Electronics Engineering Project

SESSION 2018 - 2019

Project Report

On

ULTRASONIC SECURITY SYSTEM USING ARDUINO

UNDER THE ABLE GUIDANCE OF

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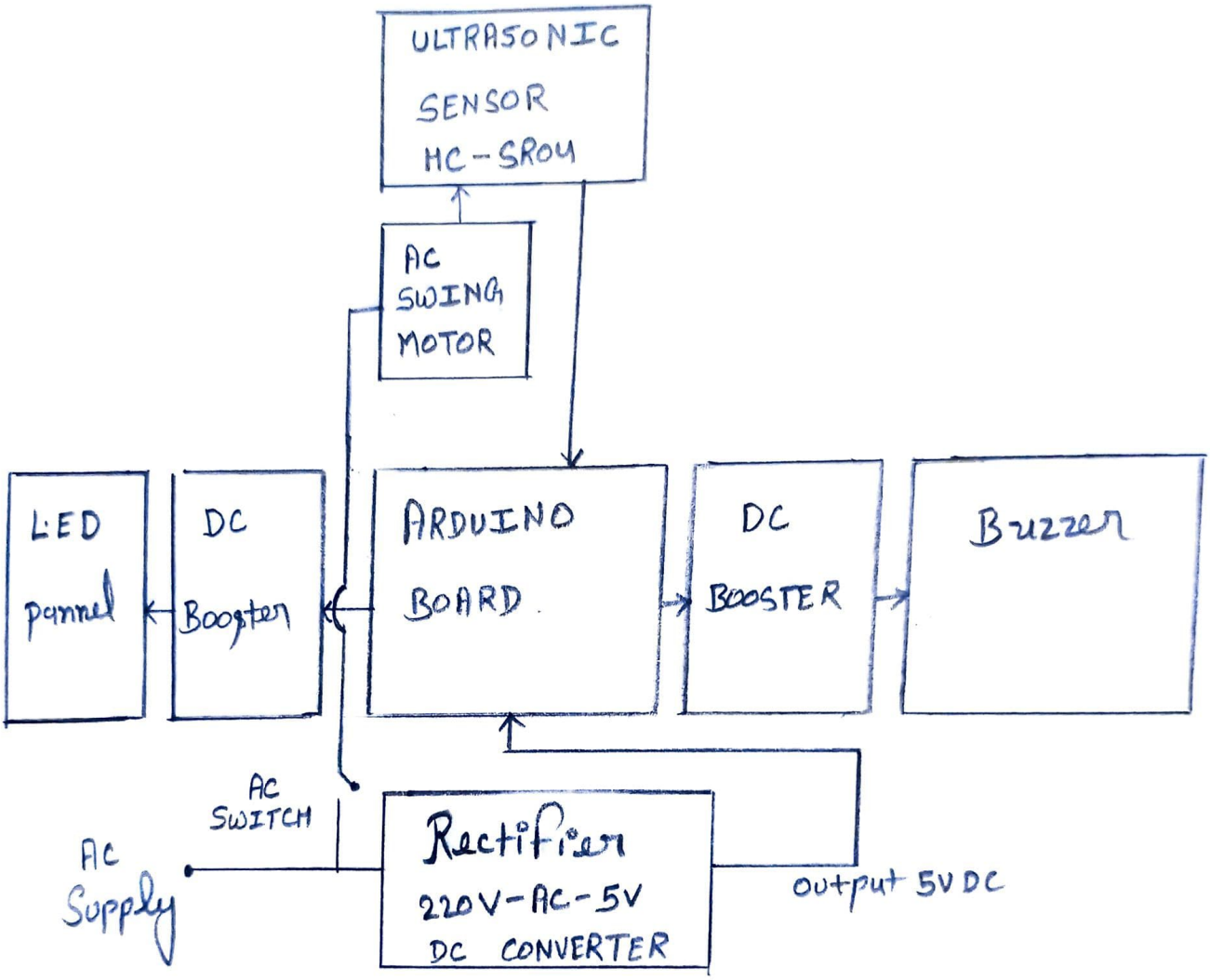
INTRODUCTION

We were inspired to build a security system based on ultrasonic technology.Security is an important part of home,banks,shops and so on.The traditional security systems based on opening of doors and windows .Our ultrasonic sensor technology is used ,it detects the intrudurs on their physical presence.Specially if we are going to share a house with prior strangers without a lock on our room door.Yes ,that is the situation we are walking into in order to drive down the cost of living in NYC.And we anticipate that many college students could face a similar problem .What is not to love about a device that looks like WALL-E and scans around for possible intruders? In case of intruders,it send off alarm and LED panel starts glow.

