WASHBASIN MIRROR LIGHT CONTROLLER

Submitted in partial fulfillment of the requirement for the award of

DIPLOMA IN ELECTRICAL & ELECTRONICS ENGINEERING

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<u>WASHBASIN MIRROR LIGHT CONTROLLER</u>

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The project report is submitted in partial fulfillment of the requirement of the diploma in **Electrical & Electronics Engineering.** State board of technical education Chennai during the academic 2019-2021.

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CHAPTER-1

INTRODUCTION OF THE PROJECT

1.1 INTRODUCTION

In today's life, electricity becomes a prior Need to people as to enjoy their social activities thus they need enough electricity to carry out their activities. Lighting is very significant to people as it is important to us; day or night. Early in 2014, government had introduced new electricity tariff due to transpire Subsidy Rationalization Programmed made by the government as to stop the energy subsidies gradually.

Due to this increase of electrical energy production price, it is becoming more significant in conserving and saving in electrical energy consumption. Electronic system can be defined as a family of an electronic circuit and component which is designed for completing either simple function or complex function. There are various examples of electronic systems such as telecommunication system, computer system and automation system. The existence of the automation systems began from 1500 years ago where they had invented the first water pump for metal working rolling mills. Automatic control is used in various control system such as in utilizing machinery especially in industrial factories where they used a numbers of boilers, heating treating oven and other applications with minimal involvement of human.

The benefits of using automatic control in our daily life are it can minimize the involvement of labor works and also it can be used in saving the energy consumption. This is because the automatic control uses the technique of self-moving processes. Household is the place where a numbers of occupant live in together.

There is a variety of household appliances used by them such as air-conditioner, personal computer, refrigerator and light system.

Lighting system is one of the huge usages in the household where it has been placed in every section of places especially in every room. There are many different types of lighting technologies that are been used for the household such as fluorescent light and LED light.

The LED lighting can minimize the usage of light because it only utilized 50% from the energy consumption in the household compared to fluorescent lighting. Through the idea of designing an automatic washroom light switch, it is hoped that the product will be a great way for people to save their energy consumption.

The occupant of a household usually consists of a variety range of ages such as children, teenagers and adults. There are many cases where these people come out from the washroom and they forgot to turn off the light unintentionally; these cases can lead to the cause of electricity wastages at home. Thus, by having this product, it is aimed to reduce the electricity utilization as well as to save the household spending.

The controller can resolve the problem of having complicated circuit and it is also more suitable device to be used for control system. In this project, we used the relay to prevent any hum at the remote control of the lighting system in the building which caused by a nonstop energized coil.

The main objective for this project is to save the electricity when there is no occupant in the washroom. Hence, the digital infrared sensor which it capable to detect the infrared reflection from movement of people, animal, or other object will be used in the project.

This controller circuit based on an infrared (IR) object sensor (Sharp 2Y0A21) is used for saving power of the mirror light near a washbasin. The circuit contains manual on and off switches and an additional automatic switching system.

CHAPTER-2

LITERATURE REVIEW

2.1. LITERATURE REVIEW

Controller-based street lighting systems have been investigated in detail by researchers in recent years. Such systems offer multi-pronged advantages and can also be combined with other systems (such as solar cell based systems) to provide a greater than standard energy benefit while reducing energy costs simultaneously [1].

Researchers have concluded such street lighting systems to be essential in the design of smart cities for optimization of power consumption, especially in the domain of public systems [2]. Intelligent street light control offers simultaneous benefits in terms of reduction of energy consumption and balancing energy generation costs, when coupled with renewable energy based systems such as solar cells [3][4].

It has also been observed by researchers that switching of streetlights based on real-time data minimizes the chance of accidents while maximizing energy benefits in a given situation [5].

Research has also been conducted on image recognition for augmenting the efficiency of such controller-based systems [6]. Finally, the type of streetlight used also affects the switching process in terms of the voltage and power required to switch on the devices, since these parameters become crucial in case frequent switching takes place [7].

The current paper thus proposes a simple IoT (Internet of Things) based controller system for conditional toggling of streetlights.

