

AUTOMATIC STREET LIGHT MONITORING, FAULT DETECTING AND CONTROLLING SYSTEM

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ABSTRACT

Street lights are most important parts of our daily life which provides large amount of electrical energy. There is a major problem occurs due to conventional system because it is manually check and it requires more power consumption, energy wastage and find out fault and also man power requirement and overcome the problem of this paper use details of automatic street light checking and controlling street light Intensity. Using PIC controller and different sensors automatic street light monitoring, controlling and faultfinding system is introduced.

Keywords– Microcontroller PIC16F877A, Automated Street light checking system

1. INTRODUCTION

In early days we use street lights which needs man power. A person has to physically turn ON and OFF light as per need. the problem occurs if a person goes late or forget to turn off light, it will glow continuous till morning. This led to wastage of energy/electricity. Another problem occurs if there is any fault in bulbs, it will be detected only when the technicians check it monthly/manually. If there is delay in fault detection any problem may occur. The power consumption rate of traditional system (Standard lamp) is more than street lights (Lamp SL) [11].as shown in fig.1.

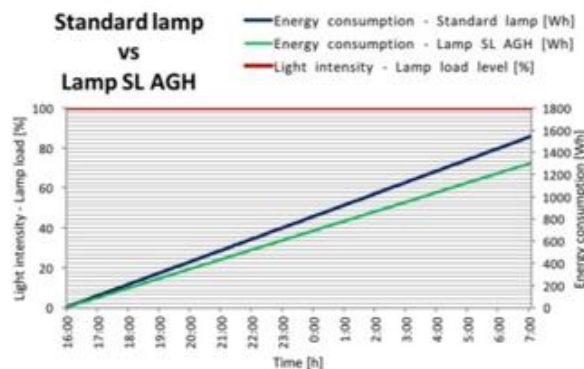


Fig 1. Energy Consumption of Lamp

Fig. 1 shows energy consumption in standard lamp is 1800Wh and in Lamp SL is 1600Wh. thus, 2000Wh more energy consumes (or wasted) in standard lamp in one hour [11].

So, to overcome all these problems automated device is needed which is used to control light intensity, power consumption, detect faults automatically without woman efforts, save more time and energy. In this system intensity of street light is controlled based on vehicles are present or not. In night, if vehicle is present then bulb will glow with 100% intensity, if no vehicle then bulb will glow with 50% intensity. This system consists of different sensors (IR, I, V, LDR), PIC controller, LoRa module. Thus, this Automated Public Lighting is introduced.

2. LITERATURE REVIEW

In Study [1], N. Sravani, Y. Latha, G. Nirmla had worked on automated control system for street light. Which Ables to detect and monitor faults using lora module. It is an IoT based automated public street light control system and it helps to save energy and power consumption, reduce man power, detecting fault and displaying fault's location or pol number quickly. In this system two main techniques had used first, wireless communication for certain range, second is wired communication.

In Study [2], Y. M. Jagadeesh, S. Akilesh, S. Karthika, Prasanth had implemented new modern street lights which is automatically controls all system problem, for this system less human efforts are required. This system consists of various sensors like (IR sensor, PIR sensors), pic controller had included.

In study [3], B. K. Subramanyam, K. Bhaskar Reddy had designed and developed wireless street light control system with monitoring ability along with GUI Application. New methods are included as to overcome the energy wastage and maintain proper utilization of power as per requirement. solar panel is used at lamp post using LDR so, power and energy wastage is Low. GUI Application is used to control and monitor street lights when needed.

In study [4], P. Premalatha, R. Banumathi, R. Aandal had implemented system, to overcome the old manual street light. This system initiated a new technology by using automation techniques which control and detect faults in street lights and displayed information immediately. The status of street light control system can be accessed anytime at any location. this system uses Arduino Uno and IOT.

