SIDDAGANGA INSTITUTE OF TECHNOLOGY, TUMAKURU-572103

(An Autonomous Institute under Visvesvaraya Technological University, Belagavi)

Project Report on

"Movement Based Smart Street Light System"

submitted in partial fulfillment of the requirement for the completion of VI semester of

BACHELOR OF ENGINEERING

in

ELECTRONICS & COMMUNICATION ENGINEERING

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2020-21

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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

CERTIFICATE

Certified that the mini project work entitled "MOVEMENT BASED SMART STREET LIGHT SYSTEM" is a bonafide work carried out by NEKEEL N (1SI18EC062), SINDHURA K (1SI18EC098), SUSHMA S (1SI18EC110) and YASHAS A JAIN (1SI18EC119) in partial fulfillment for the completion of VI Semister of Bachelor of Engineering in Electronics & Communication Engineering from Siddaganga Institute of Technology, an autonomous institute under Visvesvaraya Technological University, Belagavi during the academic year 2020-21 It is certified that all corrections/suggestions indicated for internal assessment have been incorporated in the report deposited in the department library. The Mini project report has been approved as it satisfies the academic requirements in respect of project work prescribed for the Bachelor of Engineering degree.

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We offer our humble pranams at the lotus feet of **His** Holiness, **Dr. Sree Sree Sivakumara Swamigalu**, Founder President and **His** Holiness, **Sree Sree Siddalinga Swamigalu**, President, Sree Siddaganga Education Society, Sree Siddaganga Math for bestowing upon their blessings.

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Course Outcomes

CO 1 : Identify , formulate the problem and define the objectives

CO 2 : Review the literature and provide efficient design solution with appropriate consideration for societal, health and safety issues

CO 3 : Select the engineering tools/components and develop an experimental setup to validate the design

CO 4 : Test, analyse and interpret the results of the experiments in compliance with the defined objectives

CO 5 : Document as per the standard, present effectively the work following professional ethics and interact with target group

CO 6 : Contribute to the team, lead the diverse team, demonstrating engineering and management principles

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1	3												3	
CO-2		2				1							2	1
CO-3			2		2							2	2	2
CO-4				2										2
CO-5								2		2		2		2
CO-6									2		1			1
Average	3	2	2	2	2	1		2	2	2	1	2	2	2

Attainment level: - 1: Slight (low) 2: Moderate (medium) 3: Substantial (high)

POs: PO1: Engineering Knowledge, PO2: Problem analysis, PO3: Design/Development of solutions, PO4: Conduct investigations of complex problems, PO5: Modern tool usage, PO6: Engineer and society, PO7: Environment and sustainability, PO8: Ethics, PO9: Individual and team work, PO10: Communication, PO11: Project management and finance, PO12: Lifelong learning

Abstract

With the raise in demand for power and the increasing gap between demand and supply issues such as power outages and usage of bright lights in low foot fall areas, lead to enormous consumption of electric energy.

To optimize the consumption of power, this project proposes a smart streetlight system which is more energy efficient and does not compromise the needs and safety of citizens, smart street light system is implemented using light intensity sensor, motion sensor and a short-distance communication network. The intensity of light is increased when movement is detected and the intensity is reduced if their is no movement .

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Chapter 1

Introduction

1.1 Motivation

Street lights demand for a very high amount of energy consumption. In certain places there are lesser amount of vehicle movement, or no movement at all on a particular day. Even then all the street lights are turned on during the night in conventional street lighting systems. To overcome this issue, proper energy saving methods and lighting control is to be implemented.

1.2 Objective of the project

1. To control street lights to turn on only when needed and to remain in a dim state otherwise.

2. To prevent high consumption of power from street lights.

3. To design the smart light system without compromising citizen needs and safety.

1.3 Organisation of the report

The report is divided into 8 chapters. We have discussed about literature survey in chapter 2, equations used in chapter 3, overview of our system block diagram in chapter 4,different types of sensors and architecture of microcontroller in chapter 5 , system software requirements and algorithm in chapter 6, project results in chapter 7 and Chapter 8 gives the details regarding work carried out and the future work planned.

Chapter 2

Literature Survey

With the development in automations the standards of electronic applications are increasing. Automation provides advantages like accuracy, efficiency, time saving, compactness and user friendliness has gone up resulting in reducing human dependency. Providing street lighting is one of the most important responsibilities of a city. Street lighting is a particularly critical concern for public authorities in developing countries because of its strategic importance for economic and social stability. Inefficient lighting, wastes significant number of financial resources every year, and poor lighting creates unsafe conditions. Energy efficient technologies and design mechanism can reduce cost of the street lighting drastically.

