Design and implementation of street light control using FM technology

E.V.Santhi

(Asst. Professor, Department of ECE,
Narasaraopeta Engineering College, Guntur)

***Abstract*—** *Street lighting is an indispensable part of a city's infrastructure, the main function of which is to illuminate the city's streets during the dark hours of the day. It is important for the public and city governance to guarantee switching ON/OFF the street lights. The main consideration for computing this system is to achieve optimum utilization and reduce wastage of power. The objective of this project is to provide a reliable system for controlling a large number of street lights from a central location through FM broadcast with highest reliability. The system developed is aimed at introducing more systematic and rational thinking in a way which is both technically feasible and economical. The project involves two stages namely Communication technology and Power switching arrangement. This project includes transmission of coded DTMF signals to the FM transmitter through wireless technology by using echo coupler for controlling street lights. Any of existing FM stations can be used for transmitting the coded DTMF signal.*

Keyword - *DTMF, Echo coupler, FM, Micro controller, Relays.*

1. INTRODUCTION

The main benefits of street light control and management is Energy savings combined with reduced maintenance costs.Energy saving is equivalent to the production of energy. Modern technology has also been utilized in realizing this project. Any loss of power by street light shall have a significant effect on load management, since lighting accounts for around 20% of the world's total electricity consumption.

The energy loss in distribution system especially in street lights in Indiais of great concern. But it is very often seen that most of the lamppost lights remains switched-on during day time also. It is one of the major sources of power loss for the country. Hence the main objective of this work is aimed to design and implement a reliable system for street light control to avoid huge power loss.

In the beginning, street lighting was switched on at dusk and switched off at dawn by manual operation, and then the smart controller was used to switch street lighting on and off automatically through pre-set timers at sunrise/sunset times or based on the ambient light intensity in controller surroundings at each power substation.

Although the smart controller can automatically turn ON/OFF the streetlight, there are several cases of street lighting on during daytime hours and off during night time hours. Such things often occur because of the wrong settings of the smart controller or due to the accumulation of the light sensor, any one or both may be the cause. In order to find out failure streetlight and reduce power consumption, the maintenance of the operator needs to patrol street by street at night and day. This increases the maintenance and management cost. Due to all of these reasons and streetlight control diversification, by smart controller also can't meet with the specific requirements. This project is designed to meet those specific requirements.

2. OVERVIEW OF THE PROJECT

The project is developed in response to a need for centralized remote control of street lights switching at desired time. City street lights are frequently energized in groups of up to 50 on 230 volt AC, 50 Hz power lines. For manual control of street light in any one location needs at least one employee. The salary and other perks depend of the geographic location and skill of the employee. The proposed system not only saves the employee cost but also results in terms of great energy saving. Hence this system is technically reliable and economically beneficial. This design is simple, easy to maintain, low cost, fast acting and highly reliable. It is obvious that huge energy wastage may be reduced using this system.

The project involves mainly two stages

(i) Communication technology
(ii) Power switching technology

(i) Communication technology

It involves encoded DTMF signals, these signals are coupled to the FM transmitter by using echo coupler. The FM transmitter transmits the encoded DTMF signals; the FM receivers receive them within the range of the transmitter. It also involves a micro controller, DTMF decoder and a LCD display. The DTMF decoder is used to decode the received encoded DTMF signals.

The microcontroller is used for programming the code to display the decoded

signals on the LCD screen and also to give a set - reset logic to turn ON/OFF the power switching device.

(ii) Power switching Technology

It involves a Hex buffer inverter, relay driver and SPDT 12V-30Amps relay. The relay driver amplifies the weak output current from the microcontroller and gives logic high when the output of the microcontroller is low. The relay switches ON the street lights and when high switches OFF.

3. DESIGN OF THE PROJECT

The project comprises of mainly of two modules. One is the Transmitter module and the second, the Receiver module. The transmitter is placed at the central power station which consists of the components viz. Keypad, DTMF Encoder, Op-Amp, Speaker and FM Transmitter for transmitting coded DTMF signal. These encoded DTMF signals are amplified by using Op-Amp and then send to the speaker. These amplified DTMF signals are coupled trough speaker to the FM transmitter by using echo coupler. The FM transmitter transmits the encoded DTMF signals; the FM receivers receive them within the range of the transmitter.Block diagram of the Transmitter module is shown Fig: 1.

