EEE - 160025

Design and construction of Smoke Detector With Water flow System

A Dissertation Submitted to The Department of Electrical and Electronics Engineering of Sonargaon University in Patiala Fulfillment of the Requirements for the Degree of Bachelor of Science in Engineering.

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Executive Summary

Security is a prime concern in our day-today life. Everyone wants to be as much secure as possible. A smoke detector is a device that detects smoke, typically as an indicator of fire. Commercial, industrial, and mass residential devices issue a signal to a fire alarm system, while household detectors, known as smoke alarms, generally issue a local audible and/or visual alarm from the detector itself. Smoke detectors save thousands of lives each year. In fact, it is recommended that every home have one smoke detector per floor. Our smoke detectors consist of two basic parts: a sensor to sense the smoke and a very loud electronic horn to wake people up & water flow automatically to reduce fire.To design & construct a fire alarm system,, first information has been collected from books. Electronic circuit of this digital lock has been designed using Op amp & flip flop. Some electronic components shops have been visited and the required components have been purchased from Patuatuli market, Dhaka. According to the design all those electronic components have been populated in printed circuit board by soldering iron.

The primary objective of this project is to indicate the fire which is control by flip-flop ic When smoke pass between light source and ldr it will indicate gradually through led. When smoke is low then led1 will be on. As the smoke is high then led 2, 3, 4 will be on and when led 4 will be on then buzzer will be also on & water flow automatically.Here we can use two separate switch to control alarm & water flow.

After construction this digital lock it has been found to be very accurate and effective requiring only Tk 5,000 to purchased it. So this project can be a very economical and effective.

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Chapter 1

Smoke detector

1.1 Introduction

A smoke detector is a device that detects smoke, typically as an indicator of fire. Commercial, industrial, and mass residential devices issue a signal to a fire alarm system, while household detectors, known as smoke alarms, generally issue a local audible and/or visual alarm from the detector itself. Smoke detectors save thousands of lives each year. In fact, it is recommended that every home have one smoke detector per floor. Our smoke detectors consist of two basic parts: a sensor to sense the smoke and a very loud electronic horn to wake people up.

1.2 Historical background

The first automatic electric fire alarm was invented in 1890 by Francis Robbins Upton (U.S. patent no. 436,961). Upton was an associate of Thomas Edison, but there is no evidence that Edison contributed to this project.

In the late 1930s the Swiss physicist Walter Jaeger tried to invent a sensor for poison gas. He expected that gas entering the sensor would bind to ionized air molecules and thereby alter an electric current in a circuit in the instrument. His device failed: small concentrations of gas had no effect on the sensor's conductivity. Frustrated, Jaeger lit a cigarette—and was soon surprised to notice that a meter on the instrument had registered a drop in current. Smoke particles had apparently done what poison gas could not. Jaeger's experiment was one of the advances that paved the way for the modern smoke detector.

It was 30 years, however, before progress in nuclear chemistry and solid-state electronics made a cheap sensor possible. While home smoke detectors were available during most of the 1960s, the price of these devices was rather high. Before that, alarms were so expensive that only major businesses and theaters could afford them.

The first truly affordable home smoke detector was invented by Duane D. Pearsall in 1965, featuring an individual battery powered unit that could be easily installed and replaced. The first units for mass production came from Duane Pearsall's company, Statutory Corporation, in Lakewood, Colorado. These first units were made from strong fire resistant steel and shaped much like a bee's hive. The battery was a rechargeable specialized unit created by Gates Energy. The need for a quick replace battery didn't take long to show itself and the rechargeable was replaced with a pair of AA batteries along with a plastic shell encasing the detector. The small assembly line sent close to 500 units per day before Statutory sold its invention to Emerson Electric in 1980 and Sears's retailers picked up full distribution of the 'now required in every home' smoke detector.

The first commercial smoke detectors came to market in 1969. Today they are installed in 93% of U.S. homes and 85% of UK homes. However it is estimated that any given time over 30% of these alarms does not work, as users remove the batteries, or forget to replace them.

1.3 Objectives

Smoke detecor is a system of security. Detetor has been designed for modernize the security system. This project is carried out with the following specific objectives:

- **The main objective of this project was to develop a flip flop ic, ldr and buzzer and pnp transistor.**
- **To detect smoke here using a LDR & LED .**
- **To water flow automatic using a Solenoid valve for fire off .**
- **To setup an alarm system for smoke detect and fire off rapidly**
- **To secure any precious things and highly restricted rooms & otherr places**
- **Cost analysis.**

1.4 Methodology

a) Information has been collected from books.

b) Some electronic components shops have been visited and the required components have been purchased from Patuatuli market, Dhaka.

c) According to the design all those electronic components were populated in printed circuit board by soldering iron.

1.5 Market Survey and cost analysis

all component available and cost effective.

We visit some electronic components shop in Stadium Market, Gulistan and Patuatuli market, Dhaka. We parches our require component in Patuatuli, because this shop have

1.6 Components used in circuit and its price:

Sl.No	Description	Quantity	Rate	Taka
1	Op amp	1	120	120
2	flip flop	1	300	300
3	Transistor BC 547,	2	20	40
4	Diode–4P	4	13	50
5	Transformer	1	220	220
6	Capacitor	2	20	40
7	Resistor	13	5	60
8	Button Switch	2	10	10
9	Push pull switch	1	10	10
10	Buzzer	1	100	100
11	PCB board	1	400	400
12	Cable, Caching	1	250	250
13	Solenoid valve	1	2500	2500
14	Other			300
Total cost of Components:				4380/=

CHAPTER 2: Description

2.1 Block diagram of smoke detector:

The ac source is connected to step down transformer transform.then it is rectified by using rectifier.smoke level is controlled by op amp. The signal of op is used as input of flip flop.This flip flop will be buzzer on and solenoid will be also on to water flow.

