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Dynamic Solar Wireless Charging for Electric Vehicle

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ABSTRACT -This project outlines the design of a solar-powered charging station for electric vehicles, addressing the issues of fuel dependency and pollution. Electric vehicles are becoming increasingly popular worldwide due to their environmental benefits and cost-effectiveness compared to traditional fuel-powered vehicles. The innovative EV charging system developed here offers a unique solution by enabling vehicles to charge wirelessly while on the move, eliminating the need to stop for charging. The system utilizes solar power to sustain the charging process without requiring an external power supply. Components such as solar panels, batteries, transformers, regulator circuitry, copper coils, AC to DC converters, an at mega controller, and an LCD display are integrated to create this efficient charging system. This system showcases the possibility of charging electric vehicles on the go, paving the way for a solar-powered wireless charging infrastructure that can be seamlessly integrated into roads.

Key Words: Solar Powered Charging, Electric Vehicles, Wireless Charging Technology, Batteries, Solar Panels, Transformers ,Arduino ATmega328p.

1.INTRODUCTION:

The incorporation of renewable energy sources and cutting-edge technologies in transportation systems has seen a significant rise in recent years. A prime example of this shift is the emergence of Electric Vehicles (EVs) powered by eco-friendly energy alternatives. EVs function using electric motors or traction motors for propulsion, drawing power from either an external collector system or internal mechanisms like batteries, solar panels, fuel cells, or electric generators.

This initiative introduces an innovative strategy to cater to the evolving requirements of electric vehicle charging infrastructure by leveraging solar power and wireless charging technology. The system design comprises various components such as solar panels, batteries, transformers, regulator circuitry, copper coils, AC to DC converters, Arduino AT mega controllers, and LCD displays, all working in harmony to enable convenient on-the-go charging for electric vehicles.

To address these challenges, efforts are underway to implement multiport generators, which aim to reduce the power rating of individual converters. Strategies include utilizing active rectifiers and integrated generator rectifier systems based on permanent magnet synchronous generators (PMSGs). Control frameworks play a crucial role in maximizing the efficiency of these systems, particularly in achieving maximum power point tracking (MPPT).

1.1 OBJECTIVE:

The main objective of this project is to design a solar-powered wireless charging system for electric vehicles that allows them to charge while moving on the road. To eliminating the need to stop for charging and reducing the reliance on traditional fuels. Thus to promote environmental sustainability and cost savings.

2.EXISTING METHOD:

A static wireless charging station for electric vehicles offers several benefits similar as convenience, safety,and reduced environmental impact. The system eliminates the need for lines and connectors, making the charging process simpler and more effective. It also reduces the threat of electrical shock and eliminates the need for homemade running of lines.

Further more, the use of wireless charging stations for EVs reduces hothouse gas emigrations and improves air quality since EVs produce zero tailpipe emigrations. This contributes to a cleaner and healthier terrain for all.

The stationary wireless charging system for electric vehicles operates on mutual induction, where energy is transmitted wirelessly from a sender coil to a receiver coil on the EV. This process involve transferring power,over seeing and regulating the charging procedure, and disconnecting the system once the battery reaches full capacity.

3.PROPOSED METHOD:

Dynamic wireless charging for electric vehicles (EVs) presents an innovative solution to address the range limitations and charging infrastructure challenges. The proposed method involves establishing a network of wireless charging infrastructure along key roadways, equipped with inductive charging technology. These charging coils, strategically placed at regular intervals, utilize transmitting coils embedded in the road surface and receiving coils installed on the underside of EVs. As vehicles travel along the road, the transmitting coils generate a magnetic field, inducing a current in the receiving coils of the EVs, effectively charging their batteries wirelessly. This setup allows for continuous charging of EVs as they move along the road, without the need for them to stop for recharging. Dynamic wireless charging offers a promising solution for enhancing the convenience and viability of electric vehicles, streamlining the charging process and potentially reducing range anxiety among EV drivers.

The EV charging system developed provides a groundbreaking solution, enabling wireless charging while vehicles remain in motion, eliminating the need to halt. Powered by solar energy, this system operates independently, removing the necessity for an external power source. Its potential to revolutionize transportation infrastructure by minimizing dependence on conventional charging stations and fostering sustainable energy practices is substantial.