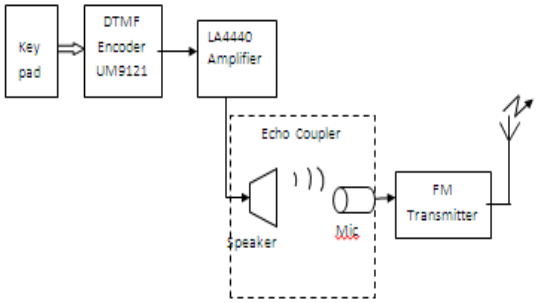

Fig1: Block diagram of transmitter module

The Receiver section consists of FM Receiver, micro controller, DTMF decoder, Relay Driver and a LCD display. The DTMF decoder is used to decode the received encoded DTMF signals. The microcontroller is used for programming the code to display the decoded signals on the LCD screen and also to give a set - reset logic to turn ON/OFF the power switching device. The relay driver amplifies the weak output current from the microcontroller and gives logic high when the output of the microcontroller is low, the relay switches ON the street lights and when it is high switches OFF the street lights.Block diagram of the Receiver module is shown Fig2.

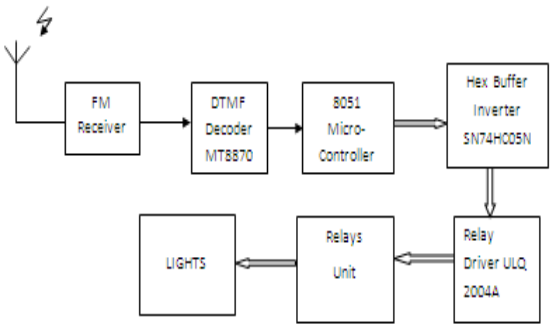

Fig2: Block diagram of receiver module

4. HARDWARE IMPLEMENTATION AND RESULT

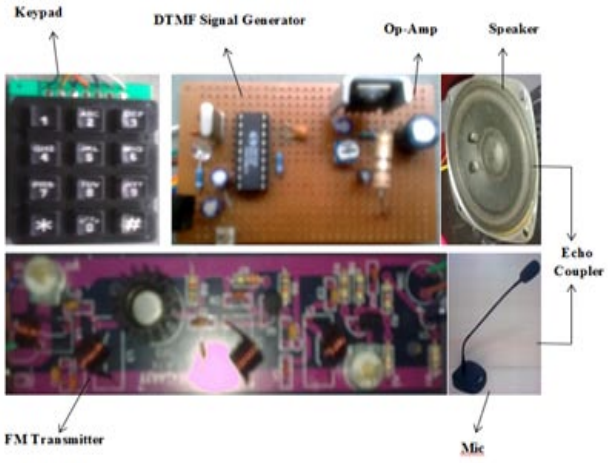

Fig 3: Transmitter module using echo coupling

This project employs DTMF techniques to switch on/off the streetlights. The controller uses telephone type keypad with 12 press-to-on switches. These switches are arranged in four rows and three columns using seven lines that are terminated at corresponding inputs of DTMF encoder. This DTMF encoder generates 12 distinct dual-tone signals corresponding to the switch pressed. These encoded DTMF signals are amplified by using Op-Amp and then send to the speaker. These amplified DTMF signals arecoupled through speaker to the FM transmitter by using echo coupler. The echo coupler is between DTMF encoder and FM transmitter can be designed in order to install our system at existing FM station's transmitter.The FM transmitter transmits the encoded DTMF signals; the FM receivers receive them within the range of the transmitter. The hardware design of Transmitter module using echo coupler is shown Fig 3.

Hardware design of receiver module is shown in fig 4.The FM receiver unit decodes the received DTMF signal with the help of DTMF decoder and provides the binary output according to the switch pressed in the handheld unit. The binary output (Q1Q2Q3Q4) of the DTMF decoder is connected as the input to the microcontroller. The outputs Q1Q2Q3Q4 are processed by microcontroller and sent to the relay. The microcontroller is used for programming the code to display the decoded signals on the LCD screen and also to give a set - reset logic to turn ON/OFF the power switching device. The relay driveramplifies the weak output current from the microcontroller and gives logic high when the output of the microcontroller is low. The relay switches ON the street lights and when high switches OFF.

