SYNOPSIS

This electric vehicle systems are based on various modules that should ensure the high power and stability of the vehicle on the track. The majority of these components are linked to the charging mechanism. In this regard, dynamic wireless power transfer is a practical method to solve electric vehicle range anxiety and reduce the cost of onboard batteries.

Wireless recharging has long been common with pure electric vehicles and is designed to allow charging even when the vehicle is in motion. However, it is difficult to analyse this method since its operating philosophy is complex, particularly with the existence of several variables and parameters. Also, the state of the vehicle, whether it is in motion or not, defines several parameters such as the vehicle speed as well as the sizes and dimensions of the coil receivers. This project presents a novel method to improve the performance of the dynamic wireless recharging system.

In the proposed system, receiver coils have been added to maximize charging power by offering a dynamic mathematical model that can describe and measure source-to-vehicle power transmission even though it is in motion. In the proposed mathematical model, all physical parameters describing the model were presented and discussed. The results showed the effectiveness of the proposed model. Also, this project confirmed the validity of the practical results obtained by providing two coil receivers under the vehicle.

CHAPTER-1

INTRODUCTION

INTRODUCTION

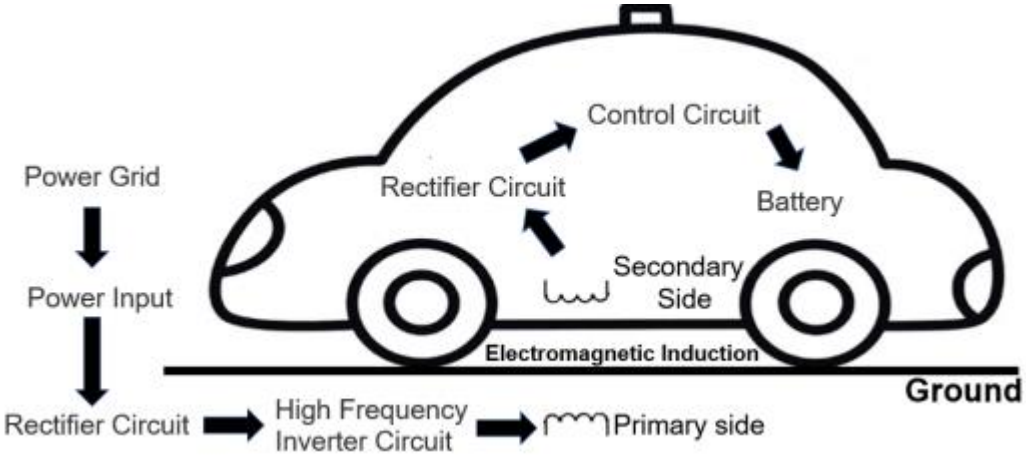
Existing Technology:

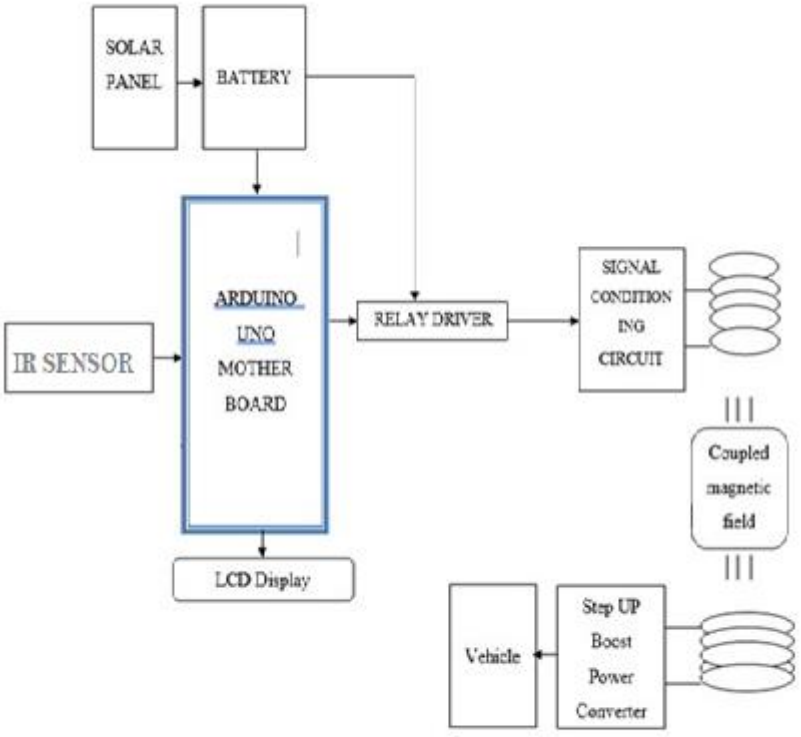
- In current charging technology, wired charging is the most common way to charge electric vehicles.
- Electric vehicles get energy from the grid through charging piles, which is extremely inconvenient for users because they need to wait for the charging to complete. It takes a long time due to its low efficiency.
- To overcome the limitations of electric vehicles (EV) driving range, numerous researches have been focused on making better batteries with larger energy density and capacity.
- Meanwhile, other technologies appeared, like the wireless charging technology of electric vehicles (WEVC), which has immense potential and interest.

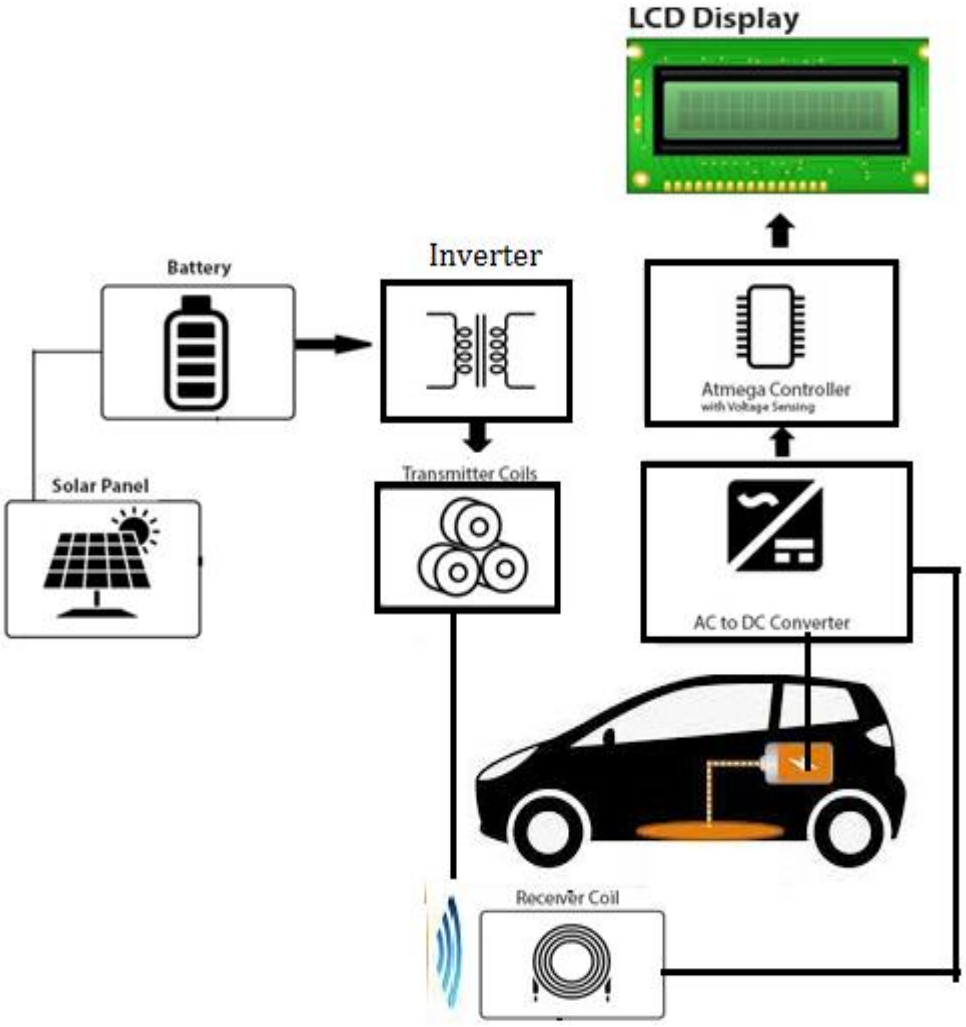
FUTURE:

- **Electric Vehicle Charging Technology**: The growth of the electric vehicle market will drive further advancements in electric vehicle charging technology. In the future, wireless charging systems may be embedded in roads, parking lots, and home garages, enabling convenient charging for electric vehicles without the need for plugs.
- **Fast Charging and High-Power Charging**
- **Multi-Device Charging**
- **Smart Charging**
- **Environmental Sustainability**
- **Standardization and Universality**
- **Further Integration of Mobile Devices**

BLOCK DIAGRAM:





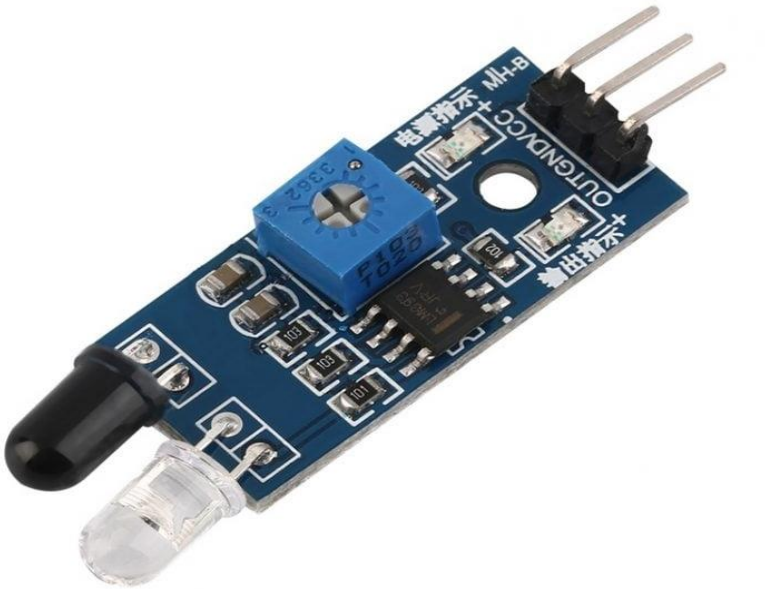

LCD Display
Inverter
Battery
Atmega Controller
with Voltage Sensing
Solar Panel
Transmitter Coils
AC to DC Converter
Receiver Coil

CHAPTER-2
SENSOR

INTRODUCTION

Introduction of IR Sensor

IR sensor is an electronic device, that emits the light in order to sense some object of the surroundings. An **IR sensor** can measure the heat of an object as well as detects the motion. Usually, in the **infrared spectrum**, all the objects radiate some form of thermal radiation. These types of radiations are invisible to our eyes, but infrared sensor can detect these radiations.



The emitter is simply an IR LED **(Light Emitting Diode**) and the detector is simply an IR photodiode. Photodiode is sensitive to IR light of the same wavelength which is emitted by the IR LED. When IR light falls on the photodiode, the resistances and the output voltages will change in proportion to the magnitude of the IR light received.

There are five basic elements used in a typical infrared detection system: an infrared source, a transmission medium, optical component, infrared detectors or receivers and signal processing. Infrared lasers and Infrared LED's of specific wavelength used as infrared sources.

