A MINI PROJECT REPORT ON OVER VOLTAGE AND UNDER VOLTAGE PROTECTION

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Submitted in partial fulfillment for Project work lab

Electrical & Electronics Engineering

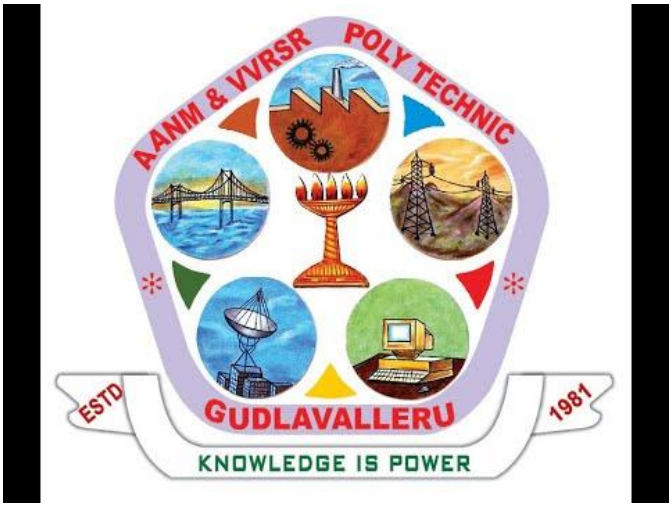
By

A DINESH	**[21030-EE-010]**
CH RAJASHEKHAR	**[21030-EE-049]**
D DOONDI	**[21030-EE-054]**
D SRIRAM	**[21030-EE-053]**
CH RAGHAVA	**[21030-EE-045]**
C JOEL RUNJALA	**[21030-EE-038]**

Under the guidance of

R. SIRISHA , B.Tech

Assistant Professor



Department of Electrical & Electronics Engineering

A.A.N.M & V.V.R.S.R POLYTECHNIC.

Gudllavaleru Krishna dt

[2021-2024]

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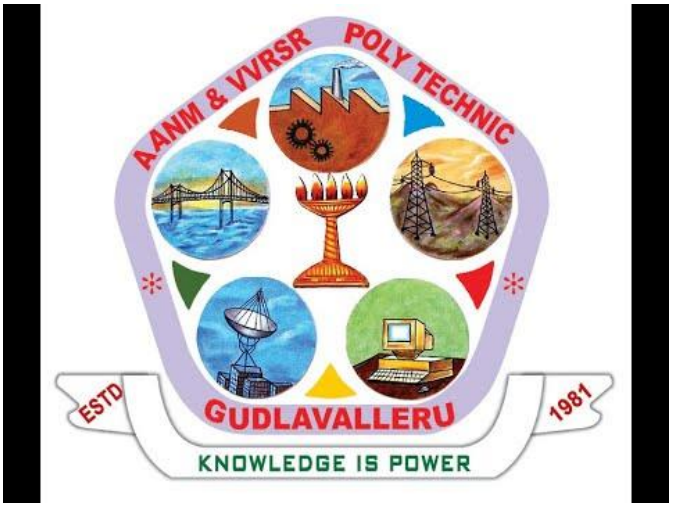

CERTIFICATE

This is to certify that the project report entitled **OVER VOLTAGE AND UNDER VOLTAGE PROTECTION"**that is being submitted by A.DINESH[21030-EE-010],CH.RAJASHEKHAR[21030-EE-049],D.DOONDI[21030-EE-054],C.JOEL[21030-EE-038],D.SRIRAM[21030-EE-053],AND CH.RAGHAVA[21030-EE-045] in partial fulfillment for project work laboratory in Electrical and Electronics Engineering of state board of technical education and training a.p.vijayawada during the academic year 2021-2024.

Date:

Signature of Guide
R.SIRISHA .B.Tech

Signature
M.VINAY SIR M.Tech

Head of department

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successfully.

Project Members

A.DINESH [21030-EE-010]
CH.RAJASEKHAR [21030-EE-049]
D.DOONDI [21030-EE-054]
CH.RAGHAVA [21030-EE-045]
C.JOEL [21030-EE-038]
D.SRIRAM [21030-EE-053]

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ABSTRACT

Overvoltage And Undervoltage Protection System

Abstract- The sudden change in voltage is huge issue in enterprises and in home machines and it causes misfortunes in electrical circuits. The on-time postpone circuit shields the heap from exchanging floods as well as from speedy changeover [off and on] impact. Here is an economical auto cut-off circuit, which is manufactured utilizing transistor and other discrete parts. It very well may be utilized to secure loads, for example, T.V, Refrigerator and so forth., from unwanted over and under line voltages. This circuit might be embedded between a current programmed/manual stabilizer and the heap. The over/under voltage cut-off with ON-Time delay gives different sorts of security: Over voltage/under voltage assurance, insurance against homeless people and so on. Keywords: zener diode, relay etc

1. **Introduction**[1] The sudden instability in voltage is colossal and noteworthy issue in undertakings and homes ,it causes hardships and moreover hurt the electrical circuit. These incidents cause low impact factor in the supply and by much proportion of impact will be misused. What's more, besides impact the unfaltering nature of other voltage controlling devices. Voltage swells and over voltage conditions are about caused by a sudden reduction in stack. Right when RMS voltage or current drops in the region of 0.1 and 0.9 pu at the power recurrence for the ranges of 0.5 cycles to 1 minute then it is said to be hang condition. The swell condition will happen when RMS voltage or current climbs in the region of 1.1 and 1.8 pu at the power repeat for lengths of 0.5 to 1 minute. Or then again more the 1.8pu and underneath circuit with a hurt voltage controller, notwithstanding the way that they can in like manner be caused by a hurt or free impartial affiliation.
2. **Hard ware implementation**

2.1 12V 1A SMPS Power Supply

What is 12V 1A SMPS Power Supply?

A 12V 1A SMPS (Switched Mode Power Supply) is an electronic device that provides a stable and regulated direct current (DC) output voltage of 12 volts with a maximum output current of 1 ampere. These power supplies are commonly used to deliver power to various electronic devices, such as routers, modems, LED lighting systems, and low-power electronics. The term "switched mode" in SMPS refers to the efficient switching technology it employs to regulate voltage and current, making it more energy-efficient and compact compared to traditional linear power supplies. The 12V 1A rating means it can deliver up to 12 watts of power, which is suitable for devices with relatively low power demands. These power supplies are known for their reliability and versatility, making them a popular choice for a wide range of applications in electronics and telecommunications. They ensure a steady and precisely regulated power source, which is essential for the reliable operation of electronic equipment.

A 12V 1A SMPS power supply is designed to offer a consistent and reliable source of 12 volts at a current rating of 1 ampere, ensuring that the connected devices receive the appropriate voltage and current levels they require for optimal performance. These power supplies are commonly used in scenarios where low to moderate power is needed, such as powering surveillance cameras, small appliances, IoT devices, and various types of embedded systems.

The switched-mode design of these power supplies makes them highly efficient, producing less heat and consuming less energy compared to traditional linear power supplies. This efficiency is particularly valuable in applications where minimizing power waste and reducing heat generation are crucial.

These power supplies typically feature a compact and lightweight design, making them ideal for situations where space and portability are key considerations. They often come with safety features, including overcurrent protection and short-circuit protection, to safeguard both the connected devices and the power supply itself.

A 12V 1A SMPS power supply is a versatile and efficient solution for delivering regulated power to a wide range of electronics, combining reliability, energy efficiency, and compact design to meet the diverse power needs of many different devices and applications**.**

Certainly! A 12V 1A SMPS (Switched Mode Power Supply) is a versatile and widely used electronic component that converts alternating current (AC) from an electrical outlet into a stable 12-volt direct current (DC) output. The "1A" designation indicates that it can provide up to 1 ampere of current, which amounts to a maximum power delivery of 12 watts. These power supplies are popular for various applications, including powering LED lighting systems, small appliances,

and low-power electronic devices like routers and microcontrollers. The switched-mode design ensures efficient energy conversion and regulation, leading to less power wastage and heat generation compared to older linear power supplies.
These power supplies are known for their reliability, compact size, and lightweight build. They often incorporate safety features such as short-circuit protection and overcurrent protection to prevent damage to connected devices or the power supply itself. With their ability to deliver a precise voltage and current output, 12V 1A SMPS power supplies are essential in ensuring that electronic devices operate consistently and safely, making them a vital component in the world of modern electronics and technology.