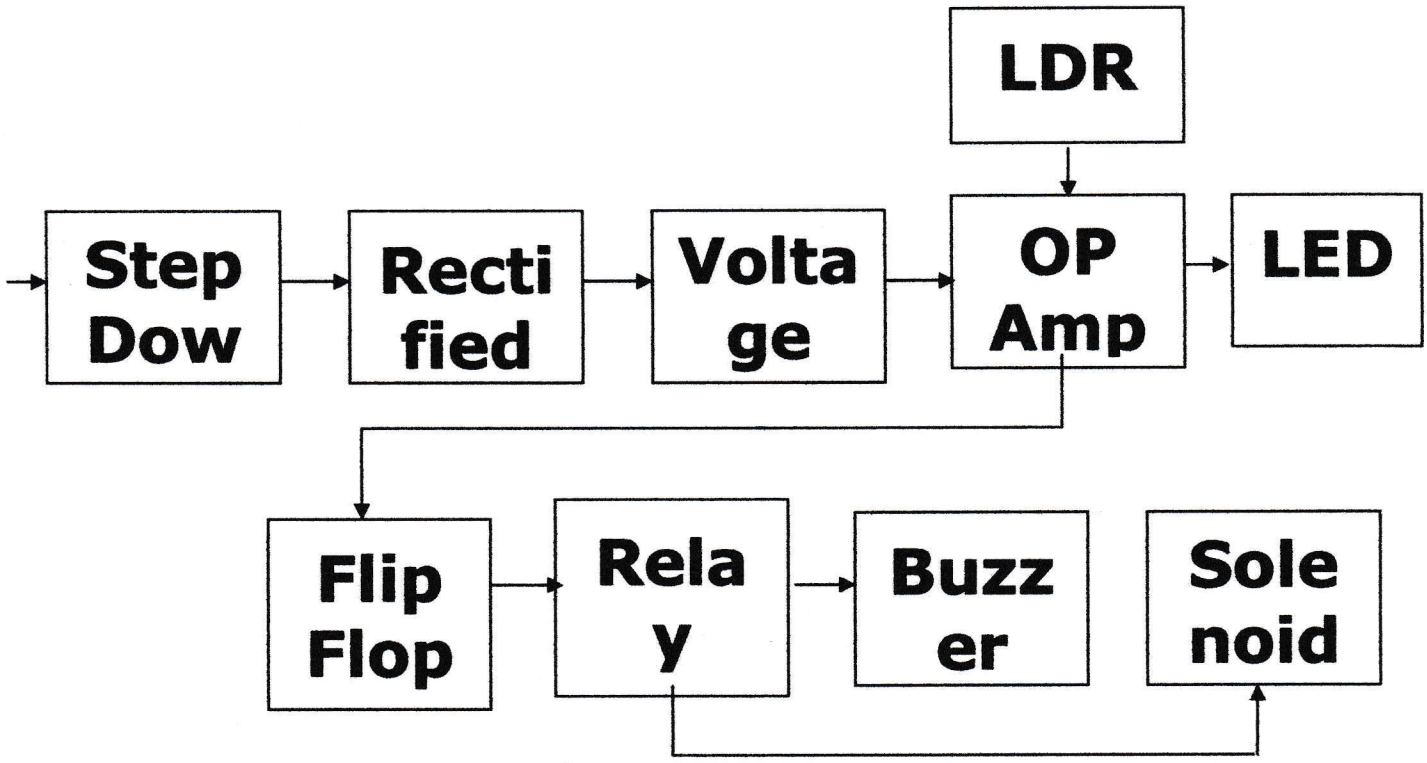
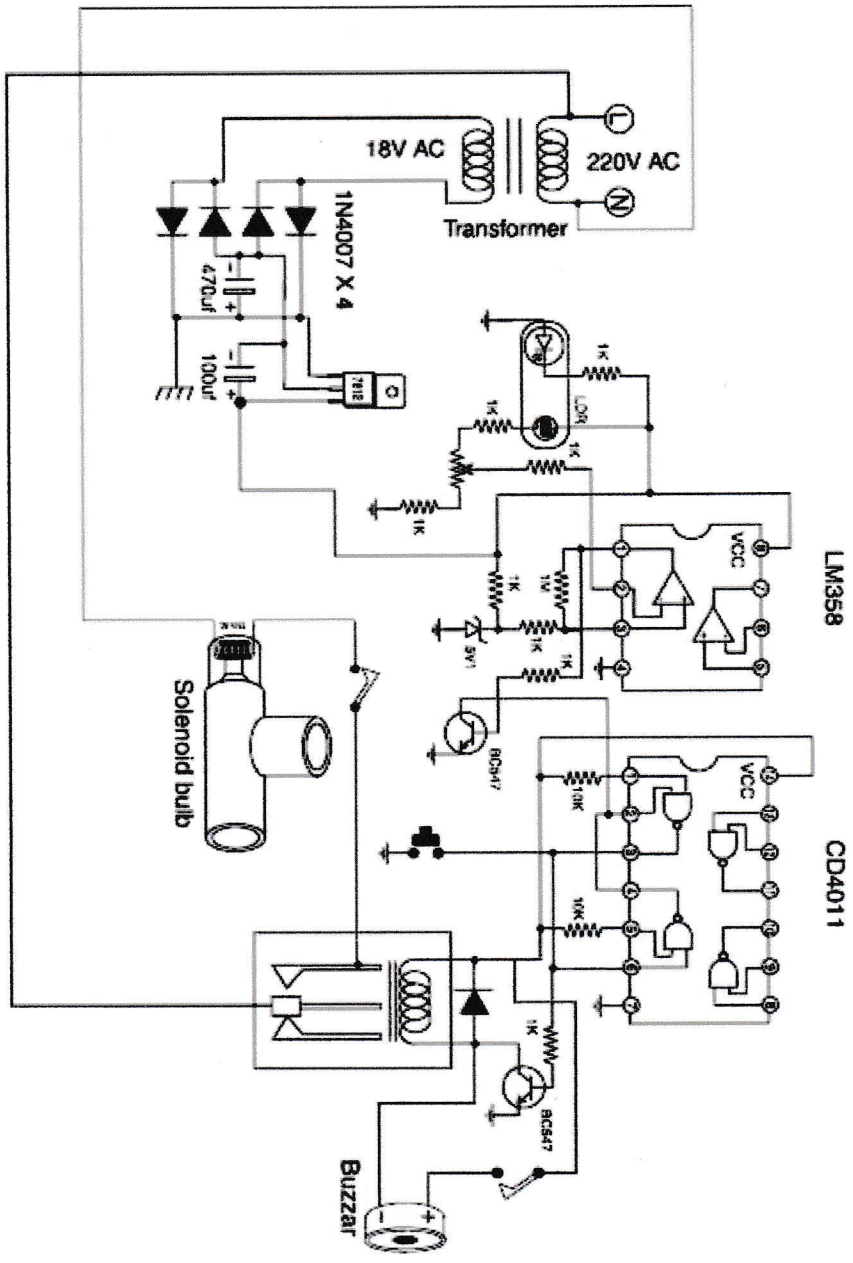


Figure: 2.1 **Block diagram of smoke detector and water flow**

2.2: Circuit Diagram of the Smoke detector with water flow:



2.2 Fig: Circuit Diagram of the smoke detector

2.3 Circuit Description

The main objective of this project was to develop a flip flop ic, ldr and buzzer and pnp transistor.

Smoke detector lever indicator implementation needs the following equipment:

1. Step down Transformer
2. Rectifier
3. Voltage regulator
4. Flip flop
5. Pnp transistor
6. Led
7. Buzzer
8. Light dependent resistor
9. Variable resistor
10. Resistor

2.4 Outline of overall Circuit Diagram of designed Project

The outline of the overall block diagram of project can briefly be illustrated using the figure

a) The ac source is connected to step down transformer transform it to 12v.
b) This 12v ac current converted into dc current by using rectifier.
c) Regulator IC-7812 is used to keep 12v stable.
d) 12V dc supplied to the op amp ic Lm324
e) Smoke level is control by op amp
f) Smoke level is indicated by led
g) When smoke level is high then npn transistor will be on and send the input in flip flop IC.
h) Then the output of this IC turn on the npn transitor 2 and relay will be on.
i) The buzzer and solenoid valve will be on.

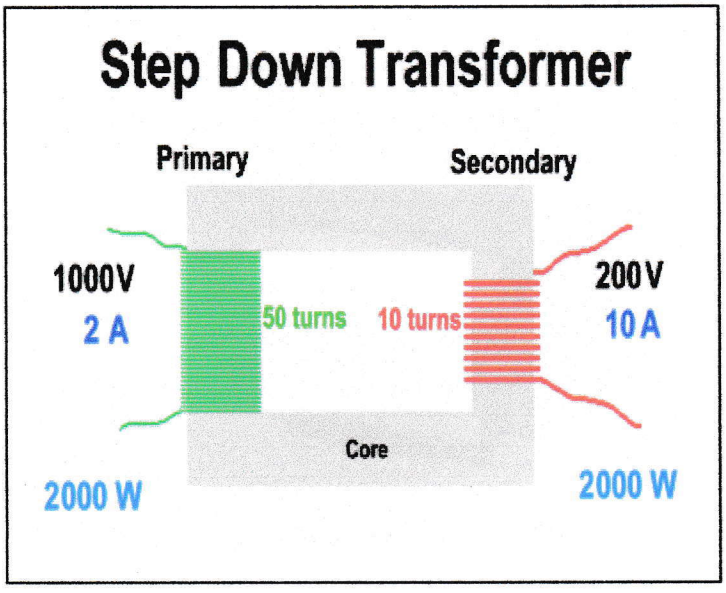
2.5 The functions of all the different components used in this Project

In order to achieve the proposed results it is necessary to illustrate the function of each and every devices and how the interact with one another. This is necessary so as to mention how important these devices are to this project.

