Energy Efficency Architecture for Indoor Lightning using Smart Sensor and Led Based DC Grid

A. Umamageshwari.
PG student, Department of EEE,
Anna university regional center,
Coimbatore.

Dr. S. N. Deepa
Associate professor, Department of EEE,
Anna university regional center,
Coimbatore.

***Abstract*— Conventional systems are only designed for power reduction of the consumer electronics. However, due to their architectural confines the recent systems are not flexible with respect to LED light control for power reduction. We need to consider proficient self-sufficient power control based on intelligent devices and the power-aware service prediction in networked environments. In this project, we propose a power-aware LED light enabler with light sensors, activity sensors and set of connections interface. The LED light enabler also communicates with context-aware middleware using an intelligent power gateway that adaptively determines the optimal power control by analyzing user living patterns using sensing data obtained by strategy. Our power-aware LED light enabler with adaptive middleware dynamically reconfigures the power-aware services. An elucidation requirement is as the combination of background and concentrated elucidation demands and users' locations. We consider two prerequisite models, namely, binary satisfaction and continuous contentment models, and propose two decision algorithms to determine the proper elucidations of devices and to achieve the desired optimization goals. Then, a closed-loop contrivance control algorithm is applied to adjust the elucidation levels of lighting devices. The proposed adaptive middleware facilitates the learning mechanism which analyzes the elucidation and the user motion, and controls the LED lights only when users exist around the devices.**

***Keywords*— LED light enabler, power aware LED, Light sensor**

I. INTRODUCTION

Recent years, people have been concerned about Green IT and how it relates to environmental pollution and the regulation of carbon emissions as well as with the energy crisis. Although, in the past, Green IT had focused on decreasing hazardous substances and curtailing the use of obsolete electronic devices, nowadays Green IT has changed its direction to the management of efficient energy usage and decreased power consumption. Therefore, many studies for efficient power reduction have been done in various fields.

One research shows that artificial lighting can cause 20~60% of an office building's total electric utilization. This means that there is much room for the possibility of power reduction through less lighting consumption. Notably, the invention of LEDs which have only 50% of the power consumption as compared to fluorescent is expected to help to lessen the energy consumption problem. Moreover, LEDs have a much longer life-time and consist of environmentally friendly components; these have many advantages in environmental aspects. Because they are a kind of electronic devices, it is possible to control them in various ways to save on power consumption. Through their passive advantages, people have tried to use LEDs to reduce energy consumption but this just focuses on the substitution of existing fluorescent lights. Therefore, finding ways to use LED lights more efficiently can bring more power saving. That is, to use LED lights more efficiently, an integrated management system is needed to have a flexible flow of power management because these lighting devices should not be simply regarded as independent systems, but as systems which interwork with other kinds of devices.Recent advances in ubiquitous technologies facilitate location-aware and power-aware systems that can provide predefined services. Recent research hard work are based on control mechanisms for standby power cutback. Conventional systems are only designed for power reduction of the consumer electronics. However, due to their architectural confines the recent systems are not flexible with respect to LED light control for power cutback. We need to consider efficient autonomous power control based on intelligent devices and the power-aware service prediction in networked environments. In this project, we propose a power-aware LED light enabler with light sensors, activity sensors and network interfaces.

II. RELATED WORK

Power Supply by using a Step-down transformer and a full wave rectifier AC is converted into DC. A regulator which maintains the DC output at constant 5V, 12v is flexible for the constitution of various LED arrays. Here the power MOSFET acts as a LED driver. This section is composed of constant current controller for driving LEDs to make the most of the LED's characteristics. There are six ports with a maximum 1A output, and each port is controllable and can adjust for 10 steps of brightness. Communication Part The basic constitution is the RS-232 module which can expand to USB modules if needed. In addition, there is an expansion slot for a Zig Bee module where the status of the Lighting & other Loads is send to a monitoring server.

