Project Report On

“Smart City: Street Light System”

SILVER OAK UNIVERSITY

EDUCATION TO INNOVATION

RESEARCH BY

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Aditya Silver Oak Institute of Technology
Semester – V

Submitted to,
Department of Information Technology

CERTIFICATE

TO WHOM SO EVER IT MAY CONCERN

This is to certify that Khushali Patel satisfactorycompleted Research Project on **"Smart City: Smart Street Lighting System"** for The Problem Based Learning(PBL) within the four walls of **"Aditya Silver Oak Institute Of Technology"** in academic year 2021.

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The satisfaction that accompanies that the successful completion of any task would be incomplete without the mention of people whose ceaseless cooperation made it possible, whose constant guidance and encouragement crown all efforts with success.

We hereby take this opportunity to thank everyone who has directly or indirectly helped us in preparing our project on “Smart Street Light System”.

Thanks to All those valuable suggestion and comments. The text has benefited so much. We express our gratitude towards all faculty members who have guided and directed us at every moment to fulfil our mission and produce this work in front of you. We hope you would undoubtedly find the matter interesting and information as well.

With Sincere Regards,
Patel Khushali P.

ABSTRACT

We need to save or conserve energy because most of the energy sources we depend on, like coal and natural gas can't be replaced. Once we use them up, they're gone forever. Saving power is very important, instead of using the power in unnecessary times it should be switched off. In any city "STREET LIGHT" is one of major power consuming factors. Most of the time we see street lights are ON even after sunrise thus wasting lot of energy.

Over here we are avoiding the problem by having an automatic system which turns ON & OFF the street lights at given time or when the ambient light falls below a specific intensity. Each controller has an LDR which is used to detect the ambient light. If the ambient light is below a specific value, the lights are turned ON.

