COMPUTER UNIVERSITY (MANDALAY)

FINAL YEAR PROJECT REPORT

ON

HIGH AND LOW VOLTAGE CUTOFF WITH ALARM

Bachelor of Computer Technology

(B.C.Tech.)

Presented by Group (4)

2014-2015

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Abstract

When the power high/low, it will generate a sound.Red LED is used for high/low indication.Green LED is used for indicating normal supply voltage.Electrical and sensitive electronic equipments are not immune from noisy and detrimental main's power supply. Voltage surges,spikes and transients in excess of kilovolts and hundreds of amperes in very short duration of microseconds, power outages, brownouts,and mains under and over-voltage conditions can cause unprotected appliances either in the home or office to malfunction. A huge number of domestic andindustrial appliances have sustained irreparable damage as a result of either excessively high (>240V), low (<140 V) or unstable and noisy fluctuating mains supplies.

Project Schedule

Project Proposal : : March

First Seminar : : 11.6.2015

Second Seminar : : 9.7.2015

Third Seminar : :7.8.2015

Book Submission : : September, 2015

Time Schedule	March 2015	June 2015	July 2015	August 2015	September 2015
Project Proposal	■				
First Seminar		■			
Second Seminar			■		
Third Seminar				■	
Book Submission					■

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Computer University (Mandalay)

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CHAPTER (1)

INTRODUCTION

1.1 Introduction of the System

This project is made to detect the voltage cutoff.If the connection gives according to the circuit diagram, it will cutoff automatically input supply voltage low or high.When the power is high/low, we can listen to sound and Red LED will turn ON.

This project presents the design and construction of a low cost under and over voltage protective device, which was fabricated using transistor, IC and other discrete components. The over/under voltage cut-off with time delay provides over/under-voltage protection. Voltage irregularities are one of the greatest power quality issues facing industry and home today, and often times, isresponsible for damaging valuable electrical equipment.

Electrical Power System protection is required for protection of both user and the system equipment from fault, hence electrical appliances are not allowed to operate without any protective device installed. Power System fault is defined as undesirable condition that occurs in the power system, and the undesirable conditions are short circuit, current leakage, ground short, overcurrent, under and over voltage.

Electronic and electrical appliances used in most homes in the country are designed to operate at a nominal 220V AC, which ought to be acceptable within certain tolerable upper and lower limits. Excessive fluctuations beyond these limits may cause the appliance to malfunction or get irreparably damaged. The design provides a safe operating voltage range of 180V to 240V and offers practically the same functions as those of the imported brands.Basically, the design consists of various circuit building blocks and circuit techniques that would be of interestto the electronic hobbyist.

1.2 Objectives of the System

- To generate a sound with the help of buzzer when a voltage is high or low.
- To prevent fire from burning by voltage stabilizer.
- To know consuming less power by stabilized voltage .
- To understand the operation of IC 555timer.
- To be able to utilize this system in electronic components such as air-con, air cooler, etc.

1.3 Project Requirements

The design consists of various circuit building blocks and circuit techniques that would be of interest to the electronic hobbyist.

1.3.1 Hardware Requirements

The following components are required in this project:

- Step down transformer
- 555timer
- Capacitor(100uF,10u,0.1u)
- Resistor(1k,3.3k,500k,1.5k,10k)
- Buzzer
- Zener diode(6.5v)
- Transistor (C828)
- Diode(1N4001)
- Relay(JQC-3F(T73)-12V DC)
- LED(RED,GREEN)
- Variable resistor(5k)

CHAPTER (2)

BACKGROUND THEORY

2.1Electronic Circuits as Linear Systems

Most electronic circuits can be represented as a system with an input and anoutput as shown in *Figure (2.1)*. The input signal is typically a voltage that is generated by a sensor or by another circuit. The output signal is also often a voltage and is used to power an actuator or transmit signals to another circuit.

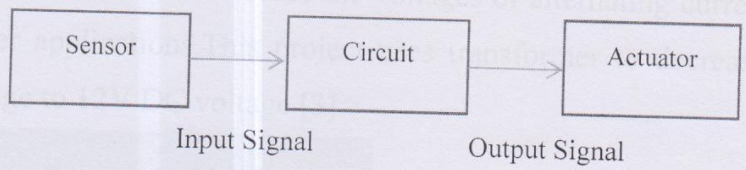


Figure (2.1) Electronic Circuit Represented as a Linear System

Electronic means the branch of physics that deals with the emission and effects of electrons; and the use of electronic devices and Science of the motion of charges in a gas, vacuum or semiconductor. An electronic building block packaged in a discrete form with two or more connect ingleads or metallic pads.Components are connected together to create an electronic circuit with a particular function.E.g.: an amplifier, radio receiver, or oscillator.Active components are sometimes called devices.

Composed of subsystems or electronic circuits, which may include amplifiers signal sources, power supplies etc…E.g.: Laptop, DVD players, iPOD, PDA, mobile phones [3].

Electronic signals are represented either by voltage or current. The time dependent characteristics of voltage or current signals can take a number of forms including DC, sinusoidal (also known as AC), square wave, linear ramps, and pulse width modulated signals. Sinusoidal signals are perhaps the most important signal forms since once the circuit response to sinusoidal signals are known, the result can be generalized to predict how the circuit will respond to a much greater variety of signals using the mathematical tools of Fourier and Laplace transforms.

2.2Step-down Transformer

A transformer is an electrical device that transfers energy between two or more circuits through electromagnetic induction.Transformers are used to increase or decrease the voltages of alternating current in electric power applications.This project uses transformer to decrease 220V AC voltage to 12V DC voltage [3].