Working:
The operation of a 12V 1A SMPS (Switched Mode Power Supply) involves several key steps to convert alternating current (AC) from a power source into a stable and regulated 12-volt direct current (DC) output. These power supplies employ high-frequency switching technology for efficiency and precise voltage control.
Initially, the AC input is passed through a rectifier circuit, which converts it into unregulated DC voltage. This unregulated voltage then enters a high-frequency switching stage, typically through a power semiconductor like a MOSFET. The switching operation rapidly turns the DC voltage on and off. This generates a high-frequency AC waveform, which is then fed into a compact transformer. The transformer steps down or steps up the voltage, depending on the specific design, while also providing electrical isolation for safety.
After transforming the voltage, the output is rectified once again to ensure a stable DC voltage. This output is typically higher than the desired 12V, so it goes through a voltage regulation stage, using feedback control to precisely adjust the output voltage. The power supply monitors the output voltage and adjusts the switching operation to maintain the desired 12V, even when input voltage or load conditions change.
The result is a regulated and efficient 12V output, suitable for powering various electronic devices and applications. These power supplies are known for their energy

efficiency, compact design, and reliability, making them essential components in the world of electronics and power distribution.
The key working principle of a 12V 1A SMPS power supply involves three primary stages: rectification, voltage transformation, and regulation. In the rectification stage, the AC input voltage from the power source is converted into an unregulated DC voltage. This unregulated DC voltage is then fed into the switching stage, where high-frequency switching components like MOSFETs are employed. The switching operation rapidly turns the voltage on and off, resulting in a high-frequency AC waveform.

Following this, the high-frequency AC waveform is passed through a compact transformer, which serves to either step up or step down the voltage, depending on the design requirements. The transformer also provides electrical isolation for safety. Once the voltage has been transformed, it is rectified once again to ensure a stable DC voltage. However, at this stage, the voltage is typically higher than the desired 12V output. Therefore, a voltage regulation stage, equipped with feedback control, is employed to precisely adjust the output voltage to the specified 12V. The power supply continuously monitors the output voltage and dynamically adjusts the switching operation to maintain the desired voltage, even when input voltage or load conditions fluctuate.
The result is a precisely regulated and efficient 12V output, which is suitable for powering a wide range of electronic devices and applications. These power supplies are celebrated for their energy efficiency, compact design, and reliability, making them essential components in the realm of modern electronics and power distribution.

Features:

- Protection: over-voltage over current circuit protection
- AC input: AC 100-265 V (Global common)
- AC frequency: 50 HZ/60 HZ
- Output voltage: DC 12 V
- Output Current: 1A
- Modulation: Pulse width modulation

Specification

Model :	WX-DC1205
Input Voltage :	100-265VAC
Output Voltage :	12VDC
Output Current :	1A

Frequency :	50HZ/60HZ
Overvoltage Protection:	Yes
Over Current Protection:	Yes
Length (mm):	63
Width (mm):	30
Height (mm):	20
Weight (gm):	27
Shipment Weight:	0.03 kg
Shipment Dimensions:	8 × 10 × 3 cm

SMPS using VIPer22A:

Looking at the figure we can easily see that the configuration does not involve too many stages or parts.

The input mains AC, as usual is first rectified using ordinary 1N4007 diodes which is fixed in the bridge network mode.

The rectified high voltage DC is filtered using the high voltage capacitor.

The next stage is the crucial one which incorporates the outstanding chip VIPer22A manufactured by ST Microelectronics.

The IC alone functions as the oscillator and induces a frequency of around 100 KHz into the primary winding of the ferrite E core transformer.

The IC is absolutely rugged and is internally protected from sudden voltage in rush and other voltage related component hazards.

The IC also incorporates built in over heat protection which makes the IC virtually indestructible.

The voltage induced at the input is effectively stepped down at the output winding, due to low eddy current losses, about 1 amp current becomes available from a relatively tiny ferrite transformer.

With the coil specs shown the voltage is around 12 and the current is around 1amp.

A special feedback circuitry is also included in the circuit for maintaining high degree of protection and power saving features.

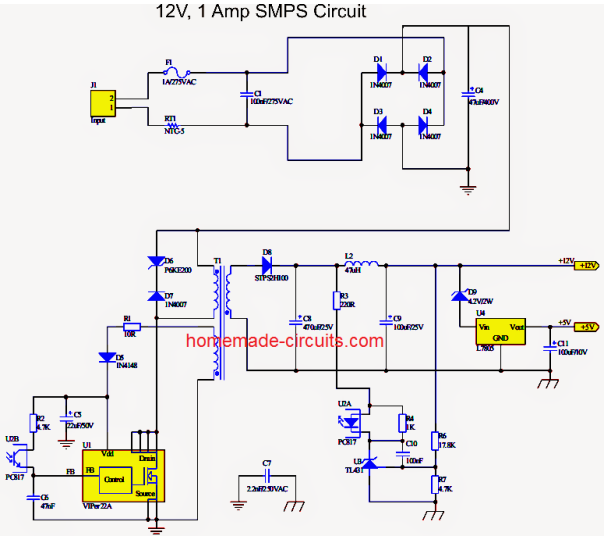
The feedback loop is implemented via an opto-coupler which becomes active during abnormal circuit conditions.

When the output voltage tends to rise beyond the set threshold the feed back loop becomes operative and feeds an error signal to the IC FB input.

The IC instantly comes into an corrective mode and switches off the input to the primary winding until the output returns to the normal range.

You may also want to read this: 24watt, 12V, 2 amp SMPS using a single IC Most recommended for you.

Circuit Diagram:



2.2 LED

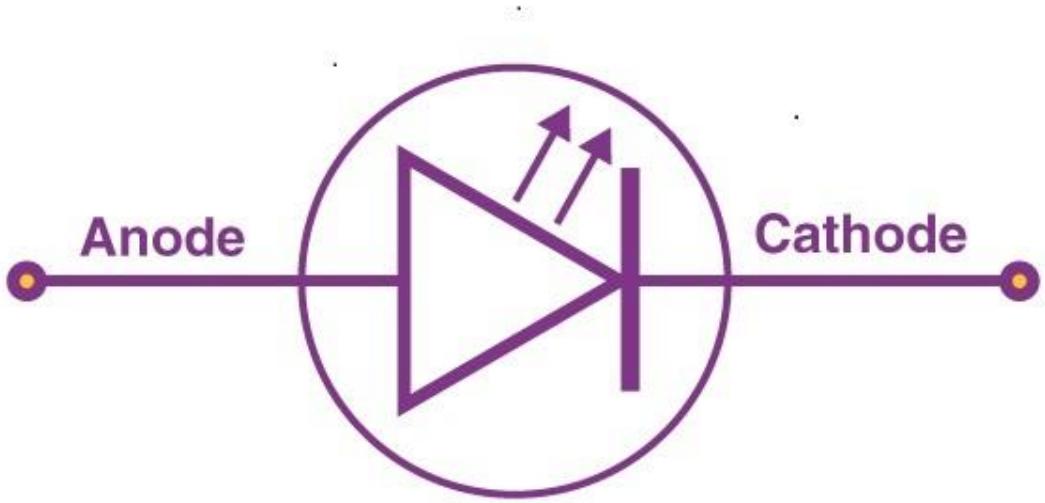
LED

What is LED?

"LED" typically stands for "Light Emitting Diode." It is a semiconductor device that emits light when an electric current passes through it. LEDs are commonly used in various applications, including displays, indicators, lighting, and more, due to their energy efficiency and long lifespan. An LED, or Light Emitting Diode, is a semiconductor device that emits light when an electric current flows through it. Unlike traditional incandescent bulbs, which rely on heating a filament to produce light, LEDs work based on a different principle. When electrons within the semiconductor material recombine with electron holes, they release energy in the form of photons, creating light. LEDs are known for their exceptional energy efficiency, durability, and versatility. They come in a variety of colors and can emit a focused, directional light, making them suitable for a wide range of applications, from lighting up displays and indicators to providing energy-efficient illumination in homes, businesses, and various electronic devices. LEDs have become increasingly popular due to their long lifespan, low power consumption, and reduced environmental impact compared to traditional lighting technologies.

LED Symbol:

The LED symbol is the standard symbol for a diode, with the addition of two small arrows denoting the emission of light**.**



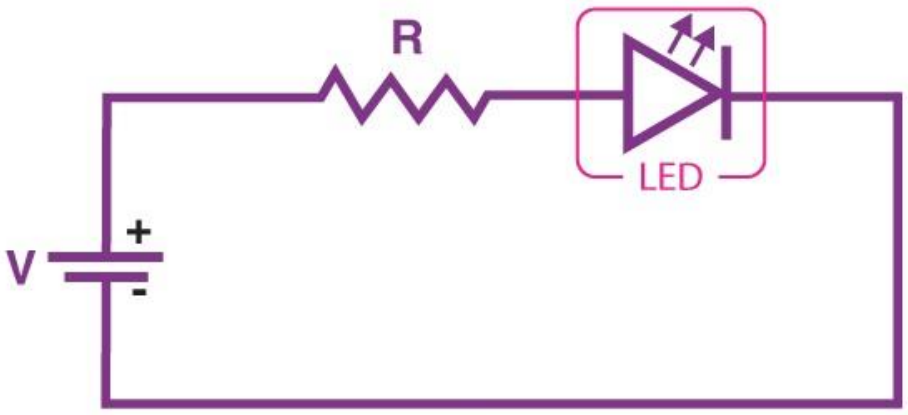
LED Symbol

Types of LED:
Below is the list of different types of LED that are designed using semiconductors:

- Miniature LEDs
- High-Power LEDs
- Flash LED
- Bi and Tri-Colour
- Red Green Blue LEDs
- Alphanumeric LED
- Lighting LED

Simple LED Circuit:

The figure below shows a simple LED circuit.