There have been many papers and research made under this topic, and have used various other sensors, Raghu N has used the idea of transition of street lamps from dark to bright state for less density areas. Transition of street lamps from dull to bright state for more density areas. Photodiode and IR sensor is used to detect the motion and transistor is used as switch[1]

Mircea Popa, Costin Cepisca has used a control center that utilizes a server to maintain the database of street light, laser sensor is used for detection, Raspberry Pi is used as controller[2]

Kaushik K S, Athish S, Vijay Shetty, Yogain Kumar, here LDR is used to detect time of day, if the value from the LDR is more than the threshold it implies night. When object the is near the system it gets detected by the camera and the input is send to Arduino, correspondingly lights are set [3]

Mustafa Saad, Abdalhalim Farij, Ahamed salah and Abdalroof Abdaljalil, here Photoelectric sensor is used to detect the movement in the street. But its sensing range is affected due to color and reflectivity of the target, PICI6F877A controller is used [4]

Prof. K.Y.Rajput, Gargeyee Khata, Monica Pujari , Priyanka Yadav has explained a system where CO2 sensor, Temperature sensor, Air qualifying sensor are used to monitor the environmental parameters. 8051 microcontroller is used and IR sensor is used detect

the motion [5]

Radhi Priyasree ; Rafiya Kauser.H ; Vinitha.E ; Gangatharan.N explained a Smart street light that reduces road accidents and detects consumption of alcohol by the driver. PIR sensor is used to detect motion and breadth and skin sensor is used to impair the user from travelling[6]

Prof. K.Y.Rajput, Gargeyee Khata, Monica Pujari , Priyanka Yadav has explained a system is mainly based on IOT and wireless devices. ARM7 LPC2148 controller is used which utilizes less power compared to others, if the weather is foggy or cloudy all lights are turned on [7]

Lucky Gangwar, Mohd Azaz, Mohit Singh, Mubashshir ,Dr. Farooq Hussain, The proposed system talks of a laser source as sensor employed in either side of the roads to detect the vehicle. Laser sensors are typically more expensive and delicate because very precise calibration must be maintained in order for them to work properly [8]

This chapter discussed about the literature survey carried out for the project regarding different motion detecting sensors and microcontrollers. The survey carried out has given insight about the advantages and disadvantages of microcontrollers and sensors.

Chapter 3

Mathematical Equations

This chapter consist of mathematical equation that has been used in the project.

3.1 Speed Equations

$$S = \frac{d}{t}$$

where,

$S = speed$,

$d = distance$ and

$t = time$

Chapter 4

System Overview

The block diagram of street light system as shown in Fig. 3.1 consists of a microcontroller, LDR, Ultrasonic sensor. By using the LDR we can operate the lights, i.e., when the light is available then it will be in the OFF state and when it is dark the light will be in ON state, it means the resistance value of LDR is inversely proportional to intensity of light. When the light falls on the LDR it sends the commands to the microcontroller that it should be in the OFF state then it switches OFF the light, the PIR sensor will be used to turn ON or OFF the light according to the presence or absent of the movement. The ultrasonic sensors are used to calculate speed of the vehicle so as to switch lights accordingly. All these commands are sent to the controller then according to that the device operates. We use a relay to act as an ON/OFF switch.

