Zigbee Based Automatic Streetlighting System

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Abstract Energy problem is a social focus nowadays. According to our road conditions, street lighting system of our country is still emerging technologies. In this paper to reach the purpose of energy saving, it deals with an information method to deal with the problem of street lighting. It also can save the energy and time. In this paper, we try to designed an wireless streetlight system with the help of zigbee technology which can be help in detection of faulty lights and control it. For monitoring purpose, we create an graphical user interface which helps in monitoring purpose.
Index terms: ZigBee, microcontroller 89c51.

I.   INTRODUCTION

Streetlight system is a very important system and it plays very crucial role in developing country. Today, there are many inventions occur in advancing the effectivity of current streetlight system. There is standard format of Streetlight system, in which the streetlight splits in three sections, first is the streetlight, substation and last is main station. Main purpose of streetlight system is to provide a safety to the pedestrians. Researchers have shown that nighttime results in a large number of crashes. In highways of India, there are number of disastrous cases occur like gang murder, chain snatchers etc. The propose system is taken into consideration under wireless sensor network.

There are many key factors involve in the streetlight system. First is the maintenance. Maintenance is the one of the important key factor. Maintenance costs and number of person for repair , this are the two factors which affect the every efficient streetlight control system. Another key factor of streetlight control system is what kind of the communication protocol we will use. In this proposed system, we will used Zigbee technology. ZigBee is a specification for a suite of high level communication protocols using small, low-power digital radios based on an IEEE 802 standard for personal area networks. ZigBee is a low-cost, low-power, wireless mesh network standard. Data transmission rates vary from 20 to 250 kilobits/second. ZigBee builds upon the physical layer and medium access control defined in IEEE standard 802.15.4 (2003 version) for low-rate WPAN.

The controlling of streetlight system is also a important consideration. If a streetlight control system is cost effective but there is no proper controlling between lights then that streetlight system is not cost effective.

Existing streetlight control and monitoring system requires an employee to check the each streetlight terminal on highway which yields very time and money consumption. The main aim of this paper is to design more efficient wireless streetlight control and monitoring system which also analyses the incoming information which detects the faulty lights and re-correct it and sends them back to the streetlight terminal.

II. IMPLEMENTATION OF AUTOMATIC STREET LIGHT SYSTEM

The block diagram of proposed wireless streetlight control system using zigbee is as shown in fig. In this, we   use microcontroller, two zigbee module, max

232, two voltage regulator , step down transformer, SPST relay,four opto-coupler for reversing leakage current control.

The purpose of microcontroller is to take the data from all the streetlight through parallel processing   and convert them into serial communication.
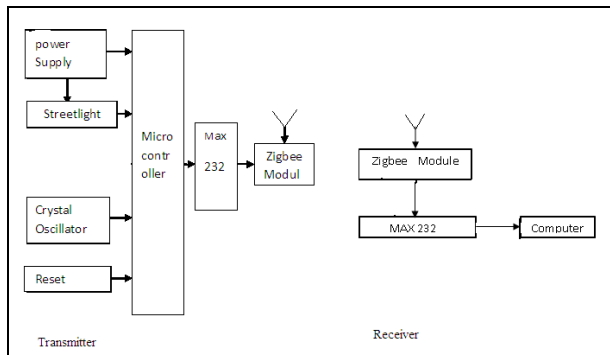

Fig.1 Block diagram of streetlight control system

We will use microcontroller 89c51. The AT89C51 provides the following standard features: 4Kbytes of Flash, 128 bytes of RAM, 32 I/O lines, two 16-bit timer/counters, five vector two-level interrupt architecture.In this, for operation of IC purpose, we use two voltage regulator, one is 7805 and another is LM 317T respectively. ZigBee technology have low data rate,it consumes low power, it is very low cost effective. ZigBee is the IEEE standard for low rate WPAN. Voltage conversion is done by IC MAX 232 and it is used to transmit data from microcontroller to PC. For microcontroller 0-0v, 1-5 v and for PC 0-+9to+13v, 1--9to-13v. In this way MAX 232 matches the voltages of microcontroller with PC.

III. DEVELOPMENT OF NEW STREET LIGHT CONTROL SYSTEM

We developed a prototype street light control system with the help of zigbee technology.
Developed streetlight system is composed of 2 different units, streetlight terminal at the transmitter side, and centralized control system at the receiver side. Among them, street light transmitter terminal are hardware based system and Centralized control system is works was S/W oriented.
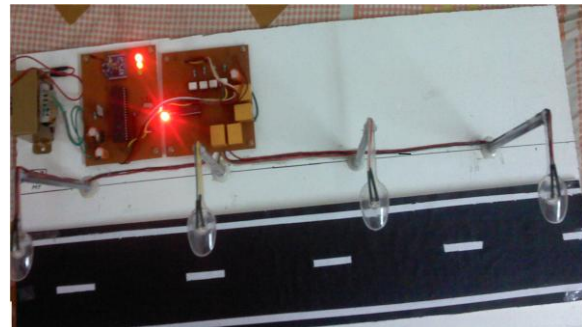Figure 2 shows developed street light terminal at the transmitter side.

Fig.2 streetlight terminal at the transmitter side

As you can see, there is step down transformer for converting 230v ac to 12v ac supply. For ac to dc conversion, we used simply bridge rectifier. After that, you can see also microcontroller 89c51, it simply converts all data parallel to serial form, also there is zigbee module for transmitting and receiving purpose, its operating frequency is 2.4 GHz and operates at 3.3v and its data rate is 250 kbps..Communication between the microcontroller and zigbee module was done with the help of asynchronous serial communication. As you can see, there is 4 streetlight terminal, we can use 4 single pole single throw relay.

