

# Controlling The Brightness of Light by Using Touch Sensor

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## ABSTRACT

A Red Light Emitting Diodes (LED) replaces HID lamps in street lighting system to include dimming feature. A Arduino is used to control the intensity that drives a TIP122 to switch the LED's according to achieve desired operation. In the present system, mostly the lightning up of highways is done through High Intensity Discharge lamps (HID), whose energy consumption is high. Its intensity cannot be controlled according to the requirement so there is a need to switch on to an alternative method of lightning system i.e., by using LED's. This system is build to overcome the present day drawbacks of HID lamps. This system demonstrates the usage of the LED's (light emitting diodes) as the light source and its variable intensity control, according to the requirement.

**Index Terms** - Micro controller Touch sensor, LED Light, Transistor, Printed Circuit Board.

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## I. INTRODUCTION

Early dimmers were directly controlled through the manual manipulation of large dimmer panels. This required all power to come through the lighting control location, which could be inconvenient, inefficient and potentially dangerous for large or high-powered systems, such as those used for stage lightning.

### 1.1 Modern Light Dimmers:

Solid-state light dimmers work by varying the "duty cycle" (on/off time) of the full AC voltage that is applied to the lights being controlled. For example, if

the voltage is applied for only half of each AC cycle, the light bulb will appear to be much less bright than when it get the full AC voltage, because it get's less power to heat the filament. Solid-state dimmers use the brightness knob setting to determine at what point in each voltage cycle to switch the light on and off. Typical light dimmers are built using thyristors and the exact time when the thyristor is triggered relative to the zero crossings of the AC power is used to determine the power level. When the thyristor is triggered it keeps conducting until the current passing though it goes to zero. By changing the phase at which you trigger the triac you change the duty cycle and therefore the brightness of the light.

## 1.2 Touch Sensor :

The dimmer action is achieved with the help of a Touch Sensor. While a regular switch is used to simply turn ON or OFF a light, a Dimmer (or Dimmer Switch) will allow us to control the brightness of the light. Without a Dimmer Switch, the light bulbs tend to glow at full brightness consuming maximum power. If full brightness is not required, then Dimmer Switches can be used and save some energy. With the help of a Dimmer Switch, we can vary the brightness from fully off to fully on. Different light bulbs need different dimmer switches and there are different types of Dimmer Switches available in the market. Some of the commonly found Dimmer Switches are Slider type and rotary type.

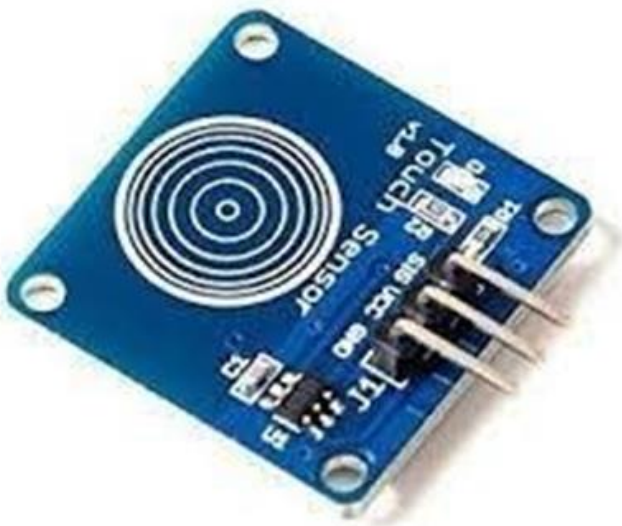


Fig 1 : Touch Sensor

Adapt to new needs and challenges, differentiating its offer from simple 8-bit boards to products for IoT applications, wearable, 3D printing, and embedded environments.

All Arduino boards are completely open-source, empowering users to build them independently and eventually adapt them to their particular needs. The software, too, is open-source, and it is growing through the contributions of users worldwide.

## 1.3 Arduino

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a micro controller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.

The Arduino platform has become quite popular with people just starting out with electronics, and for good reason.

Unlike most previous programmable circuit boards, the Arduino does not need a separate piece of hardware (called a programmer) in order to load new code onto the board – you can simply use a USB cable. Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program. Finally, Arduino provides a standard form factor that breaks out the functions of the micro-controller into a more accessible pack.