LED Circuit

The circuit consists of an LED, a voltage supply and a resistor to regulate the current and voltage.

LED Interfacing with Arduino/Raspberry Pi:

Interfacing LEDs with popular microcontroller platforms like the Raspberry Pi and Arduino is a fundamental step in electronics and programming projects. These microcontrollers provide a versatile and accessible way to control LEDs for various applications. When interfacing LEDs with a Raspberry Pi, you can use its GPIO (General Purpose Input/Output) pins to control the LED's state, allowing you to create lighting effects, indicators, or even interactive projects. Similarly, when connecting LEDs to an Arduino, you can leverage its GPIO pins and programming capabilities to control the LED's behavior based on sensor inputs or specific code logic. This integration of LEDs with microcontrollers forms the foundation for more complex projects, from simple blinking patterns to intricate IoT (Internet of Things) systems, making it a crucial skill for electronics enthusiasts and engineers alike. It's a gateway to exploring the world of embedded systems and physical computing, offering endless possibilities for innovation and creativity.

Interfacing LEDs with microcontroller platforms like the Raspberry Pi and Arduino opens up a world of possibilities for electronics enthusiasts and engineers. When working with a Raspberry Pi, you can make use of its GPIO (General Purpose Input/Output) pins to control LEDs. By writing code in Python or other programming languages, you can manipulate these pins to turn the LED on or off, create dazzling lighting effects, or build interactive projects that respond to various inputs. Raspberry Pi's versatility and capabilities make it ideal for projects ranging from home automation to robotics.

Similarly, Arduino, with its user-friendly development environment and a wide range of available sensors and shields, offers an excellent platform for LED interfacing. Arduino's GPIO pins can be used to control LEDs, but it goes further by allowing you to integrate sensors, buttons, or other input devices. This enables you to create responsive LED displays that change based on sensor readings or user interactions. Whether you're building a simple blinking LED project for beginners or developing sophisticated IoT systems that use LEDs as indicators or data displays, the Arduino's flexibility and ease of use make it an excellent choice.

In essence, interfacing LEDs with these microcontrollers serves as a foundational skill for anyone interested in electronics and programming. It lays the groundwork for more complex projects, helping you explore the realms of embedded systems and physical computing. Whether

you're a hobbyist or a professional, these platforms provide the tools and resources needed to bring your LED-based projects to life, fostering innovation and creativity in the world of electronics.

2.3 BUZZER

What is Buzzer?

A buzzer is a simple electrocoaustic device designed to produce a buzzing or beeping sound when an electrical current is applied to it. It consists of a coil of wire wound around a magnetic core and a diaphragm or vibrating element, typically made of metal or plastic. When an electrical voltage is applied to the coil, it generates a magnetic field that interacts with the magnetic core. This interaction causes the diaphragm to vibrate rapidly, producing sound waves. Buzzer devices are commonly used in a wide range of applications, from alarm systems and timers to electronic games and appliances, to provide audible alerts or notifications. Their simplicity and reliability make them a popular choice for signaling purposes in various electronic and industrial settings.

Buzzer Symbol:

Working of the Buzzer:

The operation of a buzzer is based on the principle of electromagnetic vibration. Inside a typical buzzer, there is a coil of wire wrapped around a magnetic core, and a diaphragm or vibrating element, usually made of metal or plastic. When an electrical current is applied to the coil, it generates a magnetic field around the core. This magnetic field interacts with the core, causing it to become magnetized. The magnetic attraction and repulsion between the core and the coil rapidly move the diaphragm back and forth. As the diaphragm vibrates, it compresses and rarefies the air

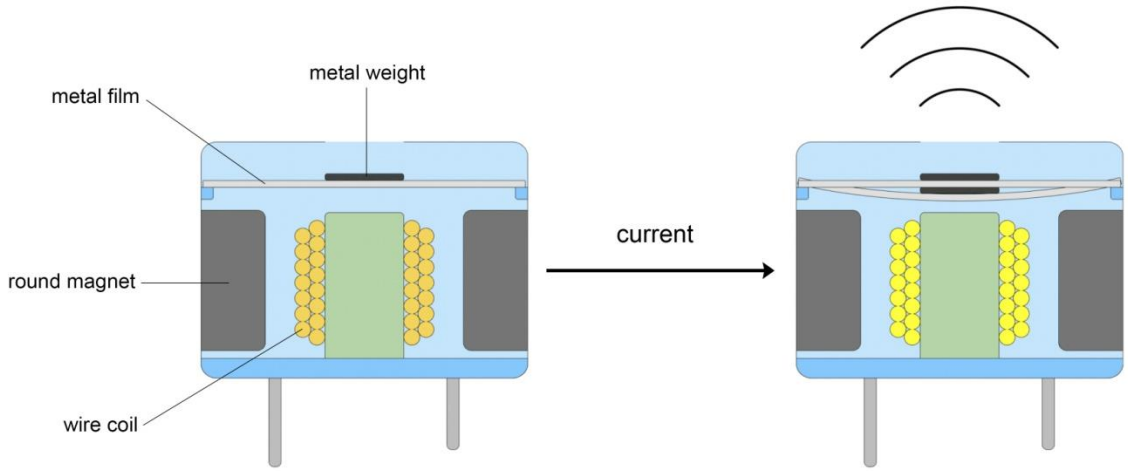
in front of it, creating pressure waves that propagate through the air as sound waves. This rapid vibration of the diaphragm produces the characteristic buzzing or beeping sound associated with buzzers. The frequency and volume of the sound can be controlled by varying the electrical current and the design of the buzzer, allowing for different tones and intensities to suit various applications.

The fundamental working principle of a buzzer involves the conversion of electrical energy into mechanical vibrations and then into audible sound waves. Inside the buzzer, the coil of wire is connected to an electrical circuit. When an alternating current (AC) or direct current (DC) voltage is applied to the coil, it induces a magnetic field around the magnetic core.

The diaphragm, which is positioned close to the magnetic core, is attracted and repelled by the magnetic field in rapid succession due to the alternating nature of the current. This magnetic attraction and repulsion force the diaphragm to move back and forth at the same frequency as the electrical signal, causing it to vibrate. These vibrations are transmitted to the surrounding air as pressure waves, creating sound waves that our ears perceive as audible sound.

The frequency or pitch of the sound produced by the buzzer is determined by the frequency of the electrical current applied to the coil. Higher frequencies result in higher-pitched sounds, while lower frequencies produce lower-pitched sounds. Additionally, the intensity or volume of the sound can be adjusted by controlling the amplitude of the electrical current or by modifying the physical design of the buzzer, such as the size and shape of the diaphragm.

A buzzer's operation is based on the interaction between an electromagnetic field created by the coil and the magnetic core, which drives the diaphragm to vibrate rapidly and produce audible sound waves. This simple yet effective mechanism makes buzzers an essential component in a wide range of applications where audible alerts or notifications are required.



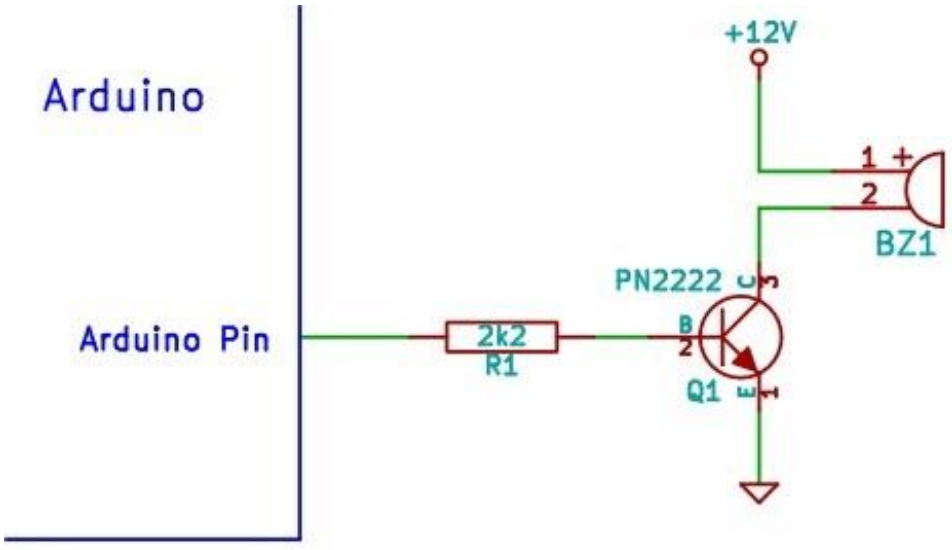
Buzzer interfacing with Arduino/Raspberry Pi