The three main types of media used for infrared transmission are vacuum, atmosphere and optical fibres. Optical components are used to focus the infrared radiation or to limit the spectral response.

Types of IR Sensors

There are two types of IR sensors are available and they are,

- Active Infrared Sensor
- Passive Infrared Sensor

Active Infrared Sensor

Active infrared sensors consist of two elements: infrared source and infrared detector. Infrared sources include the LED or infrared **laser diode**. Infrared detectors include photodiodes or phototransistors. The energy emitted by the infrared source is reflected by an object and falls on the infrared detector.

Passive Infrared Sensor

Passive infrared **sensors** are basically Infrared detectors. Passive infrared sensors do not use any infrared source and detector. They are of two types: quantum and thermal. Thermal infrared sensors use infrared energy as the source of heat. **Thermocouples**, pyroelectric detectors and bolometers are the common types of thermal infrared detectors. Quantum type infrared sensors offer higher detection performance. It is faster than thermal type infrared detectors. The photo sensitivity of quantum type detectors is wavelength dependent.

IR Sensor Working Principle

There are different types of infrared transmitters depending on their wavelengths, output power and response time. An IR sensor consists of an IR LED and an IR Photodiode, together they are called as Photocoupler or Optocoupler.

IR Transmitter or IR LED

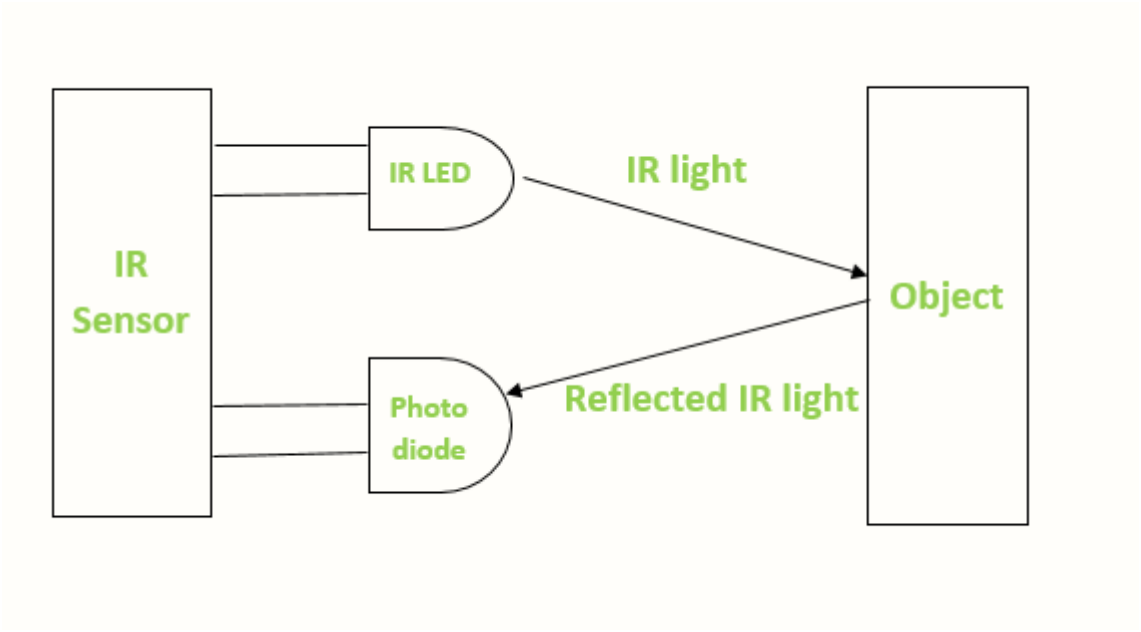
Infrared Transmitter is a light emitting diode (LED) which emits infrared radiations called as IR LED's. Even though an IR LED looks like a normal LED, the radiation emitted by it is invisible to the human eye.

IR Receiver or Photodiode

Infrared receivers or infrared sensors detect the radiation from an IR transmitter. IR receivers come in the form of photodiodes and phototransistors. Infrared Photodiodes are different from normal photo diodes as they detect only infrared radiation. Below image shows the picture of an IR receiver or a photodiode,

Different types of IR receivers exist based on the wavelength, voltage, package, etc. When used in an infrared transmitter – receiver combination, the wavelength of the receiver should match with that of the transmitter.

The emitter is an IR LED and the detector is an IR photodiode. The IR photodiode is sensitive to the IR light emitted by an IR LED. The photo-diode's resistance and output voltage change in proportion to the IR light received. This is the underlying working principle of the IR sensor.



When the IR transmitter emits radiation, it reaches the object and some of the radiation reflects back to the IR receiver. Based on the intensity of the reception by the IR receiver, the output of the **sensor** defines.

Applications of IR Sensor

IR sensors use in various projects and also in various electronic devices. They all are as follow,

Night Vision Devices

An Infrared technology implemented in **night vision equipment** if there is not enough visible light available to see unaided. Night vision devices convert ambient photons of light into electrons and then amplify them using a chemical and electrical process before finally converting them back into visible light.

Radiation Thermometers

IR sensors are used in radiation **thermometers** to measure the temperature depend upon the temperature and the material of the object and these thermometers have some of the following features

- Measurement without direct contact with the object
- Faster response
- Easy pattern measurements

Infrared Tracking

An Infrared tracking or Infrared homing, is a missile guidance system which operates using the infrared **electromagnetic radiation** emitted from a target to track it.

IR Imaging Devices

IR image device is one of the major applications of IR waves, primarily by virtue of its property that is not visible. It uses for thermal imagers, **night vision devices** etc.

Other Key Application Areas

Other key application areas that use infrared sensors include:

- Climatology
- Meteorology
- Photo biomodulation
- Flame Monitors
- Gas detectors
- Water analysis
- Moisture Analyzers
- Anesthesiology testing
- Petroleum exploration
- Rail safety
- Gas Analyzers

CHAPTER-3

WIRELESS CHARGING TECHNOLOGY

WIRELESS POWER CHARGING TECHNOLOGIES

Using the Qi (inductive power standard), Epec can embed wireless charging electronics in your custom battery pack to work with off-the-shelf wireless charging pads that already exists. We also have in-house engineering resources to help you develop a custom charging pad specific for your end product.

Wireless Charging Working Details:

The overall system comprises of a charger pad and the battery. Each part has planar coils that are used to transfer energy from the charging pad to the battery. The electrical energy is modulated so the charging pad and battery can communicate with each other. This allows the charging pad to verify that a valid battery is in place before it transmits full power to the battery.

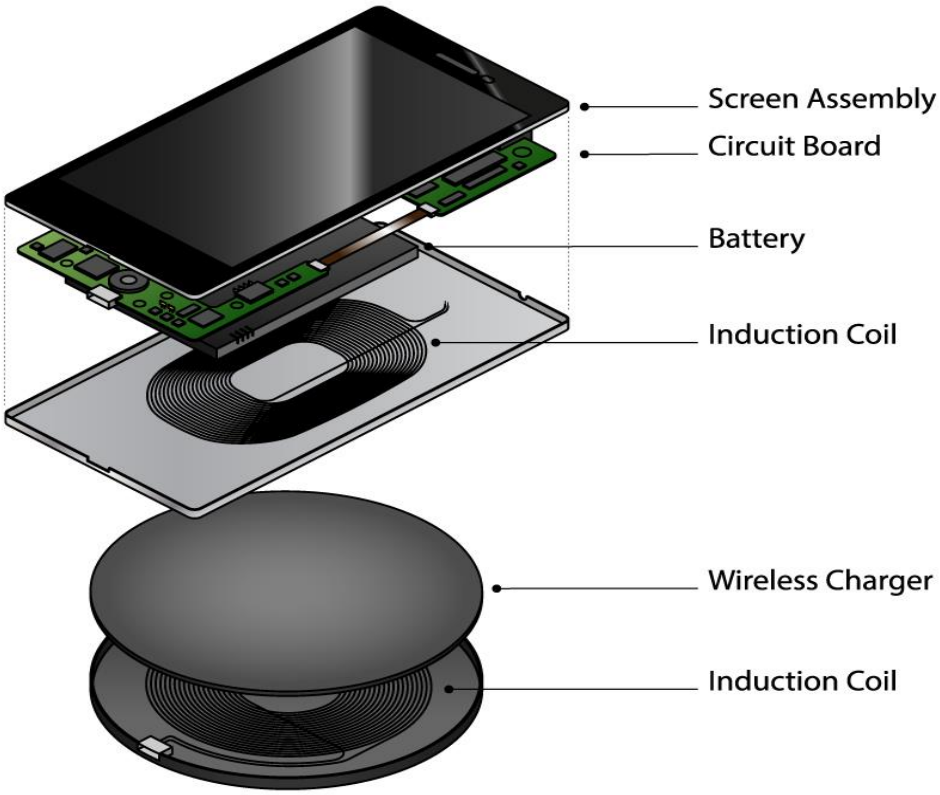


Diagram Depicting How Wireless Charging Works

This communication continues throughout the entire charging process to confirm the battery is still in place. This reduces the amount of EMI emissions from the charging pad when it is not being used.

Advantages of Wireless Charging

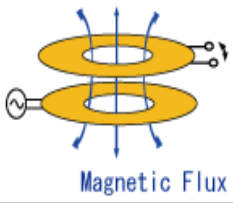
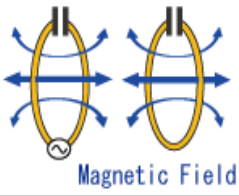
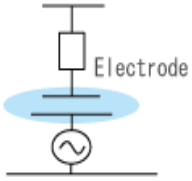
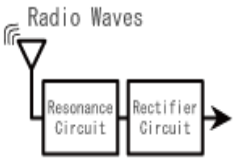
- Wireless charging is convenient when electrical contacts are not acceptable and the battery is embedded in the product or when the product cannot be reached. Wireless charging is commonly used in medical devices and food products where electrical shock or bacteria levels must be kept to a minimum and no electrical contacts are allowed.
- Wiring charging can also reduce the amount of cables and power adapters you need to have custom manufactured for your device or application.
- Wireless charging can be sized to deliver 5W or 10W of energy to the battery. It can be a good solution to charge your battery. It can also charge you battery at a fast rate depending on the size of the battery pack.
- In most applications the distance between the two coils is typically 5mm. It is possible to extend that range to at least 35mm.

Cost Factors of Wireless Power Charging Technologies

The costs associated with wireless power charging technologies have come down due to its increased popularity in the portable device market. However, it should still be used only when there is a real need for it to be used in your application. Hardwired connector type charging solutions are still much more cost competitive and can deliver much faster charge times and more energy.

Wireless Charging Methods

Various charging methods for supplying power wirelessly exist.
Below are typical configurations.

Method	Electromagnetic Induction	Magnetic Resonance	Electric Field Coupling	Radio Receptiong
Configuration				
Higher Power Consumption	○	○	◎	△
Efficiency	○ (~90％)	△ (~60％)	○ (~90％)	×
Transmission Distance	× (~several cm)	○ (~several m)	× (~several cm)	○ (~several m)

Electromagnetic Induction

A general wireless charging system featuring a simple, compact, low-cost circuit structure that transmits power using induced magnetic flux generated between the power transmission and receiving sides. It is also characterized by high efficiency. Drawbacks include short transmission distance and susceptibility to misalignment.

