Integrated Wireless charging For Electric Vehicles

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***Abstract*- Electric vehicles (EVs) are becoming one of the most anticipated technologies that are gaining global importance very rapidly. There has been a lot of focus on EV charging, which requires different charging modes so that the user has a variety of options. Solar PV(SPV) and wireless charging are two of the most promising charging strategies for EVs. We propose an integration of both techniques, i.e., wireless charging of electric vehicles using SPVs. SPVs are controlled in order to achieve maximum wireless power transfer (WPT) is also accomplished through a very simple control scheme. In summary, we can achieve a large-scale development of future vehicles that employ three techniques: Electric Motors, Super capacitors, and Wireless Power Transfer. This eliminates the requirement for engines, high performance Li-ion batteries, and quick charging stations.**

***Keywords*- WPT, EV charging, microcontroller, SPV, IoT.**

I.INTRODUCTION

It's true that the world's growing population and increasing energy demand present significant challenges when it comes to finding sustainable energy sources. Fossil fuels such as petroleum, gas, coal, and nuclear power have been the main sources of energy for many years, but their use contributes to climate change, air pollution, and other environmental problems. Electric vehicles (EVs) are also a promising way to reduce our dependence on fossil fuels in the transportation sector. By using electricity from renewable sources to power EVs, we can reduce greenhouse gas emissions and improve air quality. Wireless power transfer (WPT) and solar photovoltaic (SPV) are indeed two promising technologies for charging EVs [2].

WPT is a method of transmitting electrical power from a power source to an electrical load without the need for physical connections between them. This technology can be applied in various industries, including automotive, medical, and consumer electronics. In the automotive industry, WPT can provide convenient and safe charging for EVs, eliminating the need for physical charging cables and connectors. However, the efficiency of WPT systems is still a challenge, and further research is needed to improve their performance and reduce costs.

On the other hand, SPV systems use solar panels to convert sunlight into electricity, which can be used to charge EVs. This technology is particularly attractive as it can reduce the dependence on non-renewable sources of energy and provide a clean and sustainable way to power electric vehicles. However, the efficiency of SPV systems can be affected by factors such as weather conditions and the angle of incidence of sunlight.

Both WPT and SPV technologies have their advantages and challenges, and the choice of which technology to use for charging EVs will depend on various factors such as cost, efficiency, and convenience. It's great to see that there is ongoing research in both areas to improve these technologies and make them more accessible to the public.

II.LITERATURE SURVEY

"Performance Analysis of Solar Based Wireless Power Transmission System" is introduced by M. F. Faysal, M. S. Islam in the year of 2019. The magnetic link formed between the two circuits is the heart of a resonant inductive power transfer system. The circuit for the power source is mutually coupled to the circuit of the application that needs power. This thesis will only handle two circuit systems with one transmitting side md one receiving side. This paper proposes alternate sources like solar power. Besides using solar power is also significant in terms of renewable energy
"Modelling and experimental validation of aging factors of photovoltaic solar cells" was introduced by A. Guisandez Hernandez and S. P. Santos in the year of 2021. The basic working of a solar photovoltaic (SPV) device is similar to that of a p-n junction semiconductor device. When an SPV is exposed to light, it generates a direct current (DC) that has a linear relationship with the solar irradiance.[3]

In simpler terms, when sunlight falls on an SPV, it generates an electric current that flows in one direction. This current is directly proportional to the amount of sunlight falling on the SPV. Thus, as the intensity of sunlight increases, the amount of current generated by the SPV also increases in a linear fashion.

It is worth noting that the linear relationship between solar irradiance and the generated current is an important characteristic of an SPV. This property allows us to accurately measure the amount of sunlight falling on an SPV by measuring the current it generates.

This is useful for various applications, such as in solar power systems, where we need to know the amount of sunlight falling on the solar panels to optimize their performance.