CHAPTER-3

OVER VIEW OF THE PROJECT

3.1 BLOCK DIAGRAM

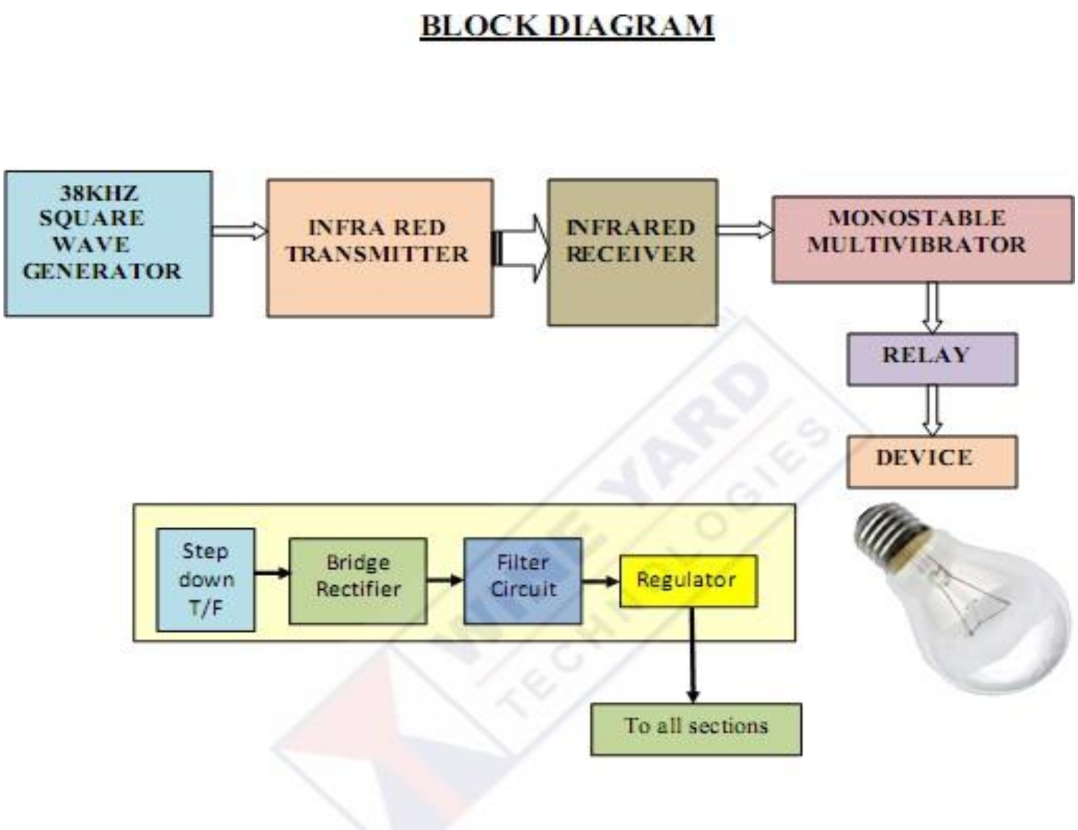

Figure: 3.1 Block diagram of washbasin mirror light controller

3.2 BLOCK DIAGRAM OPERATION

Whenever we enter in our washroom we turn on the lights and turn them off whenever we leave. But sometimes we forget to turn off the lights and other appliances while coming out of the washroom. By these silly mistakes we waste lot of electricity every day and also it decreases the lifetime of the bulb. So we should make a device which can automatically turn on and turn off the bathroom lights.

We bring you the solution to this problem by making a circuit which can automatically turn on the lights whenever someone enters the washroom and turn off the lights when someone leaves the washroom. The advantages of this circuit are that the person doesn't have to worry about wastage of electricity.

Also the person doesn't need to worry about the electricity bills as it will definitely reduce the power consumption. For this reason, we will be going to design a simple **automatic light switch for bathroom** or other related rooms where it needed.

