EFFICIENT SOLAR BASED FAST WIRELESS VEHICLE CHARGING STATION

A Thesis Submitted

In Partial Fulfilment of the Requirements

for the Degree of

BACHELOR OF TECHNOLOGY

in

ELECTRONICS AND COMMUNICATION ENGINEERING

By

Anukalp Kumar (2020041039)

Under the Supervision of

Dr. Sudhanshu Verma
Assistant Professor, ECED

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Madan Mohan Malaviya University of Technology Gorakhpur, (U.P.) INDIA

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CERTIFICATE

Certified that **Qudusiya Sahin(2020041109), Shubham Tripathi(2020041140), Anukalp Kumar(2020041039), Ashvani Kumar(2020041052)** has carried out the research work presented in this report entitled **"Efficient Solar Based Fast Wireless Vehicle Charging Station"** for the award of **Bachelor of Technology** in Electronics and Communication Engineering from **Madan Mohan Malaviya University of Technology, Gorakhpur** under my supervision and guidance. The report embodies result of original work and studies carried out by Student themselves and the contents of the thesis do not form the basis for the award of any other degree to the candidate or to anybody else.

Dr. Sudhanshu Verma
Assistant Professor
Department of ECE
M.M.M.U.T Gorakhpur

Date: 27 May 2024

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Anukalp Kumar

Roll No. 2020041039

Department of Electronics and Communication Engineering

Date: 27 May 2024

APPROVAL SHEET

This project report entitled "**Efficient Solar Based Fast Wireless Vehicle Charging Station**" by **Qudusiya Sahin (2020041109), Shubham Tripathi (2020041140), Anukalp Kumar (2020041039), Ashvani Kumar (2020041052)** is approved for the degree of **Bachelor of Technology** in Electronics and Communication Engineering.

Examiner

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Supervisor

Dr. Sudhanshu Verma

……..

Head of Department

Prof. Sanjay Kumar Soni

…….

Date: 27 May 2024

Place: Gorakhpur

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It is a matter of great pleasure and satisfaction for us to present this dissertation work entitled "**Efficient Solar Based Fast Wireless Vehicle Charging Station**", as a part of curriculum for award of "Bachelor of Technology".

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Anukalp Kumar (2020041039)

Date: 27 May 2024

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ABSTRACT

As the new era of the automobile, the industry is rapidly transforming from an IC engine vehicle to an electric vehicle. The demand for an electric vehicle is increasing, these lead to an increase in charging station as well. In this project, a wireless charging system is used to charge the vehicle wirelessly via inductive coupling. we just simply need to park the car on the charging spot. The transmission of electrical energy from source to load from a distance without any conducting wire or cables is called Wireless Power Transmission. This system doesn't require any human interaction. Wireless power transmission might be one of the technologies that are one step towards the future. This project can open up new possibilities of wireless charging that can use in our daily lives.

Wireless power transfer (WPT) using magnetic resonance is the technology which could set human free from the annoying wires. In fact, the WPT adopts the same basic theory which has already been developed for at least 30years with the term inductive power transfer. WPT technology is developing rapidly in recent years. At mill watts to kilowatts power level, the power transfer distance increases from several millimetres to several hundred millimetres with a load efficiency above 90%. The advances make the WPT very attractive to the electric vehicle (EV) charging applications in both stationary and dynamic charging scenarios. This seminar represents the technologies in the WPT area applicable to EV wireless charging. By introducing WPT in EVs, the obstacles of charging time, range, and cost can be easily mitigated. Battery technology is no longer relevant in the mass market penetration of EVs. It is hoped that researchers could be encouraged by the state-of-the-art achievements and push forward the further development of WPT as well as the expansion of EV.

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CHAPTER 1.
INTRODUCTION

We live in a world of technological advancement. New technologies emerge each and every day to make our life simpler. Despite all these, we still rely on the classical and conventional wire system to charge our everyday electronic gadgets. The conventional wire system creates a mess when it comes to charging several electric vehicles simultaneously. It also takes up a lot of electric sockets at the charging port. At this point, a question might arise. ―What if a single technology can be used to charge these electric vehicles simultaneously without the use of wires and not creating a mess in the process? We gave it a thought and came up with an idea. The solution to this problem is inductive coupling, a simple and effective way of transferring power wirelessly.

Road transportation is the majorly used transportation in the entire world. Usage of the car has drastically increased and the need for petrol and diesel has increased. So recently, Electric vehicles (EVs) are becoming popular, as they decrease reliance on fossil fuels and reduce greenhouse emissions. The problem of the Electric Vehicle is nothing else but the electricity storage technology, which is the major drawback today due to its unsatisfactory energy density, limited lifetime, and high cost. So, our project proposes a novel idea to charge the Electric vehicle wirelessly through the inductive power transfer principle using the transmitting and receiving coil while simultaneously decreasing the battery size and improving the convenience and without the requirement of the cable. The electric vehicle can be charged both by the static wireless power transmission (SWPT) and dynamic wireless power transmission (DWPT) method.

1.1 Wireless Power Transmission (WPT)

Wireless Power Transmission (WPT) is the efficient transmission of electric power from one point to another point through a vacuum or an atmosphere without the use of wire or any other substance. This can be used for applications where either an instantaneous amount or a continuous delivery of energy is needed, but where conventional wires are unaffordable, inconvenient, expensive, hazardous, unwanted, or impossible. The power can be transmitted using Inductive coupling for short-range, Resonant Induction for mid-range and Electromagnetic wave power transfer for high

range. WPT is a technology that can transport power to locations, which are otherwise not possible or impractical to reach. Charging the battery of electric vehicles by means of inductive coupling could be the next big thing.

1.2 Solar Energy

The complete system will be solar powered which will ensure renewable energy source. Solar power is completely clean, it produces no air pollution, no water pollution, and no greenhouse gas effects. It is also carbon-free, no harmful emissions are released when electricity is being produced by solar panels. It also reduces the need for finite resources. Solar panel systems are extremely durable and require little to no maintenance over their productive lifetime, which can span 25 years or more. Solar systems are also extremely easy to maintain. The main maintenance that these panels require is an occasional dusting to remove dirt, leaves, or any other fragments. One can always call a professional, to clean these panels once in a while.

1.3 Requirement

With the development of human society, the problem of global warming caused by greenhouse gas emissions and the emission from fossil fuels has intensified accordingly, and the importance of energy conservation and emission reduction becomes more significant. As most of the industries releasing greenhouse gas emissions, the transportation industry has attracted the attention of countries all over the world. As a well-known clean energy source, electrical energy can be converted to renewable energy sources. Compared to the traditional vehicles powered by fossil fuels, Electric Vehicles, which are driven by electric energy, have a unique zero-emission advantage. That is why EVs are undoubtedly the best choice for the transportation industry to promote energy structure optimization. However, the high cost, limited capacity, and the cruising range of electric vehicle battery packs limit the further promotion of EVs. Compared to the traditional plug-in-charging method, there is no physical connection between the source and the load during the wireless power transmission (WPT) charging process, therefore the charging process is flexible and safer, which makes WPT a significant method. The Wireless power transfer technology is divided into static wireless power transmission (SWPT) and dynamic wireless power transmission (DWPT). DWPT charging is developed based on SWPT charging, which

can effectively reduce the volume of the vehicle's battery pack, increases the cruising range, and further and improves the convenience of charging. The main objective of the project work area, the installation of the wireless charging path (WCP) in the Electric Vehicle Service Road (EVSR) since service roads will be easy for charging the electric vehicles wirelessly while traveling. To provide the non-cable system. To reduce the complexity of the charging process of electric vehicles. The power required to charge an electric vehicle is generated from the solar panel.

1.4 Existing system

In the existing system, a charging module is installed under slots of parking roads in public places. The drawback of this system is that an EV can only be charged when it is parked at a dedicated location that is installed with a charging point. This creates many serious problems. First, an EV must leave the dedicated parking space immediately after being charged, so that the charging point can be used to serve another EV. This may not happen all the time. Second, with increasing EV penetration, all parking spaces may require the installation of a charging point. This will increase the cost of providing charging infrastructure which may not be utilized 100% of the time.

1.5 Objective

The objective of this paper is to implement an electric vehicle wireless charging station and charging platform to transmit electrical power wirelessly through space and charge the battery of an electric vehicle. The system will work by using inductive coupling to transmit power from a transmitter to a resistive load or battery of an electric vehicle.