"Novel EV Society based on Motor/ Capacitor/ Wireless – Application of Electric Motor, Super capacitors, and Wireless Power Transfer to Enhance Operation of Future Vehicles" was introduced by Yoichi Hori. This paper deals with the issue of motion controls of EVs and Electric motors have a torque response 100 times faster than engines. Cars only need energy to overcome friction between the tire and road surface. Adhesion control can quickly reduce motor torque to prevent micro-scale tire slip and avoid friction losses.[4]

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"Grid to vehicle and vehicle to grid energy transfer using single-phase bidirectional ac-dc converter and bidirectional dc-dc converter" was introduced by Arun Kumar Verma, Bhim Singh, and D.T Shahaniin the year of 2011. This text put forward a way of realizing networking and structure,[5]construction of battery a configuration of a single-phase bidirectional AC-DC converter and bidirectional DC-DC converter is proposed to transfer electrical power from the grid to an electrical vehicle (EV) and from an EV to the grid while keeping improved power factor of the grid A proportional-integral (PI) controller is used to control the charging current and voltage

"Perturb and Observe MPPT algorithm for solar pv systems-modeling and simulation" introduced by J. J. Nedumgatt, K. B. Jayakrishnan, S. Umashankar, D. Vijayakumar, and D. P. Kothariin the year of 2011. This paper explains and validates an algorithm for Maximum Power Point Tracking using Perturb and Observe technique. The algorithm starts by setting the computed maximum power PMAX to an initial value[6] (usually zero). Next the actual PV voltage and current are measured at specific intervals and the instantaneous value of PV power, PACT is computed. PMAX and PACT are compared. PMAX and PACT are compared. If PACT is greater than PMAX, it is set as the new value of PMAX. At every instant the PACT is calculated, and the comparison is continuously executed. Hence the final value of PMAX will be the point at which maximum power can be delivered to the load. For maximum power transfer across the load, the input impedance should be equal to the load impedance. The effect on transmitter signal and receiver signal with node mcu[10] Based on the mechanism of load matching the duty cycle of the converter is varied so that the output power will almost be equal to the input in practical systems.

III.PROPOSED SYSTEM

This integrated pvsolar, wireless electricity transfer of our system is efficient way of charging without negligible amount pollution and moreover less carbon emission. The study shows that electric vehicle (EV) batteries can be charged wirelessly using solar photovoltaic (SPV) power through wireless power transfer (WPT) with simple control. The modeling and control of the system are divided into three sections: SPV, WPT, and battery modeling and control.

The control variables at the secondary side are the battery current and DC-link voltage, which are both maintained at their reference values to ensure efficient charging [1]. The rectifier at the secondary side is kept uncontrolled to maintain a simple model.

To improve the overall system efficiency, a fully controlled model can be developed in the future. Additionally, the same control techniques can be used to control the switching of all the controllers, which will further reduce complexity. Moreover, different control techniques can be explored to achieve maximum power from the SPV. The effect of display in monitoring using wireless fidelity [9].

Overall, the study demonstrates the potential of wireless charging using renewable energy sources and lays the foundation for further research to optimize the system and enhance its performance.

IV.BLOCK DIAGRAM

The solar panel provides the necessary power for the system, which is then transmitted to the battery. The model car draws a limited amount of power from the battery, which propels it forward. The WPT receiver circuit is connected to the battery, and this is where the magnetic induction charging technique comes into play. The WPT TX, or transmitter circuit, is connected to a 230V AC supply. When the coil in the transmitter circuit receives power, it transmits wireless power to the coil in the receiver circuit. The integration of both solar and wireless charging enables the EV to be charged. When the RX coil receives power from the TX coil, an LCD display on top of the car indicates that charging is taking place.

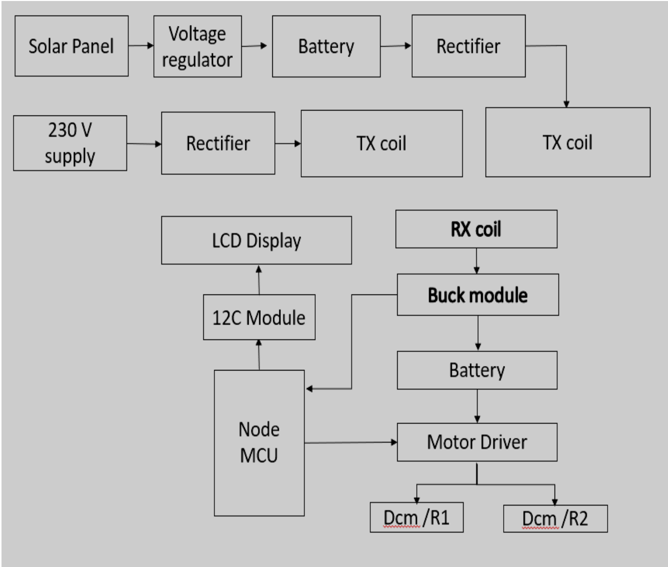

Fig 1: Block diagram

From the block diagram it is easier to understand the components connection. Each components have different application and connection. Node MCU is the main component from the vehicle side. In this project there are application such as vehicle sensing unit, while coming for charging. Rest of the application is for integrated wireless charging for electric vehicles.