2.5 .1 Step down transformer

Transformers are electrical devices that transform voltage through magnetic couplings, and they have no moving parts. There is a magnetic core with one winding of wire placed close to one or more windings, which can couple two or more alternating-current circuits together by employing the induction between the windings. The primary winding is connected to the power source and the other windings are known as secondary windings. If the secondary voltage wire is less than the primary wire, the transformer is called a step down transformer. If the secondary wiring is of higher voltage, the transformer is a step-up transformer, which increases voltage input. A step down transformer is an important key component in our electric power systems.

Figure 2.3: **step down transformer**



2.5 .2 How to convert 220 volt ac to 18 volt ac

Electrical power, when supplied from a wall electrical outlet, is often at a higher voltage rating than electrical devices require. Most electric
al or electronic devices have a voltage converter circuit that changes the voltage to the proper level for that device. One common means by which to reduce the voltage level of an alternating current signal is by use of a "step-down" transformer. A transformer will reduce the voltage, but increase the electrical current, thus keeping the same electrical power level.

a) On the center-tapped side of the transformer, slip a ring terminal over each of the outside leads. Solder each lead to each terminal.
b) On the side of the terminal that is not center-tapped, attach the first lead to one of the AC power supply terminals. Attach the other lead to the unoccupied AC power supply terminal.
c) Turn on the AC power supply. Turn on the millimeter, and set the measurement scale to "Volts AC." Attach the black millimeter lead to one of the ring terminals, and attach the red millimeter lead to the opposite terminal. It will be approximately 18 Volts AC.

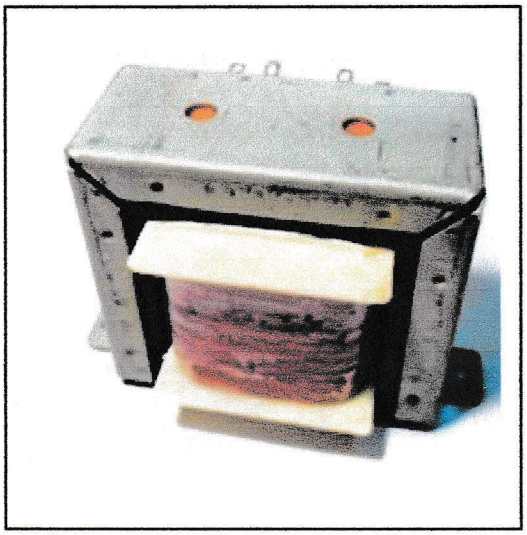


Figure 2.4 **220 volt ac to 18 volt ac transformer**

2.5 .3 Semiconductor diodes

A modern semiconductor diode is made of a crystal of semiconductor like silicon that has impurities added to it to create a region on one side that contains negative carriers, called 0n-type semiconductor, and a region on the other side that contains positive charge carriers called p-type semiconductor. The diode's terminals are attached to each of these regions. The boundary within the crystal between these two regions, called a PN junction, is where the action of the diode takes place. The crystal conducts a current of electrons in a direction from the N-type side (called the cathode) to the P-type side (called the anode), but not in the opposite direction; that is, a conventional current flows from anode to cathode. The discovery of crystals' rectifying abilities was made by German physicist Ferdinand Braun in 1874. The first semiconductor diodes, called cat's whisker diodes, developed around 1906, were made of mineral crystals such as galena. Today most diodes are made of silicon, but other semiconductors such as germanium are sometimes used.

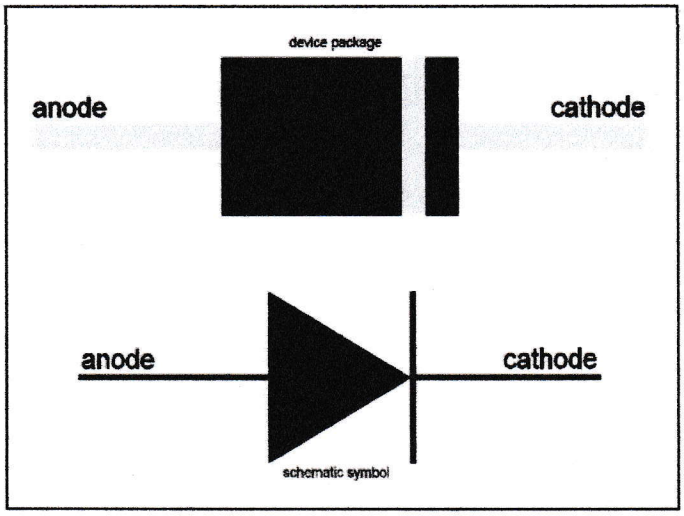
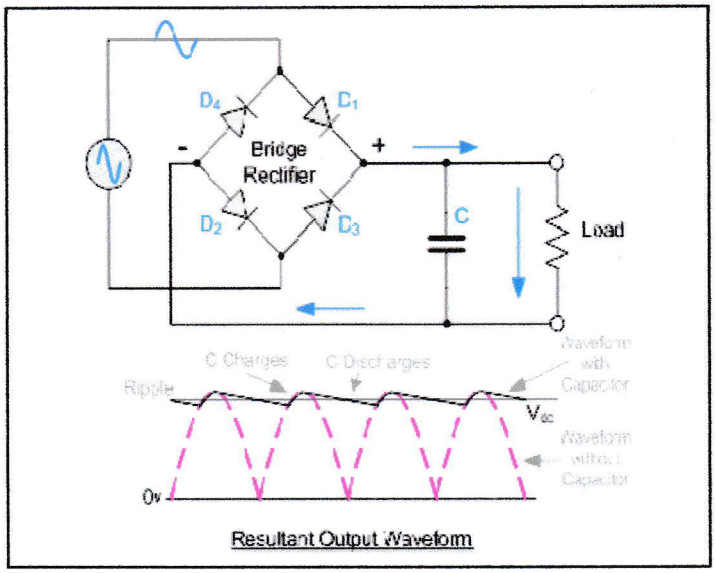


Figure 2.5 **semiconductor diode**

2.5 .4 Rectification

The most common function of a diode is to allow an electric current to pass in one direction (called the diode's forward direction), while blocking current in the opposite direction (the reverse direction).This unidirectional behavior is called rectification, and is used to convert alternating current to direct current.



2.5 .5 Bipolar junction transistor

A bipolar (junction) transistor (BJT) is a three-terminal electronic device constructed of doped semiconductor material and may be used in amplifying or switching applications. Bipolar transistors are so named because their operation involves electrons and holes. Charge flow in a BJT is due to bidirectional diffusion of charge carriers across a junction between two regions of different charge concentrations. This mode of operation is

2.5 .6 NPN transistor

NPN is one of the two types of bipolar transistors, consisting of a layer of P-doped semiconductor (the "base") between two N-doped layers. A small current entering the base is amplified to produce a large collector and emitter current. That is, an NPN transistor is "on" when its base is pulled high relative to the emitter. Most of the NPN current is carried by electrons, moving from emitter to collector as minority carriers in the P-type base region. Most bipolar transistors used today are NPN, because electron mobility is higher than hole mobility in semiconductors, allowing greater currents and faster operation.

