DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

SRINIVASA RAMANUJAN CENTRE

KUMBAKONAM, TAMIL NADU, INDIA – 612 001

EFFICIENT AND PRIVATE SCHEDULING OF WIRELESS ELECTRIC VEHICLES CHARGING SYSTEM

A project report submitted to the SASTRA Deemed to be University
in partial fulfillment of the requirements
for the award of the degree of

B. Tech. - Electrical & Electronics Engineering

Submitted by

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(Reg.no:223005030)
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June 2023

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

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Bonafide Certificate

This is to certify that the project work titled "**EFFICIENT AND PRIVATE SCHEDULING OF WIRELESS ELECTRIC VEHICLES CHARGING SYSTEM**" submitted in partial fulfillment of the requirements for the award of the degree of B. Tech. Electrical & Electronics Engineering to the SASTRA Deemed to be University, it is a bona-fide record of the work done by **Mr. B. Makesh (223005030), Mr. R. Ragul (223005039)** during the eighth semester of the academic year 2022-23, in the **Department of Electrical & Electronics Engineering**, under my supervision. This project has not formed the basis for the award of any degree, diploma, associateship, fellowship or other similar title to any candidate of any University.

Signature of Project Supervisor :

Name with Affiliation : Mr. B. Ponmudi, Assistant Professor, EEE, SASTRA

Date :

Project *Viva-vo*ce held on ________________

Examiner 1 **Examiner 2**

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

SRINIVASA RAMANUJAN CENTRE

KUMBAKONAM – 612001

Declaration

We declare that the project titled "**EFFICIENT AND PRIVATE SCHEDULING OF WIRELESS ELECTRIC VEHICLES CHARGING SYSTEM**" submitted by us is an original work done by us under the guidance of **Mr. B. Ponmudi, Assistant Professor, Department of Electrical and Electronics Engineering, SASTRA Deemed to be University, Srinivasa Ramanujan Centre** during the eighth semester of the academic year 2022-23, in the **Department of Electrical and Electronics Engineering**. The work is original and wherever we have used materials from other sources, we have given due credit and cited them in the text of the project. This project has not formed the basis for the award of any degree, diploma, associate-ship, fellowship or other similar title to any candidate of any University.

Signature of the candidate(s) :

Name of the candidate(s) : **MAKESH.B (223005030)**

: **RAGUL.R (223005039)**

Date :

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Abstract

The project aims to create a wireless charging system for electric vehicles that utilizes power transfer transmission coils to enable charging while the vehicle is in motion. The source power can be solar power or the power grid if solar energy is not available. EV charging methods that rely on physical connections between the vehicle and charging station can be limiting and inconvenient. The objective of the wireless charging system is to facilitate charging without requiring physical contact, thereby addressing the associated constraints. The system consists of a ground-embedded power transfer transmission coil and an integrated receiving coil in the Electric Vehicle. The transmission coil produces a magnetic field when given AC power. A voltage is induced in the receiving coil by the magnetic field, which enables power transfer to charge the EV's battery. Advanced control and communication techniques are utilized to ensure efficient power transfer. The methods involve adjusting the resonant frequency, regulating power, and establishing communication protocols between the electric vehicle and the charging infrastructure. Optimizing power transfer efficiency is achieved through resonant frequency tuning, which involves matching the frequencies of the transmission and receiving coils. This project aims to promote the widespread adoption of Electric Vehicles by developing an efficient and reliable wireless charging solution.

Specific Contribution

- Makesh B – Data collection, Implementing and Testing the Hardware connection.
- Ragul R – Developing simulation on proteus and testing the result.

Technical Limitations & Ethical Challenges faced:

- Placing hardware components on the transmitter and receiver sides and checking the result was a difficult task.
- Finding and connecting the circuits in the Proteus simulation is also one of the difficult challenge.

Signature of the Guide | Student Reg. No :

Name : | Name :

Table of Contents

List of Figures

CHAPTER 1

INTRODUCTION

1.1 BASIC INTRODUCTION

Wireless power transfer technology has attracted a lot of attention during the last ten year, due to its inherent benefits over traditional power transfer techniques. Applications that have been suggested include electrical vehicle converters, low-power biomedical implants, and rail carriages with at least 95% efficiency.

1.2 WIRELESS POWER TRANSFER (WPT)

As an alternative to hardwiring, wireless transmission is used to connect electrical equipment. There are two primary types of wireless power systems: those that emit electromagnetic radiation and those that do not. Inductive coupling between wire coils or capacitive coupling between metal electrodes provide non-radiative or near-field power transfer. Inductive coupling is the most prevalent wireless technology, and it is used for everything from powering or charging electric trains and buses to implanted medical devices such as RFID badges and toothbrush adapters. Current research focuses on the development of wireless systems to provide electricity to unplugged mobile computing devices such as smartphones, digital audio players, and laptops. The *Figure (1)* describe the wireless power transfer system. Power beaming refers to the transmission of energy over long distances using electromagnetic radiation beams, such as microwaves or lasers.

Although these techniques enable the transmission of energy over greater distances, they require a specialized receiver. This technology's potential implementations include solar-powered satellites and drone aircraft propelled by wireless means.

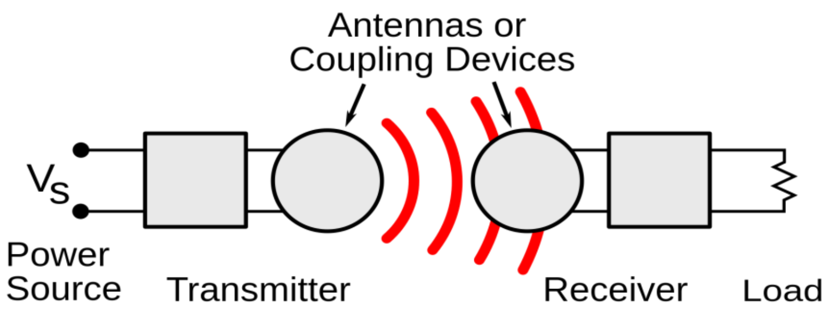


Figure (1): Wireless Power System

In a broad sense, "wireless power transfer" term refers transmitting energy through electromagnetic fields. The oscillation frequency is a crucial characteristic for classifying the waves.

1.2.1 Near-field region

Due to the non-radiative nature of these fields, the power around the transmitter is concentrated in a limited area. No energy is transmitted if there is nothing within the relatively limited range of the transmitter to couple with. There are two fundamental kinds of near field devices exist. Radius of a particular antenna: This is the frequency range where standard non-resonant capacitive or inductive coupling can transmit power efficiently. The maximum range over which resonant capacitive or inductive coupling can be used to transmit power is approximately 10 times the diameter of the antenna.