PREFACE

We came up with the idea because it could help us and others project property and privacy.Traditional household security systems often require installation and detect based on opening of doors and windows.In the case where installation is not possible and / or the area of interest has no door,our ultrasonic security system will come in handly because it requires no installation, and detects intruders based on their physical presence.



PROJECT BLOCK DIAGRAM

HARDWARE REQUIRED

- ARDUINO BOARD
- ULTRASONIC SENSOR HC-SR04
- DC BOOSTER
- RECTIFIER (AC TO DC CONVERTER)
- LED PANNEL
- BUZZER
- PCB PLATE AND JUMP WIRE
- AC SWING MOTOR
- AC SWITCH

ARDUINO PROGRAMMING

- PROGRAMMING OF ULTRASONIC SECURITY BASED SYSTEM USING ARDUINO

ARDUINO BOARD

Arduino is an open-source 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 both physically and digitally. Its products 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 Uno SMD R3

Developer	arduino.cc
Manufacturer	Many
Type	Single-board microcontroller
Operating system	None
CPU	Atmel AVR (8-bit), ARM Cortex-M0+ (32-bit), ARM Cortex-M3 (32-bit), Intel Quark (x86) (32-bit)
Memory	SRAM
Storage	Flash, EEPROM
Website	www.arduino.cc

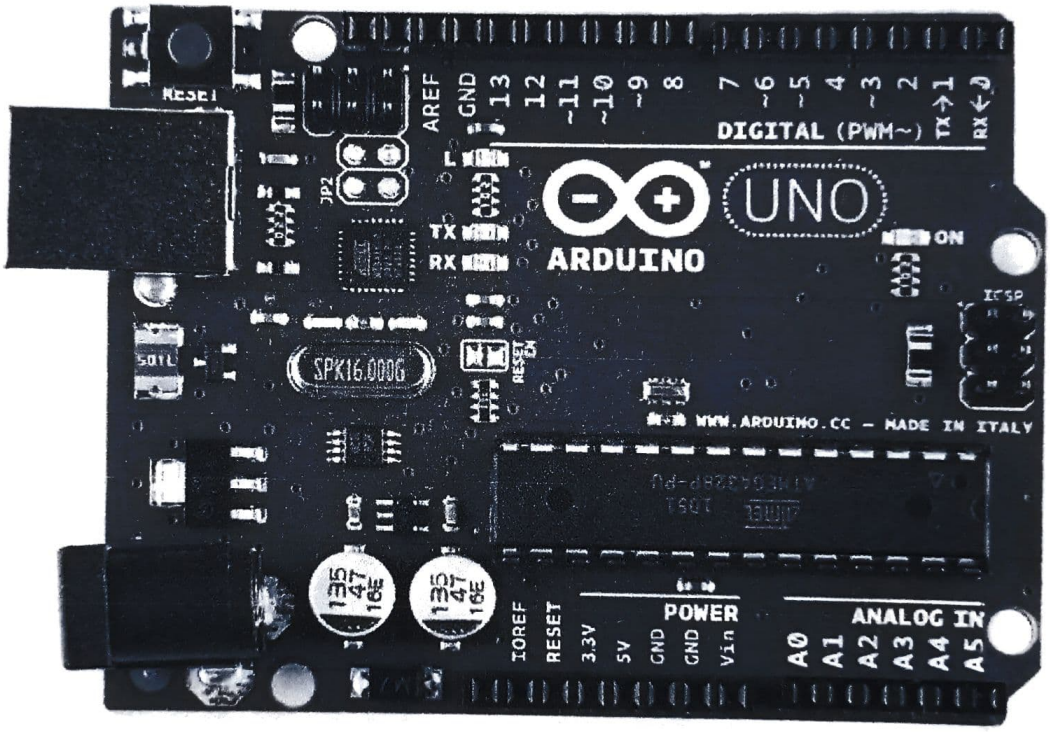
Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards or breadboards (*shields*) and other circuits. The

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.



ULTRASONIC SENSOR HC-SR04

Ultrasonic Sensor Pin Configuration

Pin Number	Pin Name	Description
1	Vcc	The Vcc pin powers the sensor, typically with +5V
2	Trigger	Trigger pin is an Input pin. This pin has to be kept high for 10us to initialize measurement by sending US wave.
3	Echo	Echo pin is an Output pin. This pin goes high for a period of time which will be equal to the time taken for

		the US wave to return back to the sensor.
4	Ground	This pin is connected to the Ground of the system.

