# Solar Led Street Lights using Ultrasonic Sensor

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**Abstract:** *The colossal measure of electrical energy of numerous nations is devoured in lighting the streets. In any case, vehicles go with low rate in particular timeframes and parts of the streets are not possessed by vehicles after some time. In this paper, we propose a framework that consequently turns off the light for the parts of the roads having no vehicles and turns on the light for these parts once there are a few vehicles that will come. It represents the road light shining framework on vehicle recognizing development. Controlling of road light is of most extreme significance in creating nation like India to decrease the power utilization. Coherently, this framework may spare a lot of the electrical power. Furthermore, it might expand the lifetime of the lights and decrease the contamination level. This framework consequently controls and screens the light of the boulevards. It utilizes sun based vitality put away amid the day to control the LEDs amid the night. Ultrasonic Sensors utilized on either sides of the street send rationale summons to the microcontroller for exchanging on the LEDs.*

***Keywords*** *- Microcontroller, Solar, Ultrasonic Sensors, Vehicle Movement.*

## I. INTRODUCTION

A standout amongst the most critical human progress files is the development of a decent transportation arrange. This incorporates streets, streets and parkways that must be satisfactorily enlightened so that an adequate perceivability is ensured with a specific end goal to diminish the mishap rate and increment the stream of the vehicles and security. In any case, these boulevards and streets are lit up continually for over 13 hours every day. This thus requires a tremendous measure of electrical energy to light every one of the boulevards and streets. Around 30% of the aggregate electrical energy of any nation is expended in lighting the streets and the lanes[1]. The spending cost for the energy is high.

We additionally realize that for a few streets, vehicles go with little rate in particular timeframes. As such, on the off chance that we separate the streets into little parts, with each part has a length of 500 meters (the base perceivability go),
we can find that in numerous streets just few these parts have vehicles that go through them and whatever is left of the parts have no vehicles, yet at the same time expending electrical power. This is a dynamic issue that implies that any piece of the street can be free and afterward in no time be involved then free once more, and so on.

That brings up a characteristic issue which is: is it conceivable to consequently cut the power for the parts of the streets that don't have vehicles and resume the current for these parts once there are a few vehicles that will come? In the event that this framework could be actualized, it can spare extensive measure of the electrical power that can be utilized to create different territories in the nation. It can likewise expand the lifetime of the Lamps and subsequently diminish the primary tenance cost. Another advantage is to decrease the environment contamination.

The proposed system uses Embedded System which is a mix of PC equipment and programming, and maybe extra mechanical or different parts, intended to play out a particular capacity. An inserted framework is a microcontroller based, programming driven, solid, continuous control framework, independent, or human or system intuitive, working on differing physical factors and in different situations and sold into a focused and cost cognizant market[2]. An installed framework is not a PC framework that is utilized principally to process, not a product framework on PC or UNIX, not a customary business or logical application. High-end embedded & lower end embedded systems. High-end embedded system - Generally 32, 64 Bit Controllers used with OS. Lower end embedded systems - Generally 8,16 Bit Controllers used with an minimal operating systems and hardware layout designed for the specific purpose`[3].

For planning a legitimate road light different variables are to be considered which incorporates its proficiency to give appropriate lighting in the city, its hurtful natural impact, establishment and running expense and so forth. So before planning a road light every one of these components ought to be considered legitimately and endeavors ought to be made to fuse advances which are more powerful like the one we have talked about here “SOLAR LED STREET LIGHT USING ULTRASONIC SENSOR”.[4] There are various types of street lights according to the lamp used such as incandescent light, mercury vapor light, metal halide light, high pressure sodium light, low pressure

sodium light, fluorescent light, compact fluorescent light, induction light and LED light..For the past several years high and low pressure sodium lamps have been used for street and security lighting but improved LED technology and their lower prices have the potential to replace them in future. LED can undoubtedly supplant conventional road light lights since they have higher adequacy and longer life separated from this they are reduced, strong and requires relatively less power. Road light is consequently exchanged ON when the daylight goes down and is naturally turned OFF when there is adequate daylight. This capacity is finished by a sensor called Light Dependant Resistor (LDR) which detects the light really like our eyes.

