

Report on Smart Street Light

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1. Introduction

1.1 What is Street Light?

Street Light is a raised source of light on the edge of a road or path .It throws light on the ground. It is also known as light pole, lamppost, street lamp, light standard, or lamp standard. Many lamps have light-sensitive photocells that activate the lamp automatically when needed, at times when there is little-to-no ambient light, such as at dusk, dawn, or at the onset of dark weather conditions. This function in older lighting systems could be performed with the aid of a solar dial. Many street light systems are being connected underground instead of wiring from one utility post to another.

1.2 Types Of Street Lights

1.2.1 Incandescent light-

Incandescent street light bulbs use tungsten-halogen filament which are commonly used in theatre's and stadiums. They have high efficiency, brightness and good colour rendition, but their lifespan is shorter than other types of bulbs.

1.2.2 Fluorescent light-

This type of street light bulb encases a metal electrode in both ends. Inside the tube, it contains mercury and argon gasses which help ignite the lamp. In effect, fluorescent street light bulbs create strong ultraviolet rays, but the visible light is weak.

1.2.3 Mercury vapor-

Mercury vapor light bulbs were developed for street lights. It stood as a significant improvement to the old incandescent lamp and fluorescent lamp as well. Today, you can find a few mercury vapor street lights, as most of them were replaced with the more efficient sodium lamps for street lighting.

1.2.4 High Pressure Sodium (HPS) lamps-

High Pressure Sodium (HPS) lamps are one of the most common bulbs for street lights in existence today. They produce white light through a mixture of different gases and they are highly preferred because of less maintenance.

1.2.5 Low pressure sodium (LPS) lamps –

Low pressure sodium (LPS) lamps are like the HPS lamps, but instead of illuminating white light, they emit exclusively warm or yellow light. LPS lamps are highly efficient as compared with its predecessors, but it also takes a few minutes before turning on. The colour of the light is purely yellow-orange.

1.2.6 Induction Lamp –

The good thing about an Induction Lamp is it has a long lifespan and is energy efficient. This type of street light bulb was developed by Nikola Tesla and is promised to render higher colour rendering index and colour temperature than Thomas Edison's incandescent light. Its downside however, is that it cannot work properly in high temperatures.

1.2.7 Compact Fluorescent Lamps (CFL)-

CFL street lights are still common today, despite of the emerging solar LED street lights. CFL bulbs mimic the physical feature of the incandescent bulb, but internally, they operate like fluorescent bulbs. Hence, they are more compact than the traditional fluorescent lamp. You can easily distinguish CFL lights with their tubular loops. CFL lights are used in many commercial building lighting and perimeter street lighting.

1.2.8 Light Emitting Diode (LED) Street Lights –

An LED street light bulb is the most energy efficient option for outdoor lighting solutions. Not only does it have an extremely long lifespan (50,000 hours), but it also does not emit toxic chemicals like mercury lamps. Today, LED is the preferred type of lighting for solar street lights and integrated solar street lights, than CFL lights. It has a high lighting efficiency of about 80 LM/watt unlike traditional street lights with only 58 LM/watt. LED lights can also be used to direct light. They can also be controlled by dimming unlike CFL lights. LED lights are also used in smart solar street lights, where automatic brightness and dimming occurs depending on set lighting controls for the street light.

1.2.9 Phosphor-converted amber-

Phosphor-converted amber or PCA LED lights have just been released 3 years ago. They are new on the market. PCA LED promises a highly efficient lighting solution with good colour rendition. The only downside is its price as they are currently expensive. It is very pleasing to the eyes, and has a higher lighting efficiency.

1.2.10 Narrow-Band Amber (NBA) LED-

Narrow-Band Amber (NBA) LED street light bulb is a new LED innovation. It emits yellow or a warm colour, rather than the traditional LED colour (blueish-white). NBA LED is promised to render good quality colour, so as not to make illuminated things look grey (like LPS lamps). Currently, it is high-priced but are very energy efficient.