3.1 BLOCK DIAGRAM

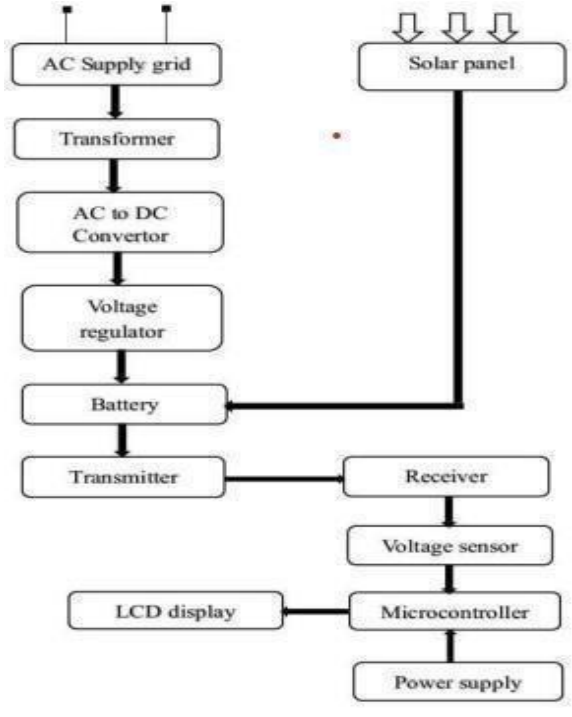


Fig-1:Block Diagram

This project shows the capability of charging electric vehicles while they're in motion on the road, removing the necessity to stop for charging. It exhibits the charging process on an LCD display as the vehicle moves.

4. HARDWARE COMPONENTS:

4.1 ARDUINO AT MEGA 328P:

The Arduino Uno relies on the Arduino ATmega328P microcontroller as its main processing unit. Belonging to the AVR family developed by Atmel (now part of Microchip Technology), the ATmega328P features 32KB of flash memory for storing programs, enabling the execution of a wide range of applications. With 2KB of SRAM for temporary data storage and 1KB of EEPROM for retaining important information even without power, the ATmega328P ensures data integrity. Additionally, its support for communication protocols like UART and SPI enhances its ability to interface with external devices and peripherals in embedded systems.

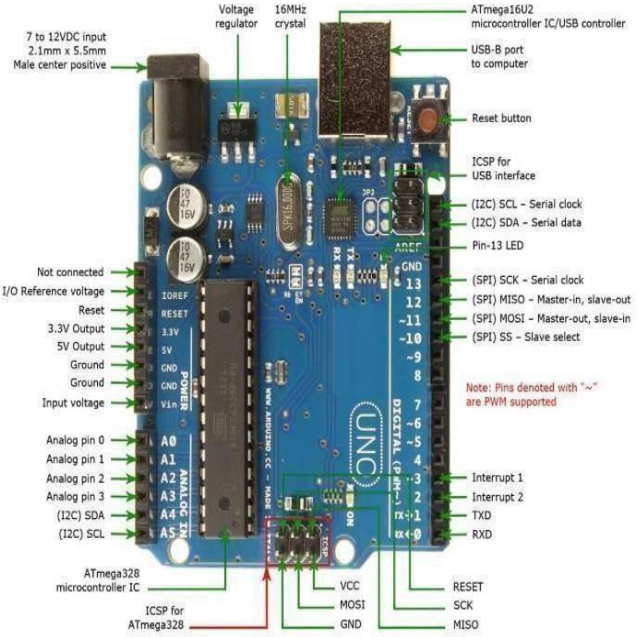


Fig-2:Arduino AT mega 328p

4.2 SOLAR PANEL:

A solar panel is a device that transforms sun into electricity through photovoltaic cells made up of semiconductor accoutrements . When exposed to sun, these cells induce a direct current(DC). Solar panels are constantly employed in renewable energy setups to capture solar energy for both domestic and marketable purposes.

Fig-3: Solar Panel

4.3 TRANSFORMER:

A transformer is an electrical outfit that transfers electrical energy from one circuit to another through electromagnetic induction. It comprises a primary winding that receives the electrical input and a secondary winding that provides the affair. The voltage metamorphosis is determined by the rate of turns in the primary and secondary windings. Mills play a vital part in power distribution by adding voltage for long- distance transmission and dwindling it for safer operation in places and marketable establishments. Their effectiveness, simplicity, and responsibility make them necessary rudiments in electrical systems across the globe.

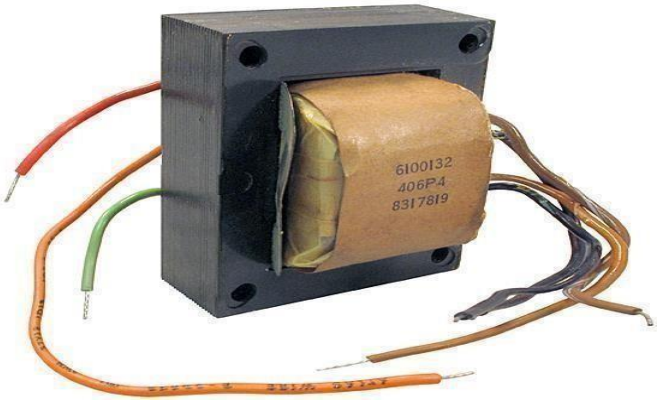


Fig-4:Transformer

4.4 COIL:

A coil is a wound conductor, typically made of copper or aluminum wire, forming a series of turns around a central core. It is a basic passive electronic component with applications in various devices such as inductors and electromagnets .When an electric current flows through the coil, it produces a magnetic field, and the number of turns influences the strength of this field. Coils are fundamental in electrical circuits for storing energy, filtering signals, and creating magnetic fields for diverse applications, from transformers to radio frequency circuits.

