A

PROJECT REPORT

ON

THE PROJECT ENTITLED

“Electrical Vehicle Wireless Charging System Using Solar Panel”

SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE DEGREE

OF

BACHELOR OF ENGINEERING

In

ELECTRONICS AND TELECOMMUNICATION ENGINEERING

By

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Submitted to

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING

STES’S SINHGAD ACADEMY OF ENGINEERING, PUNE-411048

2023-2024

CERTIFICATE

This is to certify that the project report entitled

"Electrical Vehicle Wireless Charging System Using Solar Panel"

Submitted By

Is a bonafide work carried out by them under the supervision by **Prof. U.S.Jambhale** and it is approved for the partial fulfilment of the requirement of **Savitribai Phule Pune University** for the Project in the Final Year of Electronics and Telecommunication Engineering.

This project report has not been earlier submitted to any other institute or University for the award of any degree or diploma.

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Place: Pune

Date: **Examiner**

ACKNOWLEDGEMENT

It is great pleasure for me to acknowledgment the assistance and contribution of number of individuals who helped me in developing **"Electrical vehicle wireless charging system using solar panel"** project. A project is defined as a piece of work that needs skill, efforts and careful planning but during the course of project we found that it not only sharpened our logical skill but also taught us the value joint effort and hard work.

A successful project is the result of good team work, which contains not only the people who put efforts but also who guide them

I have taken efforts in this project. However, it would not have been possible without the kind support and help of many individuals and organizations. I would like to extend my sincere thanks to all of them.

I am highly indebted to **Prof. U .S. Jambhale** for their guidance and constant supervision as well as for providing necessary information regarding the project & also for their support in completing the project.

I would like to express my special gratitude and thanks to industry persons for giving me such attention and time.

My thanks and appreciations also go to my colleague in developing the project and people who have willingly helped me out with their abilities.

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Abstract

All cars in India are switching to electric vehicles which will play a significant role in the future. 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 worldwide and are slowly growing in numbers.

Also it is proven that electric vehicle helpful in reducing cost of travel and which is cheaper than fuel. So we have developed an electric charging system with unique ideas for solving charging system problem. In this electric vehicle no need of any wire, no need of external power supply, no need to stop vehicle for charging, we can charge EV in moving condition. In this systemwe use, battery, transformer, Atmega controller, LCD display, regulatory circuit, solar panel, coils of copper, AC to DC converters to develop the system more accurate.

This whole system describes that how an electric vehicle can be charged in moving condition and also eliminating the need to stop the vehicle and charge it. Thus, insulating in the copper coil in the road, we can charge the electric vehicle in the moving condition.

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CHAPTER 1

INTRODUCTION

1. Introduction

The on-going climate condition has led to research and development of electric vehicle over the past decade. The increasing global warming has causes awareness among the people to switch to electric vehicles. The time required to wait at charging station while the battery is being charged will be reduce by the considerable amount of time when the charging will be done on road while driving the vehicle.
Even though electric vehicles are an alternative, there need to be development in its charging system to make it the prime option for transport for this purpose, the charging system should be developed. Dynamic charging system are more reliable user friendly and time is efficient.
Also, the battery size can be reduced and range can be improved. This charging system can also be implemented in the travel routes, traffic signal, and bus station.

1.1 Motivation:

Electric vehicle (EV) wireless charging system using solar panels can be an innovative and sustainable solution that addresses various environmental and practical concerns. Here are several motivations for such a system:

1. **Environmental Sustainability:** Reduction of Greenhouse Gas Emissions: EVs are already more environmentally friendly than traditional internal combustion engine vehicles. By integrating solar panels into the charging infrastructure, you further reduce the carbon footprint of EVs, as they can be charged using renewable energy.
2. **Energy Independence:** Reduced Grid Dependency: Solar panels on EV charging stations reduce dependence on the electrical grid, making charging infrastructure more resilient to power outages and reducing strain on the grid during peak hours.
3. **Cost Savings:** Lower Operating Costs: Solar energy is essentially free once the infrastructure is in place, leading to lower operational costs for EV charging stations. This can result in lower charging fees for EV owners.
4. **Increased Accessibility:** Expanding Charging Infrastructure: By deploying solar-powered wireless charging stations, it becomes economically viable to install charging points in more remote areas, making EV adoption more practical for people in less densely populated regions.
5. **User Convenience:** Hassle-Free Charging: Wireless charging eliminates the need for physical connectors, making it more convenient for EV owners to charge their vehicles. They can park over a charging pad, and the system will handle the rest.

1.2 Problem Statement

The transition to electric vehicles (EVs) as a sustainable mode of transportation presents significant environmental and logistical benefits. However, the widespread adoption of EVs is hindered by the limited availability of efficient, accessible, and environmentally friendly charging infrastructure. Current charging solutions suffer from various shortcomings, including grid dependency, insufficient coverage in remote areas, and carbon emissions associated with grid electricity. To address these challenges and promote the sustainable growth of EVs, the development of an integrated EV wireless charging system using solar panels is necessary. This system aims to provide cost-effective and eco-friendly charging options for EV owners, enhance the accessibility of charging infrastructure, reduce the carbon footprint of EVs, and improve the overall charging experience. Therefore, the problem statement for this project is as follows:
Problem Statement:
Develop an electric vehicle (EV) wireless charging system integrated with solar panels toovercome the challenges of limited charging infrastructure, grid dependency, and environmental impact, enabling widespread EV adoption and supporting the transition to clean and sustainable transportation solutions.

1.3 Objectives of the proposed work

The objectives of a proposed electric vehicle (EV) wireless charging system using solar panels can be diverse, depending on the specific goals of the project. Here are some common objectives for such a system:

1. **Sustainable Charging Infrastructure:** Develop a sustainable and eco-friendly EV charging infrastructure that harnesses solar energy to reduce the carbon footprint of EVs.

2. **Enhanced User Experience:** Create a seamless and user-friendly charging experience for EV owners, eliminating the need for physical connectors and reducing the hassle of plugging in.

3. **Cost-Effective Charging:** Provide cost-effective charging options for EV owners, leveraging free solar energy to lower the overall cost of EV ownership.

4. **Reduced Grid Dependency:** Minimize the dependence on the electrical grid for EV charging, making the system more resilient and reducing strain on the grid during peak hours.

5. **Improved Accessibility:** Increase the accessibility of EV charging infrastructure by deploying charging stations in remote or less densely populated areas, promoting EV adoption in underserved regions.

