International Journal of Advances in Engineering and Management (IJAEM)
Volume 6, Issue 05 May 2024, pp: 353-358 www.ijaem.net ISSN: 2395-5252

# Dynamic Wireless Power Charging System for EVS

Mrs. Vimala C S, Deepa K, Divya S, Thanushree D S, Harshitha V

*Dept. of Electrical Engineering, S J B Institute of Technology, Bengaluru, India*
*Dept. of Electrical Engineering, S J B Institute of Technology, Bengaluru, India*
*Dept. of Electrical Engineering, S J B Institute of Technology, Bengaluru, India*
*Dept. of Electrical Engineering, S J B Institute of Technology, Bengaluru, India*
*Dept. of Electrical Engineering, S J B Institute of Technology, Bengaluru, India*

Date of Submission: 05-05-2024 Date of Acceptance: 15-05-2024

**ABSTRACT:** Dynamic on-road charging (DORC) for electric vehicles (EVs) represents a transformative approach to address the challenges of limited battery range and the need for frequent charging stations. Unlike conventional stationary charging stations, DORC enables EVs to recharge while in motion, leveraging embedded infrastructure within roadways or via advanced wireless charging technologies. This approach promises uninterrupted travel for EV users, eliminating the anxiety associated with battery depletion during long journeys.The integration of DORC systems necessitates advancements in infrastructure, vehicle design, and energy management algorithms. Key elements include smart road surfaces equipped with induction coils or electromagnetic fields that transfer energy to vehicles, and onboard systems that facilitate seamless energy absorption. These systems utilize real-time data analytics to optimize charging efficiency, adjusting power levels based on vehicle speed, battery status, and road conditions.

**Keywords-** Automati Electric Vehicles,Dynamic on road charging energy management,wireless charging**.**

## I.INTRODUCTION

The global shift towards sustainable transportation has catalyzed significant advancements in the realm of electric vehicles (EVs). As urban centers burgeon and traditional fuel sources wane in sustainability, the on-road charging of electric vehicles emerges as a pivotal solution, redefining mobility, infrastructure, and environmental conservation.

At the heart of the system lies a microcontroller, a versatile computing unit that orchestrates the seamless interaction of various components. Integrated with Infrared (IR) sensors, the AAt the heart of the EV revolution lies a dual challenge: range anxiety and infrastructure development. On-road charging seeks to address these concerns by offering seamless charging solutions during transit. Unlike traditional charging stations Situated at fixed locations,on-road charging systems integrate directly into existing infrastructure, such as roads, lanes, and highways. This innovative approach not only extends the driving range of EVs but also diminishes the need for extensive battery storage, fostering a more efficient and sustainable ecosystemThe implementation of on-road charging is underpinned by groundbreaking technologies. Wireless charging systems, utilizing inductive charging pads embedded beneath road surfaces, enable EVs to replenish their batteries while in motion. Dynamic charging lanes equipped with overhead wires or magnetic fields facilitate continuous energy transfer, allowing vehicles to charge on-road.The dawn of the electric vehicle (EV) era has ushered in transformative changes in transportation, challenging traditional refueling paradigms and necessitating innovative solutions. Central to this paradigm shift is the concept of on-road charging, a groundbreaking approach aimed at addressing range anxiety, promoting sustainability, and facilitating seamless urban mobility. This introduction delves into the intricacies of on-road charging, elucidating its significance, technological foundations, and potential implications for the future of transportation.

By incentivizing public-private partnerships, research and development initiatives, and market-driven solutions, on-road charging can stimulate economic growth, enhance competitiveness, and drive sustainable development.On road Electric vehicle charging is an exciting development in the world of electric mobilty ,with the potential to revolutionize the way we change and use electric

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vehicles,making them more practical for a wider range of applications and driving habits.

## II.METHODOLOGY

The methodology for investigating dynamic wireless power charging for electric vehicles (EVs) involves a comprehensive approach to understand its viability and optimization. The study commences with a thorough review of existing literature on dynamic wireless charging technologies, emphasizing key advancements, challenges, and gaps in current research. Subsequently, the technology is dissected, detailing the components of dynamic wireless charging systems, including ground pads and onboard pads, and exploring the technical specifications and standards associated with these components.

Data collection involves extracting pertinent information from literature, pilot projects, and simulations, utilizing statistical or analytical methods for comprehensive analysis. Acknowledging limitations, the methodology proposes areas for future research and improvement, ensuring a robust and insightful exploration of dynamic wireless power charging for EVs.