- **Inductive Coupling**

Inductive coupling is the transmission of electricity between wire coils using a magnetic field. Transformers are created when the coils of a transmitter and receiver are connected. The rectifier in a receiver may convert the AC current generated by the generator into DC current, which can then be used to power the load. The below *Figure (2)* shows that inductive wireless power system

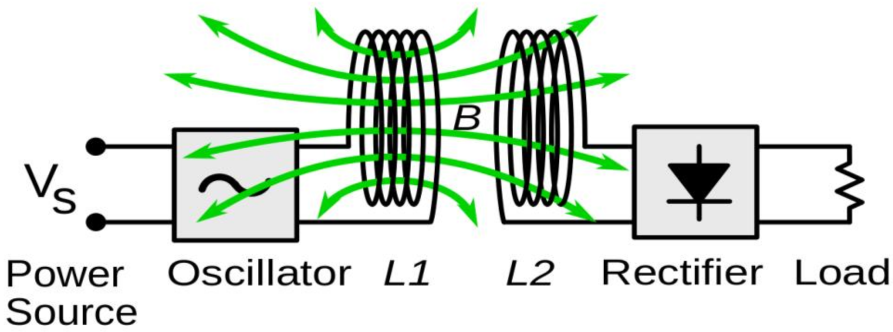


Figure (2): Inductive wireless power system

- **Resonant inductive coupling**

Every resonant circuit is comprised of a wire coil coupled to a capacitor, another resonator with internal capacitance, or a self-resonant coil. Both have been calibrated to resonate at the same frequency. Similar to the sympathetic vibrations generated by a vibrating tuning fork in a distant tuning fork with the same pitch, resonance between the coils may significantly improve coupling and power transmission. The below *Figure (3)* shows that the system of resonant inductive wireless power

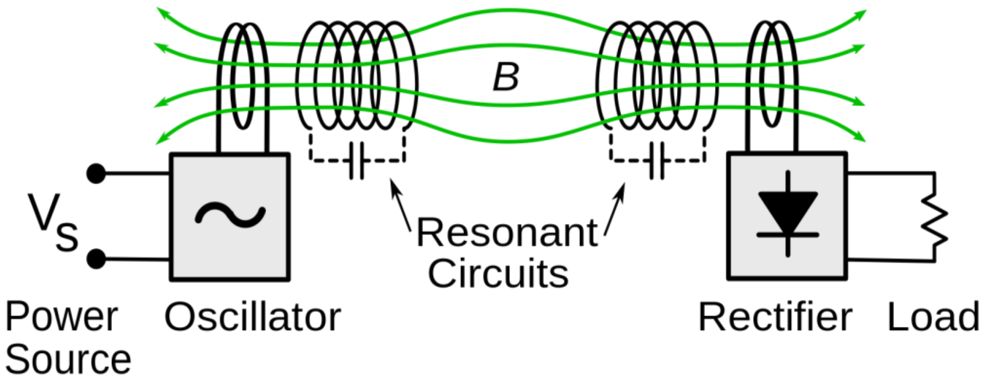


Figure (3): Resonant inductive wireless power system

CHAPTER 2

2.1 EXISTING SYSTEM

A recently developed wireless charger is designed for small load systems and boasts advanced features. The second option utilises an electronic platform that is open-source, providing the required precision, remote data collection, and adaptable capabilities. The sun's irradiance, the room temperature, and the wind speed were all carefully adjusted to determine the model's predicted results. These findings were then compared to experimental data for confirmation. An authorized framework like this may aid in identifying when a hybrid structure is preferable to using two separate devices.

- **Limitations**
  - Difficulty in Switching process
  - Power losses are high

2.2 PROPOSED SYSTEM

In this project, we used microcontroller devices to charge the electric vehicle wirelessly, which consist of an Atmega328 and a Mosfet. The primary coil that will be placed on the road will get power from a solar panel or the electric grid (if solar power is not possible). When the vehicle with the secondary coil moves along the primary coil that was placed on the road, the battery in the vehicle is charged automatically. The primary coil consists of several transmitters to transmit the energy. The technology used in the coil is magnetic induction, which exchanges the energy from the primary coil, which is placed on the road, to the secondary coil, which is placed underneath the vehicle.

- **Advantages**
  - No need for charging station
  - Reducing charging time

2.3 BLOCK DIAGRAM

Transmitter Block and its description

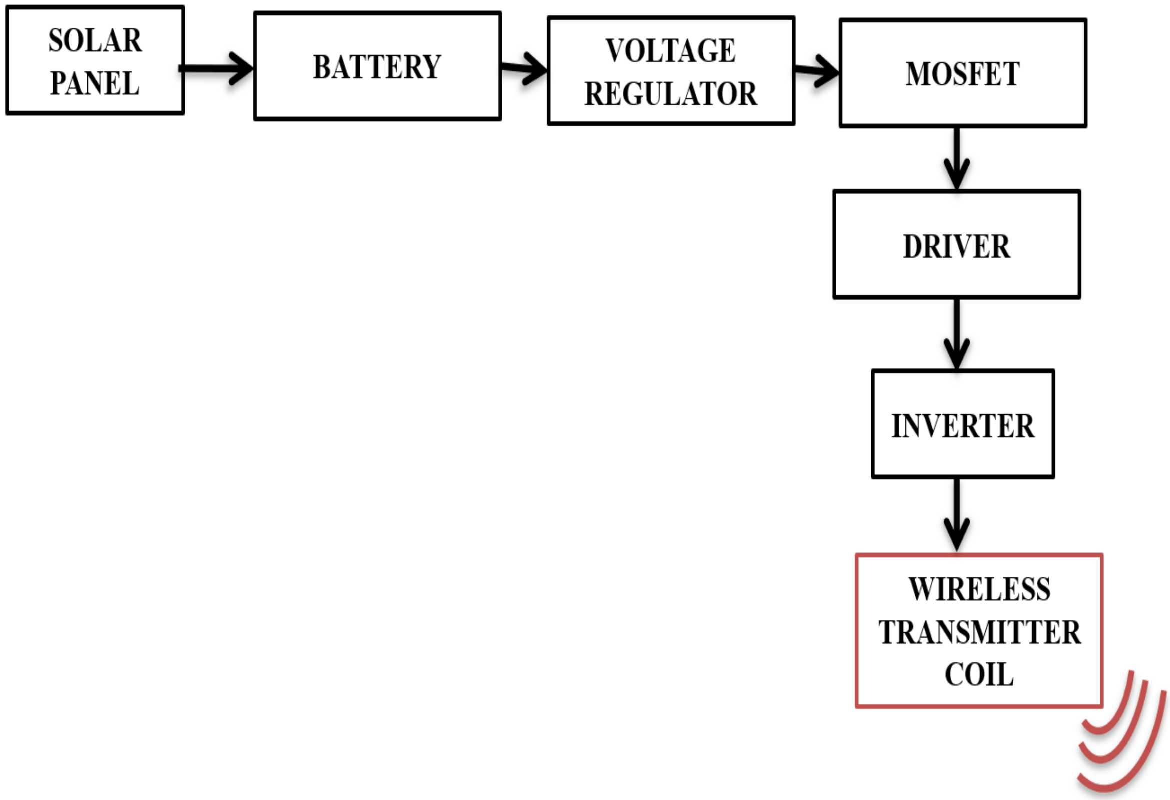


Figure (4): Block diagram of Transmitter Block

The above *Figure (4)* shows that the block diagram of transmitter block. In the Transmitter Side, a Battery, transmitting coil, Mosfet, inverter, and rectifier are used. From the solar panel, Solar power is stored and then the power is delivered from the battery to the inverter circuit, and then the power is rectified by the rectifier circuit. Then the rectified power from rectifier circuit is transferred to the coil which is transmission coil.