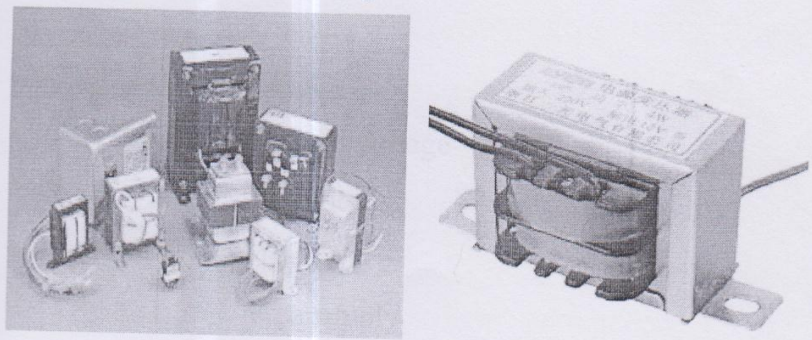


Figure (2.2) Step-down Transformer

2.3555 Timer

IC 555 is widely used in IC device and it can be configured in two different modes: 1. Monostable (one shot) and 2. Astable(Pulse oscillator).The device consists of comparators, transistor, flip-flop and buffered output.This IC has eight pins [1, 3].

Figure (2.3) 555 Timer

2.3.1.Pin Description of 555 Timer

Pin Number	Statement
1	Ground
2	Trigged
3	Output
4	Reset
5	Control voltage
6	Threshold
7	Discharge
8	V cc supply

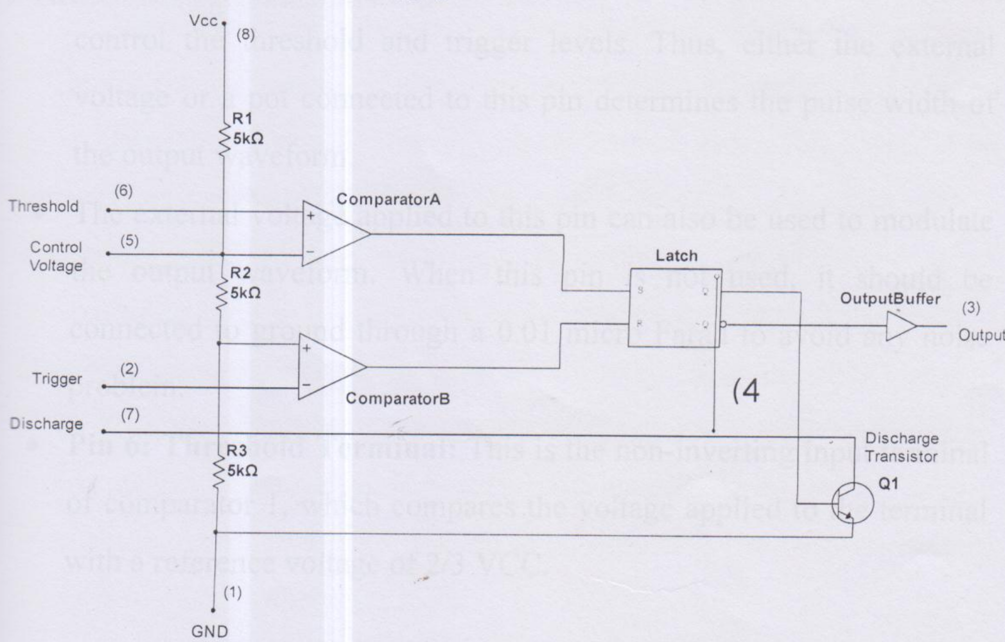


Figure (2.4) Internal Diagram of the 555 Timer IC

2.3.2 Explanation of Terminals for 8 Pin 555

- **Pin 1: Grounded Terminal:** This pin is ground pin.
- **Pin 2: Trigger Terminal:** This pin is an inverting input to a comparator that is responsible for 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.
- **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 either between pin 3 and ground pin (pin 1) or between pin 3 and supply pin (pin 8). The load connected between pin 3 and the supply pin is called the ***normally on load*** and the load connected between pin 3 and ground pin is called the ***normally off load.***
- **Pin 4: Reset Terminal:** To disable or reset the timer a negative pulse is applied to this pin due to the fact it is referred to as reset terminal.When this pin is not to be used for reset purpose, it should be connected to + V avoids any possibility of false triggering.
- **Pin 5: Control Voltage Terminal:** The function of thisterminal is to control the threshold and trigger levels. Thus, either the external voltage or a pot connected to this pin determines the pulse width of the output waveform.
- The external voltage applied to this pin can also be used to modulate the output waveform. When this pin is not used, it should be connected 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 VCC.

- **Pin 7: Discharge Terminal:** This pin is connected internally to the collector of transistor and is connected between this terminal and ground.
- **Pin 8: Supply Terminal:** A supply voltage of + 5 V to + 18 V is applied to this terminal with respect to ground (pin 1) [1, 3].

2.4Capacitor

A capacitor is a two-terminal electrical component used to store energy in the form of an electrostatic field.Capacitors are widely used in electronic circuits for blocking direct current while allowing alternating current to pass.

A capacitor is a device that stores energy in the form of voltage. The most common form of capacitors is made of two parallel plates separated by a dielectric material. Charges of opposite polarity can be deposited on the plates, resulting in a voltage V across the capacitor plates. Capacitance is a measure of the amount of electrical charge required to build up one unit of voltage across the plates.