Magnetic Resonance

In this system, power is transmitted through magnetic resonance utilizing resonators on the transmitting and receiving sides. This method is typically used when long transmission distance is required, and is being promoted for EV charger applications. However, efficiency is an issue.

Electric Field Coupling

A transmission method achieved by facing electrodes on the power transmitting and receiving sides towards each other to form a capacitor, using the phenomenon in which current flows between electrodes at high frequency (harmonic current). The transmission distance is short, similar to the electromagnetic induction method, but is less susceptible to misalignment and less heat is generated in the power supply block. One disadvantage is increased thickness of the high voltage transformer.

Radio Reception

This system converts current to electromagnetic waves on the transmitter side, receives the electromagnetic waves from an antenna on the receiver side, converts the waves to direct current using a rectifier circuit, then transmits power through an electromagnetic field. Although the transmission distance is relatively long (up to several meters), efficiency is poor.

Difference between wired charger and wireless charger:

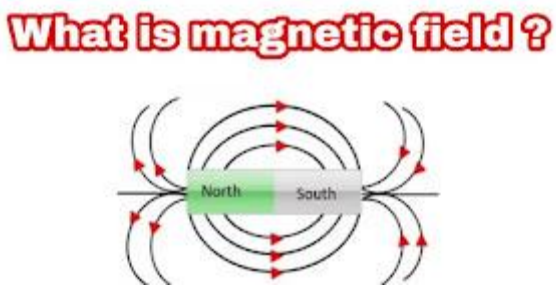
To charge our mobile phone, we use any mobile charger, so we will need a mobile charger cable from the ocean. Then we will be able to charge our mobile phone. But when we use wireless mobile charger then you will not need any mobile charger cable or keep your mobile near the charge and it will start charging.

The wireless charger does a magnetic field and converts the power supply into a magnet, after that a magnetic field enters its mobile, then the system installed in our mobile converts the same magnetic field into electric current. And that electricity

charges our mobile. About which we will be done in details. And for Magnetic Field you need to know about Inductor Coil.

How to make wireless charger as fastest wireless charger

If you want to make a wireless mobile charger, then it is important for you to have some necessary electronics components. This wireless charger can charge any electric product not only in your mobile. Depending on the electronic components used in the wireless charger, how quickly your mobile or any electric parts will charge.



Fastest wireless charger Every electronic component used are used original, if you also use original electronic components, then you too will make Fastest wireless charger at your home itself. The fastest wireless charger will be able to charge your mobile as much as the capacity of your mobile and the magnetic field of the coil on the wireless charger can do that.

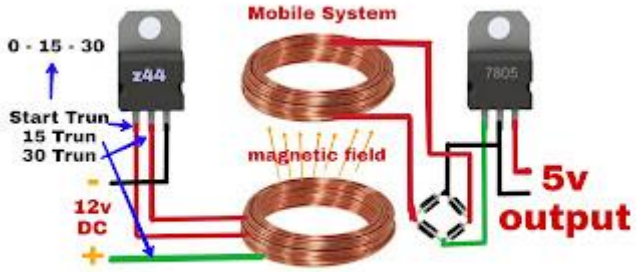
Wireless charger Circuit Diagram and Required Electronics components

To make a wireless mobile number at home, you will need some things which I have told you.

All you will need to make Electronics Components For wireless mobile charger.

1. QTY 1k Ohm Register ×2
2. Copper wire (25 gauge) coil ×2
3. 5407 Diode

4. 1000uf Capacitor
5. 7805 Regulator
6. Z44 MOSFET
7. 12v DC Charger (battery)



Wireless mobile charger Diagram

Best wireless mobile charger list

You will find many wireless mobile chargers in the market. Wireless mobile charger. The fastest wireless charger comes in your mobile, due to which your mobile charge is done quickly. charger for iPhone.

1. one plus wireless charger
2. wireless charger Samsung
3. apple wireless charger
4. best wireless charger for iPhone
5. Bluetooth charging
6. car wireless charger
7. Samsung 15watt charger
8. air pod charger
9. Belkin wireless charger

CHAPTER– 4

BATTERY

Battery

A battery can be defined as an electrochemical device (consisting of one or more electrochemical cells) which can be charged with an electric current and discharged whenever required. Batteries are usually devices that are made up of multiple electrochemical cells that are connected to external inputs and outputs.

Battery Chargers

If you use secondary-type batteries, *you can rely on battery chargers*. Click the cells in the charging device, plug it in, and they will be good as new in a few hours – and ready to use again.

A battery charger is designed to provide a safe, consistent charge to batteries. The structure consists of three main components:

- **Power supply.** This part includes an AC/DC adapter or connection cable to take energy from the wall outlet.
- **Charging circuit.** Takes the energy and converts it into a sustainable voltage for the battery.
- **Control circuitry.** Regulates the charger's output to optimize charging speed. At the same time, it protects the charger and battery from overcharging or short-circuiting.

Different Types of Battery Chargers

As technology has advanced, so too have the various types of battery chargers. Here is a look at some of the different types of battery chargers on the market today:

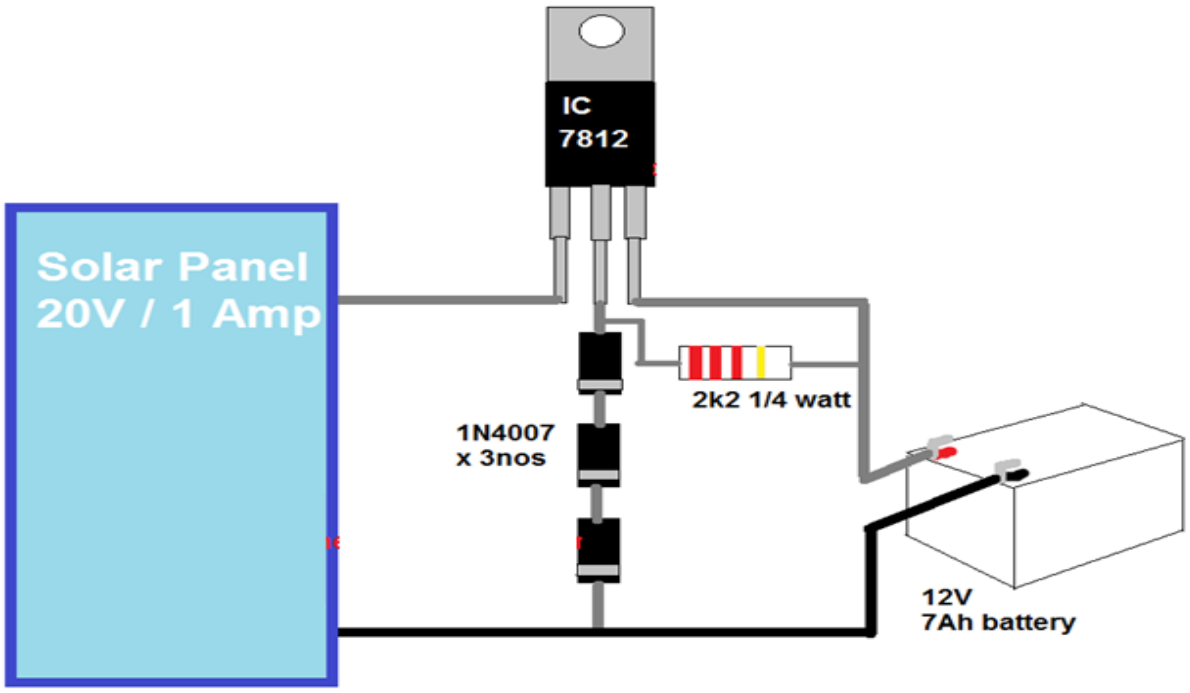
- Manual battery chargers
- Automatic battery chargers
- Solar battery chargers
- Trickle chargers

Solar battery charger which will ensure safe and guaranteed charging of a small 12V 7 Ah battery through a small solar panel:

Parts Required

- Solar Panel - 20V, 1 amp
- IC 7812 - 1no
- 1N4007 Diodes - 3nos
- 2k2 1/4-watt resistor - 1no

That looks cool isn't it. In fact, the IC and the diodes could already rest in your electronic junk box, so need of buying them. Now let's see how these can be configured for the final outcome.



Estimated time taken to charge the battery from 11V to 14V is around 8 hours.

As we know the IC 7812 will produce a fixed 12V at the output which cannot be used for charging a 12V battery. The 3 diodes connected at its ground (GND) terminals is introduced specifically to counter this problem, and to upgrade the IC output to about 12 + 0.7 + 0.7 + 0.7 V = 14.1 V, which is exactly what is required for charging a 12 V battery fully.

The drop of 0.7 V across each diode raises the grounding threshold of the IC by stipulated level forcing the IC to regulate the output at 14.1 V instead of 12 V. The 2k2 resistor is used to activate or bias the diodes so that it can conduct and enforce the intended 2.1 V total drop.

Making it Even Simpler

If you are looking for an even simpler solar charger, then probably there cannot be anything more straightforward than connecting an appropriately rated solar panel directly with the matching battery via a blocking diode, as shown below:

Although, the above design does not incorporate a regulator, it will still work since the panel current output is nominal, and this value will only show a deterioration as the sun changes its position.

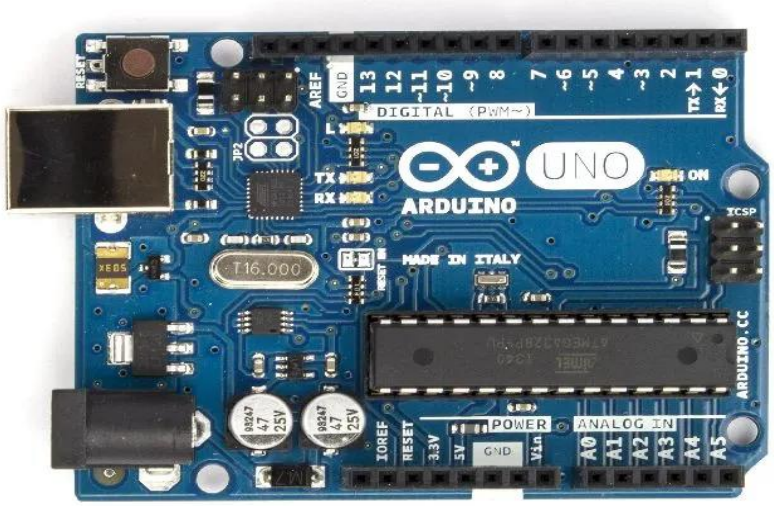
However, for a battery that is not fully discharged, the above simple set up may cause some harm to the battery, since the battery will tend to get charged quickly, and will continue to get charged to unsafe levels and for longer periods of time.

CHAPTER-5

ARDUINO UNO

Introduction of Arduino UNO and its specifications:

The Arduino Uno is an open-source microcontroller board that is based on the Microchip ATmega328P (for Arduino UNO R3) or Microchip ATmega4809 (for Arduino UNO WIFI R2) micro-controller by Atmel and was the first USB powered board developed by Arduino.



Both Atmega328 and ATmega4809 have a built-in bootloader, which makes it very convenient to flash the board with our code. Like all Arduino boards, we can program the software running on the board using a language derived from C and C++. The easiest development environment is the Arduino IDE.

