An Energy Efficient LED Lighting System for Domestic Applications

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Abstract— **This project is implemented on ARM, the sensor which detects the day light is used to switch outdoor lighting and the PIR sensor which detects the entering person into room are used here to regulate the indoor lighting intensity, which is done through PWM shifting technique. Saving the electricity is not difficult. Just by turn off the light when leaving the room, turn off computer when finish the work, unplug electronic accessories when finish recharging and etc. Various light regulate systems are introduced in prevailing markets, because the installed lighting systems are outdated and energy-inefficient. However, due to architectural constraints, the existing light regulate systems cannot be successfully applied to home and office buildings. Therefore, this paper proposes an intelligent domiciliary LED lighting system considering energy efficiency and user satisfaction. The proposed system employs multi sensors and wireless communication technology in order to regulate an LED light according to the user's state and the surroundings. The proposed LED lighting system can individually adapt the minimum light intensity value to enhance both energy efficiency and user satisfaction**.

Keywords- ***Domiciliary LED lighting. DC motor, Gas sensor, GSM, ARM, fire sensor, IR sensor, PIR sensor***.

I. INTRODUCTION

In order to use efficient Electricity we propose an Intelligent Domiciliary LED Lighting System, which automatically regulates the lighting system outside & inside of house and timely displays the consumed Energy, There are many researches on the lighting regulate system. Pan proposed a wireless sensor network-based intelligent light regulate system for indoor environments.

This light regulate system manages lighting accessories according to user's activities and profiles. Two algorithms (Illumination decision algorithm and device regulate algorithm) are proposed to meet requirements of the user and to save energy. Uhm *et al* proposed an LED light system with light sensors, motion Sensors, and network interfaces.

This light regulate system can regulate illumination intensity of an LED light based on Brightness of surrounding and movement of residents. Park *Presented* lighting regulate system based on a building automation and regulate network (BACnet). Proposed a light regulate system with detailed design for energy saving by regulating the intensity of illumination. In this paper, a logical low cost design is introduced to conserve electrical energy taking daylight illumination into Consideration by using a wireless sensor network.

Presented an building lighting automation system using digital addressable lighting interface (DALI) accessories with wireless sensor networks.

The proposed system basically regulates illumination intensity of a lighting device according to user movement and brightness of surroundings. That is, when the maximum value of illumination intensity of a lighting device is *Lmax* and the minimum value is *Lmin*, the illumination intensity becomes *Lmax,* if user movement is detected and becomes *Lmin,* if user movement is not detected for certain period time. It can be confirmed that as *Tr* is longer, *Tm* and *Tf* are shorter, and *Lmax* and *Lmin* are smaller, the energy saving effect becomes larger.

However, it implies the possibility that inconvenience of users can be bigger because of frequent light on/off, and dark indoor environment, etc. whereas the energy saving effect becomes larger. Therefore, it is necessary to properly set the value according to space environmental Characteristics

II DESIGN AND IMPLEMENTATION

The block diagram for the proposed system is shown which Consists of LED lighting system, outdoor bulb, person detection sensor ,IR sensor, Gas sensor and display units.

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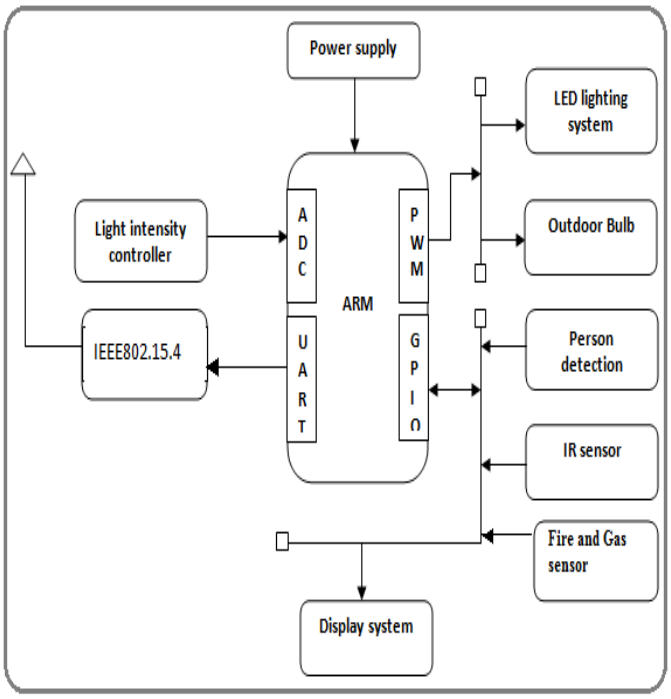

