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Research Article

Street Light Automation Controller using Zigbee Network and Sensor with Accident Alert System

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Abstract

Electrically powered ON/OFF of street lighting has brought a sense of wellbeing and freedom from risk or danger but street lights in town centres, traffic lights and pedestrian crossings stay ON all night. This amount of lighting is not required in that it adds no benefit to the community. Continuous ON state of street light leads to power wastage. In other case, it is getting very difficult to analyze the failure of street lights in all places. In this Paper we have analyzed these problems. This paper consists of a group of measuring stations in the street (one station located in each lamppost) and a base station located nearby. The measuring stations are used to observe street conditions as the intensity of daylight and, depending on the conditions they activate or off the lamps. For these reasons every lamp is designed independent to decide about the activation of light. The base station continuously checks for proper operation of the lamp and sends the information using the wireless network to the operator.

Keywords: *Lighting system, LDR sensor, ZIGBEE, MEMS, ARM, GSM*

1. Introduction

The main driver behind this analysis relates to the current Project work consists of a bunch of measure stations within the street (one station set in every lamppost) and a base station set near. The measure stations area unit accustomed observe street conditions because the intensity of daylight and, reckoning on the conditions they activate or off the lamps. For these reasons each lamp is meant freelance to make a decision regarding the activation of Light. The bottom station put together checks if any lamp is properly in operation and sends the information. In olden days street management is done by manually switching ON/OFF depending upon the time basis. Due to this process light's are in ON condition continuously without Vehicles on road. Due to this we loss a huge amount of power without useful. Then all the power is not fully Energy Efficient usage systems and No monitoring system to monitor the failures in lighting, we have to check manually. In this proposed system we are using fully automated with monitoring dedicated base station for monitoring the any types of lighting failures, Passes the information about vehicle crowd and passing it through wireless sensor networking system for utilize the energy in efficient way along with accident alert message passing through GSM, Zigbee and having emergency switch. After the sunlight has been reduced in the street then the Street light will glow by using a light sensor. By using this wastage of electricity will be reduced and human effect also reduced.

2. Designing model and implementation

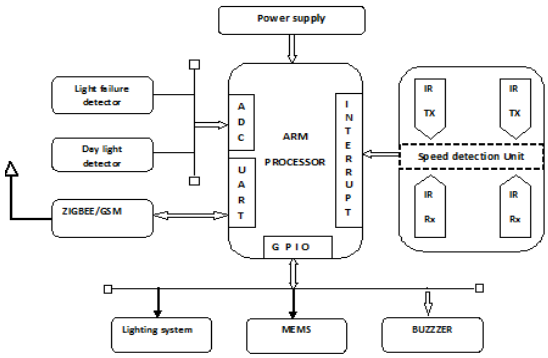

Fig 1: Measuring Section or lighting controlling system

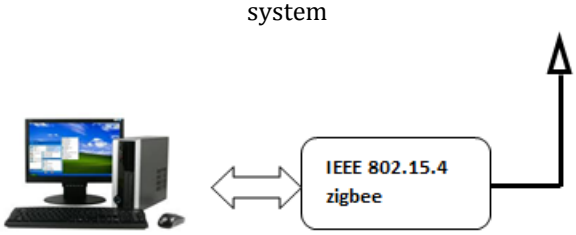

Fig 2: Monitoring Section

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Street light control systems are composed of three parts, centralized control center, remote concentrator and street light control terminals. Centralized control center for street lights are reside in local government office usually. At the centralized control center, operators monitor and control street lights by using operator's terminal. Centralized control center computers communicate with remote concentrator which control lights installed alongside every road. Remote concentrators control lights and gather status information. Remote concentrators usually control lights that are connected to power delivery feeder, 60Hz 220V. Street light control system is composed hierarchically. Centralized control center are communicate with remote concentrator. Remote concentrators communicate with each remote street light control terminal which installed in every light pole. Remote concentrator's roles are control of individual remote controller and gathering of status information from remote control terminals.

3. Hardware Modules Description

3.1 LPC2148 Processor

LPC2148 Microcontroller 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.

Interrupt controller

The Vectored Interrupt Controller (VIC) accepts all of the interrupt request inputs from the User section and categorizes them as Fast Interrupt Request (FIQ), vectored Interrupt Request (IRQ), and non-vectored IRQ as defined by programmable settings.