UNO refers to number 1 in Latin. Yes, it's a Latin word and does not have any full form**.** Since this was the first official Arduino board released by the company, hence the word UNO in it.

Arduino UNO is neither a microprocessor nor a microcontroller. It is actually a development board that uses a microcontroller called Atmega328p to perform various functions. You can say, atmega328p is the brain of the Arduino UNO development board.

Microprocessor Vs Microcontroller Vs Development board

Microprocessor: It is the brain of any embedded system. It performs all the numeric and logic calculations. And is responsible for executing the commands that are given to the system (like Arduino UNO). But it's important to note that a microprocessor cannot execute commands by itself. It needs external components and devices like RAM, ROM, Registers, I/O, etc, to send or store the data.

Microcontroller: A microcontroller is made up of a Microprocessor and other units required to perform certain functions like Memory units, Inputs/Outputs, ADCs, etc. That's why a Microcontroller can execute commands by itself. But it's not easy to program a Microcontroller directly due to the absence of a USB port, GPIO header, etc., and hence it is not recommended to beginners.

Development board: A development board makes it easy to connect the external peripherals to the Microcontroller. It is easy to program and create projects using a development board like the Arduino UNO.

Specifications of Arduino UNO

Arduino UNO Specifications

Given below is the brief info about the specs of the latest Arduino UNO Rev3 board like Microcontroller used, number of digital/analog pins, memory, voltage, and current ratings, etc.

Microcontroller	ATmega328P
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limit)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
PWM Pins	6(Pin 3, 5, 6, 9, 10, and 11)
Analog Input Pins	6
Communication protocol	UART x 1, SPI x 1, I2C x 1
DC Current per I/O Pin	20 Ma

DC Current for 3.3V Pin	50 Ma
ICSP Header	2
Flash Memory	32 KB (ATmega328P) of which 0.5 KB used by the bootloader
SRAM	2 KB (ATmega328P)
EEPROM	1 KB (ATmega328P)
Clock Speed	16 MHz
LED_BUILTIN	13
Power Sources	Power Jack, USB port, Vin pin
Length	68.6 mm
Width	53.4 mm
Weight	25 g

Arduino UNO Specification table

Arduino UNO is a simple microcontroller board without any operating system or powerful processor. Unlike your laptop or mobile phone, it can run only one program at a time. Of course, you can add multiple tasks in a single program but they will be executed one by one.

Arduino UNO Board Layout (Updated)

Atmega328P Microcontroller– The ATmega328p is a single-chip, high-performance, efficient microcontroller created by Atmel in the megaAVR family. It is an 8-bit AVR RISC-based microcontroller chip. It consists of **32 KB ISP flash memory** with read-while-write capabilities, **2 KB SRAM** (Static RAM), **1 KB of EEPROM**, **23 general-purpose I/O pins**.

Atmega 16U2 Microcontroller– The Atmega 16U2 is used as a USB to serial converter in Arduino UNO.

Voltage Regulator-The voltage regulator converts the input voltage to 5V. The primary use of a voltage regulator is to control the voltage level in the Arduino board. Even if there are any fluctuations in the input supply voltage of the regulator, the output voltage remains constant and near 5 volts.

Regulator, Oscillator, and Reset Button

Crystal Oscillator– The Crystal oscillator has a frequency of 16MHz, which provides the clock signal to the microcontroller. It provides the basic timing and control to the board.

RESET Button–It is used to reset the board. It's recommended to press this button every time we flash the code to the board.

Barrel Jack – The Barrel jack or DC Power Jack is used to power the Arduino board using an external power supply. The barrel jack is usually connected to an adapter. The board can be powered by an adapter that ranges between 5-20 volts but the manufacturer recommends keeping it between 7-12 volts.

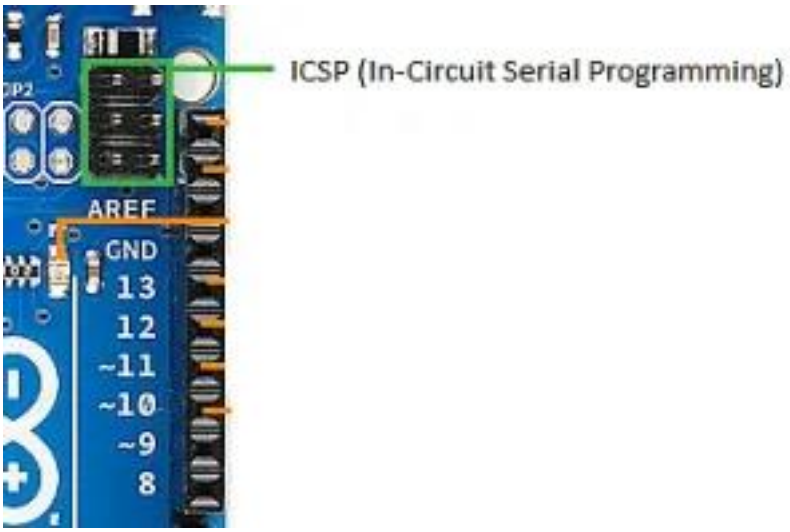
USB B-port–The USB Interface is used to plug in the USB cable. This port can be used to power the device from the 5V supply. It allows us to connect the board to the computer. The program is uploaded to the board serially from the computer through the USB cable.

ICSP header– It stands for **In-Circuit Serial Programming**. We can use these pins to program the Arduino board's firmware. The firmware changes with the new functionalities are sent to the microcontroller with the help of the ICSP header.

Arduino UNO Pinout /Pin diagram (Updated):

If we take a look at the Arduino board we will find that there is a total of 32 pins on it (excluding the ICSP header). Out of these 32 pins, 14 are digital I/O pins, 6 are analog pins, 3 GND and single 5V,3.3V, Vin and reset pin, and more.

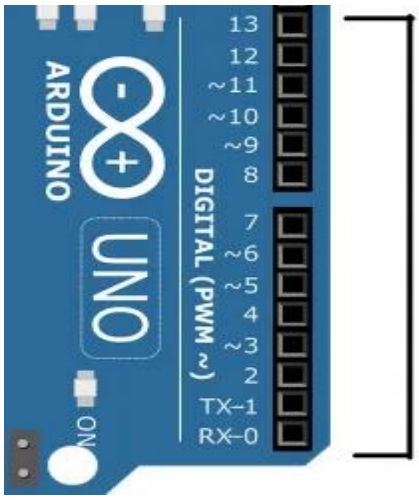
ICSP pins:



It stands for **In-Circuit Serial Programming**. We can use these pins to program the Arduino board's firmware. The firmware changes with the new functionalities are sent to the microcontroller with the help of the ICSP header.

The ICSP header consists of 6 pins.

Digital Pins:



Digital Pins on Arduino UNO

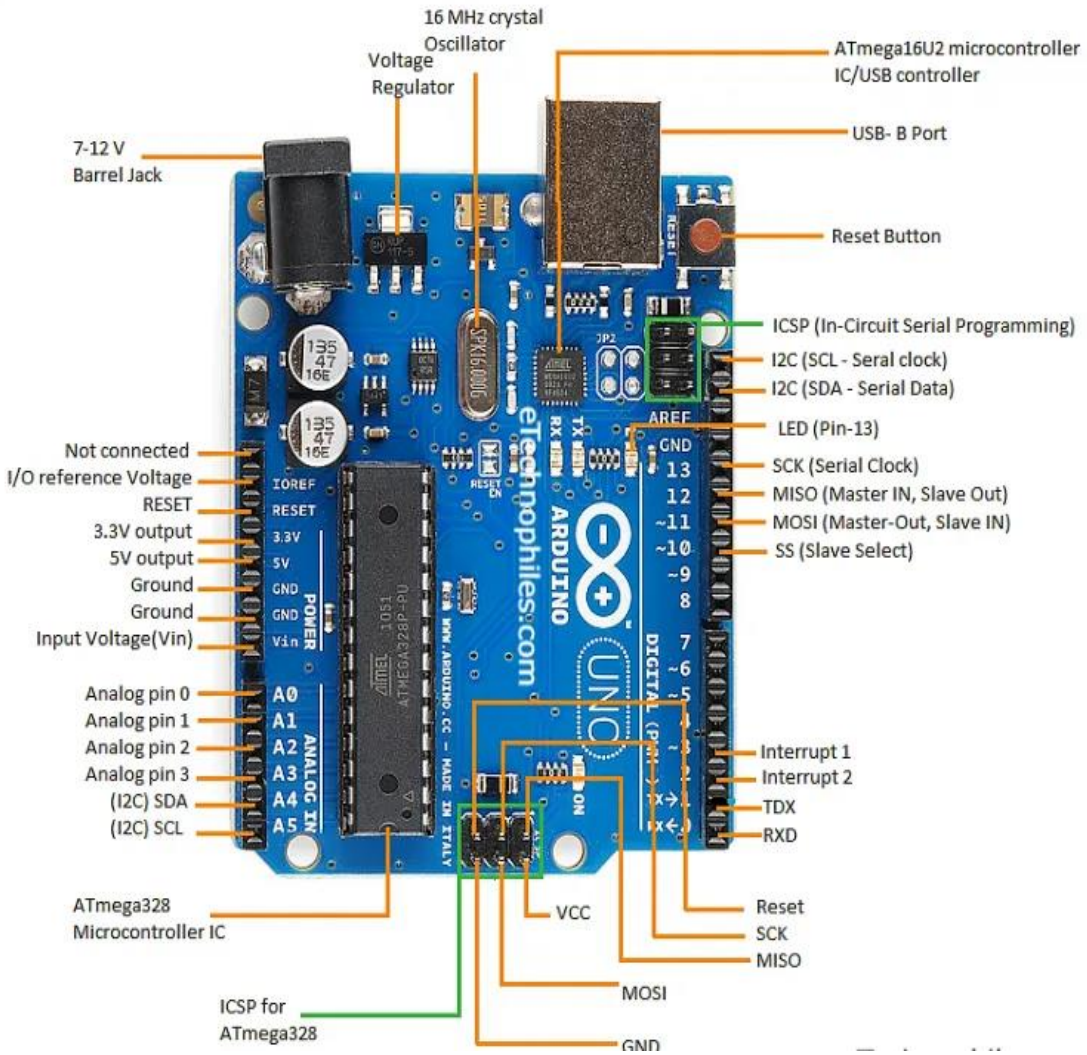
On the Arduino UNO board, pins 0-13 are digital input/output pins.

The Arduino digital pins can read only two states: when there is a voltage signal and when there is no signal. This kind of input is usually called digital (or binary) and these states are referred to as HIGH and LOW or 1 and 0.

LED (13): On the board, there is a built-in LED connected to digital pin 13. When this pin is HIGH or 1, the LED is switched on, when the pin is LOW or 0, it's switched off.

