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Smart Electricity Meter for Efficient Control over Utilization of Electricity

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Abstract--*Rescuing energy has become one of the most important problems these days. The maximum waste of energy is caused by the inefficient use of the consumer appliances. Particularly, a light accounts for a huge part of the total energy consumption. There are number of light control systems introduced in today's market, because the installed lighting systems are outdated and energy- inefficacious. However, due to architectural imperfections, the existing light control systems cannot be successfully applied to home and working places such as office buildings, laboratories. Therefore, this paper proposes an intelligent household LED lighting system considering energy efficiency and user satisfaction. The forth put system employees multi sensors and wireless communication technology in order to control an LED light according to the user's state and the surroundings. The intended LED lighting system can autonomously adjust the minimum light intensity value to enhance both energy efficiency and user satisfaction.*

Keywords*:optocoupler,energy meter*

INTRODUCTION

Many researches are done on the lighting system. It is discovered lighting system that can control illumination intensity of LED light accordingly to the
surrounding. It provides complete survey of various WSAN (Wireless Sensor and Actuator Networks) based schemes for lighting control for future studies. This survey also provides classification of many intelligent lighting control system based on the different schemes (centralized and decentralized schemes) used. It is proposed lighting system with
the help of dimming process. In this process user's location is considered as a center position and only lamps in this region

LITERATURE SURVEY

Energy saving solutions has been becoming increasingly essential in recent years because of environmental issues such as climate change and global warming. Environmental problems are very important issue and these problems are largely caused by the excessive use of energy. Since the existing systems are designed without considering user satisfaction ,it is not appropriate to the places such as house and office where the user satisfaction is more crucial factor than cost benefit due to energy saving. All things considered, design goals of the new intelligent lightning control system are as follows; the new intelligent lightning control system should be designed to maximize the utilization of LED lighting. The new intelligent lightning control system should be designed to have the communication capability. The system should be designed to both energy efficiency and user satisfaction.

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PROPOSED SCHEME

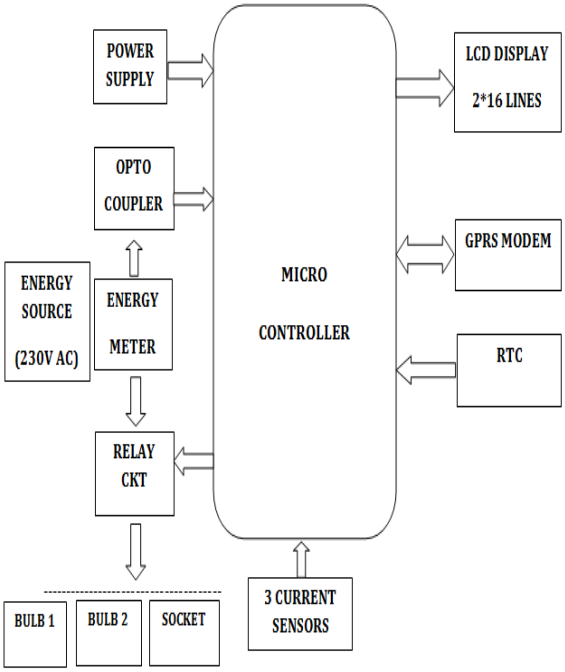

FIG: 1:Block diagram

METHODOLOGY

Micro controller:

This section forms the control unit of the whole project. This section basically consists of a Microcontroller with its associated circuitry like Crystal with capacitors, Reset circuitry, Pull up resistors (if needed) and so on. The Microcontroller forms the heart of the project because it controls the devices being interfaced and communicates with the devices according to the program being written.

ARM7TDMI:

ARM is the abbreviation of Advanced RISC machines; it is the name of a class of processors, and is the name of a kind technology too. The RISC instruction set, and related decode mechanism are much simpler than those of Complex Instruction Set Computer(CISC) designs.

Liquid-crystal display (LCD)

It is a flat panel display, electronic visual display that uses the light modulation properties of liquid crystals. Liquid crystals do not emit light directly. LCDs are available to display arbitrary images or fixed images which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock.

Opto Couplers:

There are many situations where signals and data need to be transferred from one system to another within a piece of electronics equipment, or from one piece of equipment to another, without making a direct electrical connection. Often this is because the source and destination are (or may be at times) at very different voltage levels, like a microcontroller which is operating from 5V DC but being used to control a triac which is switching 230V AC. In such situations the link between the two must be an isolated one, to protect the microprocessor from over voltage damage. Relays can of course provide this kind of isolation, but even small relays tend to be fairly bulky compared with ICs and many of today's other miniature circuit components. Because they are electro-mechanical, relays are also not as reliable ó and only capable of relatively low speed operation. Where small size, higher speed and greater reliability are important, a much better alternative is to use an Optocoupler. These use a beam of light to transmit the signals or data across an electrical barrier, and achieve excellent isolation.