A capacitor will store energy when an electric charge is forced onto its plates from a power source. A capacitor will still retain this charge even after disconnection from the power source. However, it would be impractical to try to discharge the power from the capacitor into a different circuit, as you would do, for example, by placing charged batteries into your radio. Compared to a storage battery,the total amount of energy stored by a capacitor is relatively small. Also, the discharge rate of a capacitor is rapid, so the release of the stored energy only occurs during a short time interval. However, a mishandled capacitor will deliver a shock that can be severe and even fatal, especially for large capacitors charged to a high voltage [1, 2, 3].

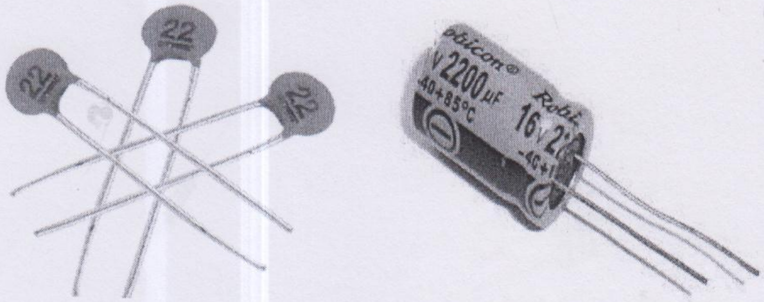


Figure (2.5) Capacitor Circuits

2.5Resistor

Resistors are used to reduce current flow and to lower voltage levels within circuits.When there is high resistance, then the flow of current is small.When the resistance is low, the flow of current is large. Resistors are the most simple and most commonly used electronic component.Resistors have a linear current-voltage relationship as stated by Ohm's law. The unit of resistance is an *ohm*, which is represented by the letter omega (Ω). Common resistor values range from 1 Ω to 22 MΩ.

Resistance, voltage and current are connected in an electrical circuit by Ohm's law (V=IR).Resistors are found in many circuits as shown in Figure (2.6). They are designed to allow for a measured resistance that can affect either voltage or current as calculated by using Ohm's law.

Fixed resistors can be made from nickel wire wound on a ceramic tube and then covered with porcelain. Smaller fixed resistors are made from mixtures of powdered carbon and insulating materials molded into a round tubular shape. Variable resistors have a tightly wound coil of resistance wire made into a circular shape. The resistance value is changed by turning an adjustment that moves the point of contact along the circular coil[1, 2, 3].

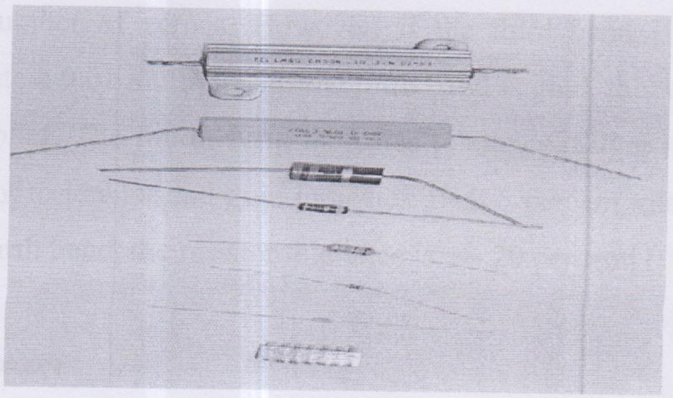


Figure (2.6a) Resistor Circuits

0	BLACK
1	BROWN
2	RED
3	ORANGE
4	YELLOW
5	GREEN
6	BLUE
7	VIOLET
8	GREY
9	WHITE
0.1	GOLD
0.01	SILVER
5%	GOLD-TOLERANCE
10%	SILVER-TOLERANCE

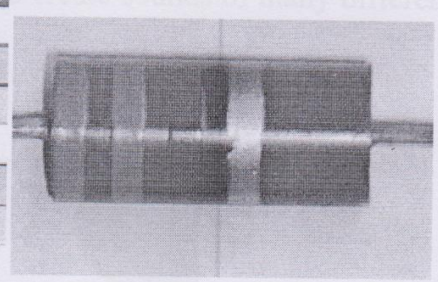


Figure (2.6b) Resistor Color-code Chart

2.5.1 Resistor Color Bands

Markings on resistors can vary. Larger resistors have printed resistance values, while smaller resistors have color-coded bands. To determine the resistance of a color-coded resistor,start from the end opposite the silver or gold band.Use the color code chart from Figure (2.6b) to determine the resistance values. The first two bands identify the first and second digits of the resistance value, and the third band indicates the number of zeroes. However, if the third band is silver, this will indicate a 0.01 multiplier. If the third band is gold, this will indicate a 0.1 multiplier. The fourth band indicates tolerance. Silver indicates a +/- 10 percent to lerance,and gold indicates a +/- 5 percent tolerance. If there is no fourth band, the resistor tolerance is +/- 20 percent[1, 2, 3].

2.6Buzzer

A buzzer is an audio signaling device with two-terminal positive pin and negative pin for connection to an external circuit.To interface a buzzer the standard transistor inter facing circuit is used. Note that if a different power supply is used for the buzzer, the 0V rails of each power supply must be connected to provide a common reference.If a battery is used as the power supply, it is worth remembering that piezo sounders draw much less current than buzzers. Buzzers also just have one 'tone', whereas a piezo sounder is able to create sounds of many different tones [4].