New Arduino UNO R3 Pinout

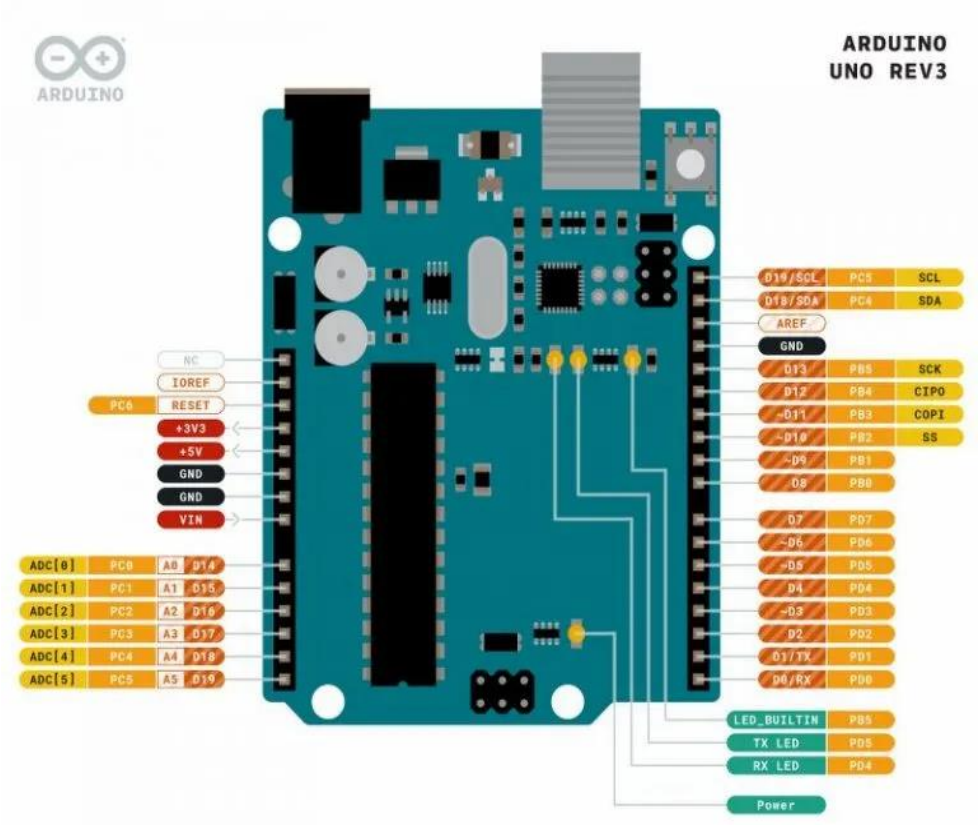
The picture given below is the pin diagram of Arduino UNO:



Arduino UNO pinout

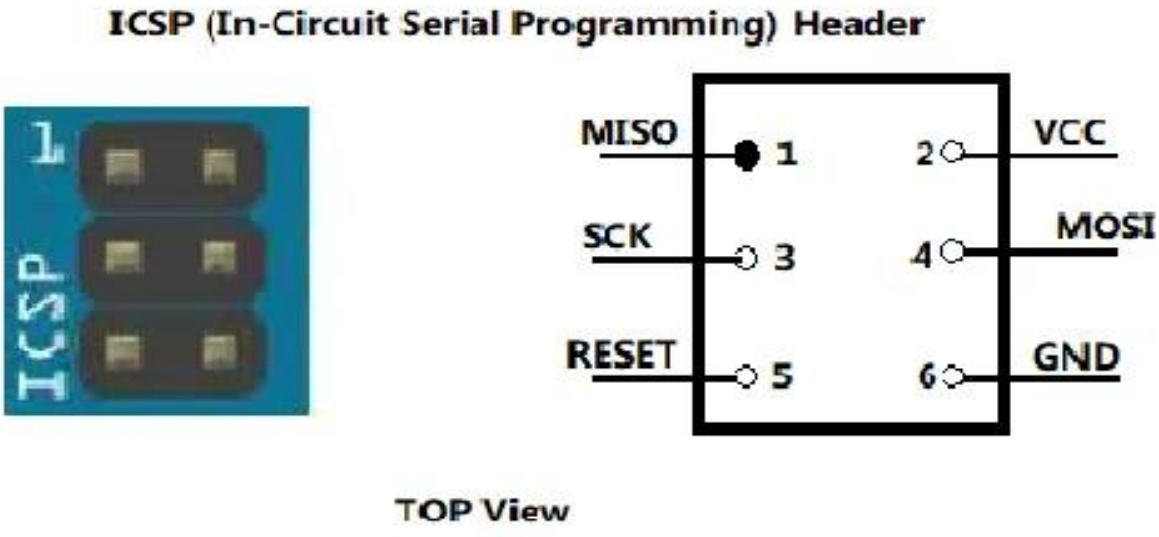
Official Arduino UNO Rev3 Pinout:

Given below is the official pin diagram of Arduino UNO Rev3 by Arduino.cc



Arduino UNO R3 Pin diagram

I2C Pins on Arduino UNO pin diagram:

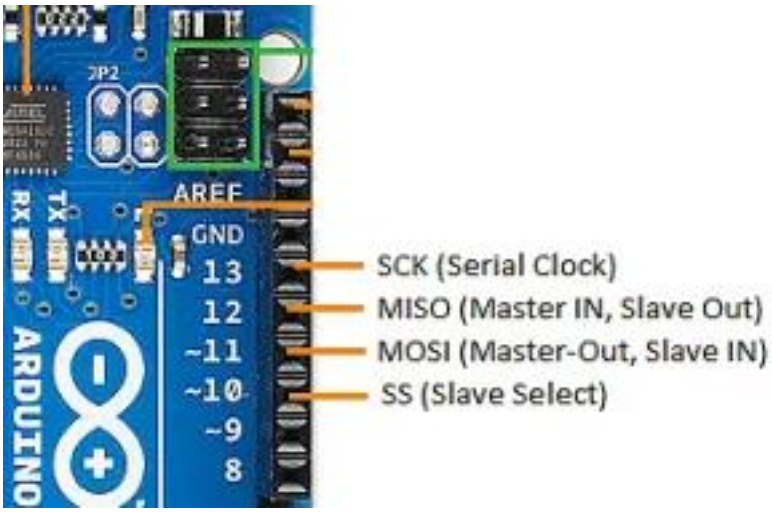


I2C Pins on Arduino UNO

I2C is the two-wire serial communication protocol. It stands for Inter-Integrated Circuits. The I2C uses two lines to send and receive data: a serial clock pin uses (SCL) and a serial data (SDA) (SDA) pin.

- **SCL**-It stands for **Serial Clock**. It is the pin or line that transfers the clock data. It is used to synchronize the shift of data between the two devices (master and slave). The Serial Clock is generated by the master device.
- **SDA**-It stands for **Serial Data**. It is defined as the line used by the slave and master to send and receive the data. That's why it is called the **data line,** while SCL is called a clock line.

SPI Pins on Arduino UNO pin diagram:



SPI Pins on Arduino UNO

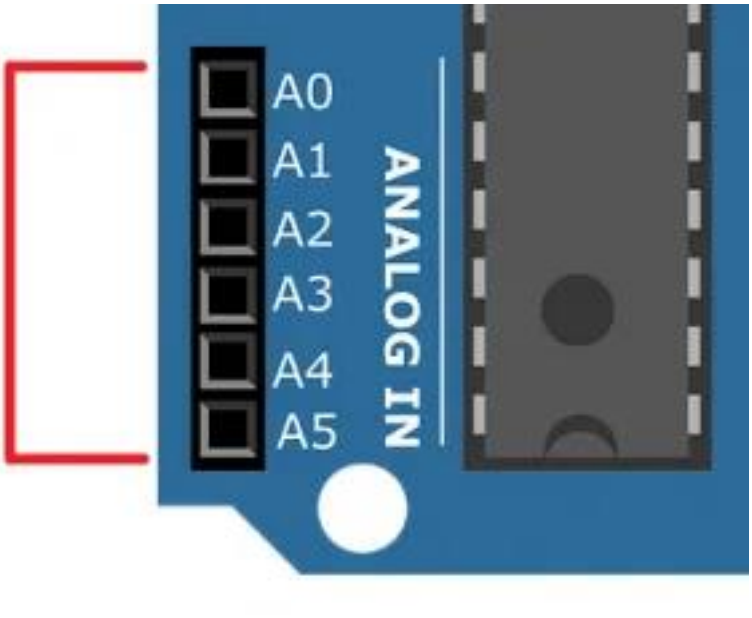
SPI stands for **Serial Peripheral Interface**. It is used by microcontrollers to communicate with one or more peripheral devices quickly.

- **SCK-**It stands for **Serial Clock**. These are the clock pulses, that is used to synchronize the transfer of data.
- **MISO-**It stands for **Master Input/ Slave Output**. This data line in the MISO pin is used to receive the data from the Slave.
- **MOSI-**It stands for **Master Output/ Slave Input**. This line is used for sending data to the peripherals.
- **SS-**It stands for **Slave Select**. This line is used by the master. It acts as the enable line. When a device's Slave Select pin value is LOW, it can communicate with the master. When it's value HIGH, it ignores the master. This allows us to have multiple SPI peripheral devices sharing the same MISO, MOSI, and CLK lines.

External Interrupts (2 and 3)- These pins can be used to trigger an interrupt on a low value, a rising or falling edge, or a change in value.

TXD and RXD-TXD and RXD pins are used for serial communication. The TXD is used to transmit the data, and RXD is used to receive the data. It also represents the successful flow of data.

Arduino Uno Pinout – Analog Pins:



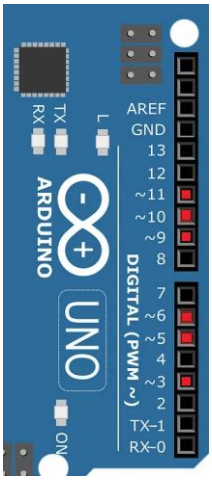
Analog Pins on Arduino UNO

The Arduino Uno consists of **6 analog pins**, which use ADC (Analog to Digital converter). These pins can serve as analog inputs but can also function as digital inputs or digital outputs. These pins accept inputs in the form of Analog signals and return values that range between 0 and 1023 (because the Arduino Uno has a **10-bit Analog to Digital converter** or **2^{10} resolution**).

An Analog to digital converter works in three stages: sampling, quantization, and digitization. Because the Arduino operates on a 0–5 volts range, the step size of the device is 5/1023=0.00488*volts* or 4.88*mV*.

Thus, we can interpret a 4.88 mV input voltage to any of the analog pins as 1, 9.77 mV as 2, and so on until 5 V as 1023. Anything below 4.88 mV is considered 0 and above 4.99 V as 1023.

PWM pins:

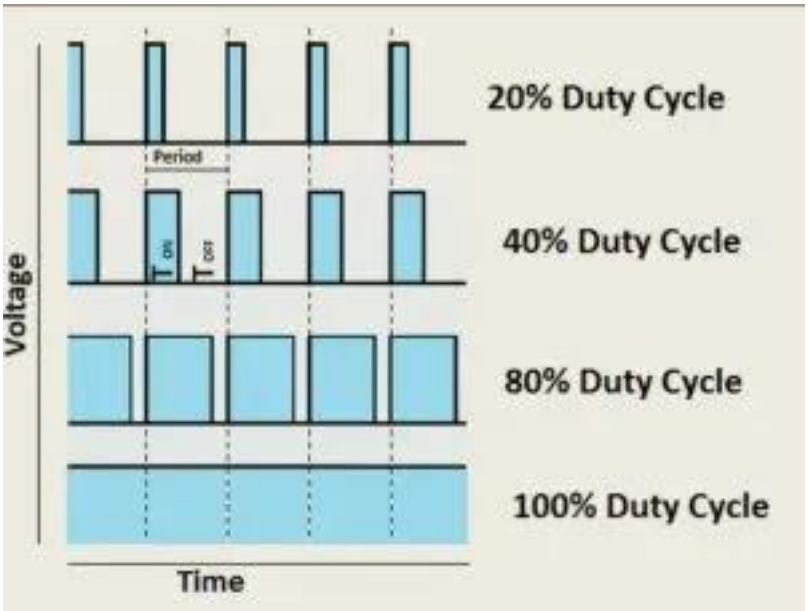


PWM pins of Arduino UNO

If you look closely, you will find the '~' symbol on digital pin **3,5,6,9,10, and 11**. These pins have an additional feature called PWM. Hence these pins are called PWM pins.