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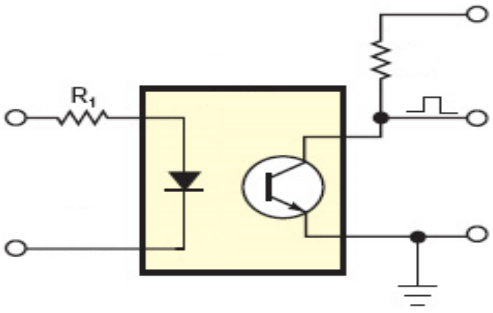

FIG: 2:Optocoupler structure

Energy Meter

An electricity meter or energy meter is a device that measures the amount of electric energy consumed by a residence, business, or an electrically powered device.Electricity meters are typically calibrated in billing units, the most common one being the kilowatt hour. Periodic readings of electric meters establishes billing cycles and energy used during a cycle.In settings when energy savings during certain periods are desired, meters may measure demand, the maximum use of power in some interval. In some areas the electric rates are higher during certain times of day, reflecting the higher cost of power resources during peak demand time periods. Also, in some areas meters have relays to turn off nonessential equipment.

GPRS:

GPRS (general packet radio service) is a packet-based data bearer service for wireless communication services that is delivered as a network overlay for GSM, CDMA and TDMA (ANSI-I36) networks. GPRS applies a packet radio principle to transfer user data packets in an efficient way between GSM mobile stations and external packet data networks. Packet switching is where data is split into packets that are transmitted separately and then reassembled at the receiving end. GPRS supports the world's leading packet-based Internet communication protocols, Internet protocol (IP) and X.25, a protocol that is used mainly in Europe. GPRS enables any existing IP or X.25 application to operate over a GSM cellular connection. Cellular networks with GPRS capabilities are wireless extensions of the Internet and X.25 networks.

Fig:3: GPRS module

RESULTS

The following figure shows the kit arrangement of System module. Initially the LPC2148 board is powered. The Energy meter, GPRS modem, Liquid crystal display, Real time clock and Current sensors are connected to the microcontroller. Relay is connected to the loads.

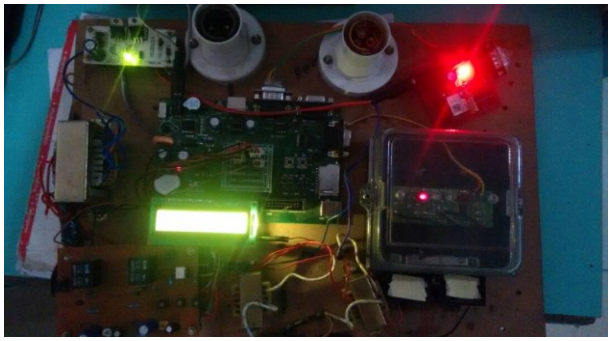

Fig 4.1 Project Hardware kit arrangement

The below shows that after the board is powdered then LCD gets initialized. The Liquid crystal display(LCD) displays that "WELCOME TO METER SECTION".

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Fig 4.2 Welcome to Meter section

The below figure shows that the current consumption of loads (bulb1, bulb2). The Liquid crystal display (LCD) displays as d1:000 and d2:000 values (initial values).

Fig 4.3 Current values of loads

The below figure shows the units consumption of loads(bulb1, bulb2). The Liquid crystal display (LCD) displays as UNITS: 000 (initial values).

Fig 4.4 Units consumption

After the RTC gets initialized(set hours, minutes, seconds, date, month, year of present day) then GPRS communication starts connecting after inserting the sim in GPRS module and network led starts glowing.

Fig 4.5 GPRS connecting

After entering the url number in web page
then Internet of things (IOT) window opens. In home page window displays the last meter IOT system.

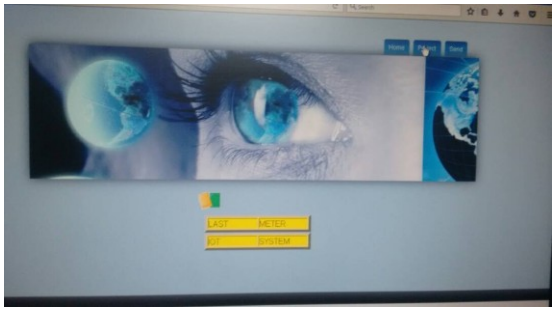

Fig 4.6 IOT window

The below figure shows the current and units consumption of loads (bulb1, bulb2) data will be updated after every six cycles. The LCD displays that the data sending

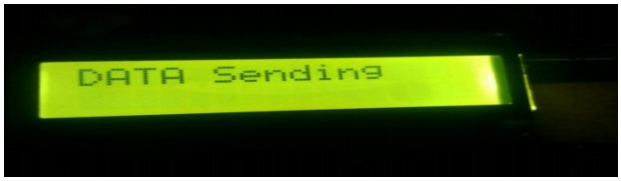

Fig 4.7 Data sending

After sending the data then click on project in IOT window. Online service window is opened.
In online service it displays the usage status, meter number, units consumped, current consumped by loads(dev1, dev2) in amp and the amount for the usage .