Figure 1: Block Diagram

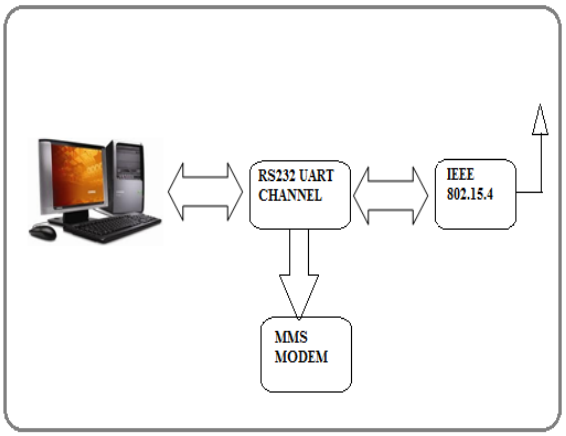

Figure 2: Monitoring System

III HARDWARE DESIGN

i) *ARM core*:

The ARM7 family includes the ARM7TDMI, ARM7TDMI-S, ARM720T, and ARM7EJ-S processors. The ARM7TDMI core is the industry's most widely used 32-bit embedded RISC microprocessor solution. Optimized for cost and power-sensitive applications, the ARM7TDMI solution provides the low power consumption, small size, and high performance needed in portable, embedded applications.

The ARM7TDMI-S core is the synthesizable version of the ARM7TDMI core, available in both VERILOG and VHDL, ready for compilation into processes supported by in-house or commercially available synthesis libraries. Optimized for flexibility and featuring an identical feature set to the hard macro cell, it improves time-to-market by reducing development time while allowing for increased design flexibility, and enabling >>98% fault coverage. The ARM720T hard macro cell contains the ARM7TDMI core, 8kb unified cache, and a Memory Management Unit (MMU) that allows the use of protected execution spaces and virtual memory. This macro cell is compatible with leading operating systems including Windows CE, Linux, palm OS, and SYMBIAN OS.

A. LPC2148 Processor:

LPC2148 Microregulateler Architecture. The ARM7TDMI-S is a general purpose 32-bit microprocessor, which offers high performance and very low power consumption. The ARM architecture is based on Reduced Instruction Set Computer (RISC) principles, and the instruction set and related decode mechanism are much simpler than those of micro programmed Complex Instruction Set Computers (CISC). This simplicity results in a high instruction throughput and impressive real-time interrupt response from a small and cost-effective processor core.

Pipeline techniques are employed so that all parts of the processing and memory systems can operate continuously. Typically, while one instruction is being executed, its successor is being decoded, and a third instruction is being fetched from memory. The ARM7TDMI-S processor also employs a unique architectural strategy known as Thumb, which makes it ideally suited to high-volume applications with memory restrictions, or applications where code density is an issue.

The key idea behind Thumb is that of a super-reduced instruction set. Essentially, the ARM7TDMI-S processor has two instruction sets:

- The standard 32-bit ARM set.
- A 16-bit Thumb set.

The Thumb set's 16-bit instruction length allows it to approach twice the density of standard ARM code while retaining most of the ARM's performance advantage over a traditional 16-bit processor using 16-bit registers. This is

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possible because Thumb code operates on the same 32-bit register set as ARM code. Thumb code is able to provide up to 65% of the code size of ARM, and 160% of the performance of an equivalent ARM processor connected to a 16-bit memory system.