3.3 CIRCUIT DIAGRAM

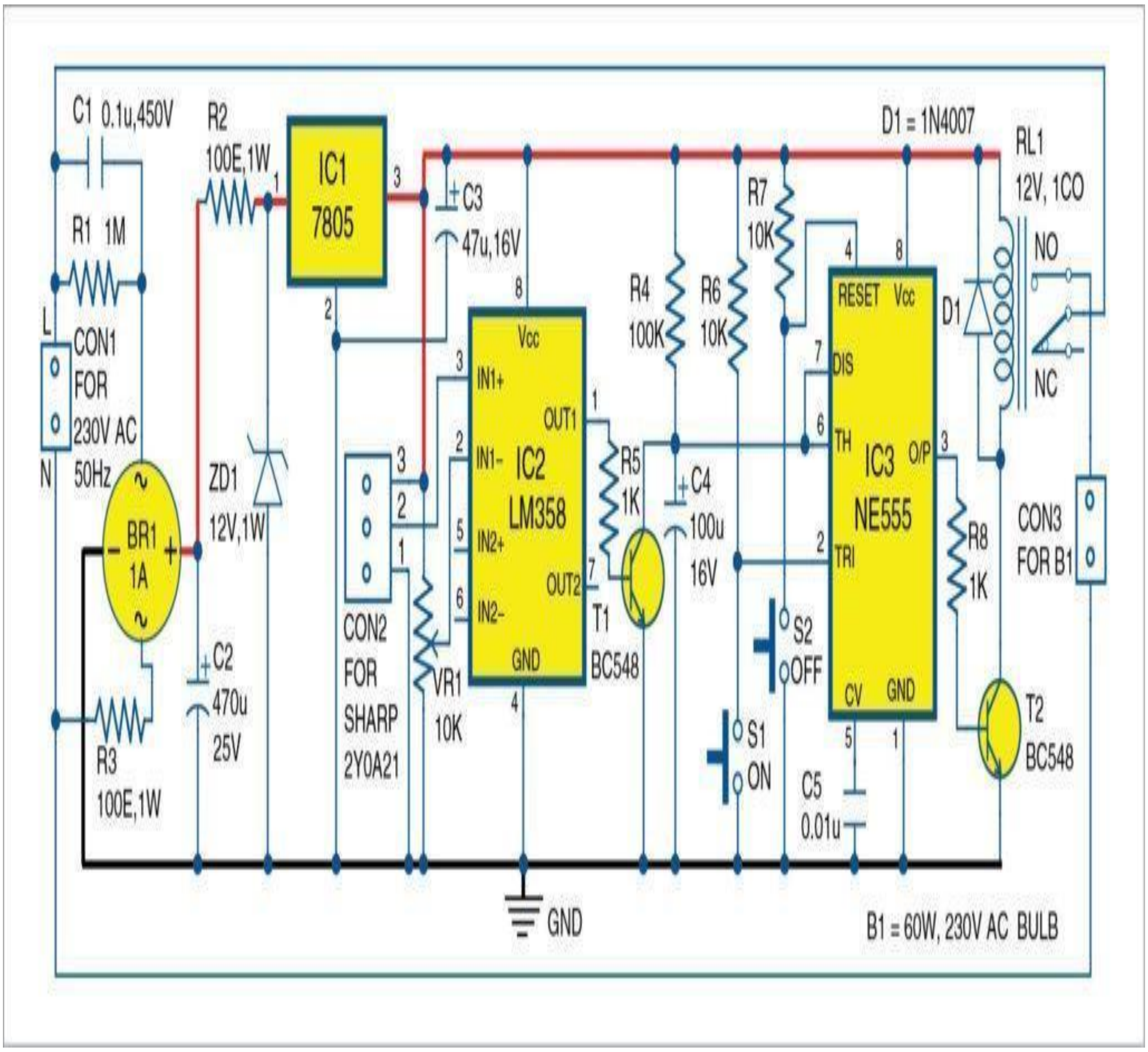

Figure: 3.2 Circuit Diagram of washbasin mirror light controller

The circuit diagram of the washbasin mirror light controller is shown in Fig. 3.2.It is built around bridge rectifier BR1, 5V voltage regulator 7805 (IC1), LM358 opamp (IC2), NE555 timer (IC3), two BC548 transistors (T1 and T2), 12V single changeover relay (RL1), object sensor (Sharp 2Y0A21) and a few other components. If you forget to turn off the light, the circuit automatically turns it off after a few seconds.

Light bulb B1 connected across connector CON3 is turned on with the help of switch S1 and turned off using S2 after using the washbasin. LM358 (IC2) is configured as a comparator. Its non-inverting input (pin 3) and inverting input (pin 2) are used as inputs. Pin 2 of IC2 is connected to voltage-divider pot meter VR1. Using VR1, vary the reference voltage at pin 2. Initially, output pin 1 of IC2 is low.

NE555 (IC3) is designed as a mono stable multivibrator. On time of IC3 is adjusted to eleven seconds with the help of timing capacitor C4 and resistor R4. Output pin 3 of IC3 is fed to relay driver transistor BC548 (T2).
When S1 is pressed, IC3 is triggered and, hence, its output pin 3 goes high, and mirror light bulb turns on through relay (RL1) contacts. When S2 is pressed after use, the light turns off.

If you forget to switch the light off, the sensor comes into action. Object sensor output is connected to inverting pin 2 of IC2. Under normal conditions, voltage at pin 3 of IC2 is low. When a person comes in front of the sensor connected across CON2, voltage at pin 3 is higher than voltage at pin 2 of IC2. Hence, output pin 1 of LM358 is high. This output is connected to the base of transistor T1. Collector and emitter of T1 are connected across C4. Discharging time of C4 extends the on time of the light bulb.

When the sensor detects the absence of a person in front of the mirror, the circuit automatically turns it off after eleven seconds. This saves energy and prevents unnecessary power consumption.

3.4 CONSTRUCTION AND TESTING

An actual-size PCB layout for the washbasin mirror light controller is shown in Fig. 2 and its components layout in Fig. 3.3. After assembling the circuit on the PCB, connect 230V AC, 50Hz across CON1. Connect RL1 to the PCB and bulb B1 across CON3. Mount S1, S2 and the Sharp 2Y0A21 sensor (Fig. 4) on the front panel of the cabinet.