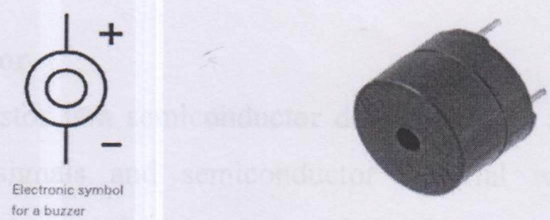


Figure (2.7) Buzzer Circuits

2.7Zener Diode

The zener diode can be used as a type of voltage regulator for providing stable reference voltage.Zener diodes are intended to operate in breakdown region.If breakdown voltage > 6V: **avalanche** breakdown.If breakdown voltage < 6V: **tunneling** mechanism of breakdown.

If the reverse-bias voltage magnitude is increased above a threshold (the specific value depends on the junction geometry and material parameters) one or the other (possibly even both concurrently) of two new phenomena occur. These phenomena, which are different from the junction phenomena described before, establish a new mechanism of current flow, generically referred to as 'Zener breakdown', which masks the junction reverse-bias leakage current. In the breakdown region of operation large current changes occur with very small changes in reverse-bias voltage, similar to forward-bias operation but for quite different reasons[4].

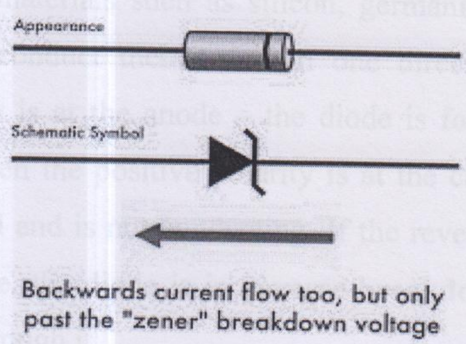


Figure (2.8) Zener Diode

2.8 Transistor

Transistor is a semiconductor device used to amplify and switch electronic signals and semiconductor material with at least three terminals for connection to an external circuit.

Transistors were one of the first most popular solid-state devices used and became well-known for the mass production of transistor radios. They can be used as a switch or to amplify an electrical signal. As an example, in a HVACRsystem, these can be used to amplify a signal of low-voltage/low-current power to a higher-voltage/ higher-current power to operate a relay [1,2,3].

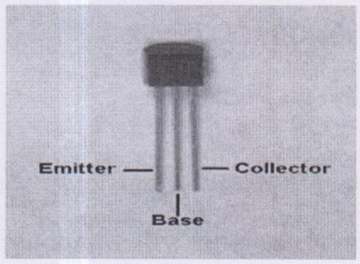


Figure (2.9) Transistor Circuit

2.9 Diode

Diode is a specialized electronic component with two electrodes called the anode and the cathode.Most diodes are made with semiconductor materials such as silicon, germanium, a semiconductor device, which conduct the current in one direction only. When the positive polarity is at the anode – the diode is **forward biased** and is conducting. When the positive polarity is at the cathode – the diode is **reversed biased** and is not conducting. If the reverse-biasing voltage is sufficiently large, the diode is in **reverse-breakdown** region and large current flows through it.

A diode is a semiconductor that acts similar to a check valve, allowing for one-way flow through an electrical circuit.A diode has an anode and a cathode. If the anode is connected to the positive terminal, then the diode is forward biased and current will flow. If the anode is connected to the negative terminal, then the diode is reverse-biased and no current will flow. Diodes can vary from the size of a pinhead to much larger sizes for ratings of 500 amperes or more [1, 2, 3].

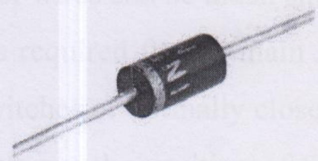


Figure (2.10) Diode

2.10 Relay

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays.Relays (and switches) come in different configurations. The most common are shown to the right. Single Pole Single Throw (SPST) is the simplest with only two contacts. Single Pole Double Throw (SPDT) has three contacts. The contacts are usually labeled Common (COM), Normally Open (NO), and Normally Closed (NC). The Normally Closed contact will be connected to the Common contact when no power is applied to the coil. The Normally Open contact will be open (i.e. not connected) when no power is applied to the coil. When the coil is energized, the Common is connected to the Normally Open contact and the Normally Closed contact is left floating. The Double Pole versions are the same as the Single Pole version except there are two switches that open and close together.

An automatic switch requires some method for opening and closing. This is often accomplished through the use of a relay (Figure 2.11). A relay is an electrically operated switch that uses an electromagnet to open or close a set of electrical contacts. Normally only a small amount of current is required to energize the electromagnet [5].

This allows for a device with a high current rating, such as an electric heater, to be operated by a control relay operated by a low-current signal. The control wires can be much smaller and separate from the large main supply lines required for the main load.Relays can be designed for normally open switches or normally closed switches. The normal position of the switch is always the position of the switch when the relay coil is de-energized.