Receiver Block and its description

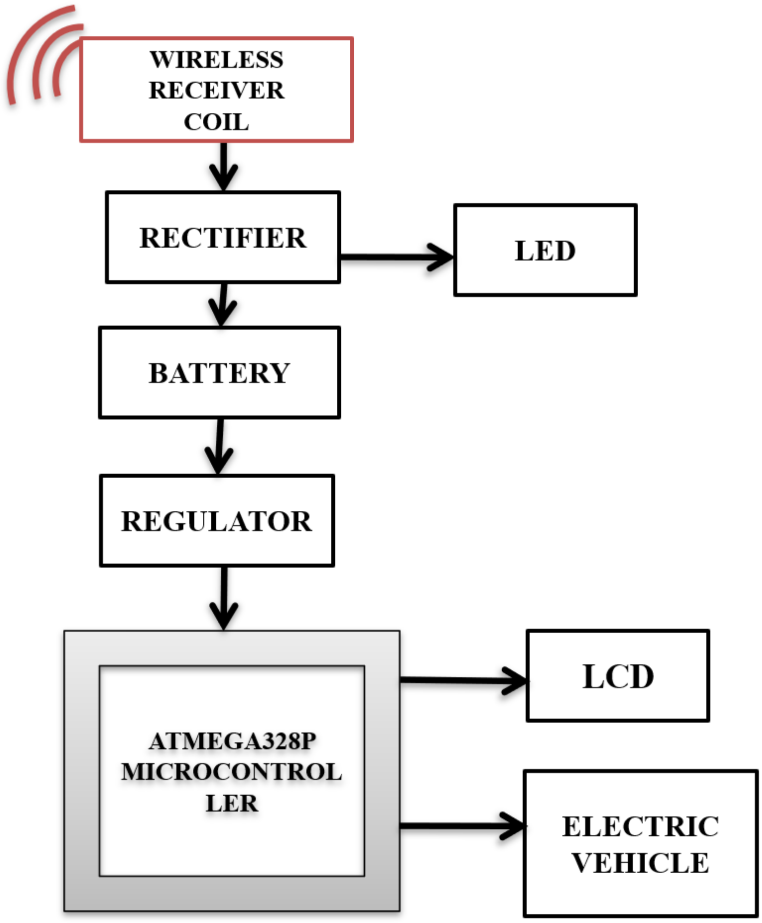


Figure (5): Block diagram of Receiver block

The above *Figure (5)* shows that the block diagram of receiver block. In the Receiver Side, the power is received and regulated. The regulated power is used to drive the motor of the vehicle. We used LCD and LED devices to indicate the status of power transfer and charging information

2.4 CIRCUIT DIAGRAM

The *Figure (6)* shows the circuit diagram of transmitter side and circuit diagram of receiver side. In transmission side the power from solar energy is obtained in solar panel which then transferred to battery which then converted from direct current to alternate current using inverter. The ac current will be then transferred to transmission coil.

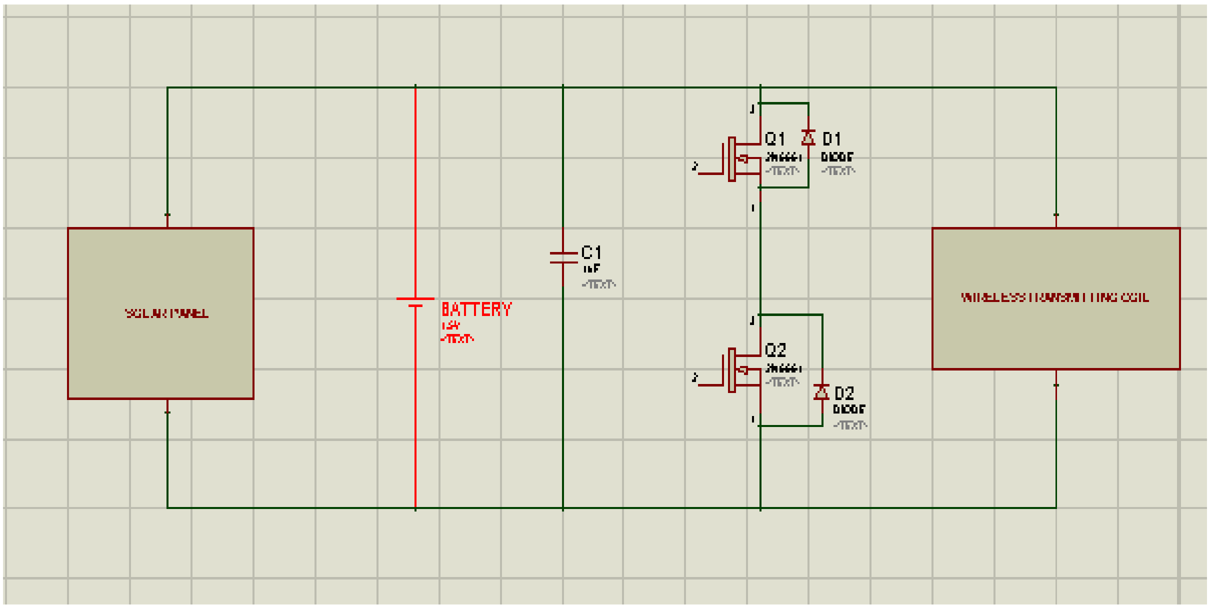


Figure (6): Circuit diagram of Transmitter Side

The *Figure (7)* shows the circuit diagram of receiver side, in which the alternate current from transmission coil is received by receiver coil, which will be then converted from alternate current to direct current using rectifier.