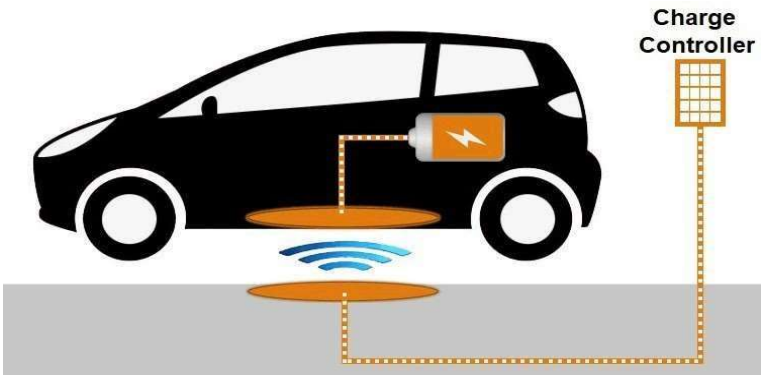

Fig1.1 Wireless EV Charging

CHAPTER 2.

LITERATURE REVIEW

Supriyadi and Edi Rakhman. [1] demonstrate the effect of wire diameter (AWG) and a number of turns used is directly proportional to the amount of power that can be transferred. When the number of windings increases, more the power will be transferred. When we use the enameled copper wire of 0.5mm diameter and keep the number of turns to 26, and apply the input frequency of 470KHz. The power efficiency obtained at a distance of 1 cm is about 1.51%. This result can turn on 1 Watt LED lamp.

N. Uthaya Banu and U. Arun Kumar. [2] This study representing the various technologies related to Wireless Power Transfer System, which is used to avoid the flux leakage during the transmission of power and to operate the cars with high efficiency and improve the quality parameters. This project also shows the progress of generating power source through renewable energy.

Govind Yatnalkar and Husnu Narman. [3] present a survey of Duration of Charging of Electric Vehicles is limited. Therefore, wireless charging is important for Electric Vehicles in order to overcome the charging duration problem. This paper also provides a current scenario of the art in electric vehicle wireless charging and the parameters that require for charging section. The most important parameters for electric vehicle wireless charging are the distance between the transmission and reception coils, the position of the coils placed on Electric Vehicle, battery sizes, and the time for charging.

Electrical vehicles require a charging station similar to current fuel car require a petrol pump and obviously charging takes some time so it is better to charge the car when it is parked, therefore it is efficient to combine both the charging and parking system which is based on the IoT technology which makes the system user friendly. One can upload information on cloud and simultaneously on smart phones. Car safety while parking is one of the issues faced by people. The internet of things (IoT) is best platform for monitoring the status of WPT system which is able to provide the wider connectivity, modified sensing, information processing and greater flexibility. So, With the help of IoT, it is easy to monitor vehicle parking as well as charging of vehicles when they are parked at the same time that means it helps in synchronized parking. Another important factor of using IoT is we can store data on cloud that we can access

anytime from anywhere, which makes life easy and simple. Thus, there are many advantages of this system. Thus, approaches to support electric vehicles and their charging demands are needed which should be able to use parking and charging infrastructures as efficiently as possible.

It considers two types of EV based on their mobility. One is regular EVs and another is irregular EVs. Electrical Vehicles require sufficient time for charging.

In this study, an intelligent WPT system is introduced and simulated to charge EV. For EV charging, Wireless power transfer is a new field of development.

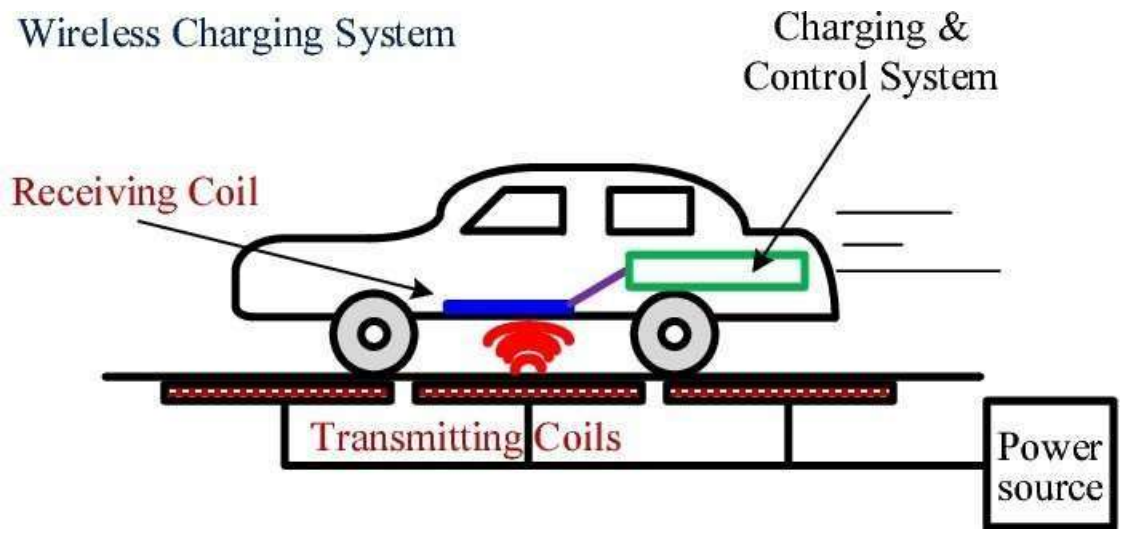

Fig 2.1 Wireless Charging System

CHAPTER 3.
SYSTEM COMPONENTS

3.1 Software

The ATMega328p microcontroller IC with Arduino bootloader makes a lot of work easier in this project as Arduino code is written in C++ with an addition of special methods and functions, which we'll mention later on. C++ is a human-readable programming language. When you create a 'sketch' (the name given to Arduino code files), it is processed and compiled to machine language.

The Arduino Integrated Development Environment (IDE) is the main text editing program used for Arduino programming. It is where you'll be typing up your code before uploading it to the board you want to program. Arduino code is referred to as sketches.

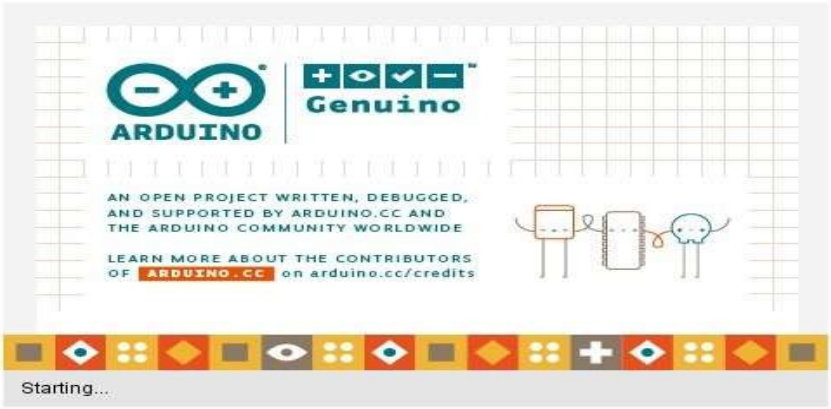

Fig 3.1 Arduino IDE

3.2 Hardware

1. Arduino NANO Microcontroller
2. IR Sensors
3. Copper Coil
4. MOSFET
5. 16x2 LCD Display
6. Potentiometer

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20. Transformer
21. Diodes
22. Capacitor

3.2.1 Arduino Nano:

Arduino boards are widely used in robotics, embedded systems, automation, Internet of Things (IoT) and electronics projects. These boards were initially introduced for the students and non-technical users but nowadays Arduino boards are widely used in industrial projects.

"The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328P released in 2008. It offers the same connectivity and specs of the Arduino Uno board in a smaller form factor. The Arduino Nano is equipped with 30 male I/O headers, in a DIP30-like configuration, which can be programmed using the Arduino Software integrated development environment (IDE), which is common to all Arduino

boards and running both online and offline. The board can be powered through a type-B mini-USB cable or from a 9 V battery."