A .Sensor & Signal Processing: To characterize the location-awareness aspect as presented above, the three sensors which are needed to organize the lighting system, the elucidation sensor (LDR) and the motion detection sensor (PIR) and a Temperature sensor are included here. There is also an extension slot for an additional different type of sensor. Comparator processes the elucidation sensor outputs. Signal processing unit interfaces the sensor signals to the microcontroller.

B. Main Controller Unit: By using an 8 bit microcontroller, this part controls the other parts of the light enabler. The microcontroller modifies the internal parameters to adapt itself to the various environments by controlling Light elucidation levels according to ambient light and controls the fans by ambient temperature sensing along with human sensing for power saving mode.

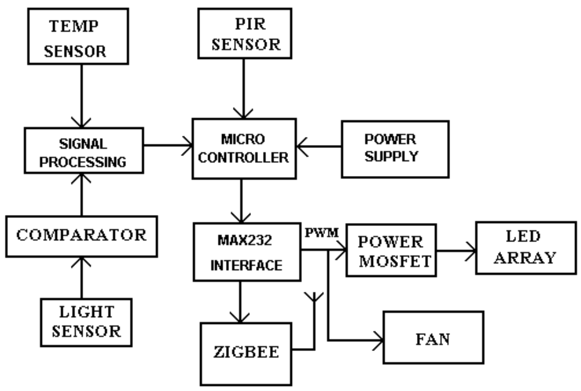

Fig .1. Overview of Block diagram Transmitter

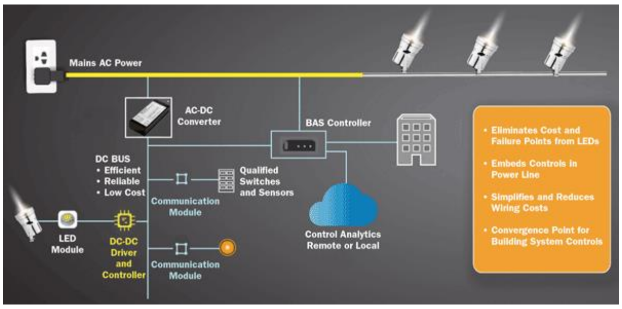

Fig.4.*Indoor-lighting DC distribution per room (not per LED).*

DC distribution building grid for LED lighting.50% energy saving is expected as compared to the original ac fluorescent system. Day light sensing energy saving along with intelligent dimming system. Energy saving by Motion detection Alert system for lighting system failures..ZigBee is a specification for a suite of high level communication protocols using small, low-power digital radios for wireless delicate area networks (WPANs), such as wireless headphones connecting with cell phones via short-range radio. The technology defined by the ZigBee specification is intended to be simpler and less expensive than other WPANs, such as Bluetooth. ZigBee is beleaguered at radio-frequency (RF) applications that require a low data rate, The regulated DC supply for the IC s and other parts of the circuit is provided by the separate DC power supply. The transformer used here is a step-down transformer which converts 230v AC into 12v AC.A full wave bridge rectifier made around the diodes converts the ac supply into a pulsating dc supply. Here the bridge consists of four IN4001 silicon diodes which are capable of delivering current up to 1 amps. The ripple content in the rectifier output is smoothened by adding a capacitor filter in parallel to the output. The value of capacitor may be from 100 to 4700 microfarads. Higher the chosen value more is the filtering. The 12v dc is regulated to 5v dc using a 3-terminal series pass regulator with the input pin (pin1) to output of rectifier, output pin(pin3) to the supply output. The common pin (pin2) is connected to the supply ground. The output of the regulator will be 5volts.

