ABSTRACT

Electric cars (EVs) are becoming more and more popular in place of combustion engine vehicles as a means of lowering environmental pollution and the demand on fossil fuels. Several charging techniques are being used to meet the primary concern of EV users. Setting up the infrastructure for charging EVs is the main challenge. In the expanding EV industry, one of the most popular options is the wireless charging system (WCS). WCS is designed using inductively linked power transfer technology to charge electric automobiles. A MATLAB/SIMULINK simulation system is created, and the simulation results are used to validate the system's performance. Wireless Power Transfer (WPT) is seen as a plug-free substitute for charging electric vehicles (EVs).

The WPT idea views magnetic or induction coupling as appropriate EV charging procedures. The WPT system for EV is examined and simulated in this work. To charge EVs, an intelligent WPT system is presented and simulated. By employing the finger print approach, this device can automatically align the transmitting and receiving coils.

The developed method may eliminate human error in the car's WPT approach, save energy, and start the car's charging intelligently during off-peak hours, all while saving the driver time. For EV users, it offers significant advantages in terms of energy conservation and lower electricity costs. First and foremost, the project uses MATLAB Simulink to create a software simulation of an electric vehicle's wireless charging system. It displays the system's voltage flow from the DC source to the load. The system's values can be changed to see how the output voltage changes. Second, the model's hardware prototype is built with transmitter and receiver coils to harness solar energy for wirelessly charging an electric car.

CHAPTER 1

1. INTRODUCTION

Today, there are steadily more electric vehicles on the road. Electric vehicles have proven effective in reducing travel costs by switching from fuel to electricity, which is much less expensive, in addition to the environmental benefits. As technology develops, wireless charging is being introduced. Inductive EV charging does not involve any wires. The proposed method demonstrates how electric vehicle scan be charged quickly without the need to plug-in for refueling. The charging mechanism is powered by solar energy, thus there is no need for an additional power source. To improve charging station efficiency, electric vehicles will be the future mode of transportation. Electric vehicle charging will play a significant role in raising EV demand in the market. With the increase of population the use of combustion engines (mainly in vehicles)is increasing rapidly.

As a result the use of fossil fuel is also increasing day by day, which is creating pressure on the fossil fuel resources as well as increasing environmental pollutions and global warming. An effective solution of this problem is the use of electric vehicles (EV). The charging of these EV can be made convenient by using wireless charging methodology. The use of inductivebased wireless charging system (WCS) for EV is more convenient, flexible, reliable and saferthan conductive charging and provides operator free charging facility. For the implementation of the charging system two coils are needed, one of which is installed in the parking garage (primary coil/transmitter coil) and another is inside the EV(secondary coil/receiver coil).The EV side coil should be small in size and light in weight in order to reduce additional load on the EV.

1.1 Background

Environmental pollution is considered as significant issue for the entire Globe. Global warming , greenhouse gases, air pollution and acid rains are only some of the consequences to name a few .Large contribution to pollution is obtained from vehicle emissions. Gasoline- powered cars emit greenhouse gases into natural atmosphere, which could be the
Primary cause of global warming.

Transition to sustainable technologies is one of the possible solutions to stabilize the climate and a starting point to deal with vehicle pollution. Transition from petrol-powered transports to EV's would be ponderable contribution to sustain healthy environment. EV implementation is a relatively global-accepted idea in transportation industry and great step to reach eco-friendly technologies. EVs run on electricity obtaining their power from the battery installed in the car, which power the motors and run the wheels. The battery is rechargeable using grid electricity. EV sare petrol- free and they are quite economy alternatives as the
fossil fuelprice increase steadily. Along with ecofriendliness, electric cars considerably reduce noise pollution and require less vehicle maintenance in comparison with conventional cars.

1.2 Motivation

The motive is to maximize the use of PV energy for EV charging with minimal energy exchange with the grid. The advantages of such an EV–PV charger will be reduced energy demand on the grid due to EV charging as the charging power is locally generated in a 'green' manner through solar panels.

1.3 Problem Statement

1.3.1 Safety the cable and connector typically delivers 2-3 times more power than standard plug sathome, and this increases risk of electrocution especially in wet and hostile environments.

1.3.2 Present charging stations require the vehicle to be connected with wires. In harsh climates that commonly have snow and ice , the plug- incharge point may become frozen on to the vehicle. Proposed EV charging does not involve any wires.

1.3.3 Also, it needs a power source to charge the EV. Solar powered charging stationis introduced to overcome this issue.

1.3.4 The long wire poses a trip hazard and gives to poor aesthetics for such systems.

1.3.5 It also makes recharging easy for people with moving disabilities and does not require the use of cables.

1.4 Objectives

1.4.1 To show working of wireless charging station using MATLAB Simulink.

1.4.2 To develop a prototype of a charging station which charge more for utilizing thecar for a longer period.

1.4.3 To use renewable sources (solar energy) in charging stations.

CHAPTER 2

2. THEORETICAL ASPECTS OF THE REPORT

Solar wireless electric vehicle charging systems (SWEVCS) offer several advantages over traditional EV charging solutions. Here are some of the key benefits:

2.1 Advantages

Sustainability :SWEVCS harness the power of the sun to generate electricity for EV charging, reducing reliance on the power grid and promoting sustainable transportation.

Convenience: Wireless charging eliminates the need for physical connections and cables, making it easier and more convenient to charge EVs. Drivers simply park their vehicles over charging pads embedded in the road or parking surfaces , and the charging process begins automatically.

Efficiency: SWEVCS can be highly efficient, with energy transfer rates reaching upto90 %.This means that less energy is lost during the charging process, reducing overall energy consumption.

