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Wireless Charging System for Electric Vehicle using Solar System

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***Abstract*—The primary objective of wireless electric charging pollution is to transmit power through a specific area using an electromagnetic field. It is essential to change the battery charging procedure in order to improve reliability because electric vehicles are a better option to reduce continuous pollution. Electric vehicle batteries can be charged wirelessly or by plugging them into plugs at charging stations. Static or dynamic charging systems can be used to perform wireless power transmission. The car can be charged even while it is moving with the help of a dynamic charging system. Power can be delivered from the source through the transformer windings to the rechargeable batteries using inductive power transfers. Battery charging stations of this type can be set up for pre planned trips. In addition to increasing the adoption of electric vehicles, this will also boost their efficiency and durability over long distances. In particular, the research paper offers an assessment of potential wireless charging technologies and future EV development.**

***Index Terms*— Arduino UNO, wireless charging, electric vehicle.**

I. INTRODUCTION

For moving people and goods around, mankind has used automobiles. Internal combustion (IC) engines are used to power these automobiles. Due to an increase in automobiles, there is environmental pollution from IC engines and a decrease in fossil fuels [1]-[2]. The newest innovations in the automotive sector are assisting in enhancing fuel economy and lowering pollutants. Hybrid vehicles, which employ both internal combustion (IC) engines and electric motors to drive the vehicles—or a car, to put it simply—help to minimize the amount of pollution produced while preserving the performance of the engine—are an example of such a technical innovation. Future attention will be placed on clean, green energy that produces no emissions. Current industry is extremely interested in the design and production of electric vehicles. The main problems of these cars are their high cost, short range, and longer charging times because they are battery-powered. Customers are always seeking for improved ways to increase travel productivity [3]-[4]. Consequently, every gas station was equipped with wired charging equipment. The drawbacks of wired charging also include the lack of plug points, the space taken up by the charging station, the wire's short range, and the requirement that the car alter its orientation in order to connect to the charger. Wireless charging devices for electric vehicles can help with this [5]-[9]. This allows for flexible and hassle-free charging and also allows for the installation of systems for the home, garage, parking lot, etc. The wireless charging system used in the automotive industry is shown in a simplified manner in Fig. 1. This technology is implemented using a wide variety of wireless power transmission techniques. This process transmits power using coils [6]. A short-range magnetic field is produced by the coil, and an electric current flow across it when a second coil is added. Induction is the process through which the magnetic field transmits power from one coil to another.

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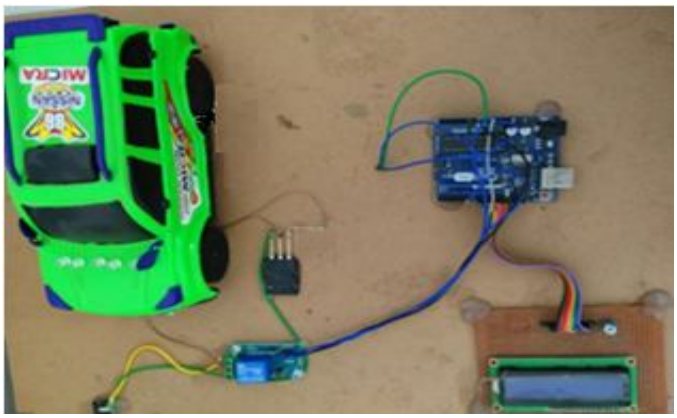