1.3 What is Smart Street Light?

A smart streetlight is a public lighting fixture that incorporates technology, such as cameras, light-sensing photocells and other sensors, to introduce real-time monitoring functionalities. Also referred to as *adaptive lighting* or *intelligent street lighting*, this type of lighting system is recognized as a significant step in the development of smart cities. In addition to enabling cities to provide the proper amount of street light for local conditions, installing intelligent lighting will help improve citizen satisfaction regarding security and safety, while bringing municipalities significant savings in power consumption and lighting system maintenance.

2 Requirements

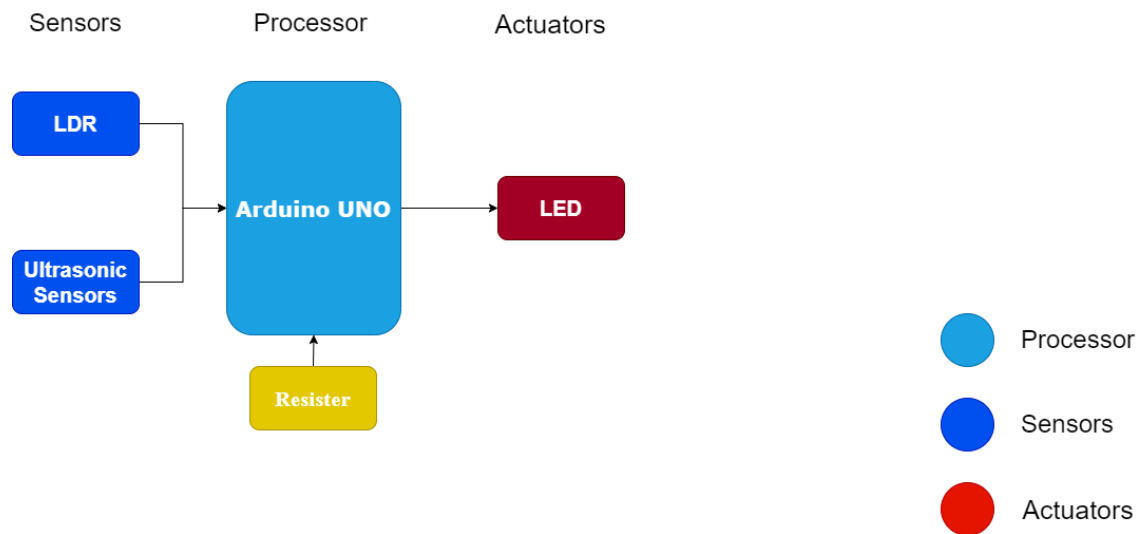
2.1 High Level Requirements –

Requirement Id	Design Consideration
HL01	It Shall have Arduino Uno
HL02	It Shall have Ultrasonic Sensor(HC-SR04)
HL03	It Shall have LDR
HL04	It Shall have Resistor
HL05	It Shall have LED

2.2 Low Level Requirements –

Requirement Id	Low Level Requirement ID	Design Consideration
HL01	LL01	Arduino Board Not Recognized
HL01	LL02	Invalid Device Signature Error
HL01	LL03	Serial Port Already in use
HL02	LL04	Limited Detection Range
HL01	LL05	Range Limited
HL01	LL06	Loose Connection
HL01	LL07	Incorrect Dimming Set-Up