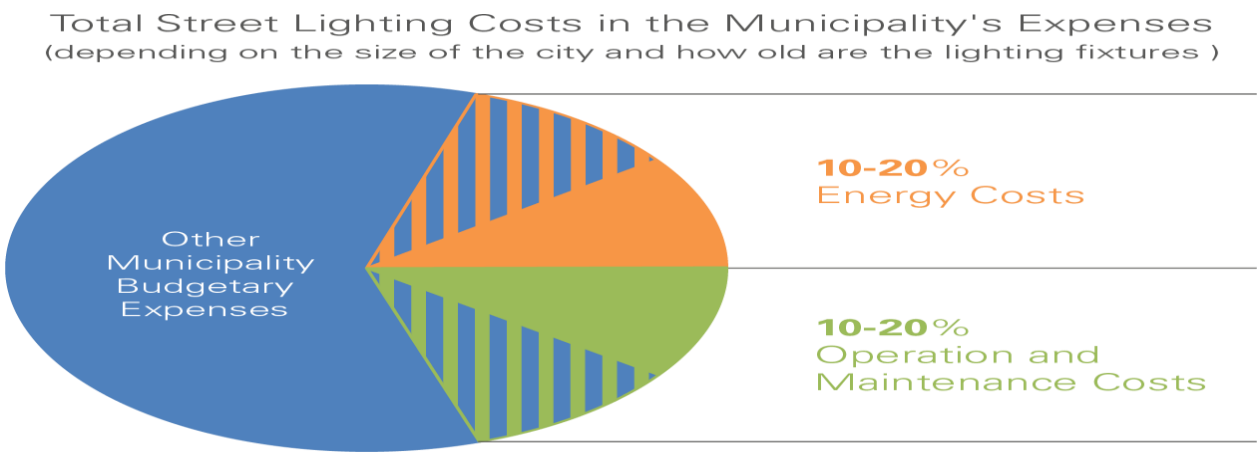
CHAPTER 1 INTRODUCTION

1.1 Introduction

The street lighting is one of the largest energy expenses for a city. An intelligent street lightingsystem can cut municipal street lighting costs as much as 50% - 70%. The present system is likethe lights will be switched on in the evening before the sun sets and they are switched off the next day morning after there is sufficient light on the outside. But the actual timing for these lights to be switched on are when there is absolute darkness. With this, the power will be wasted up to some extent. In sunny and rainy days, ON and OFF time differ discernibly which is one of the significant hindrances of the present street lights systems. Also the manual operation of the lighting system is completely eliminated. The energy consumption in entire world is increasing at the fastest rates due to population growth and economic development and the availability of energy sources remains constrained. Street lights are an integral part of any developing locality. They are present on all major roadways and in the suburbs too. Every day, street lights are powered from sunset to sunrise at full strength, even when there is no one around. On a global scale, millions of dollars are spent each day on these street lights to provide the required electrical energy. The maintenance and replacement costs of conventional incandescent bulbs are immense. They consume a lot of electric power to function and their heat emissions are also quite high. All of this contributes to greater demand of electricity production and consequently, more carbon dioxide emissions from powerhouses. So, along with unnecessary light pollution, this practice causes damage to our planet too. The main aim of this Project is to provide an “Automatic Street Lightning System” powered with solar energy during night time.

We use the word “smart” because the system not only provide power to the street lights but also helps in detecting the direction of movement of the pedestrian and helps them by meansof illuminating the path of movement till the near next street light. By integrating the entire street lights with Smart street light system it is possible to systematically help the pedestrian to reach the destination in the remote rural areas which are facing serious electric power supply problem. The same system can also be used in metropolitan cities as well. This would save a lot of energy and also reduce cost of operation of the street lights. We can check the status of street light on internet from anywhere in real time and solve the issues if happen during the processing.

Costs for Municipalities:



CHAPTER 2 OBJECTIVE

The main objective of this project is to implement an Automatic Street Lightning System. As the traffic decreases slowly during late-night hours, the intensity gets reduced progressively till morning to save energy and thus, the street lights switch ON at the dusk and then switch OFF at the dawn, automatically. The process repeats every day.

White Light Emitting Diodes (LED) replaces conventional HID lamps in street lighting system to include dimming feature. The intensity is not possible to be controlled by the high intensity discharge (HID) lamp which is generally used in urban street lights.

LED lights are the future of lighting because of their low energy consumption and long life. LED lights are fast replacing conventional lights because intensity control is possible by the pulse width modulation. This proposed system uses an Arduino board. Strings of LED are interfaced to the Arduino board. A programmed Arduino board is engaged to provide different intensities at different times of the night. This project is enhanced by integrating the LDR to follow the switching operation precisely and IOT to display the status of street on Internet and help in controlling it.

The main Objectives are as follows:

- To avoid unnecessary Waste of light.
- Provide efficient, automatic and smart lighting system.
- Totally based on Renewable energy sources.
- Longer life expectancy.
- Energy Saving.

CHAPTER 3 PROPOSED METHOD

The present system employs power delivery via a single phase line to the streetlight. The proposed system involves five more components to regulate the power delivery. An Infra - Red Proximity Sensor at the base of the street light detects presence in a small area around the street light. The data from the sensor is sent to the Arduino which forms brain of the circuit. The Arduino then commands to switch between dim and bright modes depending upon the requirement and thus controls the brightness of the street light. A battery eliminator, also powered by the single phase line, is used to supply 5V inputs to the sensors and Arduino.

Arduino IDE:

The Arduino Software (IDE) is an open source software and it makes easy to the code and upload it to the board. I t runs on the different plant from Windows, MAC OS, Linux. The environment is written in Java and before running the IDE Java software tobe installed on the machine this software can be used with any Arduino board.

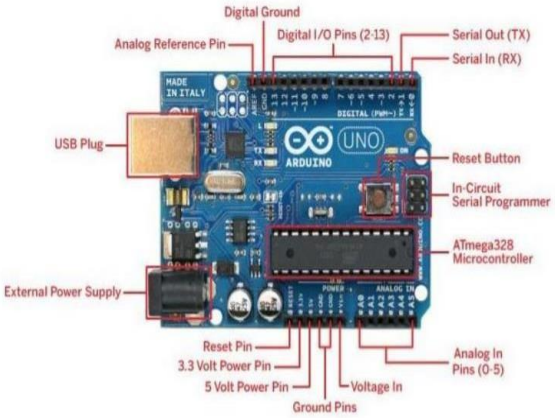


Fig 2: Arduino UNO Board

LDE:

A Light Dependent Resistor (LDR) or a photo resistor is a device whose resistivity is a function of the incident electromagnetic radiation. Hence, they are light sensitive devices. They are also called as photo conductors, photo conductive cells or simply photocells. They are made up of semiconductor materials having high resistance. A light dependent resistor works on the principle of photo conductivity.