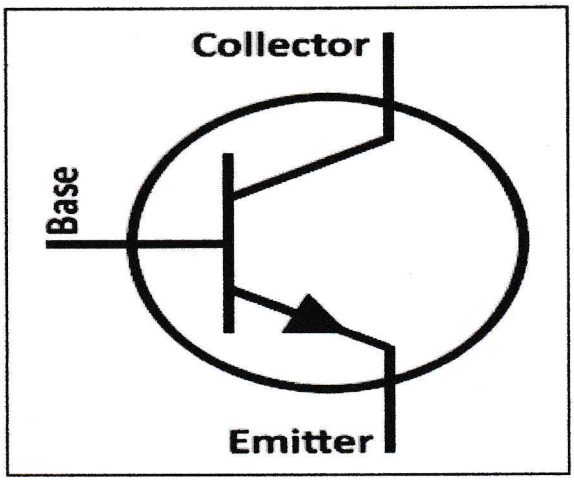


Table2.1 **Regions of operation of npn transistor**

Applied voltages	B-E Junction Bias (NPN)	B-C Junction Bias (NPN)	Mode (NPN)
E < B < C	Forward	Reverse	Forward active
E < B > C	Forward	Forward	Saturation
E > B < C	Reverse	Reverse	Cut-off
E > B > C	Reverse	Forward	Reverse-active

2.5 .7 Pnp transistor

The other type of BJT is the PNP, consisting of a layer of N-doped semiconductor between two layers of P-doped material. A small current leaving the base is amplified in the collector output. That is, a PNP transistor is "on" when its base is pulled low relative to the emitter. The arrows in the NPN and PNP transistor symbols are on the emitter legs and point in the direction of the conventional current flow when the device is in forward active mode.

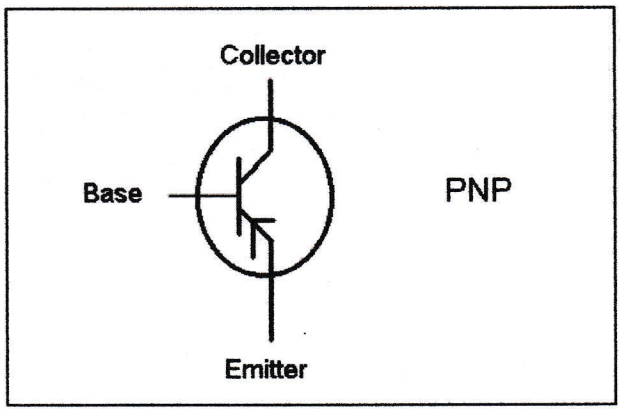


Figure 2.8: **PnP transistor**

Table2.2 **Regions of operation of pnp transistor**

Applied voltages	B-E Junction Bias (PNP)	B-C Junction Bias (PNP)	Mode (PNP)
E < B < C	**Reverse**	**Forward**	**Reverse-active**
E < B > C	**Reverse**	**Forward**	**Cut-off**
E > B < C	**Forward**	**Reverse**	**Saturation**
E > B > C	**Forward**	**Reverse**	**Forward active**

2.5 .8 Variable resistor

A potentiometer is a three-terminal resistor with a sliding contact that forms an adjustable voltage divider. If only two terminals are used (one side and the wiper), it acts as a variable resistor or rheostat. Potentiometers are commonly used to control electrical devices such as volume controls on audio equipment. Potentiometers operated by a mechanism can be used as position transducers, for example, in a joystick.

Potentiometers are rarely used to directly control significant power (more than a watt), since the power dissipated in the potentiometer would be comparable to the power in the controlled load (see infinite switch). Instead they are used to adjust the level of analog signals, and as control inputs for electronic circuits. For example, a light dimmer uses a potentiometer to control the switching of a TRIAC and so indirectly control the brightness of lamps.

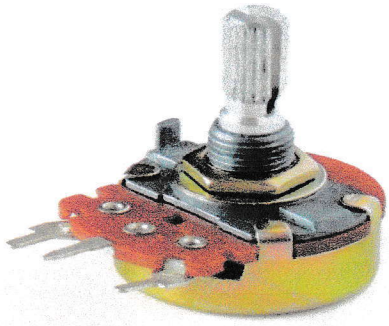


Figure 2.9 variable resistor

2.5 .9 Buzzer

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarms, timers and confirmation of user input such as a mouse click or keystroke. Early devices were based on an electromechanical system identical to an electric bell without the metal gong. Similarly, a relay may be connected to interrupt its own actuating current, causing the contacts to buzz. Often these units were anchored to a wall or ceiling to use it as a

sounding board. The word "buzzer" comes from the rasping noise that electromechanical buzzers made.

A piezoelectric element may be driven by an oscillating electronic circuit or other audio signal source, driven with a piezoelectric audio amplifier. Sounds commonly used to indicate that a button has been pressed are a click, a ring or a beep.

we used buzzer in Annunciate panels , Electronic metronomes, Game shows, Microwave ovens and other household appliances, Sporting events such as basketball games many other application

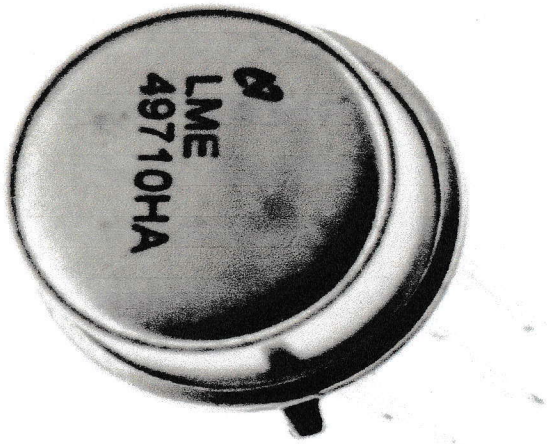


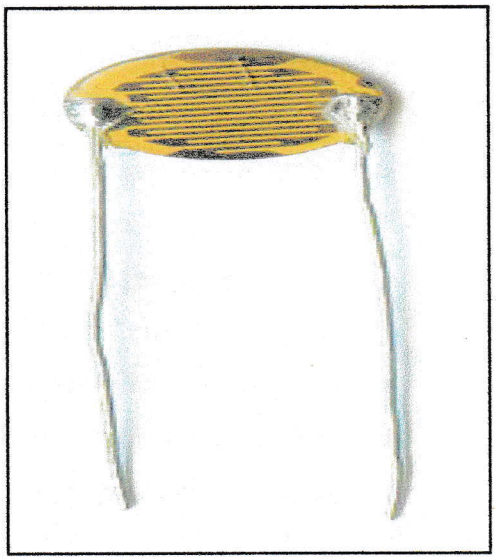
Figure 2.10 buzzer

2.5 .10 Light dependent resistor (LDR)

A photo resistor or light dependent resistor is a resistor whose resistance decreases with increasing incident light intensity. It can also be referred to as a photoconductor.

