## Energy saving using Automated Smart

## Street Lights

*Submitted in partial fulfillment of the requirements for the degree of*

**Bachelor of Technology**

in

**Electronics and Communication Engineering**

*by*

**Maneesh Busi**

**16BEC0710**

**Under the guidance of**

**Prof. / Dr. Elizabeth Rufus**

**SENSE**

**VIT, Vellore.**



May, 2020

## DECLARATION

I hereby declare that the thesis entitled “Energy saving using automated smart street lights” submitted by me, for the award of the degree of *Bachelor of Technology in* *Electronics and Communication Engineering* to VIT is a record of bonafide work carried out by me under thesupervision of **Prof.Elizabeth Rufus**.

I further declare that the work reported in this thesis has not been submitted and will not be submitted, either in part or in full, for the award of any other degree or diploma in this institute or any other institute or university.

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Date :

**Signature of the Candidate**

## CERTIFICATE

This is to certify that the thesis entitled “Energy saving using automated smart street lights ” submitted by **Maneesh Busi, 16BEC0710, SENSE**, VIT University, for the award of thedegree of *Bachelor of Technology in Electronics and Communication Engineering*, is a record of bonafide work carried out by him under my supervision during the period, 01. 12. 2018 to 30.04.2019, as per the VIT code of academic and research ethics.

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**Internal Examiner** **External Examiner**

Head of the Department

SENSE

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**Maneesh Busi**

## Executive Summary

Currently, in the world, enormous electric energy is consumed by the street lights, which are automatically turned on when it becomes dark and automatically turned off when it becomes bright. This is a huge waste of energy. This paper discusses a smart street light system.

The main aim of smart street light systems is that lights turn on when needed with the minimum required intensity so as to not use too much power, and light turn off when not needed.

The smart street light system consists of LED lights, brightness sensors, motion sensors and short-distance communication networks. The lights turn on before pedestrians and vehicles come and turn off or reduce brightness when there is no one. It will be difficult for pedestrians and drivers of vehicles to distinguish our smart street lights and the conventional street lights because our street lights all turn on before they come.

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|  | **List of Abbreviations** |
| 3GPP | Third Generation Partnership Project |
| 2G | Second Generation |
| 3G | Third Generation |
| 4G | Fourth Generation |
| AWGN | Additive White Gaussian Noise |

**Symbols and Notations**

f

CFO

NCFO

## 1. INTRODUCTION

#### 1.1. OBJECTIVE

Automation’s main goal is to reduce manual labour or man power with the help of intelligent systems so that humans can be used for more creative and thought-based work instead of physical work. But usage of machines usually requires a lot of electrical power. So one of the main considerations when automating a particular system is cost effectiveness and power consumption.

The main aim of the project is Automatic street power saving system using Ambient Light resistor and Infra-red sensors. We can save power automatically using this system instead of someone manually doing it. So it’s also cost effective.

#### 1.2. MOTIVATION

Nowadays, in the whole world, street lights consume enormous electric energy. The number of street lights is not known accurately, but it is said that one hundred million or one billion street lights exist in the whole world. If one hundred million street lights exist, each street light consumes 20W and a half of all street lights always turn on in the whole world, 8760GWh electric power, which is about 0.8% of annual consumption of electric power in Japan. In the future, many developing countries will install many street lights and consume much electric power. Thus, to save electric power that is consumed by street lights is important to reduce greenhouse gases.

Current street lights are controlled only by means of the embedded brightness sensors; they are automatically turn on when it becomes dark and automatically turn off when it becomes bright. This is the huge waste of energy in the whole world and should be changed. There are some attempts in which the energy wastes of the street lights are reduced. A sensor light, which is controlled by a brightness sensor and a motion sensor, is sometimes used to reduce wastes of energy. It only turns on for a while when the motion is detected in front of the light and it is dark. However, usually a sensor light is too late to turn on when pedestrians or vehicles come in front of it. The light should turn on before pedestrians or vehicles come. Ideally, it is desirable that smart street lights look like usual street lights; no one notices that smart street lights are usual street lights.

#### 1.3. BACKGROUND

When you get up in the morning you may have noticed that street lights are still ON when it’s not necessary & when you travel to rural areas either there is no street lamp or there are not so many vehicles to fully utilize that facility. Simply it means the wastage of electricity. At the beginning, street lamps were controlled manually in which the control switch was set in each of the street lamps. That was called as the first generation of the original street light. Another method that has been used after that was based on the optical control method. In this method the high pressure sodium lamps were used. Even the new automated street lights usually require some kind of human intervention to run perfectly. The amount of resources in the above examples is a little too much for something as simple as a street light, something which even rural areas have. Most rural areas won’t be able to afford the cost required for these resources. This project suggests an automatic system which uses less power and provides more features as compared to other street light systems.

## 2. PROJECT DESCRIPTION AND GOALS

The automated light system controls the street light to give out the minimum intensity required to light up the surrounding area. It is a simple yet powerful concept using ambient light sensors and IR sensors.

The lights switch on and glow at a low intensity at a given time. This intensity depends on the light falling on the ambient light sensor placed near the chosen lane. The intensity is recorded and updated in our custom-made IoT UI Dashboard using a messaging protocol called MQTT.

