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Wireless Charging for EV

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Abstract: *Electric vehicles are today's zero emission vehicular technology which are considered as the future of automotive industry. The batteries of the vehicles get charged in order to drive the vehicle. The methodology of charging the electric vehicle currently is through plug-in method where the charging station charges the battery of an electric vehicle. However, an alternative method for charging the battery of an electric vehicle is through Wireless Power Transfer where it can be as a Static system. Static charging System can be implemented to charge the batteries of the electric vehicles when the vehicle is parked in static mode. This method of wireless charging of electric vehicle is done through inductive power transfer where wireless transmission of power is achieved by mutual induction of magnetic field between transmitter and receiver coil. The type of charging system we have implemented is static charging system.*

Keywords: Electric vehicles

I. INTRODUCTION

Electric vehicles have now hit the road worldwide and are slowly growing in numbers. Apart from environmental benefits electric vehicles have also proven helpful in reducing cost of travel by replacing fuel by electricity which is way cheaper. Now a days world is shifting towards electrified mobility to reduce the pollutant emissions caused by non-renewable fossil fueled vehicles and to provide the alternative to pricey fuel for transportation. But for electric vehicles, traveling range and charging process are the two major issues affecting it's adoption over conventional vehicles. With the introduction of Wire charging technology, no more waiting at charging stations for hours, now get your vehicle charged by just parking it on parking spot or by parking at your garage or even while driving you can charge your electric vehicle. As of now, we are very much familiar with wireless transmission of data, audio and video signals so why can't we transfer power over the Air. Basic principle of wireless charging is same as transformer working principle. In wireless charging there are transmitter and receiver, 220V 50Hz AC supply is converted into High frequency alternating current and this high frequency AC is supplied to transmitter coil, then it creates alternating magnetic field that cuts the receiver coil and causes the production of AC power output in receiver coil. But the important thing for efficient wireless charging is to maintain the resonance frequency between transmitter and receiver. Then finally, this AC power at receiver side rectified to DC and fed to the battery.

II. METHODOLOGY AND IMPLEMENTATION

The DC power generated from the solar panel will be stored in the battery using charge controller. The DC power is converted into high frequency AC using inverter. The inverter will be mounted on transmitter coil along with the DC power generated from the solar panel, during the unavailability of sunlight or during cloudy weather conditions, the domestic current that is AC 220v 50HZ power supply will be used to charge electric vehicles. This AC current is converted into DC, the DC power will be supplied to transmitter coil , the transmitter coil has inverter which converts DC to high frequency AC. The high frequency AC will be transmitted from transmitter coil to receiver coil wirelessly. The received high frequency AC will again be converted to DC and stored in receiver battery through battery charger module. The power stored in the battery helps to run the electric vehicle. If the fire sensor senses fire or smoke, the relay module automatically stops the power transmission which results in stopping the charging of electric vehicles. Project aims at developing wireless charging methods from different sources of energy and to provide sustainable & efficient model for Electric Vehicles. It mainly uses solar panels in the rooftops to charge in the daytime. During the event of energy shortage in the battery the controller automatically switches to use the mains supply to charge the

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vehicle wirelessly. In the receiver part, the controller features a IoT approach monitor the vehicles charging characteristics and uploads the data to the cloud server. This enables the user to monitor the vehicles data from anywhere needed. Also, to enhance safe conditions to operate the controller is equipped with fire sensor to detect fire hazards and safely disconnect from the supply. The paper also examines the various components of an electric car, including the battery, motor, and charging system. Furthermore, the paper explores the challenges and opportunities of electric car adoption, including government policies, market demand, and technological innovation. Finally, the paper concludes with a discussion of the future prospects of electric cars, highlighting the potential benefits and drawbacks of widespread adoption. Overall, this paper provides a comprehensive analysis of electric cars, their current status, and their potential to transform the transportation industry in the coming years.