6. **Scalability and Flexibility:** Design a system that is easily scalable to accommodate the growing demand for EV charging infrastructure and adaptable to different locations and charging

CHAPTER 2
LITERATURE SURVEY

1) S. S. Rajput, M. R. Khan, and M. S. Al-Haddad "Solar-Powered Wireless Charging of Electric Vehicles: This review article provides a comprehensive overview of solar-powered wireless charging for electric vehicles. It covers various aspects of the technology, including the underlying principles, system components, and control strategies. The article also discusses the current state of research and development in this field and identifies the challenges and opportunities associated with solar-powered wireless EV charging.

2) S. H. Han and H. J. Lee "Wireless Solar-Powered Charging Station for Electric Vehicles" This research paper proposes a wireless solar-powered charging station for electric vehicles. The system consists of a solar panel array, a wireless power transfer unit, and a battery storage system.The paper describes the design and implementation of the system and evaluates its performance under different operating conditions.

3) M. N. Islam, S. S. Rajput, and M. R. Khan "Optimal Design of Solar-Powered Wireless Charging System for Electric Vehicles" by This research paper presents an optimal design methodology for a solar-powered wireless charging system for electric vehicles. The methodology considers various factors such as system efficiency, cost, and environmental impact to arrive at an optimal design. The paper also includes a case study to demonstrate the effectiveness of the proposed methodology.

4) Bugatha Ram Vara Prasad et al. (2021) proposed a solar charging station for electric vehicles that utilizes a solar panel array and a power conditioning unit to convert the solar energy into electrical energy. The system includes an energy management system that regulates the charging process and optimizes the use of renewable energy sources.T.D. Nguyen et al. (2020) conducted a feasibility study on bipolar pads for wireless power chargers. The study evaluated the performance and efficiency of bipolar pads for wireless charging, highlighting the potential benefits of this technology in reducing the reliance on physical connections. Bugatha Ram Vara Prasad and K. Aswini (2021) designed a bidirectional battery charger for electric vehicles that enables efficient charging and discharging of the vehicle's battery. The system includes a battery management system that regulates the charging process and ensures optimal performance .M. Singh et al. (2019) proposed a real-time coordination system for electric vehicles to support the grid at the distribution substation level. The system utilizes a communication network and intelligent algorithms to manage the charging and discharging of the vehicles, optimizing the use of renewable energy sources and reducing the reliance on the power grid.

The literature review highlights the importance of renewable energy sources and wireless charging technologies in promoting sustainable and efficient charging solutions for electric vehicles. The

studies emphasize the need for advanced energy management systems and intelligent algorithms to regulate the charging process and optimize the use of renewable energy sources.

5) Nikola Tesla was the first who invented Wireless Power Transmission [WPT] technology in 1890.He wanted to create the supply system without use of the wire thus he invented inductive and capacitive coupling system for WPT. He invented coil known as Tesla Coil.
Erhuvwu Ayisire has given the idea related charging system for Electrical vehicle [EV] . N. Uthaya Banu, U. Arunkumar, A. Gokulakannan, M. K. Hari Prasad and A. B. Shathish Sharma has given the knowledge about the battery charging by using solar energy and it also analysed primary and secondary side in detail [1].The most difficult and important part while designing wireless charging system that is designing part of the coil. This paper gives knowledge about the Wireless Charging in Electrical Vehicle by using Solar Energy.

6) Professors S. Patil and Monalee S. Pawar invented solar roads for wireless charging of electric automobiles. Wireless power distribution using a solar panel and an Arduino.
Rajbansi Devmani, Kamal Bahadur, Konar S. Suresh, and S.Prabhu Ram created a solar-powered charging station that allows electric cars to be charged wirelessly. The ICPT principle of electromagnetic induction is used to transmit energy.
Manoj D. Patil and Ankita S. Patil used the WPT, approach to produce solar-powered wireless charging of batteries in electric vehicles. Using a solar PV-wind system, **Bhuvanesh Arulraj and Marudavel Elumalai** developed wireless charging for electric automobiles. This concept makes use of solar panels, windmills, and a wireless charging station.

