Smart Home Lighting System for High Efficiency by Using WSN and Ethernet

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Abstract: *This paper describes the design and implementation of the micro controller-based system for protecting power. Transformer. The system includes facilities for discrimination between internal fault current and magnetizing imush current, differential protection, over current protection, over voltage protection and under voltage protection. In this paper, software and hardware of micro controller based system have been explained and designed. The design implementation and testing of the system are also presented.*
Keywords: *Zigbee module, Ethernet, Current sensor, Voltage sensor.*

I.   Introduction

It is foreseen that service and personal care wireless mechatronic systems will become more and more ubiquitous at home in the near future and will be very useful in assistive healthcare particularly for the elderly and disabled people. Wireless mechatronic systems consist of numerous spatially distributed sensors with limited data collection and processing capability to monitor the environmental situation. Wireless sensor networks (WSNs) have become increasingly important because of their ability to monitor and manage situational information for various intelligent services. Due to those advantages, WSNs has been applied in many fields, such as the military, industry, environmental monitoring, and healthcare .The WSNs are increasingly being used in the home for energy controlling services. Regular household appliances are monitored and controlled by WSNs installed in the home. New technologies include cutting-edge advancements in information technology, sensors, metering, transmission, distribution, and electricity storage technology, as well as providing new information and flexibility to both consumers and providers of electricity. The ZigBee Alliance, wireless communication platform is presently examining Japan's new smart home wireless system implication by having a new initiative with Japan's Government that will evaluate use of the forthcoming ZigBee, Internet Protocol (IP) specification, and the IEEE 802.15.4g standard to help Japan to create smart homes that improve energy management and efficiency .It is expected that 65 million households will equip with smart meters by 2015 in the United States, and it is a realistic estimate of the size of the home energy management market .

There are several proposals to interconnect various domestic appliances by wireless networks to monitor and control. But the prototypes are verified using test bed scenarios. Also, smart meter systems like have been designed to specific usages particularly related to geographical usages and are limited to specific places. Different information and communication technologies integrating with smart meter devices have been proposed and tested at different flats in a residential area for optimal power utilization, but individual controlling of the devices are limited to specific houses. There has been design and developments of smart meters predicting the usage of power consumption. However, a low-cost, flexible, and robust system to continuously monitor and control based on consumer requirements is at the early stages of development. In this study, we have designed and implemented a ZigBee-based intelligent home energy management and control service. We used the ZigBee (the IEEE 802.15.4 standard) technology for networking and communication, because it has low-power and low-cost characteristics, which enable it to be widely used in home and building environments .The paper focuses on human-friendly technical solutions for monitoring and easy control of household appliances. The inhabitant's comfort will be increased and better assistance can be provided. This paper emphasizes the realization of monitoring and controlling of electrical appliances in many ways.The developed system has the following distinct features.

1) Use of Traic with opto-isolated driver for controlling electrical appliances: Household appliances are controlled either remotely or automatically with the help of fabricated smart sensing unit consisting of triac – BT138 [14].

2) No microprocessor/microcontroller: The design of smart sensing unit does not require a processing unit at the sensing end.

3) Flexibility in controlling the appliances: Depending on the user requirements, appliances can be monitored and controlled in different ways.

II. The Hardware System

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**) 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. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements.

II.Design of Proposed Hardware

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.
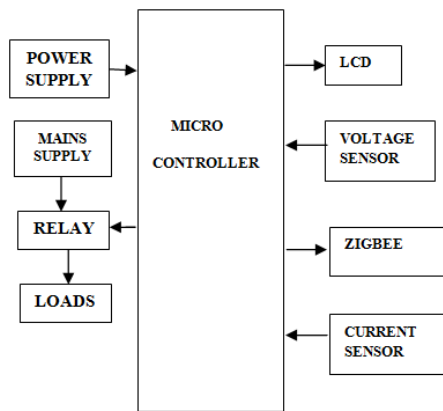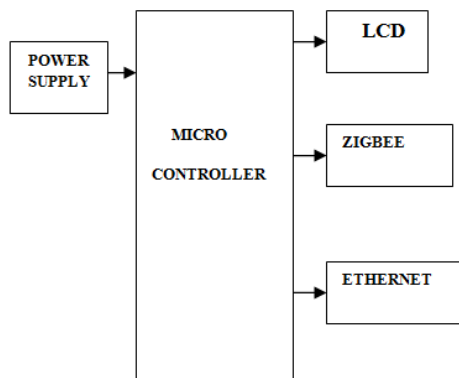

Fig. 1.load section

Fig. 2.monitoring section

III. Board Hardware Resources Features

Zigbee:

Zigbee modules feature a UART interface, which allows any microcontroller or microprocessor to immediately use the services of the Zigbee protocol. All a Zigbee hardware designer has to do in this ase is ensure that the host's serial port logic levels are compatible with the XBee's 2.8- to 3.4-V logic levels. The logic level conversion can be performed using either a standard RS-232 IC or logic level translators such as the

74LVTH125 when the host is directly connected to the XBee UART. Data is presented to the X-Bee module through its DIN pin, and it must be in the asynchronous serial format, which consists of a start bit, 8 data bits, and a stop bit. Because the input data goes directly into the input of a UART within the X-Bee module, no bit inversions are necessary within the asynchronous serial data stream. All of the required timing and parity checking is automatically taken care of by the X-Bee's Just in case you are producing data faster than the X-Bee can process and transmit it, both X-Bee modules incorporate a clear-to-send (CTS) function to throttle the data being presented to the X-Bee module's DIN pin. You can eliminate the need for the CTS signal by sending small data packets at slower data rates.

