ISSN: 2278 – 7798
International Journal of Science, Engineering and Technology Research (IJSETR)
Volume 5, Issue 8, August 2016

A Low Cost and Real Time Streetlight Monitoring System

M. C. Janardhan Reddy[1],Dr. D. Vishnu Vardhan[2]

M.tech in Digital Electronics and Communication Systems in JNTUACEP, Pulivendula, Andhra Pradesh, India

Assistant Professor of ECE Department in JNTUACEK, Kalikiri, Andhra Pradesh, India

***Abstract*- The main objective of streetlights is to prevent vehicle accidents and also to provide safety for pedestrians. In present days, people majorly depend on electrical inspectors for functioning of streetlights. But this may take lot of time to detect and repair them. Some advanced techniques use wireless networks which consists of sensors placed on each streetlight pole and some network modules to detect the problem at any instant, which is very expensive. In this paper we use a single sensor and special device (ARM microcontroller, GSM and GPS) that is placed on the top of any vehicle (like city-bus) to collect the data about location and intensity of light on the road. The data collected is updated to the server wirelessly and the data can also be seen online on Google maps, which shows location of streetlight and condition of lighting on the road at that particular location. This method can reduce the cost and can be used as a complementary system for electrical inspectors.**

***Index terms*-Fault streetlights, ARM7, GSM, GPS, update, real-time, management.**

I.INTRODUCTION

Road accidents are the biggest cause for death and injuries, majorly in developing and undeveloped countries. Street lightning can decrease the count of accidents that occur during night times. Faulty, less intensity streetlights are also responsible for many crimes and vehicle accidents. So proper streetlight management is required. Here, we use light intensity sensor placed on the vehicle to measure lighting on roads and this data is send to online server through GSM-GPS, where we can see the condition of streetlight and location on Google maps.

II. EXISTING METHOD

Currently, communities mostly depend on electrical inspectors to check the condition of streetlights, which includes delay in detecting and repairing. Some studies suggest that keeping sensors and wireless networks (ZigBee, RF) to each streetlight can avoid the problem, but it increases the cost and complexity in detecting the faulty streetlights.

III. PROPOSED METHOD

This model has light intensity sensor, GSM, GPS and ARM 7 Microcontroller. Intensity sensor senses the light on roads and the data is analyzed in ARM7 and sent to online server through GSM-GPS system. The data can be seen online through internet on Google maps designed for this particular application. A proper conditioned light on roads can be indicated by green mark at the respective location on maps, an improper lightning condition can be shown as red mark on the map at that respective location. This system can have the following advantages:

- Cost cut-down: No need of Access Point (AP) and Check Point (CP).
- Simple Manner: No need of creating Illumination Maps (IMaps), which increases software complexity.

- Real-time: It updates the information from vehicle itself through GSM-GPS, and reduces the time delay.
- Now-a-days as GPS system is readily available on vehicles (Bus). So we can add-on this. No need of new set-up.

IV.SYSTEM ARCHITECTURE

The architecture of our proposed system consists of two parts:

1. Vehicle client and
2. Back-end server.

The architecture of vehicle client is shown below:

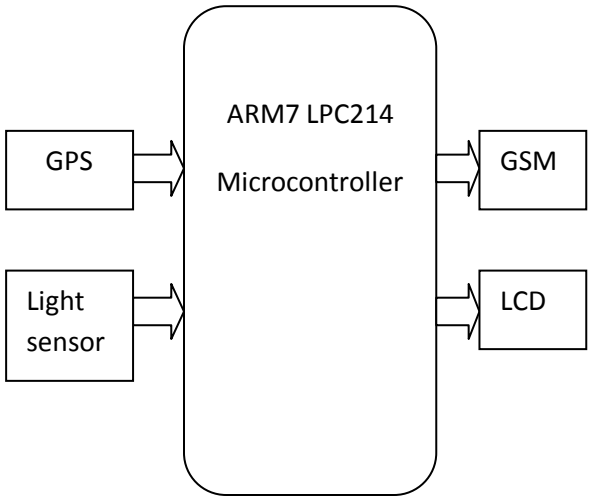

Fig.1. Architecture of vehicle client.