CHAPTER 3

PROJECT DESCRIPTION

3.1 Hardware and software components

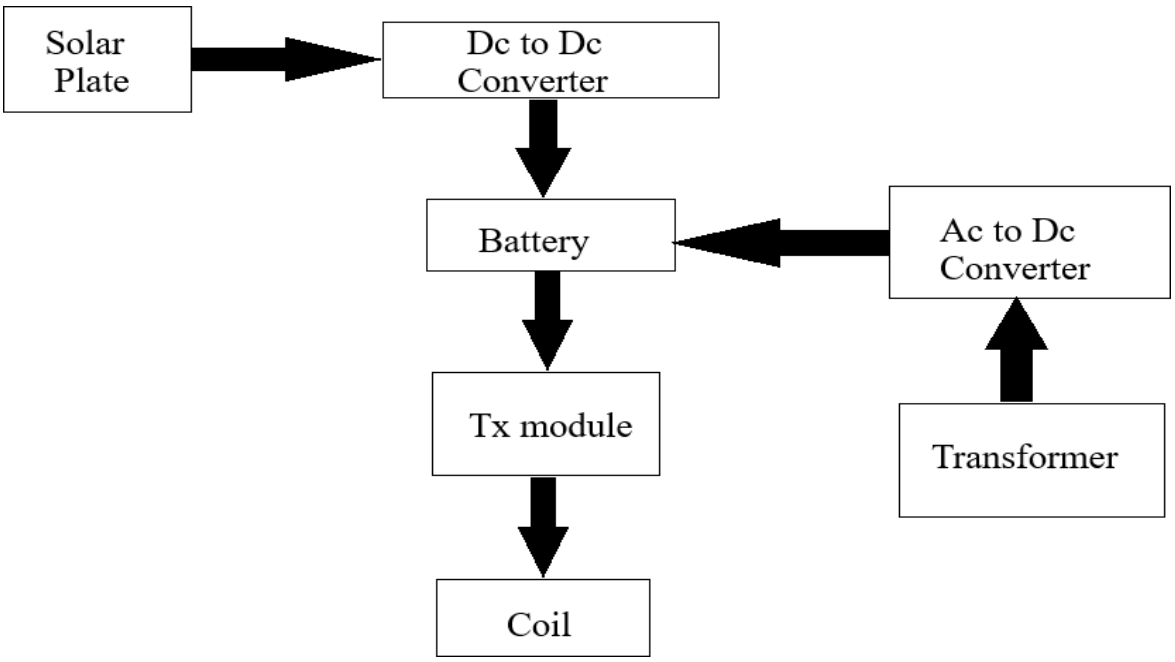
Components

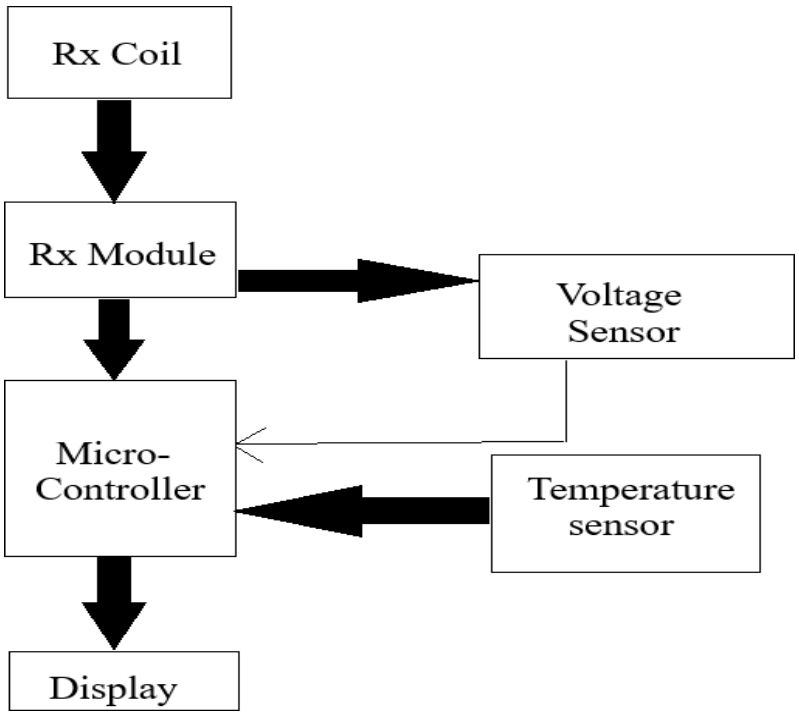
- Atmega Controller
- Battery
- Voltage Sensor
- LCD Display
- Transformer
- Regulator Circuitry
- Transmitter and Receiver Coils
- Vehicle Body
- Wheels
- Switches
- LED’s
- PCB Board
- Resistors
- Capacitors
- Transistors
- Cables and Connectors

Software used

- Arduino ide

3.2 Block Diagram





WORKING

Start: The system begins operation.

Solar Panels Capture Sunlight: Solar panels capture sunlight and convert it into electrical energy.

Energy Stored in Battery: The electrical energy generated is stored in a battery.

Energy Sent to Transformer: The stored energy is sent to a transformer to adjust the voltage levels as needed.

Regulated Energy Sent to Copper Coils: The adjusted energy is sent through a regulatory circuit to ensure stability, then to the copper coils for wireless transfer.

Atmega Controller Manages Charging: An Atmega controller manages the system operations and the charging process.

LCD Displays Charging Status: An LCD screen displays the current status of the charging process.

Energy Received by EV's Receiver Coil: The energy is received by the EV's receiver coil and converted from AC to DC using an AC to DC converter.

EV Battery Charges Wirelessly: The EV battery charges wirelessly with the received energy.

End: The system continues operating or stops as required.

A. Solar Panel

Solar energy is transformed into electrical energy by solar panels. They make advantage of the photoelectric 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 I started. Two separate sales structures exist for silicon. Both single-crystalline and multi crystalline Mono crystalline solar panels are produced in silicon wafer format from the final silicon block. In the same way that monocrystalline silicon cells are more effective but more expensive than polycrystalline ones, polycrystalline silicon cells are likewise silicon cells made through melting many of the silicon crystals together.

B. Batteries (Power Supply)

Batteries are particularly useful as a power supply in situations where a stable source of power is not available or where mobility is important. To use a battery as a power supply, the device being powered must be designed to use the specific type of battery being used. The device must also be designed to operate within the voltage range and current output capabilities of the battery. When using batteries as a power supply, it is important to monitor the battery level and recharge or replace the battery when necessary. Over time, batteries can lose their capacity to hold a charge and may need to be replaced. Overall, batteries are a versatile and convenient way to provide power in a wide range of applications where a portable or backup power source is needed.

C. Step Down Transformer

A step-down transformer is an electrical device that reduces the voltage of an alternating current (AC) power supply. It consists of a primary winding, a secondary winding, and an iron core. When an AC voltage is applied to the primary winding, it creates a fluctuating magnetic field in the iron core. When an AC voltage is applied to the primary winding, it creates a fluctuating magnetic field in the iron core. This magnetic field then induces a voltage in the secondary winding but at a lower voltage level than the primary winding.

D. Transmission Coil

This coil is employed to transfer power to the wireless power receiver coil in CAR SYSTEM. This gets power from Grid and solar panels. The transmitting coil is 28 gauge and 32 gauge.

E. Receiving Coil

The fundamental components of the receiver section are the receiving inductor coil, the bridge rectifier, the voltage regulator, and the rechargeable battery. Bridge rectifiers are used to convert the AC signal received by the coil into a DC signal. The voltage produced by the bridge rectifiers is unregulated and needs to be changed into a regulated constant voltage.

F. Bridge Rectifier

Alternating current is changed into direct current using a bridge rectifier. When compared to a centre tapped full wave rectifier, it offers excellent rectification efficiency (82%) and cheap implementation costs. It uses a 1N4007 diode. • Electric Cars

- Heating and Ventilation
- Transportation
- Consumer Electronics
- Industrial Engineering