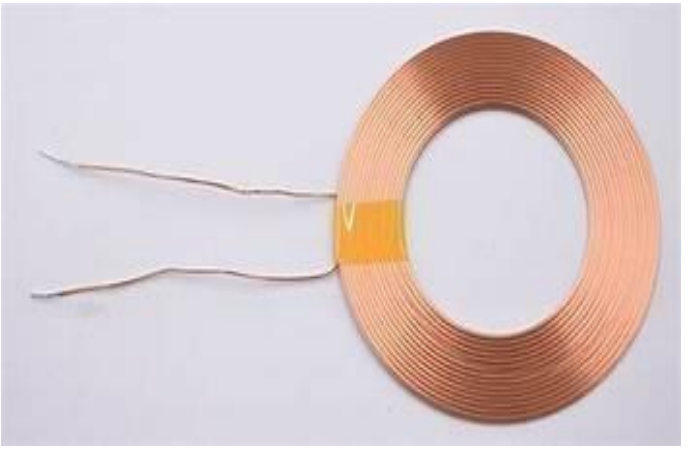
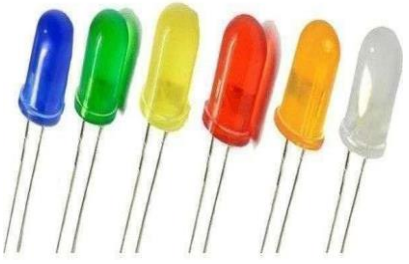


Fig-5: Coil

4.5 LED:

Light-Emitting Diodes (LEDs) are semiconductor components that produce light when an electrical current flows through them. They are known for their energy efficiency and widespread use in illumination across diverse settings. LEDs are available in various colors and offer easy brightness adjustment. Unlike conventional light sources, LEDs have extended lifespans and are environmentally friendly due to their reduced energy consumption. These adaptable devices play a vital role in contemporary lighting setups, electronic screens, and indicators, promoting energy efficiency and technological advancement.

Fig-6:LED



4.6 DCMOTOR:

A DC motor refers to a configuration containing motors powered by direct current within a system. These motors utilize DC power and are frequently utilized in robotics, automation, and other electro-mechanical scenarios. Each motor generally

features two terminals for power input, and their rotation speed and direction can be adjusted by altering the voltage polarity and level. In robotics, pairs of DC motors commonly propel wheels or other mechanical parts, delivering essential motion and management.

Fig-7:DC Motor

4.7 LCD:

A 16x2 LCD display module is a crucial component commonly found in a variety of devices and circuits. Unlike seven-segment displays and other multi-segment LEDs, these modules are preferred for several reasons: they are cost-effective, easily programmable, and have no limitations when it comes to displaying special characters or even custom ones, as opposed to seven-segment displays. Additionally, they can display animations and other features.

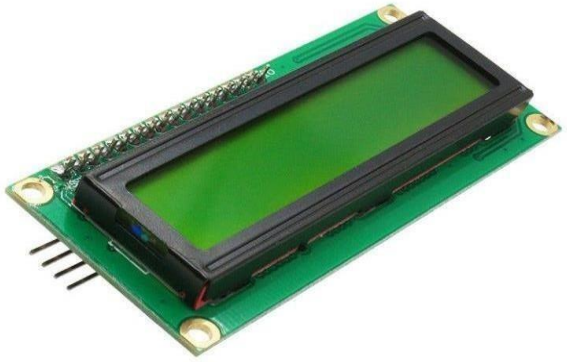


Fig-8:LCD

4.8 BATTERY:

Batteries act as storage units, preserving the electrical energy harnessed from solar panels. Subsequently, they supply this stored power to charge the electric vehicle's battery as required, guaranteeing a dependable energy source even during periods of limited or no sunlight.

Fig-9: Battery

4.9 DRIVER CIRCUIT:

A driver circuit is an electronic setup responsible for regulating and directing the electrical power sent to a load, usually to operate another electronic element like LEDs, motors, or transistors. It guarantees the appropriate voltage, current, and signal levels required by the connected device, thereby improving its effectiveness and energy usage. Driver circuits frequently include protective mechanisms to safeguard both the load and the driver from potential damage.