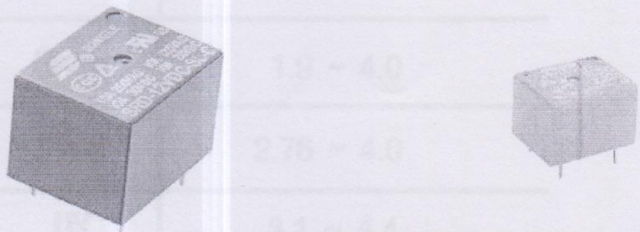
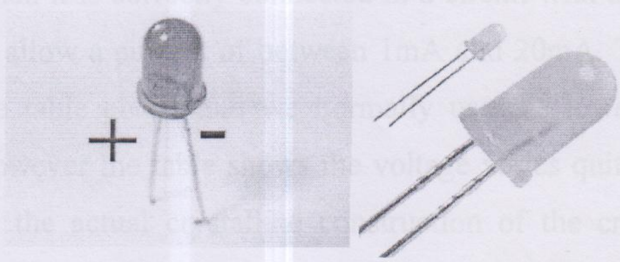
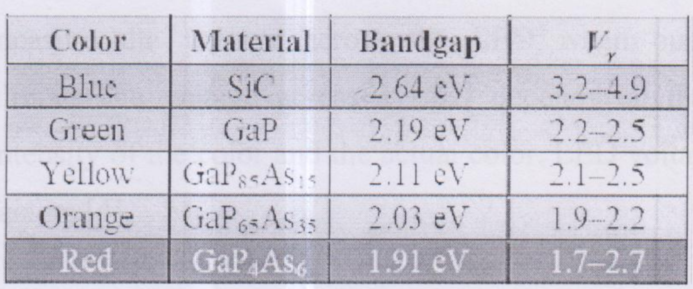


Figure (2.11) Relay Circuit

2.11 LED Lamp

LED is a light emitting diode (LED) product that is produced into a lamp (or light bulb). LEDs are semiconductor light sources.They operate an low voltage and power.This project RED LED is used for power indication and GRRN LED is used for normal supply voltage [4].





Color	Material	Bandgap	V_f
Blue	SiC	2.64 eV	3.2–4.9
Green	GaP	2.19 eV	2.2–2.5
Yellow	$GaP_{85}As_{15}$	2.11 eV	2.1–2.5
Orange	$GaP_{65}As_{35}$	2.03 eV	1.9–2.2
Red	GaP_4As_6	1.91 eV	1.7–2.7

Figure (2.12a) LED and Color Materials

Color of LED	Voltage Drop (Volt)
Red	1.63 ~ 2.03
Yellow	2.10 ~ 2.18
Orange	2.03 ~ 2.10
Blue	2.48 ~ 3.7
Green	1.9 ~ 4.0
Violet	2.76 ~ 4.0
UV	3.1 ~ 4.4
White	3.2 to 3.6

Figure (2.12b) Voltage Drop for Color of LED

A "Natural" or "Characteristic" voltage develops across a LED when it is correctly connected in a circuit with a current limiting resistor to allow a current of between 1mA and 20mA. This voltage is shown in the table above and we normally use the lower value for each color. However the table shows the voltage varies quite a lot and this depends on the actual crystalline construction of the crystal and the way it is manufactured. You cannot change this and that's why you need to measure the voltage across the LED when building some of the circuits.The voltage across a LED depends on the manufacturer, the intensity of the color and the actual color. LED voltages depend on many factors [4].

Color	Material	Wavelength (nm)	V-forward
Super Red	GaAlAs	660	1.8
Green	GaP	565	2
Red	GaAsP	635	2
Red	AlInGaP	636	2
Orange	AlInGaP	610	2
Yellow	AlInGaP	590	2
Amber	GaAsP	605	2.1
Red	GaP	700	2.1
Green	GaP	555	2.1
Green	AlInGaP	574	2.2
Blue	SiC	430	3.5
Green	InGaN	505	3.5
Blue	InGaN	470	3.5
White	InGaN		3.5
Green	InGaN	525	3.7
Green	InGaN	525	4
Blue	SiC	430	4.5

Figure (2.12c) LED Voltages

2.12 Variable Resistor

Variable resistors are resistors that have a variable resistance. We can adjust the turning a shaft. This shaft moves a wiper across the actual resistor element. By changing the amounts of resistor between the wiper connection and the connection to the resistor element, it can change the resistance.

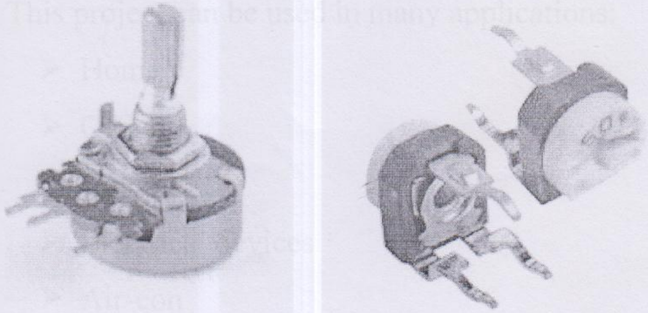


Figure (2.13) Variable Resistor

When a resistor is constructed so its value can be adjusted, it is called a variable resistor. Figure 2.14 shows the basic elements present in all variable resistors. First, a resistive material is deposited on anon-conducting base. Next, stationary contacts are connected to each end of the resistive material.Finally, a moving contact or wiper is constructed to move along the resistive material and tap off the desired resistance. There are many methods for constructing variable resistors, but they all contain these three basic principles [2].