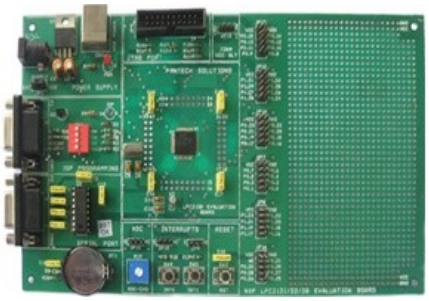

Figure 3: ARM7TDMI PCB board

ii) GSM Overview:

Global System for Mobile Communications or GSM (originally from Groupe Special Mobile) is the world's most popular standard for mobile telephone systems. The GSM Association estimate that 80% of the global mobile market uses the standard.GSM is used by over 1.5 billion people across more than 212 countries and territories. This ubiquity means that subscribers can use their phones throughout the world, enabled by international roaming arrangements between mobile network operators. GSM differs from its predecessor technologies in that both signaling and speech channels are digital, and thus GSM is considered a second generation (2G) mobile phone system. The GSM standard has been an advantage to both consumers, who may benefit from the ability to roam and switch carriers without replacing phones, and also to network operators, who can choose equipment from many GSM equipment vendors.

iii) New approaches:

Neither of these approaches proved to be the long-term solution as cellular technology needed to be more efficient. With the experience gained from the NMT system, showing that it was possible to develop a system across national boundaries, and with the political situation in Europe lending itself to international cooperation it was decided to develop a new Pan-European System. Furthermore it was GSM system. To achieve the basic definition of a new system a meeting was held in 1982 under the auspices of the Conference of European Posts and Telegraphs (CEPT). They formed a study group called The Groupie Special Mobile (GSM) to study and develop a pan-European public land mobile system.

iv)Global usage:

Originally GSM had been planned as a European system. However the first indication that the success of GSM was spreading further afield occurred when the Australian network provider, Telstra signed the GSM Memorandum of Understanding.

v) Frequencies:

Originally it had been intended that GSM would operate on frequencies in the 900 MHz cellular band. In September 1993, the British operator Mercury One-to-One launched a network. Termed DCS 1800 it operated at frequencies in a new 1800 MHz band. By adopting new frequencies new operators and further competition was introduced into the market apart from allowing additional spectrum to be used and further increasing the overall capacity.

In the USA as well a portion of spectrum at 1900 MHz was allocated for cellular usage in 1994. The licensing body, the FCC, did not legislate which technology should be used, and accordingly this enabled GSM to gain a foothold in the US market. This system was known as PCS 1900 (Personal Communication System)

vi) PIR sensor

Passive Infrareds sensors (PIRs) are electronic accessories which are used in some security alarm systems to detect motion of an infrared emitting source, usually a human body. The pyroelectric sensor is made of a crystalline material that generates a surface electric charge when exposed to heat in the form of infrared radiation. When the amount of radiation striking the crystal changes, the amount of charge also changes and can then be measured with a sensitive FET device built into the sensor.

This radiation (energy) is invisible to the human eye but can be detected by electronic accessories designed for such a purpose

Block process: The PIR325 sensor has two sensing elements connected in a voltage bucking configuration. This arrangement cancels signals caused by vibration, temperature changes and sunlight.

A body passing in front of the sensor will activate first one and then the other element whereas other sources will affect both elements simultaneously and be cancelled.

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The radiation source must pass across the sensor in a horizontal direction when sensor pins 1 and 2 are on a horizontal plane so that the elements are sequentially exposed to the IR source.