If a vehicle happens to use the lane where the street lights are installed, the IR sensor which is placed a few metres before the street light senses the vehicle. It then sends that data to the microcontroller to turn up the intensity of the light to a 100% output.

Each IR sensor will control 3 street lights that come after it. The lights wont switch off/turn down their intensity as long as the car doesn’t hit the next IR sensor i.e. the lights are not programmes to switch off after a certain delay, instead they are made to turn off when the vehicle moves forward and passes the next “checkpost” which is the IR sensor. This little algorithm will be useful when the vehicle is not in a condition to move in the middle of the road.

The project also has a parking system which uses the same technology and code used above, but instead switches off the surrounding lights except the light placed near the parking spot.

## 3. TECHNICAL SPECIFICATIONS

#### 3.1 Arduino Mega

Fig 3.1 is a pinout diagram of Arduino MEGA, the microcontroller being used for this project.

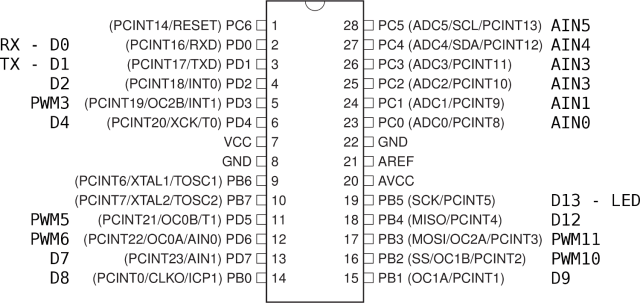
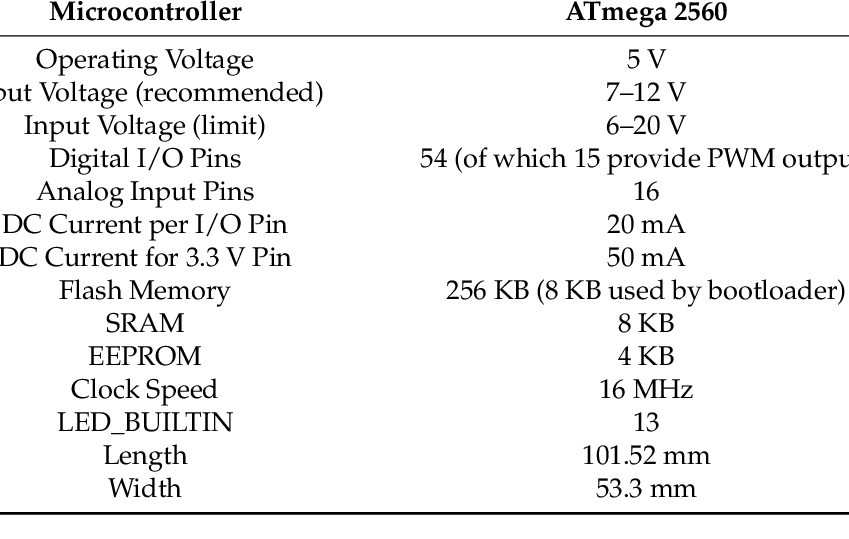


Fig. 3.1 : Pin diagram of Arduino MEGA

And Table 3.1 is the specification of the microcontroller.

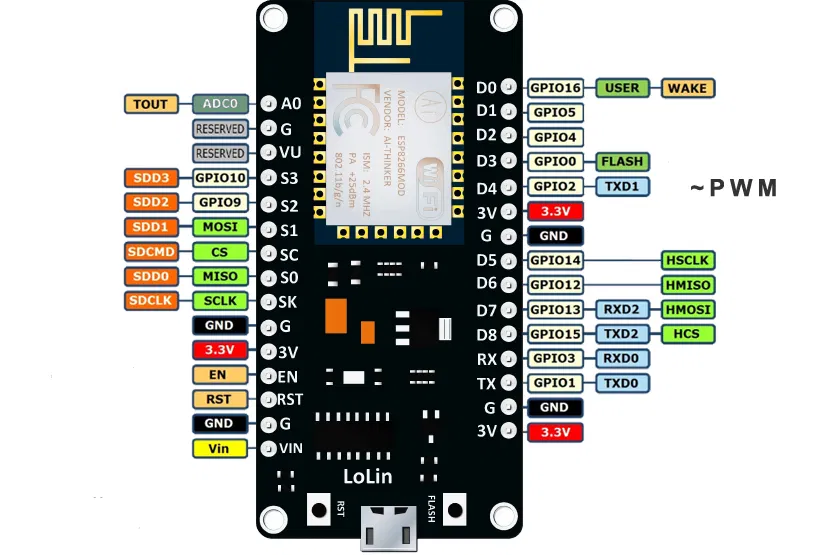
Table 3.1 :- Specification of Arduino MEGA



#### 3.2 NodeMCU

NodeMCU is also a microcontroller but doesn’t have enough power to control the whole system. So instead it is being used as a Wi-Fi Shield for the Arduino to connect to the internet.

Fig 3.2 contains the pinout diagram of the module. We will be using only 4 pins here. The Tx , Rx pins and 2 other pins which are set as a secondary input and output for serial communication.



3.3 Light Dependent Resistor (LDR)

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.

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