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Power Saving In Street Lighting System Based On Motion Detection

[1] A.N.Bharath, [2] M.MariMuthu
[1] (M.Tech), P.G.Student.,E.S.,, Siddharth Institute of Engineering & Technology, A.P, India
[2] M.E., Assistant professor Siddharth Institute of Engineering & Technology, A.P, India

***Abstract:* -- In this paper the power saving in street lighting system has been implemented based on motion detection. It helps to reduce the redundant power utilization appropriate to more illumination in natural light. By using RTC (Real-Time-Clock) it generates the timer automatically as given as based on timing conditions. With the help of PIR sensor the presence of a human being or any obstacle detected by using the presence detector, then the street lights will be switch "ON" mode. When a person on any obstacle comes in the detection range else it will be automatically "dimmer mode". The designed system keeps away from the person intrusion in power board. At last, it displays the exact demand for payment information on LCD and data can be received by authorized person with the help of GSM module. The entire procedure can be controlled and maintained by ARM 7 (LPC2148) microcontroller.**

***Keywords*— RTC (Real-Time-Clock), PIR Sensor, LCD, Relay, GSM**

I. INTRODUCTION

Streetlights are an essential part of any developing area. They are present on all major roadways and in the outer reaches also. Every day, streetlights are powered from evening to first light at full strength, even when there is no one around. On a global scale, millions of dollars are spent each day on these street lights to provide the required electrical energy. This system is commonly used in all streets of street light system. But in this method, there is a loss of heavy electricity in the whole night. If the street light is not stopped after the night, the loss will continue throughout the day. And also the street light illumination is not necessary when there are no human movements in the street. So to come out of these disadvantages this project allows the significant cost savings and a better value for the atmosphere. So, the ecological issues have been gained common international consideration, resulting in the development of energy-efficient technologies intended at reducing energy consumption. One part of the situation is an increasing demand for the reduction of the total of electricity used for illumination. In the particular energy maintenance, for large scale lighting tasks such as street lighting is an achievement for huge value. The street light system is one of the largest energy payments for a metropolitan's financial accounts for exceeding up to 35-45% of a town's benefit budget .The power saving illumination manage system can cut urban street lighting costs so far as 70%. This lighting system is a system that adjusts light intensity based on usage of the traffic as it illuminates a definite amount of street lights in front and less following, based on movement of vehicles.

II. RELATED WORK

The core intention is to design the power saving in street lighting system based on motion detection. The most use of new technologies for the sources of light is presented. In this area, the PIR sensor is used to find the human being movements and vehicle activities or gesture between any objects in the street. When the presence is senses, all nearby street lights shine at their bright form, else they continue on the dim type. Incandescent bulb is the resource electric light works by radiant (general term for heat driven light emission). It has the least effectiveness or the uppermost power consumption among the lights. So, this control can be executed throughout a GSM system. To collect the correct information interrelated to the management and maintenance of the system. Finally it transmits the information by way of SMS through the GSM set-up. It is used to check the street light position and to manage the street lights in emergency state. By using ARM7 (LPC2148) microcontroller to communicate with all the peripherals are there in the development.

2.3. Proposed System

In the proposed system, we introduced five new things are there. They are:

1. RTC (Real-Time-Clock).
2. PIR Sensor 1&2.

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3. Relay (ULN2803).
4. Incandescent Bulbs.
5. ARM7 (LPC2148).

In the figure1 shows that, block diagram of the proposed method. ARM 7 (LPC2148) using here, which is an advanced RISC machine. It is a 32 bit controller which follows Von Neumann architecture. As turn on the power supplies the experimental process will take place in evening 7PM to next morning 7AM how means based on RTC timing conditions have been given. It is able of altering its luminance level throughout day and night-time. By implementing PIR sensor, the presence of a human being or any obstacle is detected by using presence detector sensors at that time street lights can be switch "ON" only when a person or an obstacle comes in the respect range, as well the light will be "Dimming" manner. Instead of LED bulbs, incandescent bulbs can be apply here because of more effectiveness and it can be easily identified the light dim mode and bright mode. With the help of Relay Driver (ULN2803), four relays are using here. Because to control the power supply for light brightness and dimming mode. For light brightness mode the voltage can obtain in 220V and for dimming mode the voltage can obtain in 110V. Finally, it shows the related demand for payment information on LCD displaying unit and data can be send in the form of SMS way through the GSM Module. The ARM7 (LPC 2148) based hardware system consists of a processor core board and the peripheral board. The entire programming for microcontroller operation is based on Embedded C Language in Keil software. If this ultra power saving for street lights are designed and installed in the cities, subsequently, bunch of power can be saved and this will also reduce the rate of maintenance in excess of fixed wired systems.