Reduced maintenance: SWEVCS have fewer moving parts and require less maintenance compared to traditional wired charging stations, which can be prone to cable damage and wear and tear.

Safety: Wireless charging eliminates the risk of electrical hazards associated with wired charging systems. Additionally, SWEVCS can operate in any weather condition, making them more versatile and reliable.

2.2 Applications

In road charging: SWEVCS could be embedded in roads to provide continuous charging for EV as they drive.

Charging EVs in remote locations: SWEVCS could be used to charge EVs in remotelocations where there is no grid connection.

Charging EVs in hazardous environments: SWEVCS could be used to charge EVs in hazardous environments, such as industrial plants and chemical plants, where there is a risk of electrical shock or fire.

Charging EVs in emergency situations: SWEVCS could be used to charge EVs in emergency situations, such as after a natural disaster, when the grid is down.

CHAPTER 3

3. LITERATURE SURVEY

This chapter summary the relevant literature regarding the solar powered wireless charging station for electric vehicle and various methodologies employed.

3.1 Literature Review

1. **"Solar powered Wireless charging station for Electric Vehicles", Sunil Tummapudi, Ta bassum Mohammed, Ravikiran patel.** In this work, the proposed method demonstrates how electric vehicles can be charged while in motion without the need for the vehicle topull over for refueling.The charging mechanism is powered by solar energy, thus there is no need for an additional power source. The system's development involves the usage of solar panels, batteries, transformers, regulator circuits, copper coils, AC-to-DC converters, Atmega328p controllers, and LCDs.

2. **"Solar Wireless Electric Vehicle Charging Station",Ayushsen, Bhuvansharma, Drishti Gupta, Yusuf Sharif.** This study describes about the dynamic electric vehicle charging system from solar. It reduces fuel and pollution. Nowadays electric vehicle are growing in numbers because of high rates of fuel. Electric vehicle has now hit the road world wide and are slowly growing in numbers. Also it is proven that electric vehicles are helpful in reducing cost of travel as electricity is cheaper than fuel.

3. **"Wireless Charging Of Electric Vehicle", Asst Prof. Swapna Manurkar, Harshada Sat re, Bhagyashree Kolekar, Pradnya Patil, Samidha Bailmare.** In this work, the method demonstrates how electric vehicles can be charged by an electromagnetic field across agiven space. Dynamic charging system can be implemented to charge the vehicle even when it is in motion. By using inductive power transfers the powerfrom source can be transferred to the chargeable batteries through transformer windings. This will not only increase the use of electric vehicles but also make them efficient.

4. **“A new wireless charging system for electric vehicles using two receiver coils”, Naoui Mohamed a , FlahAymen a , Mohammed Alqarni b , Rania A. Turky c ,BasemAlamri d , Ziad M. Ali e,f , Shady H.E. Abdel Aleem g.** In this work, it is based on various modules that would ensure the high power and stability of electric vehicles 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 designedto allow charging even when the vehicle is in motion.

5. **“Wireless Charging System for Electric Vehicles”, K.Parmesha, Rashmi Prafullakumar Neriya and M. Varun Kumar.** This work represents the Wireless power transmission (WPT) which is popular and finding its application in various fields. The power is transferred from a source to an electrical load without the need of inter connections. WPT is use power electrical devices where physical wiring is not possible or inconvenient. The technology uses the principle of mutual inductance.The main goal of this system is to transmit power using resonance coupling and to build the charging systems. The systems deal with an AC source, transmission coil, reception coil, converter and electric load which is a battery.

CHAPTER 4

4. PROPOSED METHODOLOGY

In this proposed method, we present a Solar powered wireless charging station for the Electric Vehicle.

Solar powered wireless charging station integrate solar panels to harness sunlight, MPPT chargers for efficient energy conversion, and lithium-ion batteries for energy storage. The system employs wireless charging technology facilitated by a transmitter in the station and a receiver in electric vehicles.ESP32 microcontrollers manage communication and coordination between components, ensuring seamless charging operations. Safety features such as flame sensors and voltage sensors enhance system reliability . User interaction is facilitated through a keypad and LCD display, providing real time feedback on charging status. The station prioritizes sustainability by utilizing renewable energy and eliminating the need for physical connectors. With its user-friendly interface and eco- friendly design, the station offers convenient and environmentally conscious solution for electric vehicle charging, promoting a cleaner and greener future in transportation.

4.1 Software Requirement

1. Arudino IDE:

Code is very understandable and even people having very basic programming knowledge could fix it, The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board.

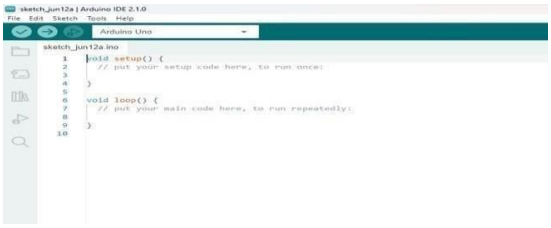


Figure1:ArduinoIDEpag

2. Blynk App

Blynk is an IoT platform for iOS or Android smartphones that is used to control Arduino, Raspberry Pi and Node MCU via the Internet. This application is used to create a graphical interface or human machine interface (HMI) by compiling and providing the appropriateaddress on the available widgets. Blynk was designed for the Internet of Things. It can control hardware remotely, it can display sensor data, it can store data, visualize it and do many other cool things.

Fig2:Blynkapp

There are three major components in the platform:

Blynk App: – It allows you to create amazing interfaces for your projects using variouswidgets which are provided.

Blynk Server:–It is responsible for all the communications between the smartphone and hardware.

Blynk Libraries: – It enables communication, for all the popular hardware platforms, with the server and process all the incoming and out coming commands.