Technical Specifications:

- Microcontroller: Microchip ATmega328P
- Operating voltage: 5 volts
- Input voltage: 6 to 20 volts
- Digital I/O pins: 14 (6 optional PWM outputs)
- Analog input pins: 8
- DC per I/O pin: 40 mA
- DC for 3.3 V pin: 50 mA
- Flash memory: 32 KB, of which 0.5 KB is used by bootloader
- SRAM: 2 KB
- EEPROM: 1 KB
- Clock speed: 16 MHz
- Length: 45 mm
- Width: 18 mm
- Mass: 7 g
- USB: Mini-USB Type-B [5]
- ICSP Header: Yes
- DC Power Jack: No

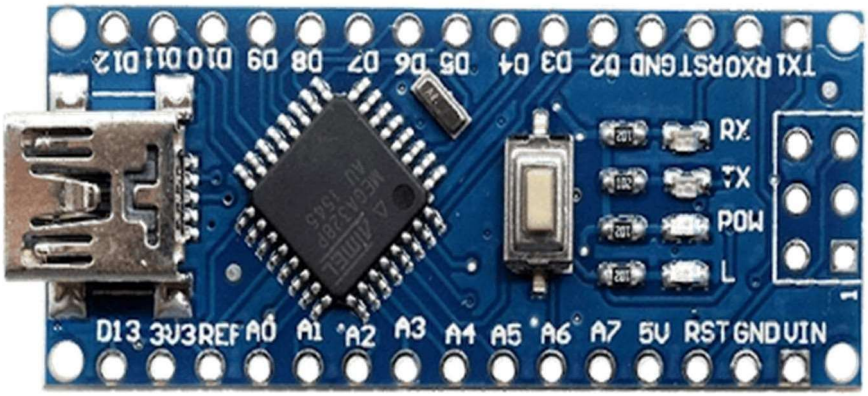

Fig 3.2 Arduino Nano

Table No. 3.1 Features of Arduino Nano

No.	Nano Features	Value
1	Microcontroller	Atmega328p
2	Crystal Oscillator	16MHz
3	Operating Voltage	5V
4	Input Voltage	6V-12V
5	Maximum Current Rating	40mA
6	USB	Type-B Micro USB
7	ICSP Header	Yes
8	DC Power Jack	No

Table No. 3.2 Pin Description of Arduino Nano

No.	Pin Number	Pin Description
1	D0 – D13	Digital Input / Output Pins.
2	A0 – A7	Analog Input / Output Pins.
3	Pin # 3, 5, 6, 9, 10, 11	Pulse Width Modulation (PWM) Pins.
4	Pin # 0 (RX) , Pin # 1 (TX)	Serial Communication Pins.
5	Pin # 10, 11, 12, 13	SPI Communication Pins.
6	Pin # A4, A5	I2C Communication Pins.
7	Pin # 13	Built-In LED for Testing.
8	D2 & D3	External Interrupt Pins.

Table No. 3.3 Communication Protocols in Arduino Nano

No.	Communication Protocols	Description
1	Serial Port	1 (Pin#0 is RX, Pin#1 is TX).
2	I2C Port	1 (Pin#A4 is SDA, Pin#A5 is SCL).
3	SPI Port	1 (Pin#10 is SS, Pin#11 is MOSI, Pin#12 is MISO, Pin#13 is SCK).

Arduino Nano is a small, complete, flexible, and breadboard-friendly Microcontroller board, based on ATmega328p, developed by Arduino.cc in Italy in 2008 and contains 30 male I/O headers, configured in a DIP30 style. Arduino Nano Pinout contains 14 digital pins, 8 analog Pins, 2 Reset Pins & 6 Power Pins.

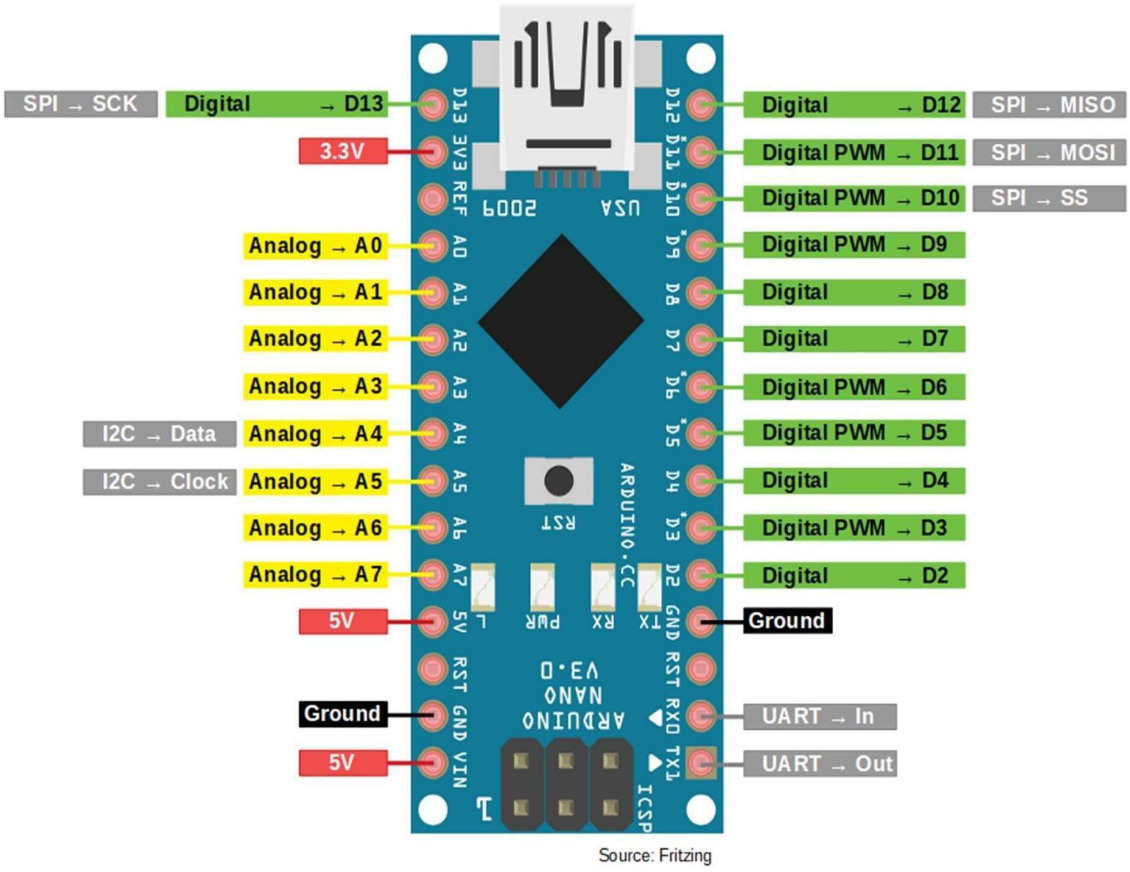

Fig 3.3 Arduino nano Pinout

3.2.2 IR Sensor

An infrared sensor is an electronic device, that emits to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measure only infrared radiation, rather than emitting it that is called a passive IR sensor. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation. These types of radiations are invisible to our eyes, which can be detected by an infrared sensor. The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode that is sensitive to IR light of the same wavelength as that 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.

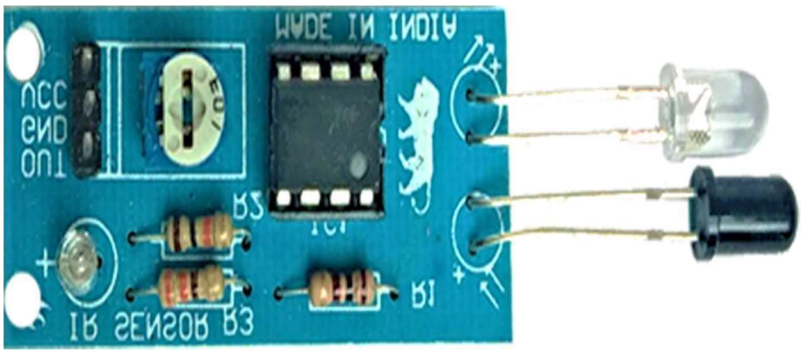

Fig 3.4 Infrared (IR) Sensor

An infrared sensor circuit is one of the basic and popular sensor modules in an electronic device. This sensor is analogous to human's visionary senses, which can be used to detect obstacles and it is one of the common applications in real-time.

Types of IR Sensors:

Infrared sensors can be passive or active. Passive infrared sensors are basically Infrared detectors. Passive infrared sensors do not use any infrared source and detects energy emitted by obstacles in the field of view. They are of two types: quantum and thermal. Thermal infrared sensors use infrared energy as the source of heat and are independent of wavelength. Thermocouples, pyroelectric detectors and bolometers are the common types of thermal infrared detectors.

Quantum type infrared detectors offer higher detection performance and are faster than thermal type infrared detectors. The photosensitivity of quantum type detectors is

wavelength dependent. Quantum type detectors are further classified into two types: intrinsic and extrinsic types. Intrinsic type quantum detectors are photoconductive cells and photovoltaic cells.

Active infrared sensors consist of two elements: infrared source and infrared detector. Infrared sources include an 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.