4.1 Block Diagram

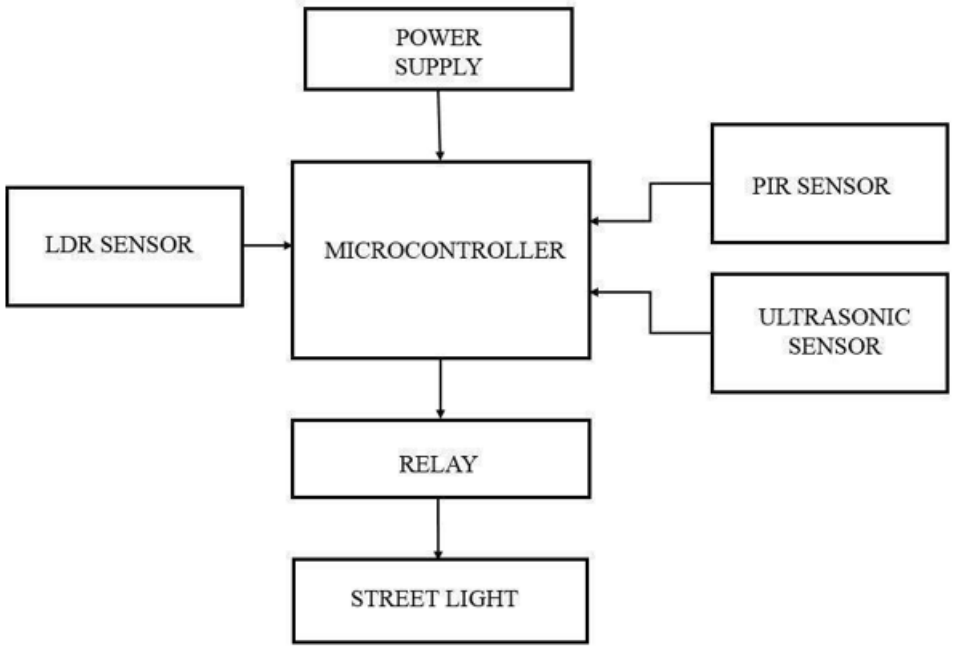

Figure 4.1: BLOCK DIAGRAM

Chapter 5

System Hardware

This chapter consists of the system hardware that has been used in the project.

The system basically consists of a LDR, Ultrasonic sensor, PIR sensor, Relays and an Arduino Micro controller (ATmega328P).

5.1 LDR Sensor

The theoretical concept of the light sensor lies behind, which is used in this circuit as a darkness detector. When the LDR detect light, its resistance will get decreased, thus if it detects darkness its resistance will increase.

In the designed smart street light system LDR is used to detect the light intensity, when the intensity is below the given threshold , it turns on the whole system.The LDR is a resistor as shown in Fig.5.1 .

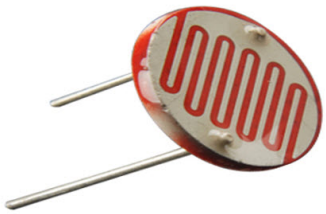

Figure 5.1: LDR Sensor

5.2 Ultrasonic Sensor

An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal.

In the designed system ultrasonic sensor is used to calculate the speed of vehicle or pedestrian.Ultrasonic sensor is as shown in fig.5.2.

Figure 5.2: Ultrasonic Sensor

5.3 Relay

Relays are remote control electrical switches that are controlled by another switch, such as a horn switch or a computer as in a power train control module. Relays allow a small current flow circuit to control a higher current circuit. Several designs of relays are in use today, 3- pin, 4-pin, 5-pin, and 6- pin, single switch or dual switches. Relays which come in various sizes, ratings, and applications, are used as remote-control switches.

In the designed system relay is used to drive high voltage bulb from 5V supply. Fig.5.3 shows an circuit of a relay.

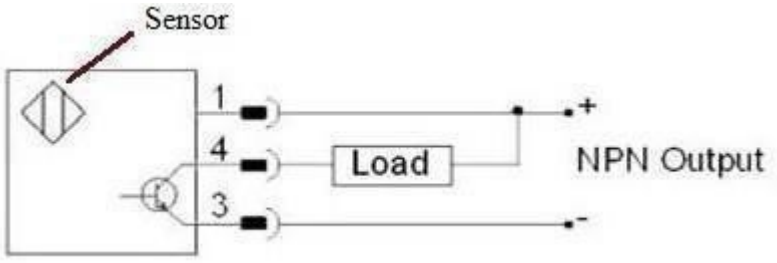

Figure 5.3: Relay Sensor

5.4 PIR Sensor

PIR sensors allow you to sense motion, it is used to detect whether a human has moved in or out of the sensors range. They are small, inexpensive, low-power, easy to use and don't wear out. Its range is in between 5 to 12m.

In the designed system PIR sensor is used to detect the movement. A PIR sensor is as shown in fig.5.4.

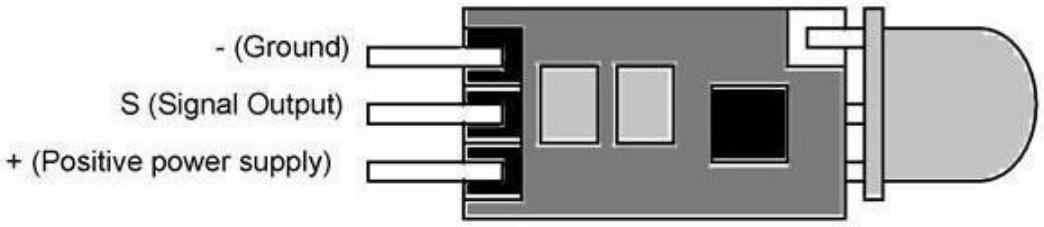

Figure 5.4: PIR Sensor

5.5 Microcontroller

A microcontroller is a computer control system on a single chip. It has many electronic circuits built into it, which can decode written instructions and convert them to electrical signals. The microcontroller will then step through these instructions and execute them one by one. As an example of this a microcontroller we can use it to controller the lighting of a street by using the exact procedures There are different types of microcontroller, this project focuses only on the ATmega328P Microcontroller. The Arduino is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards and other circuits where it's pins as shown in Fig. 5.5.