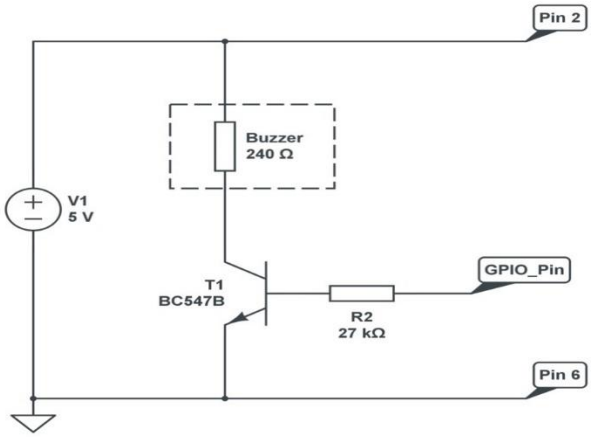
Interfacing a buzzer with an Arduino or Raspberry Pi is a straightforward process that allows you to incorporate sound alerts and notifications into your projects. To do this, you connect one terminal of the buzzer to a digital GPIO (General-Purpose Input/Output) pin on the microcontroller, while the other terminal is connected to the ground (GND) pin. You can use a suitable resistor in series with the buzzer to limit the current and protect the microcontroller.

In the case of the Arduino, you can use its built-in functions to control the buzzer. By setting the GPIO pin to a high state, you can activate the buzzer, causing it to produce sound. You can control the duration and frequency of the sound by writing code that toggles the GPIO pin on and off at specific intervals.

With a Raspberry Pi, you can achieve buzzer interfacing in a similar manner using Python or other programming languages. By utilizing the GPIO libraries available for the Raspberry Pi, you can easily control the buzzer's behavior, creating various tones and patterns of sound based on your program's logic.

This buzzer interfacing capability opens up a wide range of possibilities for your projects, including creating alarms, notifications, musical compositions, or interactive elements. Whether you are working with Arduino or Raspberry Pi, interfacing a buzzer is a valuable way to add audio feedback to your electronic creations.



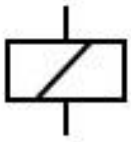


RELAY

What is Relay?

A relay is an electromechanical switch that operates by using an electromagnetic coil to control the switching of one or more electrical circuits. It serves as an interface between low-voltage control signals, such as those from microcontrollers or digital logic circuits, and high-voltage or high-current loads, like motors, lights, or appliances. When a small voltage is applied to the coil, it generates a magnetic field that attracts a movable armature, which is mechanically connected to one or more switch contacts. This magnetic force causes the switch contacts to change position, either opening or closing an electrical circuit. Relays are crucial in situations where you need to isolate or protect low-voltage control systems from high-voltage or high-current loads, making them an essential component in automation, robotics, industrial control, and many other applications. They provide a safe and reliable way to control electrical devices remotely or based on specific conditions.

Relay Symbol:



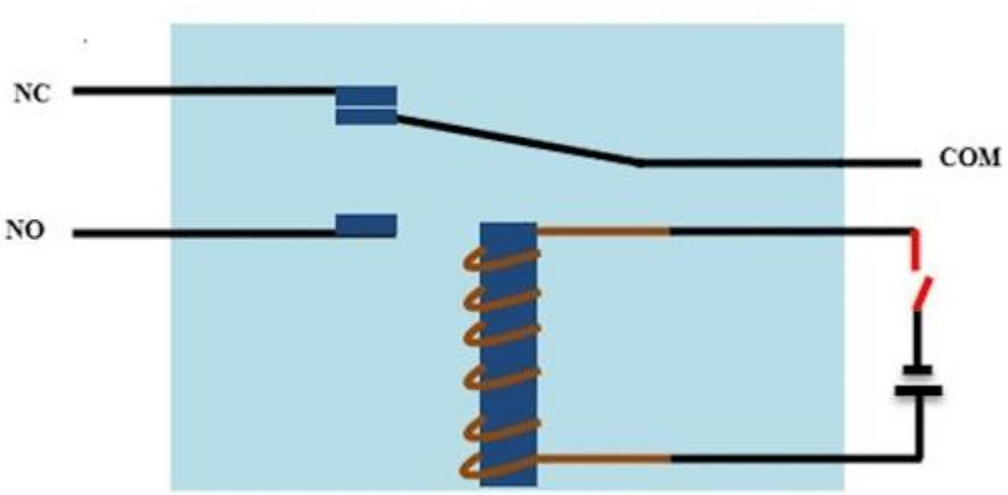
Working:

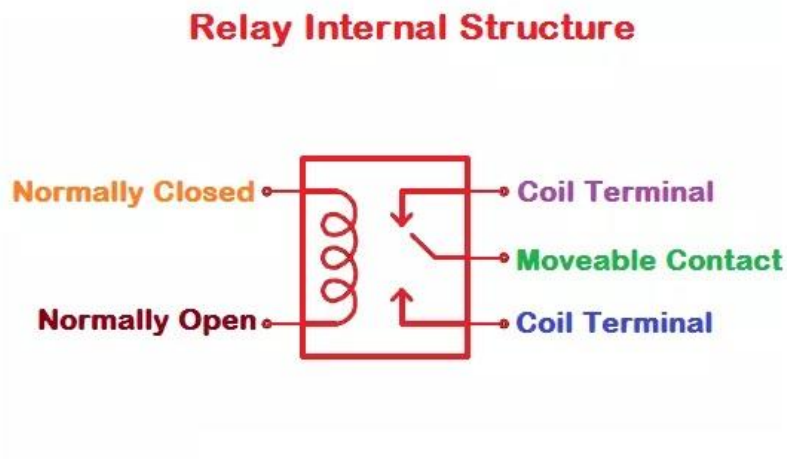
The operation of a relay is based on the principle of electromagnetic induction and mechanical switching. Inside a typical electromagnetic relay, there are two main components: an electromagnetic coil and a set of switch contacts. When an electrical current flows through the coil, it generates a magnetic field around it. This magnetic field exerts a force on an armature or movable iron core, which is connected to a set of switch contacts.

In its default or "de-energized" state, the relay's switch contacts are open, meaning the electrical circuit they control is not connected. However, when a sufficient voltage is applied to the coil, it energizes and generates a magnetic force that attracts the armature. This attraction causes the armature to move, closing the switch contacts and completing an electrical circuit.

Conversely, when the coil voltage is removed or reduced below a certain threshold, the magnetic field dissipates, allowing a spring or other mechanical mechanism to return the armature to its original position. This action opens the switch contacts, interrupting the electrical circuit.

Relays are versatile devices because they can be used to control high-power or high-voltage circuits with a relatively low-power or low-voltage control signal. They provide electrical isolation between the control circuit and the load circuit, making them valuable for applications where safety, signal protection, or galvanic separation is crucial. Electromagnetic relays are commonly used in various industries and applications, including automotive systems, industrial automation, telecommunications, and home appliances, to name just a few.

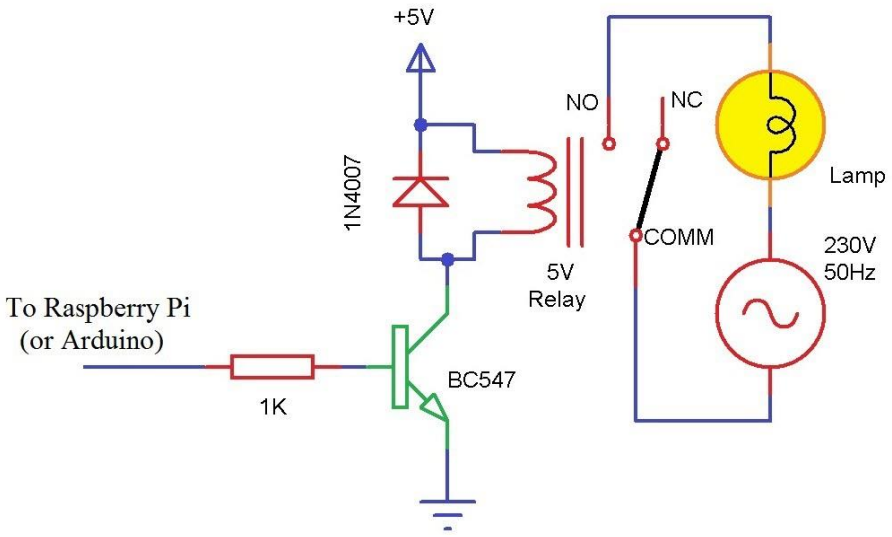




Relay Interfacing with Arduino/ Raspberry Pi:
Interfacing a relay with Arduino or Raspberry Pi is a practical and widely-used approach to control high-power electrical devices in various projects. To connect a relay, you typically use one of the microcontroller's GPIO pins to trigger the relay's coil. The relay
coil operates at a lower voltage than the load it controls, ensuring electrical isolation. When the microcontroller sends a signal to the relay, it energizes the coil, causing the relay's switch contacts to close or open, depending on the relay type.