PCB layout of washbasin mirror light controller

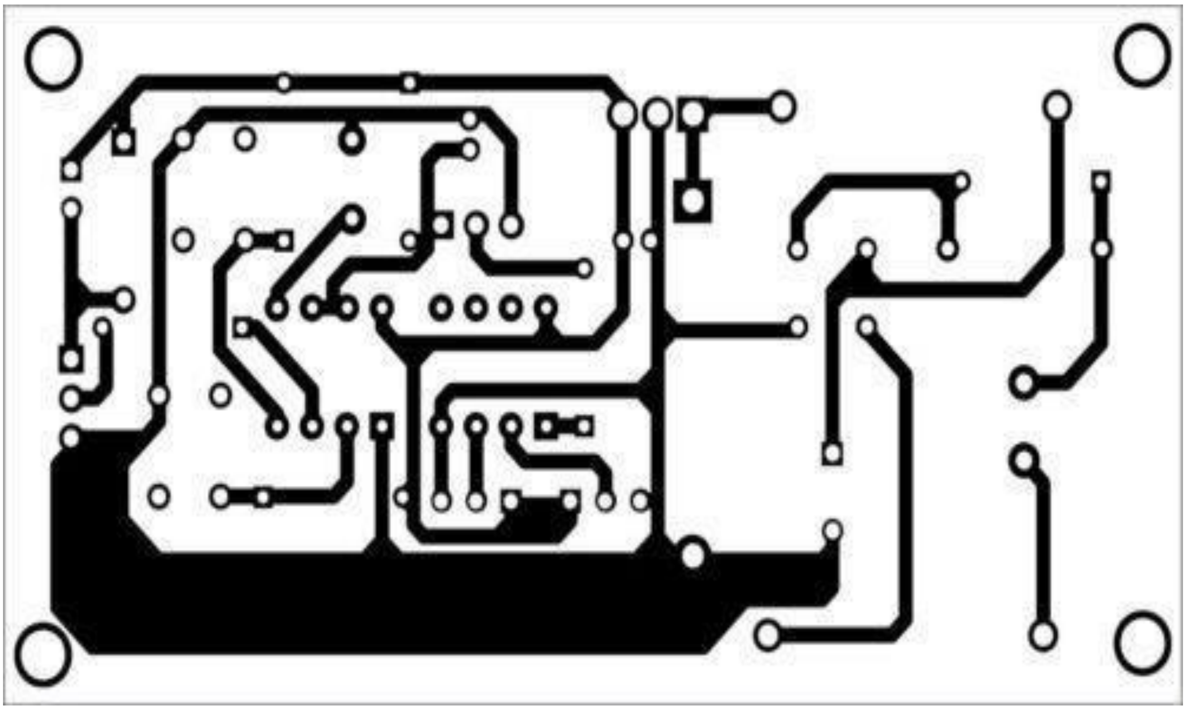

Figure: 3.3 PCB layout of washbasin mirror light controller.

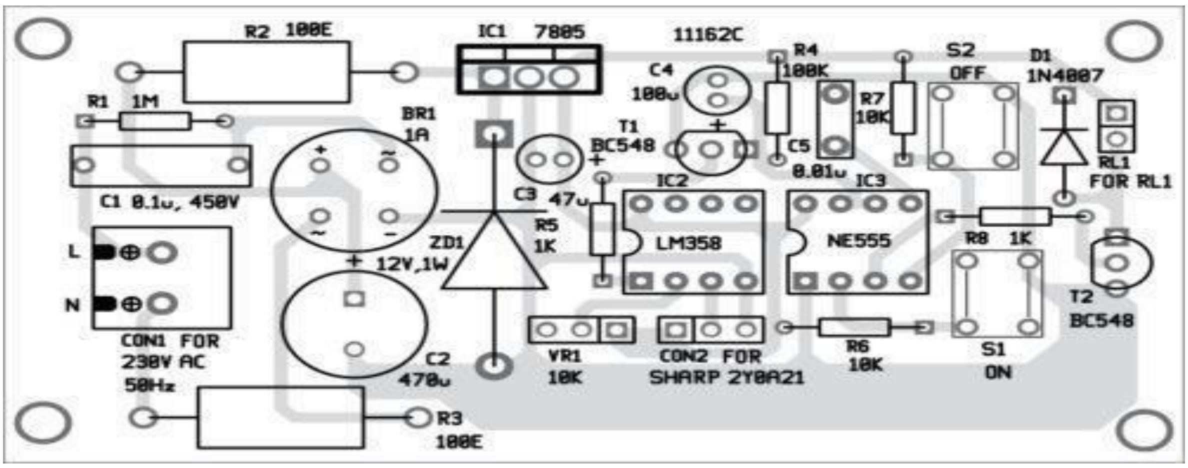

Figure: 3.4 Components layout for the PCB.

CHAPTER-4

HARDWARE IMPLEMENTATION

4.1 HARDWARE DESCRIPTION

The Hardware design of the proposed project consists of the major blocks as follows:

1. Power supply unit
2. MCB
3. Voltage regulators
4. Filter circuit
5. SPDT relay
6. Driver circuit
7. AC motor
8. Transistor circuit

4.2 POWER SUPPLY UNIT

As we all know any invention of latest technology cannot be activated without the source of power .so it this fast moving world we deliberately need a proper power source which will be apt for a particular requirement. All the electronic components starting from diode to Intel IC`s only work with a DC supply ranging from +5v to +12v. We are utilizing for the same, the most cheapest and commonly available energy source of 230v-50Hz and stepping down rectifying filtering and regulating the voltage. This will be dealt briefly in the fourth-coming sections.

10∞f/25v	: for maintaining the stability of the voltage at the load side.
O, 1∞f	: for bypassing the high frequency disturbances.

4.2.1 BRIDGE RECTIFIER

In the previous power diode tutorial we discussed ways of reducing the ripple or voltage variations on a direct DC voltage by connecting smoothing capacitors across the load resistance.

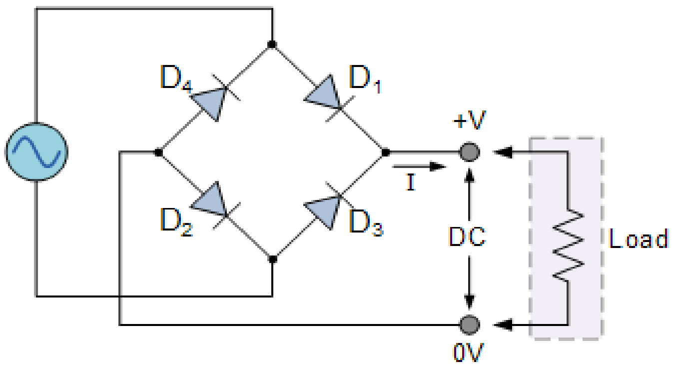

Figure: 4.1 Circuit diagram of bridge rectifier

While this method may be suitable for low power applications it is suitable to applications which need a "steady and smooth" DC supply voltage. One Method to improve on this is to use every half-cycle of the input voltage instead of every other half-cycle. The circuit which allows us to do this is called a Full Wave Rectifier**.**

Like the half wave circuit, a full wave rectifier circuit produces an output voltage or current which is purely DC or has some specified DC component. Full wave rectifiers have some fundamental advantages over their half wave rectifier counterparts. The average (DC) output voltage is higher than for half wave, the output of the full wave rectifier has much less ripple than that of the half wave rectifier producing a smoother output waveform.