3 Block Diagram



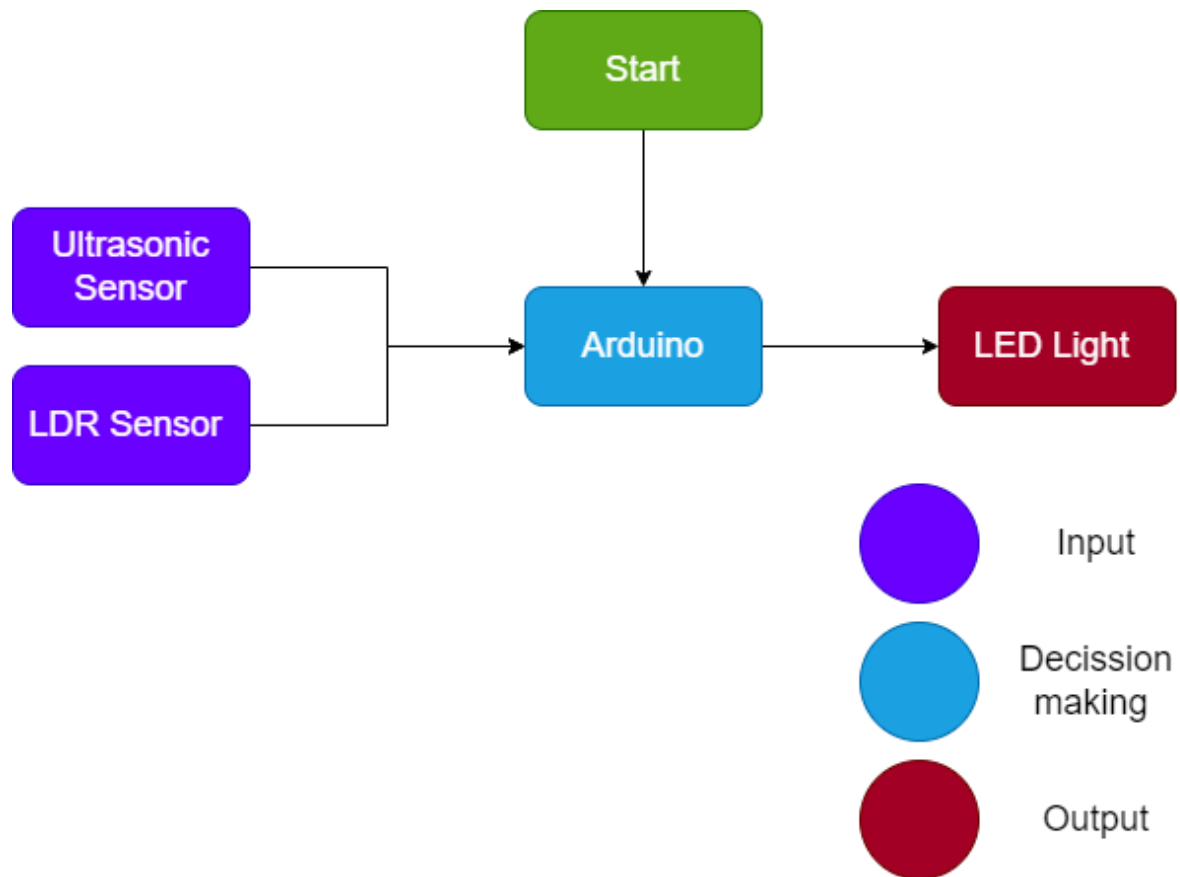
3.2 Block Diagram Explanation-

- **Arduino Uno-** Arduino Uno is a Microcontroller which works on ATmega328p.
- **LDR-** It is also known as Light Dependent Resistor . An LDR is a component that has a (variable) resistance that changes with the light intensity that falls upon it. This allows them to be used in light sensing circuits.
- **Ultrasonic Sensors-** An ultrasonic sensor is an instrument that measures the distance to an object using ultrasonic sound waves.
- **LED-** A light-emitting diode (LED) is a semiconductor light source that emits light when current flows through it.
- **Resistor -** A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element.

