A Mini Project Report on

DASHBOARD FOR STREET LIGHTS

Submitted to the Department of Computer Science & Engineering, GNITS in the partial fulfillment of the academic requirement for the Award of B.Tech (CSE) under JNTUH

By

P.DHATRI REDDY	17251A0583
MERIGA SUJITHA	17251A05A9
NAVLURI SUSMITHA	17251A05B8

Department of Computer Science & Engineering
G. Narayanamma Institute of Technology & Science
(Autonomous) (For Women)
Shaikpet, Hyderabad- 500 104.

Accredited by NBA & NAAC & Affiliated to
Jawaharlal Nehru Technological University Hyderabad
Hyderabad – 500 085
Nov, 2019

G. Narayanamma Institute of Technology & Science
(Autonomous) (For Women)

Accredited by NBA & NAAC
&Affiliated to JNTUH Hyderabad–
500104, T.S INDIA

Certificate

This is to certify that the Mini Project report on “DASHBOARD FOR STREET LIGHTS” is a bonafied work carried out by P.Dhatri Reddy (17251A05A9), Meriga Sujitha (17251A05A9), Navluri Susmitha (17251A05B8) in the partial fulfillment for the award of B.tech degree in Computer Science & Engineering, G.Narayanamma Institute of Technology & Science, Shaikpet, Hyderabad, affiliated to Jawaharlal Nehru Technological University, Hyderabad under our guidance and supervision.

The results embodied in the Mini project work have not been submitted to any other university or Institute for the award of any degree or diploma.

Internal Guide
Mrs. M. Lalitha
Assistant professor

Head of the Department
Dr. M. Seetha
Professor & Head
Department of CSE

External Examiner

Acknowledgements

We would like to express our sincere thanks to **Dr. K. Ramesh Reddy**, Principal GNITS, for providing the working facilities in the college.

Our sincere thanks and gratitude to **Dr. M. Seetha, Head and Professor**, Dept. of CSE for all timely support and valuable suggestions during the period of our project.

We are extremely thankful **to Mrs R. PallaviReddy Asst. Prof., Mrs S. Sandhya Asst. Prof., Mr Anil Asst. Prof.**, Dept. CSE, GNITS, Mini project coordinators for their encouragement and support throughout the project.

We are extremely thankful and indebted to our internal guide, **Mrs M. Lalitha Asst. Prof., Dept. of CSE**, GNITS for her constant guidance, encouragement and moral support throughout the project.

Finally, we would like to thank all faculty and staff of CSE Department who helped us directly or indirectly, parents and friends for their cooperation in competing the project work.

P. Dhatri Reddy -17251A0583

Meriga Sujitha -17251A05A9

Navluri Susmitha -17251A05B8

ABSTRACT

There are more than 350 million bulbs that light up the world consume a humongous amount of energy, which, many estimates put at about 19 percentage of world's energy consumed. These lighting costs are essential and not avoidable. An increasing number of cities around the world are opting in for smart technologies to prevent unnecessary wastage of energy, by means of switching ON/OFF these lights .

In this system the street lights are automatically ON and OFF according to the frequency of vehicles and light in the surroundings. This smart light system automatically detects the movements of the vehicles on the street and brightness of light is adjusted. Once if the sun light goes under the visible region then this system automatically switches ON light. As soon as the sun light is visible then automatically switches OFF lights. In this smart system the system uses some of the sensors like IR sensor, LDR sensor and IR sensor. This is best suited for street lighting in remote urban and rural areas where the traffic is very low. This helps to reduce energy consumption.

Table of Contents

Table Of Figures

1. INTRODUCTION

The thought of outlining a new framework for the street lights that don't devour immense measure of power and light up vast zone with high intensity is required. Smart Street lights framework is an essential piece of the smart city which represents 10-40% of aggregate power utilizations which is a discriminating attentiveness toward general society powers. So a vital and productive vitality advancements are to be executed for monetary and social security.

The present framework is similar to, the road lights will be exchanged on in the night prior to the sun sets and they are exchanged off the following day morning after there are adequate lights on the streets. The hindrance of the framework is that we require manual operation of the road light which needs labor.

In sunny and rainy days, ON and OFF time differ discernibly which is one of the significant hindrances of the present street lights systems. Conventional street lighting systems are online most of the day without purpose. The consequence is that a large amount of power is wasted meaninglessly.

With the wide accessibility of adaptable lighting innovation like light transmitting diode (LED) lights and all over accessible remote web association, quick responding, dependable working, and power moderating street lighting frameworks get to be reality. The reason for this work is to portray the Smart Street Lighting framework, a first way to deal with perform the interest for adaptable smart lighting frameworks.

The goal of this undertaking is to plan an automated lighting framework which focuses on the saving of power; to construct a vitally energy efficient smart lighting framework with integrated sensors and controllers; to outline a smart lighting framework with particular methodology plan, which makes the framework adaptability and expandability and configuration a smart lighting framework which similarity and versatility with other commercial products and mechanized automated system, which may incorporate more than lighting frameworks.

1.1 EXISTING SYSTEM

Conventional street lighting systems use constant illumination lighting which leads to high energy consumption accounting for up to 60% of a municipal government’s total electricity expenditure. Furthermore, forecasts show that the energy spending for street lights is likely to increase over the next few years as the demand and price for electricity increase.

Many urban areas are currently facing high carbon emissions due to public lighting, which are a known contributor to climate change. For example, in Harrow, street lighting consumes 6,551,500 kWh of electricity, which leads to emissions of around 3900 tons of carbon annually.

The current street lighting policy requires all lights to be fully operational during the entire night, due to security reasons and inadequate dimming technology. This leads to unnecessary energy use, lowers the lamps' life and causes significant light pollution.

The switches of street lights are switched ON/OFF manually by the workman in all the zones. This leads to the rise of manpower and time. As it is human operations it may prone to errors.

1.1.1 Advantages of Existing System

- Readily available technology and implementation techniques.
- Less cost of implementation.
-

1.1.2 Disadvantages of Existing System

- Street lights are poorly designed and inadequately maintained. Traditional street lighting system consumes high energy.
- The switches of street lights are switched ON/OFF manually by the workman in all the zones. This leads to the rise of manpower and time.
- As it is human operation it is prone to errors too.

1.2 PROPOSED SYSTEM

The proposed system offers the facilities over the existing system. So if we can use automation in this particular case so that all the street lights can be switch on and off automatically when it is really necessary. When there is enough natural light i.e. during the daytime, the sensors detect the light and the light gets OFF and when the sunlight drops then automatically the lights turn ON. And also using Infrared sensor , if that sensor detects the presence of vehicles or pedestrians then the street lights can glow with its maximum intensity in that region otherwise it should glow at a minimum intensity. Resulting in saving a huge amount of electricity.

BLOCK DIAGRAM:

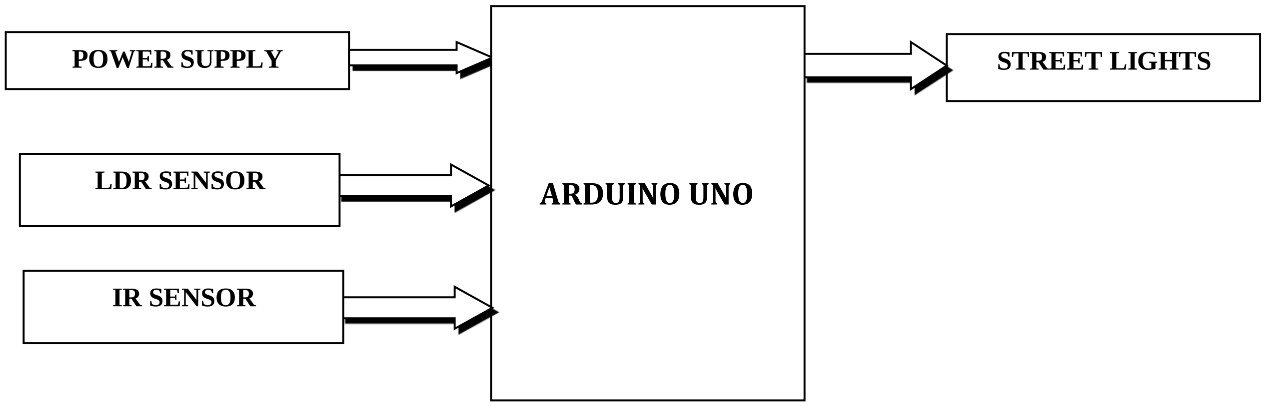

Figure: 1.1 sample block diagram of proposed system

1.2.1 Advantages of Proposed System

- There are less chances of over heating in automatic street light system and risk of accidents is also minimized.
- As the lights are automatically turned ON or OFF, huge amount of energy can be saved.
- Cost of operating automatic street lights is far less when compared to the conventional street lights.
- The emission of co2 is reduced.
- Man power is eliminated.

1.2.2 Disadvantages of Proposed System

- The automatic street light system requires a higher initial investment in comparision to convetional street lights.
- Risk of theft is higher as equipment costs are comparatively higher.

1.3 OBJECTIVES

- Automatic switching ON/OFF lights based on the availability of sun light.
- Adjusting the brightness of lights depending on traffic density.

1.4 SYSTEM REQUIREMENTS

System Requirements Specifications are the requirements and specifications for a software system is the complete description of the behaviour of a system to be developed.

1.4.1 Hardware Requirements

- IR Sensor and LDR sensor
- Arduino Board
- Microcontroller
- Breadboard and LED bulbs
- Jump wires and 10 Ohm resistor

1.4.2 Software Requirements

- Arduino IDE
- Embedded C
- Windows Operating System

2. LITERATURE SURVEY

2.1 FEASIBILITY STUDY

This study aims to evaluate the feasibility of LED based automatic street lightning by analysing energy efficiency and life cycle cost . As a result, LED lamp replacement could reduce the energy consumption by 69% compared to other lamps and also by automatically switching ON/OFF of lights according to natural light reduce the energy consumption by 70% and by controlling the intensity of lights as per presence of pedestrians or vehicles on the street could save as much as 77% energy.

The smart street-lighting system consists of IR sensors, LDRs, microcontroller, relays, transmitters, receivers and Wi-Fi Modules linked up to each other over wireless media. The resistance of an LDR decreases when light falls on them and increases in the absence of light. Vehicles passing by a street light are detected by IR sensors. Relays are used to switch on/off the street-lights. Transmitters and receivers are programmed microchips that control a computer's interface to its connected street-light system. This real-time information and data can be accessed over the internet from anywhere, anytime.

