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Smart Street Light Control System Using Arduino

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Abstract: To develop a system which will lead to energy conservation and by using this system, would be able to save some energy. The project work is accomplished by using Arduino microcontroller and sensors that will control the electricity based on night and object's detection. The beauty of the project is that the wastage of unused electricity can be reduced, lifetime of the streetlights gets enhance because the lights do not stay ON during the whole night, and also helps to increase safety measurements.

Keywords – Arduino Uno , IR sensor , LDR , LED's , Resistor , PCB board

INTRODUCTION

The need to save energy for the future because various energy resources like coal and natural gas can not be replaced and once used them, they gone forever. It is important to save the power instead of using unnecessary power . Light should be switched off when there is no need of light. In any city street light is one of the major power consuming factors. Most of the time streetlights are on even after sunrise thus wasting lot of energy. Also call it an "SMART STREET LIGHT SENSING". There are several factors need to be considered in order to design a good street lighting system such as night-time safety for community members and road users, provide public lighting at cost effective, the reduction of crime and minimizing it is effect on the environment. The research work shows automatic control of streetlights as a result of which power is saved to some extent.

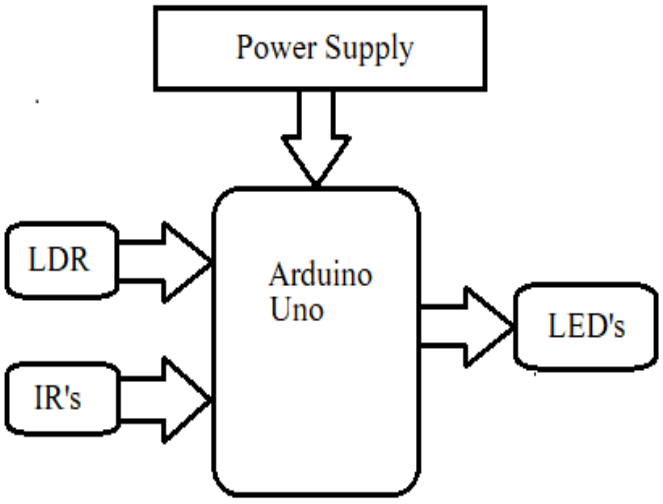

Fig : Block Diagram

Objective

The objective of the project to design an automatic streetlight control system. Turn streets lights ON when motion detects of any vehicle or pedestrian by IR sensor . But if there is no motion detected it should be automatically turn OFF , by using smart street light control system the wastage of lot of energy can be saved.

Problem Statement

In the existing system, the street lights are always on in night and a lot of energy wested and manually switched ON and OFF and need man power to maintain these, System in which the energy can be saved and not require manpower because it is an automatic street light control system and manually controlling the street lights .An LDR is used for automatically switches ON and OFF depending on the light.

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METHODOLOGY

For the working of system Initially need to make the connections according to the circuit diagram. The code is very important in making the whole equipment work. Recent days, Smart Street Light System is major component of a smart city Infrastructure and by using it the energy can be saved. The important function is to lighting the city streets using. Sensor's to save the current or power energy. In existing system using normal street lamps, It takes more current and expensive so must use LED lamps to save the current and low amount of power is required. Using IOT type system is all over the world. It is used to be watch all kind of areas in the cities.