3.2 ZIGBEE Overview

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 devices. The modules operate within the ISM 2.4 GHz frequency band and are compatible with the following:

- **Advanced Networking & Security**
  - Point-to-point, multipoint topology.
  - Self-routing, self-healing, mesh networking and fault-tolerant.
- **Low Power**
  - TX Current: 295mA
  - RX Current: 45mA
  - Power-down Current: < 1µA

RS232 Communication

Information being transferred between data processing equipment and peripherals is in the form of digital data which is transmitted in either a serial or parallel mode. Serial transmission involves the sending of data one bit at a time, over a single communications line. In contrast, parallel communications require at least as many lines as there are bits in a word being transmitted (for an 8-bit word, minimum of 8 lines are needed).

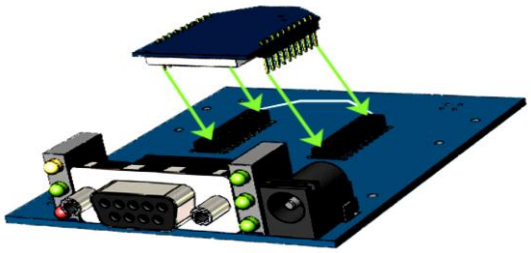

Fig 3: Zigbee Module Mounting on RS232 Interface Board

The inside tests were done considering one or additional walls between the transmitter and therefore the receiver, whereas the outside ones were performed with one or additional natural obstacles like trees or hills. Ten-thousand transmission tests were performed for each case, exploitation Associate in nursing acceptable adapter to simulate the retransmission. The X-CTU tool, employing a terminal connected to Associate in Nursing XBee module, sends a packet through the network and verifies that the data square measure properly came back from the XBee module that has received the packet. The obtained results, exploitation the minimum transmission power out there, square measure terribly satisfactory. All packets arrive to their destination and square measure properly came. Obtained average irresponsibleness was 99%. The same tests were performed on the Xbee

professional and therefore the share of irresponsibleness was 100% in every case. Positioning the lamp post at concerning 25 m from one another, the proposed system will dependably operate exploitation the Xbee normal modules with patch antenna. These modules have a nominal range of concerning one hundred m outdoors and square measure the most cost effective ones. Other practicality field tests were completed exploitation the Xbee modules put within the lamp posts (at the instant, they are four and the remote central). A primary check was to verify that the system is ready to transfer info from any lamp post to the centre passing information through the opposite lamp posts. In these cases, we tend to Obtained a transmission rate between 99% and 100% betting on the placement of the causing unit. The second check verified the case of breakdown of Associate in nursing intermediate lamp post. At the instant, the system isn't affected by this sort of drawback, considering the transmission with the same positioning of the antecedent delineate case. The system equipped with Xbee modules with a patch antenna becomes non operating only four consecutive lamp posts' transmission devices square measure inactive. This check was performed exploitation two others Zigbee transmission stations. Placed twenty five m from every other, the lampposts chain had upstream these 2 stations.

ZIGBEE TESTS

Simulate the opposite lamps. An identical check was finished the Xbee Pro modules with Associate in nursing external antenna, so as to not leave something out. It follows that the system is totally reliable additionally in the case of 5 consecutive lamp posts de-escalated (the worst-case in our check system). No bypass line is critical during this case.

3.3 LDR Sensor

LDR's are light dependent devices whose resistance decreases when light falls on them and increases in the dark. When a light dependent resistor is kept in dark, its resistance is very high. This resistance is called as dark resistance. It can be as high as 1012 Ω. Although Sunrise / Sunset clock built in that will determine when the sunrise's and sets, hence if it is dark or light outside. so, when automating light it needs to know if the lights should be activated or not. Otherwise it defeats the purpose of energy saving by automating the lights for cost savings.

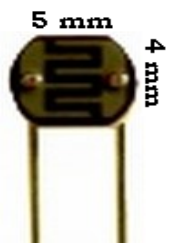

Fig 4: LDR

3.4 Relay

When a current flows through the coil, the resulting magnetic field attracts an armature that is mechanically linked to a moving contact. The movement either makes or breaks a connection with a fixed contact.

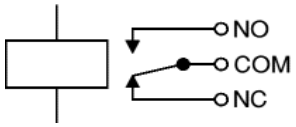

Fig 5: Circuit symbol of a relay

3.5 IR Sensor

Infrared (IR) radiation is electromagnetic radiation of a wavelength longer than that of visible light, but shorter than that of microwaves. The name means below red (from the Latin infra, below), red being the color of visible light with the longest wavelength. Infrared radiation has wavelengths between about 750 nm and 1 mm, spanning five orders of magnitude. Humans at normal body temperature can radiate at a wavelength of 10 microns.