IR Sensor:

An infrared sensor is an electronic instrument that is used to sense certain characteristics of its surroundings by either emitting and/or detecting infrared radiation. It is also capable of measuring heat of an object and detecting motion. Infrared waves are not visible to the human eye.

Ambient Light Sensors

Light Dependent Resistor is basically optically variable resistor. The resistance and the light intensity varies inversely in this sensor. When the intensity of light increases, resistance decreases as is illustrated. LDR keeps our smart street lights in OFF state during the day and as the day passes and the light in the atmosphere decreases, the resistance increases and then our system gets turned ON with LED's working at the intensity level as per the algorithm.

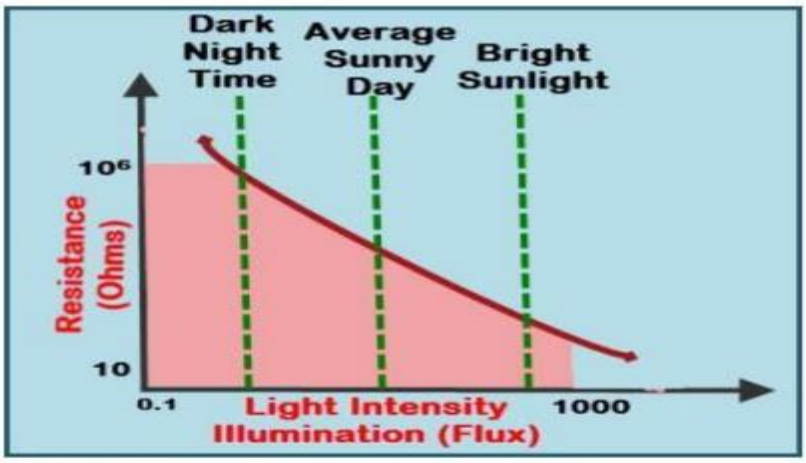


Fig. 3. Graph Characteristic of LDR

The design basically includes three working mode: -

- **OFF mode:**

When there is enough natural light in the surrounding. i.e. during the daytime, the entire system is switched off.

- **Active mode:**

When the natural light drops below a certain level the system automatically turns ON and the motion sensors are powered.

- **ON mode:**

On the presence of pedestrians, the sensors turn on which in turn switches on The LED lights. These lights turn off after a period of time.

We have decided four intensity levels as:

50% intensity:

50% intensity will be there at time of sunrise and sunset when there is some amount of natural light in the atmosphere.

100% intensity:

100% intensity will be there after sunset and before sunrise. Because after sunset, there is no natural light present in atmosphere and the traffic amount is high due to rush hours.

65% intensity:

65% intensity will be there after the peak time in night had over. At that time, we don't need 100% intensity because the amount of crowd near the midnight is very few.

10% intensity:

Our proposed model glow light to a brighter intensity only when a vehicle is there, otherwise the default intensity of street light when there is no motion near the street lights is set to 10%, so that there is little consumption of electrical energy.

CHAPTER 4 PROBLEM STATEMENT

4.1 Disadvantages of Existing Street Light:

- Street lights remain always ON when there is presence of light.
- These street lights need a manual switching operation.
- It also needs man power.
- These street lights are unnecessarily glowing with its full intensity.
- High power consumption and waste of energy.

4.2. Advantages of the Proposed System:

- Automatic Switching OFF Street lights.
- Maintenance Cost Reduction.
- Reduction of light pollution.
- Energy Saving.
- Reduction of manpower.