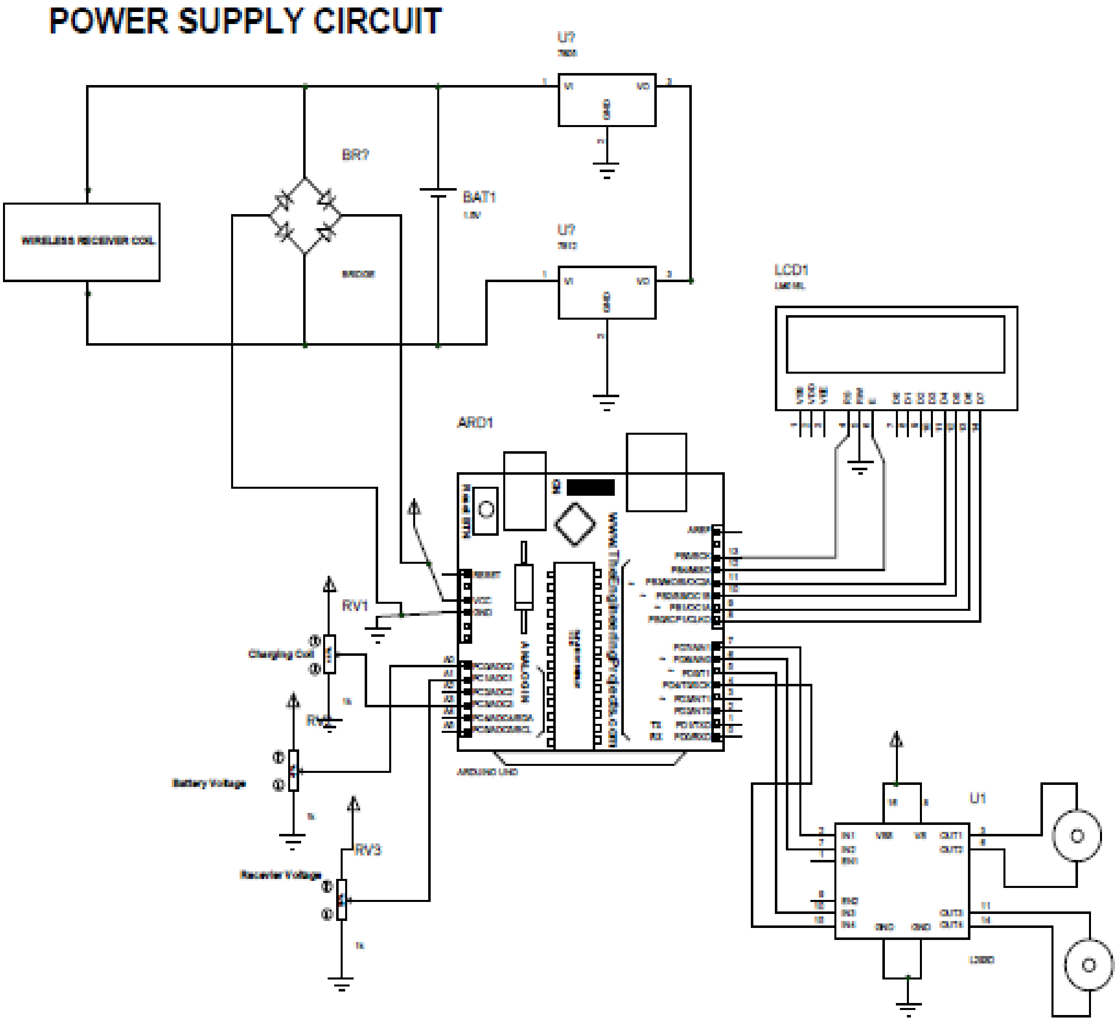


Figure (7): Circuit diagram of Receiver Side

CHAPTER 3

SOFTWARE TOOL

3.1 ARDUINO IDE SOFTWARE

Arduino.cc developed the Arduino IDE, or Arduino Integrated Development Environment, to modify, compile, and upload code for Arduino devices. The vast majority of Arduino boards are compatible with this program. The logo of Arduino IDE is shown in *Figure (8)*. The Arduino board has a USB interface for transferring data to and from a computer as well as a variety of connectors for connecting other devices. The Arduino board contains a microcontroller that can be programmed to perform any task.

Figure (8): Arduino IDE Logo

- **Arduino Software Development Kit**

The projects are saved with the.ino file extension, and you can easily search and replace terms by pressing Ctrl + F. In the domain of programming, there are two fundamental elements that stand out:

• void setup () - This is the initial process that begins when an Arduino is powered on. This procedure is invoked precisely once throughout the program's lifecycle.

• void loop () of this setup function, all ports were initialized.

This is the subsequent crucial function of the section. It contains the code that must always be executed, in contrast to the code written in the setup function. Arduino allows us to create our own devices and implement our own unique concepts in a variety of methods.

3.2 PROTEUS

Before a program written in assembly language, it can be comprehended by a microcontroller, it must be converted to binary language. Assembly language and assembler are not interchangeable concepts.

Another term for a compiled program is machine code. The microcontroller understands the same machine code instruction encoded as a 14-bit array of 0s and 1s. A analogous compilation procedure produces an array's of 0 and 1. For instance, "probe.hex" is derived from the hexadecimal representation of the file's contents.

- **Embedded C**

In the early days of microprocessor-based devices, programs were written utilizing assemblers and then burned onto EPROMs. Previously, it was impossible to determine what the software was doing. LEDs and other devices were used to monitor the program's execution and ensure that it ran as intended. In-circuit simulators were accessible to engineers who were "extremely fortunate," but they were expensive and unreliable. If embedded C is to be used, the compiler must generate executable files that can be sent to the microcontrollers or microprocessors that will execute the code. Compilers embedded provide access to every instrument.

It is easier to comprehend, study, employ, and resolve flaws in than most other languages. C has the advantage of not being microprocessor or microcontroller-specific, making it simple to write programs that execute on a wide variety of computers.

Different types of programming languages are used in the creation of embedded systems:

1. Machine Code
2. Assembly language, a low-level language
3. High level languages like Ada, C, C++, and Java.
4. Languages used for applications, such as Visual Basic, scripting, etc.

- **PROTEUS ISIS7 SIMULATOR**

Simone Zanella developed the procedural programming language PROcessor for TExt Easy to USe in 1998. when dealing with strings and has hundreds of specific functions for this purpose. The Greek Sea deity Proteus delivered instructions and dealt with Neptune's followers, he was known for his ability to change forms and was the source of the name Proteus.

Hundreds of specialized functions were eventually added to the language, which was then made specifically for Windows.

Proteus is useful (quick, easy, comprehensive), readable, and consistent.

- The ability to manipulate strings effectively,
- The availability of complex data structures like arrays, stacks, bit maps, sets, and AVL trees are some of its best features.

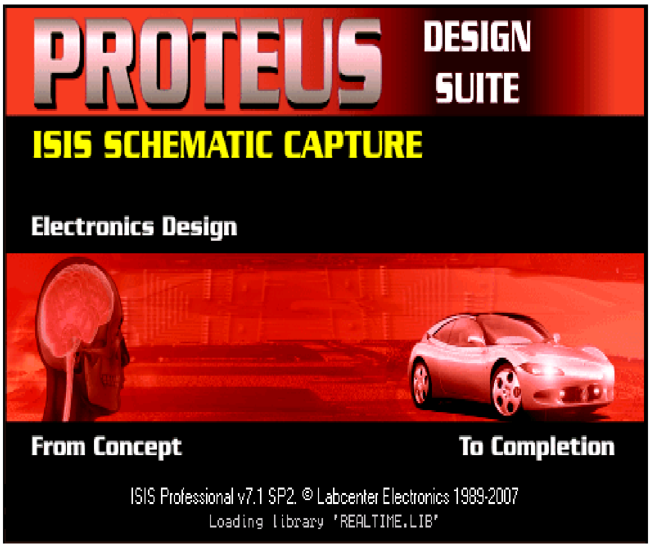


Figure (9): Proteus

The F*igure (9)* shows the logo of Proteus Software. By including user functions generated in Proteus or DLLs made in C/C++, the language may be expanded. Proteus is design software created by Lab Centre Electronics for PCB design, schematic capture, and electronic circuit modelling.

Proteus may at first glance resemble Basic, although these superficial similarities are only superficial: All common control structures are available, including if-then-else, for-next, while-loop, repeat-until, and switch-case.

CHAPTER 4

HARDWARE COMPONENTS

4.1 REQUIRED COMPONENTS

- ATMEGA328 MICROCONTROLLER
- POWER SUPPLY CIRCUIT
- LCD DISPLAY
- DC MOTOR
- L293D MOTOR DRIVER IC
- MOSFET
- RECTIFIER
- INVERTER
- BATTERY
- SOLAR PANEL

4.2 ATMEGA328 MICROCONTROLLER

The Atmega328 microcontroller is employed in various Arduino platforms, including the Arduino UNO, Arduino Nano, and Arduino Pro Mini. The ATmega328 microcontroller is classified as an Advanced Virtual RISC (AVR) device. The device exhibits the ability to process data with a bit depth of 8. The microcontroller known as the ATmega328 possesses an internal flash memory capacity of 32 kilobytes. The F*igure (10)* shows the Atmega328 microcontroller. The ATmega328 microcontroller is equipped with 1 kilobyte of EEPROM storage.