A photo resistor is made of a high resistance semiconductor. If light falling on the device is of high enough frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electron (and its hole partner) conduct electricity, thereby lowering resistance. A photoelectric device can be either intrinsic or extrinsic. An intrinsic semiconductor has its own charge carriers and is not an efficient semiconductor, silicon. In intrinsic devices the only available electrons are in the valence band, and hence the photon must have enough

energy to excite the electron across the entire band gap. Extrinsic devices have impurities, also called do pants, and added whose ground state energy is closer to the conduction band; since the electrons do not have as far to jump, lower energy photons (i.e., longer wavelengths and lower frequencies) are sufficient to trigger the device. If a sample of silicon has some of its atoms replaced by phosphorus atoms (impurities), there will be extra electrons available for conduction. This is an example of an extrinsic semiconductor. The figure of light of light dependent resistor is given below



.5 .11 LM 358 IC (Op amp)

Figure 2.11 **light dependent resistors**

The operational amplifier is arguably the most useful single device in analog electronic circuitry. With only a handful of external components, it can be made to perform a wide variety of analog signal processing tasks. It is also quite affordable, most general-purpose amplifiers selling for under a dollar apiece. Modern designs have been engineered with durability in mind as well: several "op-amps" are manufactured that can sustain direct short-circuits on their outputs without damage. An operational amplifier ("op-amp") is a DC-coupled high-gain electronic voltage amplifier with a differential input and, usually, a single-ended output. An op-amp produces an output voltage that is typically hundreds of thousands times larger than the voltage difference between its input terminals.
One key to the usefulness of these little circuits is in the engineering principle of feedback, particularly negative feedback, which constitutes the foundation of almost all

automatic control processes. The principles presented here in operational amplifier circuits, therefore, extend well beyond the immediate scope of electronics. It is well worth the electronics student's time to learn these principles and learn them well. In our project we use Low Power Quad Operational Amplifiers IC-LM 358.

2.5.11 (a) General Description of Low Power Quad Operational Amplifiers

The LM358 series consists of four independent, high gains; internally frequency compensated operational amplifiers which were designed specifically to operate from a single power supply over a wide range of voltages. Operation from split power supplies is also possible and the low power supply current drain is independent of the magnitude of the power supply voltage. Application areas include transducer amplifiers, DC gain blocks and all the conventional op amp circuits which now can be more easily implemented in single power supply systems. For example, the LM 358 series can be directly operated off of the standard +5V power supply voltage which is used in digital systems and will easily provide the required interface electronics without requiring the additional ±15V power supplies.

Unique Characteristics

a) In the linear mode the input common-mode voltage range includes ground and the output voltage can also swing to ground, even though operated from only a single power supply voltage.
b) The unity gain cross frequency is temperature compensated.
c) The input bias current is also temperature compensated.

Advantages

a) Eliminates need for dual supplies
b) Four internally compensated op amps in a single package
c) Allows directly sensing near GND and VOUT also goes to GND
d) Compatible with all forms of logic
e) Power drain suitable for battery operation

Features

a) Internally frequency compensated for unity gain
b) Large DC voltage gain 100 dB
c) Wide bandwidth (unity gain) 1 MHz (temperature compensated)
d) Wide power supply range: Single supply 3V to 32V or dual supplies ±1.5V to ±16V
e) Very low supply current drain (700 μA)—essentially independent of supply voltage
f) Low input biasing current 45 nA (temperature compensated)
g) Low input offset voltage 2 mV and offset current: 5 nA
h) Input common-mode voltage range includes ground
i) Differential input voltage range equal to the power supply voltage
j) Large output voltage swing 0V to V+ − 1.5V

Application

The LM358 series are op amps which operate with only a single power supply voltage, have true-differential inputs, and remain in the linear mode with an input common-mode voltage of 0 VDC. These amplifiers operate over a wide range of power supply voltage with little change in performance characteristics. At 25°C amplifier operation is possible down to a minimum supply voltage of 2.3 VDC. The pinouts of the package have been designed to simplify PC board layouts. Inverting inputs are adjacent to outputs for all of the amplifiers and the outputs have also been placed at the corners of the package (pins 1, 7, 8, and 14). Precautions should be taken to insure that the power supply for the integrated circuit never becomes reversed in polarity or that the unit is not inadvertently installed backwards in a test socket as an unlimited current surge through the resulting forward diode within the IC could cause fusing of the internal conductors and result in a destroyed unit. Large differential input voltages can be easily accommodated and, as

input differential voltage protection diodes are not needed, no large input currents result from large differential input voltages. The differential input voltage may be larger than V+ without damaging the device. Protection should be provided to prevent the input voltages from going negative more than -0.3 VDC (at 25°C). An input clamp diode with a resistor to the IC input terminal can be used. To reduce the power supply drain, the amplifiers have a class A output stage for small signal levels which converts to class B in a large signal mode. These allow the amplifiers to both source and sink large output currents. Therefore both NPN and PNP external current boost transistors can be used to extend the power capability of the basic amplifiers. The output voltage needs to raise approximately 1 diode drop above ground to bias the on-chip vertical PNP transistor for output current sinking applications. For ac applications, where the load is capacitive coupled to the output of the amplifier, a resistor should be used, from the output of the amplifier to ground to increase the class a bias current and prevent crossover distortion. Where the load is directly coupled, as in dc applications, there is no crossover distortion. Capacitive loads which are applied directly to the output of the amplifier reduce the loop stability margin. Values of 50 pF can be accommodated using the worst-case no inverting unity gain connection. Large closed loop gains or resistive isolation should be used if larger load capacitance must be driven by the amplifier.

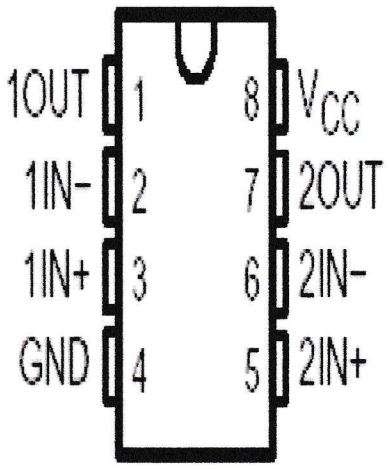


Fig: 2.12 pin diagram of LM 358

The LM358 series consists of four independent, high gain, internally frequency compensated operational amplifiers which were designed specifically to operate from a single power supply over a wide range of voltages. Operation from split power supplies is also possible and the low power supply current drain is independent of the magnitude of the power supply voltage. Application areas include transducer amplifiers, DC gain blocks and all the conventional op amp circuits which now can be more easily implemented in single power supply systems. For example, the LM358 series can be directly operated off of the standard +5V power supply voltage which is used in digital systems and will easily provide the required interface electronics without requiring the additional ±15V power supplies.

2.5.12 Relay

A relay is an electrically operated switch. Many relays use electromagnet to operate a switching mechanism, but other operating principles are also used. Relays find operation where it is necessary to control a circuit by a low power signal, or where several circuits can be controlled by one signal. Solid state relays control power circuits with no moving parts; rather switching is done by a semiconductor device. In electric circuits, it is used to protect from overload or faults. These relays are called protection relays. The figure of a simple electric relay is given below