2.2 A Survey on Literature Publishments

B. K. Subramanyam, worked on intelligent wireless street light control and monitoring system, which integrates new technologies, offering ease of maintenance and energy savings. Using solar panel at the lamp post By using LDR it is possible to save some more power and energy, and also we can monitored and controlled the street lights using GUI application, which shows the status of the lights in street or highway lighting systems.

P. Nithya, in their work on Design of Wireless Framework for Energy Efficient Street Light Automation suggested an Intelligent management of the lamp posts by sending data to a central station by ZigBee wireless communication. With the suggested system, maintenance can be easily and efficiently planned from the central station, allowing additional savings. Srikanth M, in their work on ZigBee

Based Remote Control Automatic Street Light System. This streetlight control system helps in energy savings, detection of faulty lights and maintenance time and increase in life span of system.

Anila Devi Y, worked on GSM Based Remote Control System of High Efficiency Intelligent Street Lighting System Using A Zigbee Network of Devices and Sensor. New intelligent and smart street light system is designed with wireless technology for maintenance and network of sensors for controlling. In which, they used high efficiency LED lamp which consumes less energy with high life time and which are supplied with renewable energy of solar panels.

2.3 TECHNOLOGY

2.3.1 Arduino IDE

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino_boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino_programming language (based on wiring), and the_Arduino software (IDE), based on processing.
Arduino programming language can be divided in three main parts: functions, values (variables and constants), and structure.
For controlling the Arduino board and performing computations, there are many functions.

2.3.1.1 Software

A program for Arduino hardware may be written in any programming language with compilers that produce binary machine code for the target processor. Atmel provides a development environment for their 8-bit AVR and 32-bit ARM Cortex-M based microcontrollers:

1) IDE

The Arduino integrated development environment (IDE) is a cross-platform application (for Windows, mac OS, and Linux) that is written in the programming language Java. It originated from the IDE for the languages *Processing* and *Wiring*. It includes a code editor with features such as text cutting and pasting, searching and replacing text, automatic indenting, brace matching, and syntax highlighting, and provides simple *one-click* mechanisms to compile and upload programs to an Arduino board. It also contains a message area, a text console, a toolbar with buttons for common functions and a hierarchy of operation menus. The source code for the IDE is released under the GNU General Public License, version 2.

The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub *main()* into an executable cyclic executive program with the GNU tool chain, also included with the IDE distribution. The Arduino IDE employs the program *avrdude* to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.

2) Pro IDE

On October 18, 2019, Arduino Pro IDE (alpha preview) was released. The system still uses Arduino CLI (Command Line Interface), but improvements include a more professional development environment, auto completion support, and Git integration. The application frontend is based on the Eclipse Theia Open Source IDE. The main features available in the alpha release are:

Modern, fully featured development environment

- Dual Mode, Classic Mode (identical to the Classic Arduino IDE) and Pro Mode (File System view)
- New Board Manager
- New Library Manager
- Board List
- Basic Auto-Completion (Arm targets only)
- Git Integration
- Serial Monitor
- Dark Mode

2.3.1.2 Arduino UNO 3

Arduino makes several different boards, each with different capabilities. In addition, part of being open source hardware means that others can modify and produce derivatives of Arduino boards that provide even more form factors and functionality. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a USB connection, a power jack, a reset button and more.

2.3.2 MicroController

A program for a microcontroller must be structured in the same manner as it functions. A microcontroller must be “aware” of its hardware environment and know how to interact with it.

A microcontroller can interact with other hardware components or devices only through these five ways:

1. Digital Input. This may be received in digital LOW or HIGH from other devices. These will be TTL logic levels or voltages converted to TTL logic levels before being applied to the GPIO.
2. Digital Output. This may be output that’s digital LOW or HIGH compared to other devices. Again, the output will be TTL logic levels.
3. Analog Input. It may “sense” analog voltage from other devices. The sensed voltage is converted to a digital value using a built-in, analog-to-digital converter.
4. Analog Output. It may output analog voltage to other devices. This analog output is not analog voltage but a PWM signal that approximates analog voltage levels.
5. Serial Communication. It may transmit, receive, or transceive data with other devices in serial, according to a standard serial data protocol such as UART, USART, I2C, SPI, microwire, 1-wire, and CAN, etc. The serial communication with other devices can be peer-to-peer (UART/USART), half-duplex (I2C), or full-duplex (SPI).

Users that know how to perform these five types of microcontroller interactions can interface any hardware with it.

An Arduino program or any microcontroller program must first have code for initialization. This may include:

- Defining variables and constants
- Setting up pinModes
- Setting up ADC/PWM channels
- Initializing settings for serial communications

A microcontroller simply intercepts incoming data, processes it according to programmed instructions, and outputs data through its I/O peripherals. This means the program must be organized in specific sections that can handle input data, process data, and control output.

Unlike desktop applications, µc programs are not designed to terminate. These programs keep iterating for an infinite number of times until the system is shut down or it meets failure. After a power shutdown, Arduino or any microcontroller resets on the “power resume” and begins execution of its program from the beginning.

The program includes code to handle failures when possible. So, any Arduino program can be visualized as a four-step program as follows:

1. Initialization

2. Input – this should include code for data validation and to handle incorrect or unexpected incoming data

3. Processing – this should include code for unexpected failures or exceptions raised while data processing

4. Output – this may include code for verification of expected results if the interfaced device can also communicate back to the microcontroller

2.3.3 Embedded C

In every embedded system based projects, Embedded C programming plays a key role to make the microcontroller run & perform the preferred actions. At present, we normally utilize several electronic devices like mobile phones, washing machines, security systems, refrigerators, digital cameras, etc. The controlling of these embedded devices can be done with the help of an embedded C program. For example in a digital camera, if we press a camera button to capture a photo then the microcontroller will execute the required function to click the image as well as to store it.

Embedded C programming builds with a set of functions where every function is a set of statements that are utilized to execute some particular tasks. Both the embedded C and C languages are the same and implemented through some fundamental elements like a variable, character set, keywords, data types, declaration of variables, expressions, statements. All these elements play a key role while writing an embedded C program.

The embedded system designers must know about the hardware architecture to write programs. These programs play a prominent role in monitoring and controlling external devices. They also directly operate and use the internal architecture of the microcontroller, such as interrupt handling, timers, serial communication, and other available features.

The embedded C program has a structure similar to C programming.

The five layers are:

1. Comments
2. Pre-processor directives
3. Global declaration
4. Local declaration
5. Main function()

Main Factors of Embedded C Program

- The main factors to be considered while choosing the programming language for developing an embedded system include the following.
- Program Size: Every programming language occupies some memory where embedded processor like microcontroller includes an extremely less amount of random access memory.
- Speed of the Program: The programming language should be very fast, so should run as quickly as possible. The speed of embedded hardware should not be reduced because of the slow-running software.
- Portability: For the different embedded processors, the compilation of similar programs can be done.
- Simple Implementation
- Simple Maintenance
- Readability

3. DESIGN AND BEHAVIOUR OF THE MODEL

3.1 EMBEDDED SYSTEM

An embedded system is a special-purpose system in which the computer is completely encapsulated by or dedicated to the device or system it controls. Unlike a general-purpose computer, such as a personal computer, an embedded system performs one or a few predefined tasks, usually with very specific requirements. Since the system is dedicated to specific tasks, design engineers can optimize it, reducing the size and cost of the product. Embedded systems are often mass-produced, benefiting from economies of scale.

Personal digital assistants (PDAs) or handheld computers are generally considered embedded devices because of the nature of their hardware design, even though they are more expandable in software terms. This line of definition continues to blur as devices expand. With the introduction of the OQO Model 2 with the Windows XP operating system and ports such as a USB port — both features usually belong to "general purpose computers", — the line of nomenclature blurs even more.

Embedded systems plays major role in electronics varies from portable devices to large stationary installations like digital watches and MP3 players, traffic lights, factory controllers, or the systems controlling nuclear power plants.

In terms of complexity embedded systems can range from very simple with a single microcontroller chip, to very complex with multiple units, peripherals and networks mounted inside a large chassis or enclosure.

Examples of Embedded Systems:

- Avionics, such as inertial guidance systems, flight control hardware/software and other integrated systems in aircraft and missiles
- Cellular telephones and telephone switches
- Engine controllers and antilock brake controllers for automobiles
- Home automation products, such as thermostats, air conditioners, sprinklers, and security monitoring systems
- Handheld calculators

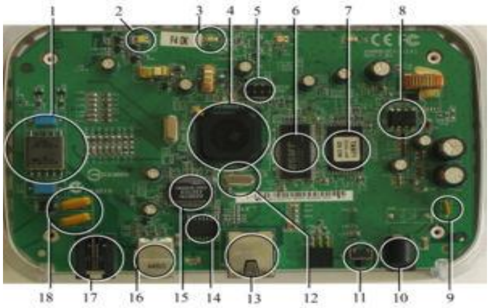

Fig 3.1 Embedded System

3.2 BLOCK DIAGRAMS

1) Flow chart

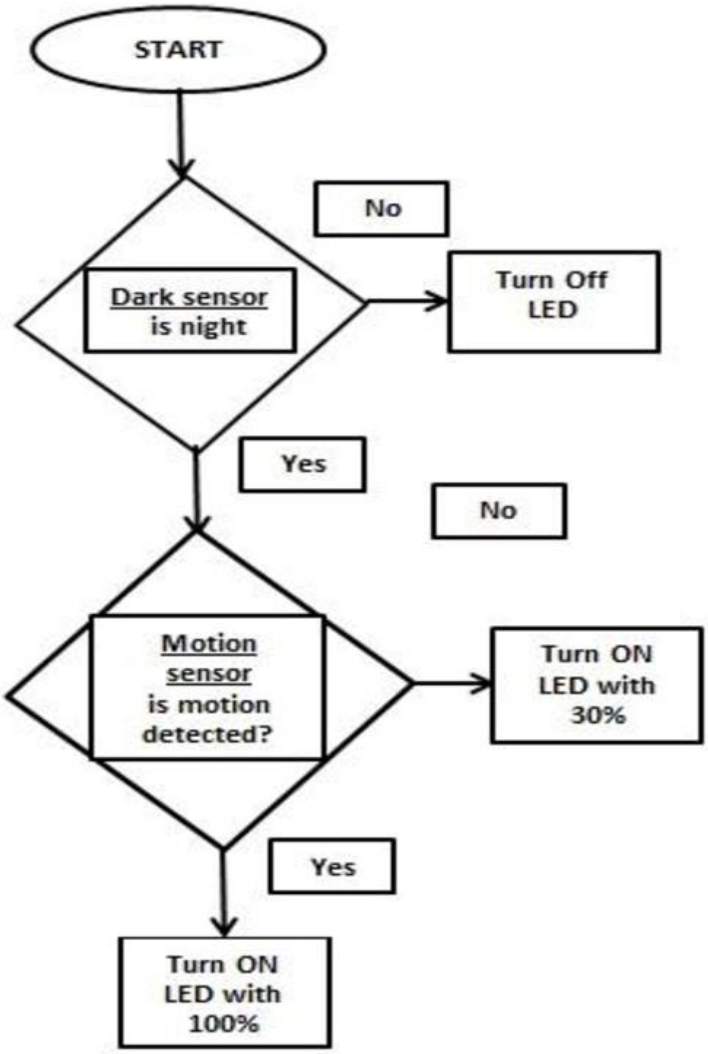

Fig 3.2 Flowchart of the model

2) Block Diagram

The block diagram depicts the basic model of the system being developed.