4.2 Components Used

1. Solar Panel

Solar energy is transformed into electrical energy by solar panels. They make advantage of the photo electric effect theory, which states that when light strikes a solar panel, electrons are emitted. Silicon cells are used to make solar panels. Since silicon has an atomic number of 14, when light strikes a silicon cell, two of its outermost electrons are present. This starts the flow of electricity that started. Two separate sales structures exist for silicon

Fig3:SolarPanel

- Input voltage to Solarpanel:12V
- Power 10W

2. MPPT Charger

Maximum power point tracking (MPPT),or sometimes just power point tracking (PPT), is a technique used with variable power sources to maximize energy extraction as conditions vary. The technique is most commonly used with photovoltaic (PV) solar systems, but can also be used with wind turbines, optical power transmission and thermophotovoltaics.

Fig4:MPPTCharger

- Maximum Power Point Tracking(MPPT) Solar Charger Module
- 2-PinJST Connectors for Solar Panel and Battery Connection
- PWM Switching Frequency of 300KHz
- Maximum Charging Current of 2A

3. Battery(lithium ion) Two 12V 30Ah(Ampere hour) sealed lead acid rechargeable batteries were used to provide power of the whole system. They were connected in series to have 24V to supply the power to the motor. Although this battery is little bit heavy weighted, this batteryis used due to its availability and comparatively lower cost.

Figure5:Lithiumionbatteries

4. MT3608 Booster

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

Fig6:MT3608Booster

- Input voltage:+5VUSB,or2VDC~24VDC
- Maximum output voltage:26V(Output voltage must be greater than input voltage)

- Maximum output current:2A
- Maximum output power(Volts*Amps):10Watts
- Maximum efficiency: Up to 97%, typically 93% at Vout=12V,Vin=5V, Iout=200mA
- Dimensions:30x17x7mm(1.2x0.7x0.24inches)

5. Wireless Charger Transmitter

A wireless charger transmitter, commonly known as a wireless charging pad or base station, is a device that wirelessly transmits energy to charge compatible devices with out the need for physical connectors or cables. The technology used for wireless charging is typically based on electromagnetic induction or resonant inductive coupling.

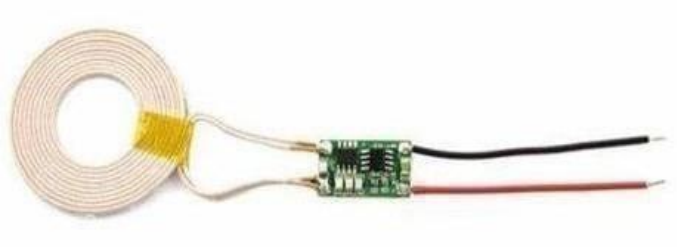


Fig7:WirelessChargerTransmitter

6. Wireless Charger Receiver

A wireless charger receiver, also known as a wireless charging receiver or receiver coil, is a component that enables a device to wirelessly receive power from a compatible wireless charger. This component is necessary for devices that don't have built- in wire less charging capabilities but can be made compatible through the addition of an external receiver.

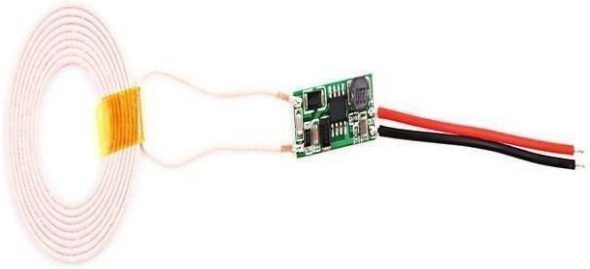


Fig8:WirelessChargerReceiver

7. Relay

A power relay module is an electrical switch that is operated by an electromagnet. The electromagnet is activated by a separate low power signal from a microcontroller. When activated, the electromagnet pulls to either open or close an electrical circuit.

Fig9:Relay

8. Buzzer

An Active Buzzer Alarm Module easily interfaced with an Arduino or other micro controllers is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric. Just like what you are viewing now, it is 3.3V to 5V DC power supply Electronic Part ActiveBuzzer Module. Using top quality material, it is long durable in use. An Active buzzer rings out as long as it is electrified. Compared with a passive buzzer, it is a bit expensive but easier to control. Typical uses of buzzers include alarm devices, timers, and confirmation of user input such as a mouse click or key stroke**.**

Fig10:Buzzer

9. ArduinoNano

The Arduino Nano is an open-source breadboard-friendly microcontroller board based on the Microchip ATmega 328P microcontroller (MCU). The Arduino Nano is equipped with 30male I/Oheaders, in a DIP-30-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 9V battery.

- Micro controller:MicrochipATmega328P[4]
- Operating voltage:5volts
- Input voltage: 5to20volts
- Digital I/Opins:14(6optionalPWMoutputs)
- Analog input pins:8
- DC per I/Opin: 40mA
- DC for 3.3 V pin: 50 mA
- Flash memory:32KB, of which 2KB is used by boot loader
- SRAM: 2KB
- EEPROM:1KB
- Clock speed:16MHz
- Length: 45mm
- Width:18 mm
- Mass:7g
- USB: Mini-USB Type-B[5]
- ICSP Header:Yes
- DC Power Jack:N