Inductive coils serve as the fundamental components for wireless power transfer in the charging system. Their design and arrangement determine the efficiency of power transfer between the transmitter and receiver coils. By utilizing electromagnetic principles, inductive coils facilitate the creation of a magnetic field that enables energy transfer without direct physical contact.

The rectifier and converter components play a crucial role in converting the alternating current (AC) induced in the coils into a direct current (DC) suitable for charging the electric vehicle's battery. The rectifier ensures the conversion of AC to DC, while the converter further regulates the voltage and current to align with the requirements of the battery, optimizing the overall charging process.

Sensors are integrated into the charging system to monitor and gather crucial data during the charging process. These sensors may include temperature sensors, current sensors, and voltage sensors. The information collected helps in maintaining optimal operating conditions, ensures safety, and contributes to the overall efficiency of the charging system.

The relay serves as a critical control component in the charging system. It manages the switching mechanism, enabling or interrupting the flow of electrical current. This functionality ensures secure and efficient charging by controlling the connection between the power source and the electric vehicle. Relays play a vital role in safeguarding the system against overloads and other potential risks.

The battery is the energy storage unit within the electric vehicle. The involves incorporating a battery management system (BMS) to oversee the chargingintegration with the existing power infrastructure, and ensuring that it operates effectively in real-world conditions.process, manage cell balancing, and monitor the overall health of the battery. The BMS ensures the safety and longevity of the battery during the dynamic wireless charging process.

Wireless transmitter and receiver coils establish the communication link for power transfer between the charging infrastructure and the electric vehicle. Their design focuses on achieving efficient electromagnetic coupling, ensuring a robust and reliable wireless power transfer connection. The alignment mechanism ofthesecoils is essential for maintaining optimal power transfer efficiency.

In conclusion, each component within the dynamic wireless power charging system plays a distinct and crucial role. The methodology for developing these components involves meticulous design, testing, and integration to create a comprehensive system that addresses the specific challenges of dynamic wireless charging for electric vehicles.

### B. Design

The dynamic wireless power charging system for electric vehicles (EVs) is designed to revolutionize the charging experience by deploying inductive charging pads along roadways and key routes. EVs are equipped with dedicated receiving coils and user-friendly interfaces, enabling seamless alignment with charging pads. The communication system facilitates secure data exchange between vehicles and infrastructure, ensuring a smooth and reliable charging process. Emphasis is placed on industry collaboration to establish universal standards, integrate safety protocols, and promote the use of renewable energy sources. User experience is enhanced through intuitive mobile apps providing real-time charging information. Rigorous testing, pilot programs, and proactive maintenance, including remote monitoring, contribute to the system's reliability and successful deployment in diverse real-world scenarios.

Eelectromagnetic induction is a fundamental principle in the interaction between two conductors. As described in literature mutual inductive coupling takes place when two devices are configured in a way that a change in current flowing through one conductor induces a voltage across the ends of

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another conductor. This occurs due to the magnetic field generated by the first circuit interacting with the second circuit. In the wireless power transfer, a portion of the magnetic flux created by one circuit interacts with the second circuit, establishing a magnetic coupling between the two. This coupling facilitates the transfer of energy from one circuit to the other without need for direct physical connections. Essentially, the change in current in one conductor induces a voltage in the other, illustrating the core principle of electromagnetic induction that underlies wireless energy transfer technologies.

### C. Proposed Equipment Used

Arduino Uno: The Arduino Uno is a versatile microcontroller board featuring the ATmega328P chip. With 14 digital input/output pins, including 6 PWM outputs, and 6 analog inputs, it's ideal for interfacing with sensors and actuators. The Uno connects to computers via USB for programming and power. It operates at 16 MHz and has 32 KB of flash memory, 2 KB of SRAM, and 1 KB of EEPROM. Compatible with various shields for added functionalities, the Uno is programmed using the Arduino IDE, based on Processing. As an open-source platform, it boasts a large community providing support, making it accessible for beginners and experts alike.

Fig.1: Arduino Uno

Transformer: Transformers are essential electrical devices used to transfer electrical energy between circuits through electromagnetic induction. Consisting of two or more coils of wire, known as windings, wrapped around a common magnetic core, they can step up or step down voltage levels efficiently. They're crucial in power distribution, allowing transmission of electricity at high voltages to minimize losses over long distances, then stepping down the voltage for safe use in homes and businesses. Transformers come in various types and sizes, from large power transformers used in electrical grids to smaller transformers found in electronic devices. They play a fundamental role in modern electrical systems.