HC-SR04 Sensor Features

- Operating voltage: +5V
- Theoretical Measuring Distance: 2cm to 450cm
- Practical Measuring Distance: 2cm to 80cm
- Accuracy: 3mm
- Measuring angle covered: <15°
- Operating Current: <15mA
- Operating Frequency: 40Hz

HC-SR04 Ultrasonic Sensor - Working

As shown above the **HC-SR04 Ultrasonic (US) sensor** is a 4 pin module, whose pin names are

Vcc, Trigger, Echo and Ground respectively. This sensor is a very popular sensor used in many applications where measuring distance or sensing objects are required. The module has two eyes like projects in the front which forms the Ultrasonic transmitter and Receiver. The sensor works with the simple high school formula that

Distance = Speed × Time

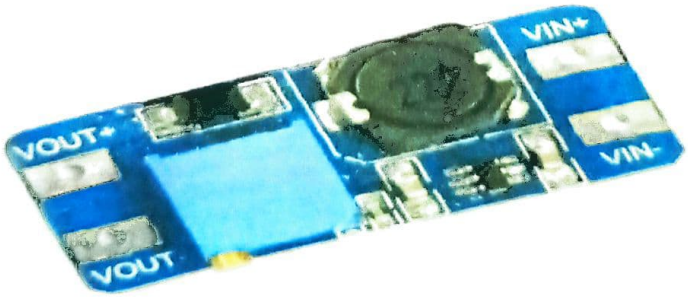
The Ultrasonic transmitter transmits an ultrasonic wave, this wave travels in air and when it gets objected by any material it gets reflected back toward the sensor this reflected wave is observed by the Ultrasonic receiver module as shown in the picture below

Applications

- Used to avoid and detect obstacles with robots like biped robot, obstacle avoider robot, path finding robot etc.
- Used to measure the distance within a wide range of 2cm to 400cm
- Can be used to map the objects surrounding the sensor by rotating it
- Depth of certain places like wells, pits etc can be measured since the waves can penetrate through water

DC BOOSTER

A **boost converter (step-up converter)** is a DC-to-DC power converter that steps up voltage (while stepping down current) from its input (supply) to its output (load). It is a class of switched-mode power supply (SMPS) containing at least two semiconductors (a diode and a transistor) and at least one energy storage element: a capacitor, inductor, or the two in combination. To reduce voltage ripple, filters made of capacitors (sometimes in combination with inductors) are normally added to such a converter's output (load-side filter) and input (supply-side filter).