- Transmitter: a blinking IR light
- Receiver: a light dependent resistor

3.6 GSM Overview

A GSM modem is a wireless modem that works with a GSM wireless network. Global system for mobile communication (GSM) is a globally accepted standard for digital cellular communication. GSM is the name of a standardization group established in 1982 to create a common European mobile telephone standard that would formulate specifications for a pan-European mobile cellular radio system operating at 900 MHz. GSM modems support an extended set of AT commands. These extended AT commands are defined in the GSM standards.

Sending the message

To send the SMS message, type the following command:

AT+CMGS=+31638740161 <ENTER>

Replace the above phone number with your own cell phone number. The modem will respond with: >You can now type the message text and send the message using the <CTRL>-<Z> key combination:

TEST GSM! <CTRL-Z>

Here CTRL-Z is keyword for sending an SMS through the mobile device. After some seconds the modem will respond with the message ID of the message, indicating that the message was sent correctly:

+CMGS: 62

For this project, GSM will send the information about Accident Detection, High Speed, and Light Failure.

3.7 MEMS

MEMS (Micro-Electro Mechanical System)-based accelerometers are devices that measure the proper acceleration. In relativity theory, proper acceleration is the physical acceleration experienced by an object. The psychical acceleration is measurable by sensors. These sensors are part of the sensing cluster of ubiquitous technologies. Sensing technologies make use of physical parameters from the environment, such as temperature, pressure, force and light.

4. Flow Chart

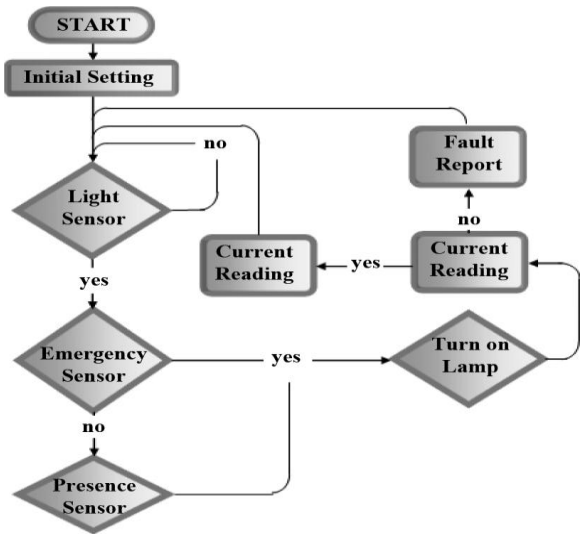

Fig 6: Flow Chart

Initially the IR sensors sense the vehicle presence or not and update the information on controller and LDR sense the light intensity. the controller checks the data and when the vehicle are passing through that way and light intensity is low then only lights ON the street lights by controller through a relay driver circuit otherwise lights OFF.

5. Results

The measure stations area unit accustomed observe street conditions because the intensity of daylight, vehicle count, emergency switch, accident alert system and, reckoning on the conditions they activate or off the lamps. For these reasons each lamp is meant freelance to make a decision regarding the activation of street light. The bottom station put together checks if any lamp is properly in operation.

Hardware Result

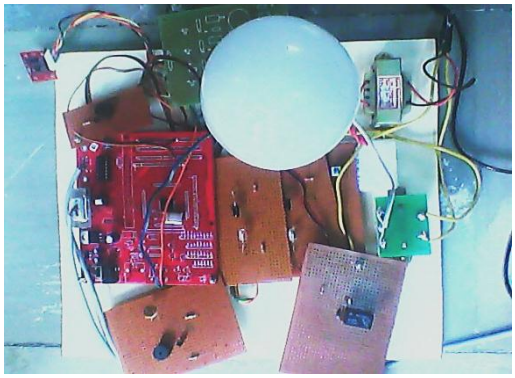

Fig 7: Hardware section of Measuring Station

Another advantage obtained by the system is that the intelligent management of lamp posts by passing information to a central station by ZigBee wireless communication, Accident Alert System through GSM provides alert signal to help. The system maintenance may be simply and expeditiously planned from the central station, permitting further savings. The projected system is especially appropriate for street lighting in urban and rural areas wherever the traffic is low at a given vary of time. Monitoring Station.