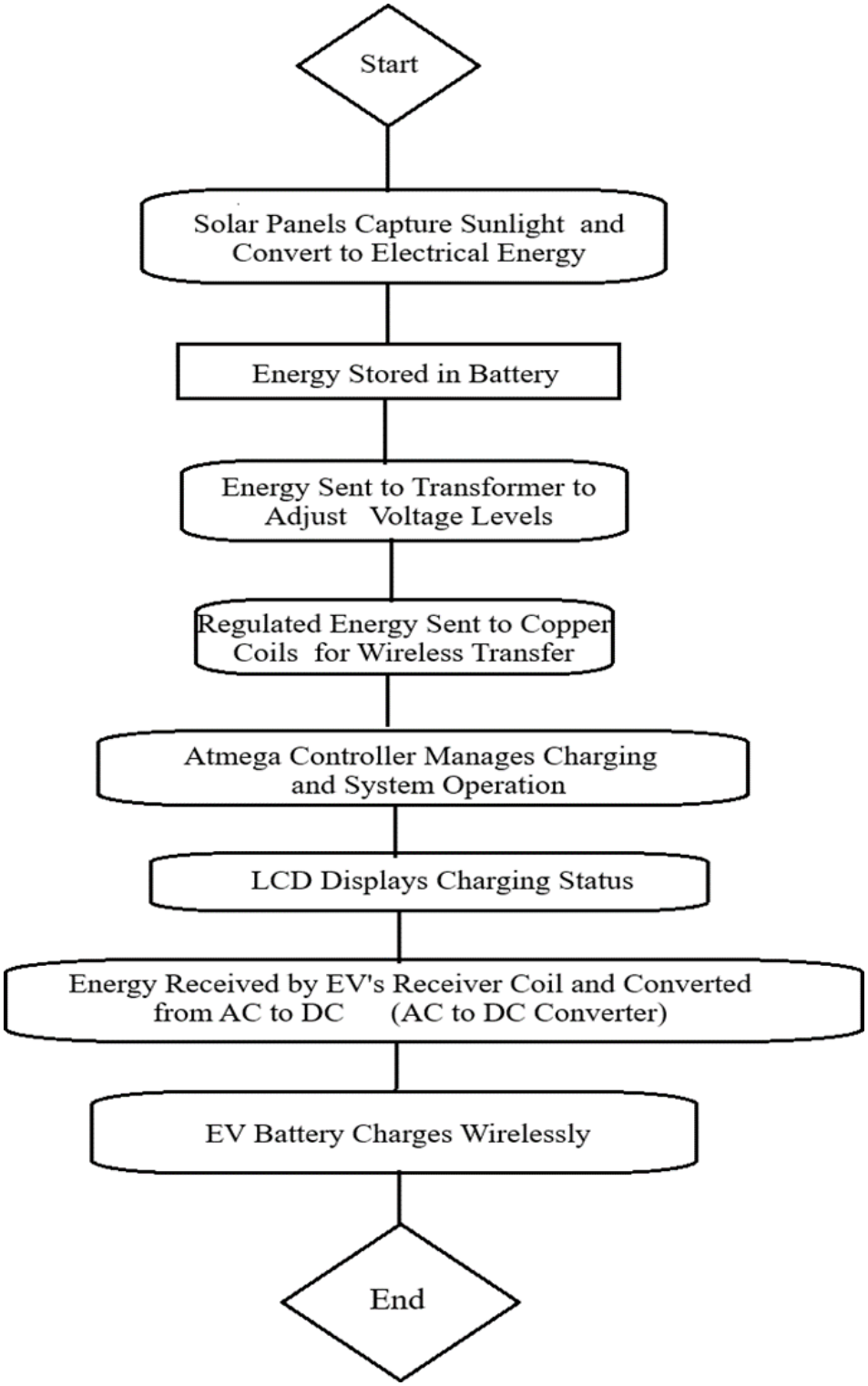
G. ATMEGA Controller

A 32K 8-bit microcontroller based on the AVR architecture is the Atmel ATmega328P. At 20MHz, a lot of instructions are processed in a single clock cycle, yielding a throughput of almost20 MIPS. The ATMEGA328-PU is compatible with our 28 pin AVR Development Board and is available in a PDIP 28 pin package. The computer, on the other hand, is made to accomplish all general-purpose activities on a single device, such as running software to perform calculations, storing multimedia files, or accessing the internet through a browser, whereas microcontrollers aremade to execute only certain tasks. A straightforward, inexpensive, low-powered micro-controller is frequently required for a variety of applications and autonomous systems. The Arduino Uno, Arduino Pro Mini, and Arduino Nano models are perhaps the most popular examples of this chip's use in development environments.

H. LCD Display

A flat panel display, electronic visual display, or video display that makes advantage of the light-modulating capabilities of liquid crystals is known as a liquid-crystal display (LCD). From liquid crystals light cannot be emitted. There are LCDs that can show random images (as on a general-purpose computer display) or fixed graphics that can be shown or hidden, including preprogramed words, numbers, and 7-segment displays like those found in digital clocks. They both make use of the same fundamental technology; however different displays have larger elements whereas random images are made up of a lot of tiny pixels. The major wide-ranging applications for LCD display can include computer monitors, televisions, mobile phones, instrument panels, cockpit displays in aircraft, and signs and many more. In this project, the LCD displays the voltage % of charging and discharging of electric vehicle

3.3 Flow chart



3.4 Advantages

- Pollution free
- Light weight vehicles.
- Low maintenance cost
- A number of device can be charged at a time
- Electrically safe
- Reduce noise \ air pollution