The Uno is one of the more popular boards in the Arduino family and a great choice for beginners. We'll talk about what's on it and what it can do later in the tutorial. Over the years Arduino has been the brain of thousands of projects, from everyday objects to complex scientific instruments. A worldwide community of makers – students, hobbyists, artists, programmers, and professionals – has gathered around this open-source platform, their contributions have added up to an incredible amount of accessible knowledge that can be of great help to novices and experts alike.

Arduino was born at the Ivrea Interaction Design Institute as an easy tool for fast prototyping, aimed at students without a background in electronics and programming. As soon as it reached a wider community, the Arduino board started changing to

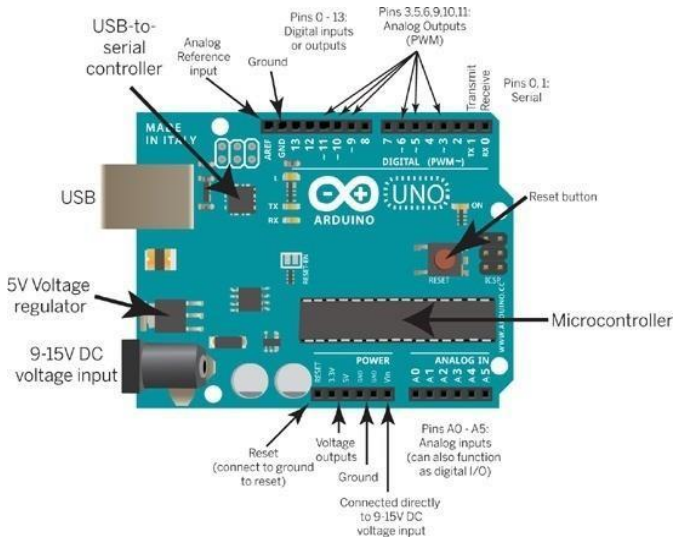


Fig: 2 Arduino

## II. PROBLEM FORMULATION

Over illumination is the presence of lighting intensity higher than that which is appropriate for a specific activity. Over illumination was commonly ignored between 1950 and 1995, especially in office and retail environments. Since then, however, the interior design community has begun to reconsider this practice. Over illumination encompasses two separate concerns. Unnecessary electric lighting is expensive and energy-intensive. Lighting accounts for approximately 9% of residential electricity use as of 200 and about 40% of commercial electricity use.

### 2.1 Existing Technology

In The 21st century is striving hard to save electrical energy. Street lights are essential, but expensive, therefore there is need to optimize the system in a way that it is affordable and efficiently conserves energy. Manually controlling the street lights is a time taking and tedious process. Working in such manner could sometimes result in large disasters and destructions.

The main problem that manual controls on the street lights face is that there would be a lot time taking during evening times when they are to be switched ON and a significant waste of energy is done at morning at

all could not be turned OFF together at once. Another way in which the wastage is done is that at mid nights lights glow at full intensity although there is not much traffic. Therefore, there is a need to come up with a system which overcomes the problems of existing systems.



Fig : 3 Traditional Switch

### 2.2 Proposed Technology

A Touch Dimmer Switch Circuit is a simple project, where the dimmer action is achieved with the help of a Touch Sensor. While a regular switch is used to simply turn ON or OFF a light, a Dimmer (or Dimmer Switch) will allow us to control the brightness of the light. Without a Dimmer Switch, the light bulbs tend to glow at full brightness consuming maximum power. If full brightness is not required, then Dimmer Switches can be used and save some energy. With the help of a Dimmer Switch, we can vary the brightness from fully off to fully on. Intelligent lighting forms part of home automation where the circuit levels are preprogrammed according to use and according to other factors such as time of day. Light fittings can be controlled individually or grouped together in circuits. Each circuit or fitting can be set to be at a different level of brightness. These levels are then stored as a "scene" which can be best of as being a complete look of a room. Some systems have 10 or more programmable scenes. Once set up scenes can be easily recalled manually from touch screen, switch panels, infra-red or wireless remote controls. They can be

recalled automatically by time clock, or according to occupancy. Once a new scene is selected the lighting will fade to the new set of levels.