CHAPTER 5 IMPLEMENTATION

Overview

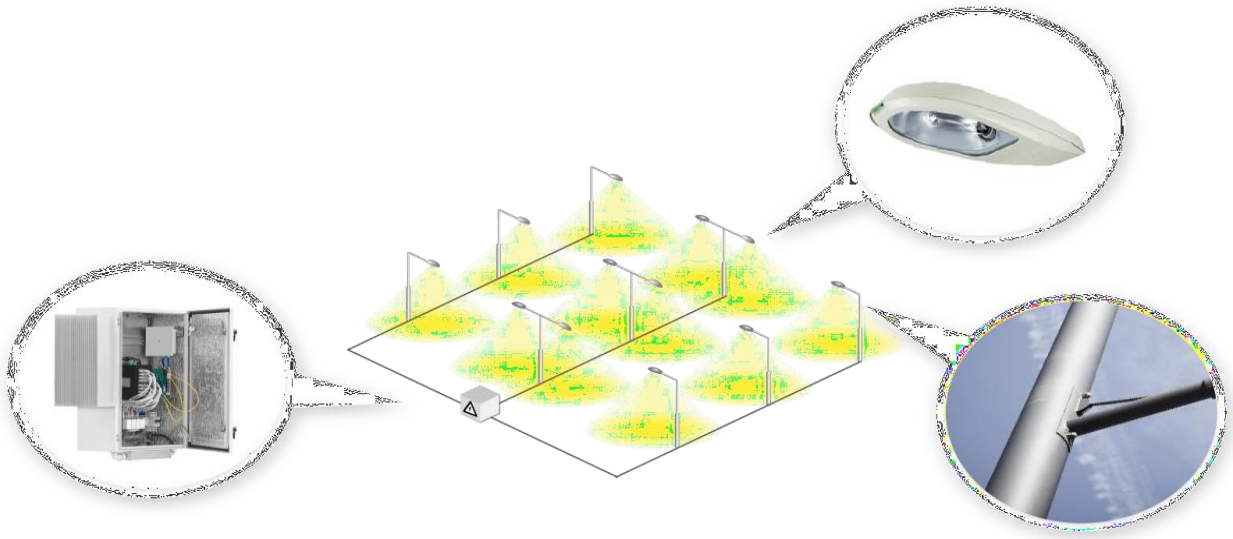


Fig. 4. Overview of System

Lamps	Street Light Poles	Power Cabinet
Luminaire	With 1,2 & more lamps	Sensors
Light Bulb		Contractor
Lamp Driver		

LAMPS:

A street lamp is made out of a Lamp Socket which mechanically supports electrical connections and allows the lamp to be conveniently replaced. The ignition provides the high-striking voltage needed to ignite a streetlamp. The ballast (or transformer) reduces the voltage and regulates the electric current to produce a steady light output. The capacitor is used to stabilize voltage and power flow.

Compared to traditional lamps, smart street lamps have the capability to be remotely powered on, off or dimmed by means of controllers. These can be integrated inside the lamp from the production stage or mounted on the lamp.

HID vs. LED lights

The main purpose of intelligent street lighting is to better light up the roads, pavements and parking spaces to guarantee citizens' security. To ensure visual safety to drivers and pedestrians, smart lighting needs to meet specific values of luminance, illuminance or dimness, uniformity, and glare according to the road type. HIDs and LED's are currently the most popular lights used to grant high-quality, efficient lighting. HID lamps are still commonly used around the world for lighting up vast areas. Even though they have a lower implementation cost and are less costly to replace than LED lights, HIDs are increasingly being replaced by LED's and for good reason. HID lights have a warm-up period of 20 seconds until reaching full power, can emit up to 70%

less visible light after only 10,000 hours of being in use, and about 30% of the energy produced is infrared which is entirely wasted energy. LED's, on the other hand, have an extremely long lifespan (new LED's last over 100,000 hours), reduce energy costs by up to 60%, don't have a warm-up period, and pay for themselves in 6 to 18 months.

STREET LIGHT POLES:

For centuries, lighting poles have been used to place street lighting sources and have evolved together with lighting technologies. Later on, they were used to support traffic lights or communication infrastructure. But the recent technology developments promise to bring it to the pole position of Smart City initiatives.

Lighting poles have two characteristics that make them essential to smart city development: they are omnipresent and they are powered. Especially with smart lamp-level control, the street lighting grids are continuously under power (even during the day – a problem with legacy street lighting). Therefore, there is a large number of sensors and Iot devices that can be mounted on and supplied from the street lighting poles, using any available communication and laying the grounds for Smart City synergies.

POWER CABINET:

The traditional method for switching a cluster of streetlights is via a device in a control cabinet triggered on a timer or by a photocell. When modernizing existing street lighting infrastructure, control cabinets are an essential element. They must be able to support energy-saving technologies such as LED lights and smart lighting management systems.

For Example,

Modern control cabinets should be able to pass the light switching impulses from a modern lighting control center on to the individual street lighting devices, or link the street lighting system to the smart sensors/ actuators, when necessary.