Object sensors are connected to Input. For the navigation L293D is connected to Dc motor with wheels that work as a robotic vehicle.

The source includes several components such as TX coils, RF TX, relay, logic circuit, object sensor, and transformer. The object sensor is responsible for detecting whether the car is correctly placed on the charging pad. Once the car is detected, the object sensor sends a signal to the logic circuit, which then permits current to flow from the transformer to the relay. The TX coil then transmits signals wirelessly to the receiving coils. This process allows the car's battery to be charged without the need for physical connections between the charging pad and the car.

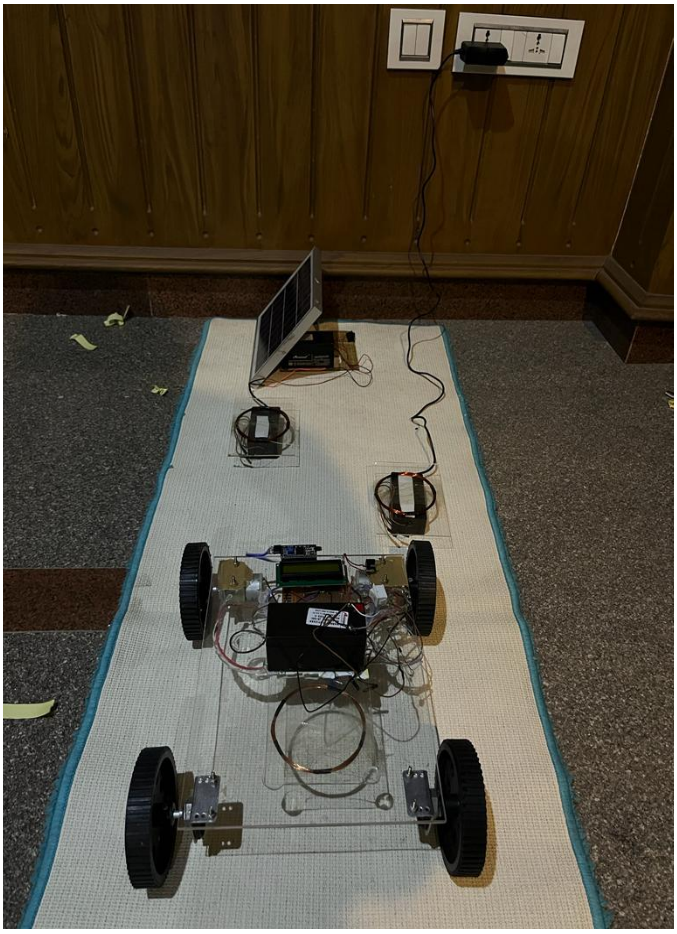

Fig 2:Proposed EV Charging System

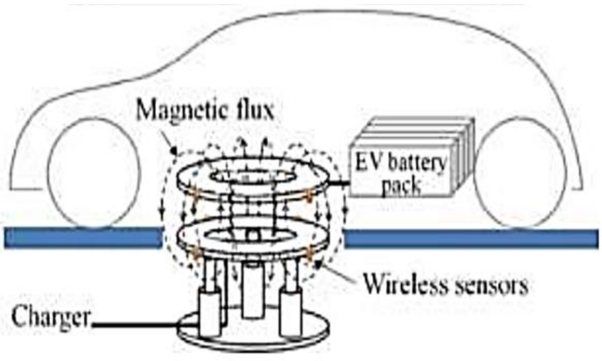

Fig 3: EV charging magnetic induction our system

From the circuit diagram we can access information about circuit connections of the components. The TX sends a signal to the receiving coil, which in turn sends voltage through the charging output to the battery. The total voltage received by the receiver is recorded as the charging voltage, while the voltage of the battery is noted as the battery voltage. These two voltages are connected to the Arduino controller. Magnetic flux is generated between the two coils, one in the source and one in the recipient. Additionally, solar power generation is also connected to the Arduino controller, allowing any power generated by the solar panels to be stored in the battery. For the navigation L293D is connected to Dc motor with wheels that work as a robotic vehicle. L293D is a Motor driver that controls the movement of the robot. TX and RX coil and the associated circuit is used for charging and solar panel is used to get the power to the battery.