### III. Hardware Implementation

The design of the Touch Dimmer Switch Circuit is very simple and is explained here. The touch sensor is given the power supply by connecting 5V to VCC and ground to GND pins. The SIG pin of the touch sensor is connected to any of the digital input / output pin of the Arduino UNO board. Here, it is connected to digital I/O pin 8.

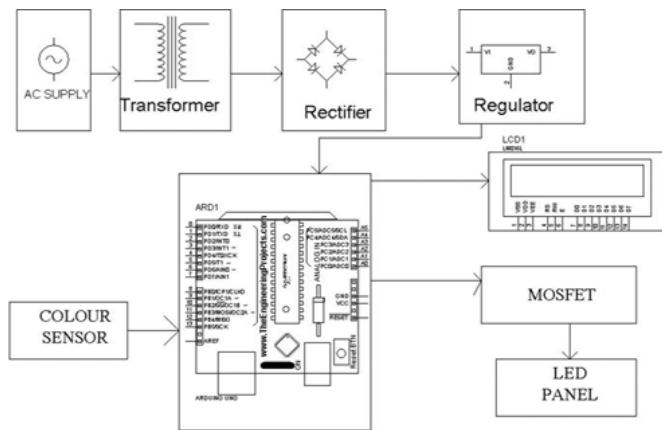


Fig 4: Block Diagram

#### 3.1 Single Phase Voltage Transformer :

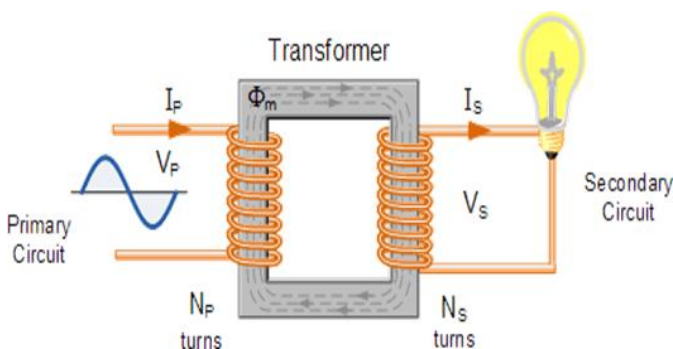


Fig 5 : Simple transformer

In other words, for a transformer there is no direct electrical connection between the two coil winding's, thereby giving it the name also of an Isolation Transformer. Generally, the primary winding of a

transformer is connected to the input voltage supply and converts or transforms the electrical power into a magnetic field. While the job of the secondary winding is to convert this alternating magnetic field into electrical power producing the required output voltage as shown.

#### 3.2 Voltage Regulator IC 7805:

##### LM7805 PINOUT DIAGRAM

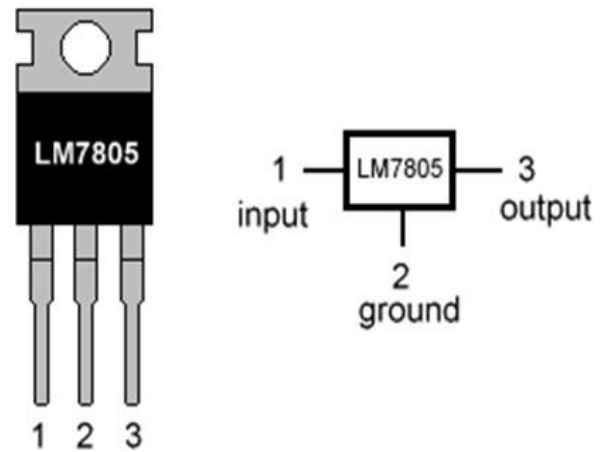


Figure 6 : Voltage regulator

7805 is a voltage regulator integrated circuit. It is a member of 78xx series of fixed linear voltage regulator ICs. The voltage source in a circuit may have fluctuations and would not give the fixed voltage output. The voltage regulator IC maintains the output voltage at a constant value. The xx in 78xx indicates the fixed output voltage it is designed to provide. 7805 provides +5V regulated power supply. Capacitors of suitable values can be connected at input and output pins depending upon the respective voltage levels.

#### 3.3 LCD Display

LCD (Liquid Crystal Display) screen is an

electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LED's.



The reasons being: LCD's are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD.