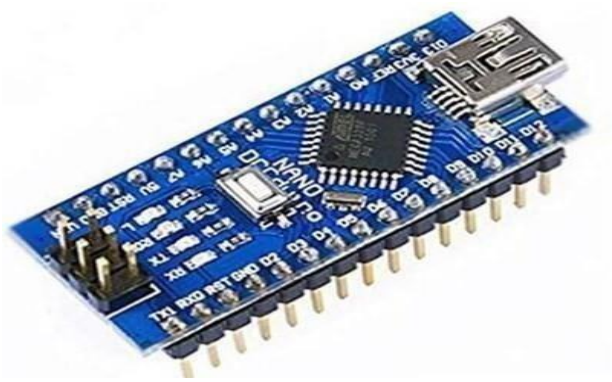


Fig11:ArduinoNano

10. LCD

This LCD 1602 Parallel Display Module is very commonly used in various devices andcircuits and also easy to interface with Arduino or Other Microcontrollers. A 1602 LCD means itcan display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x8 pixel matrix. This LCD has two registers, namely, Command and Data. This is standard controller LCD. The values shown on the display can be either a simple text or numerical values read by the sensors, such as temperature or pressure, or even the number of cycles that the Arduino is performing.

The interface consists of the following pins:

- A register select (RS) pin that controls where in the LCD's memory you'r writing data to.You can Select either the data register, which holds what goes on the screen, or an instruction register, which is where the LCD's controller looks for instructions on what to do next.
- A Read/Write (R/W) pin that selects reading mode or writing mode
- An Enable pin that enables writing to there gisters
- data pins (D0 -D7). The states of these pins (high or low) are the bits that you're writing to are gister when you write, or the values you're reading when you read.

Fig12:LCDdisplay

11. Keypad

A **4x4 membrane keypad** is a compact and a cost-effective input device that is commonly used ina variety of electronics projects. It consists of 16 buttons arranged in a 4x4 grid and is covered with a flexible membrane that protects the buttons and ensures their durability. The pinout of a4x4 membrane keypad typically consists of 8 pins, 4 for the columns and 4 for the rows. The pin configuration may vary depending on the specific keypad model, but the general idea is that the columns are connected to the Arduino's input pins and the rows are connected to the Arduino's output pins.

- Substrate: A non-conductive material, such as plastic, that serves as the base for the **keypad**.
- Conductive traces: Thin metal wires or stripes, typically made of copper or silver, that run between the buttons and the microcontroller.
- Buttons: Flexible buttons made of **silicone** or similar material, that completes an electrical circuit when pressed and connects to the conductive traces.
- Adhesive: A layer of adhesive material, such as glue or tape, that is used to attach the buttons to the substrate.

- Coverlayer: A clear layer that covers the buttons and protects the keypad from damage and wear.

- Electrical contacts: Connections between the **key pad and the microcontroller**, usually made of metalpins, that allow the microcontroller to read the state of the buttons.

Fig13:Keypad

12. RGBLED

RGB LED modules can emit various colors of light. They are manufactured by packaging three LEDs of red, green, and blue into a transparent or semi transparent plastic shell and have four pins. The three primary colors, red, green, and blue, can be mixed and compose all kinds of colors by brightness, so you can make an RGB LED emit colorful light by controlling the circuit.

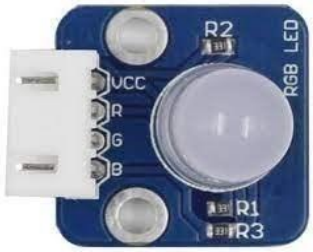


Fig14:RGB LED

13. TP4056Charger

The TP4056 is a popular lithium-ion/lithium-polymer battery charger IC (integrated circuit) thatis commonly used in DIY electronics projects and low-cost battery charging applications. TheTP4056is commonly used in applications such as USB-powered battery chargers, DIY power banks, and other projects where single-cell lithium-ion or lithium-polymer battery charging is required.

Fig15:TP4056Charger

14. ESP32

ESP32 is a series of low-cost, low-power system on a chip micro controllers with integrated Wi-Fi and dual-mode Bluetooth. A single-core RISC-V microprocessor and includes built-in antenna switches, RF balun, power amplifier, low-noise receive amplifier, filters, and power-management modules.

Features of the ESP32 includes the following:

- Processors: CPU: Xtensa dual-core (or single-core) 32-bit LX6 microprocessor, operating at 160 or 240 MHz and performing at up to 600 DMIPS. Ultra low power (ULP) co-processor
- Memory:520KiBRAM,448KiBROM
- Wireless connectivity: Wi-Fi: 802.11b/g/n.Bluetooth:v4.2BR/EDR and BLE (shares the radio with Wi Fi)
- Peripheral interfaces: 34 × programmable GPIOs.12-bit SAR ADC up to 18 channels.2 ×8-bitDACs.10×touch sensors (capacitive sensing GPIOs).4×SPI.2×I²Sinterfaces.2 ×I²Cinterfaces.3×UART.SD/SDIO/CE-ATA/MMC/eMMChostcontroller.SDIO/SPI

slave controller. Ethernet MAC interface with dedicated DMA and planned IEEE 1588 Precision Time Protocol support. CAN bus2.0.Infrared remote controller (TX/RX, up to 8 channels) .Pulse counter (capable of full quadrature decoding).Motor PWM.LED PWM(upto 16 channels).Ultra low power analog pre-amplifier

- Security: IEEE 802.11 standard security features all supported, including WPA, WPA2,WPA3 (depending on version)and WLAN Authentication and Privacy Infrastructure (WAPI).Secure boot. Flash encryption.1024-bit OTP, up to 768-bit for customers.
- Power management: Internal low-dropout regulator. Individual power domain for RTC.5µA deep sleep current. Wakeup from GPIO interrupt, timer, ADC measurements, capacitive touch sensor interrupt.