A comparative study between traditional HPS street light and LED street (for 1km) was done at three different locations in Greater Noida. Table below shows wattage of HPS bulb and LED array for same lux[5]. Table 1 gives wattage comparison of HPS and Led array for the same lux and pole length.

TABLE 1: HPS vs LED WATTAGE

| Area | HPS | LED Array | Pole Length |
|---|---|---|---|
| Highway | 250W | 110W | 20m |
| Service Lane | 150W | 90W | 15m |
| Sector | 70W | 40W | 10m |

TABLE 2: HPS vs LED

| LEDs vs. High-Pressure Sodium (HPS) Lamps | | | | | |
|---|---|---|---|---|---|
| Fixture Type | Wattage | Lifespan | | Energy Use (24 hrs/day) | Annual Cost (maintenance + electricity) |
| | | Hrs | Yrs | Annual | @ $0.11/kWh |
| HPS | 191 W | 24,000 | 2.7 | 1,674 kWh | $195 |
| LED | 78 W | 50,000 | 5.7 | 683 kWh | $75 |

## II. Literature Review

### A. Origin of the Research Problem

Because of the expansion of natural concerns, lighting control frameworks will assume an imperative part in the lessening of vitality utilization of the lighting without hindering solace objectives. As said in the IEA Annex 31 (IEA 2001), vitality is the absolute most critical parameter to consider while surveying the effects of specialized frameworks on the earth. Vitality related outflows are in charge of around 80% of air emanations (IEA 2001), and key to the most genuine worldwide natural effects and perils, including environmental change, corrosive statement, exhaust cloud and particulates. Lighting is regularly the biggest electrical load in workplaces, yet the cost of lighting vitality utilization stays low when contrasted with the staff costs. Accordingly its vitality sparing potential is frequently ignored. As per an IEA study (IEA 2006), worldwide framework based power utilization for lighting was around 2650 TWh in 2005, which was a likeness 19% of aggregate worldwide power utilization. European office structures devote around half of their power for lighting, though the share of power for lighting is around 20-30% in clinics, 15% in manufacturing plants, 10-15% in schools and 10% in private structures ( EC 2007). Open lighting in boulevards, burrows, downtown areas, ports and squares and so forth can represent around 30% of the urban vitality utilization. Furthermore, the upkeep expenses are high. India is confronting an immense vitality emergency which must be routed to at the most punctual utilizing gadgets that are vitality proficient. In view of natural and financial variables, urban areas require brilliant vitality administration frameworks critically for vitality sparing, upkeep costs lessening and CO2 emanation decrease.

### B. Related Works

There are a few endeavors to control the street lighting for sparing the vitality and to diminish the contamination. In [6,7] a street lighting shrewd control framework is proposed. The framework depends on remote system control that can execute ongoing observing for street lighting. The proposed framework utilizes the Zigbee remote systems and GPRS standard to screen the status of the lights. The objective is to permit a focal checking of the status of street light terminals that are furnished with remote controller and electronic counterweights to have the capacity to remotely turn on or off the terminals. Moreover, the framework can be ace grammed to switch every one of the terminals to half-control state at particular time to spare the vitality. There are a few constraints of this framework. In the first place, its intricacy and cost: every hub or terminal must have microchip, controller, and remote interface. This can expand the cost excessively and thus prevent the wide-scale sending of the framework. Second, it is utilizing a totally new system instead of utilizing the current system for the street lighting control and administration. Third, the framework is not programmed. The framework will be customized to dime the terminals at particular time. The framework does not consider the nearness of vehicles or not. In this way, it can't accomplish the greatest power-sparing. Another recommendation that is like the framework proposed in [6,7] is given in [8]. Comparative control framework that utilizations GPRS