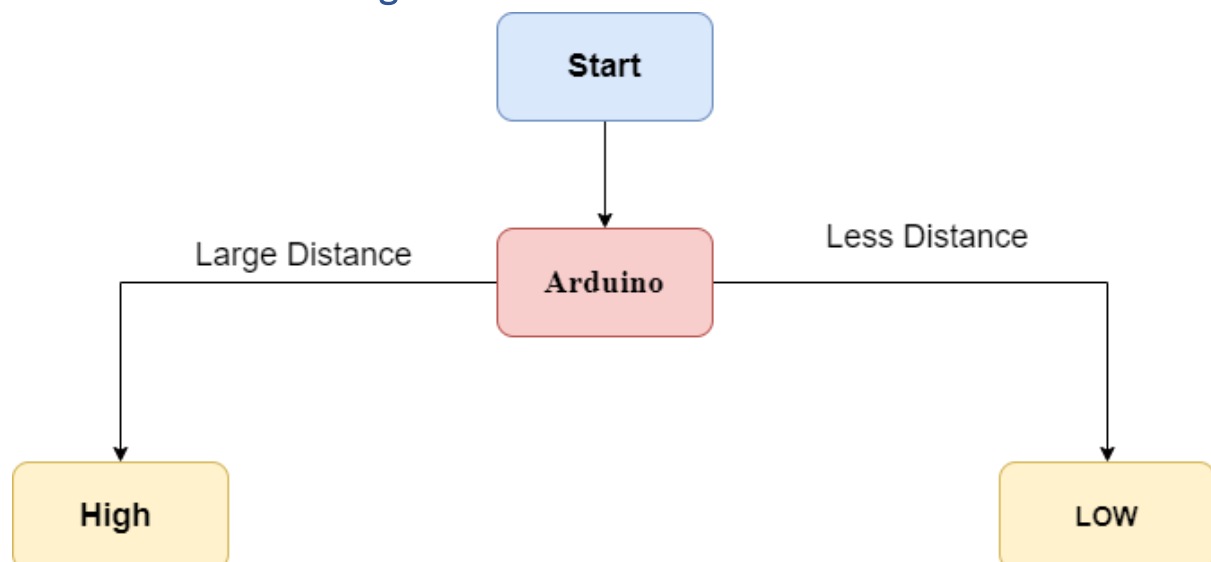
The working principle is very simple. The Arduino Uno continuously checks for the communication from ultrasonic sensor and LDR. The led will be ON when the light intensity and the distance from ultrasonic sensor are satisfied. Otherwise the led will be in OFF position. This is the working principle of Smart Street Lights With LDR and ultrasonic sensor. So that we can minimize the power usage of street lights

