A Dexterous Approach to Monitor Street Light Systems using LDR and GSM Technologies

Rajkumar. S[1], Ramvignesh. P[2], Logeshwari. V[3], Ranjith. G.R[4]

[1]Assistant Professor, Department of CSE, K. S. Rangasamy College of Technology, Tiruchengode, Tamil Nadu, India
[2, 3, 4] Student, Department of CSE, K. S. Rangasamy College of Technology, Tiruchengode, Tamil Nadu, India

Abstract*—The upkeep of street lights is one of the major problems for any electricity board. On the other hand it also has the problem to save the powers which are consumed by the street lights. To maintain and control the street light is more complex and uneconomical. At present there are various street light controlling systems. But all of them have their own discrepancies. The proposal aims at designing a system with the help of the advanced development in embedded systems for reducing the wastage of electricity happening via street lights. The proposal thereby offers a way to save electricity. It is hence keen in eliminating the inconsistencies of the present system. The key idea of the proposal travels around the automation of switching control in the street light system. To create such advancement in the street lighting control system and street lighting maintenance system, few technologies related to wireless communication and optical sensing has become the key requirements. The proposal is about an entirely new mechanism that is to maintain the street light with automated switching control by using a simple circuit composing of an LDR and a microcontroller which completely eliminates the manual operation involved in the current traditional lighting system. Also, GSM technology is incorporated to facilitate with a fault detection mechanism which becomes a complement for the system.*

Keywords—Circuit breakage detection, GSM, LDR, Microcontroller, Street lamps.

I. INTRODUCTION

Electricity has become a very mandatory need in everyone's life. Almost everything needs electricity to make a human's life comfortable. Cookers have become electrical. Bikes have become electrical. And more of our daily use articles have become electrical. Electricity therefore has become one of the most necessary things for our current life style. So, it is very much essential to save electricity in all possible means. And to start off, it is very vital to keep track of all the ways through which electricity is wasted. The resource is wasted in many ways. One of such ways that is often exposed to human conscience is the glowing of street lights even after the commencement of the day lights. In recent times, human has become too busy, and is unable to find time even to switch the lights off wherever not necessary. The present system is like, the street lights will be switched on in the evening before the sun sets and they are switched off the next day morning after there is sufficient light on the roads. The paper proposes a system that overcomes all these issues. The heart part of the system design includes microcontrollers, LDRs (Light Dependent Resistors) and street lamps.

A variety of sensors are needed for the implementation of the system that provides automation in the switching control system of street lights. LDR (Light Dependent Resistor) is the one chief variety of sensors that is to made use of in the system proposed. Other key elements of the circuit design include a microcontroller and voltage sensing circuit. The rest of the circuit design includes all the street lights, a GSM (Global System for Mobile Communication) circuit and other connector circuits involved in the middle of all the chief circuits.

A. LDR (LIGHT DEPENDENT RESISTOR).

The theoretical concept of the light sensor lies behind its varying resistance according to the amount of light falling on its surface. When the LDR detects light its resistance will get decreased. If it detects darkness, its resistance will get increased.

B. MICROCONTROLLER

A microcontroller is a computer control system on a single chip. It has many electronic circuits built into it, which can decode written instructions and convert them to electrical signals. The microcontroller will then step through these instructions and execute them one by one. For example, a microcontroller can be used as controller to the switching of street lights by giving it the exact procedures.

Microcontrollers are changing the electronic designs highly. Instead of hard wiring a number of logic gates together to perform some function, microcontrollers can be instructed to wire the gates electronically. The list of these instructions

given to the microcontroller is called a program. The process of feeding in the written program to the microcontroller is called as burning. A special hardware kit called burning kit is used for that purpose.

There are a variety of microcontrollers existing. Each microcontroller variety has its own design of burning kit. The instructions can be burnt into the microcontroller only with the help of its compatible burning kit.

C. VOLTAGE SENSING CIRCUIT

The voltage sensing circuit helps in fault detection. It keeps track of the voltage in the system. Once the voltage is found to be infinite, a fault notification is generated. With the help of the fault notification, the failed sub-circuit can be identified easily.