In Arduino, you can utilize libraries like "Arduino Relay" or "Arduino RelayShield" to simplify the relay interfacing process. These libraries provide functions to set the relay state (ON or OFF) and control the load. This makes it easy to integrate relays into projects such as home automation systems, smart appliances, or industrial control setups.
For Raspberry Pi, Python libraries like "RPi.GPIO" are commonly used to interface with relays. By configuring GPIO pins and writing Python scripts, you can control relays to operate lights, fans, motors, and other high-power devices. This capability is valuable for creating home automation solutions, IoT projects, and DIY electronics projects.
Whether you're using Arduino or Raspberry Pi, interfacing relays enables you to safely and efficiently control high-voltage and high-current loads, making it a fundamental technique for expanding the capabilities of your microcontroller-based projects. It's particularly useful in scenarios where you need to switch appliances, motors, or other devices while ensuring electrical safety and isolation.

Relay Interfacing with Arduino/ Raspberry Pi:



MAKING OF PCB:

4.5.1: INTRODUCTION

One of the most discouraging things about making a hardware project is building the printed circuit board-PCB.it is sometimes possible to use strip board or some other pre-fabricated board but more often than not the circuit complexity and performance requires a proper PCB to be made .The good news is that due to improvements in printing and processing technologies it is now relatively easy to make inexpensive high quality PCB's at home.

WARNING-Making PCB's requires the use of Ferric Chloride(FeCi3) which is corrosive so avoid skin and eye contact .Remember safety-first so, use glasses, gloves and protective overalls .Ferric

Chloride is also very good at distorting cloths weeks after you think you have washed it off. If you do get any on your skin then wash it off immediately with lots of water and soap.

4.5.2: THE ARTWORK

The first stage is to transfer the circuit layout from the PC to the special Press-n-Peel film. Put the film in the laser printer so that the print will appear on it. This will produce a contact print where the black image will end up as copper on the final PCB. Now to transfer the artwork to the Copper board by following the instructions with the Press-n-Peel film:

- Clean the copper board very well with the PCB cleaning rubber.
- Heat the cloths iron to 300 deg F.
- Hole the film with the print in contact to the copper and smoothly iron the film down until the print appears black through the film (about 1min).
- Allow 5min to cool down (or speed up this with water) then peel the film off.

This should produce a clean black print on to the copper. If you let the film move or overheat then you will find that the tracks and writing will be smeared and out of focus also the film may be wrinkled up. If you don't use enough heat or heat unevenly then the film may not stick or to be dark enough. In either case clean off the PCB and try again, you should get it right after a couple of goes.

4.5.3: THE ETCHING

Etching the PCB is to remove the unwanted copper.

- Dilute the concentrated Ferric Chloride fluid with water (1:1) and pour into the one liter glass jar.
- Put the PCB copper side up on the top tray and pour all Ferric Chloride on top.
- Gently rock the top tray to keep the etch fluid moving avoiding spillage.
- After about 15min all of the unwanted copper disappears.

- Remove the board and drop it into a bucket of cold water to clean off.

4.5.4: DRILLING

Drilling with 0.8mm drill bits can be bit tricky as it is easy to break the drill bits. Always hold the drill straight and do not bend it when the hole has started .Using a 0.8mm PCB drill bit, drill out all of the component holes that are required. So, now the PCB is finished and it is ready to solder.

4.5.5: ADVANTAGES OF PCB

- Reducing wiring errors.
- Decreases assembly cost.
- Typically consume less space than traditionally build circuits.

4.5.6: ADVANTAGES AND APPLICATIONS

ADVANTAGES:

- Small in size.
- Easy to operate from a remote place.
- Cost of manufacture is very less.
- Flexibility of using in various applications.

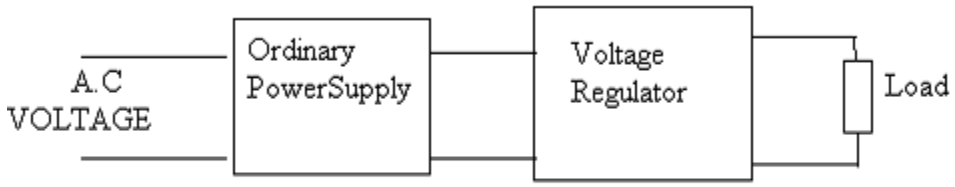
APPLICATIONS:

After some small modifications made, the same kit can find many applications.

- Automation in industries ,house hold appliances etc
- Also used in a remote areas where the facility of Cell network is provided.

Power supply:

-
- The supply given is the +5V D.C. The incoming power is 230V A.C. , there is a need to convert it into +5V D.C.
- The input a.c. supply is stepped down from 230V to 9-0-9V. The rectifier consists of diodes D1 and D2 makes the supply D.C. that is, unidirectional waveform. The output from rectifier is a URDC, whose value is 12.726V peak to peak. The voltage regulator makes this URDC to RDC of +5V. The capacitor C1 is used to maintain constant voltage between two consecutive positive cycles where as C2 is used to remove the fluctuations caused by regulator. Here we are selecting 12.726V as a peak value. Because of fluctuations, the peak voltage may decrease, then regulator cannot step up to +5V. If we select peak value, a higher one, then the problem can be overcome.
-

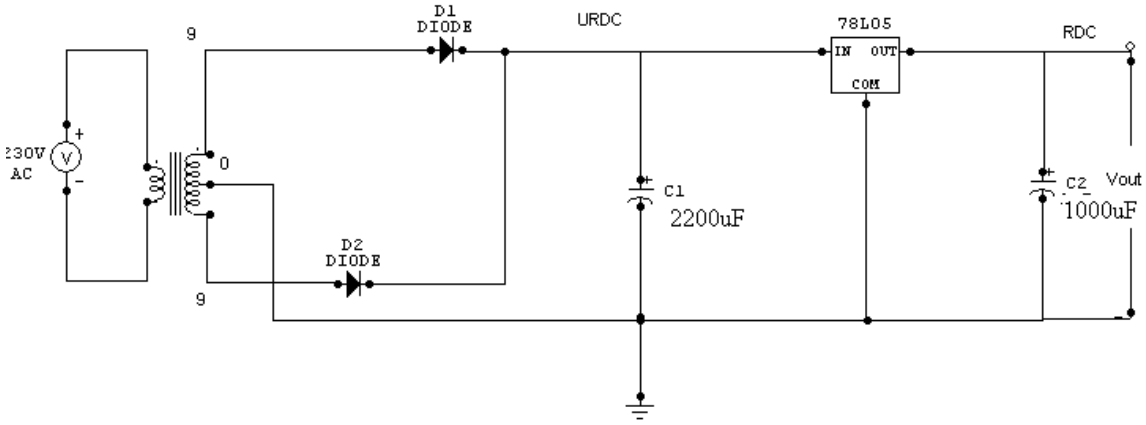


6.4 Block diagram of R.P.S.

-
-
- A regulated power supply which maintains the output voltage constant irrespective of a.c. mains fluctuations or load variations is known as regulated power supply. A regulated power supply consists of an ordinary power supply and voltage regulating device. The output of ordinary power supply is fed to the voltage regulator which produces the final output. The output voltage remains constant whether the load current changes or there are fluctuations in the input a.c. voltage.
- The rectifier converts the transformer secondary a.c. voltage into pulsating voltage. The pulsating d.c. voltage is applied to the capacitor filter. This filter reduces the pulsations

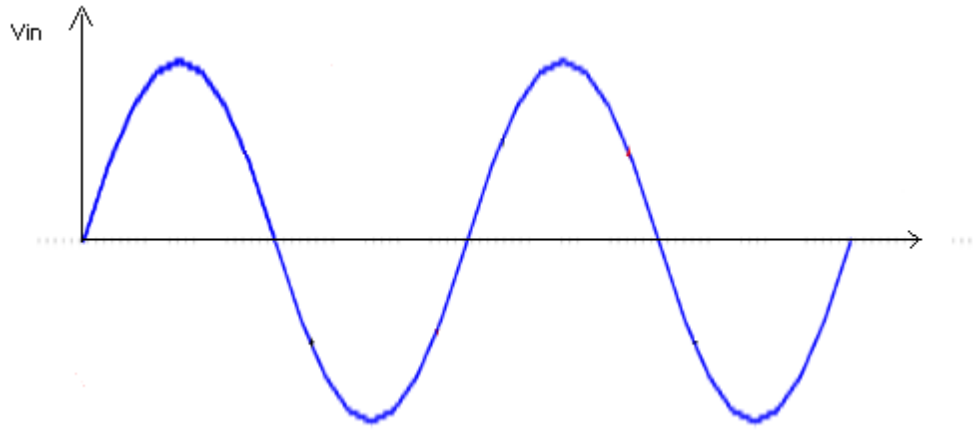
in the rectifier d.c. output voltage. Finally, it reduces the variations in the filtered output voltage