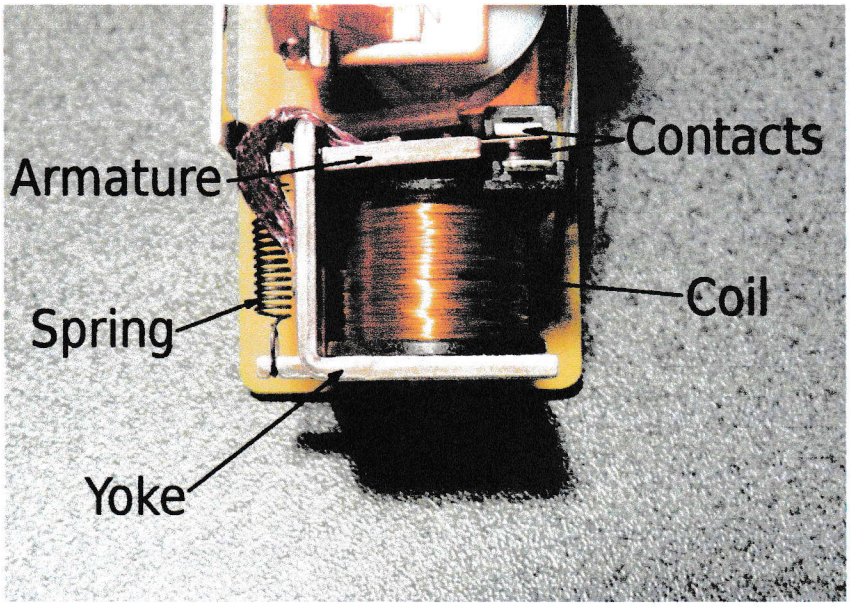


Figure 2.13: **Simple Electrical Relay.**

2.5.12 (a) Theory

A simple electromagnetic relay consists of a coil of wire surrounding a soft iron core, an iron yoke, which provides a low reluctance path for magnetic flux, a movable iron armature, and a set, or sets, of contacts; two in the relay pictured. The armature is hinged to the yoke and mechanically linked to a moving contact or contacts. It is held in place by a spring so that when the relay is de-energized there is an air gap in the magnetic circuit. In this condition, one of the two sets of contacts in the relay pictured is closed, and the other set is open. Other relays may have more or fewer sets of contacts depending on their function. The relay in the picture also has a wire connecting the armature to the yoke. This ensures continuity of the circuit between the moving contacts on the armature, and the circuit track on the printed circuit board (PCB) via the yoke, which is soldered to the PCB.

When an electric current is passed through the coil, the resulting magnetic field attracts the armature and the consequent movement of the movable contact or contacts either makes or breaks a connection with a fixed contact. If the set of contacts was closed when the relay was de-energized, then the movement opens the contacts and breaks the connection, and vice versa if the contacts were open. When the current to the coil is switched off, the armature is returned by a force, approximately half as strong as the magnetic force, to its relaxed position. Usually this force is provided by a spring, but gravity is also used commonly in industrial motor starters. Most relays are manufactured to operate quickly. In a low voltage application, this is to reduce noise. In a high voltage or high current application, this is to reduce arcing.

When the coil is energized with direct current, a diode is often placed across the coil to dissipate the energy from the collapsing magnetic field at deactivation, which would otherwise generate a voltage spike dangerous to circuit components. Some automotive relays already include a diode inside the relay case. Alternatively a contact protection network, consisting of a capacitor and resistor in series, may absorb the surge. If the coil is designed to be energized with alternating current (AC), a small copper ring can be crimped to the end of the solenoid. This "shading ring" creates a small out-of-phase current, which increases the minimum pull on the armature during the AC cycle.

2.5.12 (b) Applications

a) Control a high-voltage circuit with a low-voltage signal, as in some types of modems or audio amplifiers,

b) Control a high-current circuit with a low-current signal, as in the starter solenoid of an automobile,

c) Detect and isolate faults on transmission and distribution lines by opening and closing circuit breakers (protection relays),

d) Isolate the controlling circuit from the controlled circuit when the two are at different potentials, for example when controlling a mains-powered device from a low-voltage switch. The latter is often applied to control office lighting as the low voltage wires are easily installed in partitions, which may be often moved as needs change. They may also be controlled by room occupancy detectors in an effort to conserve energy,

e) Logic functions. For example, the Boolean AND function is realized by connecting normally open relay contacts in series, the OR function by connecting normally open contacts in parallel. The change-over or Form C contacts perform the XOR (exclusive or) function. Similar functions for NAND and NOR are accomplished using normally closed contacts. The Ladder programming language is often used for designing relay logic networks.

f) Early computing. Before vacuum tubes and transistors, relays were used as logical elements in digital computers.

g) Safety-critical logic. Because relays are much more resistant than semiconductors to nuclear radiation, they are widely used in safety-critical logic, such as the control panels of radioactive waste-handling machinery.

h) Time delay functions. Relays can be modified to delay opening or delay closing a set of contacts. A very shorts (a fraction of a second) delay would use a copper disk between the armature and moving blade assembly. Current flowing in the disk maintains magnetic field for a short time, lengthening release time. For a slightly longer (up to a minute) delay, a dashpot is used. A dashpot is a piston filled with fluid that is allowed to escape slowly. The time period can be varied by

increasing or decreasing the flow rate. For longer time periods, a mechanical clockwork timer is installed.

2.5.12 (c) Types of relay

There are many kinds of relay that are used in electrical circuits; they all have their different features and applications that are listed below:

1. Latch relay - Latching relay has two relaxed states (bitable). These are also called "impulse", "keep", or "stay" relays. When the current is switched off, the relay remains in its last state. This is achieved with a solenoid operating a ratchet and cam mechanism, or by having two opposing coils with an over-center spring or permanent magnet to hold the armature and contacts in position while the coil is relaxed. Most efficient thing about this relay is that consumes power only in its switching mode.

2. Reed relay - A reed relay has a set of contacts inside a vacuum or inert gas filled glass tube, which protects the contacts against atmospheric corrosion. The contacts are closed by a magnetic field generated when current passes through a coil around the glass tube. Reed relays are capable of faster switching speeds than larger types of relays, but have low switch current and voltage ratings.

3. Solid State relay - A solid state relay (SSR) is a solid state electronic component that provides a similar function to an electromechanical relay but does not have any moving components, increasing long-term reliability. With early SSR's, the tradeoff came from the fact that every transistor has a small voltage drop across it. This voltage drop limited the amount of current a given SSR could handle. As transistors improved, higher current SSR's, able to handle 100 to 1,200 Amperes, have become commercially available. Compared to electromagnetic relays, they may be falsely triggered by transients.

4. Overload Protective relay - Electric motors need over current protection to prevent damage from over-loading the motor, or to protect against short circuits in connecting cables or internal faults in the motor windings. One type of electric motor overload protection relay is operated by a heating element in series with the electric motor. The heat generated by the motor current heats a bimetallic strip or melts solder, releasing a spring to operate contacts. Where the overload relay is exposed to the same environment as the motor, a useful though crude compensation for motor ambient temperature is

provided. A big application of relay is in electrical circuit where it is used to remove any faults or over current in circuits.

2.5.12 (d) Choosing a relay

To choose a relay is necessary to consider several features when choosing a relay:

1. Physical size and pin arrangement

If you are choosing a relay for an existing PCB you will need to ensure that its dimensions and pin arrangement are suitable. You should find this information in the supplier's catalogue.

2. Coil voltage

The relay's coil voltage rating and resistance must suit the circuit powering the relay coil. Many relays have a coil rated for a 12V supply but 5V and 24V relays are also readily available. Some relays operate perfectly well with a supply voltage which is a little lower than their rated value.

3. Coil resistance

The circuit must be able to supply the current required by the relay coil. You can use Ohm's law to calculate the current:

Relay coil current = Supply voltage /Coil resistance

4. For example: A 12V supply relay with a coil resistance of 400ohm passes a current of 30mA. This is OK for a 555 timer IC (maximum output current 200mA), but it is too much for most ICs and they will require a transistor to amplify the current.