2.4. Block Diagram

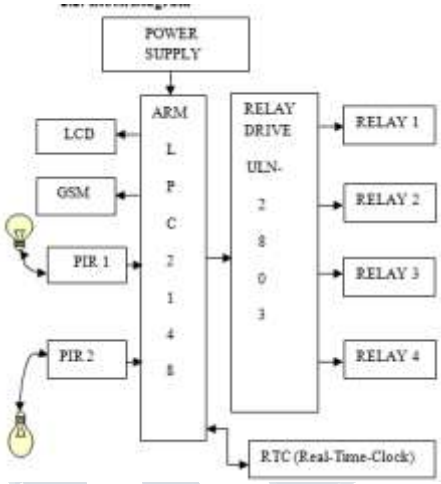

Fig1: Block diagram of the proposed system

1.1. Flow Chart

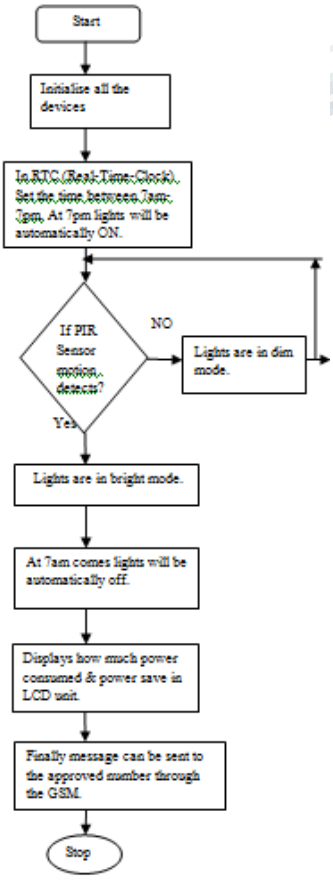

Fig 2: Flow chart of the proposed system.

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In the figure 2 represents that flow chart of the proposed system. Initially we have to start all the devices. In RTC (Real-Time-Clock) we have to set the time between 7pm-7am. If PIR motion sensor detects any human being or any obstruction means then the lights position will be in in dim mode. When the7am comes lights will be automatically going to be in off manner. Then, it displays how much power consumed & power save could be shows in LCD unit. Finally, this billing information can be received by the authorized person in the form of SMS manner. Later we have to stop the procedure.

III. APPLICATIONS

1) Cities or any remote areas also.
2) Hospitals.
3) Educational Institutions.
4) Industries and e.t.c.,

IV. ADVANTAGES

1) RTC (Real Time Clock) can work based on given timing conditions.
2) The range of PIR sensor is very high.
3) It can detect up to 6mts.
4) Billing rates will be reduced.
5) Manual work can be reduced.

V. EXPERIMENTAL RESULTS

When the power supply is connected to the supply unit. Port connections are given to the Port P0.11 is connected to PIR1 and P0.12 is connected to PIR2 sensor. The port P1.16 is for RS and P1.17 is for RW and P1.18 is for EN pins. These 3 are control lines. P1.24 to P1.31 is connected to LCD for data lines connections (D0-D7). GSM is connected to UART0. Relay connections are P1.21 for relay1 and P1.22 for relay 2 and P1.23 for relay 3 and P1.24 is for relay 4. These port connections are given as below in fig.3 schematic diagram. The experimental results are as shown as below. Here we have taken two conditions namely

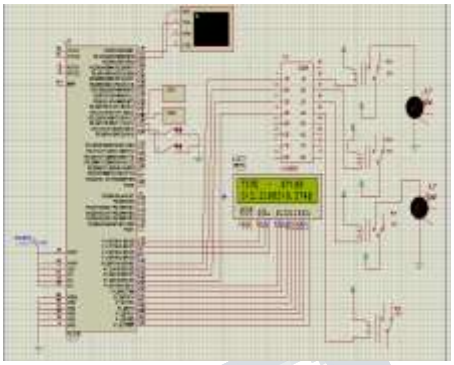

Fig 3: Schematic Diagram.