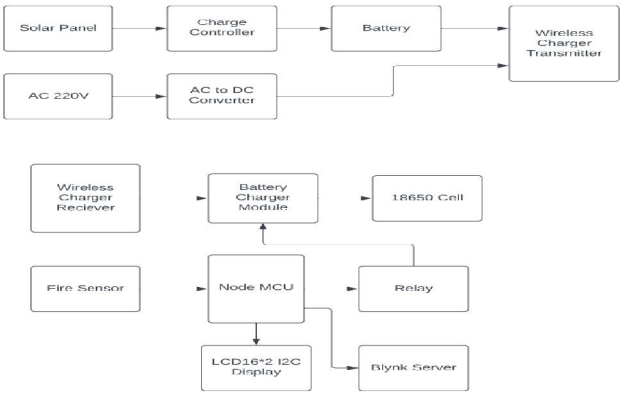

Figure 1. Block Diagram of the Proposed System

2.1 Software Components: IDE Software

The code that you write inside the Arduino IDE. The Arduino code that you write is called a sketch. The Arduino code itself is basically a derivative of the C and C++ programming languages, but with some Arduino-specific functions and structure. So if you program an Arduino, you're basically programming in C and C ++ programming languages. So those are the three components that basically make up what" Arduino is", and roughly what it does. And Figure 2 as shown below

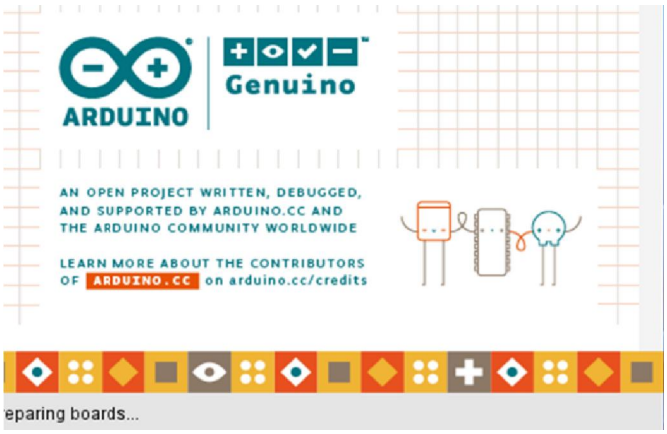

Figure 2. IDE Software

2.2 Design and Implementation

The wireless charging technology for electric vehicle has gained the sufficient attention in recent years, traditional charging methods require physical connection but wireless charging is a convenient and efficient alternative.

The implementation of the system involves the following steps:

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- Hardware setup: The first step involves setting up the hardware components required for the system. This includes a Relay module, a micro controller, Fire Sensor and a charger module. The power is transmitted from transmitter to receiver module. The DC power is stored in battery to run the EV vehicle.
- Programming: The next step involves programming the microcontroller to perform the required functions. This includes communication with Blynk App for indicating voltage and battery percentage. It Enables relay module to cut the power transmission if the fire is detected.
- Testing: The final step involves testing the system to ensure that it is working correctly. The testing part involves ensuring that the power is transmitting from the transmitter to receiver module and it also ensures that the EV Vehicle is charging.

In summary, the implementation of Wireless Charging for EV involves setting up the hardware components, programming the microcontroller. The outcome of this proposed model is wireless power transmission from transmitter coil to receiver coil Electric vehicles can be charged by using electricity generated by the solar panel or domestic electricity supply that is 220V 50Hz AC The power stored in the battery is used to run the electric vehicle. The battery voltage will be displayed on LCD and it is even displayed on our smartphone by using Blynk application.