Figure 1. Hardware

II. Literature Survey

Hui Zhi(Zak)Beh (29 jan 2014)[1] suggested a DCS (double-coupled system), which is used to charge an electric vehicle's battery. The intermediary coupler is positioned between the primary coil and the secondary pickup, acting as a switch. By distributing all losses among the branches, the system's effectiveness is increased.
Akshya K. Swain (in 27 feb 2014) [2] explains the bidirectional IPT system, which uses weak magnetic coupling to make wireless power transmission between the two sides of an air gap possible. It is challenging to design and regulate a system without a good mathematical model. State variables have created a dynamic model. This model is a common tool for the design of controllers as well as for the steady state and transient analysis of IPT systems.
Dukju Ahn and Songcheol Hong [3] tells, the IPT system can make use of the repeater concept, which includes installing intermediate repeaters to increase the power transmission distance between the transmitter and receiver coil. It is carefully determined where the repeater should be placed between the transmitter and receiver. While generating the same amount of electricity, the efficiency for two alternative setups differs greatly from one another. If the repeater is placed closer to the transmitter than the receiver, efficiency is improved. The 10-15 cm gap between the road surface and the bottom of an electric vehicle is significant for larger vehicles like trucks or buses, hence certain techniques are required to increase the charging distance depending on the gaps. Repeaters are inserted to accomplish this objective. Jesus sallan describes a new design procedure where design factors are taken into account while selecting a coreless IPT's parameters, such as the ideal number of coils, compensating capacitors, and frequency. If the right design is chosen, there is a chance to deliver high power with great efficiency.
Sheldon S.Williamson, K.Rathore,Fei Gao, et. Al [4], [25 January 2017] , According to his description of the findings, the biggest barriers to CPT are high costs, insufficient range, limited power efficiency, and worry over charging times. This research gives an overview of CPT systems for EV charging based on available literature. hua Liu et. al (2017) [5] discusses the coil overview for wireless electric vehicle charging. The coil design is essential for enhancing the functionality of the wireless charging system for EVs. Govind Yatnalkar et. al (2018) [6] they conduct a survey on the placement of wireless charging stations for electric vehicles. Electric vehicles' charging times are a restriction that prevents the public from adopting them generally.

III. Wireless Electric Vehicle Charging Market Size

In figure 2, the global wireless electric vehicle charging market size was estimated at 16.8 million in the year 2021 and is expected to expand at 478.5 million by 2030 and is poised to grow at a compound annual growth rate (CAGR) of 90.2% over the forecast time 2022 to 2030.

IV. Methodology

This paper proposed a project wireless charging for electric vehicle. This paper describes to decreases pollution as much as possible from the vehicle which used the diesel and petrol. Because due to pollution we see global warming is increasing day by day and pollution is one of the reasons of getting people ill. So, for decreasing the

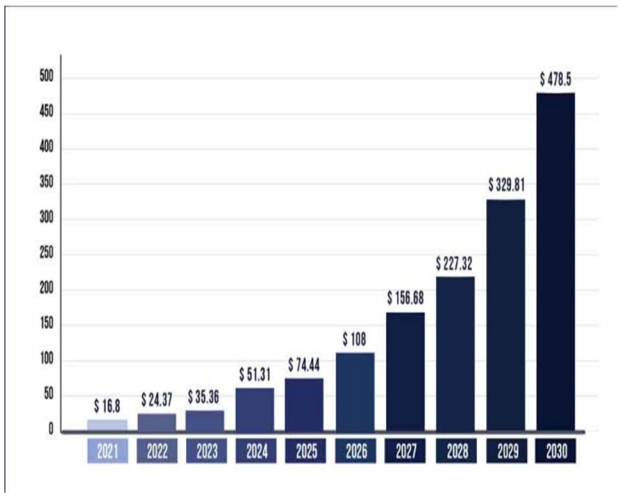


Figure -2 graph

pollution or global warming. for making this project we have used Arduino UNO as a main part so Arduino UNO id used for control the entire system it also used for to monitor and run the hole project.

Through Arduino uno pins all the jumping wires are connected. There is total 13 pins in Arduino UNO. Also, Arduino uno is used to upload the code, due to code we are able to run the project. So, it is the main part of our project. The second component we have used is the relay which is used to turn on and off the charging spots.it also helps to control the high current load like motor, helps to control voltage, solenoid values, lamps and AC load.

Here TTC5200 MOSFET model is also used. It is a NPN transistor and it designed for power amplifier and switching application. So basically, in our project we are using this NPN transistor for fast switching operation of primary binding.

This paper also includes IR sensor is used to detect the vehicle when any vehicle go on the spot of charging point where this IR sensor is fitted and it will detect that there is a vehicle and it automatically turn on the charger.

Here in our project LCD is also used its helps to show the status of charging spots. It shows the charging and non-charging status of charging station. For the power supply in Arduino, we have used the adaptor and for the power supply in whole system we have used power supplier wire.