Condition 1: Both the street lights are in dimming mode.

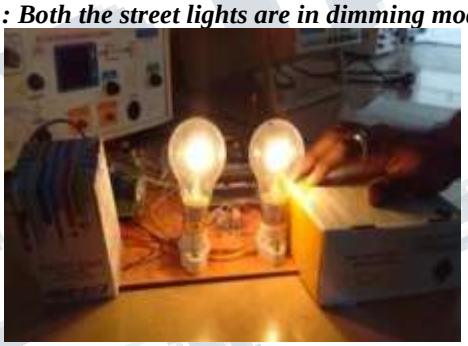

Fig4: Both the street lights are in dim mode.

In the figure 4 represents that, both the street lights are in dim mode .It indicates that both the PIR sensors are closed. It means that there is no motion detection happens at this moment. Here the experimental operation can takes place in 2 minutes.

For 2 minutes calculations:

Total power = power consumed + power save
= 0.5610W+0.5610W
displays in LCD unit.

Fig5: Power consumes & power saves displayed in LCD unit.

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In the above figure 5 represents that 'C' indicates that Consume and 'S' indicates that Save.

Fig6: Message sent to the control room.

Fig7: Message received to the prescribed number.

In the above figure6 & 7 represents that, message can be sent to the control room then how much power consume and power save it receives in the form of SMS way to the prescribed number.

Condition 2: Both the street lights are in bright mode.

Fig8: Both the street lights are in bright mode.

In the above figure 8 represents that both the street lights are in bright mode. Here the experimental operation can takes place in 5 minutes.

For 5 minutes calculations:

Total power = power consumed + power save
= 2.2100W + 0.3740W displays in LCD unit.

Fig 9: Power consumes & power saves displayed in LCD unit.

In the above figure 9 represents that 'C' indicates that Consume and 'S' indicates that Save.

Fig 10: Message sent to the control room.

Fig11: Message received to the prescribed number.

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In the above figure10 & 11 represents that, message sending to the prescribed number & how much power consumes and power save received to the prescribed number.

Tabular Column:

Table 1: Power calculations in minute's format

S.No.	Conditions	Time (Sec)	Power Consume in (W)	Power save in (W)	Total power(W)
1.	Both the street lights are in dim mode.	For 2 minutes	0.5610 (W)	0.5610 (W)	1.1220 (W)
2.	Both the street lights are in bright mode.	For 5 minutes	2.2100 (W)	0.3740(W)	2.5840 (W)

S.NO	Conditions	Time(s)	Power consume in (W)	Power Save in (W)	Total power (W)
1	Both the street lights are in dim mode.	1 hour	16.830 W	16.830 W	33.66W
2	Both the street lights are in bright mode.	1 hour	26.524 W	4.704 W	31.228W

Table 2: Power calculations in 1hour format

The above proposed system application in streetlight control for each lamp will reduce in streetlight electricity and maintenance cost, and increase availability of street light.

5.3. Main Functions in the system

1. Remote on/off, dimming manner (based on Real-Time-Clock).
2. Date Management (energy consumption report).
3. Reduce energy use by up to 40%
4. Reduce maintenance by up to 50%.

5.4. Analysis of the system

Nature of the Bulb:

- Incandescent Bulbs

Network:

- Fix in parallel arrangement.

Type of the bulb applying here:

1) Generally Incandescent bulb of 250W or 150W.
2) 250W is used for main roads.
3) 150W is used for internal roads.