- Need of RPS: In an ordinary power supply, the voltage regulation is poor i.e. d.c. output voltage changes with load current. Output voltage also changes due to variations in the input a.c. voltage. This is due to the following reasons



6.5 Circuit diagram of R.P.S. :

- 1. There are considerable variations in a.c. line voltage caused by outside factors beyond our control. This changes the d.c. output voltage. Most of the electronic circuits will refuse to work satisfactorily on such output voltage fluctuations. This necessities to use regulated d.c. power supply.
- 2. The internal resistance of ordinary power supply in relatively large. Therefore, output voltage is markedly affected by the amount of load current drawn from the supply.
- These variations in d.c. voltage may cause erratic operation of electronic circuits.
- Therefore, regulated d.c. power supply is the only solution in such situations.



➢

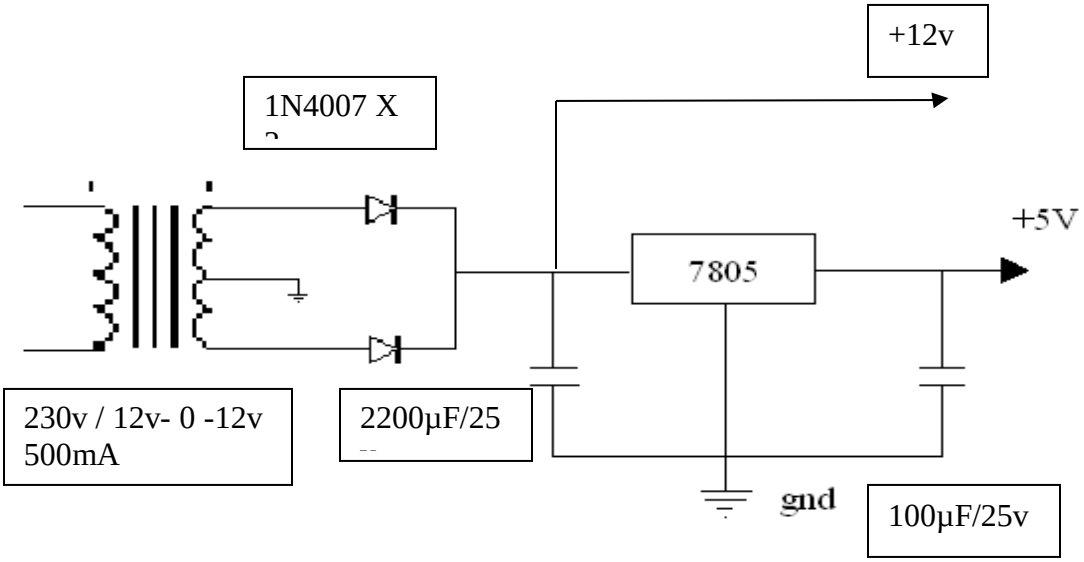
4.6 POWER SUPPLY:

Description:

The Power Supply is a Primary requirement for the project work. The required DC power supply for the base unit as well as for the recharging unit is derived from the mains line. For this purpose center tapped secondary of 12V-012V transformer is used. From this transformer we getting 5V power supply. In this +5V output is a regulated output and it is designed using 7805 positive voltage regulator. This is a 3 Pin voltage regulator, can deliver current up to 800 milliamps.

Rectification is a process of rendering an alternating current or voltage into a unidirectional one. The component used for rectification is called 'Rectifier'. A rectifier permits current to flow only during positive half cycles of the applied AC voltage. Thus, pulsating DC is obtained to obtain smooth DC power additional filter circuits required.

Circuit diagram:



A diode can be used as rectifier. There are various types of diodes. However, semiconductor diodes are very popularly used as rectifiers. A semiconductor diode is a solid-state device consisting of two elements is being an electron emitter or cathode, the other an electron collector or anode. Since electrons in a semiconductor diode can flow in one direction only-form emitter to collector-the diode provides the unilateral conduction necessary for rectification.

The rectified Output is filtered for smoothening the DC, for this purpose capacitor is used in the filter circuit. The filter capacitors are usually connected in parallel with the rectifier output and the load. The AC can pass through a capacitor but DC cannot, the ripples are thus limited and the output becomes smoothed. When the voltage across the capacitor plates tends to rise, it stores up energy back into voltage and current. Thus, the fluctuation in the output voltage is reduced considerable.

4.6.1: VOLTAGE REGULATOR:

3.4.1: LM 78XX SERIES VOLTAGE REGULATOR

The LM 78XXX series of the three terminal regulations is available with several fixed output voltages making them useful in a wide range of applications. One of these is local on card regulation. The voltages available allow these regulators to be used in logic systems,

instrumentation and other solid state electronic equipment. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltages and currents. The LM78XX series is available in aluminum to 3 packages which will allow over 1.5A load current if adequate heat sinking is provided. Current limiting is included to limit the peak output current to a safe value. The LM 78XX is available in the metal 3 leads to 5 and the plastic to 92. For this type, with adequate heat sinking. The regulator can deliver 100mA output current.

The advantage of this type of regulator is, it is easy to use and minimize the number of external components.

The following are the features voltage regulators:

a) Output current in exces of 1.5A for 78 and 78L series

b) Internal thermal overload protection

c) No external components required

d) Output transistor sage area protection

e) Internal short circuit current limit.

f) Available in aluminum 3 package.

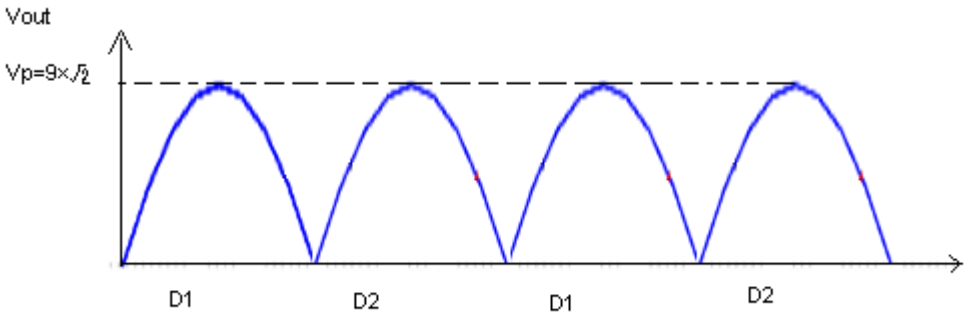
3.4.2: POSITIVE VOLTAGE REGULATOR

The positive voltage regulator has different features like

- Output current up to 1.5A
- No external components
- Internal thermal overload protection
- High power dissipation capability

- Internal short-circuit current limiting
- Output transistor safe area compensation
- Direct replacements for Fairchild microA7800 series

Nominal Output Voltage	Regulator
5V	uA7805C
6V	uA7806C
8V	uA7808C
8.5V	uA7885C
10V	uA7810C
12V	uA7812C
15V	uA7815C
18V	uA7818C
24V	uA7824C



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4.7 ARDUNO

Arduino is an open source computer hardware and software company, project, and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical world. The project's products are distributed as open-source hardware and software, which are licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL),[1] permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially in preassembled form, or as do-it-yourself (DIY) kits.

Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (*shields*) and other

circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers. The microcontrollers are typically programmed using a dialect of features from the programming languages C and C++. In addition to using traditional compiler toolchains, the Arduino project provides an integrated development environment (IDE) based on the Processing language project.

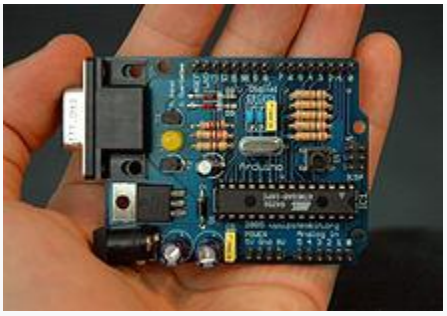
The Arduino project started in 2003 as a program for students at the Interaction Design Institute Ivrea in Ivrea, Italy,[2] aiming to provide a low-cost and easy way for novices and professionals to create devices that interact with their environment using sensors and actuators. Common examples of such devices intended for beginner hobbyists include simple robots, thermostats, and motion detectors.