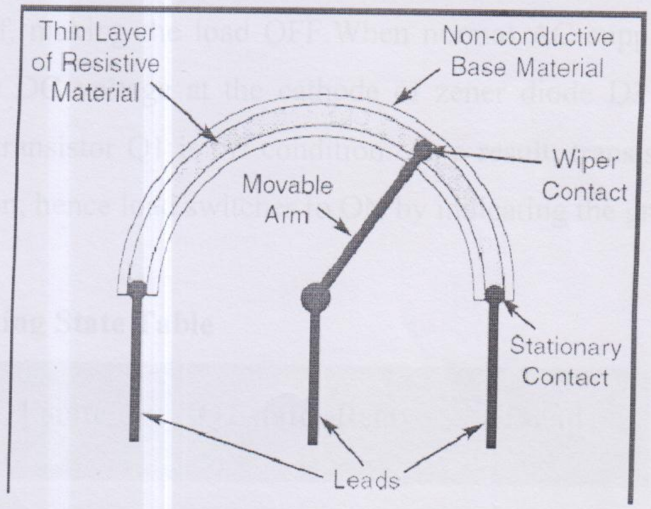


Figure (2.14) The Basic Elements in All Variable Resistors

2.13 Application Area

This project can be used in many applications:

- Home
- Office
- Computer
- Electrical devices
- Air-con

CHAPTER (3)

DESIGN AND IMPLEMENTATION

3.1 Overview of the System

When supply voltage is high, the DC voltage at the cathode of zener diode D3 becomes greater than 6.5V. As a result, transistor Q1 is in ON and transistor Q2 gets switched off. Hence, the relay RL1 OFF and load would be in OFF condition. Under low supply voltage condition, transistor Q1 switches to OFF condition and as a result, transistor Q2 switches off, making the load OFF.When normal AC supply voltage is applied, the DC voltage at the cathode of zener diode D3 is less than 6.5V; now transistor Q1 is off condition. As a result, transistor Q2 is in ON condition, hence load switches to ON by indicating the green LED.

3.1.1 Working State Table

Supply voltage	Q1 state	Q2 state	Relay	Lo ad
High	*ON*	*OFF*	*OFF*	*OFF*
Low	OFF	OFF	OFF	OFF
Normal	OFF	ON	ON	ON

3.2Experimental Result

This project is implemented to setup the input supply voltage low or high. We can see RED LED is ON and then simultaneously listen to a sound the input supply voltage is made low or high. Now, it can be observed that load automatically switches off.Normal supply voltage is applied. Now, it can observe that load will run by indicating the GREEN LED.

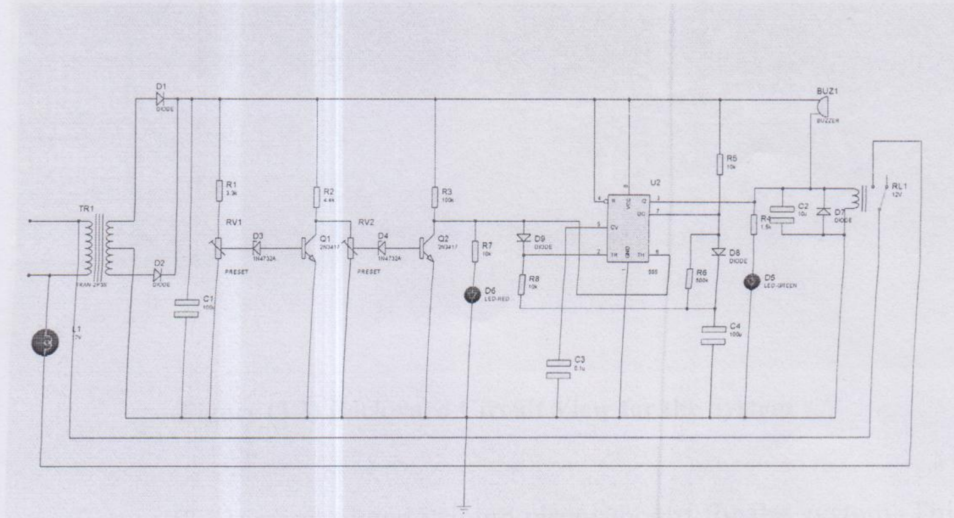


Figure (3.1) Completed Circuit Diagram for the System

Figure (3.2) and (3.3) display the working view of the system in back side and upper side of Circuit.