Height of Street Light:

- Distance from ground 7m, 8m, 9m, 10m

Power:

1) 70 Watts for 7m & 8m poles
2) 150Watts for 9m pole
3) 250 Watts for 10m pole

Distance between successive street lights:

1) 19-20m (between 7-7m and 8-8m poles)
2) 24-25m (between 9-9m and 10-10m poles)

(Distance between poles depends on width of the roads.)

Phase:

1) Single phase (230V) and
2) Three Phase (440) Used together

Table 3: Power calculations in 12 hour's format

S.No.	Conditions	Time(S)	Power consume in (W)	Power save in (W)	Total power (W)
1.	Both the street lights are in dim mode.	12 hrs	201.96 (W)	201.96(W)	403.92(W)
2.	Both the street lights are in bright mode.	12 hrs	318.288(W)	56.448 (W)	374.736(W)

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5.5. Power Consumption of the proposed system

By observing above two conditions we know that all street lights are ON from 07:00 PM to 07:00 AM, then street lights are running completely for 12hrs a day. By assuming here 10 nodes to be working power consumed by them will be given as:

1) Incandescent Bulb used = 60 W=0.06 KW
2) □ Number of poles = 10 poles
3) □ Numberof working hours per day = 12hrs
4) □ Power Consumed/day = 10 * 12 * 0.06= 7.2KWH. So, that 7.2 * 30 = 216KWH/month
5) Monthly Bill for 10 nodes (3Rs/KWH) = 216 * 3=648Rs per month.

5.6. Comparison of Savings with LED & CFL bulbs

For LED Bulb:

S.no	Condition	Time(Sec)	Power Consume(W)	Power Save(W)	Total Power (W)
1	Both the street lights are in bright mode.	For 1 hour	39.6W	19.44W	59.04W
		For 12 hours	475.2W	233.28W	708.48W

For CFL Bulb:

S.no	Condition	Time(Sec)	Power Consume(W)	Power Save(W)	Total Power (W)
1	Both the street lights are in dim mode.	For 1 hour	15.84 W	7.992W	23.832 W
		For 12 hours	190.08W	95.904W	285.984W

VI. CONCLUSION

The proposed system can identify day/night time and means of transport are varying the dazzling of the street lights using RTC (Real–Time-Clock) method in incandescent lamps as per the traffic stream. With the help of Relay the street lights can manage in the arrangement of On/Off/dim manner. One more benefit is achieving by the control system in power reduction managing of the lamp posts, by transmitting the data to a authorized person by using GSM communication. The proposed system is mostly appropriate for street lighting in city and countryside areas where the traffic is low at a given range of time. The main objective is, to reduce the power consumption and damaging environment emissions. Thus, if an ultra power saving for street lighting system can be designed and set up in the conurbation, then, oodles of power can be save. This system is flexible and can be extended according to consumer requirements.

VII. FUTURE SCOPE

By the following of applying this power saving in street lighting system based on motion detection, the scope is for further enhancement only. Initially, we can directly go for Wireless Power Transmission which would further decrease the maintenance expenditure and power stealing of the system, as cable breaking is one of the issue nowadays. In addition to this, controlling the Traffic Signal lights would be an added feature, which may possibly look into after successful performance of our system. Depending on, the overall traffic in a particular direction is required to control the certain actions can be taken. Likewise, efforts can be complete to make sure that the entire system is independent on nonconventional power resources like solar power, windmills, Piezo-electric crystals, etc. We expect that these developments can put together this method totally robust and completely consistent in overall values.

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BIOGRAPHY of AUTHORS

A.N.BHARATH received B.Tech degree in E.I.E. from JNT University, Ananthapur, India and he is currently pursuing M.Tech degree in the specialization of Embedded Systems in Siddharth Institutue of Engineering & Technology (SIETK) in the department of E.C.E. from JNT University, Ananthapur, India.

M.MariMuthu presently working as Assistant professor at Siddharth Institute of Engineering & Technology. He received his Master degree from Anna University, Tiruchirapalli in Electronics & Communication Engineering. His research interests include Wireless Sensor Networks, Communication Systems and Embedded Systems. He is a life member of ISTE (India) and IRED.