In Study [5], Huishan Yu, Qun Sun, Kai Sheng, Zhenyou Wang had implemented the advanced technology for street light monitoring and controlling. this system consists of two technologies like ZigBee and GPRS Technology. the combination of ZigBee and GPRS technology and LED light is advanced street light controlling method. In this system ZigBee and GPRS wireless communication technologies are used.

3. METHODOLOGY

The block diagram of the implemented system is as shown in Fig.2.

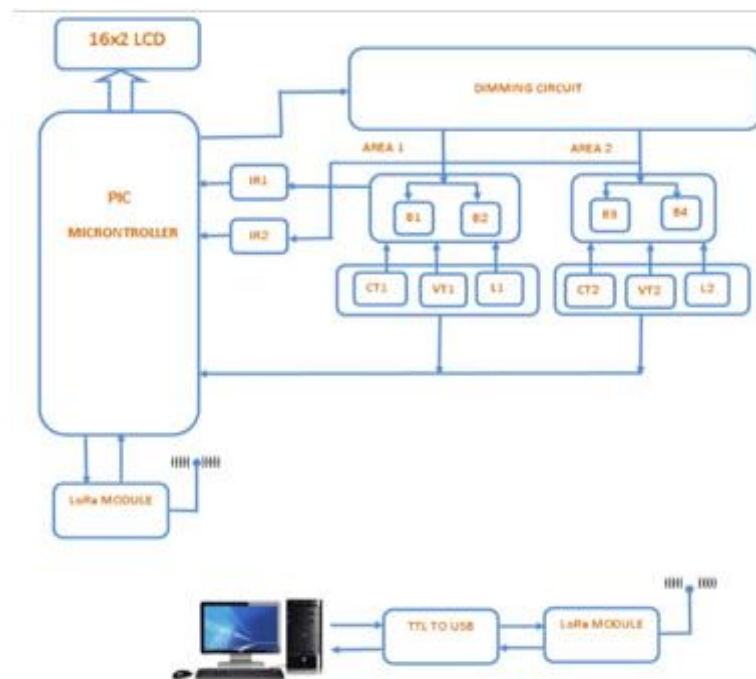


Fig.2. System Block Diagram

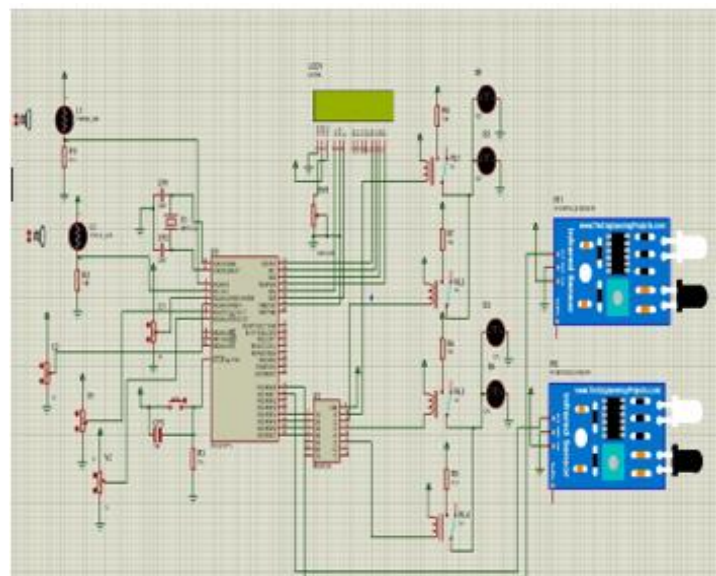


Fig. 3. Implementation using Proteus

In this system microcontroller is used as central processing unit. All the sensors are connected to microcontroller like voltage sensor, current sensor and light sensor. The microcontroller takes decision according to these inputs. All the sensor data is transmitted to a remote server using the wireless technology of LORA WAN. In this system LORA module is used [1]. It is connected wirelessly to a PC present in the region. Here, Visual Basic software is used to display all the data. The system actually controls the bulb intensity depending on the traffic present in the area. If there is no traffic on the road, then the lights will glow with the 50% (half) intensity and if there is any vehicle on the road the lights will glow with the full intensity [2].