is given in [9]. Keeping in mind the end goal to checking and control every road lighting, the remote sensor organize (WSN) was created in [10]. The framework comprises of sensor hub, remote terminal unit (RTU) and control focus. The sensor hubs were introduced at each lighting shaft and make up a system with RTUs. The sensor detects the status of the light and the light force. Utilizing the Power Line Communication (PLC) [ 10-12], the status and the control signs can be sent from the RTU and the control focus or the other way around. Another related work that uses the WSN is given in [13]. Comparable works that utilizations PLC to remote control the terminal hubs (the lights) are given in [ 1,12]. Another framework for controlling the street lighting is proposed in [14] where the avenues is isolated into locales. By utilizing vehicle-discovery circles in every district, the number of vehicles entering that area can be gotten. Along these lines, utilizing a devoted system and control framework, any district can be turned on or off contingent upon whether there are vehicles distinguished in that locale or not. They ascertained a figure of 23.7% power sparing if the framework is utilized. Another vitality sparing course, with no lighting control, is to change the old lighting framework with all the more sophisticated and vitality sparing types of gear. For instance, in [15] by supplanting the old framework in Thailand by another high weight sodium (HPS) street lighting, they set aside to 25% - 30% of the vitality. Comparable related work to this pattern is by utilizing the LEDs [16] (Light Emitting Diodes) lights that can expend just the quarter of the HPS lights and give practically the proportional iridescent viability.

## III. PROPOSED WORK

The goal for this venture is to design a smart lighting framework which focuses on the vitality sparing and self-sufficient operation on efficient reasonable for the streets. Manufacture a vitality sparing shrewd lighting framework with coordinated sensors and controllers. Plan a smart lighting framework with measured approach outline, which makes the framework versatile and expandable. Outline a smart lighting framework which perfect and versatile with other business item and mechanization framework, which may incorporate more than lighting frameworks.

### A. Components Description

**1. Microcontroller** - The microcontroller utilized as a part of this paper is an ATmega 16 board, which is an effectively accessible low-control expending, CMOS 8-bit microcontroller in light of the Harvard engineering with an In-System 16 kilobyte Programmable glimmer memory. The Harvard design incorporates a different stockpiling and flag pathways for directions and information bolsters. The framework plan of ATmega 16 permits it to upgrade control utilization verses handling speed with execution rates as high as 1 MIPS. The Harvard engineering likewise permits execution of intense directions in solitary clock cycles.

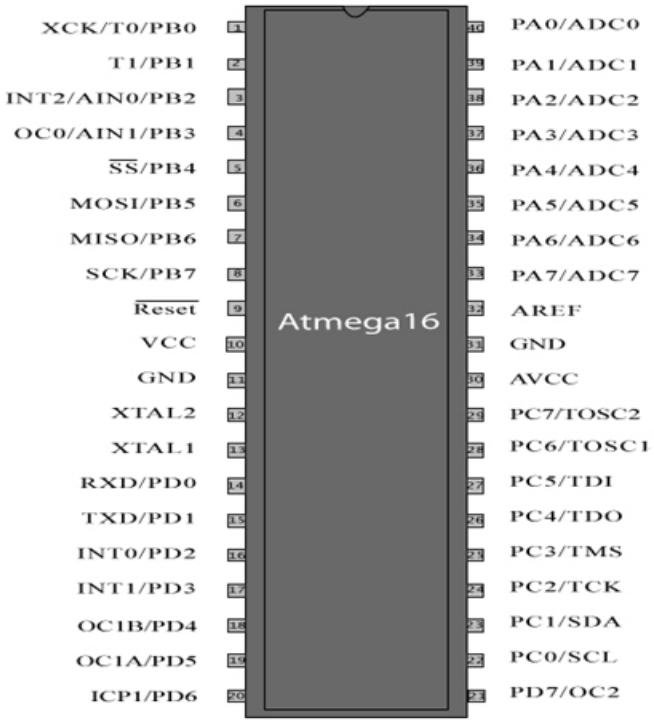


Figure 3.1 ATmega 16 Microcontroller

**2. Ultrasonic Sensor (HCSR04)** - Ultrasonic Sensors are self-contained solid-state devices designed for non-contact **sensing** of solid and liquid objects. The figure depicts the HC-SR04 ultrasonic sensor. This economical sensor gives 2cm to 400cm of non-contact estimation usefulness with a running exactness that can reach up to 3mm. Each HC-SR04 module incorporates an ultrasonic transmitter, a collector and a control circuit.


