

Traffic Signal & Street Light Automation System

Rohit Kothawale¹, Prince Kumar², Sahil Kumar³, Aniket Mahajan⁴

Student, Electronics & Telecommunication, Sinhgad College of Engineering, Pune, India^{1,2,3}

Student, Mechanical, Vellore Institute of Technology, Chennai, India⁴

Abstract: This project is based on traffic management and street light power saving measures. It is inspired by the daily observation during driving a vehicle. This system will offer us both the facilities like smart traffic signal management and street light power saving. Currently traffic signal is set by equal time for all road. This system will set the traffic signal according to density of the road from that direction. This system will improve the traffic management and will reduce the time to stop at traffic signal. Moreover, this system will save power of the street lights. At nights, all street lights are left on. Even if there is no commute on some roads, still every night, the streetlight of these roads remains on which causes lots of electricity wastage. To prevent this wastage, this system will turn on the street light only when some vehicle is going to pass from that road. The intensity of the street light will be set by the intensity of surrounding light. On some parts of the road there are lot of light sources like for example residential or commercial complexes or some advertising banner which can provide light to road, here the intensity of street light need not to be high. So in such situations, by reducing the intensity of street light, we can save electricity.

Keywords: Microcontroller, Ultrasonic Sensor (HC-S04), Led, LDR, etc.

I. INTRODUCTION

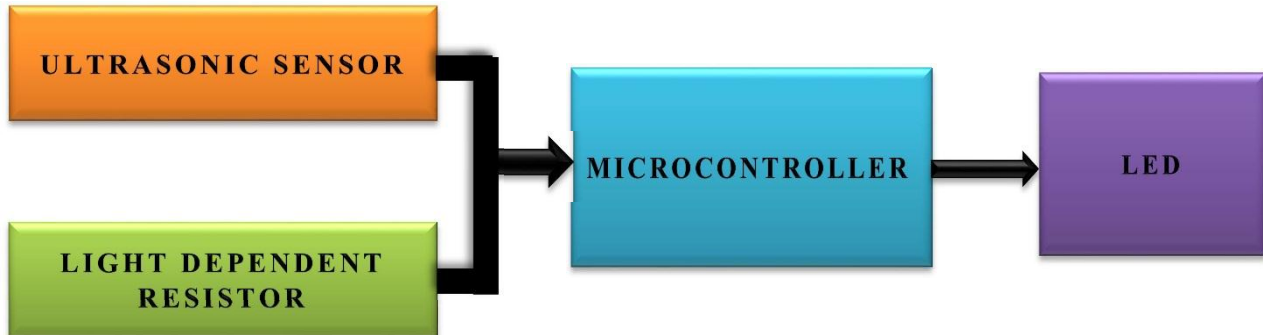
Poor Traffic Management will increase traffic of vehicles. Traffic Management can be improved by setting the traffic signal according to the density of traffic to a direction. This will reduce the traffic on roads. Currently equal time has been set to all traffic signals without considering the density travelling from that direction. Due to this, where less density traffic is travelling from that direction, then these vehicles gets less time to wait on traffic signal. While high density traffic with same signal time need to wait for long time on traffic signal. And due to this, the intensity of traffic increases. Setting traffic signal according to the density will give everyone less time to wait at the signal thus reducing the intensity of traffic.



Along with Traffic Management, this system also provides another facility that is saving power of Street Lights. All Street Lights are kept on throughout the night even if this is not required most of the times. This system will turn on street light on that part of the street where vehicle or people are going to pass from. When nothing is going to pass, at that time the street lights will be off which will save electricity. Addition to this, the system will set the intensity of street light according to the surrounding light. If the surrounding light is more, the intensity of street light will be reduced which will save more electricity.

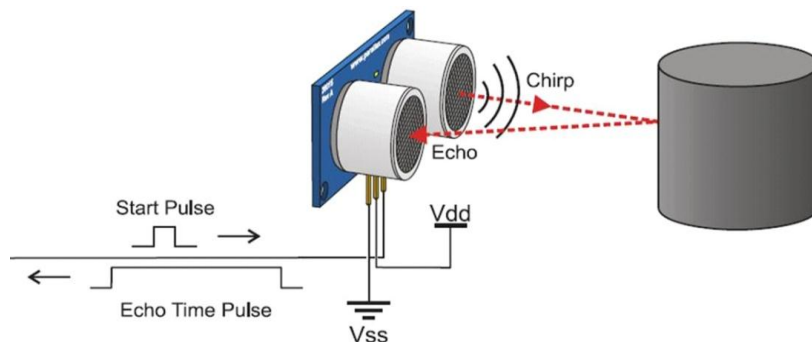
II. PROPOSED SYSTEM

Below shown is the block diagram representation of the "Traffic Signal & Street Light Automation System".