The sensor at vehicle client detects the light intensity. GPS locates the current position of client headed on vehicle and this data is processed at ARM 7 microcontroller and uploads the data to back-end server through GSM. We use data logging algorithm for measuring light intensity at regular intervals and that can be uploaded into the server.

Fig.2. Embedded kit for proposed system.

V.SYSTEM HARDWARE

Hardware components includes ARM7 LPC2148, LM1117-3.3, 2X16 LCD Display, Bridge Rectifier, GSM Modem, GPS MODEM, and Light Sensor.

A. ARM7

ARM is an Advanced RISC Machine. ARM is one of the most licensed and thus widespread processor cores in the world. The ARM7TDMI processor has two operating states:

ARM - 32-bit, word-aligned ARM instructions are executed in this state.

Thumb -16-bit, half word-aligned Thumb instructions are executed in this state. The operating state of the ARM7TDMI core can be switched between ARM state and Thumb state using the BX (branch and exchange) instructions. The ARM7TDMI-S is a general purpose 32-bit microprocessor, which offers high performance and very low power consumption.

B. LPC2148

LPC2141/42/48 microcontrollers are based on a 16-bit/32-bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combine microcontroller with embedded high speed flash

memory ranging from 32 KB to 512 KB. Due to their tiny size and low power consumption, LPC2141/42/44/46/48 are ideal for applications where miniaturization is a key requirement, such as access control and point-of-sale.

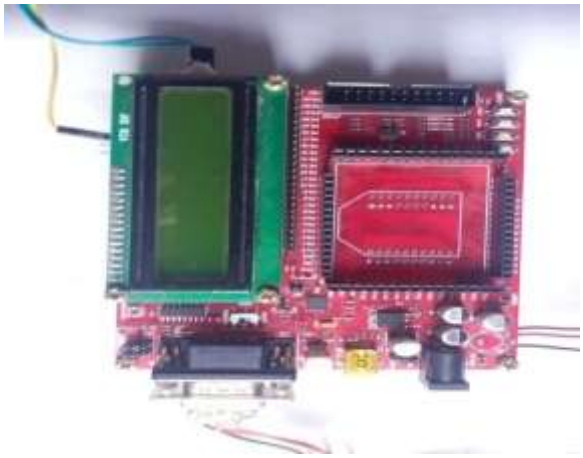

Fig.3. ARM 7 LPC2148 module

A. LM1117 3.3

The LM1117 is a series of low dropout voltage regulators with a dropout of 1.2V at 800mA of load current. It has the same pin-out as National Semiconductor's industry standard LM317.The LM1117 is available in an adjustable version, which can set the output voltage from 1.25V to 13.8V with only two external resistors. In addition, it is also available in five fixed voltages, 1.8V, 2.5V, 2.85V, 3.3V, and 5V. The LM1117 offers current limiting and thermal shutdown.

B. LCD DISPLAY

The term liquid crystal is used to describe a substance in a state between liquid and solid but which exhibits the properties of both. Molecules in liquid crystals tend to arrange themselves until they all point in the same specific direction. This arrangement of molecules enables the medium to flow as a liquid. Depending on the temperature and particular nature of a substance, liquid crystals can exist in one of several distinct phases. Liquid crystals in a pneumatic phase, in which there is no spatial ordering of the molecules. One important feature of liquid crystals is the fact that an electrical current affects them.

C. GSM

Fig.4. GSM module

The GSM specifications define the functions and interface requirements in detail but not address the hardware. The reason for this is to limit the designers as little as possible but it still to make it possible for the operators to buy equipment form different suppliers. The GSM network is divided into three major systems:

The Switching System (SS); The Base Station System (BSS); and the operation and Support System (OSS).

D. MAX232

The MAX232 is a dual driver/receiver that includes a capacitive voltage generator to supply TIA/EIA-232-F voltage levels from a single 5-V supply. Each receiver converts TIA/EIA-232-F inputs to 5-V TTL/CMOS levels. These receivers have a typical threshold of 1.3 V, a typical hysteresis of 0.5 V, and can accept ±30-V inputs. Each driver converts TTL/CMOS input levels into TIA/EIA-232-F levels.