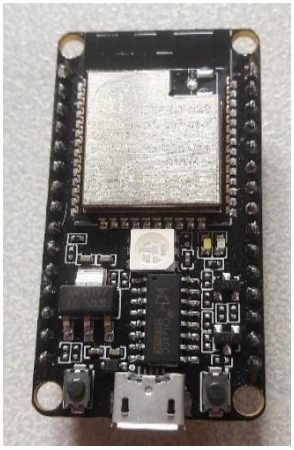


Fig16:ESP32

15. Flame Sensor

A flame sensor definition is a type of detect or that is used to detect as well as react to the occurrence of a fire or flame. A flame sensor frequently responds faster & more precisely as compared to a heat or smoke sensor because of the mechanisms it utilizes to notice the flame. Flame sensors are usually used to verify whether the furnaces are functioning correctly. These sensors are also used in an ignition system to get precise actions otherwise to inform the operator.

The specifications of the flame sensor include the following.

- The range of operating voltage ranges from3.3V to 5V.
- The operating current is15 mA.
- The comparator chip used is LM393.
- The type of sensor is YG1006 Photo Transistor.
- Sensitivity can be adjusted by a potentiometer.
- The output type is Digital o/p or Digital &Analog output.
- Red LED is for power and green LED is for output.
- The range of the spectrum is from760nmto 1100nm
- The detection angle is from 0 to 60 degrees.
- Operating temperature ranges from-25℃to85℃.
- The size of PCB is 3cm X1.6cm.

Fig17:FlameSensor

- Pin1(VCC):This is a 5V power supply pin.
- Pin2(GND): This is a GND pin.
- Pin3(OUT):This is a digital output pin.

16. Voltage Sensor

This sensor is used to monitor, calculate and determine the voltage supply. This sensor can determine the AC or DC voltage level. The input of this sensor can be the voltage whereasthe output is the switches, analog voltage signal, a current signal, an audible signal, etc. Some sensors provide sine wave forms or pulse waveforms like output & other scan generate outputs like AM(Amplitude Modulation),PWM(Pulse Width Modulation)or FM (Frequency Modulation).The measurement of these sensors can depend on the voltage divider. This sensor

includes input and output. The input side mainly includes two pins namely positive and negative pins. The two pins of the device can be connected to the positive & negative pins of thesensor. The device positive & negative pins can be connected to the positive & negative pins of the sensor. The output of this sensor mainly includes supply voltage(Vcc), ground(GND),analog o/p data.

Fig18:VoltageSensor

17. DS18B20TemperatureSensor

The DS18B20 is one type of temperature sensor and it supplies 9-bit to 12-bit readings of temperature. These values how the temperature of a particular device. The communication of this can be done through a one-wire bus protocol which uses one data line to communicate with an inner microprocessor. Additionally, this sensor gets the power supply directly from the data line so that the need for an external power supply can be eliminated. The applications of the DS18B20 temperature sensor include industrial systems consumer products systems which are sensitive thermally, thermostatic controls, and thermometers.

The specifications of this sensor include the following.

- This sensor is a programmable and digital temperature sensor
- The communication of this sensor can be done with the help of a1-Wire method
- The range of power supply is 3.0V–5.5V
- Fahrenheit equals to-67°Fto+257°F
- The accuracy of this sensor is ± 0.5°C
- Theo/pre solution will range from 9-bitto12-bit

- Itchangesthe12-bittemperaturetodigitalwordwithin750mstime
- This sensor can be power-driven from the data line
- Alarm options are programmable
- ThemultiplexingcanbeenabledbyUnique64-bit address
- Thetemperaturecanbecalculatedfrom-55°Cto+125°C.
- TheseareobtainablelikeSOP,To-92,andalsoasawaterproofsensor

Fig 19:Temperature

Sensor The pin configuration of DS18B20 discussed

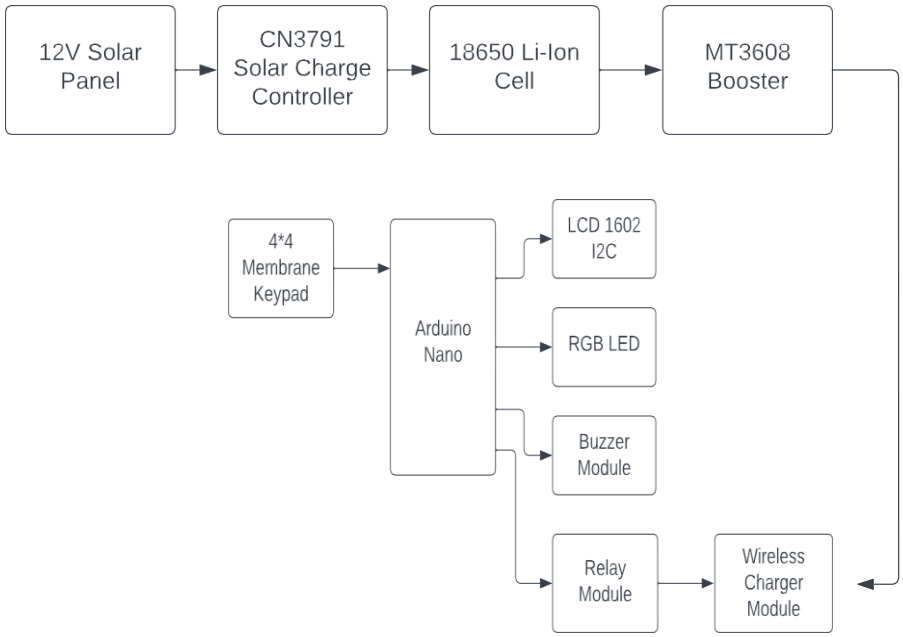
- Pin1(Ground):This pin is used to connect to the GND terminal of the circuit
- Pin2 (Vcc): This pin is used to give the power to the sensor which ranges from 3.3V or5V
- Pin3(Data):

  The data pin supplies the temperature value, whichcan communicate with the help of 1- wire method.