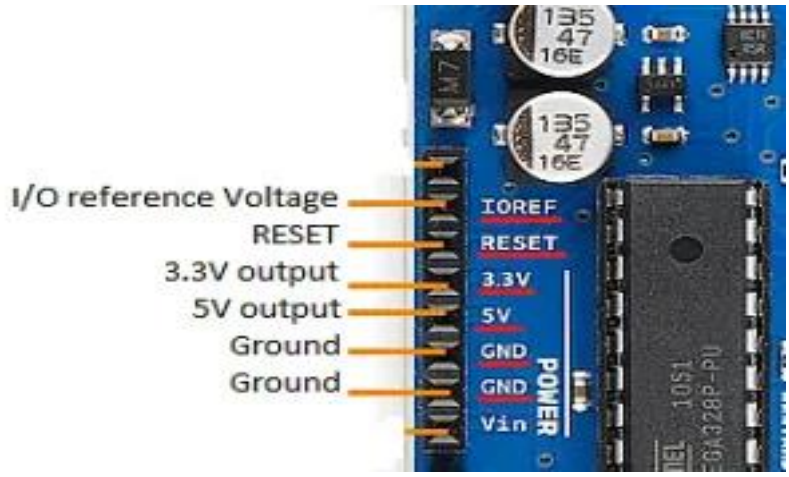
PWM stands for "Pulse Width Modulation". It means, that an analog value is being **modulated** on a digital signal. Suppose you want a DC motor to run at a certain analog voltage between 0 and 5 V. This is not possible because the Arduino board is MOSFET-based.

PWM Waveform with a Duty cycle



Thus, to attain the desired output, we can only s**imulate** an analog signal by switching our output on and off very quickly. Thus, PWM can only **mimic** and **simulate** the effects of a pure analog signal, it can never perform pure digital to analog conversion (which generally requires some active components like capacitors and inductors).

Other pins on Arduino UNO:



GND (Ground pins): There are 5 ground pins available on the board.

RESET – Use to reset the Arduino Board. If this pin is supplied with 5 V, the board will reset automatically.

I/O Reference Voltage (IOREF) – This pin is the input/output reference. It provides the voltage reference at which the microcontroller is currently operating. Sending a signal to this pin does nothing.

3.3V and **5V:** These pins provide regulated 5v and 3.3v respectively to the external components connected to the board.

V_{in}**–**It is the modulated DC supply voltage, which is used to regulate the IC's used in the connection. It is also called the primary voltage for IC's present on the Arduino board. The Vcc voltage value can be negative or positive to the GND pin.

CHAPTER-6

LCD DISPLAY

LCD DISPLAY

(Liquid Crystal Display)

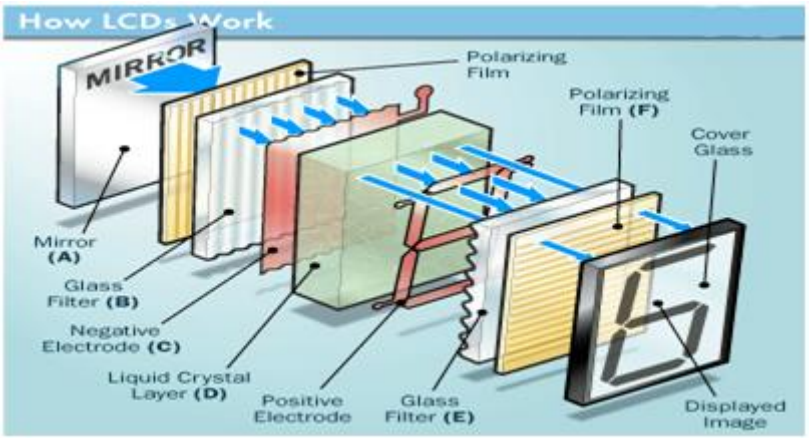
A liquid crystal display or LCD draws its definition from its name itself. It is combination of two states of matter, the solid and the liquid. LCD uses a liquid crystal to produce a visible image. Liquid crystal displays are super-thin technology display screen that are generally used in laptop computer screen, TVs, cell phones and portable video games. LCD's technologies allow displays to be much thinner when compared to cathode ray tube (CRT) technology.

Liquid crystal display is composed of several layers which include two polarized panel filters and electrodes. LCD technology is used for displaying the image in notebook or some other electronic devices like mini computers. Light is projected from a lens on a layer of liquid crystal. This combination of colored light with the grayscale image of the crystal (formed as electric current flows through the crystal) forms the colored image. This image is then displayed on the screen.

An LCD is either made up of an active matrix display grid or a passive display grid. Most of the Smartphone's with LCD display technology uses active matrix display, but some of the older displays still make use of the passive display grid designs. Most of the electronic devices mainly depend on liquid crystal display technology for their display. The liquid has a unique advantage of having low power consumption than the LED or cathode ray tube.

Liquid crystal display screen works on the principle of blocking light rather than emitting light. LCD's requires backlight as they do not emit light by them. We always use devices which are made up of LCD's displays which are replacing the use of cathode ray tube. Cathode ray tube draws more power compared to LCD's and are also heavier and bigger.

How LCDs are constructed?



Simple facts that should be considered while making an LCD:

1. The basic structure of LCD should be controlled by changing the applied current.
2. We must use a polarized light.
3. Liquid crystal should able to control both of the operation to transmit or can also able to change the polarized light.

As mentioned above that we need to take two polarized glass pieces filter in the making of the liquid crystal. The glass which does not have a polarized film on the surface of it must be rubbed with a special polymer which will create microscopic grooves on the surface of the polarized glass filter. The grooves must be in the same direction of the polarized film. Now we have to add a coating of pneumatic liquid phase crystal on one of the polarized filters of the polarized glass. The microscopic channel causes the first layer molecule to align with filter orientation. When the right angle appears at the first layer piece, we should add a second piece of glass with the polarized film. The first filter will be naturally polarized as the light strikes it at the starting stage.

Thus, the light travels through each layer and guided on the next with the help of molecule. The molecule tends to change its plane of vibration of the light in order to match their angle. When the light reaches to the far end of the liquid crystal substance, it vibrates at the same angle as that of the final layer of the molecule vibrates. The light is allowed to enter into the device only if the second layer of the polarized glass matches with the final layer of the molecule.

The angle of the top polarizing filter. As a result, a little light is allowed to pass the polarized glass through a particular area of the LCD. Thus, that particular area will become dark compared to other. The LCD works on the principle of blocking light. While constructing the LCD's, a reflected mirror is arranged at the back. An electrode plane is made of indium-tin oxide which is kept on top and a polarized glass with a polarizing film is also added on the bottom of the device. The complete region of the LCD has to be enclosed by a common electrode and above it should be the liquid crystal matter.

Next comes to the second piece of glass with an electrode in the form of the rectangle on the bottom and top, another polarizing film. It must be considered that both the pieces are kept at right angles. When there is no current, the light passes through the front of the LCD it will be reflected by the mirror and bounced back. As the electrode is connected to a battery the current from it will cause the liquid crystals between the common-plane electrode and the electrode shaped like a rectangle to untwist. Thus, the light is blocked from passing through. That particular rectangular area appears blank.

Advantages of an LCD's:

- LCD's consumes less amount of power compared to CRT and LED
- LCD's are consisting of some microwatts for display in comparison to some mill watts for LED's
- LCDs are of low cost
- Provides excellent contrast
- LCD's are thinner and lighter when compared to cathode ray tube and LED.

Disadvantages of an LCD's:

- Require additional light sources
- Range of temperature is limited for operation
- Low reliability
- Speed is very low
- LCD's need an AC drive

Applications of Liquid Crystal Display

Liquid crystal technology has major applications in the field of science and engineering as well on electronic devices.

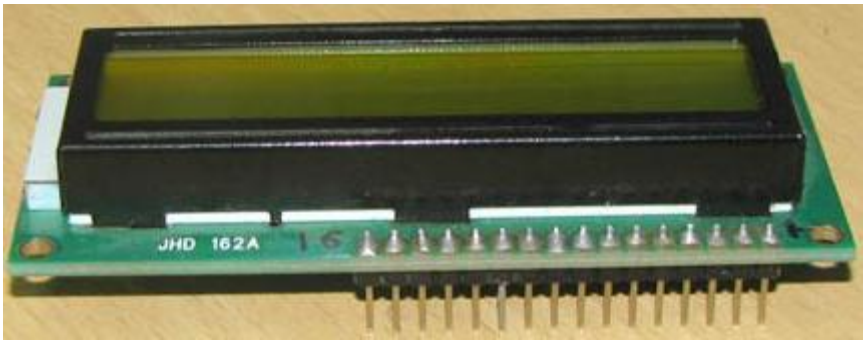
- Liquid crystal thermometer
- Optical imaging
- The liquid crystal display technique is also applicable in visualization of the radio frequency waves in the waveguide
- Used in the medical applications.

LCD (Liquid Crystal Display)

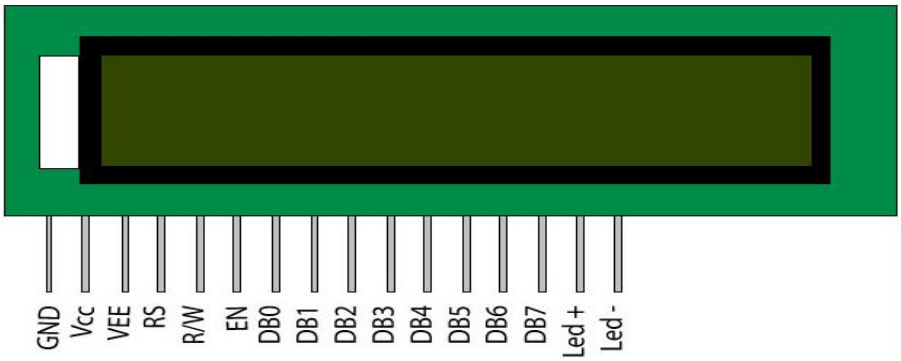
LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters , animations and so on.

A **16x2 LCD** means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD. Click to learn more about internal structure of a LCD.