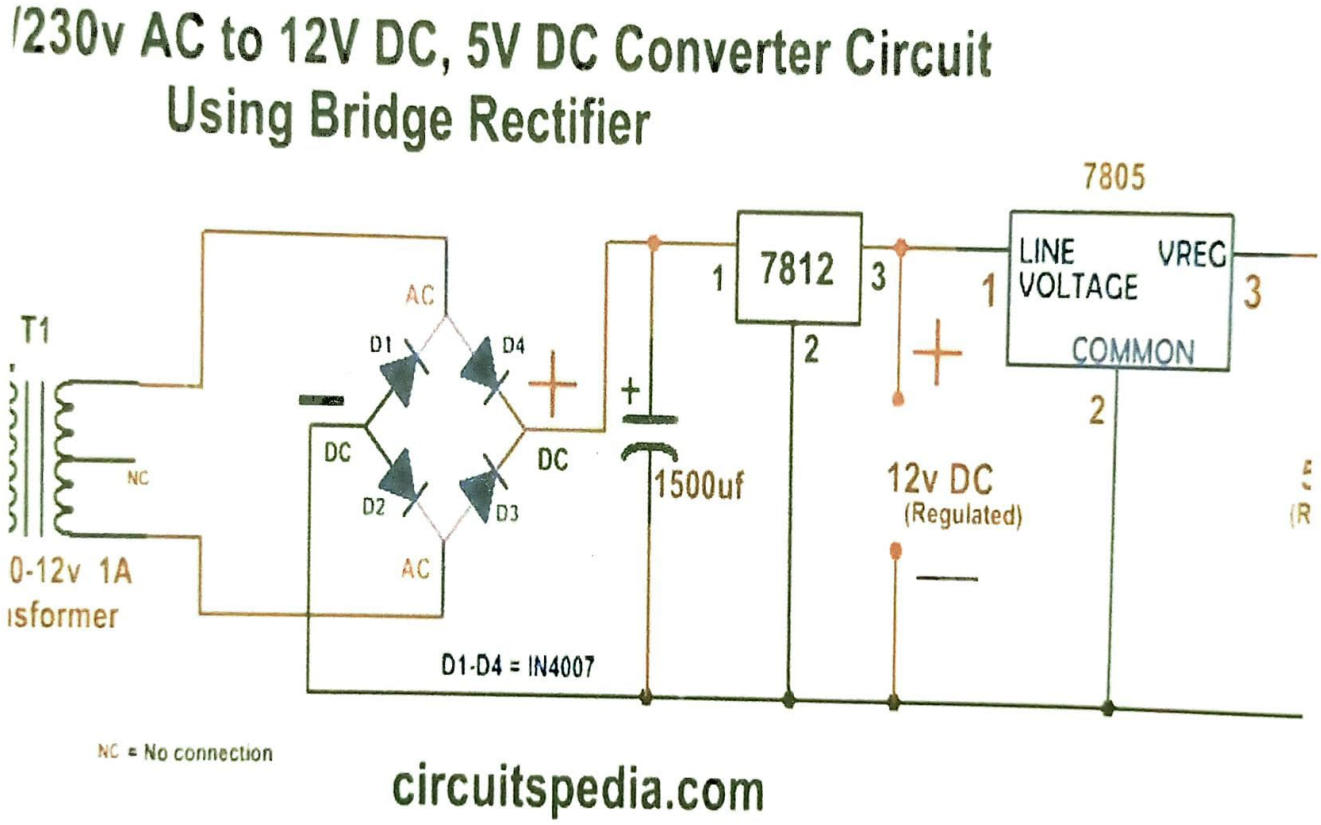
RECTIFIER (AC TO DC CONVERTER)

A **rectifier** is an electrical device that converts alternating current (AC), which periodically reverses direction, to direct current (DC), which flows in only one direction.

The process is known as *rectification*, since it "straightens" the direction of current. Physically, rectifiers take a number of forms, including vacuum tube diodes, mercury-arc valves, stacks of copper and selenium oxide plates, semiconductor diodes, silicon-controlled rectifiers and other silicon-based semiconductor switches. Historically, even synchronous electromechanical switches and motors have been used. Early radio receivers, called crystal radios, used a "cat's whisker" of fine wire pressing on a crystal of galena(lead sulfide) to serve as a point-contact rectifier or "crystal detector".

Rectifiers have many uses, but are often found serving as components of DC power supplies and high-voltage direct current power

transmission systems. Rectification may serve in roles other than to generate direct current for use as a source of power.



As noted, detectors of radio signals serve as rectifiers. In gas heating systems flame rectification is used to detect presence of a Depending on the type of alternating current supply and the arrangement of the rectifier circuit, the output voltage may require additional smoothing to produce a uniform steady voltage. Many applications of rectifiers, such as power supplies for radio, television and computer equipment, require a *steady* constant DC voltage (as would be produced by a battery). In these applications the output of the rectifier is smoothed by an electronic filter, which may be a capacitor, choke, or set of capacitors, chokes and resistors, possibly followed by a voltage regulator to produce a steady voltage.