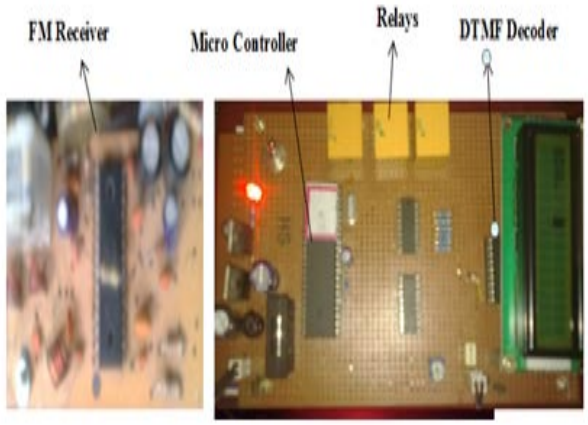

Fig4: Receiver module with controlling lights

Individual code is providedfor each relay to switch ON/OFF the bulbs. For example in the Fig 5 shows the tested output at the end of the receiver section when a code is pressed in the telephone key pad at transmitting section. The code received matches with ON password and the lamps are turned ON as the relay2 switches ON.

Fig5: result of project

5. CONCLUSION

This paper presents a method to control street lights using the DTMF tone generated by transmitting telephone instrument when the user pushes the keypad buttons of the phone. This DTMF signal is coupled to the FM Transmitter by using echo coupler. This control method uses commercial radio communication networks as the path of data transmission. By using DTMF, echo coupler and FM technology we can switch on/off street lights in desired time without wastageof power.The project represents an approach to the problem of efficiently and optimally operating scarce resources in the provision of public services namely street lighting.The system developed is aimed at introducing more systematic and rational thinking in a way which is both technically and economically feasible.

6. REFERENCES

[1] Jing Chunguo,Wang Yan "Design of street light pole controller based on WSN" *The Tenth International Conference on Electronic Measurement & Instruments,2001*
[2] Tuljappa M Ladwa*, Sanjay M Ladwa "Control of remote domestic system using DTMF" *ICICI-BME 2009*
[3] Yun Chan Cho and Jae Wook Jeon, "Remote Robot control System based on DTMF of Mobile Phone" *IEEE International Conference INDIN 2008, July 2008.*
[4] M. A. Wazed, N. Nafis, M. T. Islam "Design and fabrication of Automatic Street light control system" ISSN, 2010
[5] Wang Guijuan, Wang Zuoxun, Zhang Yingchun, "New intelligent control terminal of solar street lights" 2011 Fourth International Conference on Intelligent Computation Technology and Automation
[6] R. Sharma, K. Kumar, and S. Viq, "DTMF BasedRemote Control System," *IEEE International Conference ICIT 2006, pp. 2380-2383, December 2006.*
[7] DTMF Based Programmable FM Remote laser cutting machine with 89C51
[8] Yun Chan Cho and Jae Wook Jeon, "Remote Robot control System based on DTMF of Mobile Phone" *IEEE International Conference INDIN 2008, July 2008.*
[9] M J. Callahan, Jr., "Integrated DTMF receiver,"
ZEEE J. Solzd-State Czrcuzts, vol. Sc-14, pp. 85-90, Feb. 1979.
[10] M. Callahan Jr, "Integrated DTMF Receiver," *IEEE Transactions on communications, vol. 27, pp. 343-348, Febrary 1979.*
[11] R. Sharma, K. Kumar, and S. Viq, "DTMF Based Remote Control System," *IEEE International Conference ICIT 2006, pp. 2380-2383, December 2006.*
[12] Oppenheim, Alan V. and Schafer, Ronald W. Digital Signal Processing. Prentice-Hall of India, 1989.
[13]Suvad Selman, RaveendranParamesran, "Comparative Analysis of Methods Used in the Design of DTMF Tone Detectors" IEEE International Conference on Telecommunications and Malaysia International Conference on Communications, 14-17 May 2007, Penang, Malaysia.
[14] Chaitanya Amin ,AshutoshNerkar , ParidhiHolani , Rahul Kaul. "GSM Based Autonomous Street Illumination System for Efficient Power Management". International Journal of Engineering Trends and Technology (IJETT).V4(1):54-60 Jan 2013. ISSN:2231-5381.
[15] K.Y.Rajput, G. Khatav. M. Pujari. P. Yadav "Intelligent Street Lighting Sytem using GSM," International Journal of Enginnering Science Invention, vol. 2, no. 3, pp. 60-69, March 2013.