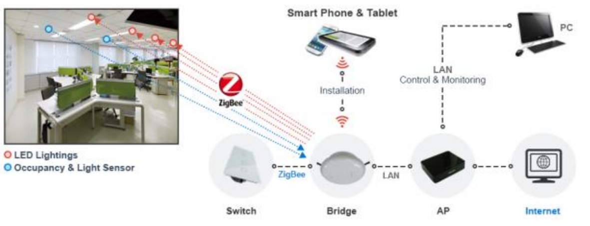

Fig.5.The energy efficiency increases smart lighting inside a building

C. *Zigbee protocols:* The protocols build on recent algorithmic research (Ad-hoc On-demand Distance Vector, neuRFon) to robotically construct a low-speed ad-hoc network of nodes. In most large network occasions, the network will be a huddle of clusters. It can also form a interconnect or a single cluster. The current profiles consequent from the ZigBee protocols support guiding light and non-guiding light enabled networks .In non-guiding light-enabled networks (those whose guiding light order is 15), an unspotted CSMA/CA channel access method is used. In this type of arrangement, ZigBee Routers typically have their receivers constantly active, requiring a more stout power supply. However, this allows for assorted networks in which some devices receive continuously, while others only transmit when an external spur is detected. The typical example of a heterogeneous network is a wireless light switch: The ZigBee node at the lamp may receive continuously, since it is connected to the mains supply, while a battery-powered light toggle would remain asleep until the switch is terrified. The switch then wakes up, sends a command to the lamp, receives an acknowledgment, and profits to sleep. In such a network the lamp node will be at

least a ZigBee Router, if not the ZigBee controller; the switch node is typically a ZigBee End Device. In guiding light-enabled networks, the special network nodes called ZigBee Routers transmit periodic guiding lights to confirm their presence to other network nodes. Nodes may sleep between guiding lights, thus lowering their duty cycle and extending their battery life. Guiding light intervals may range from 15.36 milliseconds to 15.36 ms * 214 = 251.65824 seconds at 250 kbit/s, from 24 milliseconds to 24 ms * 214 = 393.216 seconds at 40 kbit/s and from 48 milliseconds to 48 ms * 214 = 786.432 seconds at 20 kbit/s. However, low duty cycle operation with long guiding light intervals requires precise timing, which can quarrel with the need for low product cost. In general, the ZigBee etiquettes minimize the time the radio is on so as to shrink power use. In guiding lighting networks, nodes only need to be active while a guiding light is being transmitted. In non-guiding light-enabled networks,power utilization is decidedly asymmetrical: some devices are always active, while others splurge most of theirtime sleeping.

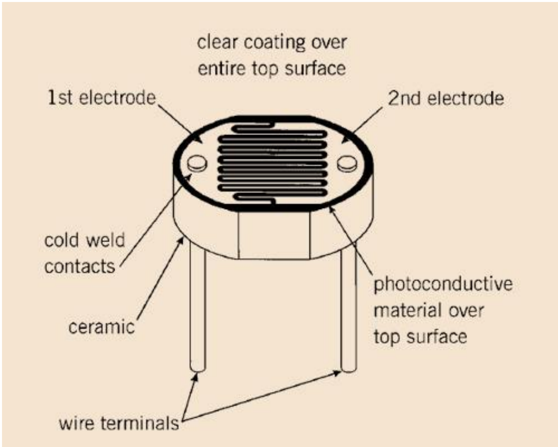

Fig.3.Light Sensor

D.Light sensor: An LDR (Light reliant resistor), as its name suggests, offers resistance in retort to the ambient light. The resistance decreases as the passion of occurrence light increases, and vice versa. In the absence of light, LDR exhibits a conflict of the order of mega-ohms which decreases to few hundred ohms in the of light. It can act as a sensor, since a anecdotal voltage drop can be obtained in accordance with the varying light. It is made up of cadmium sulphide (CdS). An LDR has a zigzag cadmium sulphide track. It is a two-pronged device, i.e., conducts in both directions in same fashion .A photo resistor or light dependent resistor (LDR) is a resistor whose conflict decreases with increasing incident light intensity; in other words, it exhibit photoconductivity. It can also be referred to as a photoconductor or CdS device, from "cadmium sulfide," which is the material from which the device is made and that actually exhibits the variation in resistance with light level. Note that while CdS is a semiconductor, it is not doped silicon. A photo resistor is made of a elevated resistance semiconductor. If light retreating on the device is of high an adequate amount frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electron (and its hole partner) conduct electricity, thereby lowering conflict. A photoelectric device can be either intrinsic or extrinsic. An intrinsic semiconductor has its individual charge carriers and is not an efficient semiconductor, e.g. silicon. In intrinsic strategy the only available electrons are in the valence band, and hence the photon must have adequate energy to excite the electron across the entire bandgap.Extrinsic strategy have impurities, also called dopants, added whose position state energy is closer to the conduction band; since the electrons do not have as far to jump, lower energy photons (i.e., longer wavelengths and lower frequencies) are sufficient to trigger the device. If a test of silicon has some of its atoms replaced by phosphorus atoms (impurities), there will subsist extra electrons accessible for conveyance. This is an example of an extrinsic semiconductor. Photoresistors are essentially photocells.