CIRCUIT DIAGRAM

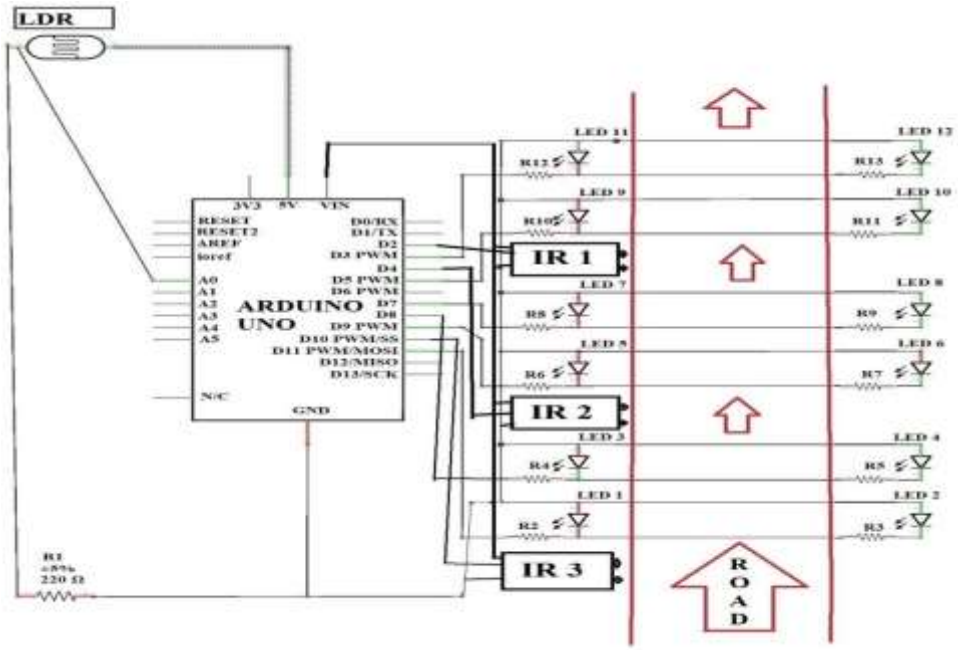

Fig : Circuit Diagram

TOOLS & TECHNOLOGIES

MICROCONTROLLER

Arduino UNO is the microcontroller used in this project, it is based on ATmega328. It is open source electronic platform based on easy to use software and hardware. It reads input-light on sensor, finger on a button, etc. it has 14 input/output and 6 analog pins. The software used in this microcontroller is ARDUINO IDE.

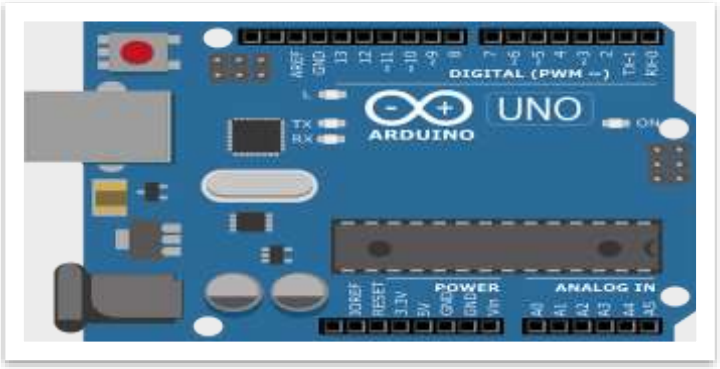

Fig: Microcontroller

INFRARED SENSORS

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 as well as the presence of an object due to intervention or interruption. These type of sensors measure only infrared radiation, rather than emitting it that is called as a passive IR sensor, an IR sensor is simply a device which detects IR radiation falling on it.

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Fig : Infrared sensor

LIGHT DEPENDENT RESISTANCE

LDRs or Light Dependent Resistors are very useful especially in light/dark sensor circuits. Normally the resistance of an LDR is very high, sometimes as high as 1000000 ohms, but when they are illuminated with light resistance drops dramatically. Electronic onto sensors are the devices that alter their electrical characteristics, in the presences of visible or invisible light. best-known devices of this type are the light dependent resistor (LDR), the photo diode etc.

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Fig : light Dependent Resistor

LIGHT EMITTING DIODE

A light-emitting diode (LED) is a two-lead semiconductor light source. It is p-n junction diode that emits light when activated. The long terminal is positive and the short terminal is negative. When a suitable current is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons. This effect is called electroluminescence, and the color of the light (corresponding to the energy of the photon) is determined by the energy band gap of the semiconductor. LEDs are typically small and integrated optical components may be used to shape the radiation pattern.

Fig : Light Emitting diode

RESISTOR

Resistor 10k Ohm 1/6th Watt PTH. Commonly used in PCBs and perf boards, these 10K resistors make excellent pull-ups, pull downs, and current limiters.