The name *Arduino* comes from a bar in Ivrea, Italy, where some of the founders of the project used to meet. The bar was named after Arduin of Ivrea, who was the margrave of the March of Ivrea and King of Italy from 1002 to 1014

Hardware

Arduino is open-source hardware. The hardware reference designs are distributed under a Creative Commons Attribution Share-Alike 2.5 license and are available on the Arduino website. Layout and production files for some versions of the hardware are also available. The source code for the IDE is released under the GNU General Public License, version 2.[16] Nevertheless, an official Bill of Materials of Arduino boards has never been released by Arduino staff.

Although the hardware and software designs are freely available under copyleft licenses, the developers have requested the name *Arduino* to be exclusive to the official product and not be used for derived works without permission. The official policy document on use of the Arduino name emphasizes that the project is open to incorporating work by others into the official product.[17] Several Arduino-compatible products commercially released have avoided the project name by using various names ending in *-duino*.[18]



An early Arduino board[19] with an RS-232 serial interface (upper left) and an Atmel ATmega8 microcontroller chip (black, lower right); the 14 digital I/O pins are at the top, the 6 analog input pins at the lower right, and the power connector at the lower left.

Most Arduino boards consist of an Atmel 8-bit AVR microcontroller (ATmega8[20], ATmega168, ATmega328, ATmega1280, ATmega2560) with varying amounts of flash memory, pins, and features.[21] The 32-bit Arduino Due, based on the Atmel SAM3X8E was introduced in 2012.[22] The boards use single or double-row pins or female headers that facilitate connections for programming and incorporation into other circuits. These may connect with add-on modules termed *shields*. Multiple, and possibly stacked shields may be individually addressable via an I²C serial bus. Most boards include a 5 V linear regulator and a 16 MHz crystal oscillator or ceramic resonator. Some designs, such as the LilyPad, run at 8 MHz and dispense with the onboard voltage regulator due to specific form-factor restrictions.

Arduino microcontrollers are pre-programmed with a boot loader that simplifies uploading of programs to the on-chip flash memory. The default bootloader of the Arduino UNO is the optiboot bootloader.[23] Boards are loaded with program code via a serial connection to another computer. Some serial Arduino boards contain a level shifter circuit to convert between RS-232 logic levels and transistor–transistor logic(TTL) level signals. Current Arduino boards are programmed via Universal Serial Bus (USB), implemented using USB-to-serial

adapter chips such as the FTDI FT232. Some boards, such as later-model Uno boards, substitute the FTDI chip with a separate AVR chip containing USB-to-serial firmware, which is reprogrammable via its own ICSP header. Other variants, such as the Arduino Mini and the unofficial Boarduino, use a detachable USB-to-serial adapter board or cable, Bluetooth or other methods, when used with traditional microcontroller tools instead of the Arduino IDE, standard AVR in-system programming (ISP) programming is used.

An official Arduino Uno R2 with descriptions of the I/O locations

The Arduino board exposes most of the microcontroller's I/O pins for use by other circuits. The *Diecimila*,[a] *Duemilanove*,[b] and current *Uno*[c] provide 14 digital I/O pins, six of which can produce pulse-width modulated signals, and six analog inputs, which can also be used as six digital I/O pins. These pins are on the top of the board, via female 0.1-inch (2.54 mm) headers. Several plug-in application shields are also commercially available. The Arduino Nano, and Arduino-compatible Bare Bones Board[24] and Boarduino[25] boards may provide male header pins on the underside of the board that can plug into solderless breadboards.

Many Arduino-compatible and Arduino-derived boards exist. Some are functionally equivalent to an Arduino and can be used interchangeably. Many enhance the basic Arduino by adding output drivers, often for use in school-level education, to simplify making buggies and small robots. Others are electrically equivalent but change the form factor, sometimes retaining compatibility with shields, sometimes not. Some variants use different processors, of varying compatibility.

Software development

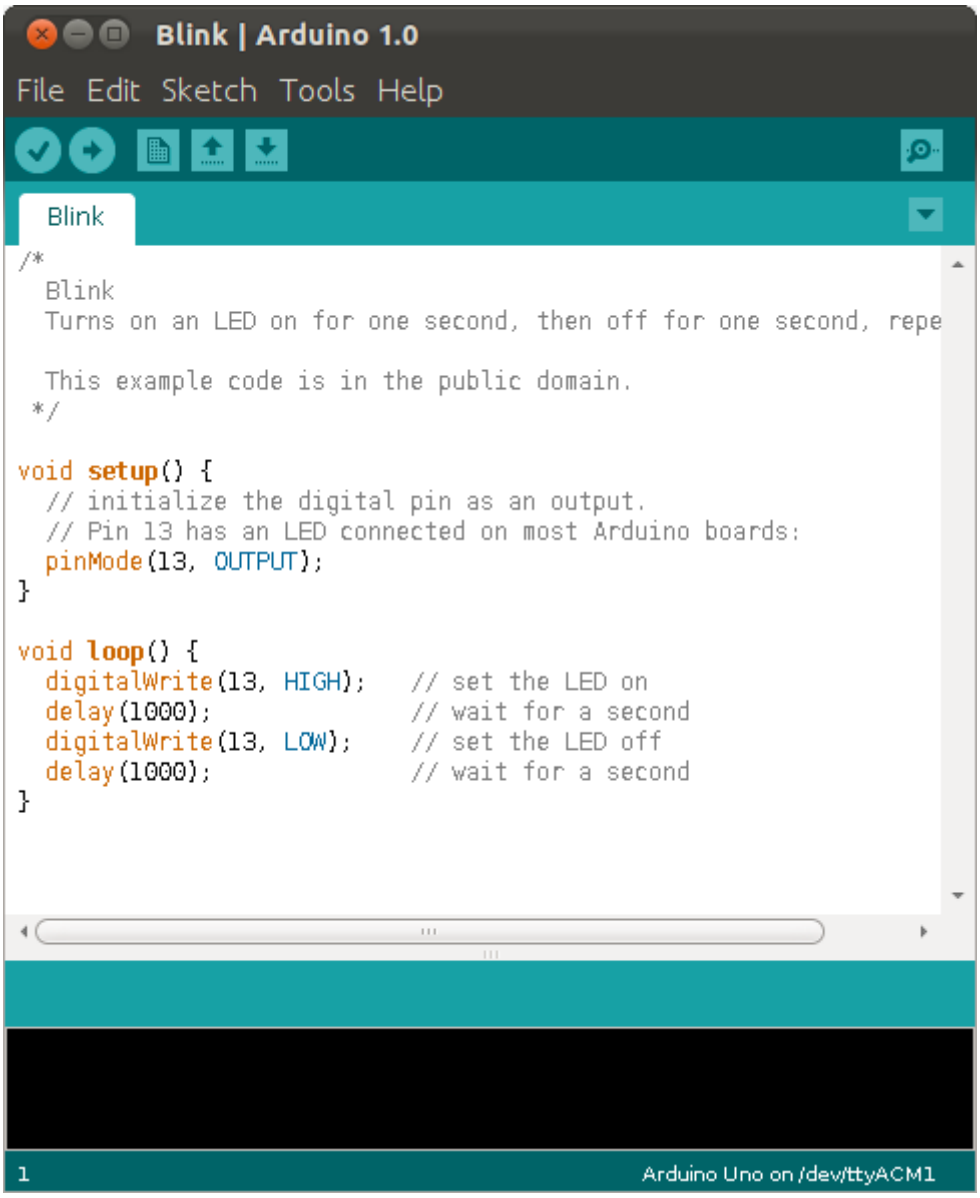
A program for Arduino may be written in any programming language for a compiler that produces binary machine code for the target processor. Atmel provides a development environment for their microcontrollers, AVR Studio and the newer Atmel Studio.[49][50][51]

The Arduino project provides the Arduino integrated development environment (IDE), which is a cross-platform application written in the programming language Java. It originated from the IDE for the languages *Processing* and *Wiring*. It includes a code editor with features such as text cutting and pasting, searching and replacing text, automatic indenting, brace matching, and syntax highlighting, and provides simple *one-click* mechanisms to compile and upload programs to an Arduino board. It also contains a message area, a text console, a toolbar with buttons for common functions and a hierarchy of operation menus.

A program written with the IDE for Arduino is called a *sketch*.[52] Sketches are saved on the development computer as text files with the file extension *.ino*. Arduino Software (IDE) pre-1.0 saved sketches with the extension *.pde*.

The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub *main()* into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution. The Arduino IDE employs the program *avrdude* to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.

Due to the company's open source nature, there exist many free public libraries for developers to use to augment their projects.