D. GSM

If one is in Europe or Asia and using a mobile phone, then most probably he is using GSM technology in your mobile phone. GSM stands for **G**lobal **S**ystem for **M**obile Communication. It is a digital cellular technology used for transmitting mobile voice and data services. The concept of GSM emerged from a cell-based mobile radio system at Bell Laboratories in the early 1970s. GSM is the name of a standardization group established in 1982 to create a common European mobile telephone standard. GSM is the most widely accepted standard in telecommunications and it is implemented globally. GSM is a circuit-switched system that divides each 200 kHz channel into eight 25 kHz time-slots. GSM operates on the mobile communication bands 900 MHz and 1800 MHz in most parts of the world. In the US, GSM operates in the bands 850 MHz and 1900 MHz. GSM owns a market share of more than 70 percent of the world's digital cellular subscribers. GSM makes use of narrowband Time Division Multiple Access (TDMA) technique for transmitting signals. GSM was developed using digital technology. It has an ability to carry 64 kbps to 120 Mbps of data rates. Presently GSM supports more than one billion mobile subscribers in more than 210 countries throughout the world. GSM provides basic to advanced voice and data services including roaming service. Roaming is the ability to use your GSM phone number in another GSM network. GSM digitizes and compresses data, then sends it down through a channel with two other streams of user data, each in its own timeslot.

II. EXISTING SYSTEM

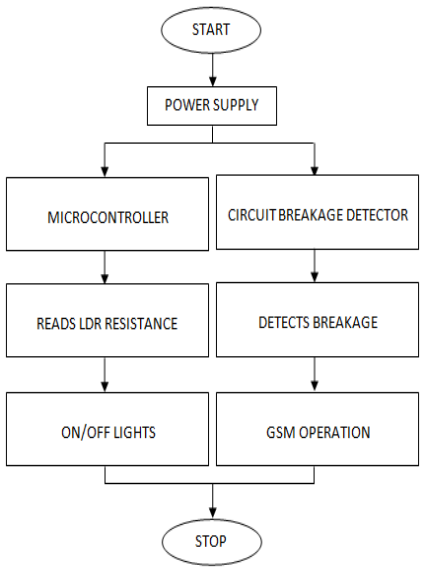
Many existing systems primarily focus in saving electricity wasted via street lights by automating the switching control of the street light system. The automation is usually done with the help of light dependant resistors and microcontrollers. Mustafa Saad's "Automatic Street Light Control Using Microcontroller" is one example for such existing systems.

Mustafa Saad et al. (2013) proposed the idea entitled as "Automatic Street Light Control Using Microcontroller". The paper is focused on advanced development in embedded systems for energy saving of street lights. The present system is like, the street lights will be switched on in the evening before the sun sets and they are switched off the next day morning after there is sufficient light on the roads.

The paper gives the best solution for electrical power wastage. Also the manual operation of the lighting system is completely eliminated. As in the paper, the system uses two sensors which are Light Dependent Resistor LDR sensor to indicate a day/night time and the photoelectric sensors to detect the movement on the street. The microcontroller PIC16F877A is used as the brain to control the street light system, where the programming language used for developing the software to the microcontroller is C-language. Finally, the system has been successfully designed and implemented as prototype system.

III. PROPOSED SYSTEM

The proposed system is constructed with two sub circuits. One being the switching automation circuit and the other one is the fault monitoring circuit. These two sub circuits are ultimately connected to the power supply line provisioned by the electricity board. The power supply line acts as the work initiator of the system which there by starts all the controls of the whole street light system. The design and working of the proposed system can be understood from the following flow diagram which outlines the significant circuit blocks of the system.



The switching circuit has an LDR and a microcontroller in it. The LDR has a change in its resistance whenever the day light falling on it changes. When the LDR gets to a resistance corresponding to the ON resistance mentioned in the microcontroller coding, it helps in switching on the street light. Similarly, it switches off the street light when the LDR gets to a resistance corresponding to the OFF resistance. The switching circuit is attached to each and every street light included in the system. The fault monitoring circuit is further divided into two sub circuits – the fault detection circuit and the fault notification circuit. The fault monitoring system is absolutely contrast to the switching circuit. It is a centralized fault monitoring system. Making it centralized reduces much of the hardware usage, power and cost. The fault detection circuit is nothing but a voltage sensing circuit.

Whenever a light fails, the corresponding light's circuit means to be failed. There will be no current flowing through that circuit. If that happens, the voltage level will be infinite. The voltage sensing circuit will thereby detect the failure. Once the failure is detected, the secondary fault monitoring circuit is triggered.

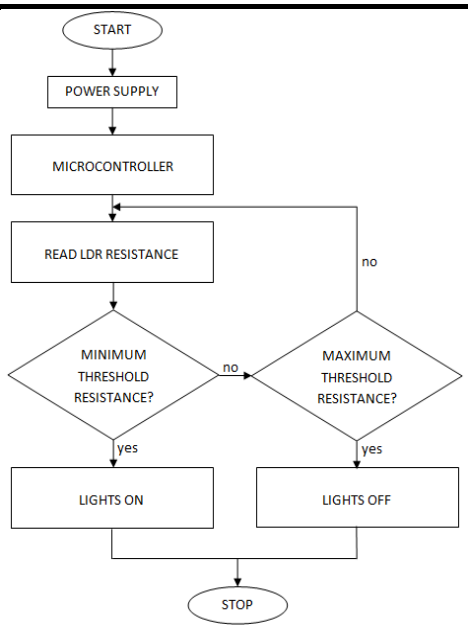
The fault notification circuit is a GSM circuit. The circuit sends a notification to the central control board as soon as a failure occurs there. The GSM switches off itself when it gets an acknowledgement for the failure notification which it sent. It helps to reduce the energy that may be wasted if the GSM is kept ON with no restrictions in time. Thus the system effectively provides a way to automate the switching of street light system and to detect system faults instantly.