So, in the figure 3 below we have shown the diagram of methodology. it shows about the simplicity (helps to understand the project easily) and this methodology helps to make the prototype and also tells which sensors and which component is used in the project.

In figure 4. This paper proposed a block diagram that shows a way of how our project works. basically, block diagram shows in how many steps and how we have to set up our project.

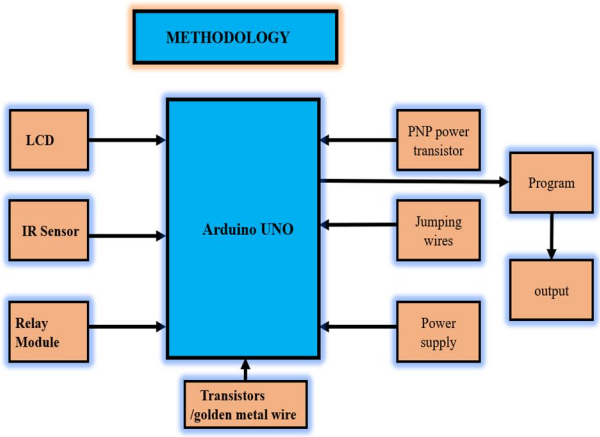


Figure 3. methodology

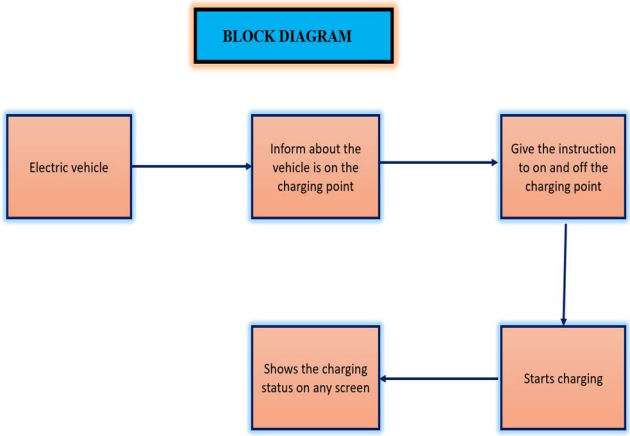


Figure 4. block diagram

V. COMPONENT REQUIRED

A. Arduino UNO

Arduino uno is a multipurpose low-cost microcontroller which is openly available in the market. It is small in size and it can perform multiple tasks at the same time. If we are talking about the multiple task preformation at the same time then it must have multiple port available for dealing with multiple input output functions. It is having 14 input and output pins as well as it is having 6 analog pins and 16 MHz quartz crystal, a power jack, a USB connection, an ICSP header and a reset button. if we are talking about the use of Arduino uno in this project. we have mainly used the Arduino uno in this project to work as a server. first of all, we import the hex file of the code whatever it is in the Arduino uno. Then we connect the Arduino uno directly with the Flame sensor, gas sensor, water sensor and LCD. It receives the data of kitchen from the connected sensors. Then after according to the code it will alert and gives result.

B. IR Sensor

In figure 6 , an IR sensor is a technology component that produces light to detect nearby objects. Both motion and object heat can be measured using an IR sensor. In the infrared spectrum, most items emit some kind of heat radiation. Although these radiations are invisible to the human eye, infrared sensors can pick them up.
The detector is just an IR photodiode, while the emitter is just an IR LED (Light Emitting Diode). The same wavelength of IR light that the IR LED emits can be detected by a photodiode. When IR light strikes the photodiode, the resistances and output voltages will alter proportionally to the intensity of the IR light received.

Figure.6- IR Sensor

C. Relay module

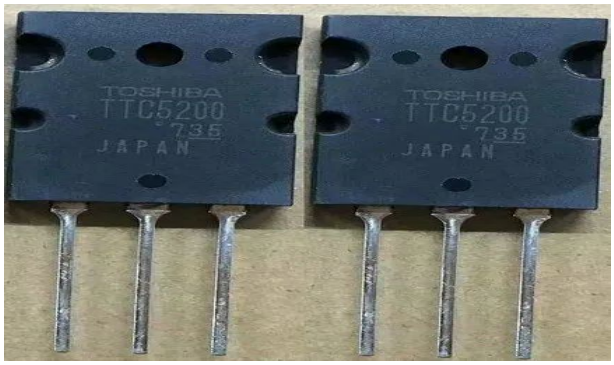
It is a single channel 5v relay module. The single-channel relay module is much more than just a simple relay; it includes elements that simplify switching and connection as well as indicators that show if the module is powered and whether the relay is operational.