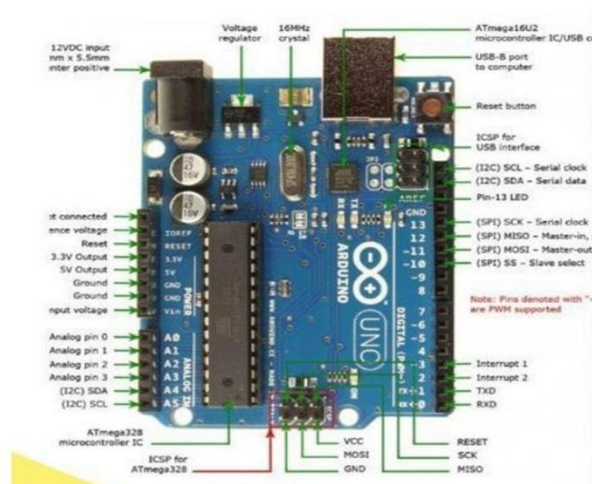


The system consists of total five blocks, the function of the five blocks are as follows:

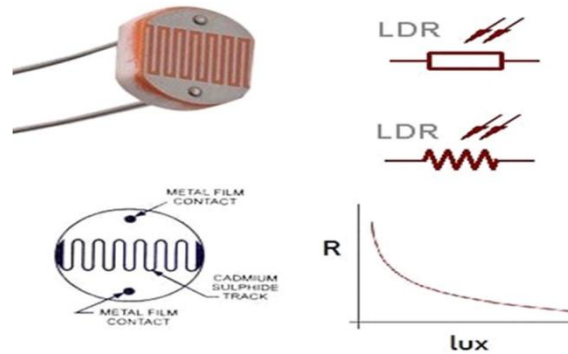
1. Ultrasonic Sensor : An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound (i.e. the sound that humans can hear). In this system the purpose of the sensor is to detect the presence of any object within 50 meters of range and send the corresponding signal to the microcontroller. Below shown is a working diagram of an ultrasonic sensor.



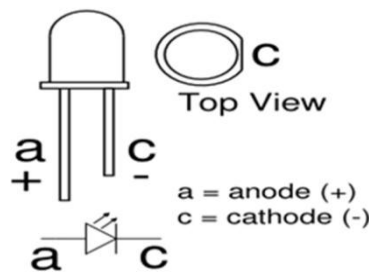
2. Microcontroller : A microcontroller is a compact integrated circuit designed to govern a specific operation in an embedded system. In this system we are using ARDUINO UNO as microcontroller. The purpose of choosing this as a microcontroller is due to its compact size and number of input/output pins available (14 digital and 8 analog pins available) which will make future development of the system of the easy and compact alongside.



3. Light Dependent Resistor(LDR): A Light Dependent Resistor (LDR) is also called a photo resistor or a cadmium sulfide (CdS) cell. It is also called a photoconductor. It is basically a photocell that works on the principle of photoconductivity. The passive component is basically a resistor whose resistance value decreases when the intensity of light increases. In this system the purpose of the sensor is to detect the light approaching from the vehicle in front and send the corresponding signal to the microcontroller. Below shown is a working diagram of LDR sensor for better understanding.



4. LED: LED (Light Emitting Diode) is basically a small light emitting device that comes under “active” semiconductor electronic components. It’s quite comparable to the normal general purpose diode, with the only big difference being its capability to emit light in different colors. The two terminals (anode and cathode) of a LED when connected to a voltage source in the correct polarity, may produce lights of different colors, as per the semiconductor substance used inside it. Here, in our system the LED works as a alert signal for the driver in the vehicle.