Figure (10): ATmega328 Microcontroller

4.3 POWER SUPPLY CIRCUIT

There are two primary categories of power supplies for electronic devices: linear and switching.

- **Bridge Rectifier:**

Maximum current capacity and maximum reverse voltage tolerance are utilized to classify bridge rectifiers (the latter must be atleast three times the supply RMS voltage to sustain peak voltages). The below *Figure (11)* shows the bridge rectifier diagram.

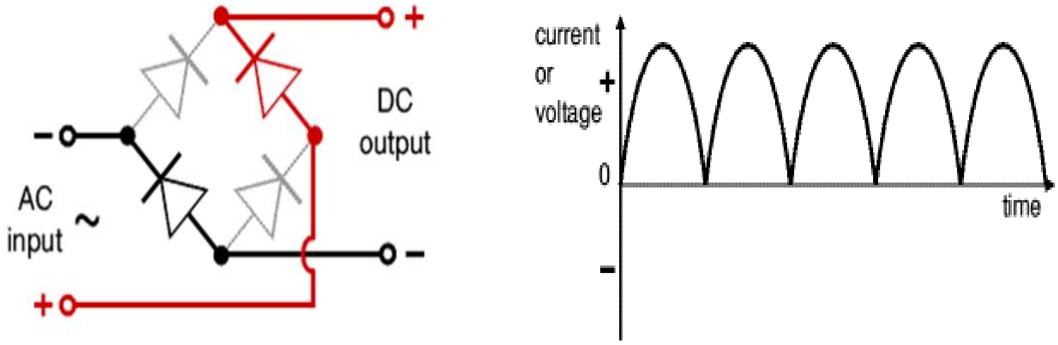


Figure (11): Bridge rectifier

- **Regulator**:

The voltage regulator output voltage of ICs may be fixed (frequently 5, 12, or 15V) or variable. (Negative) voltage regulators are frequently utilized with a variety of power sources. Modern regulators typically include overcurrent (or "overload protection") and heat (or "thermal protection") protection.

There are numerous factory-set o/p voltages for the LM78XX three-terminal regulator family. One such method is local on-card regulation, which avoids the issues associated with the dissemination of centralized regulation. If necessary, there is a cavity for attaching a heat absorber. The below *Figure (12)* shows the regulator diagram.

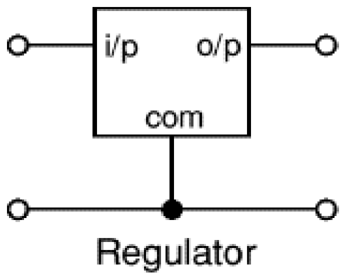
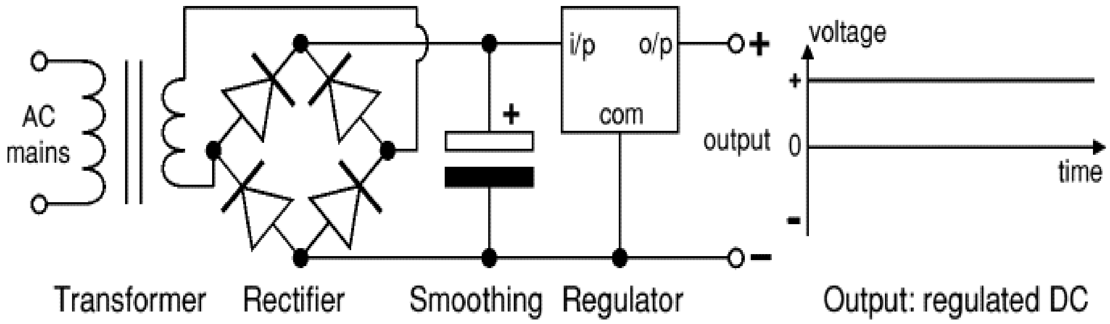


Figure (12): Regulator



The DC output of the regulator is ripple-free. It can be used in all electrical circuits without modification.

4.4 LCD DISPLAY

LCD - Its very designation suggests that it serves as a visual representation of the various textual elements. LCD has two different settings.

It consists of

- Command mode
- Switch to string.

For this setup, we opted for an RG1602A LCD, which was shown in *Figure (13).*

Figure (13): LCD Display

4.5 DC MOTOR

The Motor speed increases with input voltage. For instance, if the motor's operating voltage range is between 6 and 12, its RPM will be lowest at 6 V and highest at 12 V.

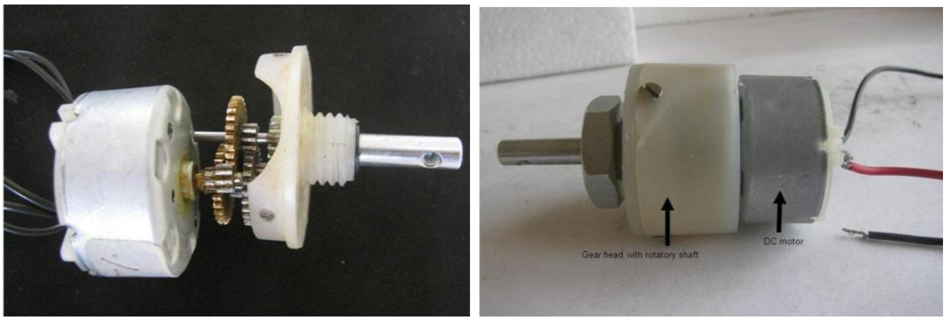


Figure (14): DC Motor

Energy conservation is adhered to when several gears are linked together. RPM and torque are negatively correlated in all DC motors, which causes it to revolve, which was shown in *Figure (14).* The smaller duplex component is turned more thoroughly by the bigger gear. The smaller duplex portion transfers the torque from the bigger portion of the previous gear, but not the speed.

4.6 L293D –MOTOR DRIVER IC

We used a Motor driving Integrated circuit which is L293D, which was shown in *Figure (15)*, It has 16 pins, each half (i.e) 8 pins are placed in both sides of the IC.

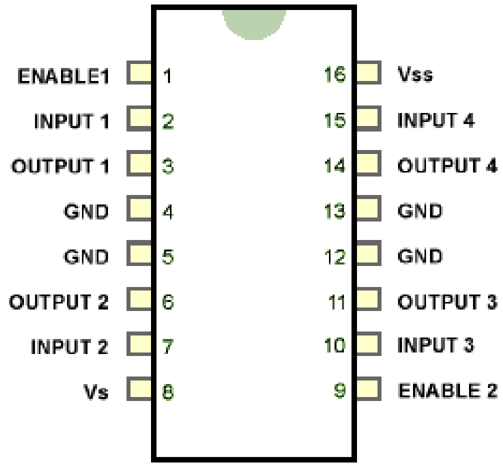


Figure (15): L293D Pin Configuration

4.7 MOSFET

The particular field-effect transistor (FET) has a unique design. A bipolar transistor has "base", "collector", and "emitter" terminals, while a MOSFET has "gate", "Drain", and "Source" terminals, which was shown in *Figure (16).* When voltage is applied to the gate, no current flows from the gate into the MOSFET because no current flows across the channel between the drain and the source.