JHD 162A

Pin Diagram:


GND
Vcc
VEE
RS
R/W
EN
DB0
DB1
DB2
DB3
DB4
DB5
DB6
DB7
Led +
Led -

Pin Description:

Pin No	Function	Name
1	Ground (0V)	Ground
2	Supply voltage; 5V (4.7V – 5.3V)	Vcc
3	Contrast adjustment; through a variable resistor	V_{EE}
4	Selects command register when low; and data register when high	Register Select
5	Low to write to the register; High to read from the register	Read/write
6	Sends data to data pins when a high to low pulse is given	Enable
7	8-bit data pins	DB0
8		DB1
9		DB2
10		DB3
11		DB4
12		DB5
13		DB6
14		DB7
15	Backlight V_{CC} (5V)	Led+
16	Backlight Ground (0V)	Led-

CHAPTER-7

INVERTER

INVERTER

Working of DC to AC Inverter and its Applications:

In most of the mini electronic projects, the conversion of DC voltage to AC voltage is a common problem. In any circuit, we can observe that if we design a circuit that takes the AC input and gives DC output. But, if we want to change the circuit from DC to AC, a DC to AC converter circuit is used. The inverter (converter) is frequently required in the circuits like where DC to AC conversion is not possible. So, an inverter circuit is employed for converting the DC to AC converter.

The converter is a power electronic device, used to convert DC to AC. These devices use switching devices. The DC to AC conversion can be done among 12V, 24V, 48V to 110V, 120V, 220V, 230V, 240V with supply frequency 50Hz/60Hz. For a better understanding of this concept here is a simple 12V DC to 220V AC Converter circuit which is designed to convert DC to AC.

DC to AC converters is mainly designed for changing a DC power supply to an AC power supply. Here, DC power supply is comparatively stable as well as positive voltage source whereas AC oscillates approximately a 0V base stage, typically in a sinusoidal or square or mode.

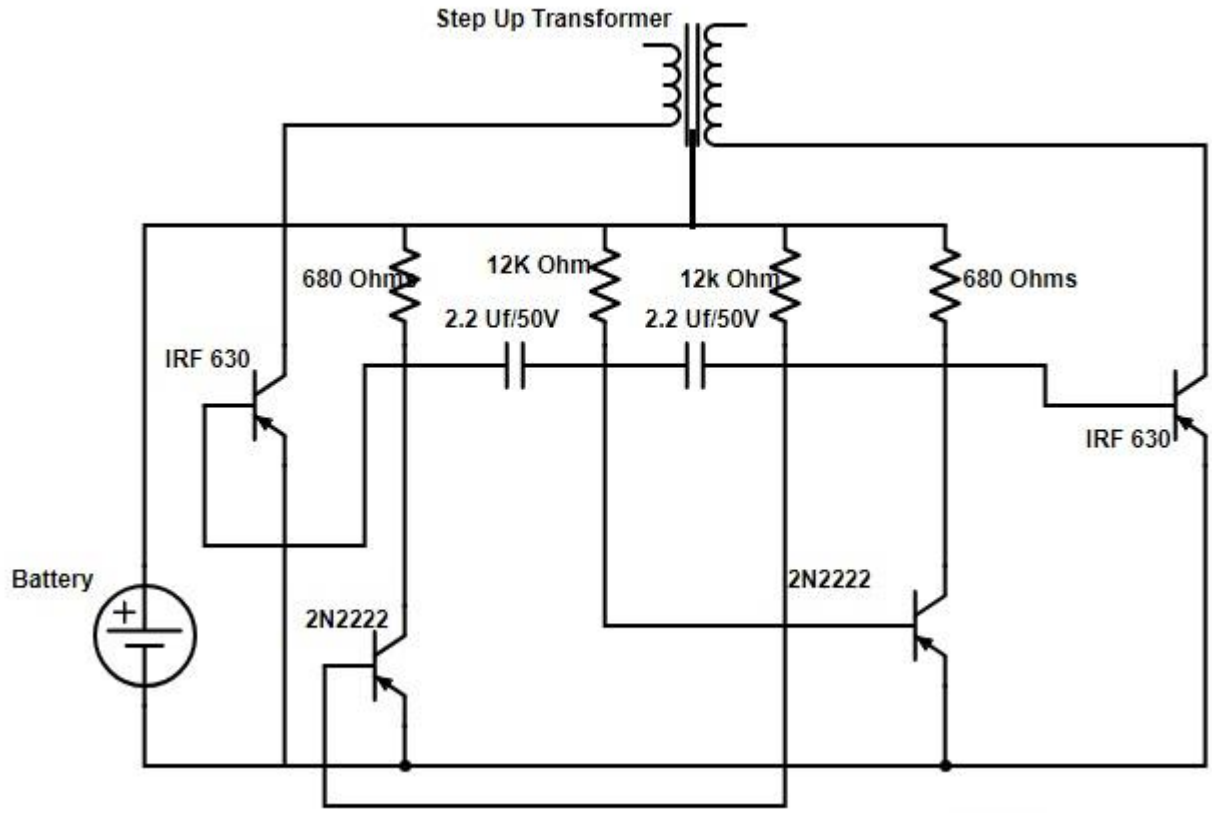
The common inverter technology used in electronics is to convert a voltage source from a battery into an AC signal. Generally, they operate with 12 volts and commonly used in applications like automotive, lead-acid technology, photovoltaic cells, etc.

A transformer coil system & a switch is the simple circuit used for an inverter. A typical transformer can be connected toward the DC signal's input through a switch to oscillate back quickly. Due to the current flow in bi-directional in the primary coil of the transformer, an alternating current signal is an output throughout the secondary coils.

How to Make a DC to AC Inverter?

The DC to AC Converter Circuit using Transistors is shown below. The basic function of an inverter circuit is to generate oscillations with the specified DC & apply these to the transformer's primary winding by increasing the current. This main voltage is then step up to a high voltage based on the number of twists within main and minor coils.

The circuit diagram of 12V DC-to-220V AC converter can be built with using simple transistors, and this circuit can be employed for powering lamps up to 35Watts although they can be designed for driving more influential loads by utilizing more MOSFETs.



DC to AC Converter Circuit using Transistors

The inverter executed in this circuit can be a square wave, & it works with devices like which do not need pure AC sine wave.

The required components to build DC to AC circuit mainly includes 12v Battery, 2N2222 Transistors, two MOSFET IRF 630, 2.2uf capacitors-2, two Resistors-12k, two 680-ohm resistors, and centre tapped transformer (step up).

Working of DC to AC circuit:

The DC to AC circuit can be separated into three portions namely amplifier, transistor, **an oscillator**. As the AC supply frequency is 50Hz then a 50Hz oscillator is used. This can be attained by designing an astable multivibrator which generates a 50Hz square wave signal. The oscillator can be formed using the resistors like R1, R2, R3, R4, capacitors like C1, & C2, and transistors like T2 & T3.

Every transistor generates square waves (inverting), and the frequency will be decided by the resistor and capacitor values. The frequency formula for the generated square wave with the astable multivibrator is

$F = 1/ (1.38 * R2 * C1)$.

The oscillator inverting signals are improved with the two Power MOSFETs such as T1 & T4, and these signals will give to the step-up transformer by its centre tap associated with 12V DC.

Limitations of DC to AC Inverter

The limitations of DC to AC converter include the following.

- The transistors usage can reduce the circuit efficiency
- The usage of switching transistors can cause cross over distortion within the o/p signal. But this limit can be reduced to some level by using biasing diodes.

DC to AC Inverter Applications

The applications of DC to AC converter circuit include the following.

- The DC to AC converters is used in a vehicle to charge their batteries.
- These circuits are mainly used for driving low-power AC motors and used in a solar power system.

Thus, this is all about DC to AC converter. These can be used in dc transmission lines for transmitting power to loads. In uninterruptable power supplies, these can be used to convert direct current to alternating current. Converters can be used in industries where consistency is a problem.

Requirement of Changing from DC to AC?

Most of the vehicles use their power from a battery of 12V. But in some cases, a 24v battery can be used. It is very significant to know the vehicle voltage due to the voltage rating of the inverter we choose must equal the battery's voltage.

In any case, the battery gives DC, which means the flow of current will be continuous from the battery's negative terminal to the positive terminal. In DC, the flow of current will be only in one direction. DC is extremely helpful; however, batteries can normally provide somewhat DC power with low voltage. Several devices require extra power to work correctly than DC can offer.

CHAPTER-8

TRANSFORMER

Transformer

Definition:

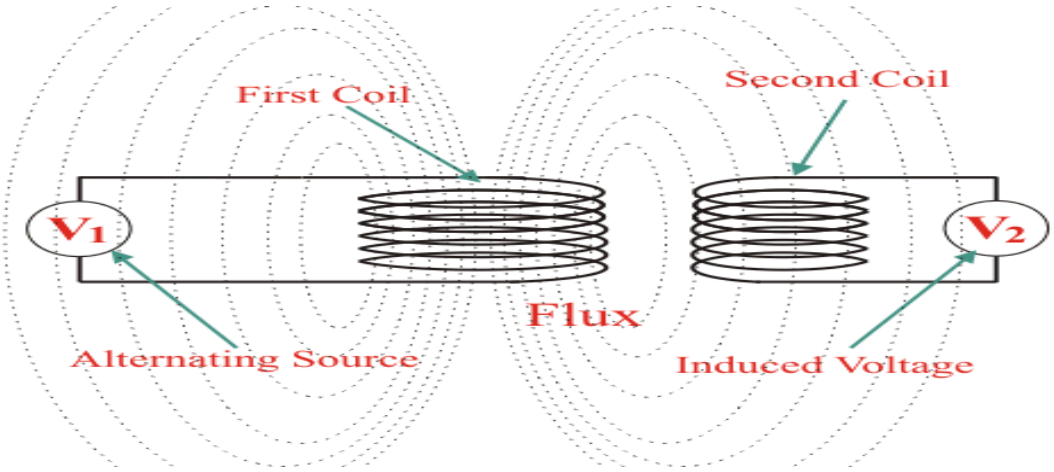
Electrical transformer is a static device which transforms electrical power from one circuit to another without any direct electrical connection and without changing frequency of power but maybe in different voltage levels with the help of mutual induction.

Working Principle of Transformer

The **working principle of transformer** is very simple. Mutual induction between two or more windings is responsible for transformation action in an electrical transformer**.**

Basic Theory of Transformer

Say you have one winding which is supplied by an alternating electrical source. The alternating current through the winding produces a continually changing and alternating flux that surrounds the winding. If any other winding is brought nearer to the previous one, obviously some portion of this flux will link with the second. As this flux is continually changing in its amplitude and direction, there must be a changing flux linkage in the second winding or coil. According to Faraday's law of electromagnetic induction, there must be an EMF induced in the second. If the circuit of the later winding is closed, there must be a current flowing through it. This is the most basic thing on which the **working principle of transformer** stands. The winding which takes electrical power from the source, is known as the primary winding. Here in our above example, it is first winding.



The winding which gives the desired output voltage due to mutual induction is commonly known as the secondary winding. Here in our example, it is second winding.

Main Constructional Parts of Transformer

The three main parts of a transformer are,

Primary Winding of Transformer
Which produces magnetic flux when it is connected to electrical source.

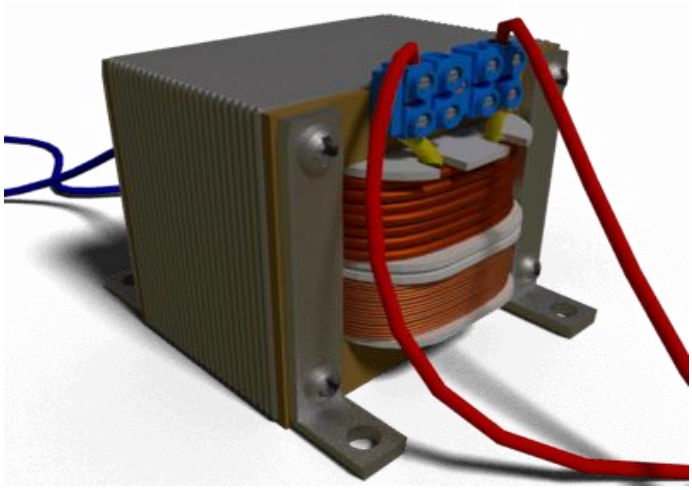
Magnetic Core of Transformer
The magnetic flux produced by the primary winding, that will pass through this low reluctance path linked with secondary winding and create a closed magnetic circuit.