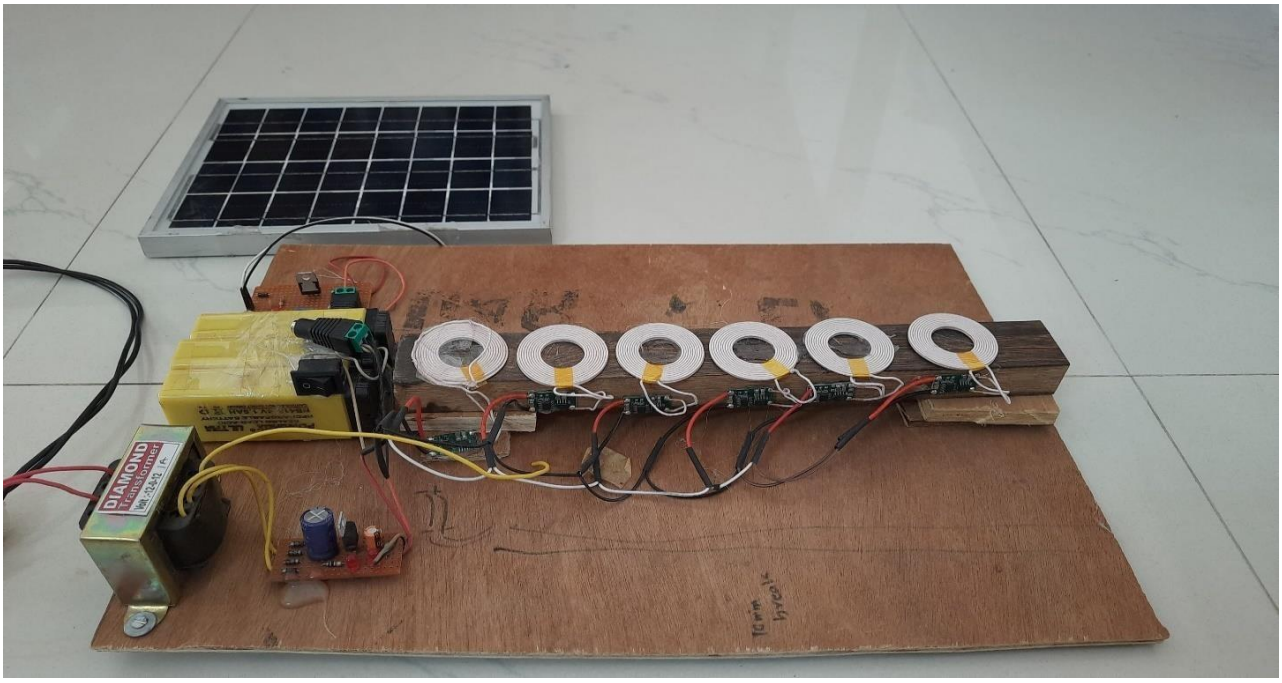
3.5 Application

- Wireless charging of vehicles without any wires.
- No need to stop for charging vehicle charges while moving
- University campuses
- Airports