There are LED bulbs and IR sensors attached to each bulb. The system has a single LDR sensor. And a power supply.

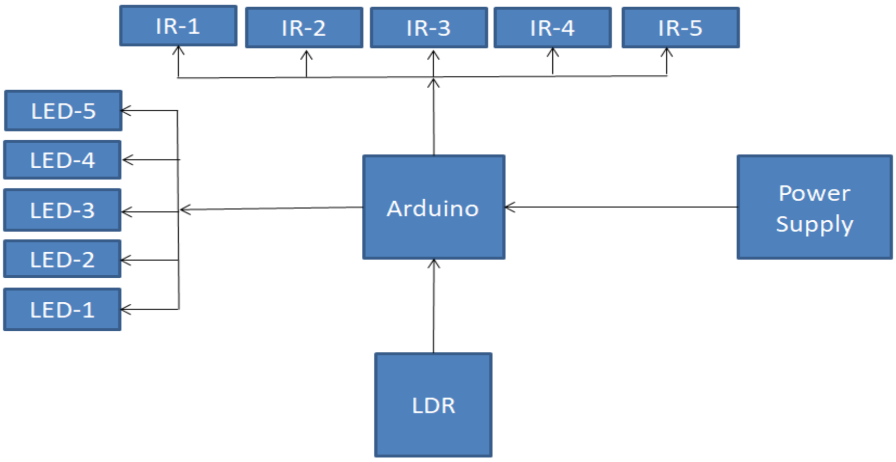

Fig 3.3 Detailed block diagram of proposed system

3) Circuit Diagram

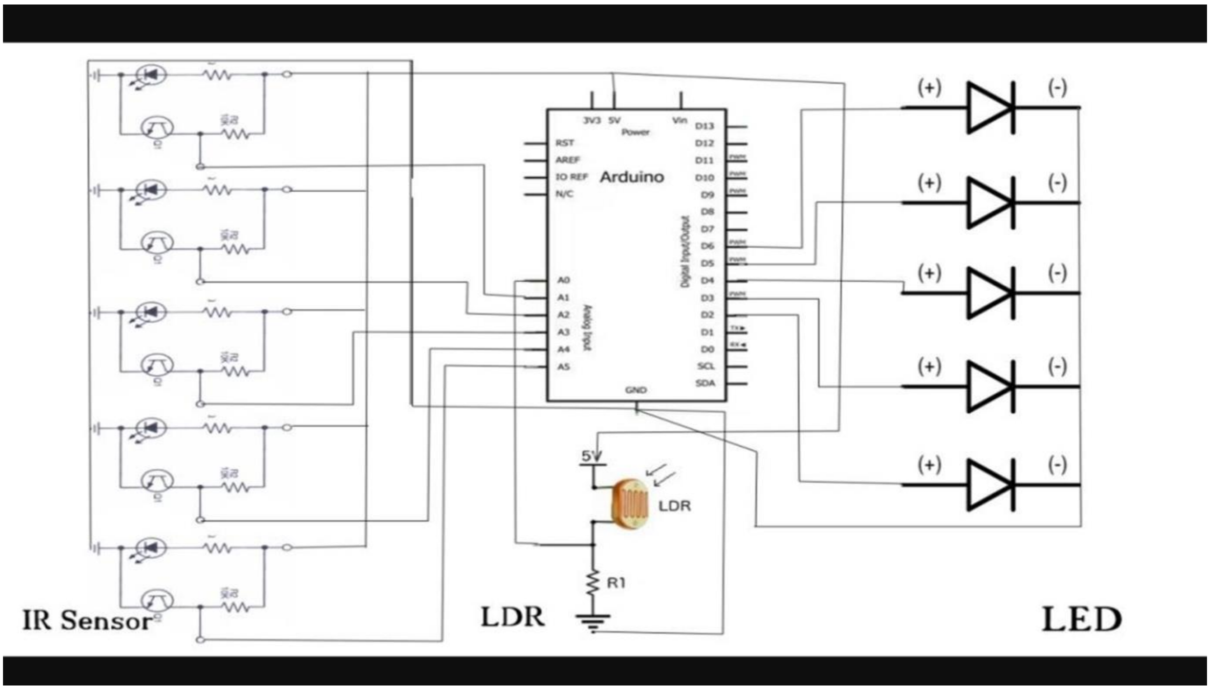

Fig 3.4 Circuit diagram

4) Schematic Diagram

In this project we required operating voltage for ARDUINO controller board is 12V/5V. Hence the 12V D.C. power supply is needed for the ARDUINO board.This regulated 12V is generated by stepping down the voltage from 230V to 18V now the step downed a.c voltage is being rectified by the Bridge Rectifier using 1N4007 diodes. The rectified a.c voltage is now filtered using a ‘C’ filter. Now the rectified, filtered D.C. voltage is fed to the Voltage Regulator. This voltage regulator provides/allows us to have a Regulated constant Voltage which is of +12V. The rectified; filtered and regulated voltage is again filtered for ripples using an electrolytic capacitor 100μF. Now the output from this section is fed to microcontroller board to supply operating voltage.

LCD is connected to 13, 12, 11, 10, 9, 8 pins

LDR1 sensor is connected to A0

IR sensors are connected to A1, A2, A3 and A4 pins

Street lights are connected 3, 5, 6 and 9th pins

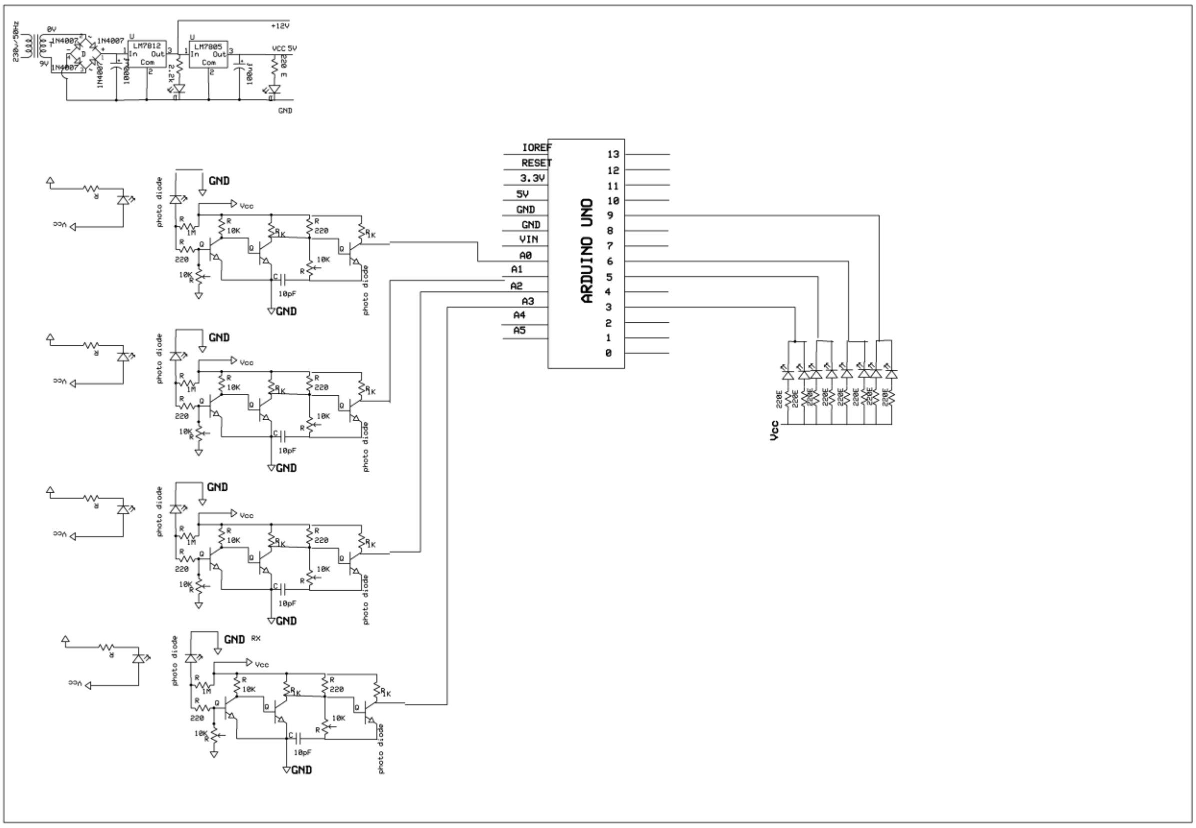

Fig 3.5: Schematic Diagram

4 IMPLEMENTATION

4.1 COMPONENT DESCRIPTION

1) Arduino UNO

The block diagram of the Smart streetlight is shown below. It works in accordance with the varying sunlight. Whenever there is sufficient sunlight in surroundings, LDR exhibits high resistance and acts as an insulator, while in darkness this LDR behaves as low resistance path and allows the flows of electricity, this LDR's operates with the help of IR sensors, these sensors are activated under low illumination conditions whenever it detects less light intensity it makes the corresponding bulb to glow with highest brightness and vice-versa.