Fig.4.PWM.Direct drive

E.PWM Direct drive: The most difficult task in direct gate drives is to optimize the circuit layout. As indicated in Figure above there might be considerable distance between the PWM checker and the MOSFET. This distance introduces a sponging inductance due tothe loop formed by the gate drive and ground return traces which can slow down the switching speed and can cause ringing in the gate drive waveform. Even with a ground level surface, the inductance can not be completely eliminated since the ground plane provides a low inductance path for the position return current only. To reduce the inductance allied to the gate drive connection, a wider PCB suggestion is enviable. Another problem in direct gate drive is the limited drive current capability of the PWM checkers. Very few integrated circuits offer more than 1A peak gate drive facility. This will limit the maximum die size which can be driven at a reasonable speed by the checker. Another limiting factor for MOSFET size with direct gate drive is the power dissipation of the driver within the checker. An external gate resistor can diminish this problem as discussed before. When direct gate drive is utterly necessary for space and/or cost savings, special deliberations are required to provide appropriate bypassing for the checker. It can disrupt the sensitive analog circuitry inside the PWM checker. As MOSFET expire size increases, so too does gate charge required. The assortment of the proper bypass capacitor calls for a little bit more scientific approach than preference the usual 0.1µF or 1µF bypass capacitor.

III.PROBLEM DEPICTION

DC distribution building grid for LED lighting.44% energy saving as compared to the original ac fluorescent system. LVDC LED system The drawback of having to use the ac-dc power converter to condition the electrical power for the LEDs has several power conversion losses. Thus a low voltage level dc grid, which is moderately much safer than conventional ac grid. main problem is lightning is too dim

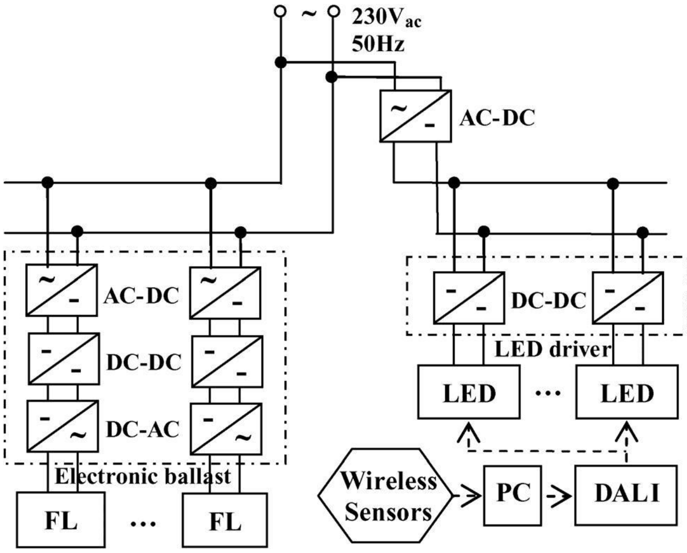

Fig.5Overview of conventional ac grid powered fluorescent system and dc grid powered LED system