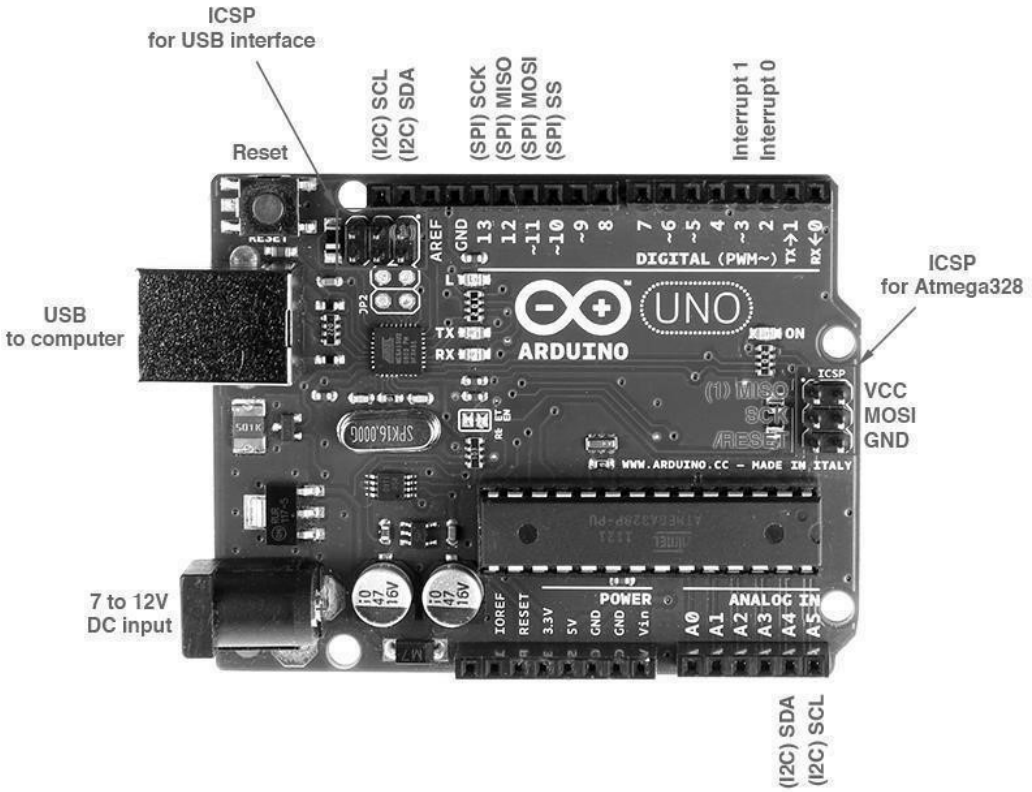

Figure 5.5: Micronotroller-Arduino

Chapter 6

System Software

6.1 Software Requirements

1. Arduino IDE is an open source software that is mainly used for writing and compiling the code into the Arduino Module.
2. The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. This software can be used with any Arduino board.
3. It is an official Arduino software, making code compilation too easy that even a common person with no prior technical knowledge can get their feet wet with the learning process.
4. It uses C and C++ as its programming language.

6.2 Algorithm

1. The module is turned ON when the LDR sensor detects the light intensity value less than 20.
2. The detection of the speed of the vehicle is started when PIR sensor detects motion.
3. Start flag is set HIGH when first ultrasonic detects the vehicle/pedestrian within its threshold range, the timer is started.
4. Stop flag is set HIGH when second ultrasonic detects the vehicle/pedestrian within its threshold range, the timer is stopped.
5. Speed of the vehicle is calculated when both start and stop flag are HIGH.
6. The vehicle is considered slow when its speed is lesser than the threshold.
7. The vehicle is considered fast when its speed is greater than the threshold.
8. The consecutive lights are turned ON at the rate corresponding to the speed of the vehicle.
9. The consecutive lights are turned OFF consecutively at the same rate.