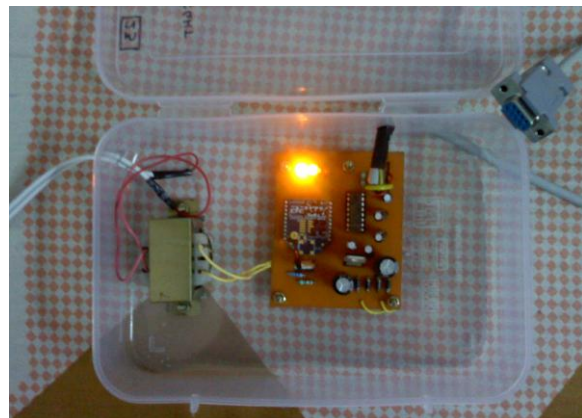Figure 3 shows developed control unit at the receiver side.

Fig.3 control unit at the receiver side

In this receiver side, you can see zigbee module which can be used to receive the data from transmitter side, also there is max 232 which can be used for voltage conversion between the pc and microcontroller 89c51.

IV. WORKING OF NEW STREETLIGHT CONTROL SYSTEM WITH THE HELP OF ZIGBEE

Under this section, we can see how this above developed streetlight system was worked. The receiver control unit has two output terminal one is connect to the computer with the help of rs 232 and another terminal is connect to the power supply. Like this connection, we also connect the transmitter terminal to the power supply. Now all connection are on. We installed the DOTNET software into the computer.

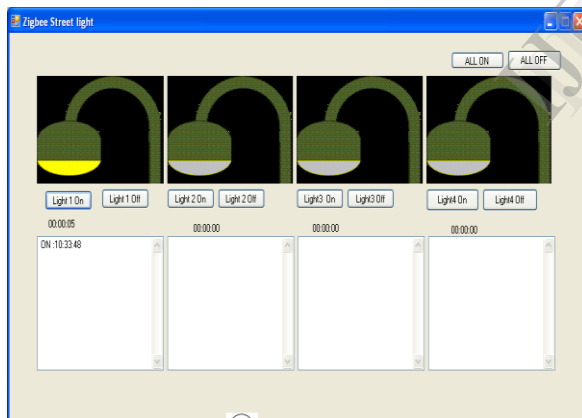Figure 4 shows the graphical representation of streetlight.

Fig.5 Light 1 ON at the streetlight terminal

Similarly when we click on the button light 1 off then the first light at the transmitter model is turned OFF.

When we click on the button ALL ON then GUI shows all lights are ON which can be shown in the following figures 6.

Fig.4 Graphical representation showing status of light 1

Fig.6 Graphical representation showing status of lights.

From this you can see that, when we click on the light 1 on button then the first light at the transmitter model is turned ON which can be shown in the following figure.
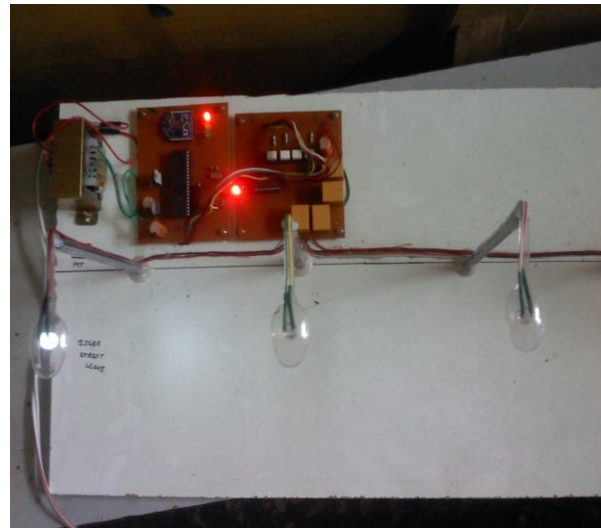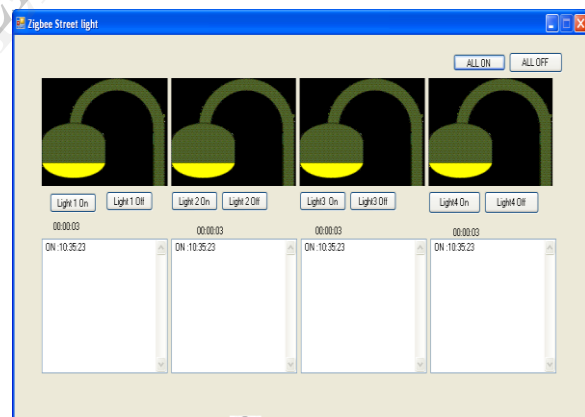
All this are done by giving the command to the computer. We assigned 'a' for light 1 then 'b' for light 2, 'c' for light 3, 'd' for light 4 respectively, for ON condition and 'e' for light 1, 'f' for light 2 then 'g' for light 3,'h' for light 4.

Fig.7 All Lights are ON at the streetlight terminal

This are all alphabets are programmed in microcontroller 89c51,with the help of IC burner. Following figure 5 shows one example of status information displayed in monitor of operators. If light 2 at the streetlight terminal will OFF due to some problem, then by monitoring this graphical display information, operators can easily know lights 2 is OFF, and it is not working well, is out of ordered. By knowing these information operators can send the alphabets 'f' to the computer and it will be ON or if that light is fuse then that operator decides what kind of action they should do. Time taken by this system is very less and it will helps in taking fast decision and it also helps in less power consumption.

V. CONCLUSION

This system provides an efficient wireless streetlight control system with the zigbee technology. This developing streetlight control system can saved detection of faulty lights and maintenance time. We surveyed various street light systems and analyzed its characteristics and requirements, especially for communication characteristics. As results of these, we choose Zigbee communication protocol to transfer data between the streetlight terminal and receiver control unit.

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