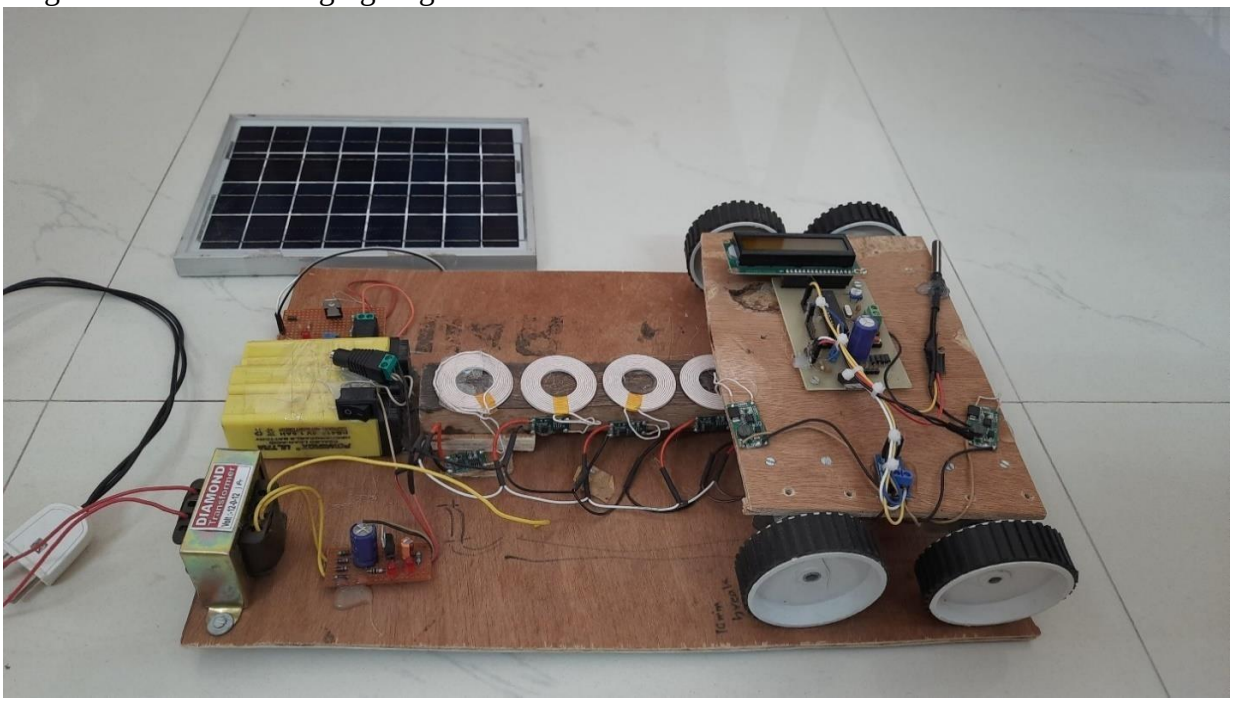
CHAPTER 4

RESULT

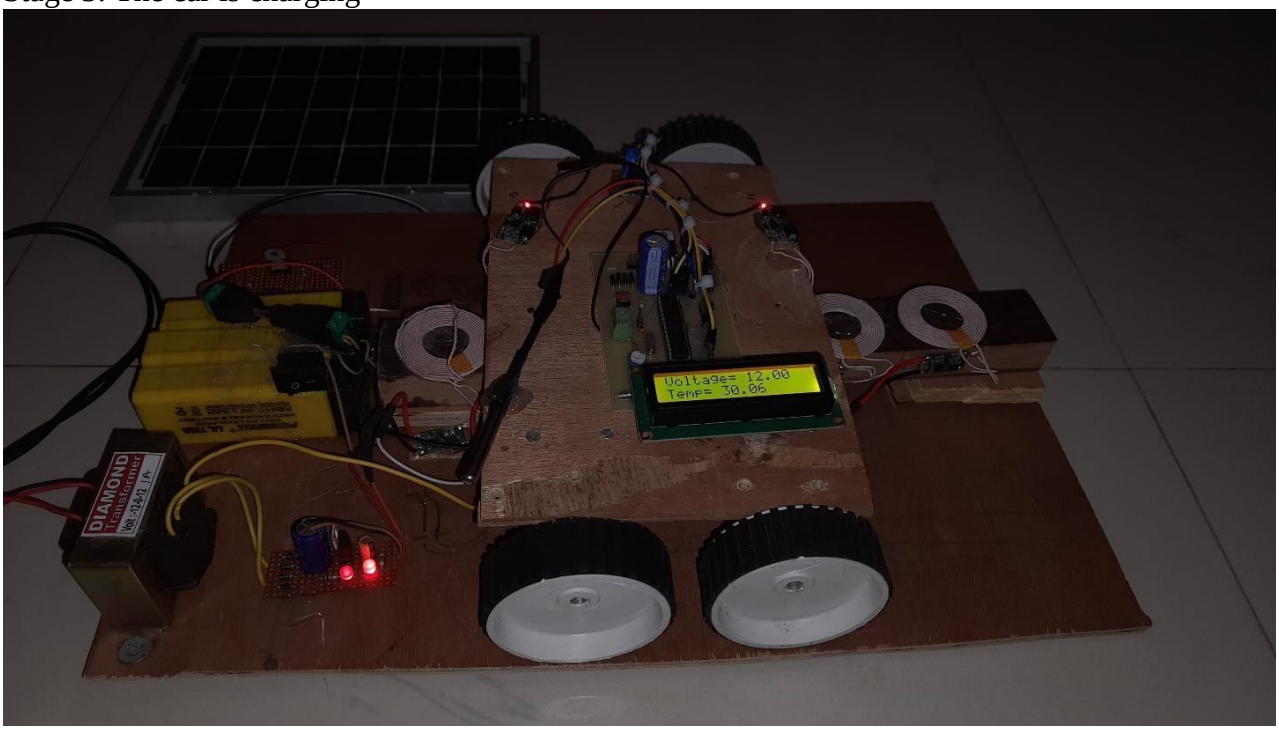
Stage1: starting setup



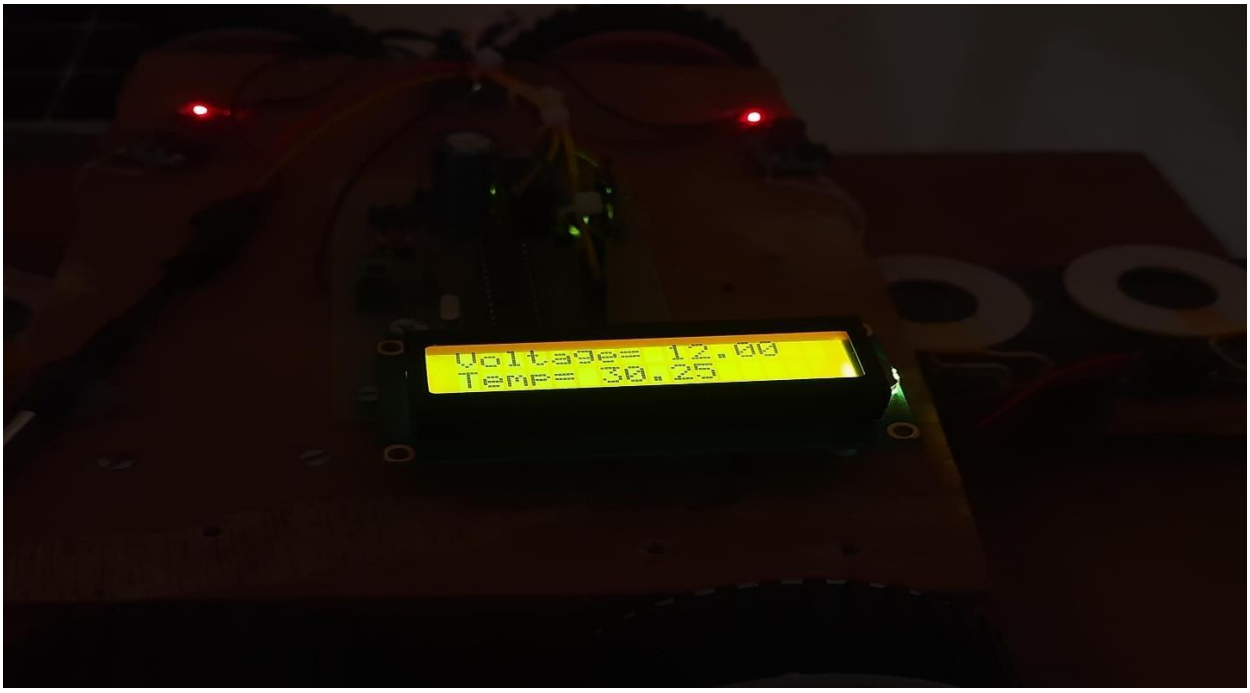
Stage 2: car is in no charging stage



Stage 3: The car is charging



Stage 4: Display the temperature and voltage on LCD



Chapter 5

5.1 Conclusion

The above study effectively demonstrated about the construction of wireless electric vehicle charging system using solar panel.

The electric vehicle charging wirelessly reduces the need of transmission wire and reduces the fuel consumption, making it a simple and more practical way.

This method reduces the rid of hardware components wear and tear. This wireless charging system can be implementing through dynamic electrical vehicle charging system.

5.2 Future Scope

1. **Advanced Technology Integration:**
   - Continued advancement in wireless charging technology, including higher power transfer efficiency and faster charging rates.
   - Integration with emerging EV technologies, such as autonomous vehicles and connected car systems.
2. **Improved Energy Efficiency:**
   - Research and development efforts focused on enhancing the energy conversion efficiency of solar panels and the wireless charging process.
3. **Higher Power Output Solar Panels:**
   - Adoption of high-efficiency solar panels, including next-generation photovoltaic technologies like perovskite solar cells, to increase energy capture and reduce charging times.
4. **Grid Independence:**
   - Reduced reliance on the electrical grid, with more off-grid or hybrid systems incorporating energy storage solutions to provide consistent charging even in low-sunlight conditions or at night.
5. **Dynamic Charging:**
   - Development of dynamic wireless charging systems, allowing EVs to charge while in motion on electrified roads or highways, further extending the range of electric vehicles.
6. **Integration with Smart Grids:**
   - Enhanced integration with smart grids to enable better load balancing, demand response, and grid stabilization through bidirectional energy flow between EVs and the grid.
7. **Global Expansion:**
   - Wider deployment of solar-powered wireless charging infrastructure worldwide, including in urban areas, highways, parking lots, and remote locations, to support the global adoption of EVs.
8. **Standardization:**
   - The development and adoption of international standards for wireless EV charging and solar panel integration to ensure interoperability and safety.
9. **Scalability:**
   - Scalable solutions that can be adapted to different scenarios, from small residential setups to large commercial and public charging networks.
10. **Energy Management:**
    - Advanced energy management and optimization algorithms that consider factors like weather conditions, grid availability, and user preferences to maximize the use of solar energy.

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[7] Bugatha Ram Vara Prasad et al. (2021) proposed a solar charging station for electric vehicles that utilizes a solar panel array and a power conditioning unit to convert the solar energy into electrical energy.

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:06/Issue:04/April-2024 Impact Factor- 7.868 www.irjmets.com

ELECTRICAL VEHICLE WIRELESS CHARGING SYSTEM USING SOLAR PANEL

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ABSTRACT

All vehicles in India are switching to electric vehicles which will play a significant part in the future. It reduces energy and pollution. Currently, electric vehicles are growing in figures because of high rates of energy Electric vehicles have now hit the road worldwide and are sluggishly growing in figures. Also, it's proven that electric vehicles help reduce the cost of trips and which is cheaper than energy. So, we have developed an electric charging system with unique ideas for working the charging system problem. In this electric vehicle no need for any line, no need for external power force, and no need to stop a vehicle for charging, we can charge EVs in moving conditions. In this system, we use, a battery, motor, Atmega regulator, TV display, nonsupervisory circuit, solar panel, coils of bobby, and AC to DC transformers to develop the system more accurately.