6.3 Flowchart

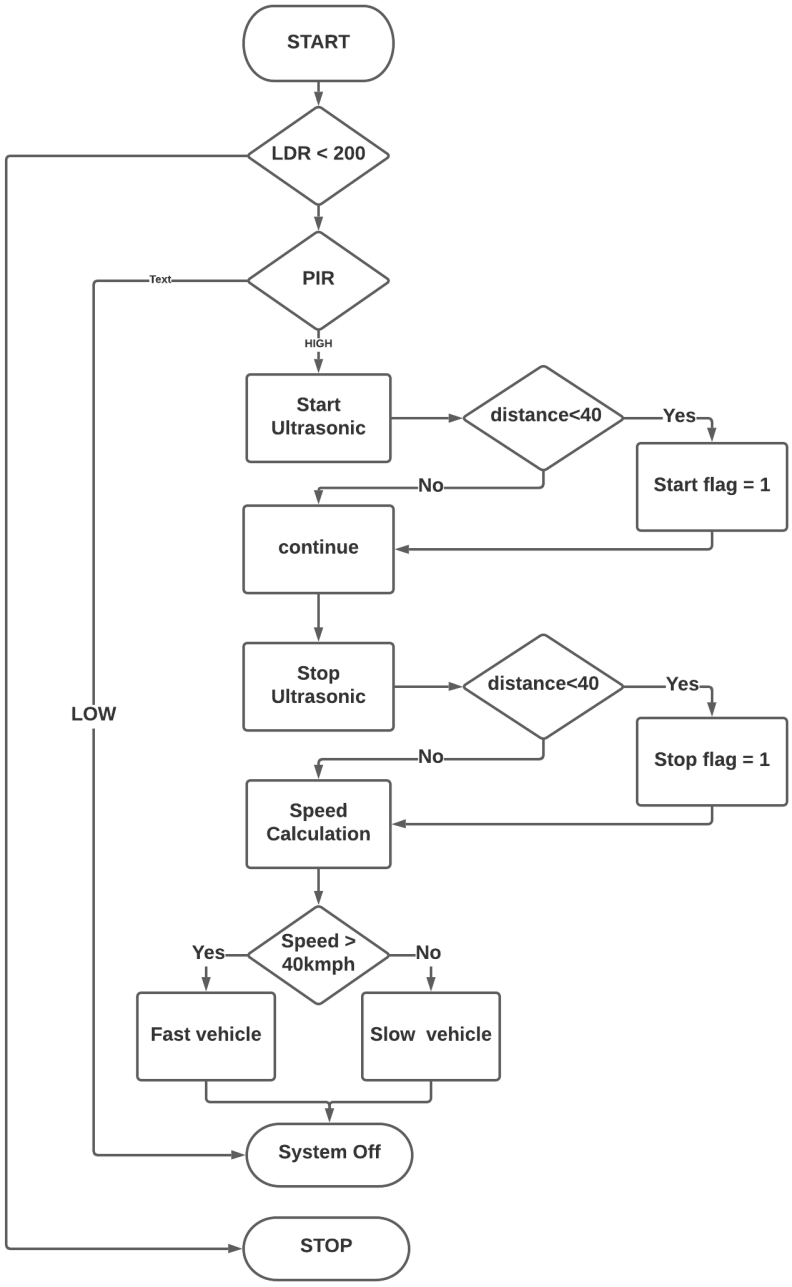

Figure 6.1: Flow Chart

Chapter 7

Results

1. The main motivation of the project is to convert conventional street light system into an efficient one.

2. The whole system is automated, hence reduces maintenance cost.

3. This system saves upto 70% more power compared to regular system(low foot fall area).

4. The system works better at optimum environmental conditions.

5. The rate of consecutive lights that turn on depends on the speed of the vehicle.

6. The project setup contains sensors that detect light intensity,motion and distance.

    a The LDR sensor gives out an analog voltage that ranges between 0-5V and is converted to digital values that range between 0-1023, the values less than 30 is considered to be dark

    b The PIR sensor detect vehicle that radiate infrared within 5m from the sensor.

    c The Ultrasonic sensors are made to sense upto 2 metre.

7.1 Snapshots

- Initial stage of the street lights that are in dim state is shown in Fig.7.1

Figure 7.1: Step 1

- PIR sensor detects motion in its range and the first set of lights are turned on is shown in Fig.7.2.