This is done with the help of a power control circuit (dimming circuit) which will provide the controlled power to the bulb. The bulbs will only start in the night [5]. As soon as the sun comes out the bulbs gets off. There will be two sections or areas that will be controlled with this system. this system helps to measure voltage and current consumption of each area. power consumption can calculate from this current and voltage values and also find out faults like low voltage, short circuit, bulb blown, etc. and also control the light intensity of the bulbs [4].

PIC 16F877A-

It is an 8-bit microcontroller and RISC architecture; it has 8 channels of 10-bit Analog-to-Digital Converter. Power-Saving modes: consist of multiple low-power modes for efficient power management, it has 5 digital I/O ports. Operating voltage is 5volt.

LoRa Module (WIRR-1286)-

It is long distance wireless transmission technology. RF center frequency of 868 MHz. long range (about 15km) reception and transmission. Operating voltage is 5 V.

Dimming Circuit-

This circuit helps to control the intensity of light. It changes the direction of electrical flow. it consists of relays and resistors. In this circuit four relays and resistors are used. Two relays are connected to two low values of resistors and another two relays are connected to two high values of resistor. when vehicle is entered in area1 and area2 then relay will switch on which is connected to low value of resistor (high current will flow) then bulb will glow with 100% intensity. if no vehicles are present in that area, then relay will switch on which is connected to high value of resistor (low current will flow) then bulb will glow with 50% intensity. Thus, dimming circuit will work detection area wise.

Working:

The system consists of sensors (voltage sensor, current sensor, IR sensor, LDR sensor), LoRa module, PIC controller. It is used as central processing device. In this system there are two area's Area1 and Area2. this system is designed to control intensity of light of two areas. each area has two current sensors [C1, C2], two voltage sensors [V1, V2], also it consists of two LDR sensor [L1, L2] it is used to turn on & off the light and IR sensor it is used to detect the object [2].

In dark mode (night), bulbs will be completely turn on and in light mode (morning), bulb will be completely turn off with help of LDR sensor. In dark mode the LDR sensor will turn ON the bulbs. When vehicles are entered in Area1 then IR sensor1 will work, vice- versa (Area2). The output of the IR sensors gives to the dimming circuit through the controller and then dimming circuit will control the intensity of light. When vehicle is present on the road then bulbs will be glow with 100% intensity otherwise bulbs will be glow with 50% intensity [2]. after that current and voltage sensor will measure the current and voltage values area wise and this calculated value will be pass to the LCD through the controller, LCD will display those values [3].

According, to code if the calculated value of current and voltage sensor is (!>=) not greater than or equal to the given value then fault is occurred [e.g bulb damaged & short circuit]. When calculated value is greater than or equal to given value then no fault is occurred [4].

Controller will give the data of fault detection to the LoRa module2 which is connected to the user PC through the LoRa module1[1]. From measured values of current and voltage sensor we can calculate the power consumption from area wise using formula $P=V*I$. This all the data will be displayed on the user PC. for e.g Power consumption and type of fault.

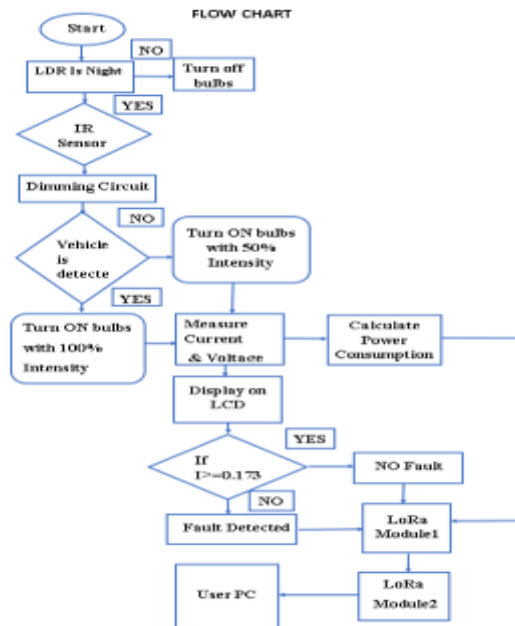


Fig. 4. Flowchart of the proposed system

The implemented system is represented in Fig.5.

