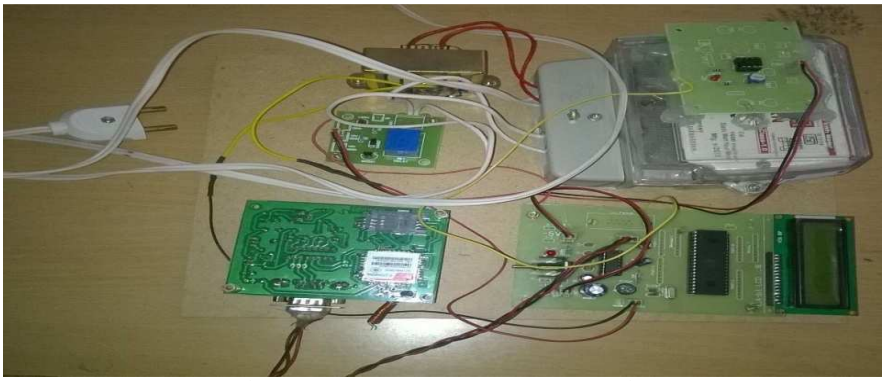

Fig. 4. A Power Sensor Tag With Interference Reduction For Electricity Monitoring Of Two-Wire Household Appliances Kit Image

A power sensor tag with interference reduction for electricity monitoring of two-wire household appliances consists of transmitter and receiver section separately. Mainly this project is used for reducing human effect and for increasing water usage in the field of agriculture automatically. First these kits are connected to the main supply (230V A.C).then it is step down to 5V dc supply. 230V A.C supply is given as input to the step down transformer then it is step down that voltage to some 18V A.C supply. Then it is given to the Bridge wave Rectifier. This converts A.C to Pulsating D.C. then this is given to the filter circuit. Here capacitive filter is used. So it converts that pulsating D.C to pure D.C. next this is connected to 7805 regulator. It produces our required 5V D.C supply. Electricity can be monitored by using the parameters like voltage and current these 2 Parameters can be sensed by using the voltage and current sensors. But the controlling of the devices in the house is not possible in the existing system. To overcome these disadvantages we are going for proposed method

VI. CONCLUSION

In this project work, we have studied and implemented a complete working model using a Microcontroller. The programming and interfacing of microcontroller has been mastered during the implementation. This work includes the study of GSM modem using sensors. The biggest advantage of using this project is each and every time the values of temperature sensor, current sensor, voltage sensor, light sensor and GSM modem as well as the values are posted by using GPS technology. Rechargeable Battery can be connected to this system to enable it to work in power failure conditions also.

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