IV. MODULE DESCRIPTION

The system is an integration of the following three modules:

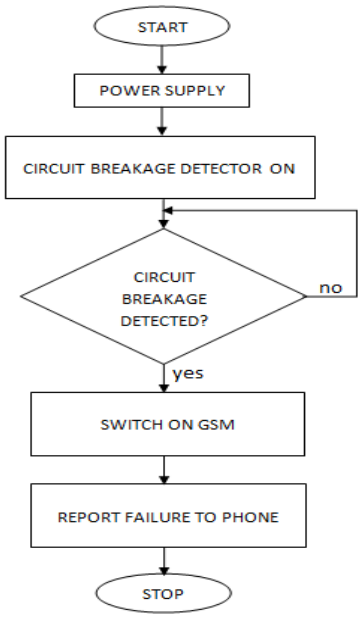
A. Power Supply Module
B. Circuit Breakage Detection
C. GSM Module

A. POWER SUPPLY MODULE: The following is the flow diagram that helps to understand the power supply module easily.



The module is all about the design and working involved in the switching automation circuit. The circuit of the module includes all the street lamps and corresponding light dependent resistors, a microcontroller and the power supply unit. The microcontroller has a program burnt onto it. The program has the minimum threshold resistance and the maximum threshold resistance for the LDRs. These values act as the deciders for switching on and off the street lamps. The microcontroller keeps on reading the dynamic values of the LDR resistances which changes with respect to the day light that falls over them. If the LDR resistance is found to be below par i.e., if the LDR resistance drops down to the minimum threshold resistance or below that, the power supply is allowed to proceed to the street lamps there by the street lamps get switched on. If the LDR resister is found to be above par i.e., if the LDR resistance mounts up to the maximum threshold resistance or above that, the power supply is restricted to the street lamps there by the street lamps get switched off. If both of these are not the case, the system keeps on reading the LDR resistance and waits for it to fall beyond or beneath the threshold resistance values. This completes the working of the switching automation circuit.

B. CIRCUIT BREAKAGE DETECTION: The following flow diagram shows the working of the circuit breakage detection and GSM module. Since both the ideas come under a single circuit the flow graph has become a combined one for the two modules.



The module is about the design and working involved in the first sub circuit of the fault monitoring circuit. The first sub circuit of the fault monitoring circuit is the fault detection circuit. It is nothing but the voltage sensing circuit. It comprises of the street lamps and the circuit that helps in detecting the occurrences of faults in the system. Those circuits can either include short circuit breakers whose basic function is to detect the condition that interrupts continuity in the electrical flow.

Once the power supply is allowed to flow through the fault detecting circuit starts its fault detection work. It keeps on checking for street light failures. As and when a circuit breakage is detected, the GSM circuit is switched on which forms the second sub circuit of the fault monitoring circuit. The rest of the work is carried on by the GSM module there on.

C. GSM MODULE: The module is the GSM module. The module includes the design and working of the second sub circuit of the fault monitoring system. The second sub circuit of the fault monitoring system is the fault notification circuit. It is switched on by the fault detection circuit on the advent of any street light failure. The GSM circuit is preprogrammed to send messages to a predetermined mobile number. The message structure is also predefined which will include the numerical identity of the failed street light along with a textual note that conveys the street light failure. Once the message is sent successfully, the GSM circuit switches itself off. This is done to ensure that not much electricity is wasted as leakage when the GSM is not sending any messages. This completes the entire working of the proposed system.

V. CONCLUSION

The proposed system is a power saving mechanism for street lights. It is a low cost, remote controlling and monitoring system of the street-lights. It turns out to be a reliable and time efficient way to switch ON/OFF street-lights. It provides an effective measure to save energy by preventing unnecessary wastage of electricity, caused due to manual switching of street lights when it is not required. With the help of an LDR, particular day light range will be set as ON/OFF condition of the entire street light system. The implementation of the fault detection mechanism adds on to the benefits of the system. The fault detection feature can specifically become handy in highways lighting system where monitoring of faults in lights is a tedious process. Thus, the proposed paper can be a forerunner for several other new lighting designs like garden lighting, highways lighting and more.