Secondary Winding of Transformer
The flux, produced by primary winding, passes through the core, will link with the secondary winding. This winding also wounds on the same core and gives the desired output of the **transformer**.

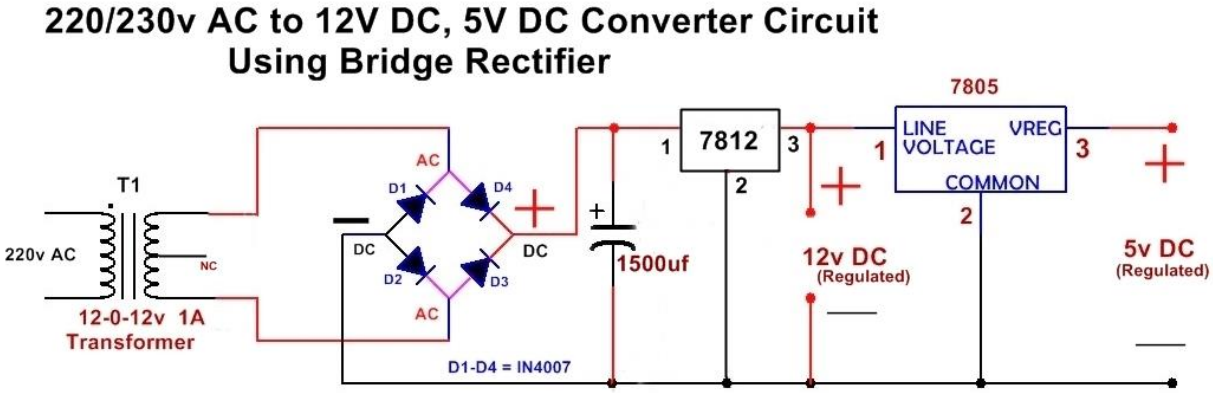
CHAPTER-9

POWER SUPPLY

AC TO DC Converter



In many electronics projects we see that there is requirement of fixed voltage power supply, fixed means no any fluctuation in voltage. output of any circuit is fully depending on input voltage supply and it should be constant. Any sensitive circuit is more essential to operate on regulated power than any normal circuit. If I use RF operation in any circuit then its frequency must be constant because there is a small bit of voltage and current fluctuation make more variation of output signal. We use voltage regulator to regulate the voltage supply which maintain constant supply.220/230v ac to 12v/5v DC Regulated Power DC converter Bridge Rectifier.



1. The first stage is in AC to DC is to make down the voltage as required level using step down transformer

2. Second stage is the Rectifying the signal, Rectifiers are used to rectifying the signal. Rectifying means convert the ac signal to dc as possible.

3. Third stage is Filter the signal. After rectifying the signal, it consists ripple noise in dc signal that is not perfectly suitable for operate the circuit. Capacitor is used to filter the signal.

4. Fourth stage is the Regulation, Regulation make the more stable of any signal to give the circuit to constant supply. Regulator IC or Zener diode is used to make the constant signal.

78xx series voltage regulator

IC Number	Output Voltage (+)	Minimum Input voltage
7805	5v	7v
7806	6v	8v
7808	8v	10v
7809	9v	11v
7812	12v	15v

Components/parts

- 12-0-12 1 A transformer
- Diode in4007-4
- Capacitor 1500uf 25v-1, 0.1uf-2
  LM7805 ic-1, for 5v and 7812 for 12v
- You need 9v dc then use 7809 and 7805 for 5v.
- minimum 15 v input power is required for regulation of 12v using 7812

CHAPTER-10

CODIING

CODING:

```
#include &lt;LiquidCrystal.h&gt;
LiquidCrystal lcd(A0,A1,A2,A3,A4,A5);
int solar = 10; // connect ir sensor module to Arduino pin 9
int charge = 8;
int solarout =13;

void setup()

{
Serial.begin(115200); // Init Serila at 115200 Baud
Serial.println(&quot;Serial Working&quot;); // Test to check if serial is working or not
pinMode(solar, INPUT); // IR Sensor pin INPUT
pinMode(charge, INPUT); // LED Pin Output
pinMode(solarout, OUTPUT); // LED Pin Output
lcd.begin(16,2);
lcd.clear();
lcd.setCursor(0,0);
lcd.print(&quot; SPC ECE &quot;);
lcd.setCursor(0,1);
lcd.print(&quot; WELCOMES YOU &quot;);
delay(2000);
lcd.clear();
lcd.setCursor(0,0);
lcd.print(&quot; THANKS TO HOD &quot;);
lcd.setCursor(0,1);
lcd.print(&quot;Dr S SENTHILARASU&quot;);
delay(2000);
```

```
lcd.clear();
lcd.setCursor(0,0);
lcd.print(&amp;quot;THANKS TO GUIDE &amp;quot;);
lcd.setCursor(0,1);
lcd.print(&amp;quot;K SARAVANAN, ME &amp;quot;);
delay(2000);

lcd.clear();
lcd.setCursor(0,0);
lcd.print(&amp;quot; SUBMITTED BY &amp;quot;);
lcd.setCursor(0,1);

lcd.print(&amp;quot; KOWSALYA M &amp;quot;);
delay(2000);
lcd.clear();
lcd.setCursor(0,0);
lcd.print(&amp;quot; YASHVANTH K &amp;quot;);
lcd.setCursor(0,1);
lcd.print(&amp;quot; THANGARAJ S &amp;quot;);
delay(2000);
lcd.clear();
lcd.setCursor(0,0);
lcd.print(&amp;quot; DEEPAK D &amp;quot;);
lcd.setCursor(0,1);
lcd.print(&amp;quot; NAVEENKUMAR R &amp;quot;);
delay(2000);
lcd.clear();
lcd.setCursor(0,1);
lcd.print(&amp;quot; THANKS TO ALL &amp;quot;);
```

```
delay(2000);
lcd.clear();
lcd.setCursor(0,0);
lcd.print(&quot; SOLAR eVEHICLE &quot;);
lcd.setCursor(0,1);
lcd.print(&quot;CHARGING SYSTEM &quot;);
delay(2000);
}

void loop()
{

CAR();
int sensorStatus = digitalRead(solar); // Set the GPIO as Input
if (sensorStatus == 1) // Check if the pin high or not
{
Serial.println(&quot;Solar Power Ok&quot;); // print Motion Detected! on the serial monitor window
lcd.clear();
lcd.setCursor(0,0);
lcd.print(&quot; SOLAR POWER &quot;);
lcd.setCursor(0,1);
lcd.print(&quot; AVAILABLE &quot;);
}
else

{
// digitalWrite(solar,LOW); // LED High
Serial.println(&quot;Solar Power Off&quot;); // print Motion Ended! on the serial monitor window
```

```
lcd.clear();
lcd.setCursor(0,0);
lcd.print(&quot; SOLAR POWER &quot;);
lcd.setCursor(0,1);
lcd.print(&quot; OFF &quot;);
delay(2000);
}
}
void CAR()
{
int sensorStatus1 = digitalRead(charge); // Set the GPIO as Input
if (sensorStatus1 == 0) // Check if the pin high or not
{
Serial.println(&quot;charging&quot;);
digitalWrite(solarout,HIGH);
lcd.setCursor(0,0);
lcd.print(&quot; WIRELESS &quot;);
lcd.setCursor(0,1);
lcd.print(&quot; CAR CHARGING &quot;);
}
else
{
digitalWrite(solarout,LOW);
}
delay(1000);
}
```

CHAPTER-11

COST ANALYSIS

COST ANALYSIS:

S.NO	NAME OF THE COMPONENTS	QUANTITY	COST in Rs.
1.	ARDUINO MODULE	1	1200.00
2.	LCD MODULE	1	200.00
3.	SOLAR PANEL	1	1500.00
4.	IR SENSOR	1	50.00
5.	SWITCH	4	50.00
6.	BATTERY	1	1000.00
7.	TRANSFORMER	1	250.00
8.	BRIDGE RECTIFIER	1	50.00
9.	CAPACITOR (1000uf)	1	10.00
10.	CAPACITOR (100uf)	2	5.00
11.	CAPACITOR(0.01UF)	1	2.00
12.	RESISTOR (2k2)	5	10.00
13.	REGULATOR (7805)	1	15.00
14.	REGULATOR (7812)	1	15.00
15.	LED	1	2.00
16.	TRANSMITTER COIL	1	350.00
17.	RECEIVER COIL	1	500.00
18.	IRF540	1	150.00
19.	MAINS CARD	1	50.00
20.	HYLAM SHEET	1 X 1	200.00
21	PCB	ALL	500.00
	TOTAL COST		**6109.00**

CHAPTER-12

CONCLUSION

CONCLUSION:

According to the analysis of the cost performance, energy transfer efficiency and transmission distance, it is found that MCR-WPT is the most suitable technology for EVs application. Besides, the current status of wireless charging technology research in various countries is briefly introduced. Then wireless charging technology is introduced from dynamic and static aspects. After that, the standards for wireless charging technology are listed. Three organizations currently developing WEVC standards are introduced — the International Electrotechnical Commission, the Society of Automotive Engineers and the International Standardization Organization. An analysis of the economic and security aspects of wireless charging and wired charging is shown at the end. Wireless charging technology for electric vehicles has been widely studied, and some progress has been made. However, there are still some problems that need to be solved, such as the cost of the transmission equipment, the efficiency and the distance of energy transmission. In conclusion, WEVC has strong adaptability to the requirement, based on different principles, it can achieve different effect. Compared to wired charging, WEVC has no physical damaged with high safety, more in line with sustainable development, to meet the requirements of people's lives. Therefore, WEVC will definitely become a dominant charging method of EV age.

CHAPTER-13

REFERENCE

REFERENCES:

[1] C. Zhang and K. S. Suslick, “Colorimetric sensor array for soft drink analysis”,

J. Agric Food Chem, vol 55, pp 237-242, 2007.

[2] P. D. Oram and J. Strine, “Color measurement of a solid active pharmaceutical ingredient as an aid to identifying key process parameters”, J. Pharm Biomed Anal, vol 40, pp 1021-1024, 2006.Author, Title of the Book, Publisher, (200X).

[3] M. Frank, Nobert Kaiser, Wolfgang Buss, Ramona Eberhardt, “High-speed industrial color and position sensors”, Electronic Imaging’99, pp 50-57, 1999.

[4] A. Pacquit, J. Frisby, Danny Diamond, King Tong Lau, Alan Farrell, Brid Quilty, Dermot Diamond, “Development of a smart packaging for the monitoring of fish spoilage”, Food Chem, vol 102, pp 466-470, 2007.

[5] E. J. Cadieux Jr, “System and method for visually inspecting a cigarette packaging process”, ed: Google Patents, 2002.