4.2.2 TRANSFORMER

The transformer is a static device (means that has no moving parts) that consists of one, two or more windings which are magnetically coupled and electrically separated with or without a magnetic core. It transfers the electrical energy from one circuit to the other by electromagnetic induction principle.

The winding connected to the AC main supply is called primary winding and the winding connected to the load or from which energy is drawn out is called as secondary winding. These two windings with proper insulation are wound on a laminated core which provides a magnetic path between windings.

4.2.3 STEP – UP AND STEP – DOWN TRANSFORMERS

So far, we've observed simulations of transformers where the primary and secondary windings were of identical inductance, giving approximately equal voltage and current levels in both circuits. Equality of voltage and current between the primary and secondary sides of a transformer, however, is not the norm for all transformers. If the inductances of the two windings are not equal, something interesting happens.

4.3 MCB (MINIATURE CIRCUIT BREAKER)

4.3.1 CONSTRUCTION OF MCB

An MCB embodies complete enclosure in a molded insulating material. This provides mechanically strong and insulated housing. The switching system consists of a fixed and a moving contact to which incoming and outgoing wires are connected.

The metal or current carrying parts are made up of electrolytic copper or silver alloy depending on the rating of the circuit breaker.

4.3.2 MINIATURE CIRCUIT BREAKERS (MCBs)

All fuses need to be replaced with MCB for better safety and control when they have done their job in the past. Unlike a fuse, an MCB operates as automatic switch that opens in the event of excessive current flowing through the circuit and once the circuit returns to normal, it can be reclosed without any manual replacement. MCBs are used primarily as an alternative to the fuse switch in most of the circuits.

A wide variety of MCBs have been in use nowadays with breaking capacity of 10KA to 16 KA, in all areas of domestic, commercial and industrial applications as a reliable means of protection. As the contacts are separated in the event of an overload or short circuit situation, an electric arc is formed. All modern MCBs are designed to handle RC interruption process where arc energy extraction and its cooling are provided by metallic arc splitter plates. These plates are held in a proper position by an insulating material. Also, arc runner is provided to force the arc that is produced between the main contacts.

4.3.3 WORKING AND OPERATION OF MCB

Under normal working conditions, MCB operates as a switch (manual one) to make the circuit ON or OFF. Under overload or short circuit condition, it automatically operates or trips so that current interruption takes place in the load circuit. The visual indication of this trip can be observed by automatic movement of the operating knob to OFF position. This automatic operation MCB can be obtained in two ways as we have seen in MCB construction; those are magnetic tripping and thermal tripping. Under overload condition, the current through the bimetal causes to raise the temperature of it. The heat generated within the bimetal itself enough to cause deflection due to thermal expansion of metals.

This deflection further releases the trip latch and hence contacts get separated. In some MCBs, magnetic field generated by the coil causes develop pull on bimetal such that it deflection activates the tripping mechanism.

Under short circuit or heavy overload conditions, magnetic tripping arrangement comes into the picture. Under normal working condition, the slug is held in a position by light spring because magnetic field generated by the coil is not sufficient to attract the latch.

When a fault current flows, the magnetic field generated by the coil is sufficient to overcome the spring force holding slug in position. And hence slug moves and then actuate the tripping mechanism. A combination of both magnetic and thermal tripping mechanisms is implemented in most of MCBs. In both magnetic and thermal tripping operations, an arc is formed when the contacts start separating. This arc is then forced into arc splitter plates via arc runner.

These arc splitter plates are also called arc chutes where arc is formed into a series of arcs and at the same time energy extracted and cools it. Hence this arrangement achieves the arc extinction.

4.3.4 TYPES OF MINIATURE CIRCUIT BREAKERS MCB's

MCBs are classified into three major types according to their instantaneous tripping currents. They are

1. *Type B MCB*
2. *Type C MCB*
3. *Type D MCB*

4.4 VOLTAGE REGULATORS

There are a number of types of voltage regulators that range from very affordable to very efficient. The most affordable and often the easiest type of voltage regulator to use are linear voltage regulators.

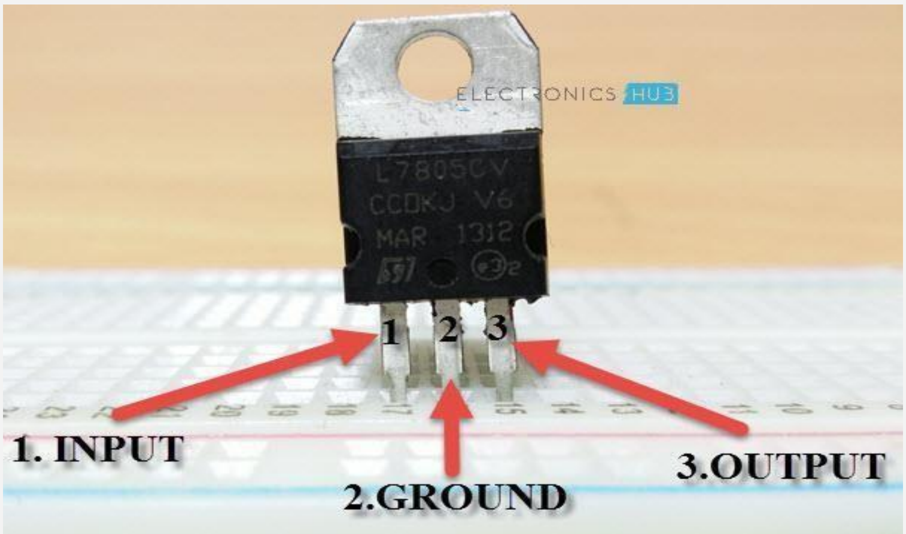

Figure: 4.2 Pin Diagram of 7805

Linear regulators come in a couple of types, are very compact, and used often in low voltage, low power systems. Switching regulators are much more efficient than linear voltage regulators, but they are harder to work with and more expensive.