Fig : Resistor

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Testing & Experimentation

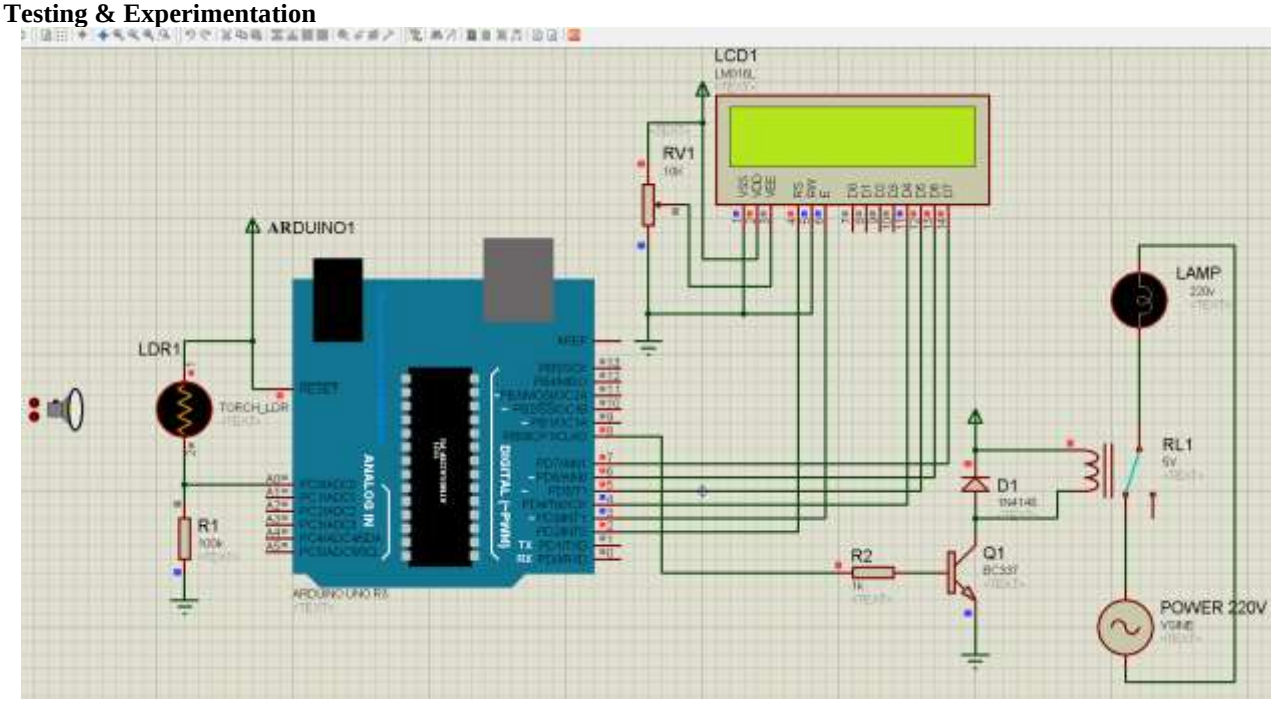

Fig : testing & Experimentation

FINDING & RESULTS :

The results of the system is that the LDR detects the light that has been falling on it then as soon as the IR sensor detect the light they will send a signal to the microcontroller (used Arduino Uno) now it's time to function the microcontroller which there by turn ON the street light and also when IR sensor detects the vehicles motion then it send the signal to microcontroller and it turn ON the street lights and when no motion detects it will back to original position by doing this the energy has been saved. For a comparative study we have to take the following assumptions:

ASSUMPTIONS:

Suppose a 10 km long one-way street contains 500 street lights and the nominal range of all the street lights are 20 meter.

1. All the street lights are supposed to glow for a period of 12 hour from 6 pm to 6 am.
2. One street light is supposed to consume 1 kwh power for a period of 1 hour when it glows with its maximum intensity so that one street light consumes maximum 12kwh in a day.
3. So 500 street lights consume maximum 12kwh*500
   =6000kwh power in a day.
4. Each lR sensor if blocked than two street light glows.

Case-1: (Let one vehicle is in motion during night)

lf two Street light glows per one lR sensor Than power consumed by two Street light = 2*1kWh = 2kWh
Maximum of only two street light glow for one vehicle movement.
Therefore, Total power consumed for 12 hrs.
= 2kWh*12 = 24 kwh
Total power saved = 6000kWh - 24kwh
=5976 kwh

Case-2: (from 5am to 6am and 12 pm to 1 am; let only 10 vehicles are in motion)

lf 10 vehicle crosses the street light one by one; than total of 20 street light glows per 10 lR sensor
Therefore, power consumed by 20 Street light = 20kWh
Total power consumed in 12 hrs = 20kwh*12
= 24O kwh
So, total power saved = 6000kWh - 240 kwh
= 5760 kwh

Case-3: (from 10pm to 12am; let only 100 vehicles are in motion)

lf 100 vehicle crosses the street light one by one; than total of 200 street light glows per 100 lR sensor
Therefore, power consumed by 200 Street light

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= 200kWh
Total power consumed in 12 hrs = 200kwh*12
= 24O0 kwh
So, total power saved = 6000kWh - 2400 kwh
= 3600 kwh

Data collection/Data analysis

Collected some data from a paper published by Uppsala university where they compared the daily energy consumption during one year for two different scenarios . the simulation stars in January and continues to the end of December .