In figure 7, A relay is an electromechanical device that utilizes an electric current to open or close a switch's contacts. The single-channel relay module is much more than just a simple relay; it includes elements that facilitate switching and connecting as well as serve as indicators to signal if the module is powered and whether the relay is active or not.

Figur.7-Relay module

D. NPN transistor (MOSFET)

It is a TTC5200 module transistor. The high collector voltage TTC5200 employed this through-hole NPN silicon transistor in a TO-3P package shown in figure 8. Power amplification is a popular application for this gadget. 230V is the collector to emitter voltage (Vce). A 230V collector to base voltage. 15A is the collector current (Ic).



Figur.8-NPN transistor

E. LCD

Liquid crystal display is referred to as LCD. It is a particular type of electronic display module used in a broad range of circuits and devices, including mobile phones, calculators, computers, TVs, and other electronics. These displays shown in figure 9, are mostly preferred for seven segments and multi-segment light-emitting diodes. The main advantages of adopting this module are its low cost, ease of programming, animations, and unlimited ability to display bespoke characters, unique animations, etc**.**

Figure.9- LCD

VI. RESULT

As we talk about the result of our project so when any vehicle comes on the charging point that is on the charging station. So first it stands on the charging spots where IR sensor is inserted for indicating the vehicle and inform to the relay. And when the vehicle stands on the charging spots for charging. First lcd shows that how much percent our electric vehicle is charged and how much we have to charge the vehicle. So as soon as IR sensor indicates about the vehicle and after indicating the vehicle it gives the message to the Arduino which is directly connected with the IR sensor. So, after getting that there is any vehicle it allows all the component or entire system to work and flow the current in the whole system. after that its Arduino gives the information to the

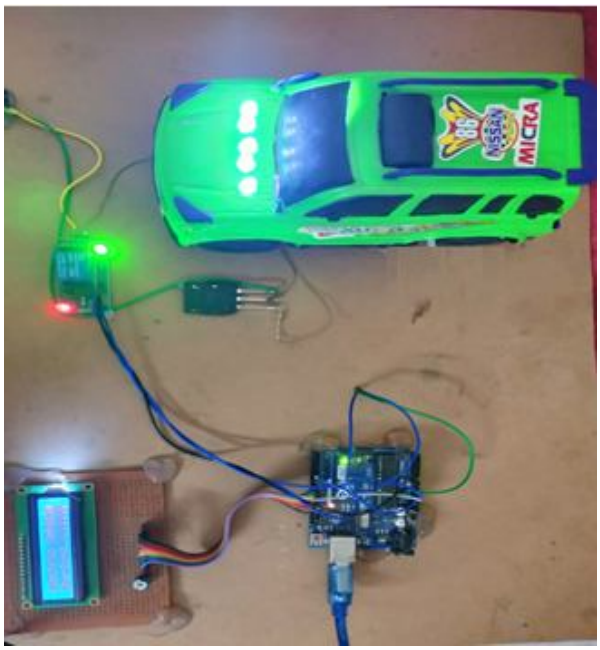


Figure 10. result

relay module. Relay, which helps to on and off the charging point and also helps to control the high current and high voltage. through relay module one power connecter is connected which also helps to connect the power supply for whole the system also thorough relay module one NPN transistor is connected, which is used for power amplifier and switching application. So basically, in our project we are using this NPN transistor for fast switching operation. The NPN transistor is connected with the IR sensor so after getting on and off by relay module information goes to the IR sensor through the NPN transistor and vehicle works according to that instruction. After charging or one the time of charging LCD shows the status about the vehicle is charging or it is fully charged.

In the below figure 10, It shows the how our hardware is set and how its runs after getting power supply. In figure 10 we see the result or output what we got.