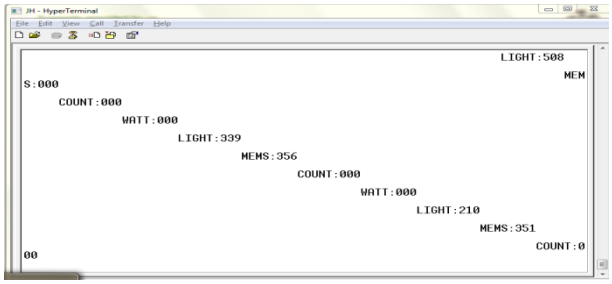

Fig 8: Monitoring Section Results

The system is always versatile, extendable, and totally liable to user wants. The simplicity of ZigBee, the irresponsibleness of electronic elements, the feature of the sensing element network, the process speed, the reduced prices, and therefore the simple installation square measure the options that characterize the projected system, that presents itself as an interesting engineering and business answer because the comparison with different technologies incontestable. The system may be adopted within the future provided by the power system that allows the observation of energy consumption. This situation is especially attention-grabbing within the case of economic incentives offered to shoppers and may be helpful. Moreover, new views arise in asking and within the intelligent management of remotely controlled and for good grid and good metering applications.

Conclusion

The proposed remote-control system can optimize management and efficiency of street lighting systems. It uses ZigBee-based wireless devices which enable

more efficient streetlamp-system management, thanks to an advanced interface and control architecture. It uses a sensor combination to control and guarantee the desired system parameters. The information is transferred point by point using ZigBee transmitters and receivers and is sent to a Monitoring section used to check the state of the street lamps and to take appropriate measures in case of failure, accident detection, vehicle crowd, high speed.

References

M. A. D. Costa, G. H. Costa, A. S. dos Santos, L. Schuch, and J. R.Pinheiro (2009), A high efficiency autonomous street lighting system based on solar energy and LEDs, in *Proc. Power Electron. Conf.*, Brazil,Oct. 1, pp. 265–273.

P.-Y. Chen, Y.-H. Liu, Y.-T. Yau, and H.-C. Lee (2008), Development of anenergy efficient street light driving system, in *Proc. IEEE Int. Conf.Sustain. Energy Technol.*, Nov. 24–27, pp. 761–764.

W. Yongqing, H. Chuncheng, Z. Suoliang, H. Yali, and W. Hong (2009),Design of solar LED street lamp automatic control circuit, in *Proc.Int. Conf. Energy Environment Technol.*, Oct. 16–18, vol. 1, pp.90–93

W. Yue, S. Changhong, Z. Xianghong, and Y. Wei (2010), Design of new intelligent street light control system, in *Proc. 8th IEEE Int. Conf. Control Autom.*, Jun. 9–11, pp. 1423–142

R. Caponetto, G. Dongola, L. Fortuna, N. Riscica, and D. Zufacchi (2008), Power consumption reduction in a remote controlled street lighting system, in *Proc. Int. Symp. Power Electron., Elect. Drives, Autom. Motion*, Jun. 11–13, pp. 428–4

Y. Chen and Z. Liu (2009), Distributed intelligent city street lamp monitoring and control system based on wireless communication chip nRF401, in *Proc. Int. Conf. Netw. Security, Wireless Commun. Trusted Computer.*, Apr. 25–26, vol. 2, pp. 278–28

L. Jianyi, J. Xiulong, and M. Qianjie (2009), Wireless monitoring system of street lamps based on zigbee, in *Proc. 5th Int. Conf. Wireless Commun., Netw. Mobile Computer*, Sep. 24–26, pp. 1–3.

D. Liu, S. Qi, T. Liu, S.-Z. Yu, and F. Sun (July 2009), The design and realizationof communication technology for street lamps control system, in Proc.4th Int.Conf. Comput. Sci. Educ., 25–28, pp. 259–2

J. Liu, C. Feng, X. Suo, and A. Yun (2008), Street lamp control system basedon power carrier wave, in Proc. Int. Symp. Intell. Inf. Technol. *Appl. Workshops*, Dec. 21–22, pp. 184–18

H. Tao and H. Zhang (2009), Forest monitoring application systems based onwireless sensor networks, in Proc. 3rd *Int. Symp.Intell. Inf. Technol. Appl. Workshops*, Nov. 21–22, pp. 227–230.

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