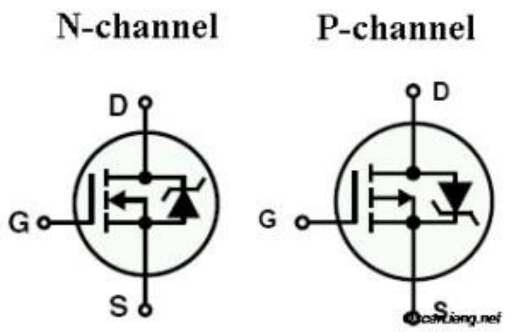


Figure (16): Mosfet Diagram

MOSFETs are utilized differently than conventional junction FETs. The infinitely high i/p impedance of MOSFETs makes them suitable for use in power amplifiers. Additionally, the devices are suitable for high-speed switching applications. Some integrated circuits used in computing incorporate minuscule MOSFETs. Because the oxide layer is so thin, MOSFETs are susceptible to electrostatic injury. In radio-frequency applications involving feeble signals, MOSFET devices typically perform less efficiently than other varieties of FET.

4.8 RECTIFIER

A rectifier is an electrical device that converts (AC), Other applications for rectification exist besides producing direct current for use as a power source. As previously stated, radio signal detectors serve as rectifiers. In gas heating systems, flame rectification is used to detect the presence of a flame. Numerous rectifier applications, including the power supply for radio, television, and computer equipment, require a constant, stable DC current, similar to what a battery would produce. In these applications, an electrical filter typically a capacitor which provides continuous current by smoothing the rectifier's output.

4.9 INVERTER

An inverter is an electronic device designed to convert direct current (DC) power into alternating current (AC) power. The power rating of an inverter determines its maximum load capacity, while efficiency ratings indicate how effectively it converts DC power to AC power, minimizing energy losses. Inverters often come equipped with protection features to prevent overloads, over-temperature issues, short circuits, and low-voltage situations. The optimal transformer efficiency may require a significantly higher frequency. Which means the power available to the device being driven by the inverter indirectly, the amount of power 150 to 3000 volts is the normal power range.

4.10 BATTERY

We used a battery which operates at a voltage of 12 volts, which was shown in *Figure (17)*, providing a continuous current capacity of 1.3 Amperes for a reliable power supply. It is important to specify the battery's chemistry, which may include options like lead-acid, nickel-cadmium, nickel-metal hydride, or lithium-ion. The battery's capacity, measured in ampere-hours (Ah) or milliampere-hours (mAh), indicates its charge storage and delivery capabilities. Additionally, it is essential to highlight the charging requirements, encompassing the charging method and time needed. Emphasize the battery's purpose within the project, particularly its role in powering specific devices or circuits.

Figure (17): 12V 1.3Amps Battery

4.11 SOLAR PANEL

A solar panel is a structure built to collect solar energy for use in heating or power generation, which was shown in *Figure (18)*. A bundled, connected arrangement of generally 610 photovoltaic solar cells is known as a PV module. A 16% efficient 230-watt module has double the area of an 8% efficient 230-watt module. A few commercially available solar modules have efficiency levels that are more than 22% and maybe even 24%. Water heating systems using solar energy are the most popular use of these panels. As a result of ongoing price reductions, solar energy is now frequently more affordable than conventional grid-supplied fossil fuel electricity in many nations.

Figure (18): Solar Panel

- **SPECIFICATION**

Power (max)	: 3W
OCV	: 21.6V
Voltage	: 17V
Current	: 0.18A
Short Circuit Current	: 0.21A

CHAPTER 5

Implementation

5.1 SOFTWARE IMPLEMENTATION

```
#include<LiquidCrystal.h>
LiquidCrystal lcd(13,12,11,10,9,8);
float correctionfactor1 = 0;
int analogInput1 = A0;
float vout1 = 0.0;
float vin1 = 0.0;
float R1_1 = 30000;
float R2_1 = 7500;
int value1 = 0;
float correctionfactor2 = 0;
int analogInput2 = A1;
float vout2 = 0.0;
float vin2 = 0.0;
float R1_2 = 30000;
float R2_2 = 7500;
int value2 = 0;
int vin1_1;
void setup()      {
Serial.begin(9600);
lcd.begin(16,2);
lcd.setCursor(0,0);
    lcd.print(" WIRELESS ");
    lcd.setCursor(0,1);
    lcd.print("CHARGING IN EV     ");
    delay(2000);
    lcd.clear();
 pinMode(A0,INPUT);
 pinMode(A1,INPUT);
pinMode(7,OUTPUT);
pinMode(6,OUTPUT);
pinMode(5,OUTPUT);
pinMode(4,OUTPUT);
pinMode(A3,INPUT)
digitalWrite(7,LOW);
digitalWrite(6,LOW);
digitalWrite(5,LOW);
digitalWrite(4,LOW); }
```

```
void loop() {
int a=analogRead(A3);
Serial.print(a);
  if(a>450)         {
    lcd.setCursor(0,0);
    lcd.print("CHARGING    ");
stopp();
    delay(1500);      }
    else if(a<450)    {
    lcd.setCursor(0,0);
    lcd.print("NOT CHARGING");
forward();            }
      voltage1();
      voltage2();     }
void voltage1() {   value1 = analogRead(analogInput1);
    vout1 = (value1 * 5) / 1023.0; // see text
    vin1 = vout1 / (R2_1/(R1_1+R2_1));
    vin1 = vin1+1 - correctionfactor1;
    lcd.setCursor(0,1);
    lcd.print("BV:");
    lcd.setCursor(3,1);
    lcd.print(vin1);
     vin1_1=((vin1/11)*100);
    lcd.setCursor(12,0);
    lcd.print(vin1_1);
    lcd.print("% ");    }
void voltage2() {   value2 = analogRead(analogInput2);
    vout2 = (value2 * 5) / 1023.0; // see text
    vin2 = vout2 / (R2_2/(R1_2+R2_2));
    vin2 = vin2 - correctionfactor2;
    lcd.setCursor(8,1);
    lcd.print("RV:");
    lcd.setCursor(11,1);
    lcd.print(vin2);      }
  void forward()
{ digitalWrite(7,HIGH);
  digitalWrite(6,LOW);
}
void stop()
{ digitalWrite(7,LOW);
  digitalWrite(6,LOW);    }
```

Figure (19): Code used in Arduino IDE

Figure (19) shows the the code which we implemented in Arduino IDE. We utilized the Arduino IDE platform to run and execute the code for the project.

5.2 HARDWARE IMPLEMENTATION

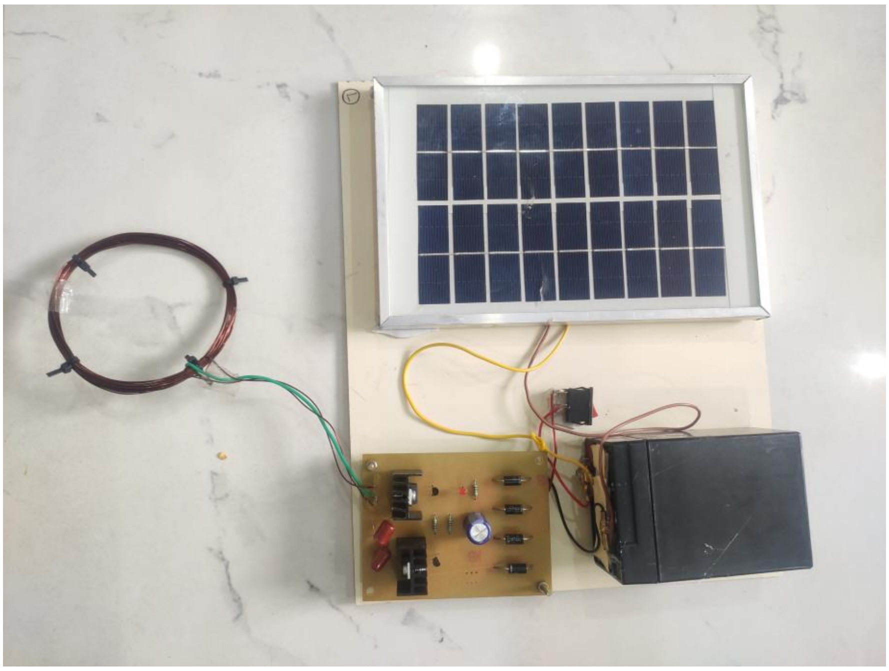


Figure (20): Wireless charging system (Transmitter side)