E. LIGHT INTENSITY SENSOR

It is used to measure the intensity of light. It is called photoresistor or Light Detecting Resistor (LDR),

which work on the principle of increasing or decreasing the resistance of circuit when placed in a voltage-divider circuit.

Fig.5. Light intensity sensor.

VI. IMPLEMENTATION AND RESULT

After assembling the hardware elements to the Embedded Board, developed Software has to be burned into ARM 7 microcontroller using USB Programmer. This kit is placed on the roof top of Bus.

To find the condition of lighting on roads the system is switched-on, and the result can be seen on android mobile application, or on computer with internet connection at the web-address www.embeddedsystemprojects.com/jntu/streetlight . The better lighting condition can be viewed as green indicator at corresponding location, as shown below:

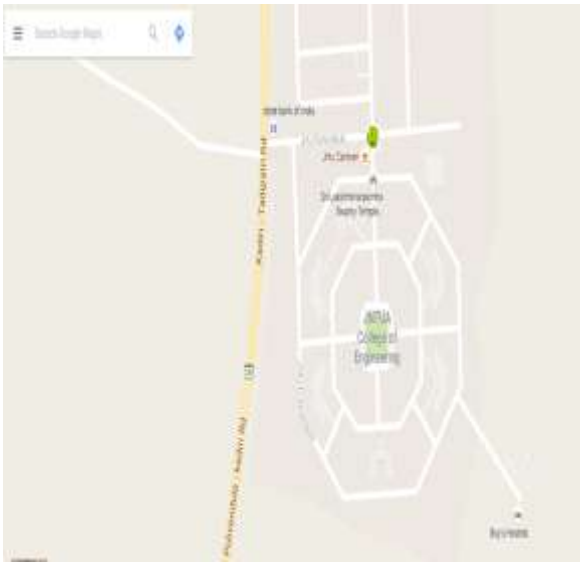

Fig.6. Picture indicating better lighting condition on road.

Poor or no lighting condition on roads can be indicated as red mark at that corresponding location on map, as shown below:

Fig.7. Picture indicating poor lighting condition on road.

To see the complete data-log of this system we can find it at web-address www.embeddedsystemprojects.com/jntu/streetlight/dataall.txt , as shown below:

Fig.8. Picture showing data log details.

VII. CONCLUSION

As this system is real time, we can detect and repair the fault streetlights instantaneously and can reduce the road accidents and crimes that may happen due to poor lighting on roads. The proposed method can have the following advantages.

1) Since we do not install sensors on every streetlight cost can cut down.
2) Can be used as Bus location identifier -As we use GPS Module we can get Bus location and no need to wait at Bus stop for long time.
3) Software complexity can be reduced, thus reducing the cost.

REFERENCES

[1] Huang-Chen Lee and Huang-Bin Huang's " A Low-Cost and Noninvasive System for the Measurement and Detection of Faulty Streetlights" Published on VOL. 64, NO. 4, April 2015.

[2] K. Ker and F. R. Beyer, "Street lighting for prevention of road traffic injuries," Injury Prevention, vol. 15, no. 4, p. 282, August. 2009.

[3] Y.-S. Huang, H.-H. Lin, and H.-C. Lee, H.-B. Huang, "Poster abstract: Managing road lighting with a hitchhiking sensor system," in *Proc. 12th ACM/IEEE Conf. Inf. Process. Sensor Netw. (IPSN)*, USA, April. 2013, pp. 325–326.

[4] W. Li, L. Sun, and S. Gong, X. Shentu, "A new streetlight monitoring system based on wireless sensor networks," in *Proc. 2nd Int. Conf. Inf. Sci. Eng. (ICISE)*, Dec. 2010, pp. 6394–6397.

[5] Y. Guo and C.-L. Fan, "The application of a ZigBee based wireless sensor network in the LED street lamp control system," in *Proc. Int. Conf. Image Anal. Signal Process. (IASP)*, October. 2011, pp. 501-504.