Software

A minimal Arduino C/C++ sketch, as seen by the Arduino IDE programmer, consist of only two functions:[54]

- *setup()*: This function is called once when a sketch starts after power-up or reset. It is used to initialize variables, input and output pin modes, and other libraries needed in the sketch.[55]
- *loop()*: After *setup()* has been called, function *loop()* is executed repeatedly in the main program. It controls the board until the board is powered off or is reset.[56]

Most Arduino boards contain a light-emitting diode (LED) and a load resistor connected between pin 13 and ground, which is a convenient feature for many tests and program functions.[57] A typical program for a beginning Arduino programmer blinks a LED repeatedly.

```
#define LED_PIN 13                  // Pin number attached to LED.

void setup() {
    pinMode(LED_PIN, OUTPUT);       // Configure pin 13 to be a digital
output.
}

void loop() {
    digitalWrite(LED_PIN, HIGH);    // Turn on the LED.
    delay(1000);                    // Wait 1 second (1000 milliseconds).
    digitalWrite(LED_PIN, LOW);     // Turn off the LED.
    delay(1000);                    // Wait 1 second.
}
```

This program uses the functions *pinMode()*, *digitalWrite()*, and *delay()*, which are provided by the internal libraries included in the IDE environment.[58][59][60] The program is usually loaded in the Arduino by the manufacturer. Arduino IDE and C language allow the programming of the low level registers in the atmega328P. instructions like DDRB=0b00000001 for changing PORTB input/output pins are allowed.

3.SOFTWARE IMPLEMANTATION

```
#include<LiquidCrystal.h>

LiquidCrystal lcd(10, 11, 4, 5, 6, 7);

const int relay = 12;
const int buzzer = 2;

float tem_degree, temp_forn;
double sensorValue1 = 0;
double sensorValue2 = 0;
int crosscount = 0;
int climb_flag = 0;
int val[100];
int max_v = 0;
double VmaxD = 0;
double VeffD = 0;
double Veff = 0;
```

```
void setup()
{
  lcd.begin(16, 2);
  Serial.begin(9600);
  pinMode(buzzer, OUTPUT);
  pinMode(relay, OUTPUT);
  digitalWrite(relay, HIGH);
  digitalWrite(buzzer, LOW);
  projectname();
}

void loop()
{
  voltage_read();
  if(Veff <= 180)
  {
    lcd.setCursor(0, 0);
    lcd.print("Voltage:        ");
    lcd.setCursor(8, 0);
    lcd.print(Veff);
    lcd.setCursor(0, 1);
    lcd.print("Under Voltage   ");
    digitalWrite(relay, LOW);
    buzzer_sound(3);
  }
  else if(Veff >= 265)
  {
    lcd.setCursor(0, 0);
    lcd.print("Voltage:        ");
    lcd.setCursor(8, 0);
    lcd.print(Veff);
    lcd.setCursor(0, 1);
    lcd.print("Over Voltage    ");
    digitalWrite(relay, LOW);
    buzzer_sound(3);
  }
  else
  {
    lcd.setCursor(0, 0);
    lcd.print("Voltage:        ");
    lcd.setCursor(8, 0);
    lcd.print(Veff);
    lcd.setCursor(0, 1);
    lcd.print("Normal Voltage  ");
    digitalWrite(relay, HIGH);
    delay(1000);
  }
}

void voltage_read()
{
  for ( int i = 0; i < 100; i++ ) {
    sensorValue1 = analogRead(A0);
    if (analogRead(A0) > 511) {
```

```
      val[i] = sensorValue1;
    }
    else {
      val[i] = 0;
    }
    delay(1);
  }
  max_v = 0;
  for ( int i = 0; i < 100; i++ )
  {
    if ( val[i] > max_v )
    {
      max_v = val[i];
    }
    val[i] = 0;
  }
  if (max_v != 0) {
    VmaxD = max_v;
    VeffD = VmaxD / sqrt(2);
    Veff = (((VeffD - 420.76) / -90.24) * -210.2) + 210.2;
  }
  else {
    Veff = 0;
  }
  if(Veff < 100 && Veff > 50)
  {
    Serial.println("POWER OFF");
    lcd.setCursor(0,0);
    lcd.print("POWER OFF       ");
    lcd.setCursor(0,1);
/* Set cursor to first colum 0 and second row 1  */
    lcd.print("                ");
    Veff = 0;
    delay(1000);
  }
  Serial.print("Voltage: ");
  Serial.println(Veff);
  //lcd.setCursor(0,0);
  //lcd.print("AC LINE VOLTAGE:");
  //lcd.setCursor(0,1);
/* Set cursor to first colum 0 and second row 1  */
  //lcd.print(Veff);
/* display current value in lcd in first row */
  //lcd.print("V               ");
  VmaxD = 0;
}

void buzzer_sound(int ntimes)
{
  for(int x=0; x<ntimes; x++)
  {
  digitalWrite(buzzer, HIGH);
  delay(300);
  digitalWrite(buzzer, LOW);
```

```
  delay(300);
  }
}

void projectname()
{
  lcd.setCursor(0, 0);
  lcd.print("  UNDER & OVER  ");
  lcd.setCursor(0, 1);
  lcd.print("VOLT. PROTECTION");
  delay(3000);
  lcd.clear();
}
```

4 .WORKING OF OV-UV-PROTECTION

OVERVOLTAGE

An Overvoltage is defined as a rise within the r.m.s. value of the voltage up to tier between 1.1 pu to 1.8 pu at power frequency for periods starting from a half cycle to a second as shown in fig. Fig. 1: Overvoltage Overvoltage are less common than undervoltage but they also arise thanks to glitches. Overvoltage can occur thanks to single line to ground fault, which successively will raise the voltage of the opposite phases. It may cause thanks to disconnection of heavy industrial loadsswitching on the capacitor banks [2]. This is generally due to ungrounded or floating ground delta systems, where a change in ground reference would give voltage rise to the ungrounded system. Type Overvoltage of Duration Magnitude Instantaneous 0.5 – 30 cycles 1.1 – 1.8 p.u. Momentary 30 cycles – 3 secs 1.1 – 1.4 p.u. Temporary 3 secs – 1 min 1.1 – 1.2 p.u. , , where L is that the inductance of the road. The effects of overvoltage are more severe and destructive. it should cause the electrical equipment to fail, because of overheating caused by high voltage. Also electronic and other sensitive equipment are liable to malfunction.

UNDERVOLTAGE

Under voltage is described as a surprising drop withinside the root imply square (r.m.s.) voltage and is commonly characterised via way of means of the remaining (retained) voltage. Undervoltage is thus, quick period discount in r.m.s. voltage, brought about especially via way of means of quick circuits, beginning of big cars and device failures. Fig. 2.Undervoltage Furthermore, Undervoltage can be categorized via way of means of their period as proven in Table-1.TABLE II Classification of Undervoltage according to IEEE Type Overvoltage of Duration Magnitude Instantaneous 0.5 – 30 cycles 0.1 – 0.9p.u. Momentary 30 cycles – 3 secs 0.1 – 0.9p.u.

5.APPILICATIONS

Application of Over Voltage and Under Voltage

- It is used in the home appliances, industries to control the voltage fluctuations
- Protection of sensitive electronic devices
- Agriculture motors
- Water pumps

Advantages of Over Voltage and Under Voltage

- The price of this circuit is very less and reliable
- It can handle heavy loads up to 7A
- In the abnormal condition automatically the switch is OFF state
- In the safe condition automatically the switch is in the ON-state
- These are highly sensitive

OUTPUT RESULT;

This circuit protects refrigerators and other electronics appliances from over and under voltages. By the name itself we can say that if the input voltage is more or less than the required voltage then the electrical appliance gets turned off and it gets disconnected from its respective power supply. This voltage protection circuit is designed to develop a low voltage and high voltage tripping mechanism to protect a load from any damage. In many of the homes and industries fluctuation in AC mains supply take place frequently. The electronic devices get easily damaged due to the fluctuations. To overcome this problem, we can implement a tripping mechanism of under/over voltage protection circuit to protect the loads from undue damage. Source 230 V, 50 Hz, Single phase transformer Ideal, K=23:1 Single phase diode bridge Ideal Capacitor 0.019 F Resistive load 120 Ω D.C. voltage source (Relay operation) 12 V Relay with 1 NO

and 1 NC changeover switches. Coil voltage= 12 V, Operating voltage= 10 V

CONCLUSION;

It has been discussed that Undervoltage and overvoltage problems are very common and can create problems for consumer goods and industrial applications. So a system has been modeled using relay and comparator and it is found to be good in disconnecting the supply when if sees any of the above problems.

FEATURE SCOPE;

FUTURE SCOPE OF DEVELOPMENT Apart from the simulation of the software of this project in PSIM we can further extend or upgrade the operation of this protection device in the following ways: Although we are applying 1 phase power supply in the prepared hardware, the implementation of the hardware can also be done applying 3 phase power supply. The concept in future can be extended by integrating an alarm which sounds when voltage fluctuations occur. It can also be interfaced with a GSM modem to convey alert message to the user via sms to take appropriate actions