CHAPTER 6

6. HARDWARE IMPLEMENTATION

6.1 Transmitters side



Components of Transmitters side;

6.1.1.1 Solar panel: The Sun Factory Portable, Light Weight, Long Life 20W **12V** Standard Poly Crystalline **Solar Panel** Module Latest Technology.

6.1.1.2 Solar Charge Controller: It is used to keep the battery from overcharging byregulating the current and voltage from the **solar panel** to the battery.

6.1.1.3 Li ion cell: 18650 batteries are most commonly lithium-based, although sodium-ion variants are available for purchase. Lithium-ion batteries consist ofan anode, typically made of graphite and a cathode, often of lithium-metal oxide.

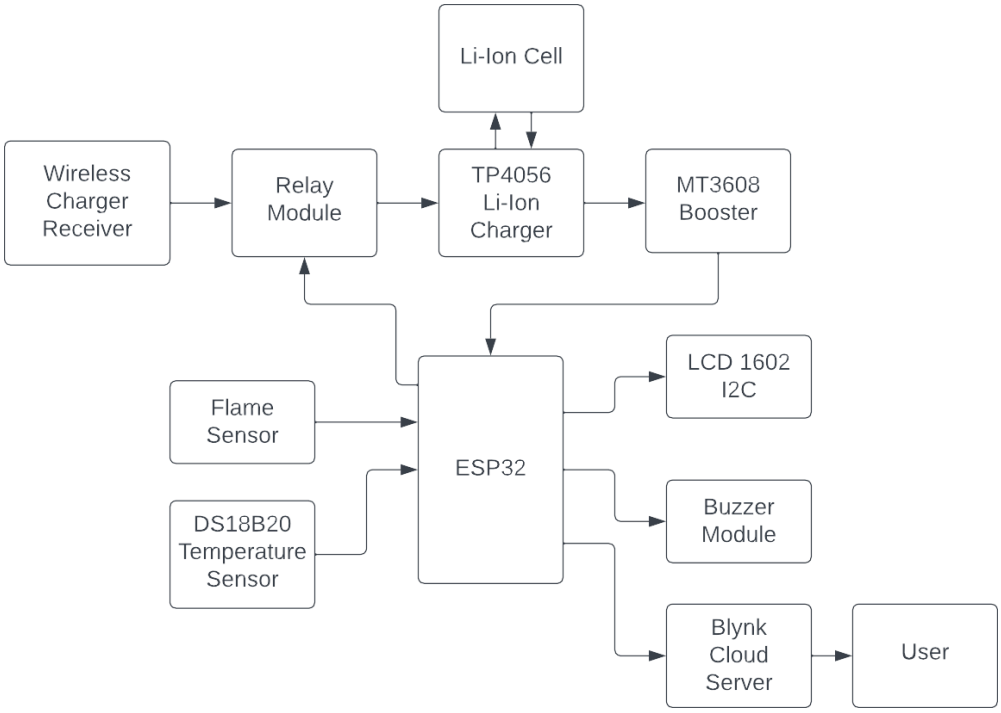
6.1.1.4 MT3608 Booster: The MT3608 Boost Converter Module is a compact, high- efficiency voltage booster designed to elevate voltages from as low as 2V up to a maximum of 28V DC.

6.1.1.5 Membrane keypad: Membrane keyboards work by electrical contact between the keyboard surface and the underlying circuits when keytop areas are pressed.

6.1.1.6 Relay module: The Single Channel Relay Module is a convenient board which

can be used to control high voltage, high current load such as motor, solenoidvalves, lamps and AC load.

6.2 Receivers side



Components of Receivers side;

6.2.1.1 Wireless charger receiver: A wireless charging receiver is used to wirelesslyreceive electric power from a wireless charging transmitter.

6.2.1.2 MT3608 Booster: The MT3608 Boost Converter Module is a compact, high-efficiency voltage booster designed to elevate voltages from as low as 2V up to a maximum of 28V DC.

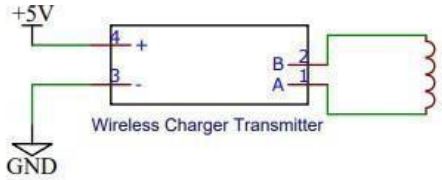
6.2.1.3 Blynk cloud server: It is responsible for all the communications between the smartphone and hardware.

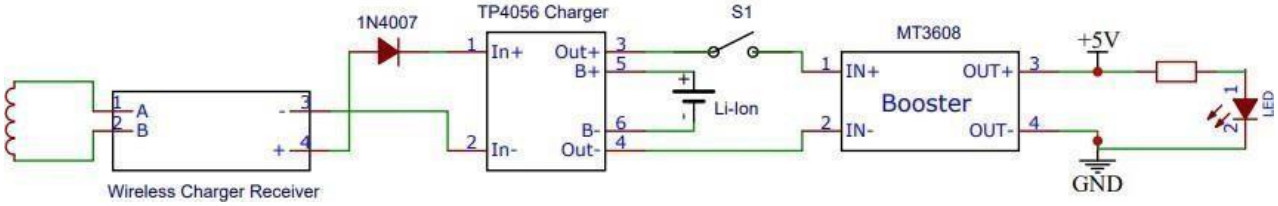
6.2.1.4 DS18B20 Temperature sensor: The DS18B20 is a small temperature sensor with a built in 12bit ADC. It can be easily connected to an Arduino digital input. The sensor communicates over a one-wire bus and requires little in the way of additional components.