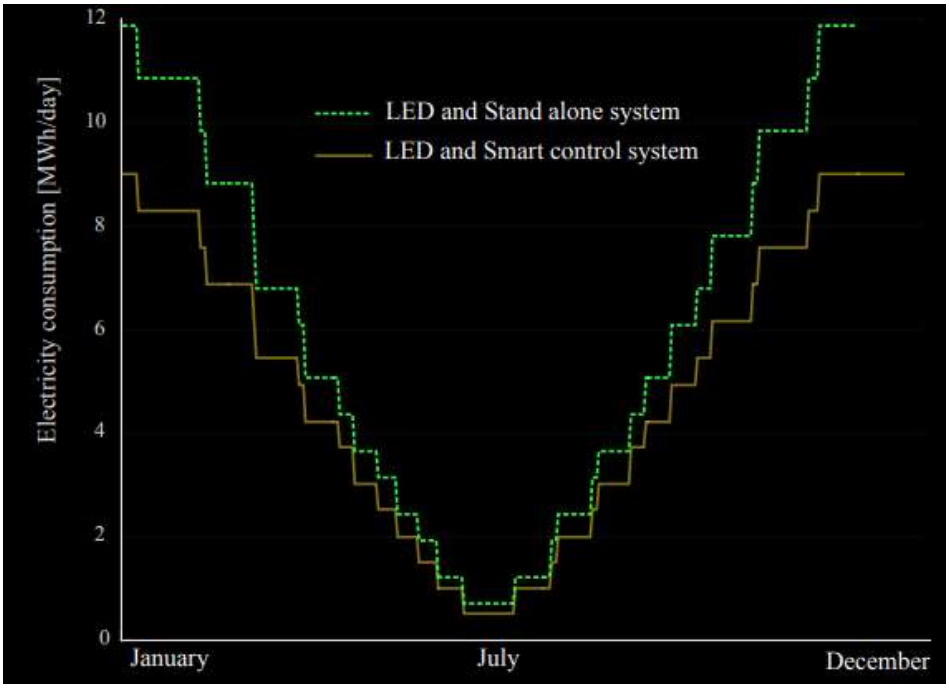

Fig : Comparison of Energy Consumption of two Scenarios for one year
Figure for Annual energy consumption for the two scenarios compared with the consumption today.

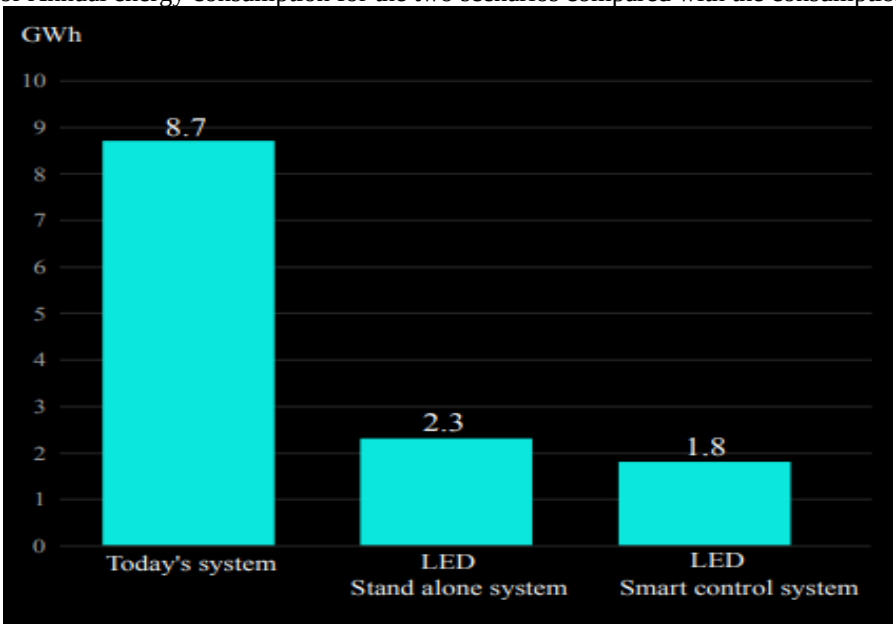

Fig : Annual energy consumption for the two scenarios compared with the consumption today

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APPLICATION

Parking Lightings
Street Lights
Garden Lights
Highways

CONCLUSION

This project will provide a competent method for lighting systems and the project report give the detail study of "Smart Street Light Control system Using Arduino "make the whole process of energy saving easier and efficient. The circuit meets it's expectations and turn ON and OFF light according to the motion detects of the vehicles. With a capability to change the amount of light emitted depending upon the outside condition is no doubt an innovation with many future application apart from the fact that it can also be used in many present day tech such as street light, park lights, industrial lights and many more. The usage of the smart lighting system will undoubtedly change the world . The final result of the project is that the project solve the power consumption problem

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