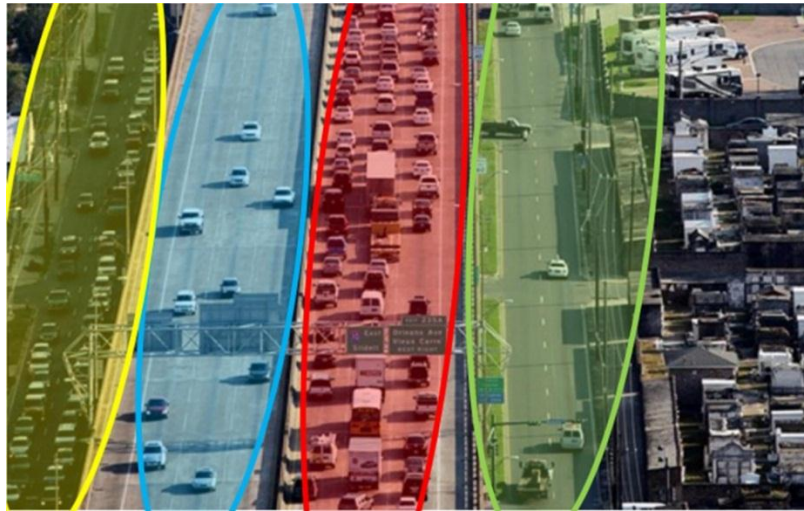
III. NEED OF THE SYSTEM

Road Traffic Control Systems collect and analyse driving information of vehicles in the area, perform the optimal traffic signal control in accordance with the constantly changing road traffic situation, and provide useful traffic information to drivers based on the data collected. Ensuring a smooth traffic flow by shortening the driving time of vehicles and reducing the number of times vehicles come to a halt will lead to benefits such as a reduction in road traffic accidents and a decrease in air pollution, which will in turn make a significant contribution to a safe and comfortable road traffic environment. A traffic system needs to cover all the objects that could interact with each other. *Therefore, the physical size of the traffic system depends on how far a vehicle could reach in a given time.* The time could be set to 5 seconds, like the value that is used by 3GPP. Therefore the size of the traffic system depends on the speed of the objects in the traffic system.

Benefits of this system:

1. Increasing the traffic handling capacity of roads.
2. Reducing collisions and waiting time for both vehicles and pedestrians.
3. Reducing travel time.
4. Reducing unnecessary stopping and starting of traffic - this in turn reduces fuel consumption, air and [noise pollution](#), and vehicle wear and tear.
5. Reducing driver frustration and [road rage](#).

Examples of traffic situations to be covered by a traffic management application:



Major advantages of street lighting include prevention of accidents and increase in safety. Studies have shown that darkness results in a large number of crashes and fatalities, especially those involving pedestrians; pedestrian fatalities are 3 to 6.75 times more likely in the dark than in daylight. Street lighting was found to reduce pedestrian crashes by approximately 50%.



This system will prevent wastage of electricity and moreover this system will also help to reduce light pollution. Of course, street light is important. But efficient use of street light can save lot of electricity. This system will not only turn on and off street light according to vehicles passing but will vary the intensity of street light to prevent wastage of electricity. Main advantage of this system is that same components of this system will complete two different applications.

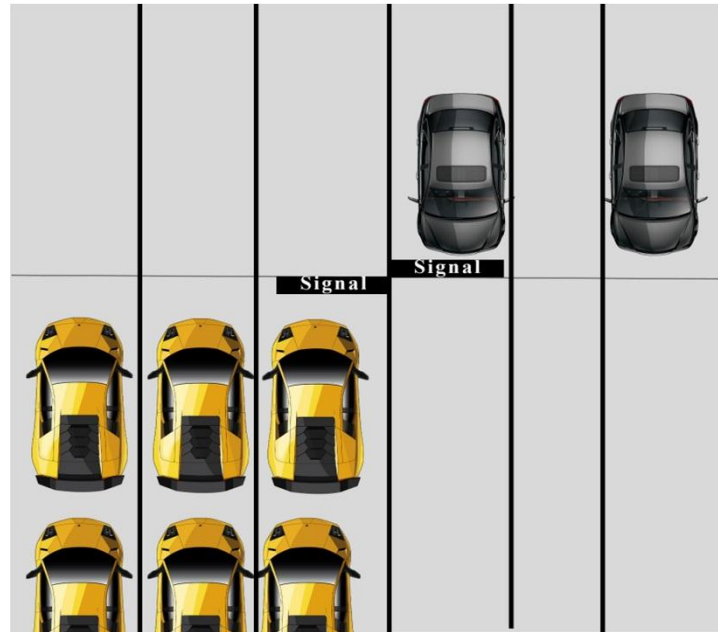
IV. WORKING

The position of Ultrasonic Sensor will be on street dividers at distance of 50 meters each. LDR will be attached on the pole of street light.

In the first application, the system is about Traffic Management. Ultrasonic Sensors readings will be given to the microcontroller.

Stages of Traffic Management:

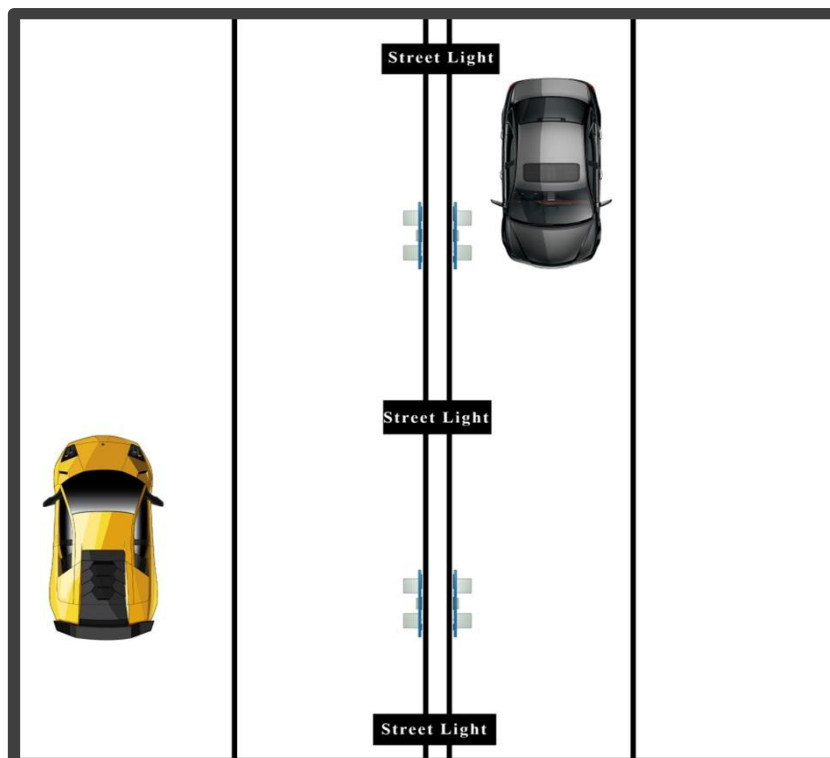
1. In the First Stage, Ultrasonic Sensors readings will be processed by the microcontroller. The readings will be compared and if one of the direction's traffic density is less than 50 % of the other, then that part of the road will get red signal and the other will get green.
2. When the situation gets opposite after sometime, then the other road gets green signal. This will ensure a smooth flow of traffic.
3. The Ultrasonic Sensor will check the first two lanes. As the first lane on Signal can be used for U-turn or Crossing road. For this, some vehicles can wait in first lane till long distance, So we can get wrong data about traffic density from this. So the Ultrasonic will take readings of first two lanes.
4. Ultrasonic won't take readings of the last lane as the vehicles waiting there can be parked.



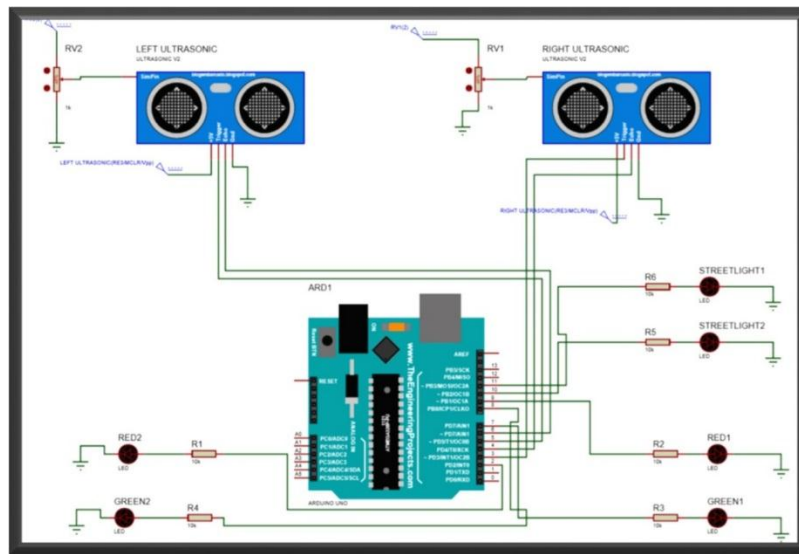
In the Second Application, the system is about Street Light Power Saving System. In this system, Ultrasonic Sensor and LDR sensor readings will be given as input to the microcontroller.

Stages of Street Light Power Saving:

1. First the microcontroller will process the LDR readings to get the surrounding light intensity.
2. If the surrounding light intensity is high, that means its daytime. So, in this situation the street light will remain off.
3. If the surrounding intensity is low, then the Ultrasonic Sensor readings will be processed.
4. If the first two Ultrasonic readings show that there is vehicle or people passing, then the next streetlights will be turned on.
5. During this situation, the LDR readings will be checked.
6. The Street light's intensity will be varied according to the intensity of the surrounding light.



V. CIRCUIT DIAGRAM



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BIOGRAPHY



Rohit Kothawale is pursuing Bachelor of Engineering in Electronics and Telecommunication at Sinhgad College of Engineering, Pune. His field of interests include Embedded System, Robotics & Automation.



Prince Kumar is pursuing Bachelor of Engineering in Electronics and Telecommunication at Sinhgad College of Engineering, Pune. His field of interests include Embedded System, Robotics & Automation.



Sahil Kumar is pursuing Bachelor of Engineering in Electronics and Telecommunication at Sinhgad College of Engineering, Pune. His field of interests include Embedded System, Robotics & Automation.



Aniket Mahajan is pursuing Bachelor of Technology in Mechanical at Vellore Institute of Technology, Chennai.