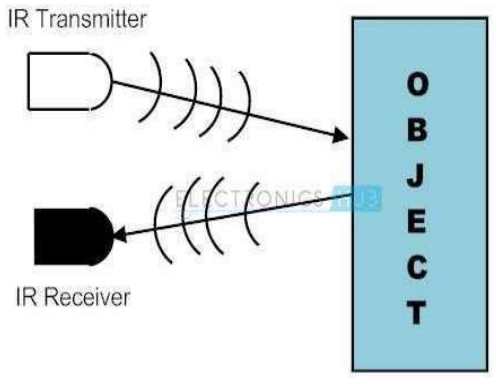

Fig 3.5 Working of an IR-sensor

Infrared Transmitter is a light emitting diode (LED) which emits infrared radiations. Hence, they are **IR Transmitter.**

There are different types of infrared transmitters depending on their wavelengths, output power and response time.

IR transmitters can be found in several applications. Some applications require infrared heat, and the best infrared source is infrared transmitter. When infrared emitters are used with Quartz, solar cells can be made.

IR Receiver:

Infrared receivers are also called as infrared sensors as they detect the radiation from an IR transmitter. IR receivers come in the form of photodiodes and phototransistors.

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.

3.2.3 Copper Coil

The wireless power transmission can be defined as, the energy can be transmitted from the transmitter to a receiver through an oscillating magnetic field.

In the TX (transmitter) section, the AC current increases a copper wire, that creates a magnetic field. Once an RX (Receiver) coil is located near to the magnetic field, then the magnetic field can induce an AC current in the receiving coil. Electrons in the receiving device, converts the AC current back into DC current, that becomes working power.

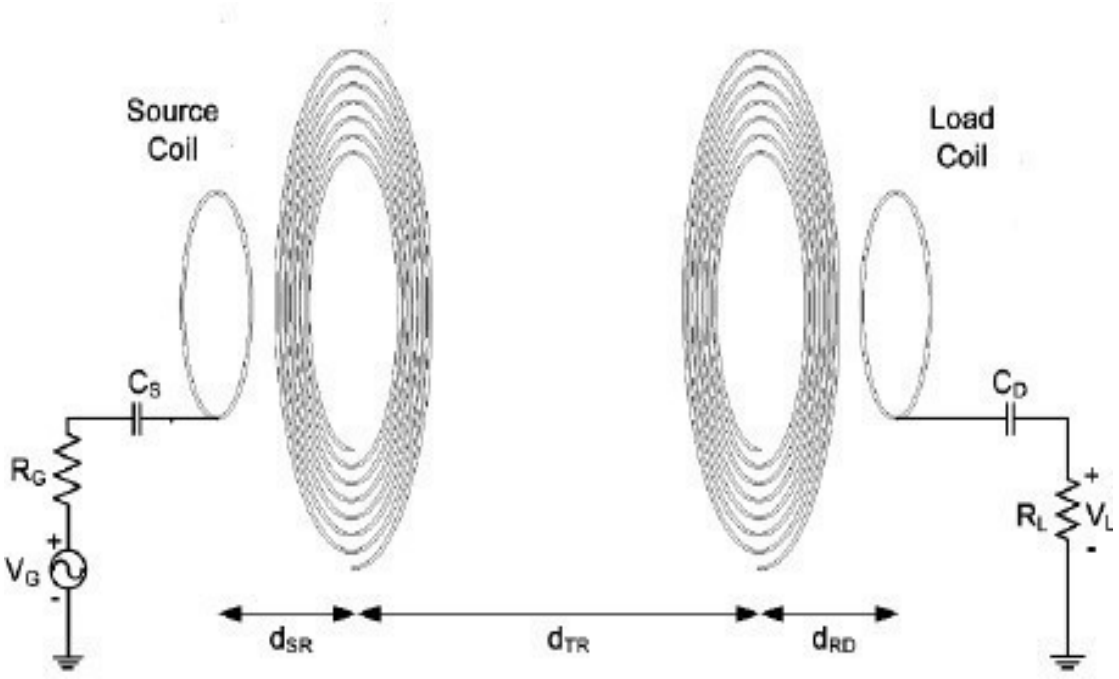

Fig 3.6 Wireless Power Transmission

The schematic diagram of a magnetic resonant coupled wireless powering scheme consists of two internal multi-turn coils (TX and RX) and two loop coils (source and load coils).

3.2.4 MOSFET

The IRFZ44N is a N-channel MOSFET with a high drain current of 49A and low Rds value of 17.5 mΩ. It also has a low threshold voltage of 4V at which the MOSFET will start conducting. Hence it is commonly used with microcontrollers to drive with 5V. However, a driver circuit is needed if the MOSFET has to be switched in completely.

The MOSFET will start turning on with a small gate voltage of 4V, but the drain current will be maximum only when a gate voltage of 10V is applied.

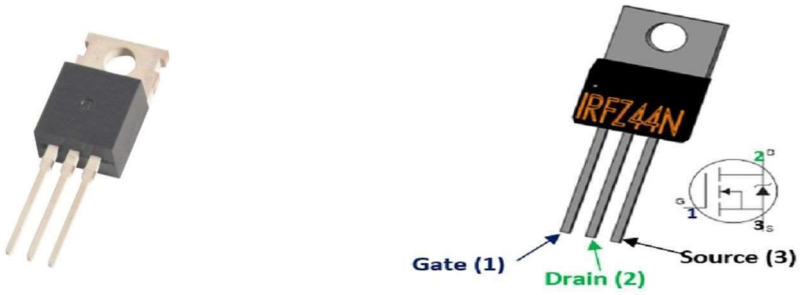

Fig 3.7 Z44 MOSFET Pinout

Table No 3.4 MOSFET Pin Description

Pin Number	Pin Name	Description
1	Gate	Controls the biasing of the MOSFET
2	Drain	Current flows in through Drain
3	Source	Current flows out through Source

3.2.5 LCD Display (16x2):

LCD modules are very commonly used in most embedded projects, the reason being its cheap price, availability and programmer friendly. Most of us would have come across these displays in our day-to-day life, either at PCO's or calculators. The appearance and the pinouts have already been visualized above now let us get a bit technical.

16×2 LCD is named so because; it has 16 Columns and 2 Rows. There are a lot of combinations available like, 8×1, 8×2, 10×2, 16×1, etc. but the most used one is the 16×2 LCD.

Fig 3.8 16x2 LCD Pin diagram

3.2.6 Potentiometer:

A potentiometer is a three-terminal resistor with a sliding or rotating contact that forms an adjustable voltage divider. If only two terminals are used, one end and the wiper, it acts as a variable resistor or rheostat.

3.2.7 7805 Voltage Regulator:

A voltage regulator IC maintains the output voltage at a constant value. 7805 IC, a member of 78xx series of fixed linear voltage regulators used to maintain such fluctuations, is a popular voltage regulator integrated circuit (IC).

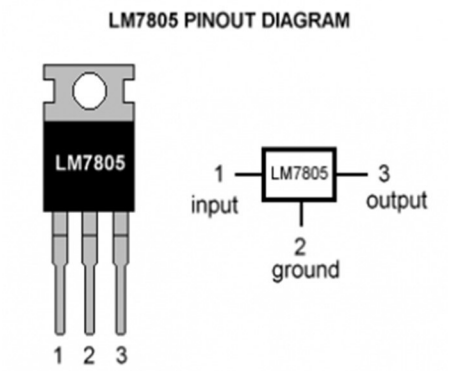

Fig 3.9 Voltage Regulator Pinout Diagram

Table No. 3.5 Voltage Regulator Pin Description

1	INPUT	Input voltage (7V-35V)	In this pin of the IC positive unregulated voltage is given in regulation.
2	GROUND	Ground (0V)	In this pin where the ground is given. This pin is neutral for equally the input and output.
3	OUTPUT	Regulated output 5V (4.8V-5.2V)	The output of the regulated 5V volt is taken out at this pin of the IC regulator

LM7805 is applied in a wide range of circuits:

- Fixed-Output Regulator
- Positive Regulator in Negative Configuration
- Adjustable Output Regulator
- Current Regulator
- Regulated Dual-Supply
- Output Polarity-Reversal-Protection Circuit

- Reverse bias projection Circuit

If differences between the input and output voltages are not well managed, LM7805 can overheat, which may result in malfunctioning. Solutions Include:

- Limiting input voltage to 2-3 volts above the output regulated voltage
- Placing a heat sink in the circuit to dissipate heat solutions

3.2.8 Soldering Iron:

The basic purpose of a soldering iron is to create a bond between two workpieces using electronically heated soft metal (i.e., the solder). The soldering iron supplies heat to the soldering tip, which is used to melt the solder. The melted solder forms a bond in the joint between two workpieces.