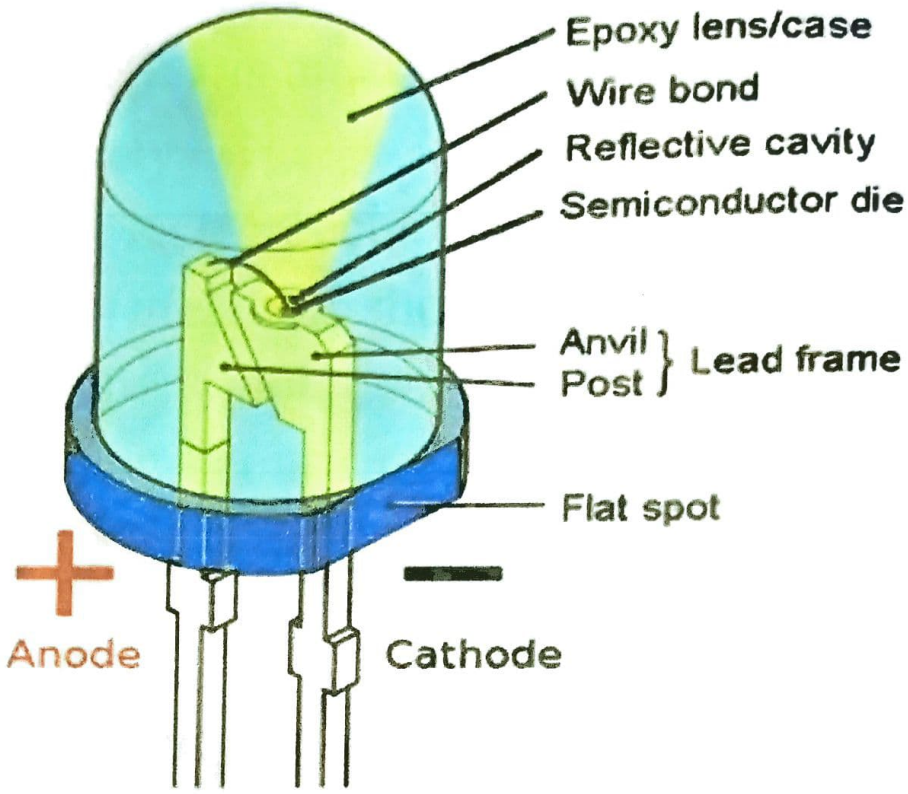
LED PANNEL

A **light-emitting diode (LED)** is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons. This effect is called electroluminescence.[5] The color of the light (corresponding to the energy of the photons) is determined by the energy required for electrons to cross the band gapof the semiconductor.[6] White light is obtained by using multiple semiconductors or a layer of light-emitting phosphor on the semiconductor device.

Appearing as practical electronic components in 1962, the earliest LEDs emitted low-intensity infrared light.[8] Infrared LEDs are used in remote-control circuits, such as those used with a wide variety of consumer electronics. The first visible-light LEDs were of low intensity and limited to red. Modern LEDs are

available across the visible, ultraviolet, and infrared wavelengths, with high light output.

Early LEDs were often used as indicator lamps, replacing small incandescent bulbs, and in seven-segment displays. Recent developments have produced white-light LEDs suitable for room lighting. LEDs have led to new displays and sensors, while their high switching rates are useful in advanced communications technology.



LEDs have many advantages over incandescent light sources, including lower energy consumption, longer lifetime, improved physical robustness, smaller size, and faster switching. Light-emitting diodes are used in applications as diverse as aviation lighting, automotive headlamps, advertising, general lighting, traffic signals, camera flashes, lighted wallpaper and medical devices

BUZZER

A **buzzer** or **beeper** is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric (*piezo* for short). Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.

Types

Electromechanical:

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.

Mechanical:

A joy buzzer is an example of a purely mechanical buzzer and they require drivers. Other examples of them are doorbells.

Piezoelectric:

Piezoelectric disk beeper

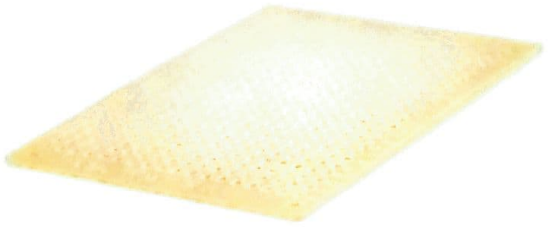
A piezoelectric element may be driven by an oscillating electronic circuit or other audio signal source, driven with a piezoelectric audio amplifier. Sounds commonly used to indicate that a button has been pressed are a click, a ring or a beep.

PCB PLATE AND JUMP WIRE

PCB PLATE:

A **printed circuit board (PCB)** mechanically supports and electrically connects electronic components or electrical components using conductive tracks, pads and other features etched from one or more sheet layers of copper laminated onto and/or between sheet layers of a non-conductive substrate. Components are generally soldered onto the PCB to both electrically connect and mechanically fasten them to it.

Printed circuit boards are used in all but the simplest electronic products. They are also used in some electrical products, such as passive switch boxes.



JUMP WIRE:

A **jump wire** (also known as jumper wire, or jumper) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.[1]

Individual jump wires are fitted by inserting their "end connectors" into the slots provided in a breadboard, the header connector of a circuit board, or a piece of test equipment.