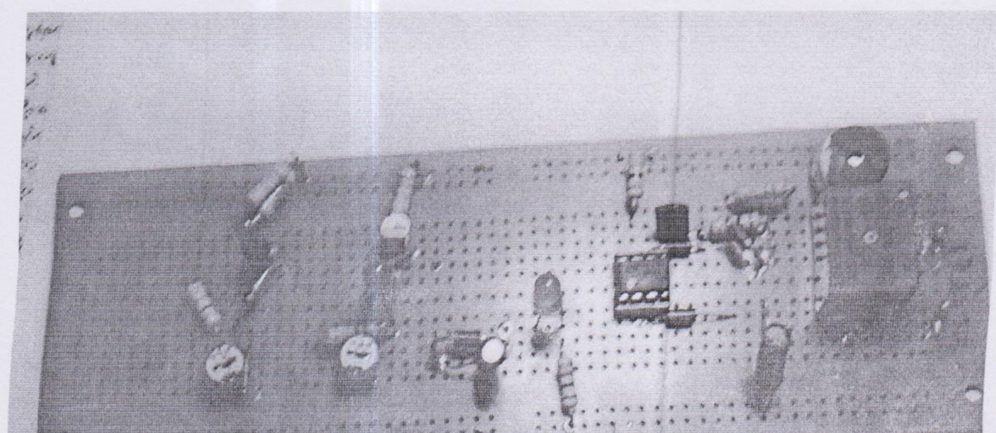


Figure (3.2) Working Circuit of Upper Side View for the System

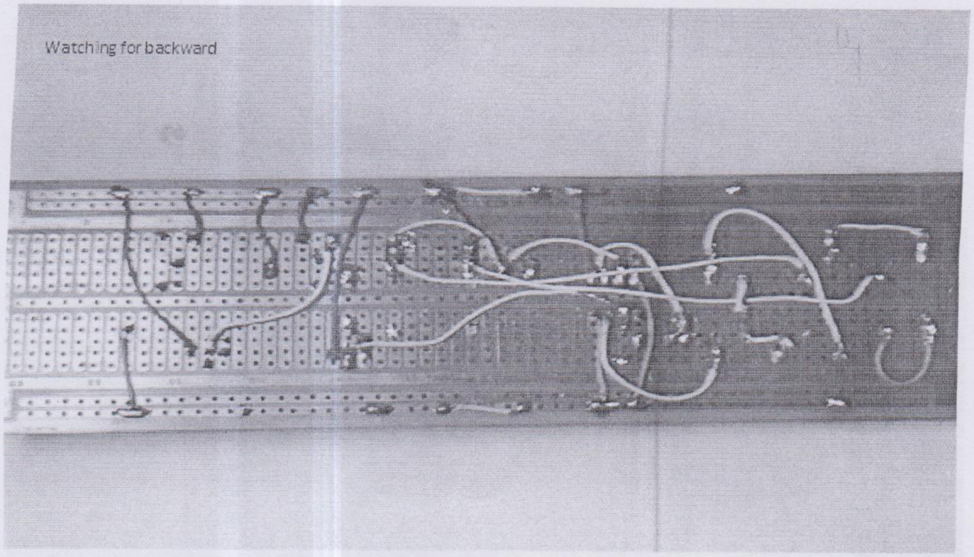


Figure (3.3) Backward Circuit View for the System

Figure (3.4) is completed printed circuit board for the system. This circuit displays signal for three voltage supply: LOW, HIGHT AND NORMAL situation with LED and alarm.

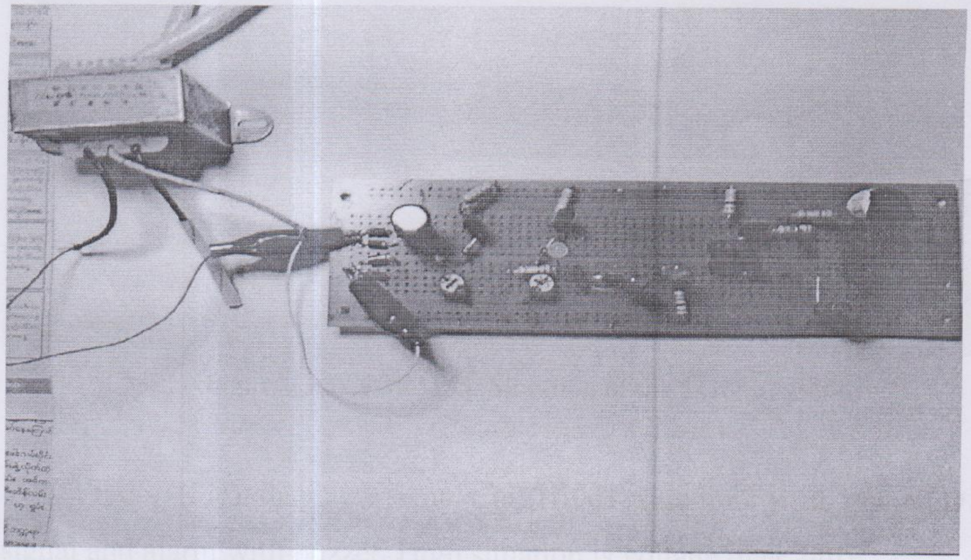


Figure (3.4) Printed Circuit Board for the System

Figure (3.5) displays signal for NORMAL situation with green LED signal. Normal situation is voltage between 140 and 240V.

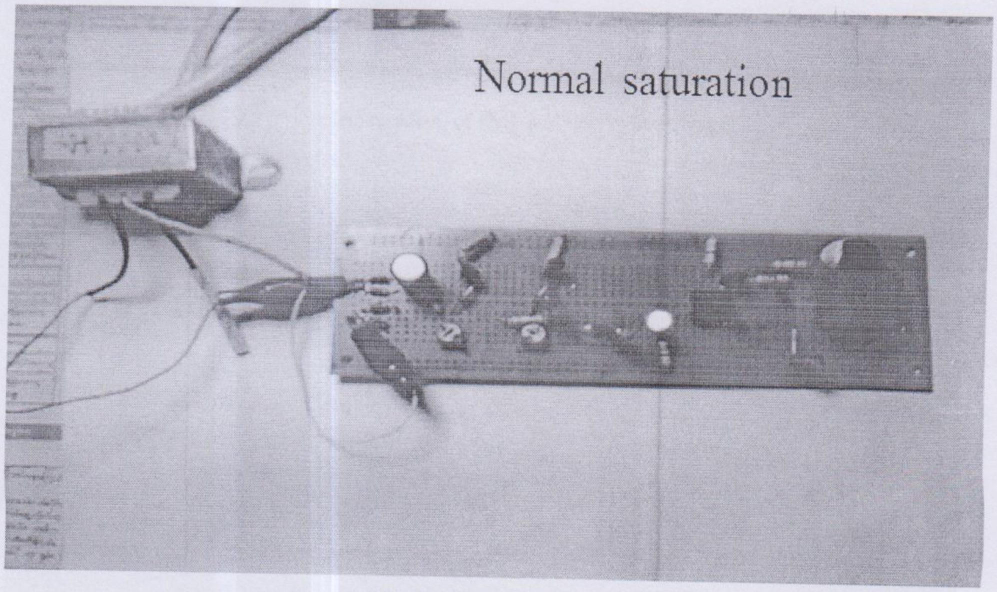


Figure (3.5) NORMAL Situation of the System

Figure (3.6) displays signal for HIGH situation with red LED signal and alarm with buzzer. High situation is voltage over 240V.