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Fig 4.8.Online service

The below figure shows that bill is generated for every month of 1st date. After setting the hours, minutes, seconds, date, month, year of 1st date of every month then the bill is generated that how much amount of current and units are consumped. And a sms is sent to the mobile that the electricity bill units consumped and the bill amount to be paid.

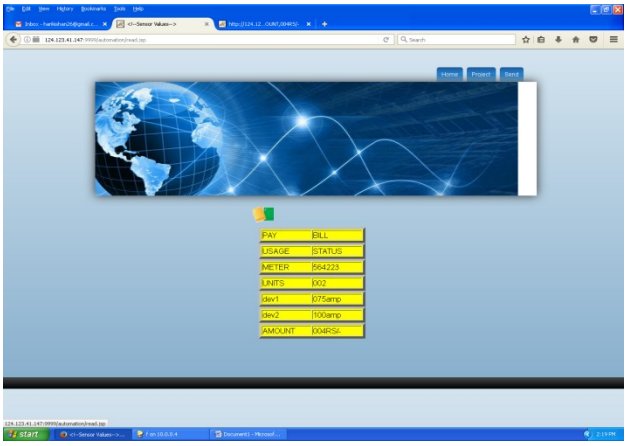

Fig 4.9 Bill Status

The below figure shows that the current and units values of loads get updated.

Fig 4.10 Data sending and data updated

The below figure shows that if the dead line of payment is reached and if the bill is not paid then the below window is opened to remind the bill payment. And if the bill is not paid then it sends a sms to the mobile that the electricity bill payment is due, kindly pay your bill. And it displays the bill to be paid (meter number, units, bill amount).

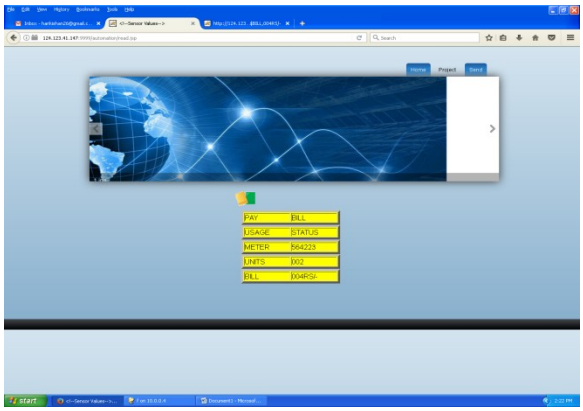

Fig 4.11 Bill status

The below shows that the loads can be controlled with a message (ON- &BULB1 ON$, &BULB2 ON$) and (OFF- &BULB1 OFF$, &BULB2 OFF$) and it sends a message to the user that the electricity bill (units, amount to be paid) . And it sends a message if the dead line is reached and if the bill is not paid and the message sent is electricity bill payment is due, kindly pay ur bill.

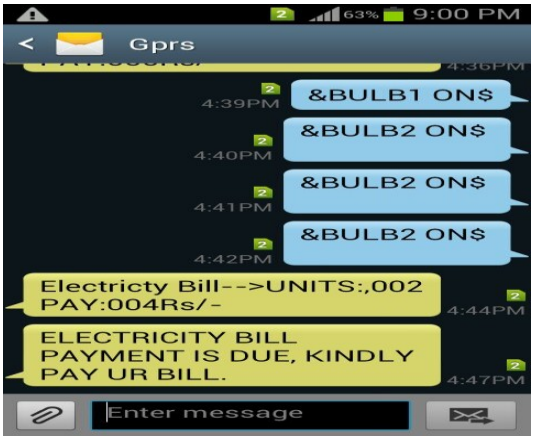

Fig 4.12 SMS sent to the mobile

CONCLUSION

We propose an intelligent household LED lighting system considering energy efficiency and user satisfaction. We have successfully control the brightness of the system autonomously according to the brightness of the surrounding. The proposed system employees multi sensors and wireless technology to enhance energy efficiency and user satisfaction by turning ON/OFF LEDs, fans and PCs as per user movement. We have also concluded that this system can be used in the applications mentioned above with more or less changes in the system.

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