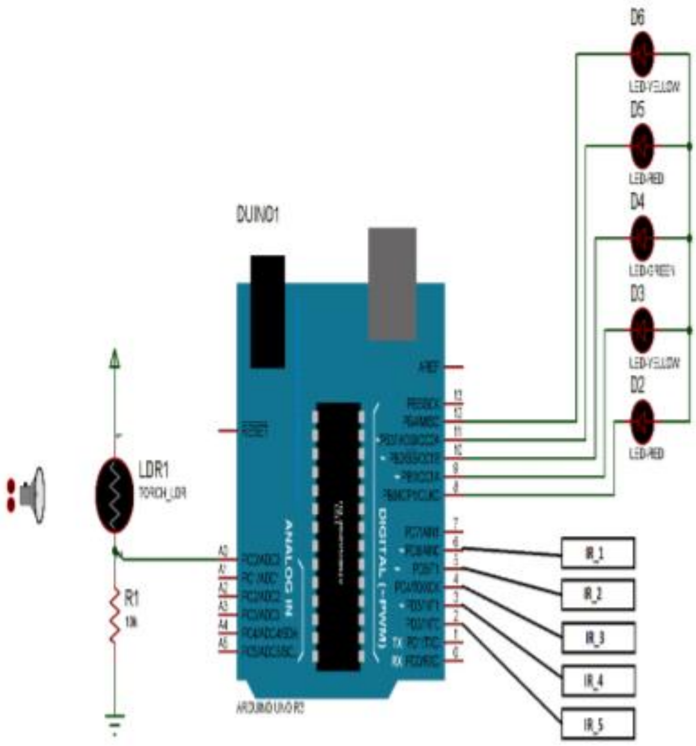

Fig 4.1: Arduino pins

Coding part is done using Arduino IDE which is dumped into the Arduino microcontroller using a USB port.

It is a microcontroller board based on the ATmega328. Arduino is an open-source, prototyping platform and its simplicity makes it ideal for hobbyists or novice to use as well as professionals. The Arduino Uno has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with AC-toDC adapter or battery to get started. The Arduino Uno R3 uses an ATmega16U2 instead of the 8U2 found on the Uno (or the FTDI found on previous generations). This allows for faster transfer rates and more memory. No drivers needed for Linux or Mac (in file for Windows is needed and included in the Arduino IDE), and the ability to have the Uno show up as a keyboard, mouse, joystick, etc. The Arduino Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip.

"Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. Preferred quality and originals are made in Italy. The Arduino Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform.

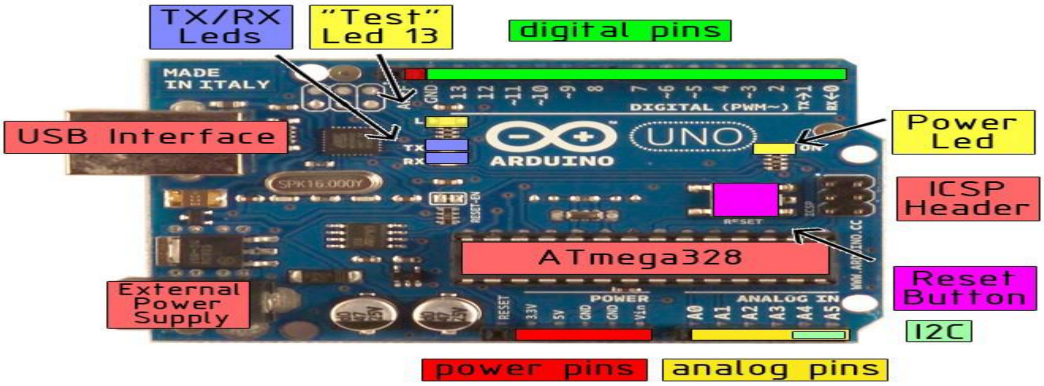

Fig 4.2: Arduino UNO

Features of the Arduino UNO:

- Microcontroller: ATmega328
- Operating Voltage: 5V
- Input Voltage (recommended): 7-12V
- Input Voltage (limits): 6-18V
- Digital I/O Pins: 14 (of which 6 provide PWM output)
- Analog Input Pins: 6
- DC Current per I/O Pin: 40 mA
- DC Current for 3.3V Pin: 50 mA
- Flash Memory: 32 KB of which 0.5 KB used by bootloader
- SRAM: 2 KB (ATmega328)
- EEPROM: 1 KB (ATmega328)
- Clock Speed: 16 MHz

The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically.

External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector.

The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.

The power pins are as follows:

VIN: The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.

5V: The regulated power supply used to power the microcontroller and other components on the board. This can come either from VIN via an on-board regulator, or be supplied by USB or another regulated 5V supply.

3V3: A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.

GND: Ground pins.

The Atmega328 has 32 KB of flash memory for storing code (of which 0,5 KB is used for the bootloader); It has also 2 KB of SRAM and 1 KB of EEPROM (which can be read and written with the EEPROM library).

Each of the 14 digital pins on the Uno can be used as an input or output, using pinMode(), digitalWrite(), and digitalRead() functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 kOhms. In addition, some pins have specialized functions:

Serial: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip .

External Interrupts: 2 and 3. These pins can be configured to trigger an interrupt on a low value, arising or falling edge, or a change in value. See the attachInterrupt () function for details.

PWM: 3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output with the analogWrite () function.

SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication, which, although provided by the underlying hardware, is not currently included in the Arduino language.

LED: 13 there is a built-in LED connected to digital pin 13.When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.

The Uno has 6 analog inputs, each of which provides 10 bits of resolution (i.e. 1024 different values). By default they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and the analogReference () function. Additionally, some pins have specialized functionality:

I2C: 4 (SDA) and 5 (SCL). Support I2C (TWI) communication using the Wire library.

There are a couple of other pins on the board:

AREF: Reference voltage for the analog inputs. Used with analogReference ().

Reset: Bring this line LOW to reset the microcontroller.Typically used to add a reset button to shields which block the one on the board.

See also the mapping between Arduino pins and Atmega328 ports.

The Arduino Uno has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers.

The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega8U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The '8U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, an *.inf file is required.

The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino board. The RX and TX LEDs on the board will flash when data is being transmitted via the USB-toserial chip and USB connection to the computer (but not for serial communication on pins 0 and 1).

A SoftwareSerial library allows for serial communication on any of the Uno's digital pins.

The ATmega328 also support I2C (TWI) and SPI communication. The Arduino software includes a Wire library to simplify use of the I2C bus; see the documentation for details. To use the SPI communication, please see the ATmega328 datasheet.

The Arduino Uno can be programmed with the Arduino software (download).ATmega328" from the Tools > Board menu (according to the microcontroller on your board).

The ATmega328 on the Arduino Uno comes preburned with a bootloader that allows you to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol (reference, C header files).

You can also bypass the bootloader and program the microcontroller through the ICSP (In-Circuit Serial Programming) header; see these instructions for details.

The ATmega8U2 firmware source code is available.The ATmega8U2 is loaded with a DFU bootloader, which can be activated by connecting the solder jumper on the back of the board (near the map of Italy) and then resetting the 8U2. You can then use Atmel's FLIP software (Windows) or the DFU programmer (Mac OS X

and Linux) to load a new firmware. Or you can use the ISP header with an external programmer (overwriting the DFU bootloader).
Rather than requiring a physical press of the reset button before an upload, the Arduino Uno is designed in a way that allows it to be reset by software running on a connected computer. One of the hardware flow control lines (DTR) of the ATmega8U2 is connected to the reset line of the ATmega328 via a 100 nanofarad capacitor. When this line is asserted (taken low), the reset line drops long enough to reset the chip.
The Arduino software uses this capability to allow you to upload code by simply pressing the upload button in the Arduino environment. This means that the bootloader can have a shorter timeout, as the lowering of DTR can be well-coordinated with the start of the upload.
This setup has other implications. When the Uno is connected to either a computer running Mac OS X or
Linux, it resets each time a connection is made to it from software (via USB). For the following half-second or so, the bootloader is running on the Uno. While it is programmed to ignore malformed data (i.e. anything besides an upload of new code), it will intercept the first few bytes of data sent to the board after a connection is opened. If a sketch running on the board receives one-time configuration or other data when it first starts, make sure that the software with which it communicates waits a second after opening the connection and before sending this data.
The Uno contains a trace that can be cut to disable the auto-reset. The pads on either side of the trace can be soldered together to re-enable it. It's labeled "RESET-EN". You may also be able to disable the auto-reset by connecting a 110 ohm resistor from 5V to the reset line; see this forum thread for details.
The Arduino Uno has a resettable polyfuse that protects your computer's USB ports from shorts and
Overcurrent.Although most computers provide their own internal protection, the fuse provides an extra layer of protection. If more than 500 mA is applied to the USB port, the fuse will automatically break the connection until the short or overload is removed.
The maximum length and width of the Uno PCB are 2.7 and 2.1 inches respectively, with the USB connector and power jack extending beyond the former dimension. Three screw holes allow the board to be attached to a surface or case. Note that the distance between digital pins 7 and 8 is 160 mil (0.16"), not an even multiple of the 100 mil spacing of the other pins
Arduino can sense the environment by receiving input from a variety of sensors and can affect its surroundings by controlling lights, motors, and other actuators.

The microcontroller on the board is programmed using the Arduino programming language (based on Wiring) and the Arduino development environment (based on Processing). Arduino projects can be stand-alone or they can communicate with software on running on a computer (e.g. Flash, Processing, Max MSP).

2)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 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. Usually in the infrared spectrum, all the objects radiate some form of thermal radiations. These types of radiations are invisible to our eyes that can be detected by an infrared sensor. The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, the resistances and these output voltages, change in proportion to the magnitude of the IR light received. An IR sensor is a device which detects IR radiation falling on it. There are numerous types of IR sensors that are built and can be built depending on the application. Proximity sensors (Used in Touch Screen phones and Edge Avoiding Robots), contrast sensors (Used in Line Following Robots) and obstruction counters/sensors (Used for counting goods and in Burglar Alarms) are some examples, which use IR sensors.

Working Mechanism:

An IR sensor is basically a device which consists of a pair of an IR LED and a photodiode which are collectively called a photo-coupler or an opto-coupler. The IR LED emits IR radiation, reception and/or intensity of reception of which by the photodiode dictates the output of the sensor. Now, there are so many ways by which the radiation may or may not be able to reach the photodiode.

Motion Detection:

According to problem statement (2) all the classical street lights are remain switched on from 6 pm to 6 am whether there is a pedestrian or vehicle is present or not present of any activity. The most probable peak time of movement is from 6 pm to 10 pm in a smart city; so after 10pm all the street lights are glowing at its full intensity which leads to loss of enormous amount of energy. So to overcome this problem if we can install a small motion detection device which will control the street light to glow at its 100% only in the presence of any activity in the street. To overcome this problem we can use IR sensor or proximity sensor or photoelectric beam detector.