3.2.9 Soldering Wire:

Solder is a fusible alloy used to join less fusible metals or wires, etc. Solder wire is comprised of different alloys, or of pure tin. Each metal requires a certain type of soldering wire to create strong bonds, because the combinations of metals that comprise soldering wire melt at different temperatures.

3.2.10 Zero PCB:

Printed circuit boards (PCBs) are the boards that are used as the base in most electronics – both as a physical support piece and as the wiring area for the surface-mounted and socketed components.

For instance, printed circuit boards are a development that makes connecting components simpler and cheaper than the way it “used to be done.”

3.2.11 Connecting Wire:

Connecting wires allows an electrical current to travel from one point on a circuit to another because electricity needs a medium through which it can move. Most of the connecting wires are made up of copper or aluminium. Copper is cheap and good conductivity.

3.2.12 LED Light:

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. The color of the light (corresponding to the energy of the photons) is determined by the energy required for electrons to cross the band gap of the semiconductor.

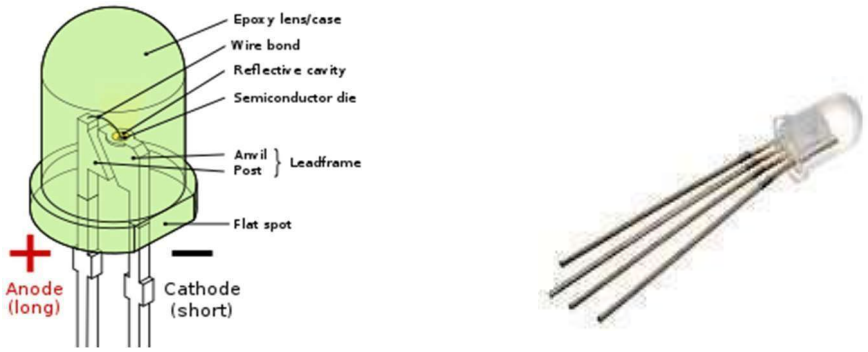

Fig 3.10 LED

LEDs have many advantages over incandescent light sources, including lower energy consumption, longer lifetime, improved physical robustness, smaller size, and faster switching.

3.2.13 Switch:

While there's an enormous variety of switches available, they mostly all do the same thing, Turn power to an electrical circuit on or off by making or breaking an electrical connection.

3.2.14 Rechargeable Battery:

An electric battery is a device consisting of one or more electrochemical cells with external connections provided to power electrical devices such as flashlights, and electric cars. When a battery is supplying electric power, its positive terminal is the cathode, and its negative terminal is the anode. The terminal marked negative is the source of electrons that will flow through an external electric circuit to the positive terminal. When a battery is connected to an external electric load, it supplies power to the load and any device connected as the load will power up for a limited period of time

but in our case, it will be charging by solar panel continuously to keep the system running without any interruptions.

Fig 3.11 Rechargeable Li-on battery

3.2.15 Solar Panel

Solar panels are devices that convert light into electricity. A solar panel is a collection of solar cells. Lots of small solar cells spread over a large area can work together to provide enough power to be useful. The more light that hits a cell, the more electricity it produces.

Solar Photovoltaic (PV) is a technology that converts sunlight (solar radiation) into direct current electricity by using semiconductors. When the sun hits the semiconductor within the PV cell, electrons are freed and form an electric current.

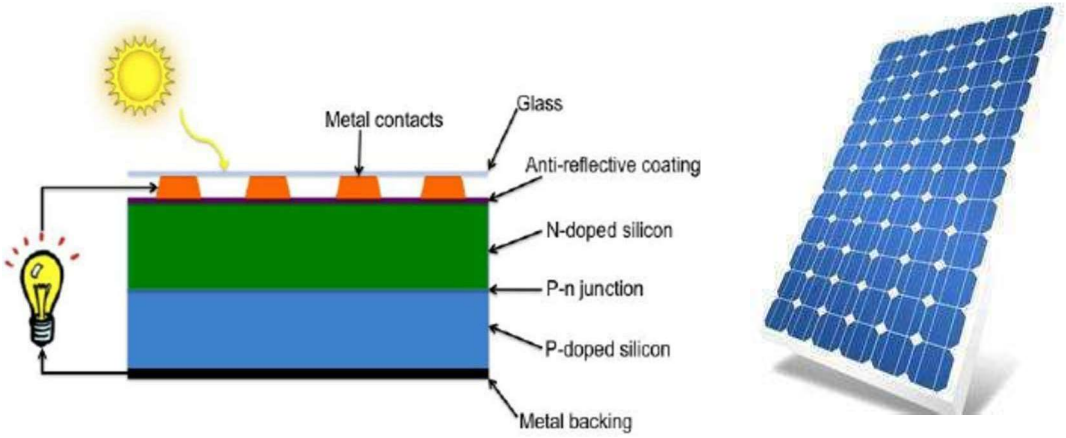

Fig 3.12 A Solar Panel

A photovoltaic system typically includes an array of photovoltaic modules, an inverter, a battery pack for storage, interconnection wiring, and optionally a solar tracking

mechanism. The most common application of solar panels is solar water heating systems.

3.2.16 Battery Management System (BMS)

A battery management system (BMS) is any electronic system that manages a rechargeable battery (cell or battery pack), such as by protecting the battery from operating outside its safe operating area.

A BMS may monitor the state of the battery as represented by various items, such as:

- Voltage: total voltage, voltages of individual cells, or voltage of periodic taps
- Temperature: average temperature, coolant intake temperature, coolant output temperature, or temperatures of individual cells
- Coolant flow: for liquid cooled batteries
- Current: current in or out of the battery
- Health of individual cells
- State of balance of cells

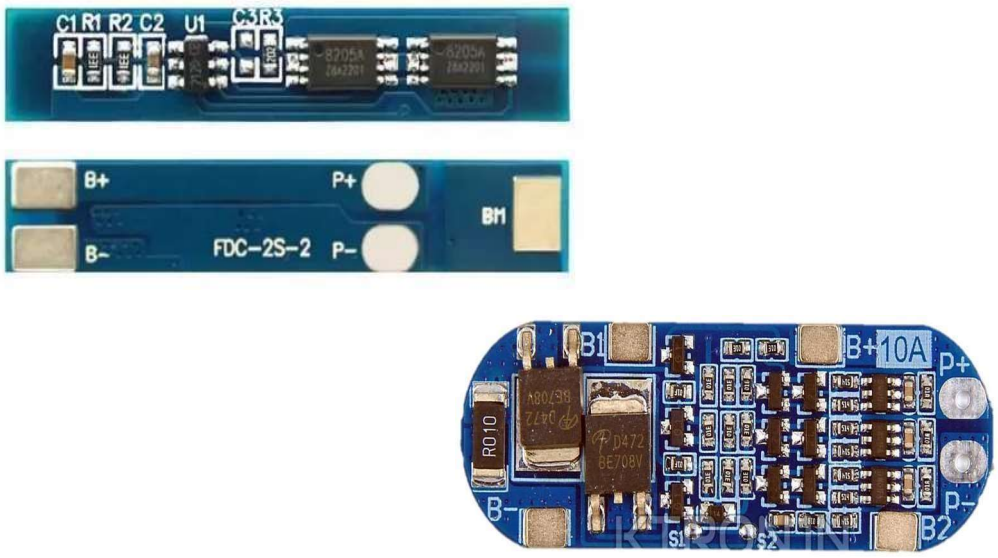

Fig 3.13 BMS Module 3s 10A - This module is used for 10V – 13V Li-ion Batteries.

3.2.17 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.

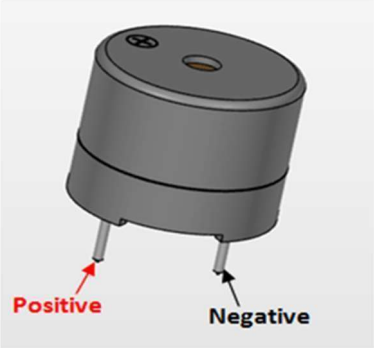

Fig 3.14 Buzzer

Table No. 3.6 Buzzer Pin Configuration

Pin Number	Pin Name	Description
1	Positive	Identified by (+) symbol or longer terminal lead. Can be powered by 6V DC
2	Negative	Identified by short terminal lead. Typically connected to the ground of the circuit

Buzzer Features and Specifications:

- Rated Voltage: 6V DC
- Operating Voltage: 4-8V DC
- Rated current: < 30 mA
- Sound Type: Continuous Beep

- Resonant Frequency: ~2300 Hz
- Small and neat sealed package

3.2.18 Resistor:

10k resistor color code is as shown in the image it is brown/black/orange/gold, color code of resistors does not depend on the power rating of resistor, the power rating of the resistor depends on its physical size and comes under standard wattage rating of 1/4 W,1/2W,1W,10W, etc.