VII. CONCLUSION

The conclusion is that this paper describe and trying to implement wireless charging system which is used to charge or recharge an electric vehicle battery. The Arduino uno is used to control and run all the system, where MOSFET (NPN transistor) is operates as a switch. Power transferred is allowed by automatically turn ON the charging spot when the vehicle is present, and automatically turn OFF the charging spot when the vehicle is absent and for indicating the vehicle presence and absence, we are using IR sensor. And we are used IR sensor for indicating the vehicle and only turn on the charging point when vehicle is present on that spot other it will be turned off. This helps in avoiding the magnetic field radiation issue as well as energy waste. We used NPN transistor, which control the system power transferred. SO to overcome the problem of pollution, energy waste and by avoiding the traffic from wired charging we have made this wireless charging system for electric vehicle . We have made a prototype of this project and its running perfect. This system provides reliability, long life and safety. So, this is the whole conclusion about our project.

This paper describes, the future plan of to connect the wireless vehicle through the wireless charger as well as we connect the solar panel with that vehicle. Because we charge the vehicle ones that vehicle will charge for some hour and if our vehicle will discharge at a time and that time, we don’t have any charger point near, so this solar system will work that time.

REFERENCES

[1] Naoui Mohamed, Flah Aymen, Turki E. A. Alharbi, Claude Ziad El-Bayeh, Sbita Lassaad, Sherifs. M. Ghoneim, Ursula Eicker A “Comprehensive Analysis of Wireless Charging Systems for Electric Vehicles” IEEE Access, Volume: 10, 43865 – 43881, April 2022.

[2] MD Rakib Raihan Razu, Sultan Mahmud, MohammaD Jalal Uddin, Sikder Sunbeam Islam, Badariah Bais, Norbahiah Misran, Mohammad Tariqul Islam, “Wireless Charging of Electric Vehicle While Driving” 157973 –157983, November 2021.
[3] Dukju Ahn and Songcheol Hong, “A study on magnetic field repeater inwireless power transfer,” IEEE Trans. Ind. Electron., vol. 60, 360 - 371, Jan. 2013.
[4] Naoui Mohamed, Flah Aymen, Turki E. A. Alharbi, Claude Ziad El-bayeh, Sbita Lassaad, Sherif S. M. Ghoneim, and Ursula Eicker “A Comprehensive Analysis on the Wireless Charging Systems for Electric Vehicles” IEEE Access 43865 - 43881, April2022.
[5] Govind Yatnalkar and Husnu Narman, “Survey on Wireless Charging and placement of wireless charging stations for electric vehicles”’ in IEEE International Symposium on Signal Processing and Information Technology (ISSPIT), December 2018
[6] D. M. Vilathgamuwa and J.P.K. Sampath, “WirelessPower Transfer (WPT) for Electric Vehicles (EVs)-Present and Future Trends” Plug in Electric Vehicles in Smart Grids, November 2014.
[7] A Kurs, A Karalis, R Moffatt, JD Joannopoulos, P Fisher "Wireless Power Transfer via Strongly Coupled Magnetic Resonances", SCIENCE, Vol 317, pp. 83-86, July 2007.
[8] Aristeidis Karalis, and Marin Sol-jacic, “Efficient wireless non-radiative midrange energy transfer”, Annals of Physics, no. 323, pp. 34- 48, 2008.
[9] A. Karalis, J.D. Joannopoulos, Marin Soljačić “Efficient wireless non-radiative mid-range energy transfer”, Elesevier, Annals of Physics, vol.323, pp. 34-48, 2008.
[10] Hui Zhi (Zak) Beh, Grant A. Covic,, and John T. Boys “Wireless Fleet Charging System for Electric Bicycles”, IEEE Journal of Emerging and Selected Topics in Power Electronics pp. 75 – 86, Volume: 3, Issue: 1, April 2014.
[11] Akshya K. Swain; Michael J. Neath; Udaya K. Madawala; Duleepa J. Thrimawithana, “A Dynamic Multivariable State-Space Model for Bidirectional Inductive Power Transfer Systems”, IEEE Transactions on Power Electronics, Volume: 27, Issue: 11, November 2012.
[12] Ravikiran Vaka and Ritesh Kumar Keshri, “Review on Contactless Power Transfer for Electric Vehicle Charging.”. *Energies*, *10*(5), 636, 2017.