The *Figure (20)* shows that the system we used to transmit the power, in this system the power will be drawn from solar energy by solar panel, which will be transferred and stored in battery and then rectified by rectifier, then the rectified power will me transferred to transmission coil, which is ready to transmit energy to receiver transmission coil.

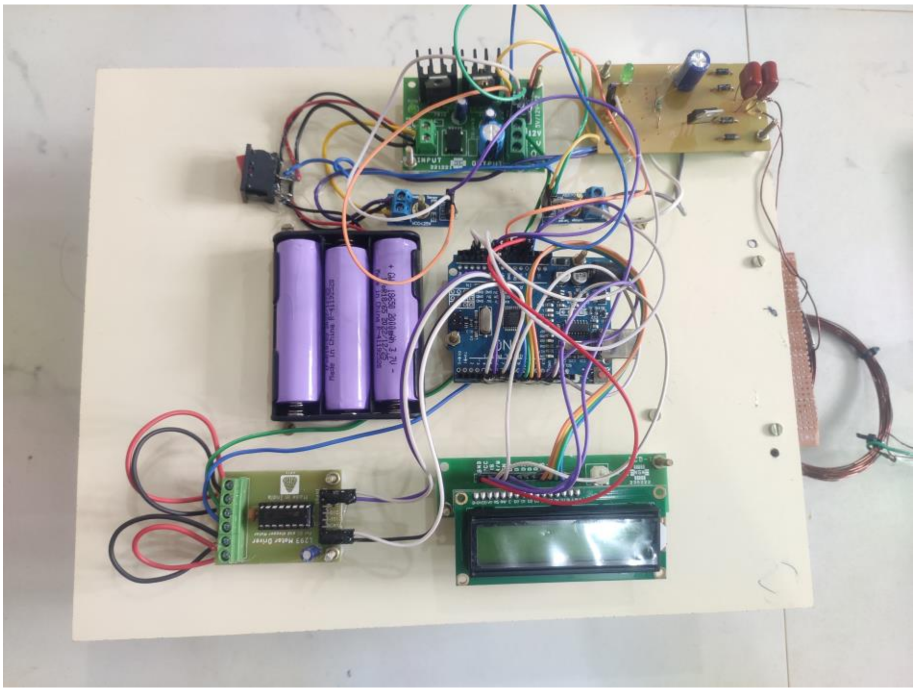


Figure (21): Wireless charging system (Receiver side)

The *Figure (21)* shows that the system we used to receive the power, in this system the power will be transmitted from transmission coil to coil which is placed in receiver side, the power will only be exchanged when the coil of receiver side and coil of transmitter side is placed together. In this the power is regulated and used to drive the motor of the vehicle, we used battery to store the power.

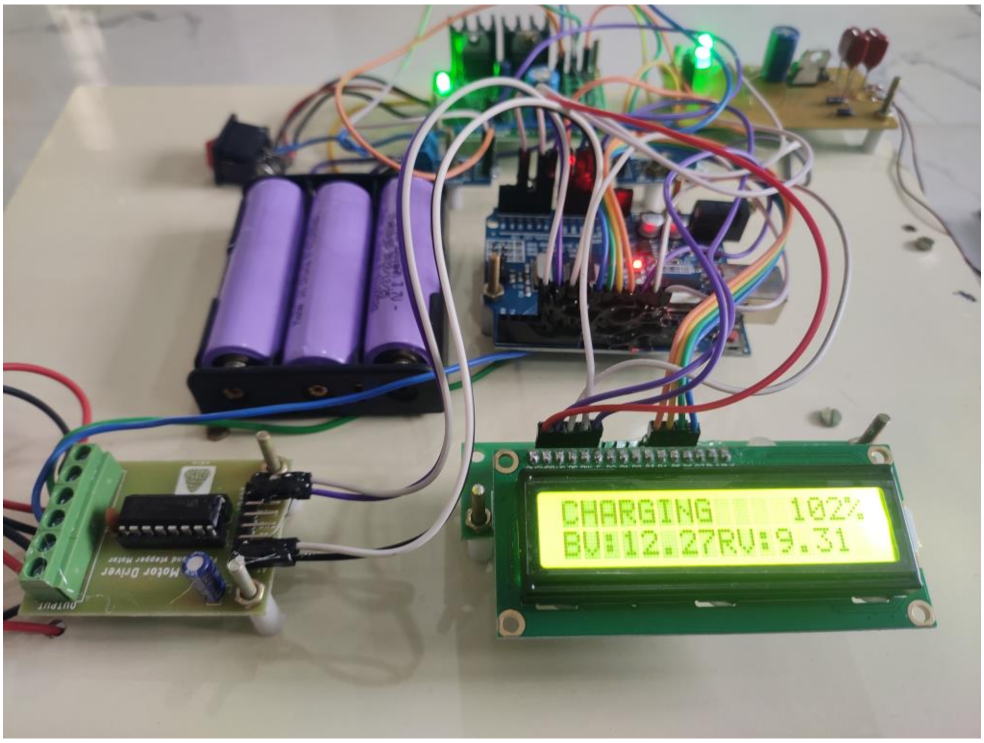


Figure (22): Wireless charging system (when charging)

When the coil of transmitter and receiver coil is interacted, the charging process will begin just like shown in *Figure (22)*, we used LCD to display the charging process and battery status.