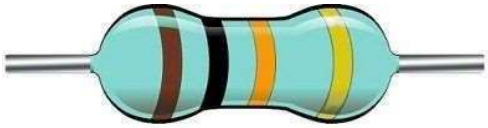

Fig 3.15 Carbon Resistor

3.2.19 Relay Module:

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal.

Typical application areas of the relays include:

- Lighting control systems
- Telecommunication
- Industrial process controllers
- Traffic control
- Motor drives control
- Protection systems of electrical power system
- Computer interfaces
- Automotive
- Home appliances

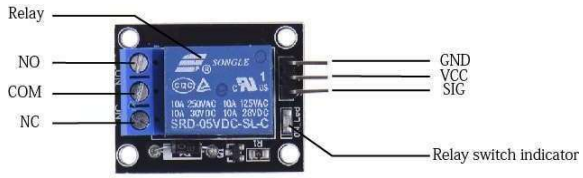

Fig 3.16 5V Single Relay Module

The maximum DC load is 10A, the maximum DC load voltage is 30V, the maximum AC load is 10A, the maximum AC load voltage is 250V.

3.2.20 Transformer:

Transformers work on the principle of mutual induction. A changing magnetic field in one loop of wire induces an electromotive force (EMF) in an adjacent loop of wire,

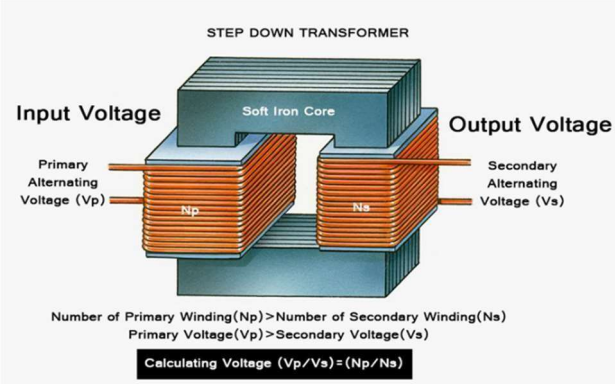

Fig 3.17 Transformer

inductively coupled to the first. In very basic terms, a transformer consists of two coils of wire with high mutual inductance. These coils are electrically separated while they share a common magnetic circuit.

- A step-down transformer has more primary windings than the secondary side.

The primary winding, which is the first set of coils, connects to an alternating-current voltage source, or primary voltage inflow. The secondary coil connects to the load, or secondary voltage outflow, distributing the electrical power away from the transformer.

Specifications:

“Voltage: 2 x 12V

Current: 1 x 1000mA

Power rated: 24VA”

The output from this transformer will be 12V AC supply which will be passed through a rectifier circuit to convert this AC supply to DC supply.

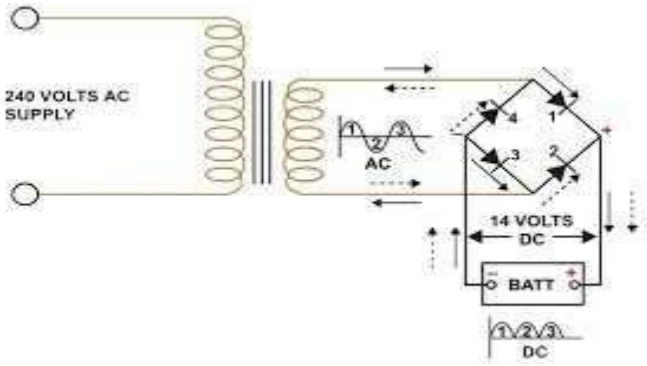

Fig 3.18 Transformer and rectifier circuit

3.2.21 Diodes:

A diode is a semiconductor device that essentially acts as a one-way switch for current. It allows current to flow easily in one direction, but severely restricts current from flowing in the opposite direction.

Diodes are also known as rectifiers because they change alternating current (ac) into pulsating direct current (dc). Diodes are rated according to their type, voltage, and current capacity.

Fig 3.19 Diodes are available in various configurations. From left: metal case, stud mount, plastic case with band, plastic case with chamfer, glass case.

When a diode allows current flow, it is forward-biased. When a diode is reverse-biased, it acts as an insulator and does not permit current to flow.

The diode symbol's arrow points against the direction of electron flow.

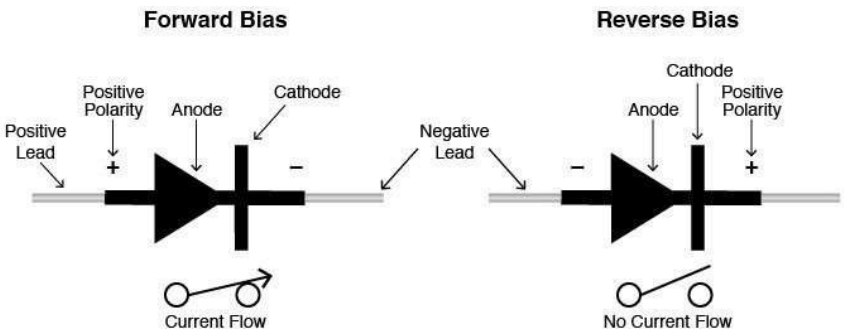

Fig 3.20. Current Flow in diode

3.2.22 Capacitor:

The capacitor is a component which has the ability or “capacity” to store energy in the form of an electrical charge producing a potential difference (Static Voltage) across its plates, much like a small rechargeable battery.

Fig 3.21 A Typical Capacitor

Due to this insulating layer, DC current cannot flow through the capacitor as it blocks it allowing instead a voltage to be present across the plates in the form of an electrical charge.

CHAPTER 4.
DESIGN AND IMPLEMENTATION

4.1 Block Diagram

The output produced by timer ic is applied to inverter circuit to invert the oscillating signal and refer as signal 2 while signal 1 for a non-inverted oscillating signal. This both original and inverted oscillating signal is applied to MOSFET driver ic to generate a high and low pulses to trigger the gate of the MOSFET terminal. This forms as a driver circuit. This driver circuit sent the Alternating current to the LC circuit. This current across the inductor and the capacitor produces the magnetic field.

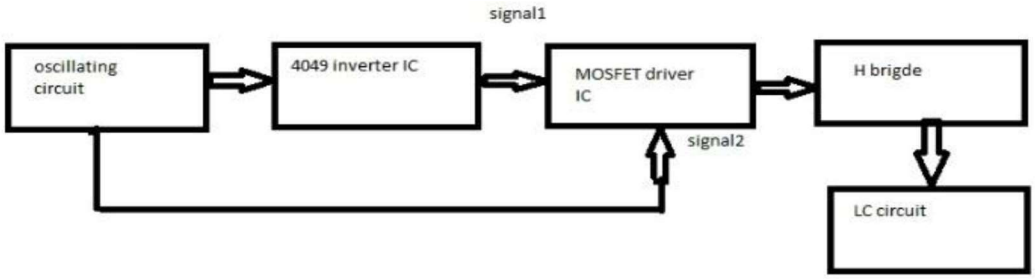

Fig 4.1 Block Diagram of Primary Circuit of WPT

The coil from the primary side gets energy and it creates the magnetic field around the coil. Due to the using of high-frequency output, the creation of magnetic flux will be very strong. When the flux from the primary coil links with the secondary coil or Receiver coil, this will induce the current in inductor and capacitor connected in parallel. The voltage generator across the LC circuit is Alternating current and this A.C. signal is applied to Bridge rectifier circuit. This circuit converts the Alternating current into Direct current and the capacitor is connected to the output to generate a smooth DC signal. The Voltage regulator is used to limit the voltage to prevent the damage to the load.