4.4.1 LINEAR REGULATORS

One of the most basic ways to regulate voltage and provide a stable voltage for electronics is to use a standard 3-pin linear voltage regulator such as the LM7805, which provides a 5 volt 1 amp output with an input voltage at up to 36 volts (depending on the model).Linear regulators work by adjusting the effective series resistance of the regulator based on a feedback voltage, essentially becoming a voltage divider circuit.

4.4.2 SWITCHING REGULATORS

Linear regulators are great solutions for low power, low cost applications where the voltage difference between the input and output is low and not much power is required. The biggest down side to linear regulators is that they are very inefficient, which is where switching regulators come into play.

When high efficiency is needed or a wide range of input voltage is expected, including inputs voltages below the desired output voltage, a switching regulator becomes the best option.

4.4.3 ZENER DIODES

One of the simplest ways to regulate voltage is with a Zener diode. While a linear regulator is a pretty basic component with few extra components required to work and very little design complexity, a Zener diode can provide adequate voltage regulation in some cases with just a single component.

Since a Zener diode shunts all extra voltage above its breakdown voltage threshold to ground, it can be used as a very simple voltage regulator with the output voltage pulled across the leads of the zener diode.

4.4.4 REGULATED POWER SUPPLY

A regulated power supply is an embedded circuit; it converts unregulated AC into a constant DC. With the help of a rectifier it converts AC supply into

DC. Its function is to supply a stable voltage (or less often current), to a circuit or device that must be operated within certain power supply limits.

4.4.5 DUAL REGULATED POWER SUPPLY

The circuit given here is of a regulated dual power supply that provides +12V and -12V from the AC mains. A power supply like this is a very essential tool on the work bench of an electronic hobbyist.

The transformer T1 steps down the AC mains voltage and diodes D1, D2, D3 and D4 does the job of rectification. Capacitors C1 and C2 does the job of filtering.C3, C4, C7and C8 are decoupling capacitors. IC 7812 and 7912 are used for the purpose of voltage regulation in which the former is a positive 12V regulator and later is a negative 12V regulator. The output of 7812 will be +12V and that of 7912 will be -12V.Assemble the circuit on a good quality PCB.

Transformer T1 can be a 230V primary; 15-0-15 V, 1A secondary step-down transformer. Fuse F1 can be a 500mA fuse. Capacitor C1, C2, C5 and C6 must be rated at least 50V.

4.5 ELECTONIC FILTER

Electronic filters are circuits which perform signal processing functions, Specifically to remove unwanted frequency components from the signal, to Enhance wanted ones, or both.

4.6 SHARP 2Y0A21 SENSOR

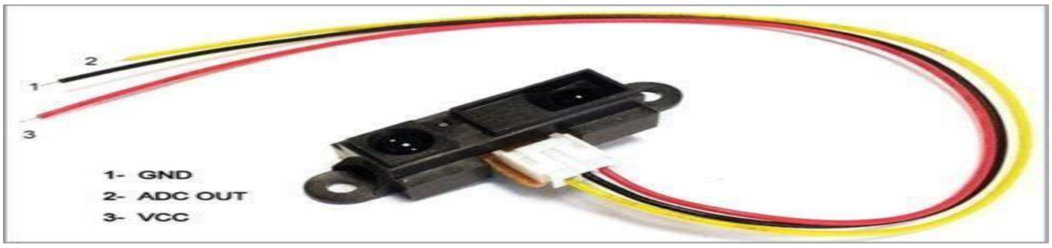

Figure. 4.3: Sharp 2Y0A21 sensor

For testing the circuit, stand in front of the sensor and press S1 to turn the bulb on. To turn it off, either press S2 to immediately turn it off, or move away from the sensor and the bulb will automatically turn off after eleven seconds.

4.7 555 TIMER IC

Figure: 4.4 555 TIMER

The 555 timer IC was introduced in the year 1970 by Stigmatic Corporation and gave the name SE/NE 555 timer. It is basically a monolithic timing circuit that produces accurate and highly stable time delays or oscillation. When compared to the applications of an op-amp in the same areas, the 555 IC is also equally reliable and is cheap in cost.

Apart from its application as a mono stable multivibrator and astable multivibrator, a 555 timer can also be used in dc-dc converters, digital logic probes, waveform generators, analog frequency meters and tachometers, temperature measurement and control devices, voltage regulators etc.

The timer IC is set up to work in either of the two modes – one-shot or monostable or as a free-running or astable multivibrator. The SE 555 can be used for temperature ranges between – 55°C to 125 °. The NE 555 can be used for a temperature range between 0° to 70°C.