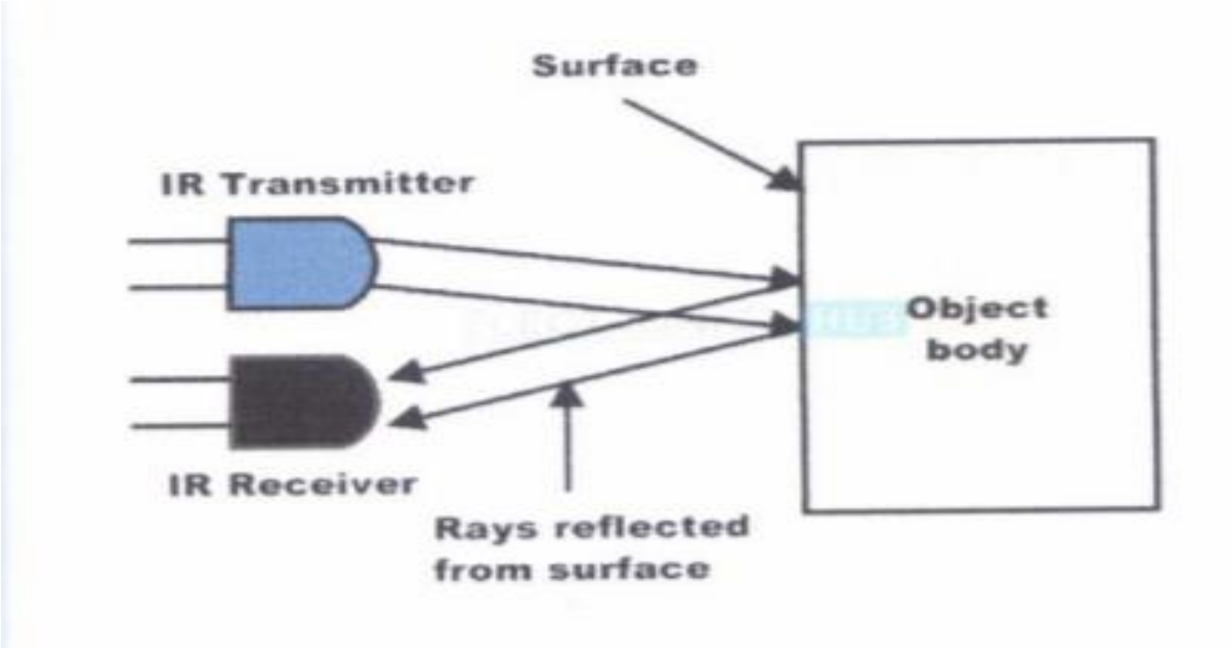

Fig 4.3: Working of IR Sensor

Direct incidence:

We may hold the IR LED directly in front of the photodiode, such that almost all the radiation emitted, reaches the photodiode. This creates an invisible line of IR radiation between the IR LED and the photodiode. Now, if an opaque object is placed obstructing this line, the radiation will not reach the photodiode and will get either reflected or absorbed by the obstructing object. This mechanism is used in object counters and burglar alarms.

Indirect Incidence:

High school physics taught us that black color absorbs all radiation, and the color white reflects all radiation. We use this very knowledge to build our IR sensor. If we place the IR LED and the photodiode side by side, close together, the radiation from the IR LED will get emitted straight in the direction to which the IR LED is pointing towards, and so is the photodiode, and hence there will be no incidence of the radiation on the photodiode. Please refer to the right part of the illustration given below for better understanding. But, if we place an opaque object in front the two, two cases occur.

1) Reflective Surface:

If the object is reflective, (White or some other light color), then most of the radiation will get reflected by it, and will get incident on the photodiode. For further understanding, please refer to the left part of the illustration below.

2) Non-reflective Surface:

If the object is non-reflective, (Black or some other dark color), then most of the radiation will get absorbed by it, and will not become incident on the photodiode. It is similar to there being no surface (object) at all, for the sensor, as in both the cases, it does not receive any radiation.

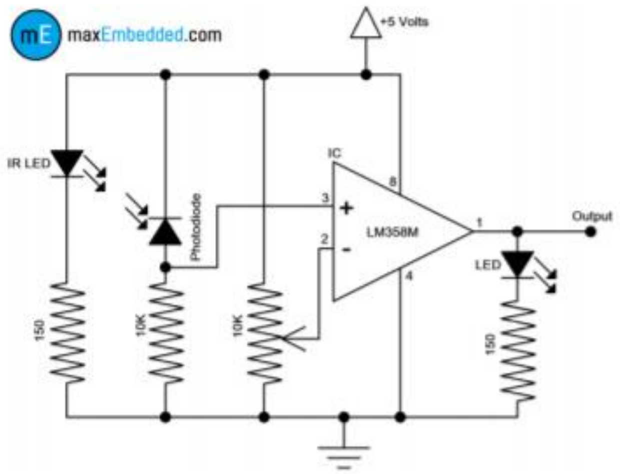

Fig. 2.2 Circuit Diagram of IR Sensor

Fig. 2.3 IR Sensor

Fig 4.4:Circuit Diagram of IR Sensor Fig 4.5 :IR Sensor

3) Light Dependent Resistor Circuit

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. The best-known devices of this type are the light dependent resistor (LDR), the photo diode and the phototransistors. Light dependent resistor as the name suggests depends on light for the variation of resistance. LDR are made by depositing a film of cadmium sulphide or cadmium selenide on a substrate of ceramic containing no or very few free electrons when not illuminated .

The longer the strip the more the value of resistance. When light falls on the strip, the resistance decreases. In the absence of light the resistance can be in the order of 10K ohm to 15K ohm and is called the dark resistance. Depending on the exposure of light the resistance can fall down to value of 500 ohms. The power ratings are usually smaller and are in the range 50mw to .5w. Though very sensitive to light, the switching time is very high and hence cannot be used for high frequency applications. They are used in chopper amplifiers. Light dependent resistors are available as discs 0.5cm to 2.5cm. The resistance rises to several Mega ohms under dark conditions. The device consists of a pair of metal film contacts separated by a snakelike track of cadmium sulphide film, designed to provide the maximum possible contact area with the two metal films. The structure is housed in a clear plastic or resin case, to provide free access to external light. Practical LDRs are available in variety of sizes and packages styles, the most popular size having a face diameter of roughly 10mm.

When an LDR is brought from a certain illuminating level into total darkness, the resistance does not increase immediately to the dark value. The recovery rate is specified in k ohm/second and for current LDR types it is more than 200k ohm/second. The recovery rate is much greater in the reverse direction, e.g. going from darkness to illumination level of 300 lux, it takes less than 10ms to reach a resistance which corresponds with a light level of 400 lux. A LDR may be connected either way round and no special precautions are required during the time of soldering.

Darkness:

Maximum resistance, about 1Mega ohm

Very bright light:

Minimum resistance, about 100 ohm. The LDR is a variable resistor whose resistance decreases with the increase in light intensity. Two cadmium photoconductive cells with spectral response are very similar to that of the human eye. The cell resistance falls with increasing light intensity. Some of its features:

1. High reliability.

2. Light weight.

3. Wide spectral response.

4. Wide ambient temperature range.

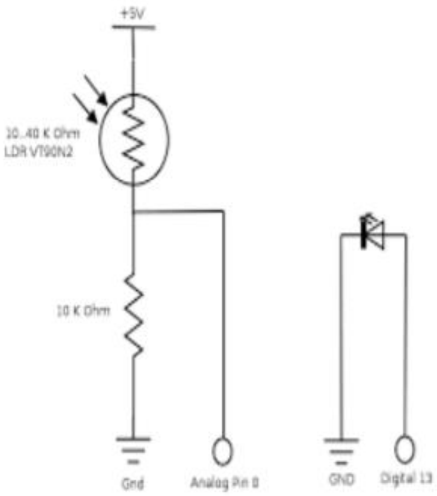

Fig. 2.4 LDR Circuit

Fig. 2.5 Light Dependant Resistor

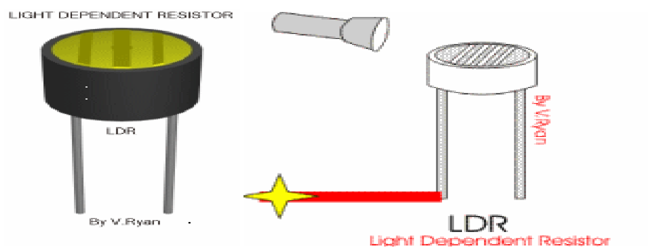

Fig 4.6 LDR Sensor 1

The general purpose photoconductive cell is also known as LDR – light dependent resistor. It is a type of semiconductor and its conductivity changes with proportional change in the intensity of light. The complete principle of an LDR is as follows. In a semiconductor an energy gap exists between conduction electrons and valence electrons. As an LDR is also known as semiconductor photo-conductive transducer, when light is incident on it, a photon is absorbed and thereby it excites an electron from valence band into conduction band. Due to such new electrons coming up in conduction band area, the electrical resistance of the device decreases. Thus the LDR or photo-conductive transducer has the resistance which is the inverse function of radiation intensity.

$$\lambda_0 = \frac{h.c}{e.E_\omega}$$

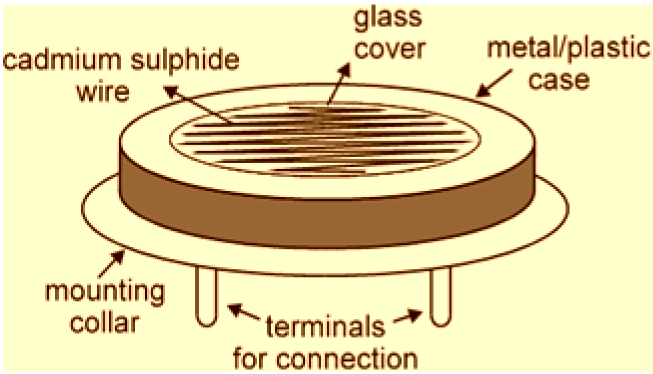

Fig 4.7 : LDR sensor 2

4) 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 (less than 1 mm to 2mm) and integrated optical components may be used to shape the radiation pattern. LEDs are versatile semiconductor with a number of attributes which make them perfect for most applications. Their features include:

• Long Life: LEDs can last over 100,000 hours (10+ years) if used at rated current

• No annoying flicker as we experience with fluorescent lamps.

• LEDs are impervious to heat, cold, shock and vibration.

• LEDs do not contain breakable glass.

• Solid-State, high shock and vibration resistant

• Extremely fast turn on/off times

• Low power consumption puts fewer loads on the electrical systems increasing battery life.

Here we have used the most common 5mm white light. White LEDs are perfect for replacing inefficient incandescent bulbs in night lights and path lights.