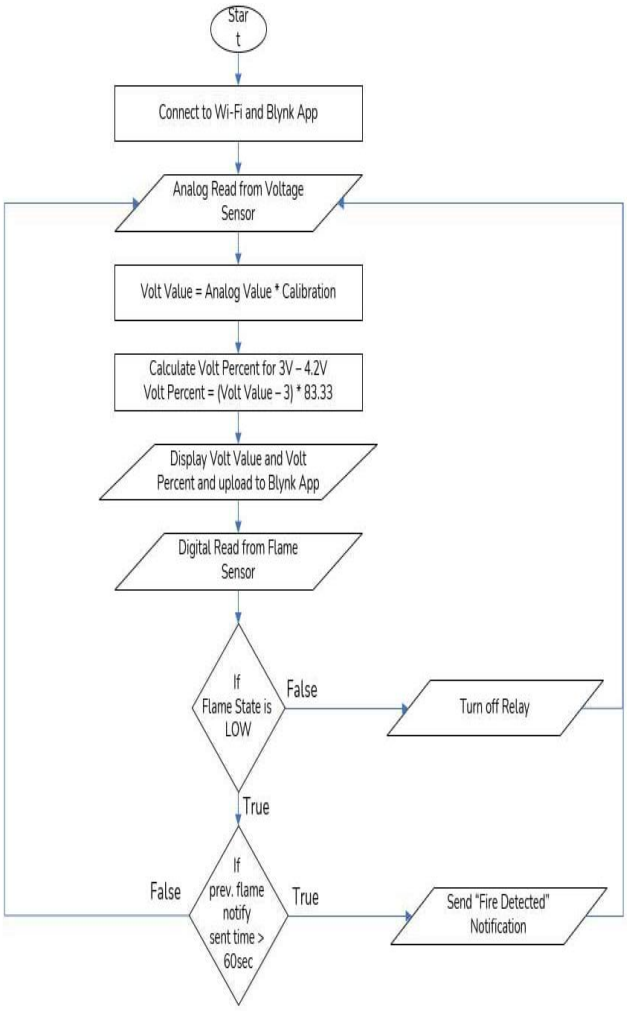

Figure 3. Flow Chart

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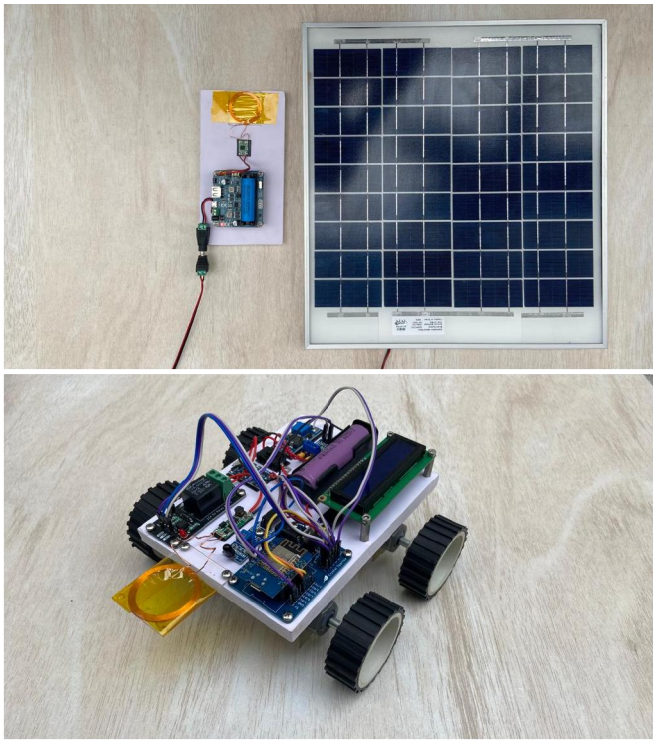
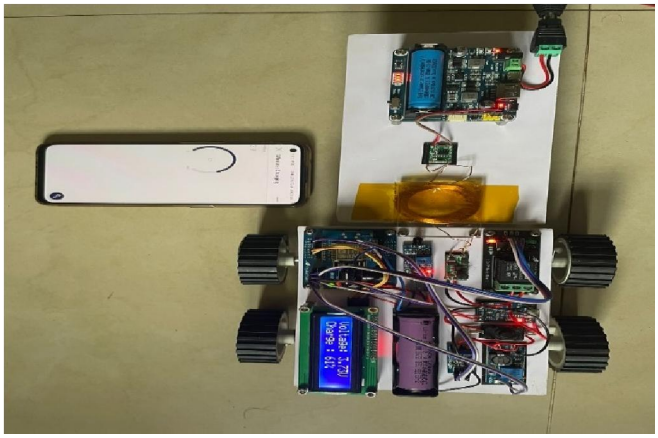