V.DESIGN AND COMPONENTS

In this section, the selected hardware components are to be used for this project are reviewed.

A) Node MCU

The Node MCU (***N***ode ***M***icro ***C***ontroller ***U***nit) is an open-source software and hardware development environment built around an inexpensive System-on-a-Chip (SoC) called the ESP8266. The ESP8266, designed and manufactured by Espressif Systems, contains the crucial elements of a computer:[8][9] CPU, RAM, networking (WiFi), and even a modern operating system and SDK. That makes it an excellent choice for Internet of Things (IoT) projects of all kinds.

B) Photovoltaic Panel

It is a new architecture for charging electric vehicles using power from photovoltaic panels. Electric vehicles having their own photovoltaic panel on the roof. The charging station or the hub consists of a large battery bank and a large photovoltaic panel. Our project placed with 5watt solar panel.

C) TX and RX Coil

These are the transmitting and receiving coils used for the magnetic induction between the car and charging base[7].The transmitter coil and receiver coil are the key part of the whole system. The coils are tightly coupled if they have the same size and same configuration. In a proposed system tight coupling configuration with small distance power transfer system is used to achieve high efficiency for electric vehicle application. System consists of two coils tuned at the same frequency. Transmitter and receiver coils have been constructed using electrically conducting copper tube with a diameter of 16cm. Each coil has 48 numbers of turns and an inductance of 56uH. The air gap between these two coils is 6cm.

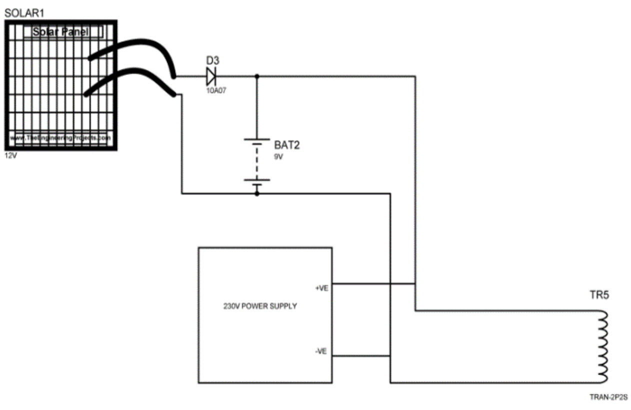

Fig 4: Circuit diagram Transmitting End

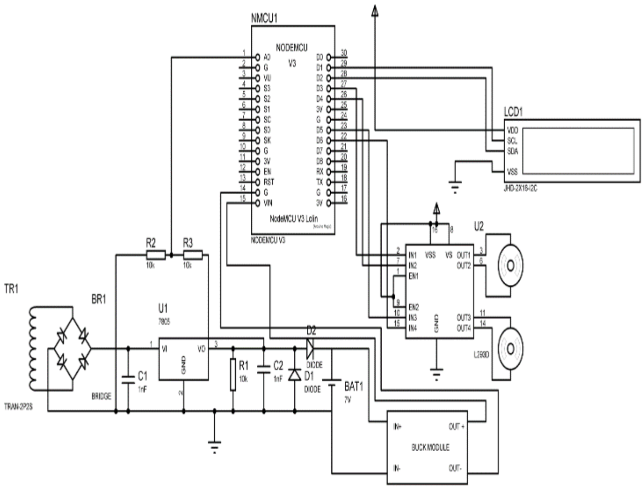

Figure 5: Circuit diagram Receiving End

VI.CONCLUSION`

By initializing wireless power transfer system, transmitter section transfers power wirelessly to receiver section. In transmitter section 50HZ frequency supply is applied to AC converter. In receiver section received power recharges the battery and runs an electric vehicle. After initializing wireless power transfer, transmitting coil transfers 12V at 50Hz frequency the receiver side will get an input 12V at gap of 3.6 cm between the two coils. Results from the calculated values and implemented electric vehicle show good correlation. As the distance increases received voltage decreases. It means the distance increase efficiency decreases. The total system efficiency 81.5 % is achieved by considering all losses and power supply. The system provides reliability, long life and safety.

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