5.3 SIMULATION AND RESULT

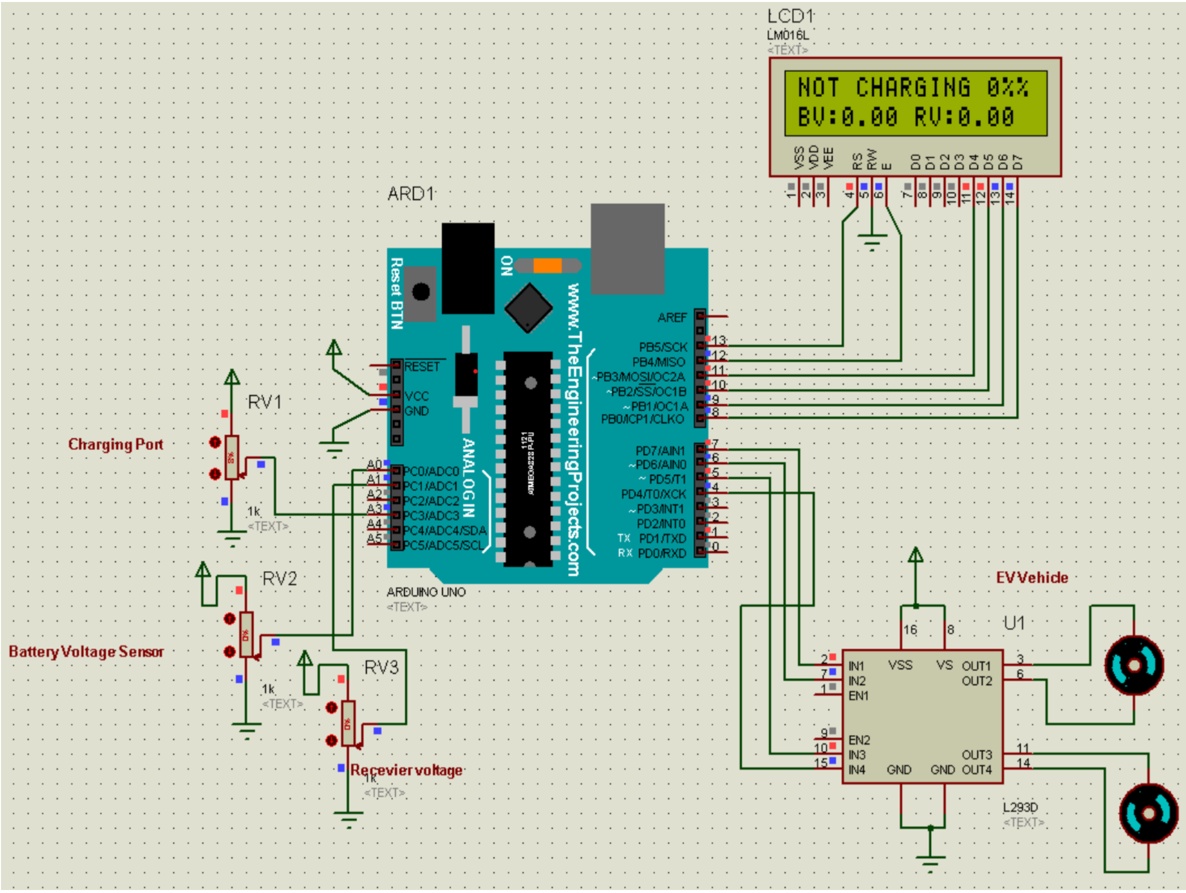


Figure (23): Proteus Simulation (idle)

During the progress of our project, we utilized the Proteus simulator as a means to simulate and assess its performance. The Proteus simulator proved to be a valuable resource in creating a virtual environment where we could accurately replicate the behavior of our project. The simulation which was done in proteus is shown in *Figure (23)*, In that we included the devices which were used in the project like Arduino, LCD display, IC, Motor.

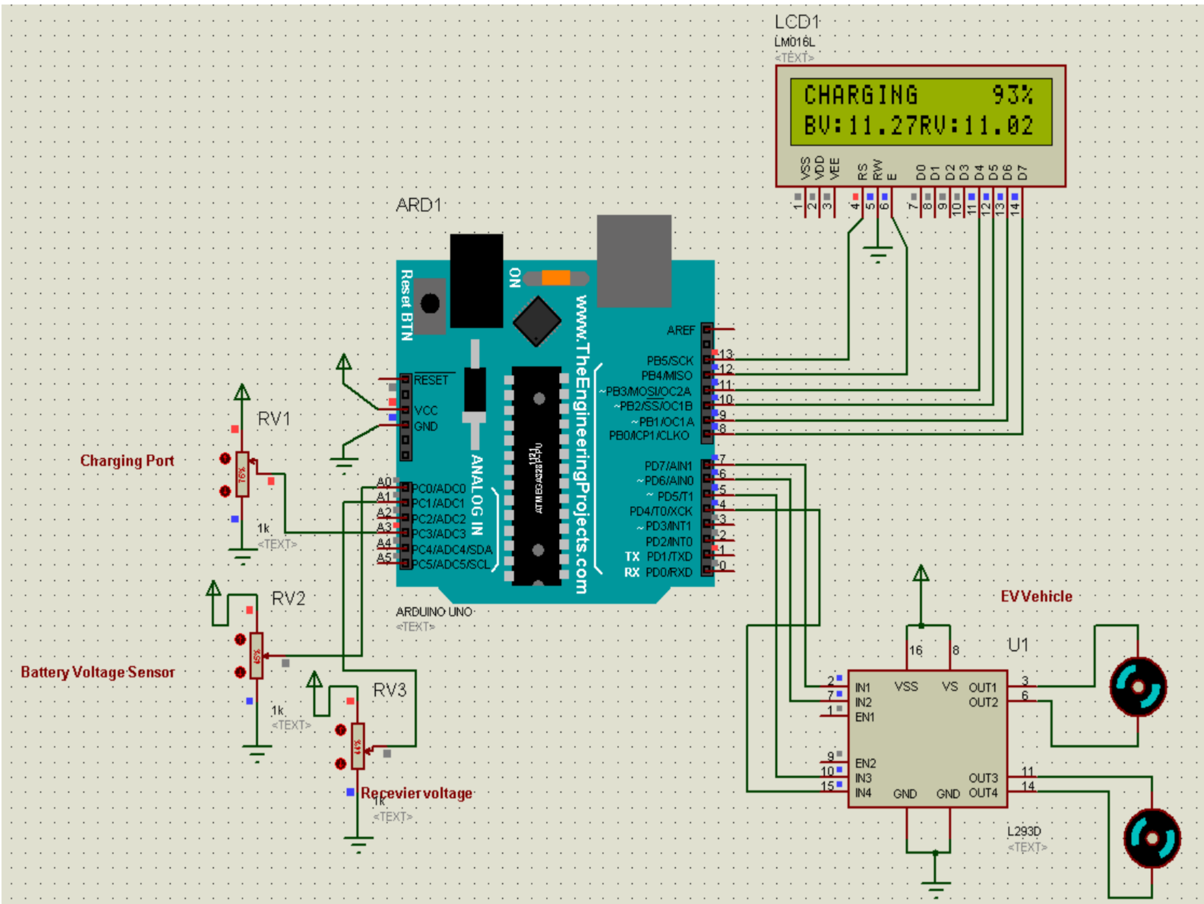


Figure (24): Proteus Simulation (Running mode)

When in idle time the charging process is not active, but when in charging time the battery voltage, reserved voltage and charging percentage can be seen, which is shown in *Figure (24)*. By employing different components and circuitry within the simulator, we were able to recreate the hardware configuration of our project.

CHAPTER-6

Conclusion

This Project presented a review of wireless charging of electric vehicles. A highly efficient wireless power transmission system is proposed for use in the recharging of electric vehicles. Extensive discussion was devoted to the system's configuration and design. Due to environmental and energy concerns, vehicle electrification is a necessity. Wireless charging has many advantages over conventional cable charging. If the advantages of wireless power transmission for EVs outweigh the disadvantages of cable charging, a number of obstacles to vehicle electrification and sustainable transportation could be eliminated. Wireless power transfer (WPT) has the potential to significantly reduce the size of an EV's onboard battery while retaining the convenience of cable charging. Solar energy, one of the most prominent renewable energy sources, was utilized in the design, construction, and testing of the prototype. As technology advances, wireless charging of electric vehicles (EVs) may become feasible. Topology, control, inverter design, and human safety require additional investigation.

Signature of the Guide   Student Reg. No :

Name :   Name :

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