### 3.4 LED:

LEDs are semiconductor devices. Like transistors, and other diodes, LED's are made out of silicon. What makes an LED give off light are the small amounts of chemical impurities that are added to the silicon, such as gallium, arsenide, indium, and nitride. When current passes through the LED, it emits photons as a byproduct. Normal light bulbs produce light by heating a metal filament until its white hot. Because LED's produce photons directly and not via heat, they are far more efficient than incandescent bulbs. Not long ago LED's were only bright enough to be used as indicators on dashboards or electronic equipment. But recent advances have made LED's bright enough to rival traditional lighting technologies. Modern LED's can replace incandescent bulbs in almost any application.

LED's are based on the semiconductor diode. When the diode is forward biased (switched on), electrons are able to recombine with holes and energy is released in the form of light. This effect is called electroluminescence and the color of the light is determined by the energy gap of the semiconductor. The LED is usually small in area (less than 1 mm<sup>2</sup>) with integrated optical components to shape its radiation pattern and assist in reflection.



Fig 7 : Led

LED's present many advantages over traditional light sources including lower energy consumption, longer lifetime, improved robustness, smaller size and faster switching. However, they are relatively expensive and require more precise current and heat management than traditional light sources. Applications of LEDs are diverse. They are used as low-energy and also for replacements for traditional light sources in well-established applications such as indicators and automotive lighting. The compact size of LEDs has allowed new text and video displays and sensors to be developed, while their high switching rates are useful in communications technology. So here the role of LED is to indicate the status of the components like relays and power circuit.

## IV. Results

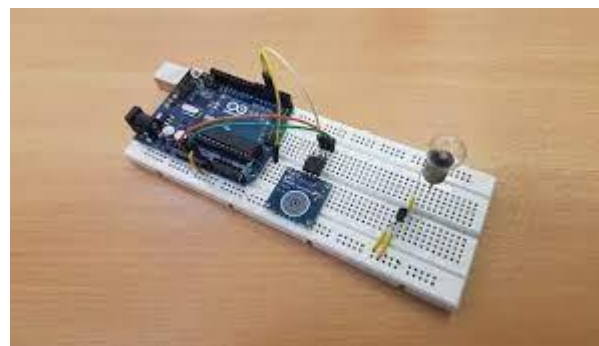


Fig 8 :Output

4 Working

We will connect a small incandescent bulb that glows on DC. The bulb is interface with the Arduino UNO board with the help of a transistor. So, first connect the base of a transistor like 2N2222 to any digital I/O pin of Arduino UNO with the help of a current limiting resistor. Then connect the collector terminal of the transistor to the 5V power supply. And finally, connect a bulb between the emitter and ground terminals. This completes the design of the circuit. As mentioned earlier, there are many types of dimmer switches for different types of bulbs. In this project, a simple touch dimmer switch circuit is designed. The working of the project is explained here. When the sensor is not touched, the SIG pin of the sensor remains LOW. Whenever we touch the sensitive part of the touch sensor, the SIG pin of the sensor goes HIGH. Since it is connected to Arduino UNO, we will detect this change in state i.e. LOW to HIGH. So, when the finger is placed on the touch sensor, Arduino UNO detects the change in the logic state of the sensor's output and drive the bulb using Pulse Width Modulation. Hence, the bulb is connected to a PWM pin of the Arduino UNO[1,2].

This is evident is that many of the products on the market today have benefited from the development of touch screen technology and particularly the use of micro controllers to process the signals from the sensing elements. This has resulted in solutions that are far more capable and reliable than older, discreet touch sensing circuits, while still providing the basic functionality of on/off switches or simple sliders or wheels for dimming.

### V. Conclusion

Mention 'touch sensors' or 'touch control' today and most people will tend to think of touchscreen displays, whether these are the cash machines (ATMs) used by banks, the self scanning checkout terminals in grocery stores, or increasingly our smartphones, tablet computers and ereader devices. These uses certainly

reflect the advances that this technology has brought to our modern life, but not every application requires this level of sophistication and more basic touch sensors still have a role to play in providing convenient, easy-to-use controls. Lighting, for the home, office or factory, is a prime example where often all that is required is the ability to turn lights on and off or apply a simple dimming function. While touch control of lighting is not new, the broader developments in touch sensing have seen a proliferation in dedicated ICs that make it even easier and more cost-effective to design touch controls for lighting.

### VI. Future Scope

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