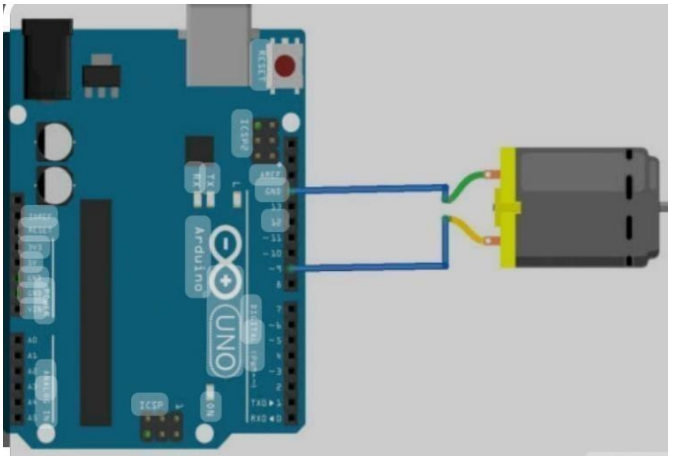


Fig-10:Driver Circuit

5.SOFTWARE COMPONENT:

ARDUINO IDE:

The Arduino Software (IDE) simplifies coding and uploading to the board without an internet connection, making it suitable for users with limited internet access. It's compatible with all Arduino boards and allows users to write and save programs, referred to as sketches, using its text editor with the .ino file extension.

6. TESTING RESULTS:

Fig-12: Experimental Setup

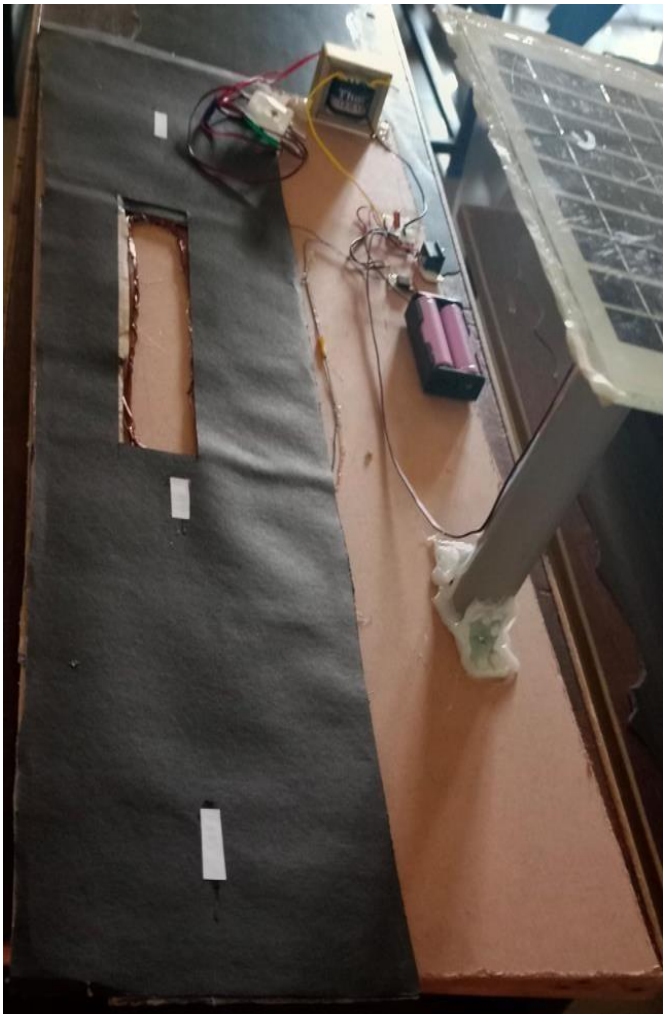


Fig-13: EV Test Track

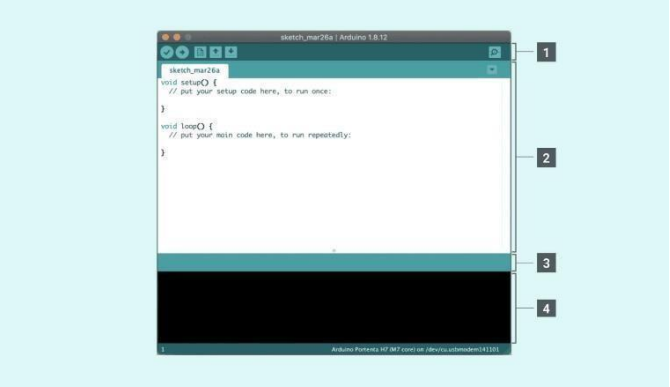


Fig-11: Arduino IDE

7.CONCLUSION:

In conclusion, utilizing sunlight to wirelessly charge electric vehicles presents a convenient and eco-friendly option for powering cars, eliminating the necessity for standard charging stations and decreasing dependence on the grid. This innovation holds potential for a greener and more effective transportation future, enhancing the accessibility and environmental friendliness of electric vehicles.

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