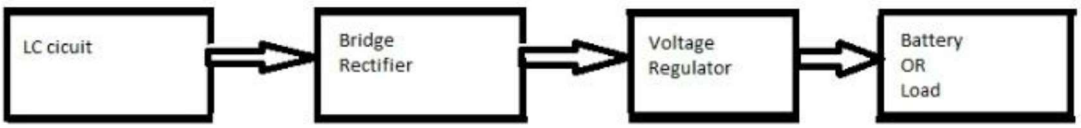

Fig 4.2 Block Diagram of Secondary Circuit of WPT

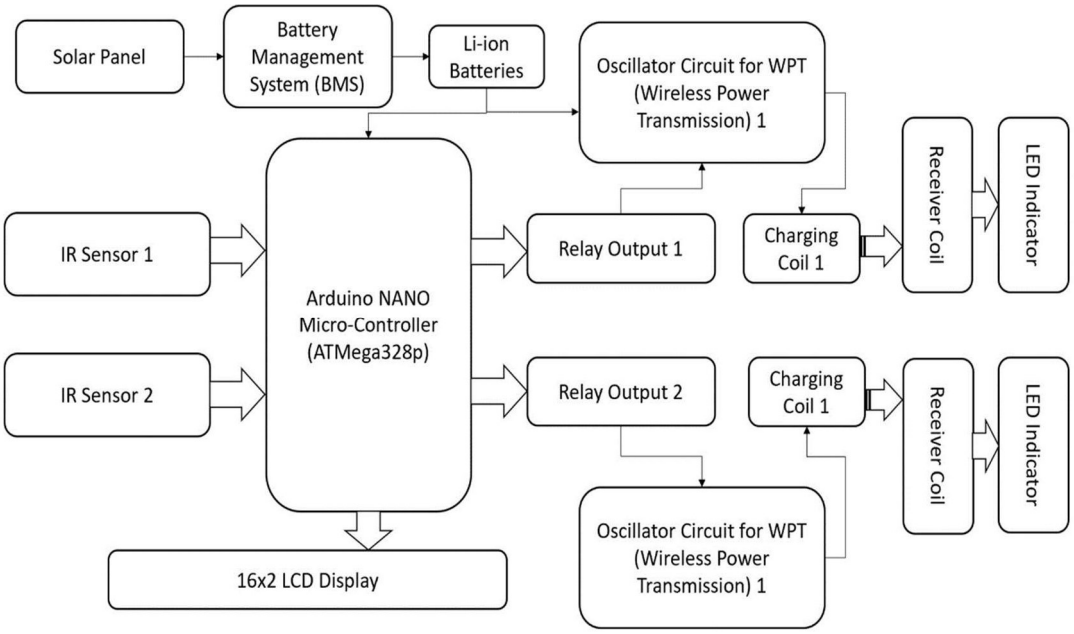

Fig 4.3 Complete Block Diagram of the System

4.2 Circuit Diagram

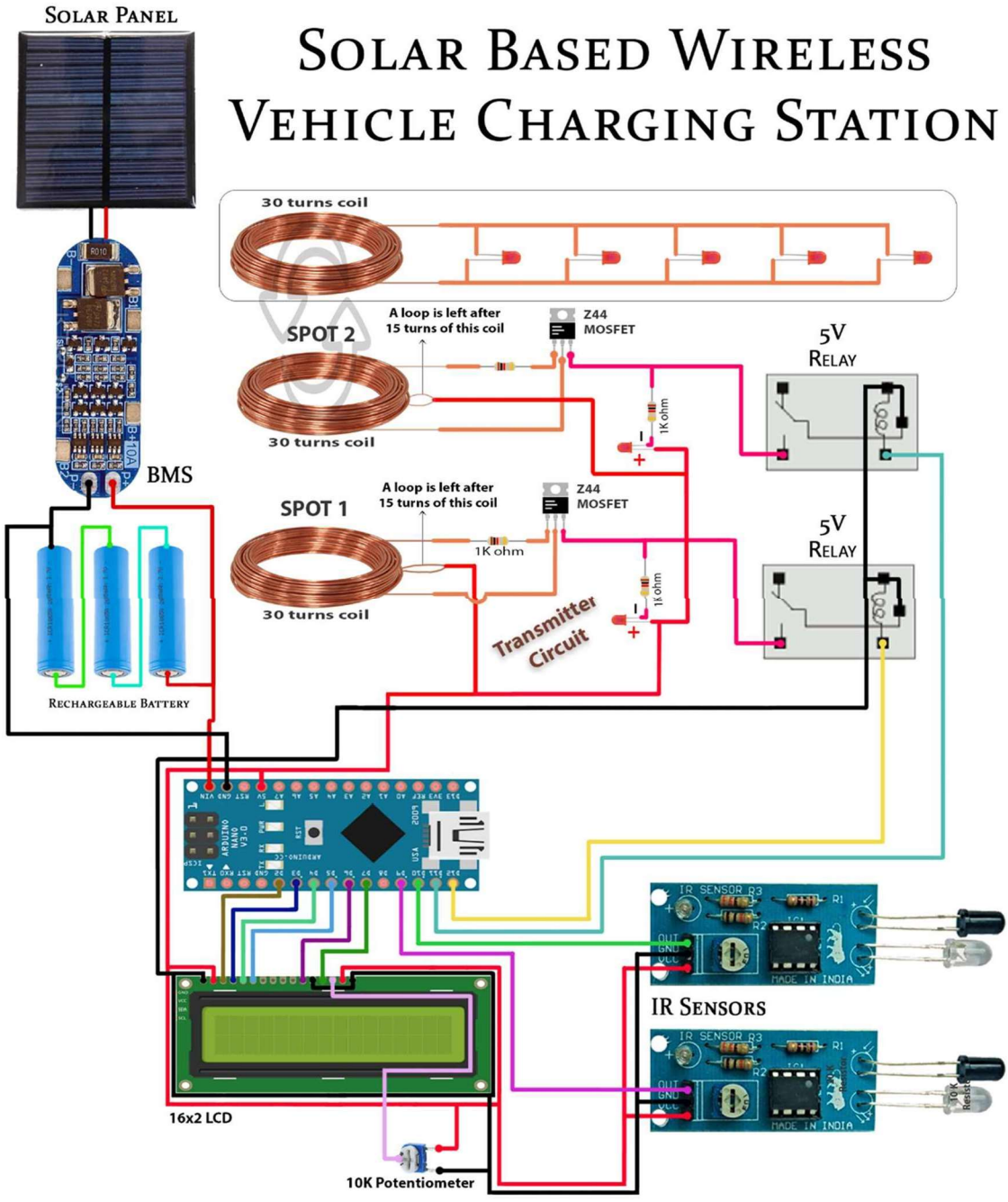

Fig 4.4 Circuit Diagram

4.3 Code

```
#include<LiquidCrystal.h>                 // Include the LiquidCrystal library
LiquidCrystal lcd(2, 3, 4, 5, 6, 7);      // Create an LCD object, specifying the pins it's
                                             connected to
int ir[2] = {9,10};                       // Array to hold the IR sensor pins
int re[2] = {11,12};                      // Array to hold the relay control pins

void setup() {
  lcd.begin(16, 2);                       // Initialize the LCD: 16 columns, 2 rows
  lcd.clear();                            // Clear the LCD screen
  lcd.setCursor(0, 0);                    // Set the cursor to the first row, first column
  lcd.print("Wireless Vehicle");          // Display "Wireless Vehicle" on the LCD
  lcd.setCursor(0, 1);                    // Set the cursor to the second row, first column
  lcd.print("Charging System");           // Display "Charging System" on the LCD
  pinMode(ir[0],INPUT);                   // Set the IR sensor pins as INPUT
  pinMode(ir[1],INPUT);
  pinMode(re[0],OUTPUT);                  // Set the relay control pins as OUTPUT
  pinMode(re[1],OUTPUT);
  delay(3000);                            // Wait for 3 seconds
  lcd.clear();                            // Clear the LCD screen
  lcd.setCursor(1, 0);                    // Set the cursor to the first row, second column
  lcd.print("Spot1");                     // Display "Spot1" at the specified location
  lcd.setCursor(10, 0);                   // Set the cursor to the first row, eleventh column
  lcd.print("Spot2");                     // Display "Spot2" at the specified location
}

void loop() {
  if(digitalRead(ir[0])) {                // Check if IR sensor 1 detects an object
    digitalWrite(re[0],HIGH);             // If detected, turn ON the relay for Spot1
    lcd.setCursor(0, 1);                  // Set the cursor to the second row, first column
    lcd.print("Charge");                  // Display "Charge" indicating charging in Spot1
  }
  else {
    digitalWrite(re[0],LOW);              // If not detected, turn OFF the relay for Spot1
    lcd.setCursor(0, 1);                  // Set the cursor to the second row, first column
    lcd.print("  OFF  ");                 // Display "OFF" indicating
  }                                          charging is off for Spot1
  if(digitalRead(ir[1])) {                // Check if IR sensor 2 detects an object
    digitalWrite(re[1],HIGH);             // If detected, turn ON the relay for Spot2
    lcd.setCursor(9, 1);                  // Set the cursor to the second row, tenth column
    lcd.print("Charge");                  // Display "Charge" indicating charging in Spot2
  }
  else {
    digitalWrite(re[1],LOW);              // If not detected, turn OFF the relay for Spot2
    lcd.setCursor(9, 1);                  // Set the cursor to the second row, tenth column
    lcd.print("  OFF  ");                 // Display "OFF" indicating charging is off for Spot2
  }
}
```

CHAPTER 5.
PERFORMANCE ANALYSIS

5.1 System Testing

The framework going for delicate products is the looking at achieved on an outright, included machine to assess the machine's congruity with its exact necessities. gadget testing would also fall inside the range of the dark compartment looking at, and in this way, it must need no data around the interior structuring of the presence of mind or the code. It's miles a totally comparable deliberate check case lettering. inside the check case lettering we ought to be equipped for compose the check case circumstances and moreover the utilization cases.

