<u>30th April 2012. Vol. 38 No.2</u>

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ISSN: 1992-8645

www.jatit.org



GSM BASED RFID APPROACH TO AUTOMATIC STREET LIGHTING SYSTEM

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ABSTRACT

In today's world, power saving is very important and difficult. Though there are many power generation methods, it has become very difficult due to insufficient resources. So, saving of power is the need for our society. This paper discusses about how power can be saved in street lights. The main objective is to control the street lights (dim during dawn and dusk time as well as bright during night time) using Dual Tone Multi Frequency (DTMF). The engineer at Electricity Board (EB) can control the street lights of various areas. If any over load occurs, the connection will be disconnected and the information is transferred through Global System for Mobile communication (GSM) to EB. In case of any detachment of jumper (EB line) then also the information is sent. Also, if there is any complaint by the consumers, they can send the information to EB through Radio Frequency Identification (RFID) Reader, which will be fixed in one of the street light posts and the tag is given to all consumers. The message will be sent to EB server through GSM.

Keywords: GSM, PIC Microcontroller, RFID, DTMF.

1. INTRODUCTION

Now-a-day's electricity problem in India is the major issue. Then and there the wastage of electricity should be avoided. This paper explains how to save the power in the street lights, overload issues as well as power cut off. RFID reader is fixed in the street lights and the tags are given to individual houses from EB. So if any problem occurs in the house, the user has to show his tag to the reader and the information will be intimated to the server (EB) through GSM. The engineer may respond to the issue immediately. GSM is used to transmit the data to the server like load balancing, disconnection of power and complaints. Regarding power in the houses, balancing a load is the major issue in the electricity. To overcome this problem current transformer is used. The function of current transformer is used to send the load details continuously to controller. Already the load values are predefined in the microcontroller are compared with the present value. If the values are more than the predefined values, it will automatically send a message through GSM. If there is a line failure in particular area it will send a message through GSM to the Server. Usually the buck converter is used to dim the street light and the boost converter is used to brighten the light. But DTMF are used for dimming and brightening the street light. With the help of DTMF, particular time will be set to ON/OFF condition and also set the dimming and brightening of the entire street light system. Design of new street light control system does not only achieve power-saving but also extend the life span of lighting equipment. On other hand, if any fault occurs in houses, the user sends information to EB through RFID via GSM.

2. DESIGN PROCESS

With the help of DTMF, the user can set time according to their clarity of light. For example according to the climatic condition the user can set the time for the brightness[1]. According to the predefined time the light will be shut down. DTMF is interfaced with PIC 16F877A. Load is maintained in the street light [2], where master board is mounted on the electrical panel and slave board is mounted in the street lamp. But here the load is maintained for the transformer in the particular street [3]. Current transformer is used to send the load details continuously. The present values are compared with the predefined values and will automatically send a message through GSM and also inform the particular line failure in the © 2005 - 2012 JATIT & LLS. All rights reserved.

ISSN: 1992-8645	www.jatit.org	E-ISSN: 1817-3195

area. The RFID is interfaced with PIC microcontroller and it should be kept in lamp post.

3. SYSTEM ARCHITECTURE

The system comprises of six devices: a PIC16F877A, LCD, Current Transformer, GSM, DTMF, and RFID. The components are interfaced with PIC microcontroller. PIC microcontroller is a RISC based Architecture. It is low cost and is used for real time application. Current transformer is connected to the PIC microcontroller to ADC pin. The predefined value is set in the controller and the current value is compared with it. If the value doesn't match, message is sent through GSM. The DTMF is connected to the transmitter in the PIC microcontroller. Wireless communication is used to transmit the data through personal area network to particular area [4]. Data cannot be sent through wide range in personal area network. To overcome this, GSM is used for wide range of transmission. The LCD is used to display the status set for the street lights, which provide a convenient channel to enable human and machine interconnect. The LCD display indicates the current operating status.

4. SYSTEM BLOCK

The Fig. 1 shows the full block diagram of the automatic street lighting system.



Fig. 1 Block Diagram of the system

4.1 PIC Microcontroller

PIC 16F877A is a 40-pin 8-Bit microcontroller. It is family of Harvard architecture and manufactured by Microchip technology. PIC stands for Peripheral Interface Controller, used by industrial developers due to wide availability space and serial programming for flash memory.

4.2 GSM Module

GSM (Global System for Mobile communication) is a technology for communication and it works based on AT command. GSM offers wide range of services like voice, data and internet access. GSM is a low cost mobile communication used by the user to activate ON/OFF control remotely[5]. The GSM device is fixed in lamp post and if any problem arises, it will send the information to EB.

4.3 Current Transformer

Current transformer is a device used to decrease the current level by stepping up the voltage and keeping the energy as constant. Hence the current transformers are basically step up transformer. The primary winding of the current transformer is connected in series with the line carrying current to be measured and therefore the primary current is depended on the load connected to the system whose current is to be measured. As the secondary voltage of current transformer is higher than the primary voltage, the secondary winding has more number of turns compared to the primary winding. In case of current transformer the secondary current is less than the primary current.

$$\frac{N2}{N1} = \frac{I1}{I2} = \frac{V2}{V1}$$

4.4 LCD and DTMF

LCD is used for displaying the load value, and DTMF (Dual Tone Multi Frequency) is used for dimming and brightening of the street light. With the help of DTMF, a particular time will be set to on and off the entire street light system.

4.5 **RFID**

Radio Frequency Identification Device is a technology which works on the principles of radio waves. If there is any complaint in any of the

Journal of Theoretical and Applied Information Technology

30th April 2012. Vol. 38 No.2

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ISSN: 1992-8645	www.jatit.org	E-ISSN: 1817-3195

houses, the user needs to send the information through RFID reader [5], which will be fixed in the street lamp and tag which will be send to individual houses.

5. FLOW DIAGRAM FOR LOAD BALANCING



Fig.2 shows flow chart of the system

The fig.2 flow diagram has given the clear picture about the load balancing of the circuit. The transformer sends the load voltage continuously to the controller. The controller verifies the threshold value with the incoming value from the transformer. If it exceeds, information will be sent to the server through GSM.

6. RESULTS AND EXPERIMENTS

Fig. 3 shows overall setup of system prototype. In case of any overload, the GSM kept on street light post intimates the server about the overload condition. If there are any complaints from houses, the user can send the information to EB through RFID.



Fig.3 Circuit design

The fig.4 shows dimming of the light. At Every dawn and dusk it will automatically glow by using DTMF technology.



Fig. 4 Dimming of the light

The fig.5 shows brightening of the light. On every night, it will glow by using DTMF technology.

ISSN: 1992-8645

<u>www.jatit.org</u>

E-ISSN: 1817-3195



Fig.5 Brightening of the light

When the reader read the data from tag, it will send a message to server (EB) through GSM. Fig.6 shows message sent to server. The engineer at EB may respond to the issues immediately.



Fig.6 Message sent to server

If any fault occurs in house the message transfer to server by using GSM. The fig.7 shows the receiving message from server.



Fig.7 Receiving message from server

7. CONCLUSION

This system proposes a new way of reduced power consumption. With this system, recovering from power failure period can be reduced. Street light maintenance, load maintenance and if there is any complaints regarding power it can be intimated through GSM. In future the Electricity department can adopt this system in order to save power as well as time. This system can be extended in such a way that time taken for processing any new power connection request can be minimized by using RFID.

ACKNOWLEDGEMENT

Authors wish to acknowledge Dr.P.Swaminathan Dean, School of computing SASTRA UNIVERSITY for his suggestion and support.

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