This whole system describes how an electric vehicle can be charged in moving conditions and also barring the need to stop the vehicle and charge it. Therefore, by separating the bobby Coil in the road, we can charge the electric vehicle in the moving condition.

Keywords: Wireless Charging System, Electric Vehicle, Solar Power, Transmitting And Receiving Coil.

I. INTRODUCTION

The increasing adoption of electric vehicles (EVs) represents a significant milestone in the transition to a cleaner and more sustainable mode of transportation. As the world seeks to reduce its reliance on fossil fuels and combat climate change, EVs have emerged as a promising solution. However, to fully realize the potential ofelectric mobility, it is essential to develop efficient and environmentally friendly charging infrastructure. This introduction explores an innovative solution in the form of an Electric Vehicle Wireless Charging System that integrates solar panels, offering a compelling answer to the growing demand for cleaner, more convenient, and sustainable charging methods.

The industry has been steadily shifting toward electric propulsion systems as EVs gain traction due to their environmental benefits and technological advancements. However, one of the key challenges in EV adoption is the availability and accessibility of charging infrastructure. Traditional charging methods often require cumbersome cables and fixed charging stations, limiting convenience and mobility.

The Need for Sustainable Charging: While electric vehicles themselves produce zero tailpipe emissions, the electricity used to charge them may still come from non-renewable sources, such as coal or natural gas. To fully capitalize on the environmental advantages of EVs, it is crucial to ensure that the electricity used for charging is generated from clean and sustainable sources.

Innovation at the Intersection of Solar Power and Wireless Charging: The solution we present in this introduction combines two transformative technologies: solar panels and wireless charging. By integrating solar panels into the EV charging infrastructure, we create an innovative system that addresses multiple challenges simultaneously. This system capitalizes on the abundance of solar energy, making it a sustainable power source for electric vehicle charging. Moreover, it removes the need for physical connectors and cables byusing wireless power transfer technology, making the charging process incredibly convenient and user- friendly.

II. LITERATURE SURVEY

1) S. S. Rajput, M. R. Khan, and M. S. Al-Haddad "Solar-Powered Wireless Charging of Electric Vehicles: This review article provides a comprehensive overview of solar-powered wireless charging for electric vehicles. It covers various aspects of the technology, including the underlying principles, system components, and control strategies. The article also discusses the current state of research and development in this field and identifies the challenges and opportunities associated with solar-powered wireless EV charging.

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
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III. TECHNICAL REQUIREMENTS

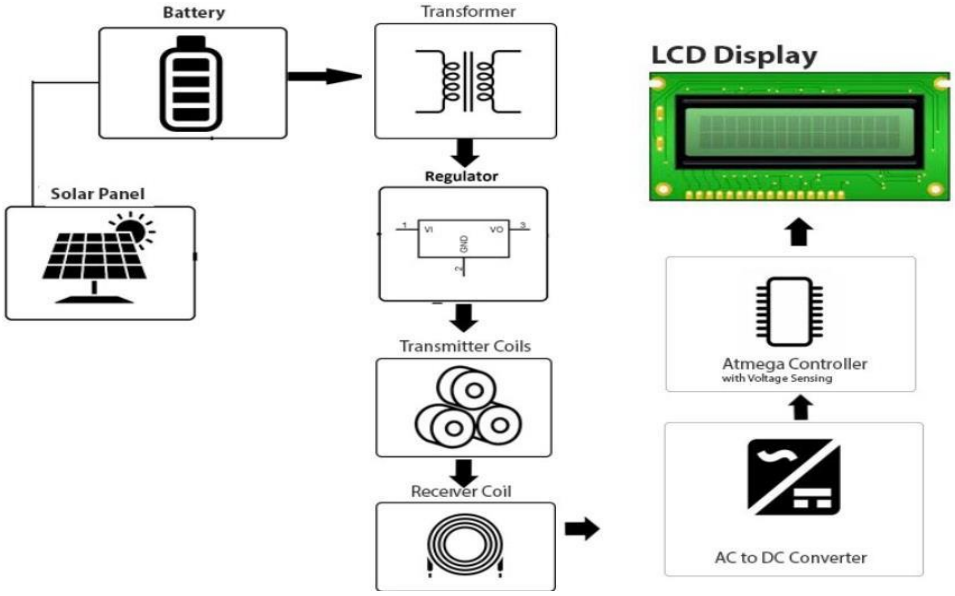
The following are requirements to build an Ev wireless charging system

- Atmega Controller
- Battery
- Voltage Sensor
- LCD Display
- Transformer
- Regulator Circuitry
- Transmitter and Receiver Coils
- Switches
- LED's
- PCB Board
- Capacitors
- Resistors
- Transistors
- Cables and Connector

IV. OBJECTIVES

The main goal of this project is to realize wireless energy transfer through inductive coupling between transmitting and receiving coils to charge the vehicle's battery.
This energy allows the vehicle to travel long distances at efficient speeds and consumes less power at a charging station