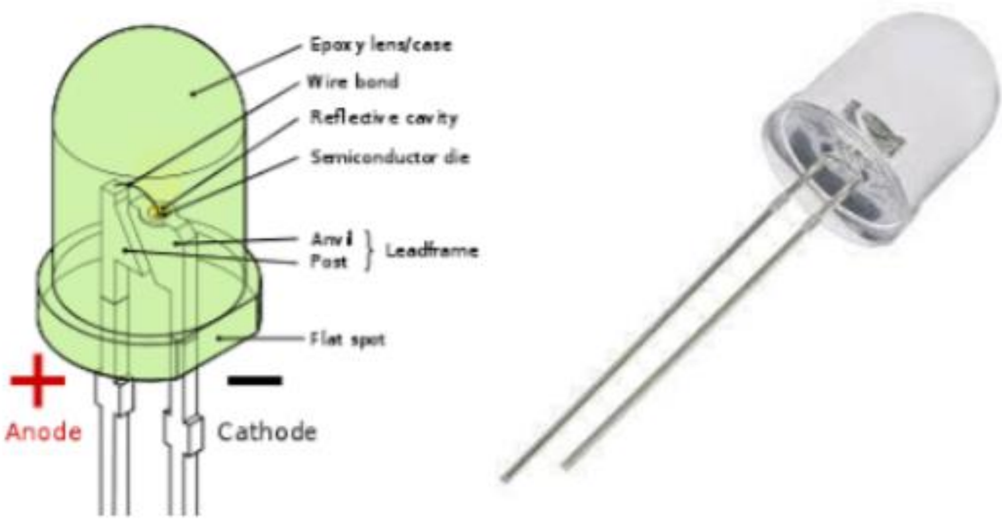

Fig4.8: LED

CAUTIONS:

LEDs produce a focused light source and extra care should be used for your eyes, though intensity is not very high. While testing the LEDs a resistance must be applied to it. Also, being a semiconductor device, they are sensitive to static charges.

5) Power Supply

The power supply is designed to convert high voltage AC mains electricity to a suitable low voltage supply for electronic circuits and other devices. A power supply can by broken down into a series of blocks, each of which performs a particular function. A D.C. power supply which maintains the output voltage constant irrespective of a.c mains fluctuations or load variations is known as "Regulated D.C Power Supply"

For example a 5V regulated power supply system as shown below:

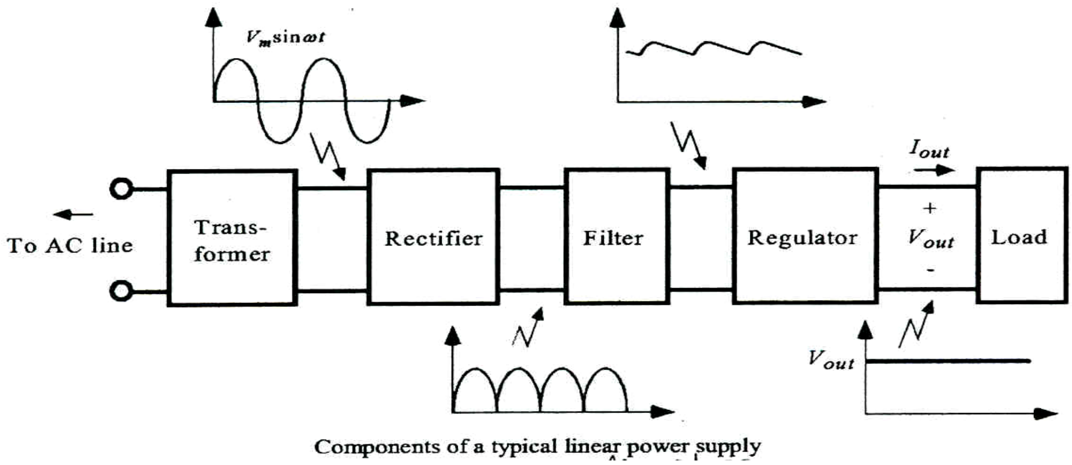

Fig 4.9: Functional Block Diagram of Power supply

6)Transformer:

A transformer is an electrical device which is used to convert electrical power from one electrical circuit to another without change in frequency.

Transformers convert AC electricity from one voltage to another with little loss of power. Transformers work only with AC and this is one of the reasons why mains electricity is AC. Step-up transformers increase in output voltage, step-down transformers decrease in output voltage. Most power supplies use a step-down transformer to reduce the dangerously high mains voltage to a safer low voltage. The input coil is called the primary and the output coil is called the secondary. There is no electrical connection between the two coils; instead they are linked by an alternating magnetic field created in the soft-iron core of the transformer. The two lines in the middle of the circuit symbol represent the core. Transformers waste very little power so the power out is (almost) equal to the power in. Note that as voltage is stepped down current is stepped up. The ratio of the number of turns on each coil, called the turn's ratio, determines the ratio of the voltages. A step-down transformer has a large number of turns on its primary (input) coil which is connected to the high voltage mains supply, and a small number of turns on its secondary (output) coil to give a low output voltage.

Fig 4.10: An Electrical Transformer

Turns ratio = $V_p / V_S = N_p / N_S$

Power Out= Power In

$V_S \times I_S = V_P \times I_P$

V_p = primary (input) voltage
N_p = number of turns on primary coil
I_p = primary (input) current

7) Rectifier

A circuit, which is used to convert a.c to dc, is known as RECTIFIER. The process of conversion a.c to d.c is called “rectification”

Types of Rectifiers:

- Half wave Rectifier
- Full wave rectifier
    1. Center tap full wave rectifier.
    2. Bridge type full bridge rectifier.

Full-wave Rectifier: From the above comparisons we came to know that full wave bridge rectifier as more advantages than the other two rectifiers. So, in our project we are using full wave bridge rectifier circuit.

Bridge Rectifier: A bridge rectifier makes use of four diodes in a bridge arrangement to achieve full-wave rectification. This is a widely used configuration, both with individual diodes wired as shown and with single component bridges where the diode bridge is wired internally.

A bridge rectifier makes use of four diodes in a bridge arrangement as shown in fig(a) to achieve full-wave rectification. This is a widely used configuration, both with individual diodes wired as shown and with single component bridges where the diode bridge is wired internally.

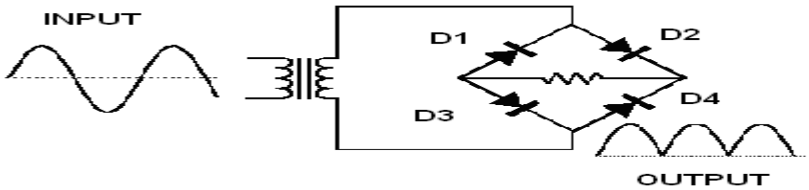

Fig 4.11: Bridge rectifier

Operation:

During positive half cycle of secondary, the diodes D2 and D3 are in forward biased while D1 and D4 are in reverse biased as shown in the fig(b). The current flow direction is shown in the fig (b) with dotted arrows.

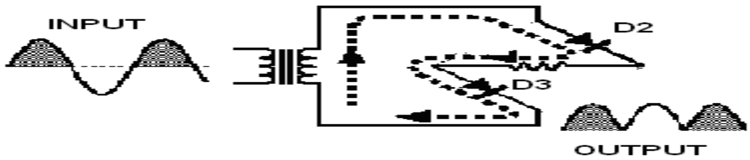

Fig 4.12: positive half cycle

During negative half cycle of secondary voltage, the diodes D1 and D4 are in forward biased while D2 and D3 are in reverse biased as shown in the fig(c). The current flow direction is shown in the fig (c) with dotted arrows.

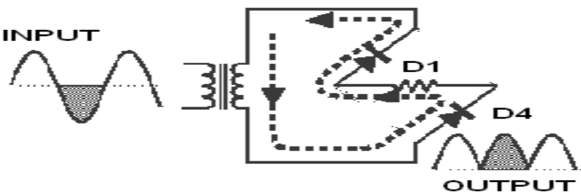

Fig 4.13: negative half cycle

8) Regulator:

Voltage regulator ICs is available with fixed (typically 5, 12 and 15V) or variable output voltages. The maximum current they can pass also rates them. Negative voltage regulators are available, mainly for use in dual supplies. Most regulators include some automatic protection from excessive current ('overload protection') and overheating ('thermal protection'). Many of the fixed voltage regulator ICs has 3 leads and look like power transistors, such as the 7805 +5V 1A regulator shown on the right. The LM7805 is simple to use. You simply connect the positive lead of your unregulated DC power supply (anything from 9VDC to 24VDC) to the Input pin, connect the negative lead to the Common pin and then when you turn on the power, you get a 5 volt supply from the output pin.

Fig 4.14: A Three Terminal Voltage Regulator

Features:

• Output Current of 1.5A

• Output Voltage Tolerance of 5%

• Internal thermal overload protection

• Internal Short-Circuit Limited

• No External Component

• Output Voltage 5.0V, 6V, 8V, 9V, 10V, 12V, 15V, 18V, 24V

• Offer in plastic TO-252, TO-220 & TO-263

• Direct Replacement for LM78XX

4.2 WORKING PROCEDURE

The working procedure of the Smart street light using IR sensors is explained below. The following are the different steps included in building a Smart street light.

1. Output of the LDR pin is connected to A0 (Analog) port of Arduino Uno board.

2. Connect all output of the IR sensors to port numbers A1, A2, A3, A4 and A5 respectively (Analog) which is the input signal to the Arduino board.

3. Connect the ground of all the IR sensors to GND port.

4. The output signals from LED are connected to port number 5, 6, 9, 10 and 11 respectively.

5. Again connect all the negative terminals of LED’s to GND port. 6. Power is passed to the Arduino (7-12V)

When any object comes in the range of IR sensors, as IR LED emits the radiations and reflected back to IR photodiode by the object. Hence, object is detected. The heart of Arduino circuit is the low power, high performance Arduino micro controller is programmed by embedded assembly programming language for implementing these tasks; this program is stored and operated by means of storage device EPROM.

The intensity of LED’s is remained at low initially (when no object is detected, at no natural light condition) by Arduino using Pulse Width Modulation (PWM) technique where analog signal is converted to digital signal, ON-OFF process of LEDs take place so rapidly in such a way, the LEDs seem to glow dimly when seen by naked eye. Hence, intensity of LEDs are controlled by varying duty cycle. While coming to the functional block i.e. LDR, LEDs, IR sensors, these components are in expensive, smaller in size, less complexity, highly reliable, low power applications, minimum risk with greater accuracy.

The project is successfully implemented in many areas based on the experimental verification proving that it can save the electrical power to greater extent removing the manual work completely; the system became the origin for upcoming advanced intelligent systems in saving both human and electrical power. The switching of the LEDs are operated through coding applied in Arduino using Arduino software.

5. RESULTS

SOFTWARE:

Before You Start Controlling the World around You, You'll need To Set up the Software to Program Your Board.