5. **Switch ratings (voltage and current)**

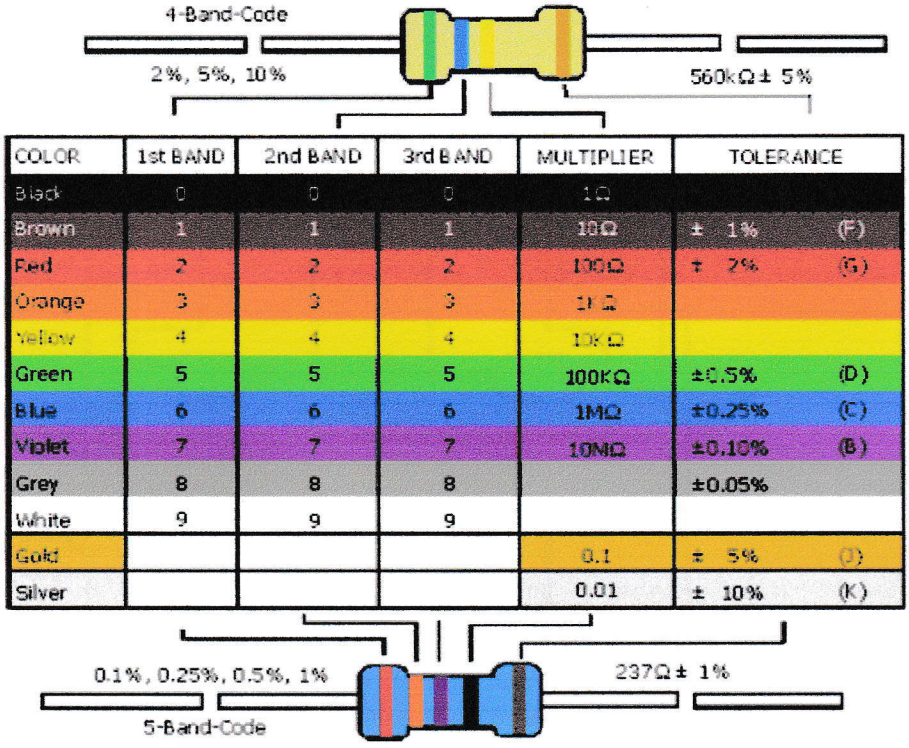
The relay's switch contacts must be suitable for the circuit they are to control. You will need to check the voltage and current ratings. Note that the voltage rating is usually higher for AC, for example: "5A at 24V DC or 125V AC".

6. Switch contact arrangement (SPDT, DPDT etc .Most relays are SPDT or DPDT which are often described as "single pole changeover" (SPCO) or "double pole changeover" (DPCO).

2.5.13 Resistors

Resistors can be fabricated in a variety of ways. The most common type in electronic devices and systems is the carbon-composition resistor. Fine granulated carbon (graphite) is mixed with clay and hardened. The resistance depends on the proportion of carbon to clay; the higher this ratio, the lower the resistance.

Another type of resistor is made from winding Nichrome or similar wire on an insulating form. This component, called a wire wound resistor, is able to handle higher currents than a carbon-composition resistor of the same physical size. However, because the wire is wound into a coil, the component acts as an inductors as well as exhibiting resistance. This does not affect performance in DC circuits.



COLOR	1st BAND	2nd BAND	3rd BAND	MULTIPLIER	TOLERANCE	
Black	0	0	0	1Ω		
Brown	1	1	1	10Ω	± 1%	(F)
Red	2	2	2	100Ω	± 2%	(G)
Orange	3	3	3	1K Ω		
Yellow	4	4	4	10K Ω		
Green	5	5	5	100KΩ	±0.5%	(D)
Blue	6	6	6	1MΩ	±0.25%	(C)
Violet	7	7	7	10MΩ	±0.10%	(B)
Grey	8	8	8		±0.05%	
White	9	9	9			
Gold				0.1	± 5%	(J)
Silver				0.01	± 10%	(K)

2.14 Fig: Resistor band code

2.5.14 Flip Flop CD4011:

The CD4001BC and CD4011BC quad gates are monolithic complementary MOS (CMOS) integrated circuits constructed with N- and P-channel enhancement mode transistors. They have equal source and sink current capabilities and conform to standard B series output drive. The devices also have buffered outputs which improve transfer characteristics by providing very high gain. All inputs are protected against static discharge with diodes to VDD and VSS.

2.5.14(a) Features

a) Low power TTL:Fan out of 2 driving 74L compatibility
b) 5V–10V–15V parametric ratings
c) Symmetrical output characteristics
d) Maximum input leakage 1 μA at 15V over full temperature range

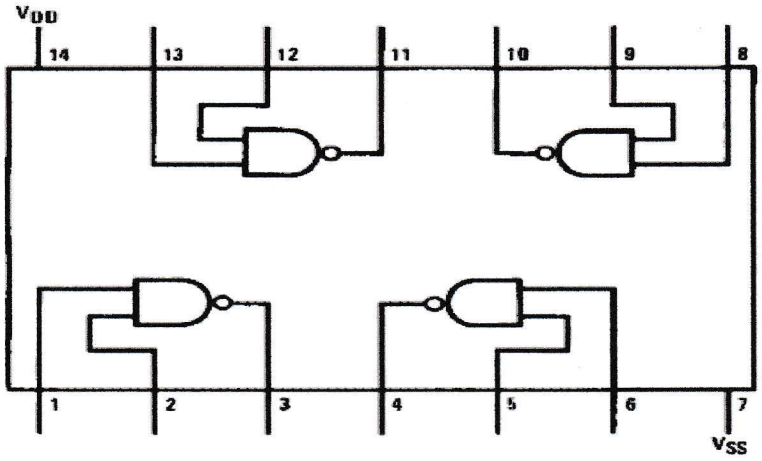


Fig 2.15: Internal Daiagram of CD 4011

2.5.14 (b) Specification

Part No:	CD4011BCN
RoHS:	Yes
Logic Function:	NAND
Minimum Operating Supply Voltage:	3 V
Output Type:	N/A
Maximum Quiescent Current:	1 uA
Family:	CD4011
Supplier Package:	PDIP
Packaging:	Rail
Fabrication Technology:	CMOS
Pin Count:	14

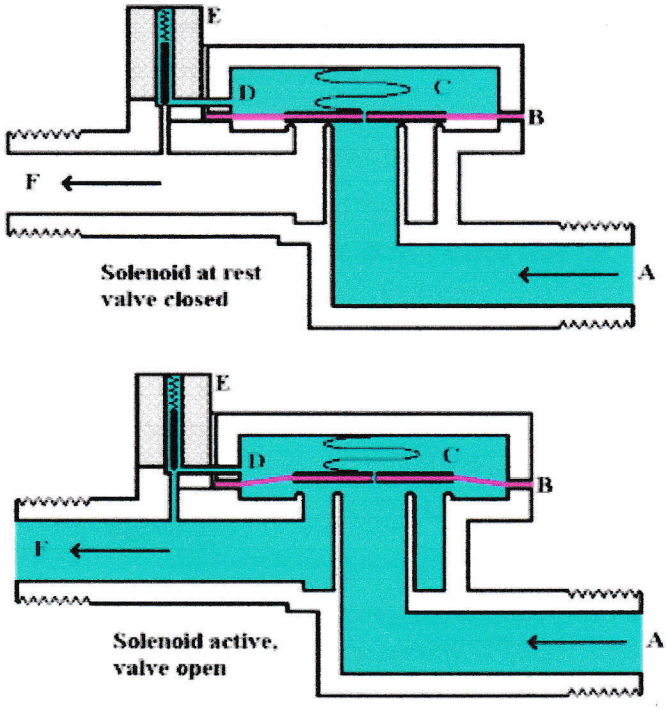
2.5.14 (c)Image of IC CD4011BCN

Figure 2.16 **FLIPFLOP IC CD4011BCN**

2.5.15 Solenoid Valve

A solenoid valve has two main parts: the solenoid and the valve. The solenoid converts electrical energy into mechanical energy which, in turn, opens or closes the valve mechanically. A *direct acting* valve has only a small flow circuit, shown within section E of this diagram (this section is mentioned below as a pilot valve). In this example, a *diaphragm piloted valve* multiplies this small pilot flow, by using it to control the flow through a much larger orifice.