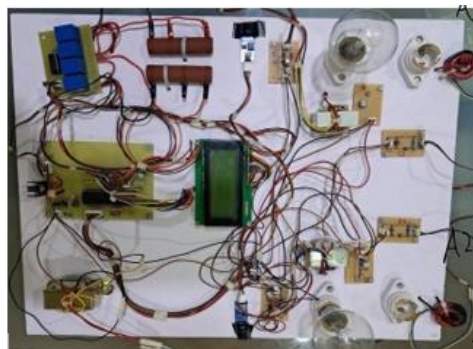


Fig. 5. Implemented System

4. RESULTS

Street light monitoring and controlling system, without monitoring system we cannot find out the fault and correct the fault and controlling. for that purpose, we design this monitoring and controlling system which includes PIC controller, LoRa module, different sensors, dimming circuit. In this system we achieve the results of street light by display.

Case 1: During Night time- Status of street light is **ON**. During night time in the **absence** of vehicles in Area2 (or objects) the status of street light is **ON with 50% intensity**.

The intensity value of the street light (Area2) during night time in absence of vehicles is shown below:

Case 2: During Night time- Status of street light is **ON**. In night time in the **presence** of vehicles (or objects) in Area2 status of street light is **ON with 100% intensity**.

The intensity value of the street light (area wise) during night time in **presence** of vehicles is shown below:

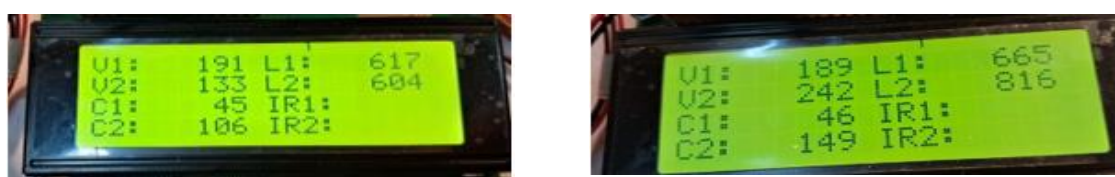


Fig. 6. Working at case 1 (left) and case 2 (right)

Case 3: During Fault detection - message will be send (when fault is occurred) to the user pc through LoRa module, then type of fault and area where fault is occurred will be display on user pc and also power consumption will be display on user pc area wise as shown in Table no.1 and Table no.2.

Table 1. Power consumption per day for Area1 (P=40W)

Voltage (V)	Current(A)	Power Consumption(kW)
191	0.20	38.2
189	0.21	39.69
188	0.21	39.48
190	0.21	39.9
240	0.17	40.8
190	0.21	39.9
242	0.16	38.72
239	0.17	40.63
Total Power consumption per day		317.32 kW
Total Power consumption in kWh per day		3.49 kWh (T=11h)

Table 2. Power consumption per day for Area2 (P=40W)

Voltage (V)	Current(A)	Power Consumption(kW)
133	0.30	39.9
242	0.16	38.72
132	0.30	39.6
243	0.16	38.88
134	0.29	38.86
131	0.31	40.61
239	0.17	40.63
188	0.21	39.48
Total Power consumption per day		354.54 kW
Total Power consumption in kWh per day		3.89 kWh (T=11h)

It's easy to find out the street light which is faulty and also easy to find out the location to resolve this problem as early as possible and easy to get analysis of data regarding power consumption area wise. Hence, this system helps to save more wastage of electricity and reduces manpower.

5. CONCLUSION

In this paper automatic street light monitoring, fault detection and controlling techniques which are discussed, this system reduces human power and delays in find out the faults and it helps to avoid crime and accidents. This paper also discussed analysis of data regarding power consumption as per area (Locations).

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