Figure 3.2 HCSR04 Ultrasonic Sensor

There are just four pins on the HC-SR04: VCC (Power), Trig (Trigger), Echo (Receiver), and GND (Ground). Table 3 below lists the features of HCSR04 Ultrasonic Sensor.

TABLE 3: Features of HCSR04 Ultrasonic Sensor

| Serial Number | FEATURE | VALUE |
|---|---|---|
| 1 | Working Voltage | +5Volt DC |
| 2 | Working Frequency | 15 mA |
| 3 | Frequency | 40 KHz |
| 4 | Maximum Range | 4 m |
| 5 | Minimum Range | 12 cm |
| 6 | Measuring Angle | 15 Degree |

**3. Light Dependent Resistor (LDR) -** LDR stands for Light Dependent Resistor or Photoresistor. It is basically a resistor which has a resistance that varies depending of the light intensity. The resistance is very high in darkness, almost high as 1 MΩ. When light falls on the LDR, the resistance decreases to a few KΩ (10-20kΩ) depending on the model.

Figure 3.3 Light Dependent Resistor

**4. Solar Panel -** Solar panel refers to a panel designed to absorb the sun's rays as a source of energy for generating electricity or heating. Photovoltaic modules use light energy (photons) from the Sun to generate electricity through the photovoltaic effect. Most of the modules use wafer-based crystalline silicon cells or thin-film cells. Solar Panel used in the prototype is of 3 Watt.

Figure 3.4 Solar Panel

**B. Working**

The Ultrasonic sensor would be mounted on the first post which will constantly send the separation range ,between the two enclosing sided of the street, to the microcontroller which would act as logic1 and LED lights would remain switched off. When this separation range is altered because of the presence of any vehicle or individual, which would act as logic 0, then the microcontroller will switch on the following 3 lights for 20 seconds. Another ultrasonic sensor would be mounted on the third pole and if this sensor identifies that there is any object (vehicle or person) present then the next 3 lights will be switched on and lights before that would be switched off. The procedure proceeds similarly for the remainder of the street and the remaining street lights and the remaining ultrasonic sensors.

The proposed model would be mounted at such a height in this way, to the point that it keeps away from the superfluous switching on of the lights by different little creatures like mutts, felines which meander around the streets amid the night. The model would likewise turn off the lights if a man stops the vehicle before the ultrasonic sensor by the utilization of the feedback mechanism. This would be so by the consistent gathering of a similar reading by the microcontroller. When the microcontroller gets a similar reading for over 30 seconds then it would send the summon for turning off the lights.

## FUTURE SCOPE

With a few progressions made to the proposed model, it can be actualized on expansive scale with some valuable increments. Some of these augmentations can be :

- It can be utilized to tell people in general of the passing fire trucks or ambulances. This can be accomplished by fitting the street light with another LED of different shading and this LED can be turned on in the event that the fire truck or emergency vehicle is passing who will send a signal to the microcontroller, which would act as an interrupt, to switch on the distinctive hued LED.
- It can be utilized to gauge the traffic density utilizing the ultrasonic sensor. It could be utilized to show the density of the vehicles going through any road to tell the general population of the activity rate and in this way illuminate about which course to take and which to stay away from. A huge show screen of LCD could be utilized for such purposes.

## CONCLUSION

The model specified in the paper can help avert pointless wastage of power and help in lessening of different unsafe gasses like CO2. It additionally, helps in beating the burden of utilizing Infrared Sensor which can't distinguish black colour and therefore can't identify any black vehicle or individuals wearing dark garments.

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