6.2.1.5 Flame sensor: A flame-sensor is one kind of detector which is mainly designed for detecting as well as responding to the occurrence of a fire or flame.

6.2.1.6 ESP32:ESP32 is a single 2.4 GHz Wi-Fi-and-Bluetooth combo chip designedwith the TSMC low-power 40 nm technology. It is designed to achieve the best power and RF performance, showing robustness, versatility and reliability in a wide variety of applications and power scenarios**.**

6.3 **Wireless Car Circuit diagram**

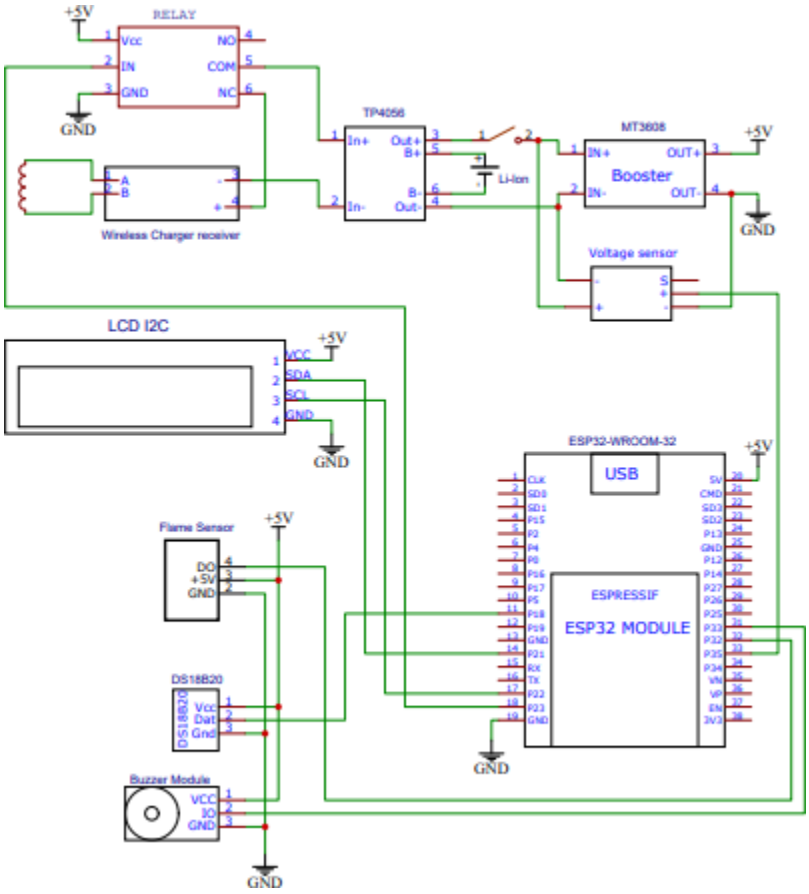




- Wireless Charger Transmitter : A wireless charger transmitter, commonly referred to simply as a wireless charger or charging pad, is a device that uses electromagnetic induction to transfer energy wirelessly to charge compatibleelectronic devices, typically smartphones, smartwatches, or other portable gadgets. The wireless charger transmitter is essentially a pad or stand that plugs into a power source, typically via a USB cable or an AC adapter. Thispad contains a coil of wire through which an alternating current (AC) passes,creating an oscillating magnetic field.
- Wireless Charger Receiver : A wireless charger receiver, also known as a wireless charging receiver or receiver coil, is a component embedded withinelectronic devices to enable them to charge wirelessly when placed on a compatible wireless charging pad or transmitter.
- 1N4007 : The 1N4007 is a silicon rectifier diode. It's part of the 1N400x series of diodes, which includes various models differing in their maximum repetitive reverse voltage (Vrrm) ratings. Rectifier diodes are used in electronic circuits to convert alternating current (AC) into direct current (DC). They allow current to flow in one direction only, blocking reverse current flow. This property makes them suitable for converting AC to DC inpower supplies, voltage regulators, and other applications where unidirectional current flow is required.

- TP4056 Charger : The TP4056 is a popular lithium-ion battery charger IC (integrated circuit) commonly used for charging single-cell lithium-ion or lithium-polymer batteries. The TP4056 is a linear charger IC that provides constant-current (CC) and constant- voltage (CV) charging stages for lithium- ion batteries. It is designed to charge single lithium-ion cells, making it suitable for various applications such as USB-powered chargers, portable power banks, and battery-powered devices. The TP4056 typically operates with input voltages ranging from 4.5V to 5.5V. This makes it compatible with USB power sources, such as USB ports on computers, USB wall adapters, or USB power banks.
- Li-Ion Battery : Lithium-ion (Li-ion) batteries are a type of rechargeable battery that has become ubiquitous in modern electronics due to their high energy density, lightweight design, and relatively low self-discharge rate. Li- ion batteries are composed of one or more cells, each containing a cathode (positive electrode), an anode (negative electrode), and an electrolyte. The cathode is typically made of lithium cobalt oxide (LiCoO2), lithium iron phosphate (LiFePO4), or other lithium-based compounds, while the anode is commonly made of graphite or other carbon-based materials. The electrolyte is usually a lithium salt dissolved in an organic solvent. During charging, lithium ions move from the positive cathode through the electrolyte to the negative anode, where they are stored. During discharging, the ions flow backto the cathode, generating electrical energy that can be used to power devices.
- MT3608 Booster : The MT3608 is a popular step-up (boost) DC-DC converter module used to increase voltage levels efficiently. The MT3608 is designed to take a lower input voltage and boost it to a higher output voltage.It operates as a step-up converter, meaning it increases the voltage level while maintaining the same or lower output current. The MT3608 can typically accept input voltages ranging from 2V to 24V and boost them to output voltages adjustable from 2V to 28V.