5.2 Black Box Testing

The Black-box looking at is an approach to “test programming that uncovers out the ability and running of a product without the peering into the inward structures or into the operations, explicit data of the products inside shape, code and programming understanding is commonly not required”. Furthermore, the analyser is enjoyably careful about unequivocally what our item is thought to do anyway it isn't responsive of ways it would do it. as a case, our analyser is responsive that one careful enter may restore a definite, never-ending yield yet it isn't sure generally how the item would convey the yield inside the essential spot.

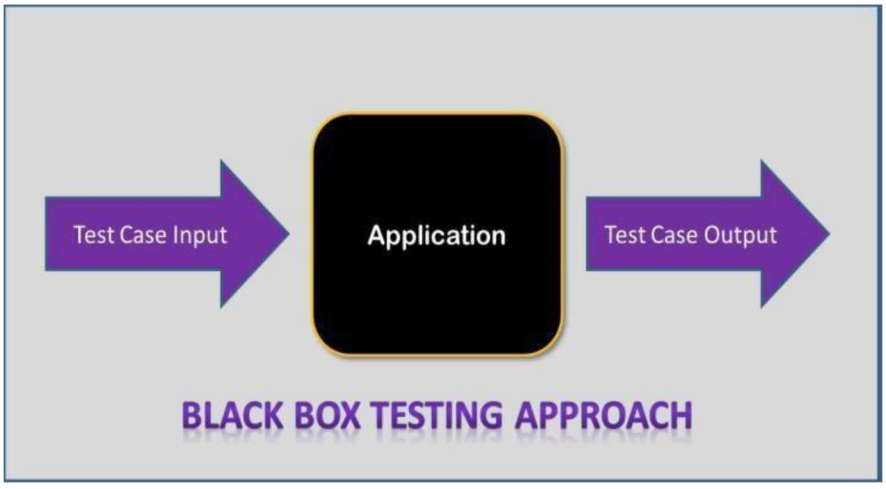

Fig 5.1 Black Box Testing

5.3 Unit Testing

Throughout pc programming and coding, we have this unit testing assisting which of the product tests approaches with the methods for which specific units of the supply code, or a fixed of 1 and now and then additional PC programming component together with related control records, managing procedures, and working methodologies, are experienced, and analysed to see whether they are strong for use.

The objective of unit checking out is in order to separate every detail of this system and to illustrate that the person factors are accurate.

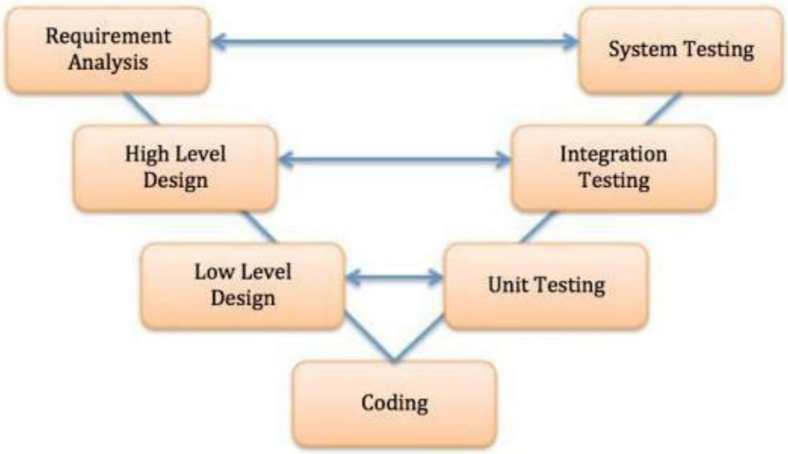

Fig 5.2 Unit Testing

CHAPTER 6.
CONCLUSION

In this system, we are presenting the Wireless Power Transmission. As the electric vehicle in the market is increasing. We can use the wireless charging system to charge our vehicles. This system shows the efficiency and implementation of the charging station in future technology. Overall, this paper compares various smart parking, charging and combined charging-parking system, which can help to solve various issues related with it. Also, it contains a table of comparison of various research paper. There are various types of methods and techniques used for parking and charging are discussed.

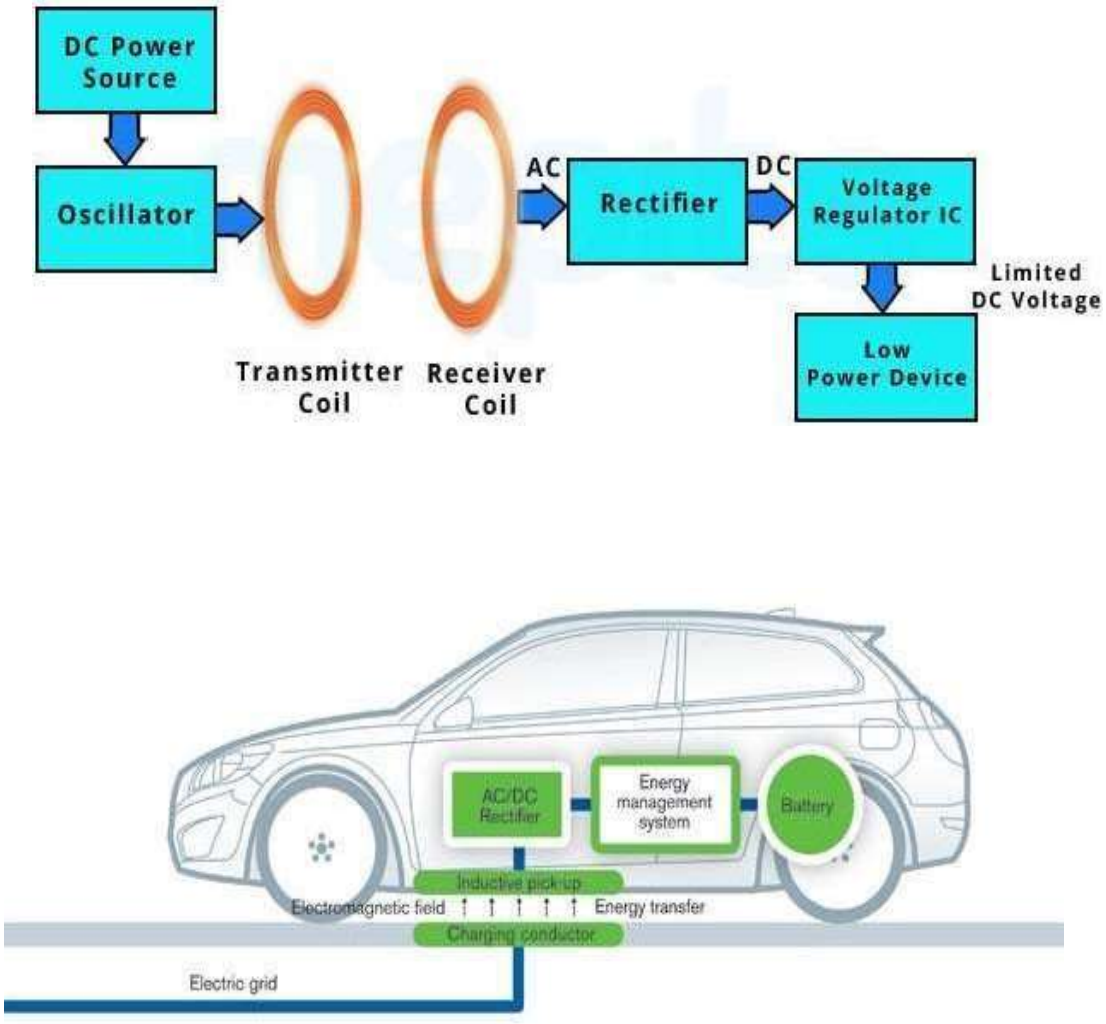

Fig 6.1 Tested Working System

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