V. BLOCK DIAGRAM



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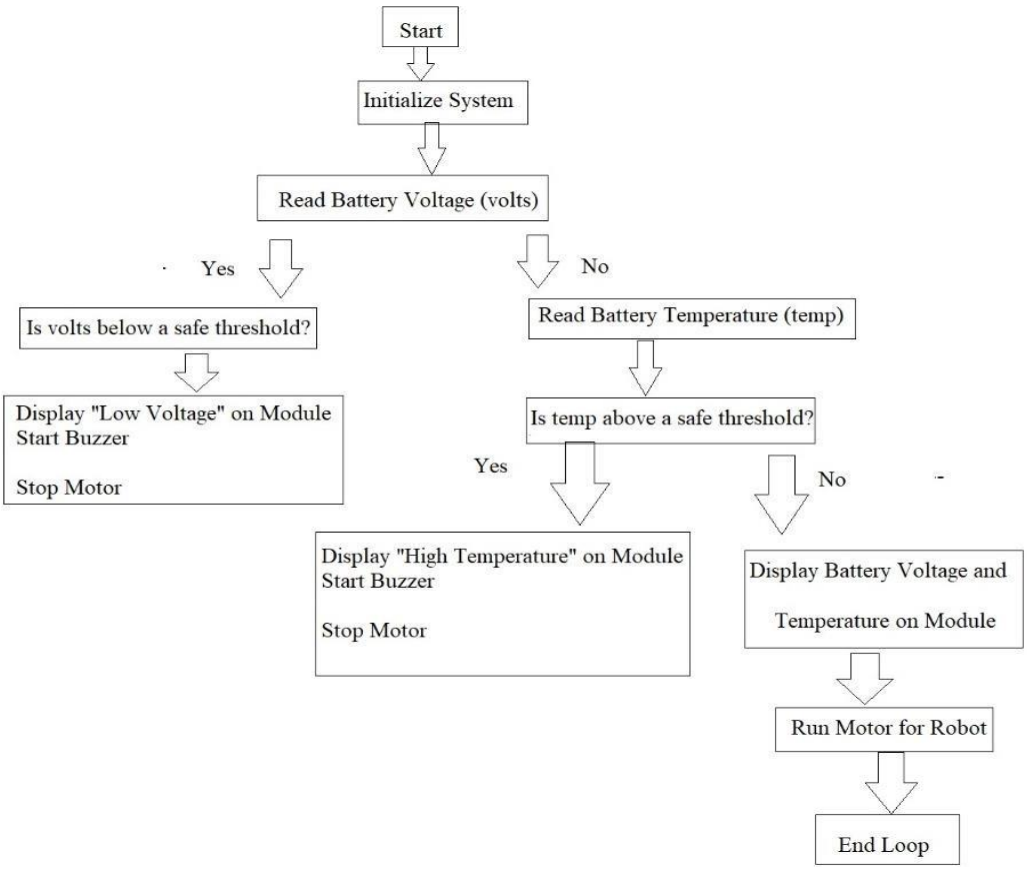
VI. ADVANTAGES

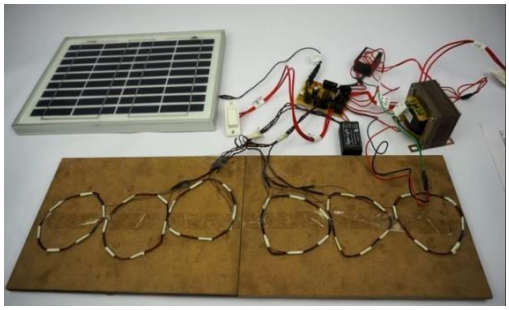
1) Wireless charging of vehicles without any wires
2) No need to stop charging, the vehicle charges while moving
3) Solar power for keeping the charging system going
4) No external power supply needed
5) Coils integrated into the road to avoid wear and tear

VII. FLOW CHART

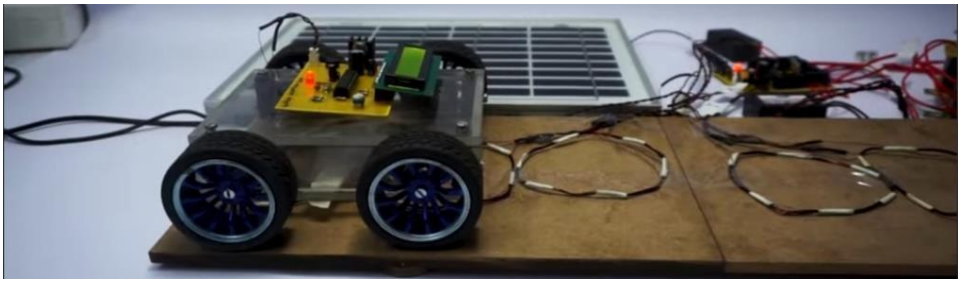


VIII. RESULTS

Stage1: starting setup



Stage 2: car is in no charging stage



e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
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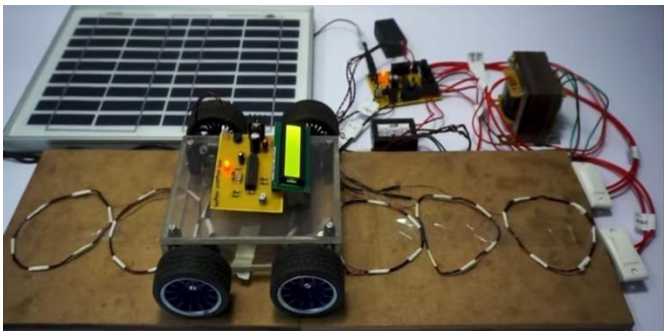
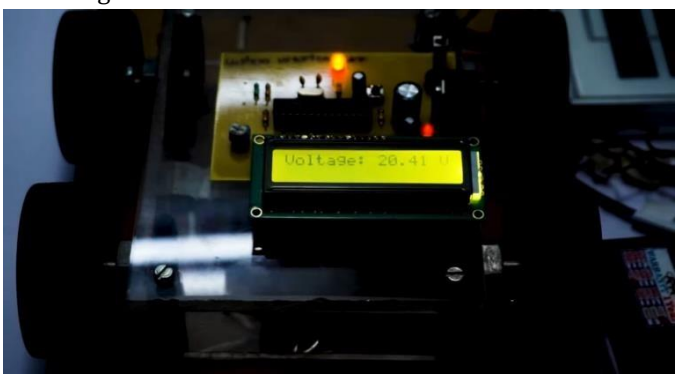
Volume:06/Issue:04/April-2024 Impact Factor- 7.868 www.irjmets.com

Stage 3: Car is charging



Stage4: LCD display the solar voltage



IX. CONCLUSION

The below study effectively demonstrated the construction of a wireless electric vehicle charging system using solar panels. The electric vehicle charging wirelessly reduces the need for a transmission line and reduces energy consumption, making it a simple and more practical way.

This system reduces the rid of tackle factors wear and tear. This wireless charging system can be enforced through a dynamic electrical vehicle charging system.

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International Research Journal Of Modernization in Engineering Technology and Science

(Peer-Reviewed, Open Access, Fully Refereed International Journal)

e-ISSN: 2582-5208

Ref: IRJMETS/Certificate/Volume 06/Issue 04/60400037625

Date: 06/04/2024

Certificate of Publication

*This is to certify that author "**Akshada Sanjay Gade**" with paper ID "**IRJMETS60400037625**" has published a paper entitled "ELECTRICAL VEHICLE WIRELESS CHARGING SYSTEM USING SOLAR PANEL" **in International Research Journal Of Modernization In Engineering Technology And Science (IRJMETS), Volume 06, Issue 04, April 2024***

IRJMETS Impact Factor 7.868

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