Figures4. Activity of our Project

III. EXPERIMENTATION AND RESULTS

The project mainly consists of two parts, Transmitter module and Receiving module. The DC power generated from the solar panel will be stored in the battery using charge controller. The DC power is converted into high frequency AC using inverter. The inverter will be mounted on transmitter coil along with theDC power generated from the solar panel, during the unavailability of sunlightor during cloudy weather conditions, the domestic current that is AC 220v 50HZ power supply will be used to charge electric vehicles. DC power will be supplied to transmitter coil, the transmitter coil has inverter which converts DC to high frequency AC. The high frequency AC will be transmitted from transmitter coil to receiver coil wirelessly. The received high frequency AC will again be converted to DC and stored in receiver battery through battery charger module. The power stored in the battery helps to run vehicle.



The above figure shows the working model of our project, the transmitter and the receiver coil both are overlapped, that starts the charging of our car by electromagnetic flux induction. The charge is stored in the transmitter module battery before the start of charging and then is transferred to receiver moduleand various other components like the charger module, voltage regulator and bug converter performs its particular operations before the charge is stored in the car battery.

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3.1 Objective:

- To design and implement wireless charging for electric vehicles in techparks/apartments
- To develop and constructing the transmitter and receiver coil, which will be used for wireless power transmission.
- Making use of solar panels to generate electricity to charge electric vehicles which efficiently uses renewable energy that is sunlight
- By using fire sensor and relay module power transmission can be stopped if there is any fire or smoke detected in the electric charging station

IV. CONCLUSION & FUTURE SCOPE

Transportation is a major concern in the development of any country. Whereas electric vehicle is the future of the transportation industry. While a lot of research has been done on this topic in the previous decade, a large part of it is yet to be explored. From our project, we conclude that a wireless charging system is implemented by our group. Along with this, a battery management unit is designed, which shows the battery voltage. Battery voltage is measured by the microcontroller & displayed on a 16x2 LCD. We have used inductive coupling technology for wireless power transfer, but it is useful only for low power applications and where the distance between receiving and transmitting coils is less. But for real- world applications, the power requirement is high and the distance between receiving and transmitting coil should also be increased. So, for this purpose, Magnetic Resonant Coupling technology is appropriate and suitable. Also, we conclude that the wireless charging method requires more time to charge a battery than the other types of charging methods. Our project only represents the prototype of Automation in the wireless charging of electric vehicle systems.

4.1 Future Scope

Wireless charging for electric vehicles (EVs) is a rapidly developing field, and there are several future scopes for this technology. Here are a few potential areas of growth:

- Researchers are continuously working on improving the efficiency of wireless chargingtechnology forEVs. Currently, wireless charging efficiency is lower compared to traditional charging methods. Still, advancements in technology are expected to increase the efficiency of wireless charging, reducing charging times and increasing the range of electric vehicles
- Currently, there is no universal standard for wireless charging technology, with different automakers using different charging standards. This creates confusion for consumers and limits the growth of the technology. In the future, there will likely be efforts to standardize wireless charging technology, which would make it easier for consumers to adopt and use.
- As more EVs hit the market, the demand for wireless charging will increase. This demand will likely lead to increased investment in wireless charging infrastructure, including public charging stations and home charging pads.
- Integration with Smart Grids: Wireless charging technology has the potential to integrate with smart grids, which could help to manage electricity demand and supply more efficiently. For example, EVs could charge during times of low demand and discharge their batteries during times of high demand, helping to stabilize the grid.
- Currently, wireless charging is a static process, where the vehicle must be parked on a charging pad to charge. However, researchers are exploring the possibility of dynamic charging, where the vehicle charges while it's in motion, potentially extending its range and eliminating the need for frequent stops to recharge.

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