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Smart Street Light Using Intensity Controller

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Abstract: *We all know that street lights are one of the main city's assets. Currently, in the whole world, enormous electric energy is consumed by the street lamps, which are automatically turned on when it becomes dark and automatically turn off when it becomes bright. This is a huge waste of energy in the whole world and should be changed. Using Light Emitting Diode (LED) instead of conventional street lights reduces the power consumption. The main aim of this project is to design a system of street light controllers to reduce power consumption. The prototype is designed by using Light Dependent Resistor (LDR), Infrared sensor (IR), battery, and LED. The brightness of the lamp is controlled to reduce power consumption. The lights turn on before pedestrians and vehicles come and turn off or reduce power when there is no one. It will be difficult for pedestrians and drivers of vehicles to distinguish our smart street lamps and the conventional street lights since our street lamps all turn on before they come.*
This project is reviewed..

Keywords: *LED lights, power consumption, smart street lights, energy consumption*

I. INTRODUCTION

Nowadays, the concept of a Smart City is one of the main future targets for a better environment. The convectional street light system consumes more energy because they turn on when it becomes dark and turned off when it becomes bright. it is important to manage this waste more efficiently to create a better world. This project is inspired by the most common question, 'what can be done to reduce this huge wastage of energy?' There are some attempts, in which the energy waste of the street lights is reduced. A sensor light, lights. If the person crosses the street from point A, this moment will be detected by the sensor and lights turn on at points 1 and 2 when the person moves forward for position E, the moment is detected by points 3 and 5 and it turn lights on and lights at point 1 and 2 will be off. So this will help to reduce energy consumption during the night. which is controlled on and lights at point 1 and 2 will be off. So this will done by the brightness sensor and the motion sensor. It only turns on for a while when the motion is detected in front of the light and it is dark. However, it usually is too late to turn the light on when a person or a car comes in front of it. The light should turn on before a person or a car comes. LED lights are insufficient to reduce power consumption so we introduce a new smart street light system. The main aim of this project is to reduce the cost of power consumption. This paper is divided into 4 sections

1) Smart street light solution
2) Proposed system of smart street lights
3) Result and analysis
4) conclusion

Smart street light solution
Following are the main components of smart street lights –

A) LED lamp
B) Controlled sensor
C) Object movement

A) LED lamps

LED lamps help to reduce energy consumption. Instead of using High-Pressure Sodium lamps or Metal Halide (400 W), it is advisable to use low-power consuming LED lamps (<150 W), which provide better luminance.

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B) Controlled Sensor

The following fig shows the concept of smart street lights. A controlled sensor is used in this system, which detects pedestrians and vehicles during the night to turn on the lights. that detect the speed of moving objects. When object approaches Sensor 1,it will start calculating the time taken to reach Sensor 2. The sensor will stop the time taken when the object reaches Sensor. The distance between the two sensors in this project is 6 cm. To obtain speed of the object, the value of the distance is divided by time taken.

Components Required:

- Arduino UNO(Microcontroller)
- PIR Sensor
- LDR Sensor
- LED
- IR Sensor
- Relay
- Resistor
- Jumper Wire

Arduino UNO

It is an open source microcontroller board based on the microchip ATmega328p.The Board is equipped with sets of digital and analog input/output(I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The Board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. It can be powered by the USB cable or by an external 9-volt battery, though it although it accepts voltages between 7 and 20 volts.

PIR Sensor

A passive infrared sensor is an electronic sensor that measures infrared(IR) light radiating from objects in its field of view. They are most often used in PIR-based motion detectors. PIR sensor are commonly used in security alarms and automatic lighting applications.

LDR

A light dependent resistor (LDR) is also called a photoresistor or a cadmium sulphide cell. It is also called a photoconductor. It is basically a photocell that works on the principle of photoconductivity. The passive component is basically a resistor whose resistance value decreases when intensity of light increases.

IR Sensor

An infrared sensor is an electronic device, that emits in order to sense some aspects of the surroundings An IR sensor can measure the heat of an object as well as detects the motion.

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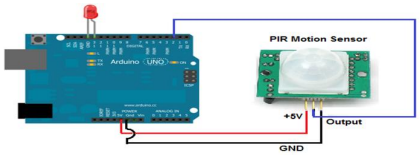
PIR Interfacing with Arduino



LDR Interfacing with Arduino:

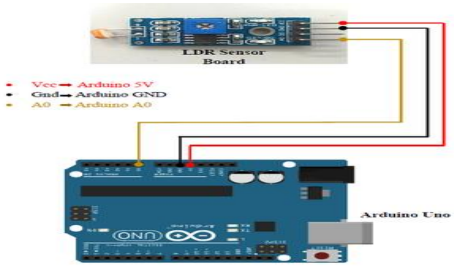


Table I has listed the speed and the light intensity in three mode of movement which is low, medium and high.

CONDITION	SPEED (km/h)	INTENSITY (%)
LOW	0-5	30
MEDIUM	<15	70
HIGH	>15	100

A. System Flowchart

Figure 3 shows the flowchart of speed detection system. The speed detection system starts with the initialization. System initialization means that all the variables must be initialized to zero. Then, Light Sensor (LDR) will detect the intensity of the light. The final result of light intensity is shown in the following fig.