Use the Online IDE (Arduino Web Editor) Arduino IDE

1. Arduino UNO board along with the USB cable and DC power supplies.
2. Download the IDE: http://www.arduino.cc
3. Mac, Windows and Penguin friendly versions available.
4. After installation it will be ready to work.

Fig 5.1: Arduino 1

The main features you need to know about are:

- Code area: This is where you will type all your code
- Verify: This allows you to compile your code to code the Arduino understands. Any mistakes you have made in the syntax of your code will be show in the info panel
- Upload: This does the same as verify but will then send your code to your Arduino if the code is verified successfully
- Info panel: This will show any errors during compiling or uploading code to your Arduino
- Serial Monitor: This will open a window that allows you to send text to and from an Arduino. We will use this feature in later lectures.

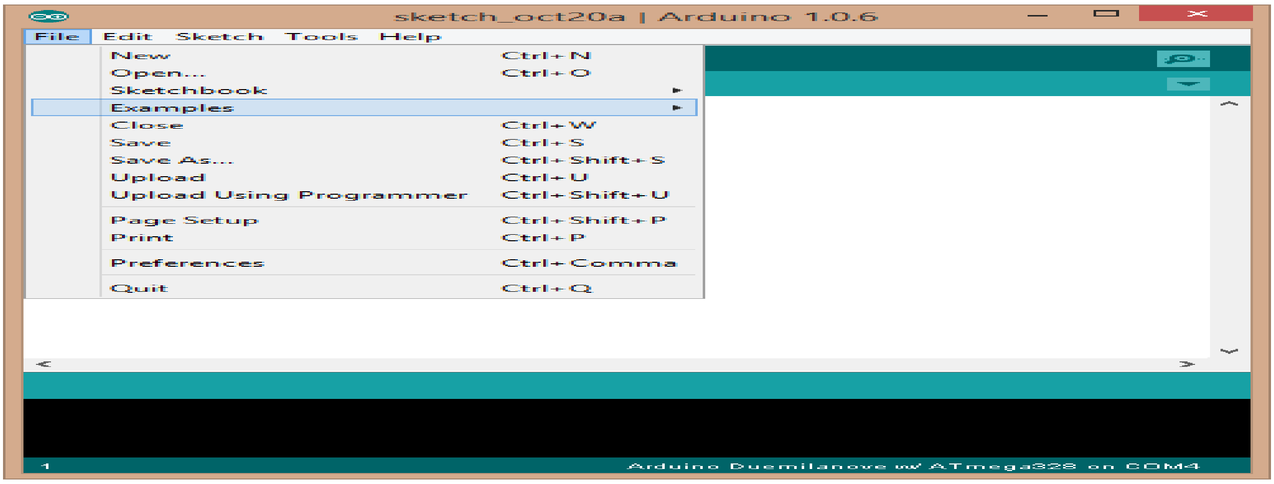

Fig 5.2: Arduino 2

By far one of the most valuable part of the Arduino software is its vast library of example programs. All features of the Arduino are demonstrated in these. Optional libraries usually add their own examples on how to use them. Arduino shields will often come with their own libraries and therefore their own examples.

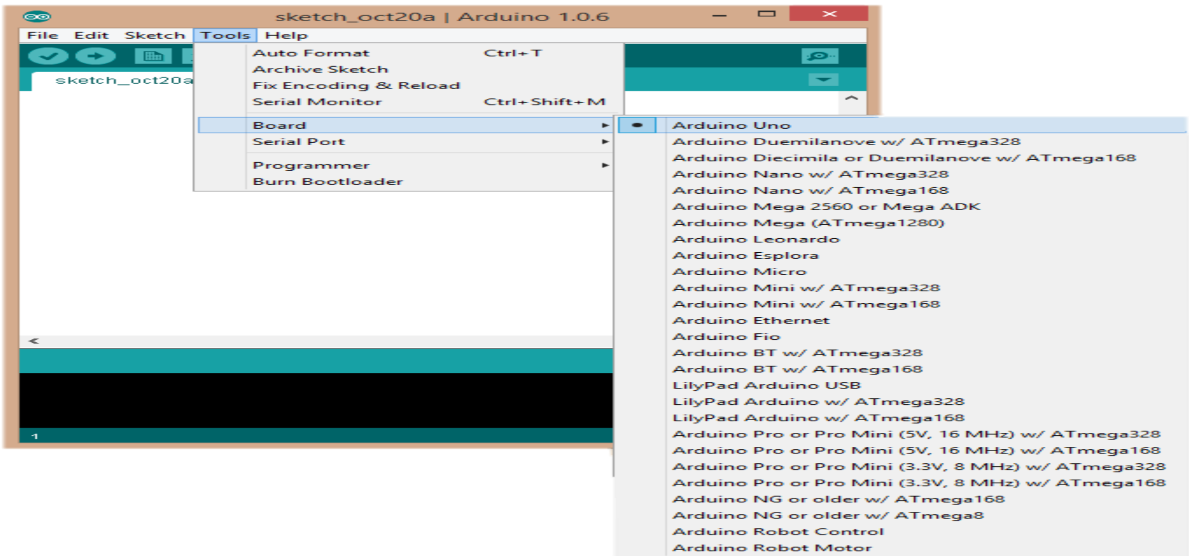

Fig 5.3: Arduino 3

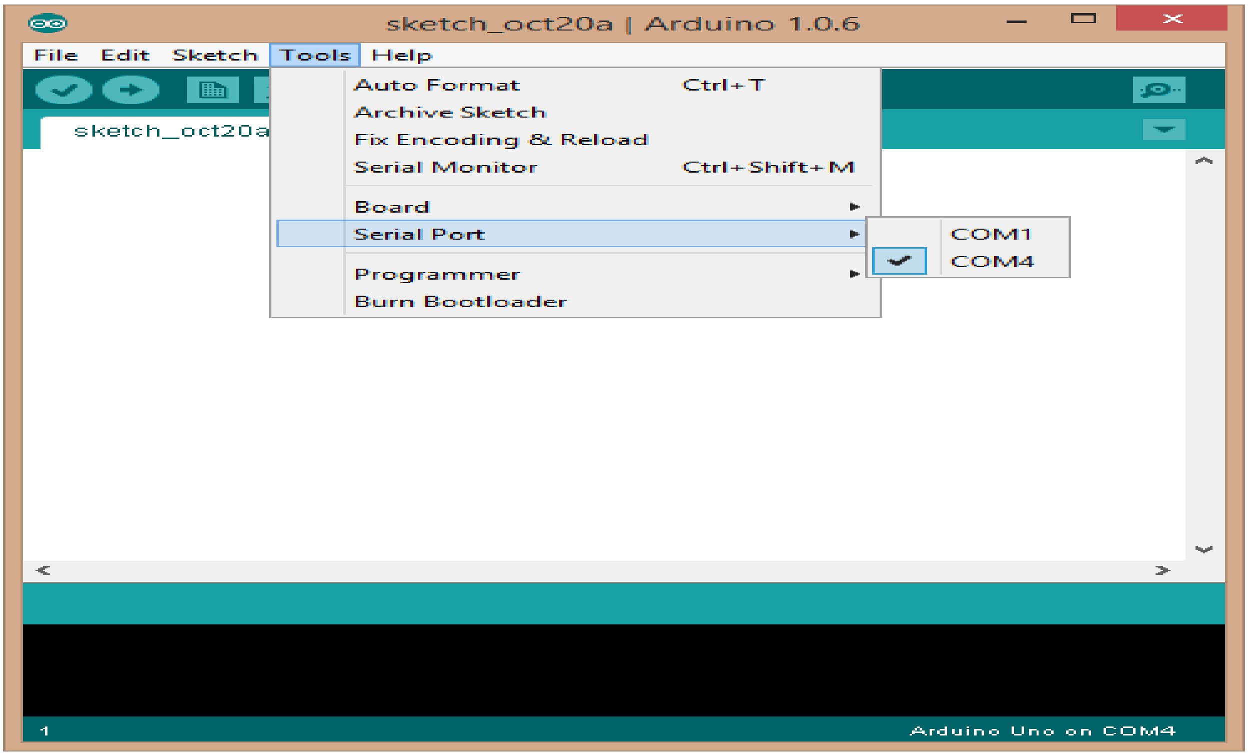

Fig 5.4: Arduino 4

Used functions:

- pinMode();
- digitalRead();
- digitalWrite();
- delay(time_ms);
- Serial.begin();
- lcd.begin();
- analogRead();
- analogWrite();

5.1 Output

1) With all the connections connected and placed on a cardboard with NO power supply.

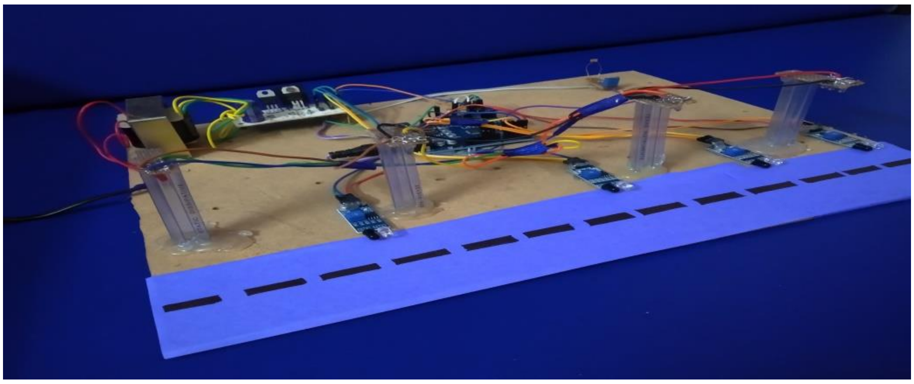

Fig 5.5: Output 1

2) Power supply is ON and the light is in the visible region.

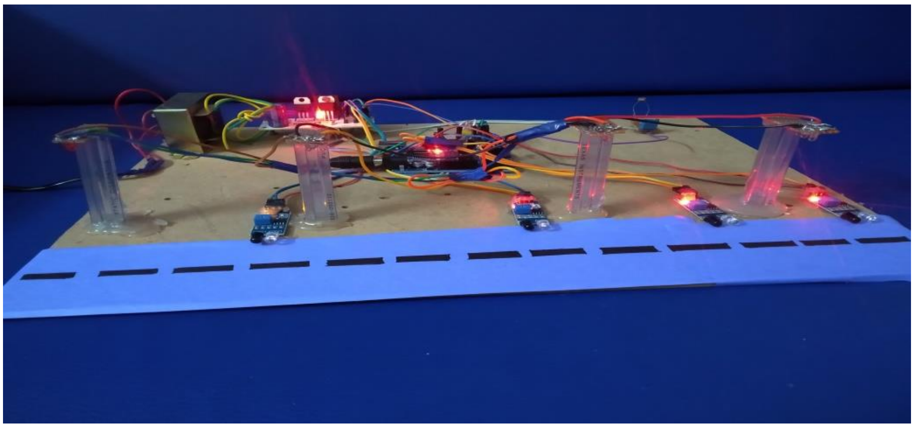

Fig 5.6: Output 2

3) When the light is not in the visible region.