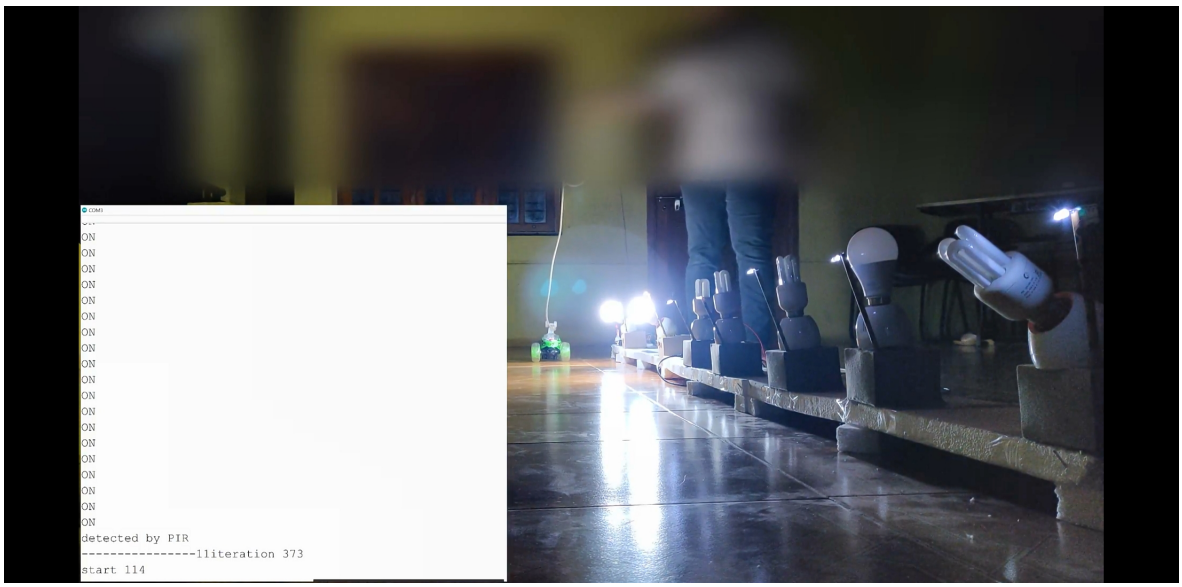

Figure 7.2: Step 2

- The vehicle is detected within the threshold range of the first ultrasonic sensor, timer is started is shown in Fig.7.3.

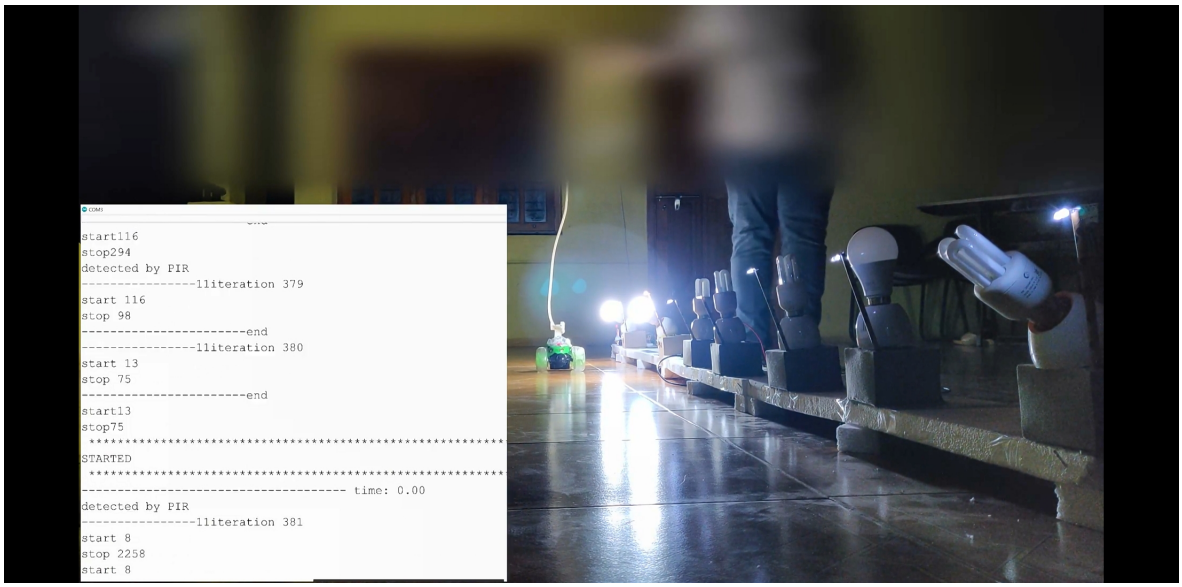

Figure 7.3: Step 3

- The vehicle is detected within the threshold range of the second ultrasonic sensor, timer is stopped and speed of the vehicle is estimated is shown in Fig.7.4.