6.4. **EV CAR Circuit Diagram**



- Wireless Charger Receiver : A wireless charger receiver, also known as a wireless charging receiver or receiver coil, is a component embedded withinelectronic devices to enable them to charge wirelessly when placed on a compatible wireless charging pad or transmitter.
- Relay : A relay is an electrically operated switch that uses an electromagnet to mechanically control the switching of one or multiple circuits. Relaysare commonly used in various electrical and electronic systems to control high-power devices or circuits with low-power signals.
- TP4056 Charger : The TP4056 is a popular lithium-ion battery charger IC

(integrated circuit) commonly used for charging single-cell lithium-ion or lithium- polymer batteries. The TP4056 is a linear charger IC that provides constant-current (CC) and constant-voltage (CV) charging stages for lithium- ion batteries. It is designed to charge single lithium-ion cells, making it suitable for various applications such as USB- powered chargers, portable power banks, and battery-powered devices. The TP4056 typically operates with input voltages ranging from 4.5V to 5.5V. This makes it compatible withUSB power sources, such as USB ports on computers, USB wall adapters, or USB power banks.

- MT3608 Booster : The MT3608 is a popular step-up (boost) DC-DC converter module used to increase voltage levels efficiently. The MT3608 is designed to take a lower input voltage and boost it to a higher output voltage.It operates as a step-up converter, meaning it increases the voltage level while maintaining the same or lower output current. The MT3608 can typically accept input voltages ranging from 2V to 24V and boost them to output voltages adjustable from 2V to 28V.
- Voltage Sensor : A voltage sensor is a device used to measure the voltagelevel in an electrical circuit. It detects and quantifies the voltage present across its terminals or probes and provides an output signal proportional to the measured voltage. Voltage sensors are essential components in variouselectronic systems for monitoring, control, and safety purposes.
- LCD I2C : An LCD with I2C (Inter-Integrated Circuit) interface, commonlyreferred to as an "LCD I2C backpack" or "I2C LCD module," is a type of liquid crystal display (LCD) that includes a small circuit board with an I2C serial interface adapter. This adapter simplifies the process of interfacing the LCD with microcontrollers or other devices by reducing the number of required I/O pins and handling communication over the I2C bus.
- Flame Sensor : A flame sensor is a device used in various systems, particularly in heating, ventilation, and air conditioning (HVAC) systems, as well as in industrial settings where flames are present. The primary functionof a flame sensor is to detect the presence of a flame or pilot light.
- ESP32 Module : The ESP32 is a versatile Wi-Fi and Bluetooth-enabled system-on- chip (SoC) developed by Espressif Systems. It's widely used in various IoT (Internet of Things) applications due to its powerful processing capabilities, low power consumption, and rich set of features.
- DS 18820 : The DS18B20 is a digital temperature sensor manufactured by Maxim Integrated. It is widely used in various applications due to its simplicity, accuracy, and digital interface.

- Buzzer Module : A buzzer module is an electronic component used to generate audible tones or sounds in various electronic projects and devices.Buzzer modules are commonly used in applications such as alarms, notifications, timers, and user interfaces to provide auditory feedback.

6.5 Hardware Result

The implementation of the solar powered wireless charging station has reached a significant milestone with the successful completion of the hardware setup integrating temperature and flame sensors for fire detection and response.

The hardware prototype is developed which is able to charge a Li-ion cell wirelessly using the transmitter and receiver coils. The transmitter side battery receives input from a solar panel, regulated by a charge controller to ensure safe charging. The duration for which we wish to charge will be set up via a keypad. The ESP module is able to receive inputs from the three sensors (voltage, temperature and flame) and display battery voltage value, charge percentage and temperature in the LCD display and the Blynk app. Charging halts upon detection of high temperature or flame, accompanied by a buzzer sound. Notifications are displayed on the vehicle's LCD screen and on mobile devices through the Blynk app, hence altering the user.

Fig 29: Hardware setup

Fig 30: Voltage percentage indication

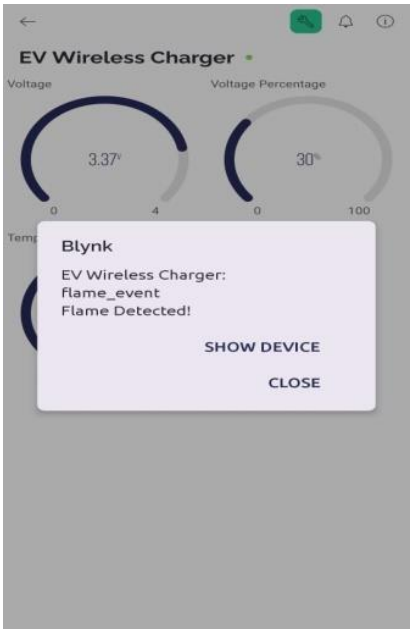


Fig 31: Flame detection

CONCLUSION

The Electric vehicles are emerging as the preferred mode of transportation compared to fossil fuel – based vehicles due to their eco-friendliness, quieter operation lower running and maintenance costs. Therefore, ensuring convenient charging methods for electric vehicles is essential. Wireless power transfer for electric vehicle charging is a rapidly developing field, The simulation has shown how charging takes place at the power electronics device level and output voltage variations for different inverter frequency and input voltage values. The hardware prototype of the charging station illustrates wireless charging between the two coils using solar power, making the process cleaner and greener, safety feature has been implemented in it and IoT is used to enable us to view the status of car battery on our mobile phone. Despite lower efficiency being a drawback of wireless charging, technological advancements offer solutions to solve this issue.