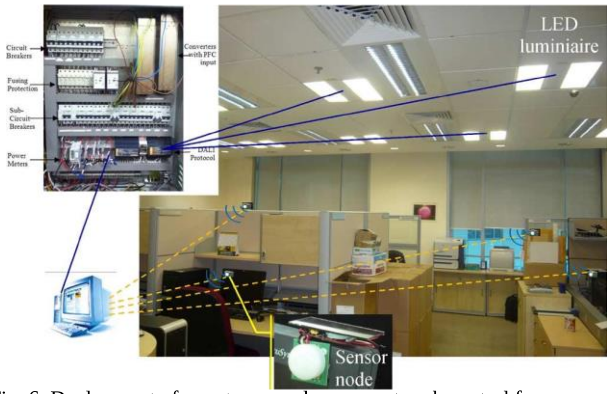

Fig. 6. Deployment of smart personal sensor network control for energy saving in dc grid powered LED lighting system.

IV.CONCLUSION

In this project, we present the light management controller for LED lights and the Intelligent Power Gateway used to manage this controller by presence aware sensing and environment sensing. The elucidation control by ambient light sensing and fan control by ambient temperature sensing have been implemented. Therefore, our light enabler is designed to be able to be modified according to the requirement of the users to be applied to various environments. Furthermore, to maximize these properties, it is be self-adaptive by using sensors to gather environmental information. We also propose the Intelligent Wireless Gateway to manage the large numbers of light enablers more efficiently.

REFERENCES

[1] M. Bodart and A. De Herde, "Global energy savings in offices buildings by the use of daylighting," Energy and Buildings, vol. 34, pp. 421-429, 2002.
[2] M. Lee, Y. Uhm, Y. Kim, G. Kim, and S. Park, "Intelligent power management device with middleware based living pattern learning for power reduction," Consumer Electronics, IEEE Transactions on, vol. 55, pp. 2081-2089, 2009.
[3] K. Chen, M. Unglert, and R. Malafa., "Energy-Saving Lighting for Industrial Applications," Industry Applications, IEEE Transactions on, vol. IA-14, pp. 242-246, 1978.
[4] D. H. W. Li, T. N. T. Lam, and S. L. Wong., "Lighting and energy performance for an office using high frequency dimming controls," Energy Conversion and Management, vol. 47, pp. 1133-1145, 2006.
[5] F. Rubinstein, M. Siminovitch, and R. Verderber, "Fifty percent energy savings with repeated lighting controls," Industry Applications, IEEE Transactions on, vol. 29, pp. 768-773, 1993.
[6] H. Jinsoo, H. Intark, and P. Kwang-Roh., "Service-oriented power management for an integrated multi-function home server," Consumer Electronics, IEEE Transactions on, vol. 53, pp. 204-208, 2007.
[7] A. Roy, S. K. Das, and K. Basu, "A Predictive Framework for Location-Aware Resource Management in Smart Homes," Mobile Computing, IEEE Transactions on, vol. 6, pp. 1270-1283, 2007.
[8] Y. Royon and S. Frenot, "Multiservice home gateways: business model, execution environment, management infrastructure," Communications Magazine, IEEE, vol. 45, pp. 122-128, 2007.[9] B. Ying-Wen and K. Yi-Te, "Automatic room light intensity detection and control using a microprocessor and light sensors," Consumer Electronics, IEEE Transactions on, vol. 54, pp. 1173-1176, 2008.
[10] P. Meng-Shiuan, Y. Lun-Wn, C. Yen-Ann. L. Yu-Hsuan. And T. Yu-Chee, "A WSN-Based smart Light Control System Considering User Activities and Profiles," Sensors Journal, IEEE, vol. 8, pp. 1710- 1721, 2008.
[11] P. Tae-Jin and H. Seung-Ho, "Experimental Case Study of a BACnet-Based Lighting Control System," Automation Science and Engineering, IEEE Transactions on, vol. 6, pp. 322-333, 2009.
[12] P. Pace, G. Aloi, and A. Palmacci, "A multi-technology location-aware wireless system for interactive fruition of multimedia contents," Consumer Electronics, IEEE Transactions on, vol. 55, pp. 342-350, 2009.