4.7.1 IMPORTANT FEATURES OF THE 555 TIMER

It operates from a wide range of power supplies ranging from + 5 Volts to + 18 Volts supply voltage. Sinking or sourcing 200 mA of load current.

The external components should be selected properly so that the timing intervals can be made into several minutes along with the frequencies exceeding several hundred kilohertz. The output of a 555 timer can drive a transistor-transistor logic (TTL) due to its high current output.

It has a temperature stability of 50 parts per million (ppm) per degree Celsius change in temperature, or equivalently 0.005 %/ °C. The duty cycle of the timer is adjustable. The maximum power dissipation per package is 600 mW and its trigger and reset inputs has logic compatibility. More features are listed in the datasheet.

4.7.2 IC PIN CONFIGURATION

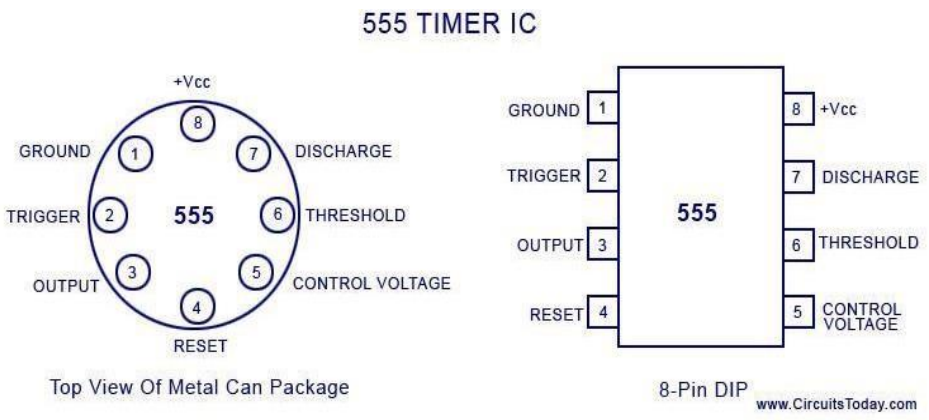

Figure: 4.5 555 Timer IC Pin Configuration

The 555 Timer IC is available as an 8-pin metal can, an 8-pin mini DIP (dual-in package) or a 14-pin DIP. The pin configuration is shown in the figures.

This IC consists of 23 transistors, 2 diodes and 16resistors. The use of each pin in the IC is explained below. The pin numbers used below refers to the 8-pin DIP and 8pin metal can packages. These pins are explained in detail, and you will get a better idea after going through the entire post.

PIN 1: Grounded Terminal: All the voltages are measured with respect to the Ground terminal.

PIN 2: Trigger Terminal: The trigger pin is used to feed the trigger input hen the 555 IC is set up as a monostable multivibrator. This pin is an inverting input of a comparator and is responsible for the transition of flip-flop from set to reset. The output of the timer depends on the amplitude of the external trigger pulse applied to this pin. A negative pulse with a dc level greater than Vcc/3 is applied to this terminal.

In the negative edge, as the trigger passes through Vcc/3, the output of the lower comparator becomes high and the complimentary of Q becomes zero. Thus the 555 IC output gets a high voltage, and thus a quasi stable state.

PIN 3: Output Terminal: Output of the timer is available at this pin. There are two ways in which a load can be connected to the output terminal. One way is to connect between output pin (pin 3) and ground pin (pin 1) or between pin 3 and supply pin (pin 8). The load connected between output and ground supply pin is called the *normally on load* and that connected between output and ground pin is called the *normally off load.*

PIN 4: Reset Terminal: Whenever the timer IC is to be reset or disabled, a negative pulse is applied to pin 4, and thus is named as reset terminal. The output is reset irrespective of the input condition. When this pin is not to be used for reset purpose, it should be connected to + V_{CC} to avoid any possibility of false triggering.

PIN 5: Control Voltage Terminal: The threshold and trigger levels are controlled using this pin. The pulse width of the output waveform is determined by connecting a POT or bringing in an external voltage to this pin. The external voltage applied to this pin can also be used to modulate the output waveform. Thus, the amount of voltage applied in this terminal will decide when the comparator is to be switched, and thus changes the pulse width of the output. When this pin is not used, it should be bypassed to ground through a 0.01 micro Farad to avoid any noise problem.

PIN 6: **Threshold Terminal:** This is the non-inverting input terminal of comparator 1, which compares the voltage applied to the terminal with a reference voltage of 2/3 V_{CC}. The amplitude of voltage applied to this terminal is responsible for the set state of flip-flop. When the voltage applied in this terminal is greater than 2/3Vcc, the upper comparator switches to +Vsat and the output gets reset.

PIN 7: Discharge Terminal: This pin is connected internally to the collector of transistor and mostly a capacitor is connected between this terminal and ground. It is called discharge terminal because when transistor saturates, capacitor discharges through the transistor. When the transistor is cut-off, the capacitor charges at a rate determined by the external resistor and capacitor.

PIN 8: Supply Terminal: A supply voltage of + 5 V to + 18 V is applied to this terminal with respect to ground (pin 1).