REFERENCES

[1] Archana M and Mahalahkshmi R, (2014), “E – Street: LED Powered IntelligentStreet Lighting System with Automatic Brightness Adjustment Based on ClimaticConditions and Vehicle Movements”, International Journal of Advanced Researching Electronics and Instrumentation Engineering, Vol. 3, pp. 61-67.

[2] Archana G, Aishwarya N, Anitha J and Vijay Kumar, (2015), “Intelligent StreetLight System”, International Journal of Recent Advances in Engineering andTechnology, Vol. 3, pp. 16-18.

[3] Nagaraju N and Kiruthika M S, (2013), “Fault Sensing in a Remote Transformer Using GSM & Automatic ON/OFF of Street Lamps”, International Journal ofAdvanced Research in Electronics and Instrumentation Engineering, Vol. 2, pp.4623-4626.

[4] Abdul Latif Saleem, Raja Sagar R, Sachin Datta N S and Sachin H S, (2015),“Street Light Monitoring and Control System”, International Journal ofEngineering and Techniques, Vol. 1, pp. 68-71.

[5] Chaitanya Amin, Ashutosh Nerkar, Paridhi Holani and Rahul Kaul, (2013),“GSM Based Autonomous Street Illumination System for Efficient PowerManagement”, International Journal of Engineering Trends and Technology,Vol. 4, pp. 54-60.

[6] Gargeyee Khatav, Monica Pujari and Priyanka Yadav, (2013), “Intelligent StreetLighting System Using GSM”, International Journal of Engineering ScienceInvention, Vol. 2, pp. 60-69.

[7] [07] Mustafa Saad, Abdalhalim Farij, Ahamed Salah and Abdalroof Abdaljalil,(2013), "Automatic Street Light Control Using Microcontroller", MathematicalMethods and Optimization Techniques in Engineering, pp. 92-96.

[8] Sakshee Srivastava, (2013), "Automatic Street Lights", Advance in Electronicand Electric Engineering, Vol. 3, pp. 539-542.

[9] Valerio R M Lo Versoa, Valentina Serraa, Luigi Giovanninib and SimoneIennarellab, (2014), "Light Versus Energy Performance of Office Rooms withCurtain Walls: A Parametric Study", Energy Procediaon Sustainability inEnergy and Buildings, pp. 462-471.

[10] R Rubananth and T Kavitha, (2012), "GSM Based RFID Approach to AutomaticStreet Lighting System", Journal of Theoretical and Applied InformationTechnology, Vol. 38, pp. 202-205.

[11] K Santha Sheela and S Padmadevi, (2014), "Survey on Street Lighting SystemBased on Vehicle Movements", IJIRS Engineering and Technology, Vol. 3,9220-9225.

[12] Umesh G Phonde and Uttam L Bombale, (2014), "Intelligent Automatic StreetLighting System with Advance Control through GSM Modem", International Journal of Advanced Research in Science and Engineering, Vol. 3, pp. 165-170.

[13] Swathi C A, Hemanth Kumar S and Annappa A R, (2014), "Smart StreetLighting System Based on Sensors using PLC and SCADA", InternationalJournal of Mechanical Engineering and Technology, Vol. 5, pp. 44-50.

[14] Srikanth M and Sudhakar K N, (2014), "ZigBee Based Remote ControlAutomatic Street Light System", International Journal of Software Engineering and Computing, June Issue, pp. 639-643.

[15] V Vellingiri, M Thirumarimurugan and T Kannadasan, (2013), "Wireless Based Closed Loop Automation of Street Light Conrol Using PIR",International Journal of Advanced Research in Computer Engineering and Technology, Vol. 2, pp. 3071-3074.

[16] Samir A Elsagheer Mohamed, (2013), "Smart Street Lighting Control and Monitoring System for Electrical Power Saving by Using VANET", International Journal of Computer Network And Security, Vol. 6, pp. 351-360.

[17] Kuldeep Singh Chauhan, Ayushi Tomar, Dheeraj Kumar and Gaurav Kumar, (2014), "Electricity Generation Using Power Hump with Automatic Street Light Control", International Journal of Engineering and Technical Research, Special Issue, pp. 228-231.

[18] D V Pushpa Latha, K R Sudha and Swati Devabhaktuni, (2014), "PLC BasedSmart Street Lighting Control", International Journal of Intelligent Systems andApplications, Vol. 2, pp. 64-72.

[19] Solanke Digamber, Jogdand Maruti, Jadhav Amol and Mandlik Sachin, (2015), "Intelligent Traffic Light and Automatic Street Lighting System According toTraffic Density", International Journal of Research in Engineering and Advanced Technology, Vol. 3, pp. 18-21.

[20] S Sugapriya and A Natarajan, (2014), "Intelligent Wireless Street LightingSystem", International Journal of Innovative Research in Computer and Communication Engineering, Vol. 2, 3681-3684.