If the microcontroller wants to send data to transceiver, it will send RTS (Request to Send) signal. If the transceiver is idle it sends CTS (Clear to Send) signal. The RTS and CTS signals are active low. When microcontroller receives CTS command it will send data to the transceiver through DIN pin. The transceiver will send the data to microcontroller through DOUT pin. The communication between transceiver and the microcontroller at the transmitter and receiver is similar. The communication between transmitter and receiver is through RF communication.

Ethernet: Networking is playing vital role in current IT era where data distribution and access is critically important. As the use of communication between two or more entities increases the networking technologies need to be improved and refurbished over time. Similarly the transmission media, the heart of a network, has been changed with the time improving on the previous one. If you know a little bit about networking you surely have heard the term Ethernet which is currently the dominant network technology. Wide spread of the Ethernet technology made most of the offices, universities and buildings use the technology for establishment of local area networks (LANs).

To understand what actually Ethernet is, we need to know about IEEE first which is a short of Institute of Electrical and Electronics Engineers. IEEE is a part of International Organization for Standardization (ISO) whose standard IEEE 802.3 is defined for Local Area Network. The standard 802.3 commonly known as ETHERNT defines the communication standards for how data is transferred from one network device to another in a local area network. Since the limit for Ethernet cable is few hundred meters Ethernet is commonly deployed for networks lying in a single building to connect devices with close proximity. The same standard for Ethernet enables manufactures from around the earth to manufacture Ethernet products in accordance with the ISO standards that are feasible for all computing devices worldwide

In 1982 Sun Microsystems was founded to develop UNIX workstations with Ethernet. Later soon Intel introduced the first Ethernet interface card. In November 1982, the second version of ethernet was launched known as Ethernet II. Next year the 802.3 specification was formally approved by IEEE and it was adopted by ISO. Soon there were many new companies like Novell, Cabletron, CISCO, Network General, and SynOptics to develop a variety of devices for Ethernet LAN. Ethernet became the major technology in computer networking by the end of 1980's. Since then the technology is continuously evolving data speeds and reliability measures.
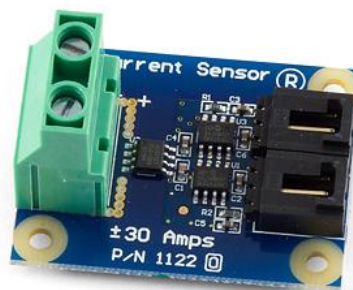
Voltage Sensor:

The voltage sensor domain contains four transmembrane helices, named S1 through S4. The S4 transmembrane helix contains a number of positively charged arginine and lysine amino acid residues. Voltage sensitivity in VSPs is generated primarily by these charges in the S4, in much the same way that voltage-gated ion channels are gated by voltage. When positive charge builds up on one side of a membrane containing such voltage sensors, it generates an electric force pressing the S4 in the opposite direction. Changes in membrane potential therefore move the S4 back and forth through the membrane, allowing the voltage sensor to act like a

switch. Activation of the voltage sensor occurs at depolarized potentials, i.e.: when the membrane collects more positive charge on the inner leaflet. Conversely, deactivation of the voltage sensor takes place at hyperpolarized potentials, when the membrane collects more negative charge on the inner leaflet. Activation of the voltage sensor increases the activity of the phosphates domain, while deactivation of the voltage sensor decreases phosphates activity.
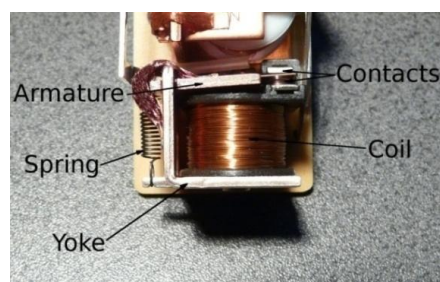

Current Sensor:

A **current sensor** is a device that detects electrical current (AC or DC) in a wire, and generates a signal proportional to it. The generated signal could be analog voltage or current or even digital output. It can be then utilized to display the measured current in an ammeter or can be stored for further analysis in a data acquisition system or can be utilized for control purpose.

RELAY:

A **relay** is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits as amplifiers: they repeated the signal coming in from one circuit and re-transmitted it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

A type of relay that can handle the high power required to directly control an electric motor or other loads is called a contactor. Solid-state relays control power circuits with no moving parts, instead using a semiconductor device to perform switching. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called "protective relays".

IV. Conclusion

A smart power monitoring and control system has been designed and developed toward the implementation of an intelligent building. The developed system effectively monitors and controls the electrical appliance usages at an elderly home. Thus, the real-time monitoring of the electrical appliances can be viewed through a website. The system can be extended for monitoring the whole intelligent building. We aim to determine the areas of daily peak hours of electricity usage levels and come with a solution by which we can lower the consumption and enhance better utilization of already limited resources during peak hours. The sensor networks are programmed with various user interfaces suitable for users of varying ability and for expert users such that the system can be maintained easily and interacted with very simply. This study also aims to assess consumer's response toward perceptions of smart grid technologies, their advantages and disadvantages, possible concerns, and overall perceived utility. The developed system is robust and flexible in operation. For the last three months, the system was able to perform the remote monitoring and control of appliances effectively. Local and remote user interfaces are easy to handle by a novice consumer and are efficient in handling the operations. In future, the system will be integrated with co-systems like smart home inhabitant behavior recognitions systems to determine the wellness of the inhabitant in terms of energy consumption.

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