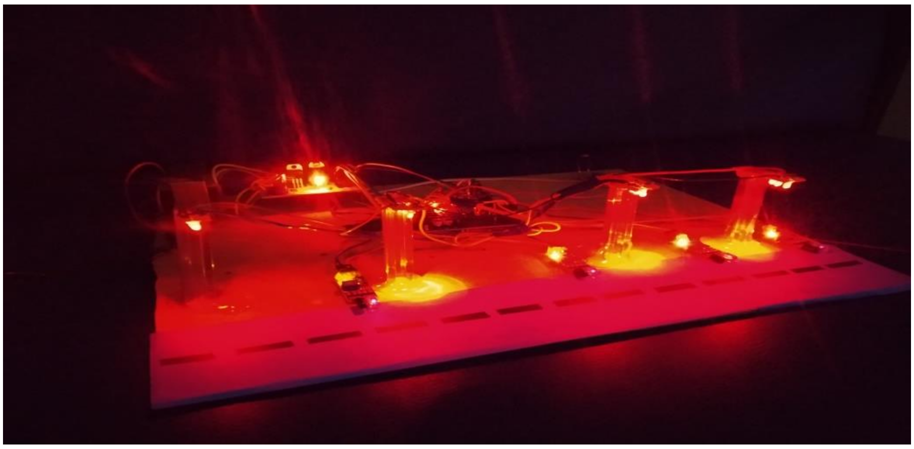

Fig 5.7: Output 3

4) When there is no light in the surroundings (the LDR sensor is covered with hand) the LEDs start glowing.

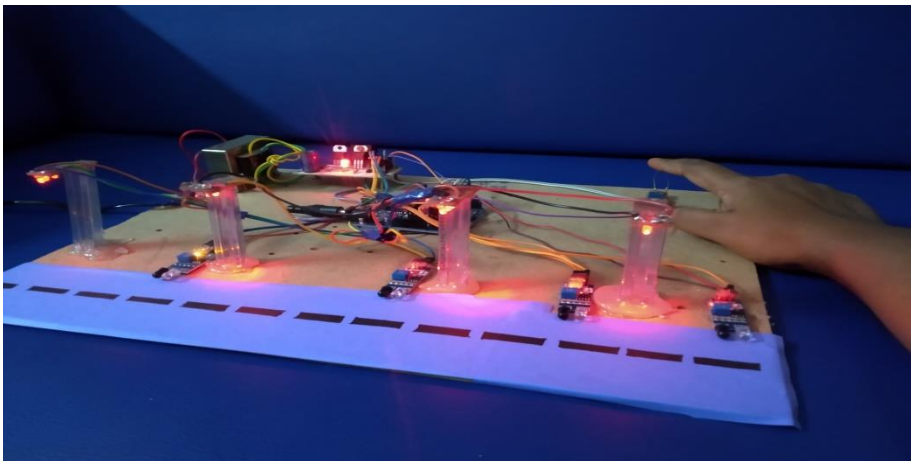

Fig 5.8: Output 4

5) When vehicle is detected at a sensor the LED corresponding to that sensor glows with highest brightness.

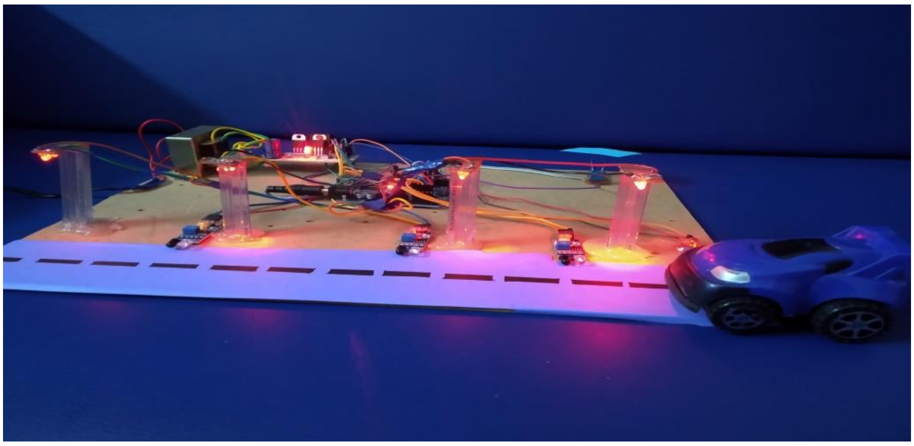

Fig 5.9: Output 5

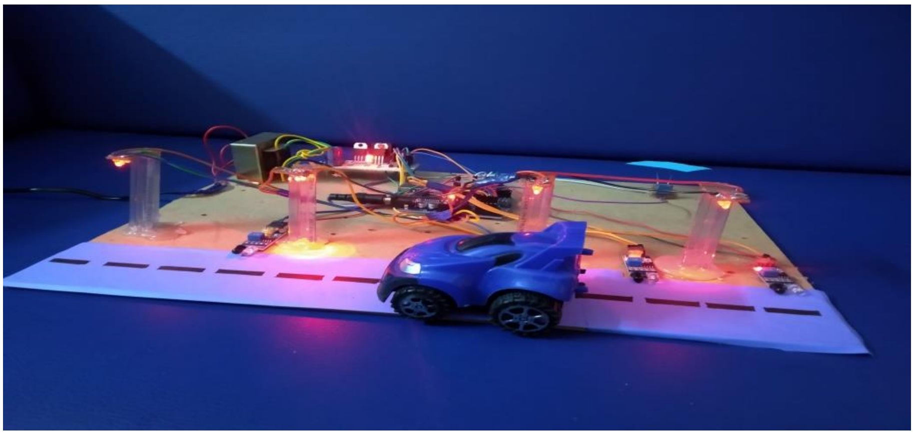

Fig 5.10: Output 6

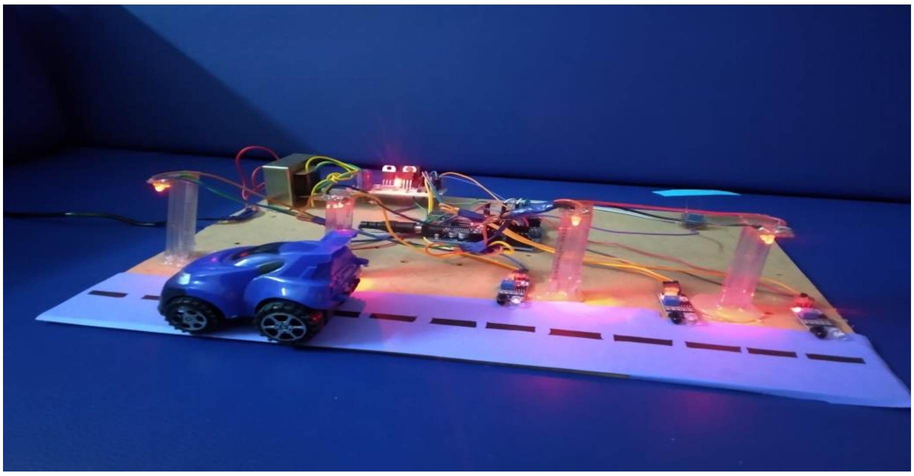

Fig 5.11: Output 7

6. CONCLUSION AND FUTURE ENHANCEMENTS

Conclusion

So, we here by conclude that the proposed smart street light control system has many benefits while compared to the existing systems, even though we can't come to an conclusion without testing the project but with the provided flow charts and the diagrams and pictures, we can be confident that the proposed project will perform better than the existing projects and systems. Therefore we can be saving an enormous amount of electricity; this system also prevents the unnecessary wastage of electricity by the manual switching of the street lights which is made possible by the sensors available, this smart street light control system can be installed both in the urban and also in the rural areas. The advantages of this system are reducing in consumption of the electricity and also to increase the life span of the system.

Future scope

Energy efficiency is one of the key factors while designing indoor or outdoor lighting systems. The street lights consume almost 30%–40% of the entire city power consumption. For this aim, because of its design based on the old lighting standards and inefficient instruments and devices, the traditional lighting systems are not suitable resulting in energy losses. Main aim is to automate street power saving system to save the power. We want to save the power automatically instead of doing it manually. So, it's easy to make it cost efficient. This saved power can be used in some other cases. Hence, in villages, towns, etc. we can design intelligent systems for the usage of street lights.

As each street light is connected with IOT devices the power consumption analysis can be made which is quite useful to decide the addition of more lights or vice-versa. The project can also be extended to send alert messages to the concerned person in case of any issues. Different sensors can be added to the system like ultra-sonic sensor to sense the objects 360 degrees; single sensor can be connected to multiple LED bulbs so that the concerned area where the vehicle enters is enlarged.

REFERENCES

1)Books

[1] Exploring Arduino: Tools and Techniques for Engineering Wizardry Second edition, by Jeremy Blum

[2] Smart Sensors at the IOT Frontier, Springer , Hiroto Yasuura, Chong-Min Kyug, Yongpan Liu

2)Papers

[1] IOT based Street Lighting and Traffic Management System, 2017 IEEE region 10 Humanitarian Technology Conference

[2] Automated Street lighting system using IOT, IEEE 2020

3) Journals

[1] Archana. G, Aishwarya N, Anitha J "Intelligent Street Light System" International Journal of Recent Advances in Engineering & Technology, Vol-3, Issue-4, 2019.

[2] AkshayBalachandran, Murali Siva, V. Parthasarathi, Surya and Shriram K. Vasudevan "An Innovation in the Field of Street Lighting System with Cost and Energy Efficiency"Indian Journal of Science and Technology,Vol-8, August 2017

[3] DeepanshuKhandelwal, Bijo M Thomas, KritikaMehndiratta, Nitin Kumar "Sensor Based Automatic Street Lighting system" International Journal of Education and Science Research Review Volume-2, Issue-2 April- 2015 .

[4] IsahAbdulazeez Watson, OshomahAbdulaiBraimah, Alexander Omoregie " Design and Implementation of an Automatic Street Light Control System" International Journal of Emerging Technology and Advanced Engineering, Volume 5, Issue 3, March 2015