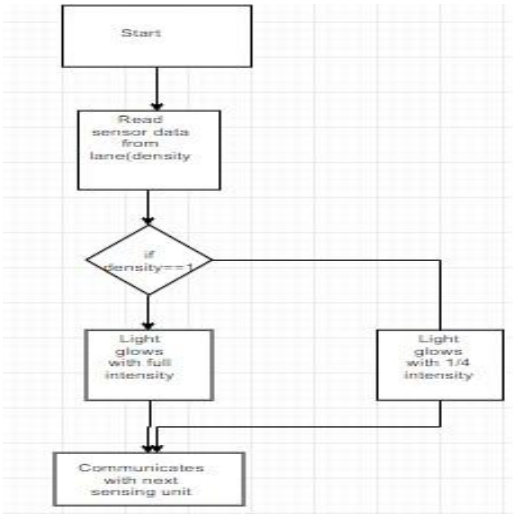


Fig. Flowchart for proposed system.

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Flow Chart Description:

Intensity Control: Initially, the process is started. Then read the sensor value. If the sensor value is equal to one then the light glow bright. If the sensor value

From the above fig, Picture A is the condition of light when LDR detects darkness but with no movement. Picture B shows the 30% intensity of light such as a pedestrian is detected. While in picture C is the 70% intensity of light when the speed of the cyclist is detected lastly picture D is the 100% level of light intensity when a car is detected.

B. Effect of LED on Power Consumption

As we want to reduce the power consumption, this paper proposed to use LED lamp. LED street lamps power is about 36W or more. Since this project used 9W LED power, therefore the energy consumption will be 9Watt-hour. The electricity is measure in kilowatt-hour, hence it is 0.009kWh. This calculation of power energy consumption by street light are estimated for a month (30 days). Therefore, the full intensity of LED for a month will be 0.27kWh.

Estimated Energy Saving = Energy Consumption / Full brightness
Estimated Energy Saving = 1.3767x 100%/ 3.24
Estimated Energy Saving = 42.45%

vehicles, thus, the usage of power consumption by LED decreases. This paper discusses the technical aspect of smart street light system and the possible energy saved by implementing this proposed system. The current problem with the conventional system is the long hour operational time which cause a lot of electricity cost. There is a huge waste if it is not taken seriously. Thus, this project proposed the solution to save the energy consumption of street light. Two sensors were used in this proposed smart street light system which is IR Sensor and LDR sensor. By using IR sensor to detect speed, it can control the light intensity level which lead to saving energy. Besides, LED bulb used in this paper is also able to control the power consumption use by street light and saves the energy up to 40% to 45% per month. Using LDR we control the street light, when the LDR value falls above the threshold value the lights are switched on and when the value falls below the threshold value the lights are switched off.

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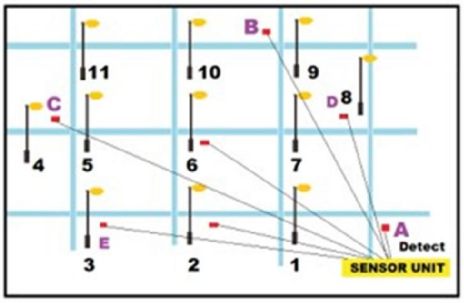

Fig 1. The components for the smart street light

C. Object Movement

The following fig shows different light intensities with respect to the movement of objects related to speed.in 1st case, light intensity increases to 80% when the sensor detects any vehicle having a speed of 30 km/hr. in 2nd case, light intensity decreases up to 20% when the sensor detects any vehicle having a slow speed.

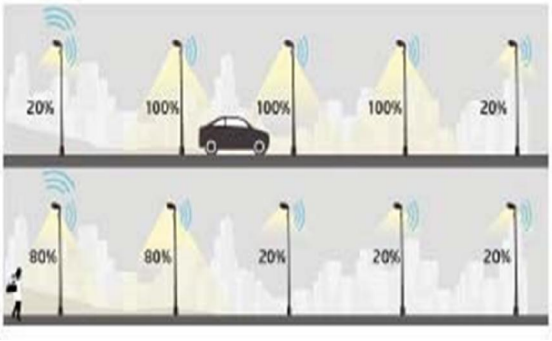

Fig 2. A different setting for a different object.

The proposed system of smart street lights-

This paper proposed a street lights system that will be turned on when it is dark but it depends on the motion of the vehicle or pedestrian. In this project, we use 2 infrared (IR) sensors If the vehicle detection was not there then the street lights still glows but glows with only ¼ intensity of light. If the moment of vehicle was detected then the street light glows with 100% intensity. The proposed method was depicted in fig. 3. The IR transmitter is put straightforwardly in viewable pathway with IR sensor, so the IR receiver persistently gets infrared beams. When the IR collector gets infrared beams, the microcontroller will detect Logic 1. If the infrared beams are hindered by certain means the microcontroller will identify logic 0 is not equal to one then the light glow dim. Finally the process is stop.

IV. RESULT AND ANALYSIS-

Effect on LDR and IR sensor on light intensity

The main aim of this project is to reduce power consumption by street lights. The intensity of light is controlled by the proposed system LDR is used to detect the darkness of the surroundings while IR is used to detect the speed of the object. It can be seen from an approximate value that the estimated energy saving for 12 hours is 42.45%. But it may save less than than this value when the calculation takes into consideration the interrupts from IR and consumption of other hardware components. By using LDR and IR sensor as proposed in this paper, the light intensity will be varied according to that. Therefore, the system can save up to 40 to 45% .

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This figure refers the street light glows on dim, if sensors not detect the motion of any object.

This figure refers the street light glows on bright, if sensors detect the motion of any object.

V. CONCLUSION:

By referring all the results, it can be concluded that both hardware and software development of this project meet the objective of design. A working prototype of street lighting automation system was successfully built using Arduino Uno. Usage of PIR sensor as the input gives energy saving to the system since LED turn on only when there is movement from

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