CHAPTER 6 DESIGN

SOFTWARE REQUIREMENT:

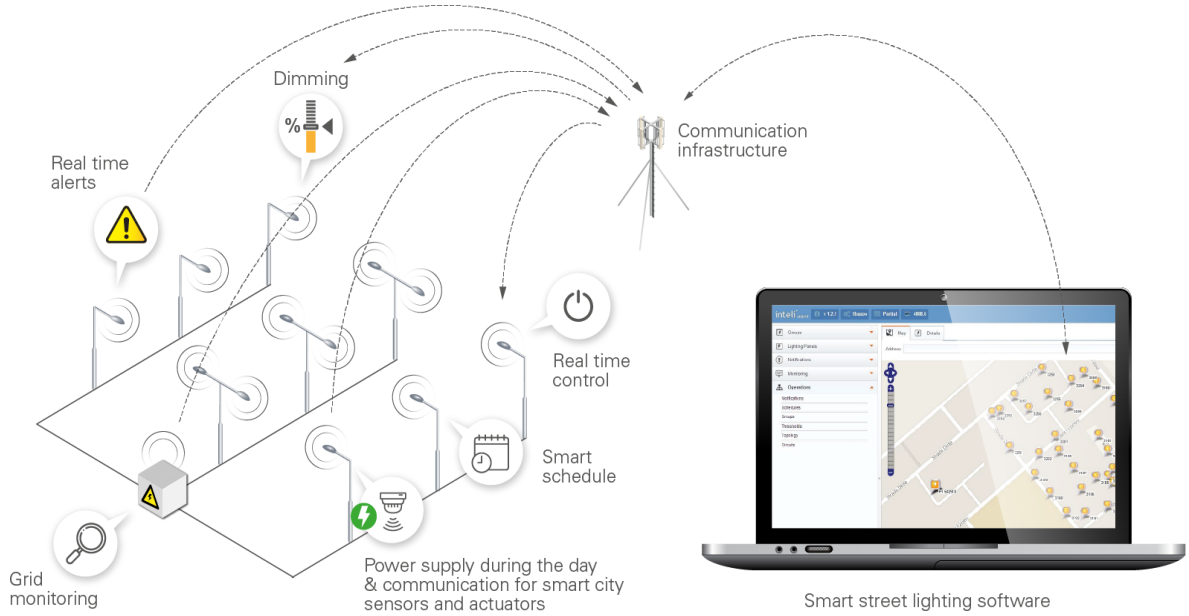


Fig. 5 Software Requirement

Modern smart lighting control systems combine software and hardware components, allowing local governments to manage large-scale public lighting networks. The communication is bidirectional, so that lamps can be controlled remotely, while sending data to be collected, stored, displayed and analyzed in the software application. Moreover, alerts for any system failures help municipalities act timely and more efficiently.

When choosing a lighting control software, it is important to make sure that the solution fulfils your most pressing needs. However, keep in mind that the efficiency of a smart lighting management software is not only determined by the software's functionalities. It will also be influenced by the communication technology and the hardware type deployed.

HARDWARE REQUIREMENT:

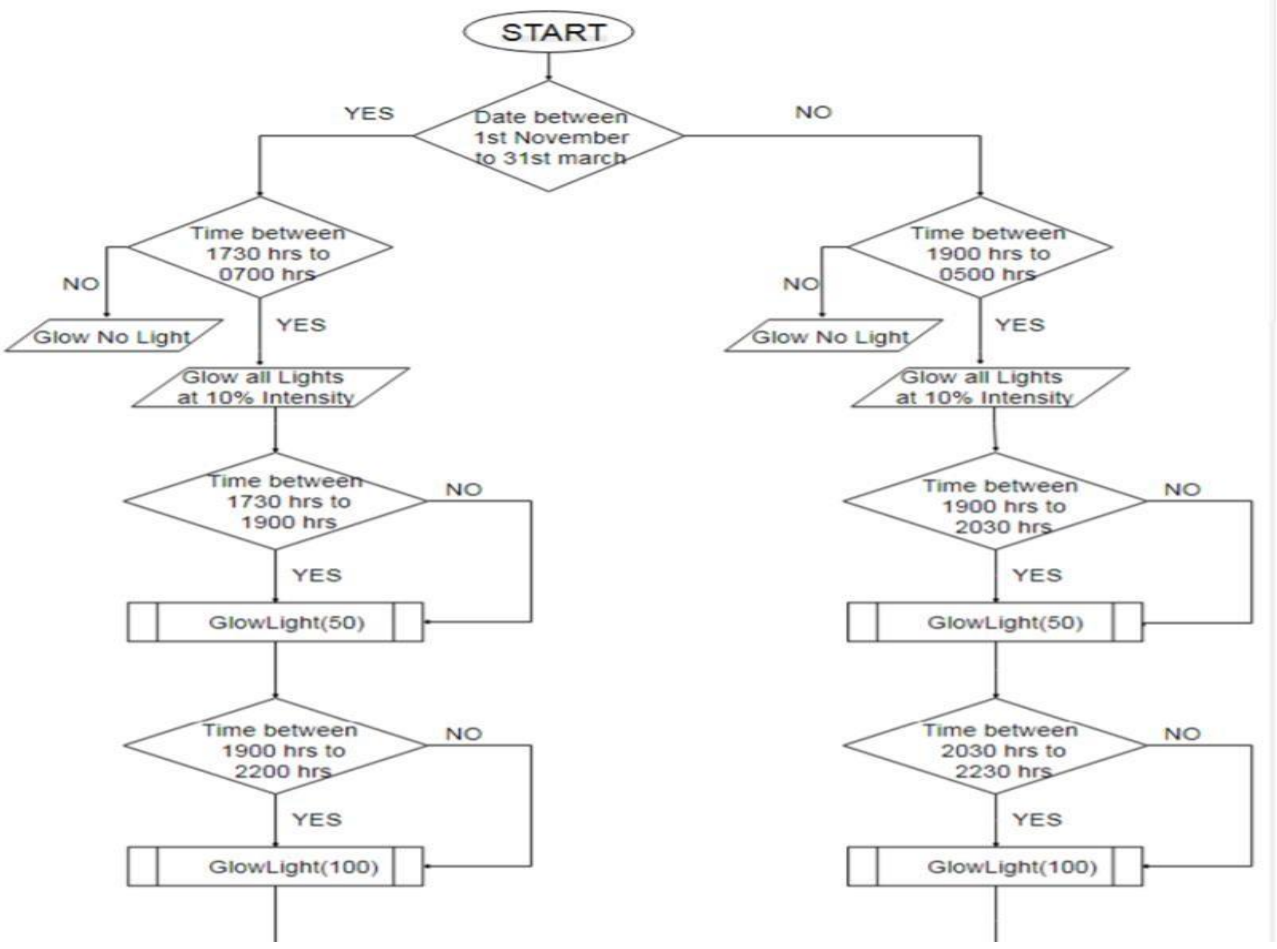
Fig. 6 Hardware Requirement

Smart Streetlight Controllers

Smart streetlight controllers are the base of every smart street lighting project. They can be connected to the power cabinet (directly to the lighting panel power source) or to the lamp, with restrictions in terms of design, installation and communication, and can be managed via a street lighting software. To keep deployment cost at minimum. We have invested in several mounting solutions to ensure smooth lamp upgrade and fast lighting controller installation: with standardized connectors and wired.

Control	Intelligence	Information	Optimisation
Remote on/off and dimming control for the lamps, on/off control for lighting cabinets.	Autonomous operation based on predefined schedules, light sensors and adaptive lighting technologies.	A wide range of lamp electrical parameters combine with a continuous flow of sensor data.	Relevant analysis and trend discovery with visual BI reports and AI integration for big data analysis.

FLOWCHART OF SMART LIGHTING SYSTEM:



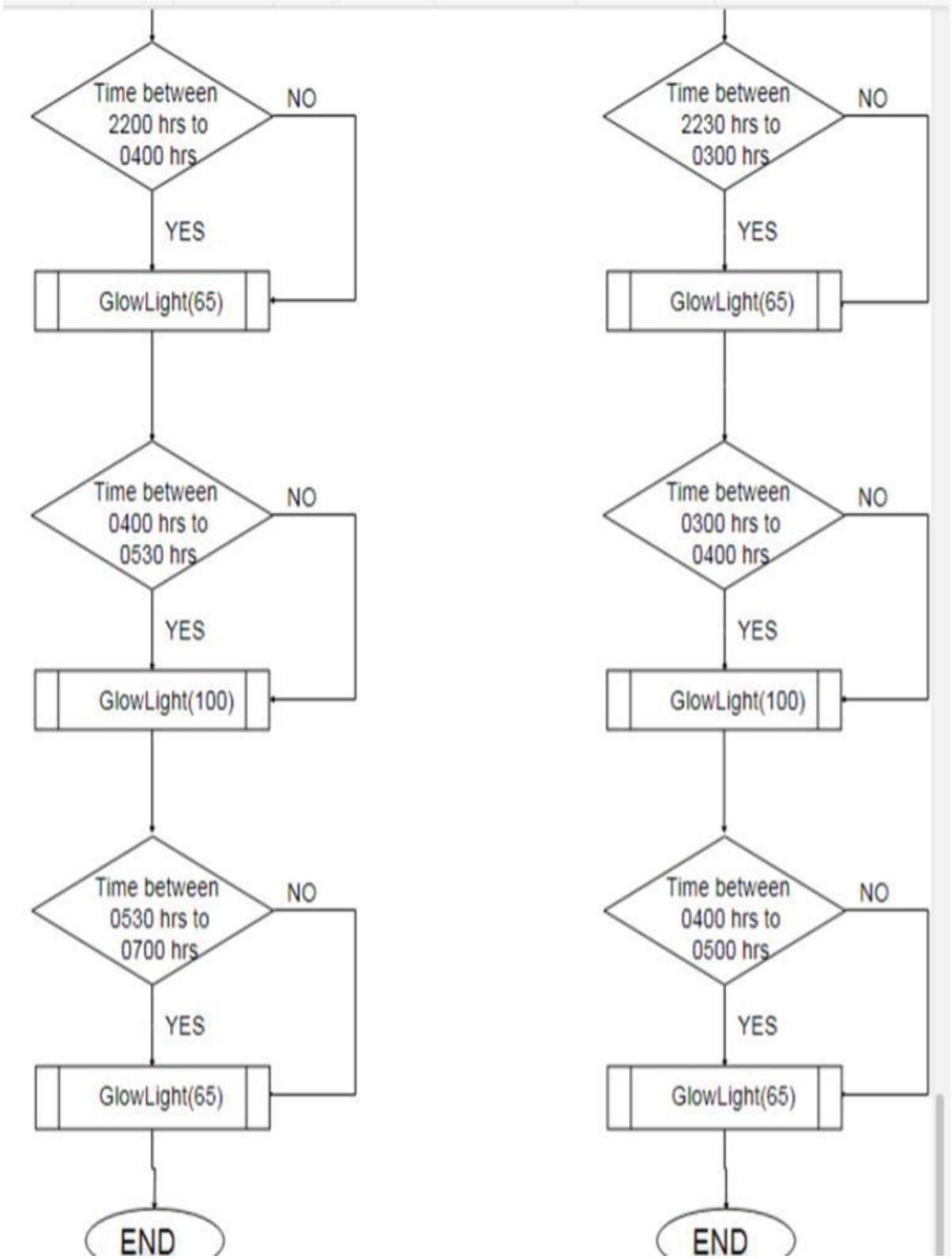


Fig. 7. Flowchart of System

CHAPTER 7 CONCLUSION & FUTURE SCOPE

This Smart Street light project not only helps in rural areas but also beneficial in urban areas too. As we are moving towards more advancement we require more power so use of renewable resources is useful and advantageous.

With the advances in technology and good resource planning the cost of the project can be cut down and also with the use of good equipment the maintenance can also be reduced in terms of periodic checks. The LED's have long life, emit cool light, donor have any toxic material and can be used for fast switching. For these reasons our project presents far more advantages which can over shadow the present limitations. Keeping in view the long term benefits and the initial cost would never be a problem as the investment return time is very less.

The project has scope in various other applications like for providing lighting in industries, campuses and parking lots of huge shopping malls. This can also be used for surveillance in corporate campuses and industries.

This project “Smart Lighting System for Smart City” is a cost effective, Eco- friendly and the safest way to save energy and this system the light status information can be accessed from anytime and anywhere. It clearly tackles the two problems that world is facing today, saving of energy and also disposal of incandescent lamps, very efficiently.

CHAPTER 8 BIBLIOGRAPHY

Definition

“A bibliography is a list of the sources you used in your research. It is usually included as a separate page or pages at the end of your assignment and titled “Bibliography,” “References”.

Website Referred

1. www.en.m.wikipedia.org
2. www.intelilight.eu/intelligent-street-lighting-control
3. www.engineeringsgarage.com/articles/embedded-systems