Solenoid valves may use metal seals or rubber seals, and may also have electrical interfaces to allow for easy control. A spring may be used to hold the valve opened (normally open) or closed (normally closed) while the valve is not activated.



A- Input side
B- Diaphragm
C- Pressure chamber
D- Pressure relief passage
E- Solenoid
F- Output side

The diagram to the right shows the design of a basic valve, controlling the flow of water in this example. At the top figure is the valve in its closed state. The water under pressure enters at A. B is an elastic diaphragm and above it is a weak spring pushing it down. The function of this spring is irrelevant for now as the valve would stay closed even without it. The diaphragm has a pinhole through its center which allows a very small amount of water to flow through it. This water fills the cavity C on the other side of the diaphragm so that pressure is equal on both sides of the diaphragm, however the compressed spring supplies a net downward force. The spring is weak and is only able to close the inlet because water pressure is equalized on both sides of the diaphragm.

In the previous configuration the small passage D was blocked by a pin which is the armature of the solenoid E and which is pushed down by a spring. If the solenoid is activated by drawing the pin upwards via magnetic force from the solenoid current, the water in chamber C will flow through this passage D to the output side of the valve. The pressure in chamber C will drop and the incoming pressure will lift the diaphragm thus opening the main valve. Water now flows directly fromA to F.

When the solenoid is again deactivated and the passage D is closed again, the spring needs very little force to push the diaphragm down again and the main valve closes. In practice there is often no separate spring, the elastomer diaphragm is molded so that it functions as its own spring, preferring to be in the closed shape.

From this explanation it can be seen that this type of valve relies on a differential of pressure between input and output as the pressure at the input must always be greater than the pressure at the output for it to work. Should the pressure at the output, for any reason, rise above that of the input then the valve would open regardless of the state of the solenoid and pilot valve.

In some solenoid valves the solenoid acts directly on the main valve. Others use a small, complete solenoid valve, known as a pilot, to actuate a larger valve. While the second type is actually a solenoid valve combined with a pneumatically actuated valve, they are sold and packaged as a single unit referred to as a solenoid valve. Piloted valves require much less power to control, but they are noticeably slower. Piloted solenoids usually need full power at all times to open and stay open, where a direct acting solenoid may only need full power for a short period of time to open it, and only low power to hold it.

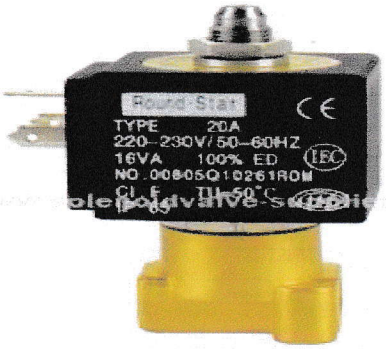


Fig 2.17 **Solenoid Valve**

2.5.16 Feature of the buzzer

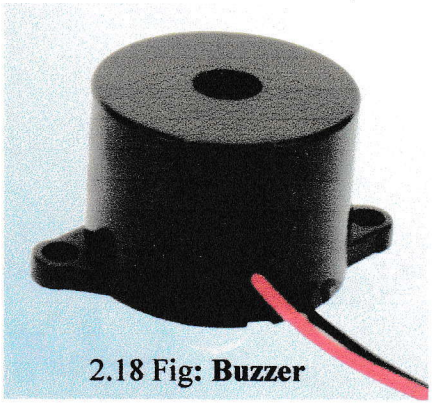
• The PS series are high-performance buzzers that employ unimorph piezoelectric elements and are designed for easy incorporation into various circuits.

• They feature extremely low power consumption in comparison to electromagnetic units.

• Because these buzzers are designed for external excitation, the same part can serve as both a musical tone oscillator and a buzzer.

• They can be used with automated inserters. Moisture-resistant models are also available.

• The lead wire type (PS1550L40N) with both-sided adhesive tape installed easily is prepared



2.18 Fig: **Buzzer**

2.5.17 SUMMARY

In this chapter a short description of the overall project along with description of all the devices used and their functions were given. It was explained that the project is mainly controlled by flip-flop IC. Any problem that might be introduced from the circuit will be only visible when it is put to test. Further modifications can then be added as the complexity of the structure is fairly low as it is the main goal of this project

Chapter 3

USES AND EFFECT OF THE IMPLEMENTED PROJECT

3.1 Advantage

1. You can respond to the alarm immediately. You can try to stop the fire from spreading. The detectors will point you to the area where the smoke is detected. This will enable you to grab a fire extinguisher so that you can attempt to contain the flames.

2. The device will notify everyone in the family right away. This is one of the major goals of having smoke detectors. It should be able to notify all the people in the house about the fire, taking place. There are also devices that you can connect with the local rescue unit so that they can respond right away as soon as your alarm system sounds.

3. It gives the people inside the house more time to get out of there. As mentioned earlier, early detection is important. Since this device sounds, or cause the fire alarm to sound as soon as it detects smoke, you will have the needed time to get out of the house immediately. This is extremely important for your safety. Fire spreads fast, if you cannot get out of your house right away, you are in great danger.

The device will surely help you when there is a fire. It is best if you have such tool in each of the rooms at home. Fire can start anywhere and it is vital that the detector can notify you right away. You also have to see to it that the alarm is audible. You should be able to hear the alarm or else, the device would not serve its purpose.

3.2 Limitation

Steam Interference

a) **Smoke detectors installed too close to bathrooms or steam rooms trigger false alarms when steam interrupts the light beams or electrical currents inside smoke detectors.**

3.3 Dusty Deception

a) High dust areas -- including workshops, wood shops or near chalkboards -- can trip the sensors inside smoke detectors, sounding false alarms.

3.4 Residual Smoke

a) Installing smoke detectors near stoves, toasters or toaster ovens is a quick recipe for false alarms. Unfortunately, these areas are among those most in need of careful monitoring for fire hazards. Heat detectors, which sound alarms based on sharp temperature change, are worthy substitutes in such areas.

b) 3.5 Statistics

a) Half of the deaths in home fires happen between 10pm and 8am.

b) A quarter of all people who die in home fires were asleep at the time.

c) On average 270 of the people killed in fires each year didn't have a smoke alarm

d) Over the last five years, more than 70 people have been killed every year because their smoke alarms didn't work - usually because the battery was flat or missing.

Discussions

This circuit warns the user against fire accidents .The voltage supply gives from the 220ac voltage. First by using by step down transformer the220v ac is converted into the 12v ac. This 12v ac current is converted into dc voltage by rectifying with diode. We use one voltage regulator IC 7812. One is IC-7812 which stables the voltage at 12 volt. This 12V dc is given as the voltage source of op amp. Pin 2, 6, 9, and 13 as the negative input of flip flop. It relies on the smoke that is produced in the event of a fire. When this smoke passes between a bulb and an LDR, the amount of light falling on the LDR decreases. When smoke level is low then led1 will be on, after raising the smoke level flip flop also be on and by through npn transistor alarm and solenoid valve will be on. The total cost of this security system is 4280tk. The minimum price of the smoke detector with water flowing available in market is around 8500 Tk. So this project can be a very economical and effective

Conclusion

This system will be helpful to prevent any probable fire damage . Thus security system is ensured electronically, that result in the satisfactory operations of the concerning system. The total cost of this security system is 4280Tk. The minimum price of the smoke detector and water flow available in market is around 8500 Tk. So this project can be a very economical and effective. This security system can be conveniently being applied for its affordable price. If this security system make commercially the total cost of this lock will be reduce.

Recommendations

The future scope of this project:

- In future it will inform the massage that, a fire occurrence is happen in any place of a building. It will notify the exact position of the fire.
- Further development user can change for more users friendly.

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