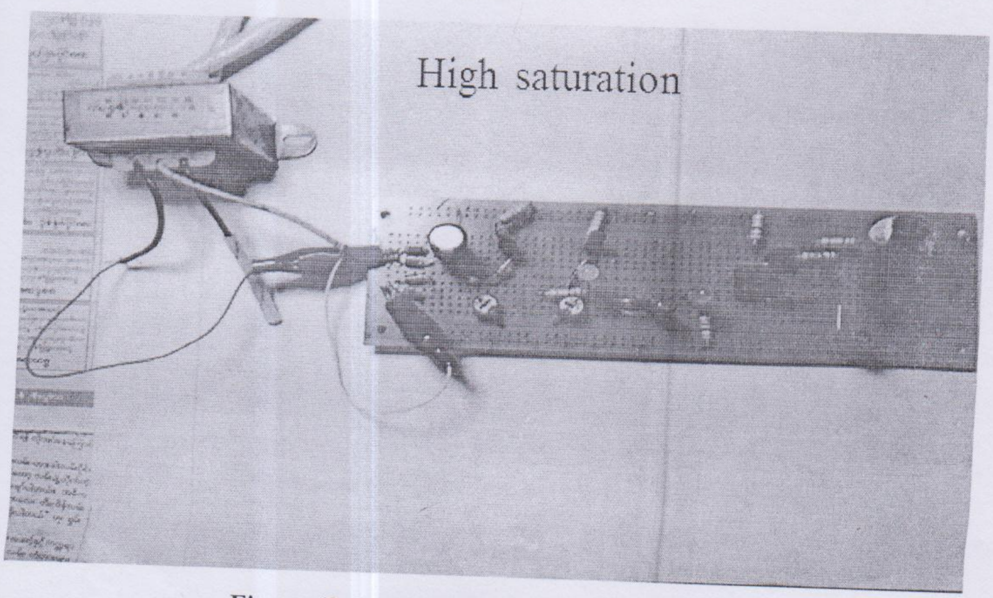


Figure (3.6) HIGH Situation of the System

Figure (3.7) displays signal for LOW situation with red LED signal and alarm with buzzer. High situation is voltage under 140V.

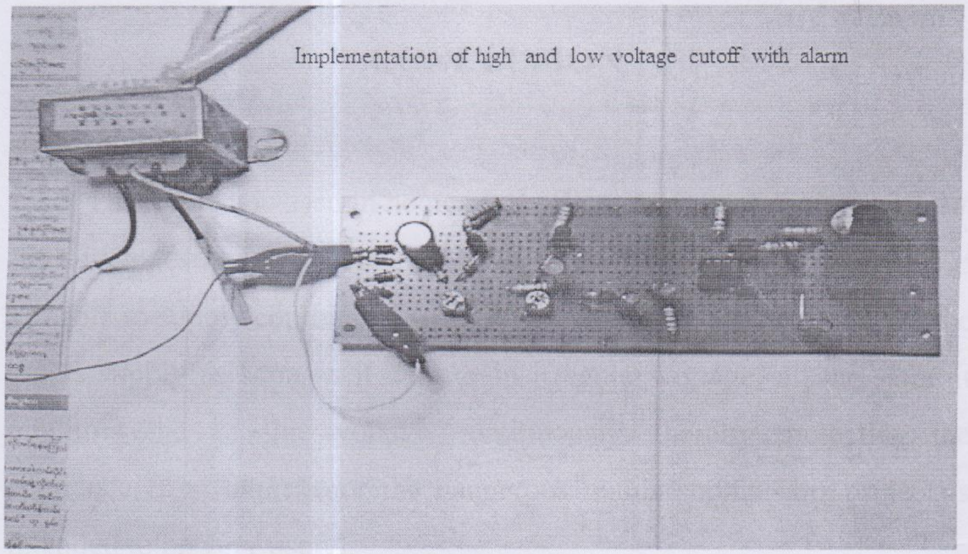


Figure (3.7) LOW Situation of the System

CHAPTER (4)

CONCLUSION

4.1 Conclusion of the System

This project is used in homes and offices to protect equipment from high voltages and low voltages. The voltage switch device presented is not able to supply continuous AC power to the load, as it disconnects the mains supply as soon as it detects an irregular voltage; all the same it monitors the ac line voltage continuously, thereby protecting the appliance from damage or the dangerous mains supply.This project is intended to be very useful.

4.2 Advantages and Disadvantages of the System

High and low voltage cutoff with alarm system for home is designed to insure protection of home devices like fan, light, lamps, television, refrigerator and all things that need to be protected in case of high and low in main supply.This circuit is used in homes and offices to protect equipment from high voltages and low voltages.It is necessary need to adjust the value of variable resistor to activate the circuit.This is not power resume.Voltage is high/ low, RED LED can be seen with less color but voice can be loudly listened.

4.3 Limitation of the System

Lower voltage level is AC 180v.Higher voltage level is AC 240v. Normal voltage level is between AC 140v to 240v. The voltage level can be adjusted to load.

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