AC SWING MOTOR:

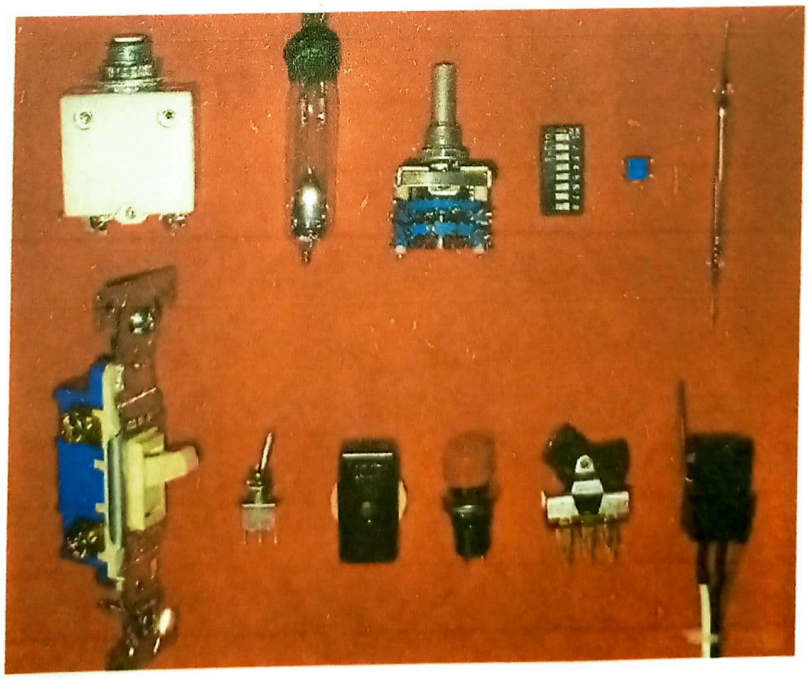
The **swing motor** is a vibration type in which the coil directly connected to the compressor (piston) moves reciprocally. Principle. When an AC current is applied to a coil placed at right angle to the magnetic field, a thrust occurs according to Fleming's left hand rule.

AC SWITCH

a **switch** is an electrical component that can "make" or "break" an electrical circuit, interrupting the current or diverting it from one conductor to another.[1][2] The mechanism of a switch removes or restores the conducting path in a circuit when it is operated. It may be operated manually, for example, a light switch or a keyboard button, may be operated by a moving object such as a door, or may be operated by some sensing element for pressure, temperature or flow. A switch will have one or more sets of contacts, which may operate simultaneously, sequentially, or alternately. Switches in high-powered circuits must operate rapidly to prevent destructive arcing, and may include special features to assist in rapidly interrupting a heavy current. Multiple forms of actuators are used for operation by hand or to sense position, level, temperature or flow. Special types are used, for example, for control of machinery, to reverse electric motors, or to sense liquid level. Many specialized forms exist.

A common use is control of lighting, where multiple switches may be wired into one circuit to allow convenient control of light fixtures.

By analogy with the devices that select one or more possible paths for electric currents, devices that route information in a computer network are also called "switches" - these are usually more complicated than simple electromechanical toggles or pushbutton devices, and operate without direct human interaction.



ARDUINO PROGRAMMING

```
const int trigPin = 9;
const int echoPin = 10;
const int buzzer = 11;
const int ledPin = 13;
void setup()
{
pinMode(trigPin, OUTPUT);
pinMode(echoPin, INPUT);
pinMode(buzzer, OUTPUT);
pinMode(ledPin, OUTPUT);
Serial.begin(9600);
}
void loop()
 {
digitalWrite(trigPin, LOW);
```

```
 delayMicroseconds(2);
 digitalWrite(trigPin, HIGH);
 delayMicroseconds(10);
 digitalWrite(trigPin, LOW);
 duration = pulseIn(echoPin, HIGH);
 safetyDistance = distance;
 if (safetyDistance <= 150){
  digitalWrite(buzzer, HIGH);
  digitalWrite(ledPin, HIGH);
 }
 else{
  digitalWrite(buzzer, LOW);
  digitalWrite(ledPin, LOW);
 }
Serial.print("Distance: ");
Serial.println(distance);
}
```

COST AND ESTIMATE

S.N	HARDWARE REQUIRED	COST
1.	ARDUINO BOARD	585
2.	ULTRASONIC SENSOR HC-SR04	230
3.	DC BOOSTER	240
4.	RECTIFIER	50
5.	LED PANNEL	70
6.	BUZZER	90
7.	PCB PLATE AND JUMP WIRE	50+20
8.	AC SWING MOTOR	140
9.	AC SWITCH	20
10.	TOTAL AMOUNT	1495

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