CHAPTER-5

HARDWARE KIT DIAGRAM PHOTOGRAPHY

5.1 HARDWARE KIT DIAGRAM PHOTOGRAPHY

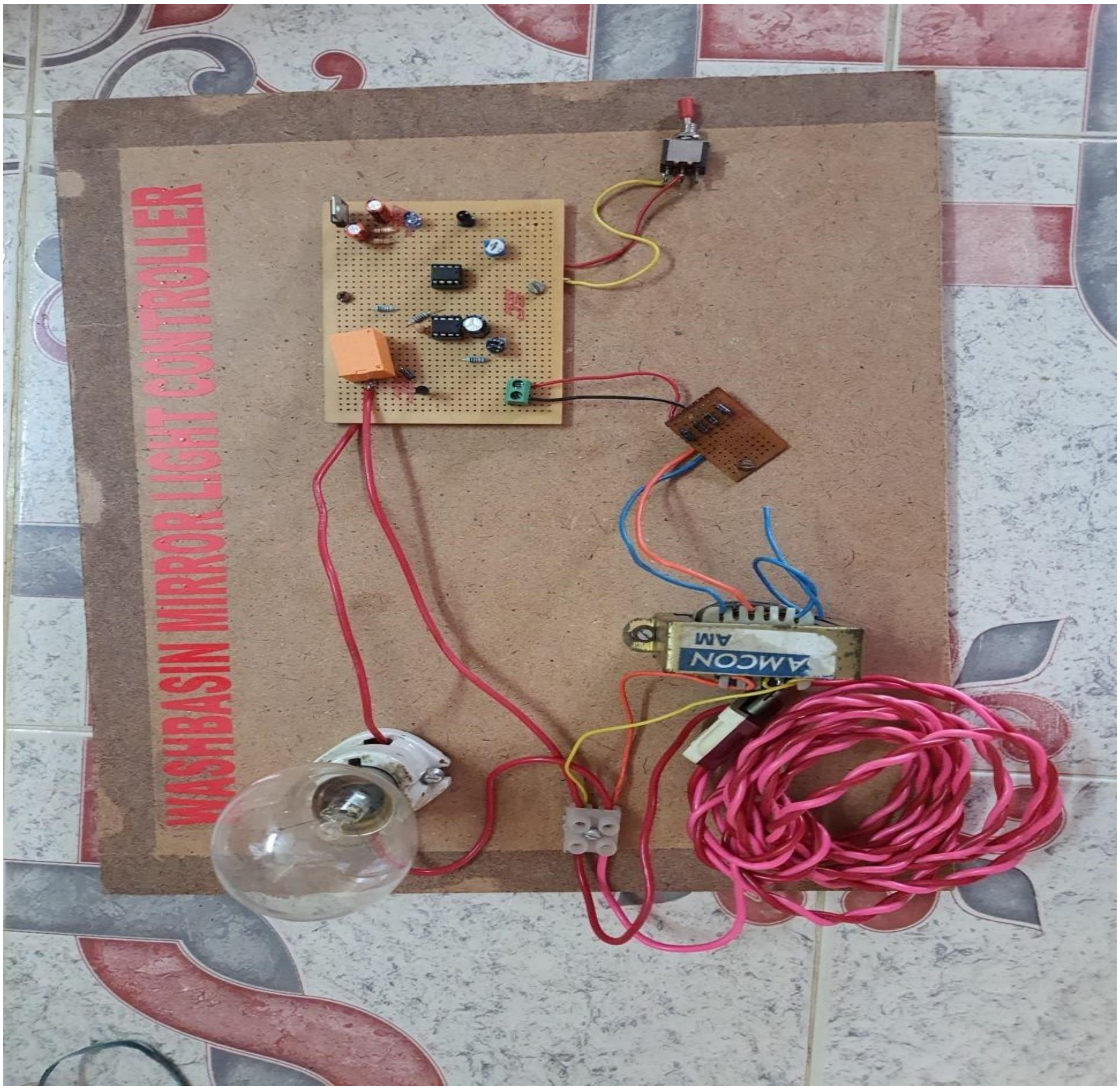

FIGURE: 5.1 HARDWARE KIT DIAGRAM PHOTOGRAPHY

5.2 ADVANTAGES

Infrared faucets have a number of advantages over regular taps. For one thing, they are far more hygienic than normal taps because they require no human contact, meaning they're far less likely to become contaminated with bacteria and viruses. This makes them ideal for places like hospitals and old people's homes where hygiene is paramount - although of course, they can be used in any facility, workplace or private household to help keep the transmission of disease to a minimum.

The lack of human contact also means that infrared faucets are far less prone to soiling. As a result, they require less cleaning and maintenance than normal taps.

5.3 APPLICATIONS

Infrared taps can also lead to significant water savings, because the taps only run for as long as is required for hand washing. Many models, such as the infrared angled basin tap, will also shut off automatically after 90 seconds of continuous use. This makes infrared taps ideal for schools, colleges and nurseries, because they eliminate the risk of children leaving the taps running.

CHAPTER-VI

6.1 CONCULSION

As a conclusion, it is hoped that the proposal of this project will be approved. The main objective of the automatic washbasin mirror light switch is to conserve and save the consumption of the electrical energy especially for home usage.

This project is developed and modified by improving the existing lighting systems to get a more user friendly product for all range of ages. Besides, it is aimed to minimize the electricity consumption and so as to save the energy. Throughout the product development, a various electronic components will be used which are suitable and compatible up to today's technology.

The digital infrared sensor which functions to detect the existence of human to activate the light in the washroom will be used. Besides, throughout the process of completing the project, it is hoped that the team members will gain knowledge in technical part and also learn on how to manage and working as a team as well as to cope with the problems.

All team members need to be responsible for their parts and help within each other to ensure the successful of the project.

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