A focusing device is usually used in front of the sensor

Figure 4: Gas Sensor

This unit can be easily incorporated into an alarm unit, to sound an alarm or give a visual indication of the LPG concentration. The sensor has excellent sensitivity combined with a quick response time. The sensor can also sense iso-butane, propane, LNG and cigarette smoke.

viii) Signal Conditioner

A signal conditioner is a device that converts one type of electronic signal into another type of signal. Its primary use is to convert a signal that may be difficult to read by conventional instrumentation into a more easily read and lower cost & power because the system ARM7TDMI micro regulater which is a Flash based micro regulater can be programmed and erased several times.

IR SENSOR:

This switch is activated when the user blinks their eye. It allows individuals to operate electronic equipment like communication aids and environmental regulates hands-format.

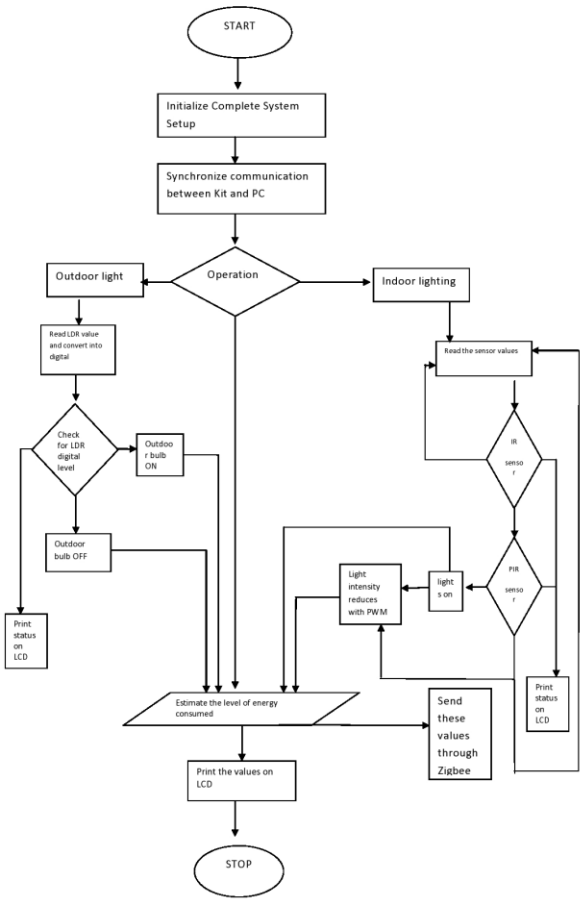

Figure 5: flowchart

IV ZIGBEE Module

The XBee/XBee-PRO RF Modules are designed to operate within the ZigBee protocol and support the unique needs of low-cost, low-power wireless sensor networks. The modules require minimal power and provide reliable delivery of data between remote accessories. The modules operate within the ISM 2.4 GHz frequency band and are compatible with the following:

- XBee RS-232 Adapter
- XBee RS-232 PH (Power Harvester) Adapter
- XBee RS-485 Adapter
- XBee Analog I/O Adapter
- XBee Digital I/O Adapter
- XBee Sensor Adapter
- XBee USB Adapter

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- XStick
- Connect Port X Gateways
- XBee Wall Router.

The XBee/XBee-PRO ZB firmware release can be installed on XBee modules. This firmware is compatible with the ZigBee 2007 specification, while the ZNet 2.5 firmware is based on Ember's proprietary "designed for ZigBee" mesh stack (EmberZNet 2.5). ZB and ZNet 2.5 firmware are similar in nature, but not over-the-air compatible. Accessories running ZNet 2.5 firmware cannot talk to accessories running the ZB firmware.

V.CONCLUSIONS

In order to use efficient Electricity we propose an Intelligent Domiciliary LED Lighting System, which automatically regulates the lighting system outside & inside of house and timely displays the consumed Energy. This project is implemented on ARM, the sensor which detects the day light is used to switch outdoor lighting and the PIR sensor which detects the entering person into room are used here to regulate the indoor lighting intensity, which is done through PWM shifting technique. The power consumed by these lighting systems will be displayed on LCD for the monitoring purpose.

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