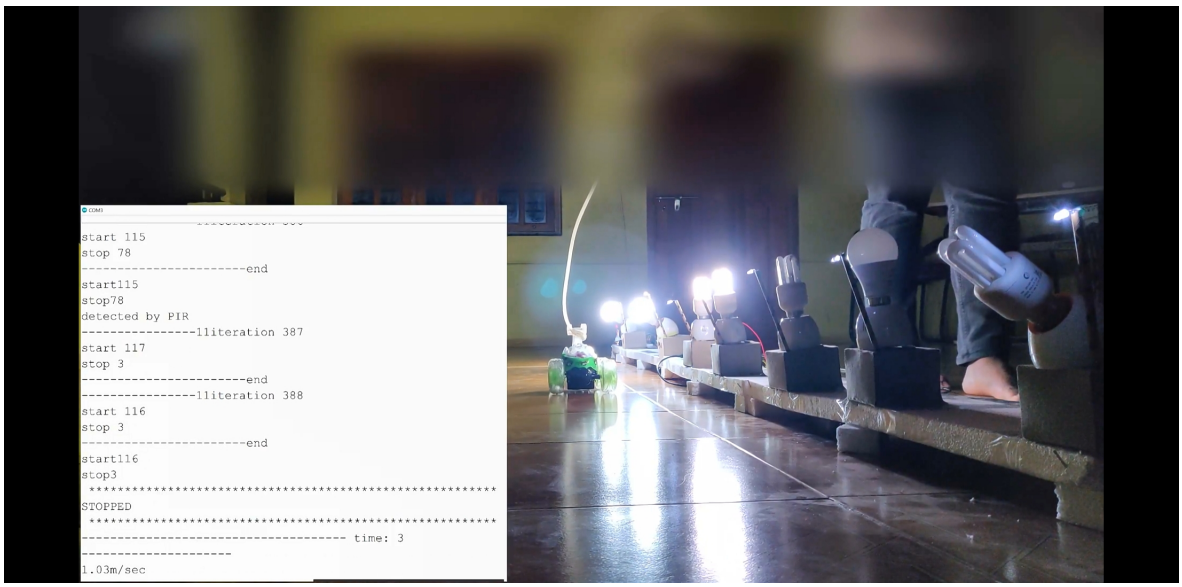

Figure 7.4: Step 4

- The consecutive lights are turned on depending on the speed of the vehicle is shown in Fig.7.5.

Figure 7.5: Step 5

- After the vehicle is passed the lights turn off in the same order, and returns back to dim state is shown in Fig.7.6.

Figure 7.6: Step 6

Chapter 8

Conclusion

The project titled “Movement Based Smart Street Light System” is successfully implemented and tested under optimum conditions.

The smart streetlight system is automated and power efficient. This system is designed in such a way that it does not effect citizen safety.

8.1 Scope for future work

- This system can be implemented using more accurate sensors.
- The system can be built which can work in various Environmental Conditions.
- The system can be built with more integrated system and features

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Appendices

Appendix A

Data Sheet of LDR Sensor

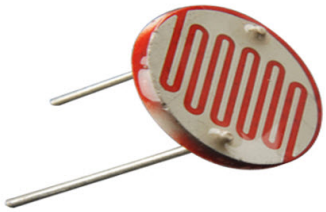

Figure A.1: LDR Sensor

Table 1.1: Specifications of LDR:

Model	GL5539
Maximum Voltage	150v DC
Maximum Wattage	100mw
Spectral Peak	540nm
Light Resistance	30K to 40K ohm
Dark Resistance	5M ohm
Response Time (ms)	Up: 20/ Down: 30
Material	Carbon
Size	4x3mm/0.2x0.12inch

Appendix B

Data Sheet of PIR Sensor

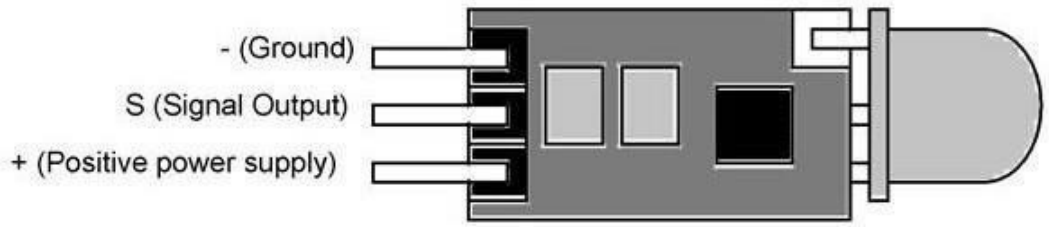

Figure B.1: PIR Sensor

Table 2.1: Specifications of PIR Sensor:

Recommended Model	D204B
Transmittance	$\geq 75\%$
Signal Output[Vp-p]	$\geq 3500mv$
Sensitivity	$\geq 3300V/M$
Noise[Vp-p]	$< 70mV$
Offset Voltage	0.3-1.2V
Supply Voltage	3-15V
Operating Temperature	-30 - 70℃

Appendix C

Data Sheet of Ultrasonic Sensor

Figure C.1: Ultrasonic Sensor

Table 3.1: Specifications of Ultrasonic Sensor:

Supply voltage	5 v
Current Consumption	15 mA
Ultrasonic Frequency	40 kHz
Maximal Range	400 cm
Minimal Range	3 cm
Resolution	1 cm
Trigger Pulse Width	10 us
Outline Dimension	43x20x15 mm

Appendix D

Data Sheet of Relay

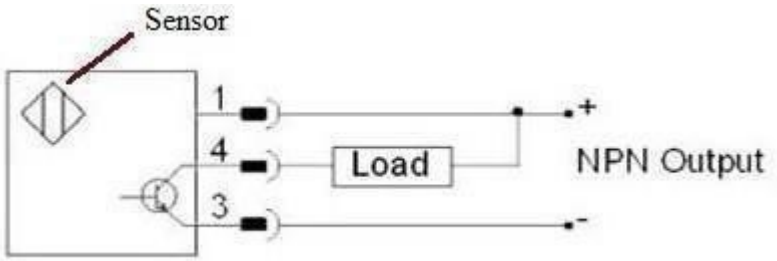

Figure D.1: Relay Sensor

Table 4.1: Specifications of Relay:

Supply voltage	5v
Current Consumption	15 mA
Trigger Current (Nominal current)	7 0mA
Maximum AC load current	10A @ 250/125V AC
Operating time	10 msec
Release time	5 msec
Maximum switching	300 operating/minute

Appendix E

Data Sheet of Microcontroller

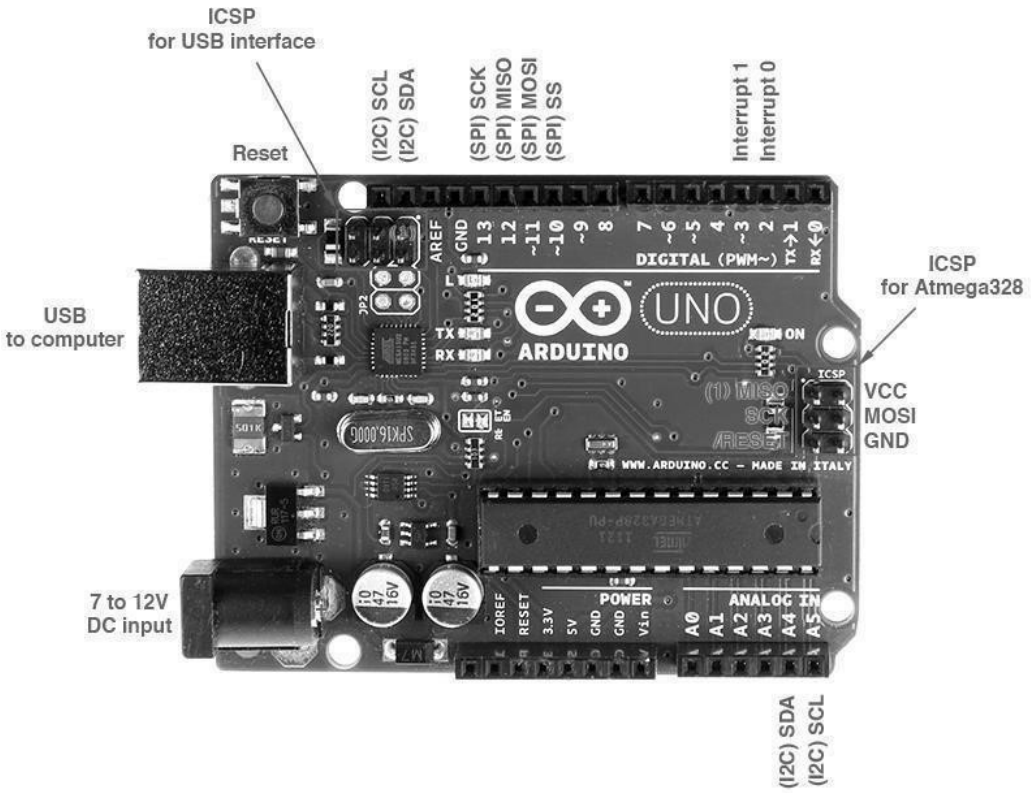

Figure E.1: Microcontroller-Arduino

Table 5.1: Specifications of Microcontroller:

Microcontroller	Microchip ATmega328P
Operating Voltage	5 Volts
Input Voltage	7 to 20 Volts
Digital I/O Pins	14 (of which 6 can provide PWM output)
UART	1
I2C	1
SPPI	1
Analog Input Pins	6
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB of which 0.5 KB used by bootloader
SRAM	2 KB
EEPROM	1 KB
Clock Speed	16 MHz
Length	68.6 mm
Width	53.4 mm
Weight	25