4 Structural Diagram

4.1 High Level Diagram-

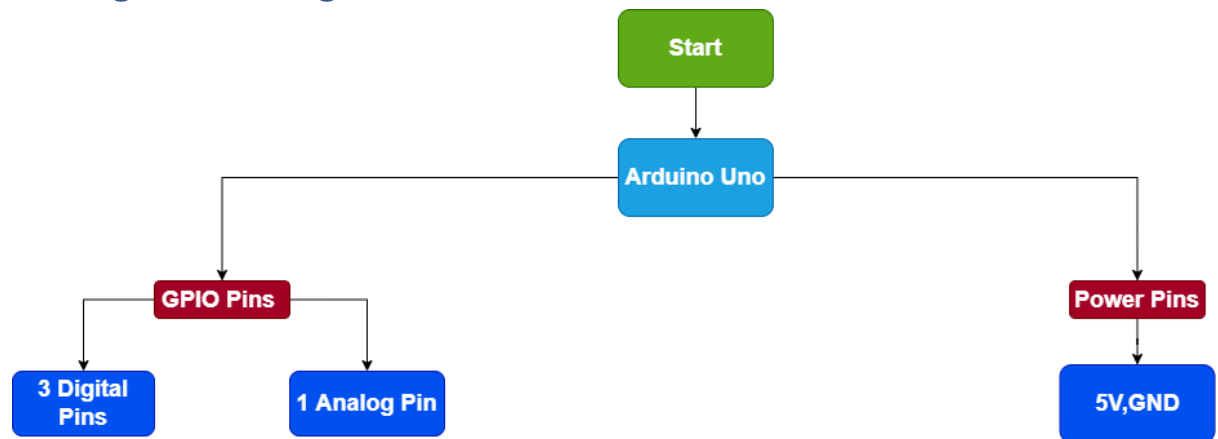


4.2 Low Level Diagram-

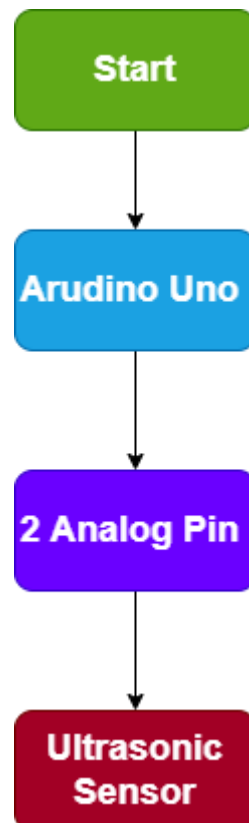


5 Behavioral Diagram

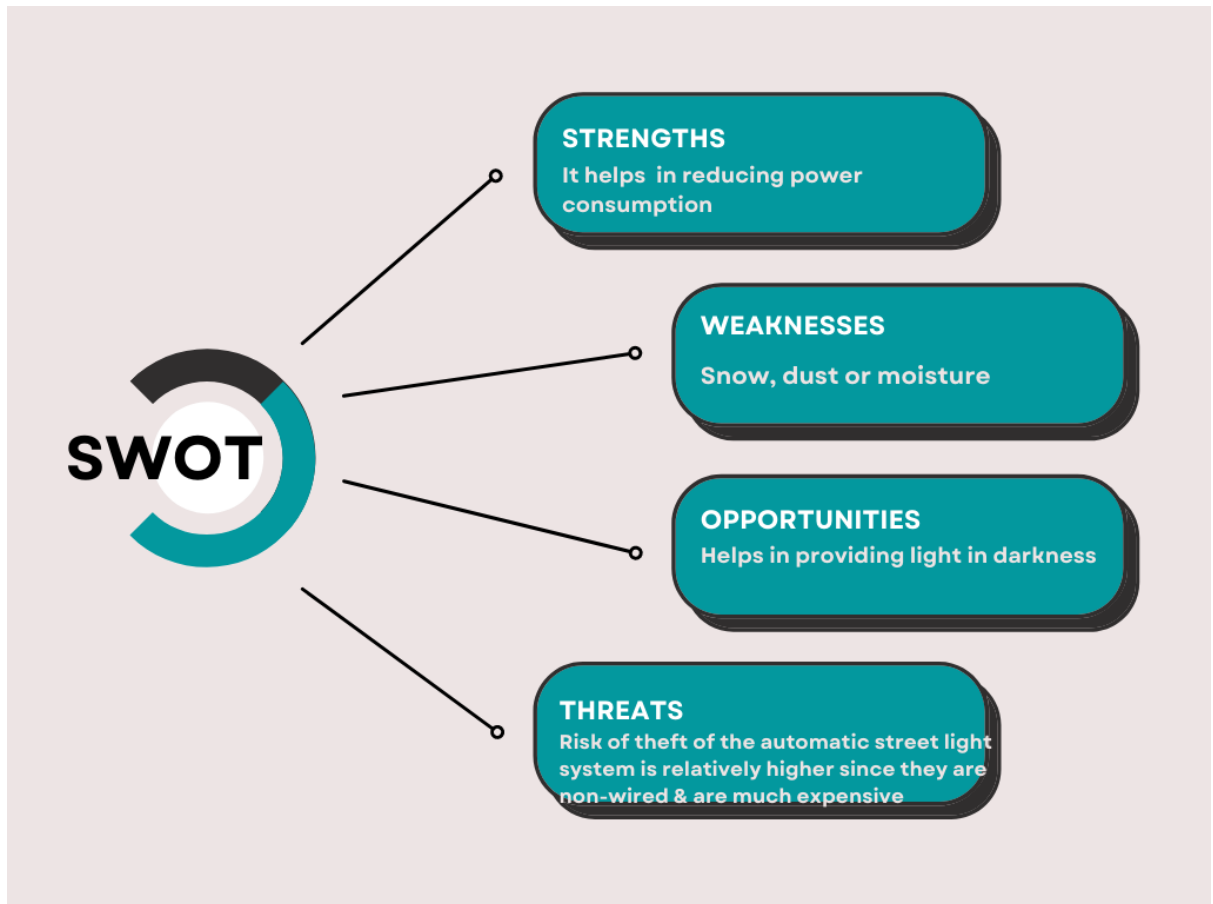
5.1 High Level Diagram



5.2 Low Level Diagram-



6 SWOT



7 Features of Smart Street Lights

- Dynamic lighting controls based on movement detection.
- Environmental and weather monitoring.
- Extended cellular and wireless communications.
- Automatic emergency response in the event of a car crash or crime.

8 Benefits of Smart Street Lights

- Reduced carbon emissions and light pollution
- Lowered repair and maintenance costs with the monitoring software.
- Reduced energy cost and usage with flexible dimming controls.
- Improved architectural planning based on real traffic patterns and insights.