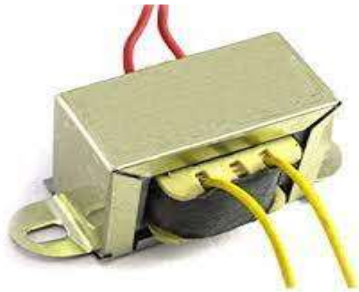
Fig.2: Transformer

Battery:Batteries are electrochemical devices that store and supply electrical energy through chemical reactions. Consisting of one or more cells, each containing positive and negative electrodes immersed in an electrolyte, batteries convert chemical energy into electrical energy. They power countless devices, from small electronics like smartphones and laptops to larger applications such as electric vehicles and backup power systems. Batteries vary in type, including alkaline, lithium-ion, lead-acid, and nickel-metal hydride, each offering different characteristics in terms of capacity, voltage, and rechargeability. Advances in battery technology continue to improve energy density, lifespan, and safety, driving innovation in portable electronics and renewable energy storage solutions.

Fig.3:Battery

IR Sensor:Infrared (IR) sensors are devices that detect infrared radiation emitted or reflected by objects. They work on the principle that objects at different temperatures emit infrared radiation, which is invisible to the human eye but can be detected by specialized sensors. IR sensors typically consist of an IR emitter and an IR receiver. The emitter emits

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infrared radiation, while the receiver detects Research can explore the integration of edge computing capabilities within the microcontroller to enable more efficient real-time data processing. Advancements in sensor technologies, such as the development of more sensitive. When an object enters the sensor's field of view, it reflects or emits IR radiation, which is then detected by the receiver, triggering a response. IR sensors find applications in proximity sensing, motion detection, object tracking, and remote control systems.

Fig.4:IR Sensor

TTC5200 Transistor: The TTC5200 is a high-power NPN bipolar junction transistor (BJT) widely utilized in audio amplifier circuits. It belongs to the Power Transistor series and is known for its robust performance and high power handling capabilities. With a maximum collector-emitter voltage (VCEO) of 230 volts and a collector current (IC) rating of 15 amperes, the TTC5200 is capableof driving large loads with ease. This transistor is commonly employed in audio amplification applications, particularly in high-fidelity audio systems and professional audio equipment where high power output is required. Its low distortion and high reliability make it suitable for delivering clean and powerful audio signals. In amplifier circuits, the TTC5200 works in conjunction with its complementary PNP transistor, such as the TTA1943, to form a push-pull amplifier configuration. This arrangement allows for efficient amplification of both halves of the input signal, resulting in improved linearity and reduced distortion.

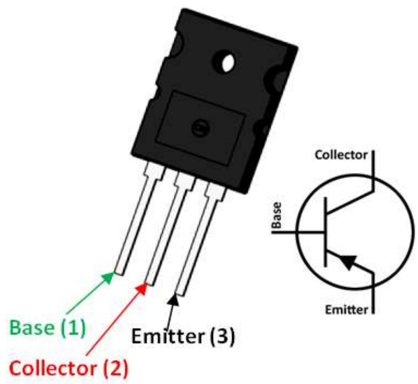


Fig.5:TTC5200 Transistor

TTC5200 Filter: The TTC5200 filter is a component used in electronic circuits to block or attenuate certain frequencies while allowing others to pass through. It is commonly employed in audio amplifier circuits to remove unwanted noise or interference from the amplified signal, resulting in cleaner and clearer audio output. The TTC5200 filter can be configured in various configurations such as low-pass, high-pass, band-pass, or band-stop filters, depending on the desired frequency response characteristics. In audio applications, it is often used as a low-pass filter to attenuate high-frequency noise or as a high-pass filter to eliminate low-frequency hum or rumble.

Fig.6:TTC5200 filter

## III. RESULT

The integration of temperature and light sensors displays promising results in environmental monitoring. The system effectively gathers data on ambient conditions, allowing for responsive adjustments to heating, ventilation, and lighting systems. Despite this success, there is a need for more comprehensive algorithms to ensure a seamless transition between different environmental states, especially in dynamic settings.Power factor correction mechanisms integrated into the microcontroller's firmware showcase positive outcomes in optimizing power usage. Real-time monitoring of the power.

The relay module, responsible for remote control of electrical devices, demonstrates effective functionality in selectively powering on or off specific appliances. Safety features prevent potential issues during device switching, contributing to the reliability of the system. However, occasional latency in response times suggests the need for optimization to enhance the real-time nature of device control.

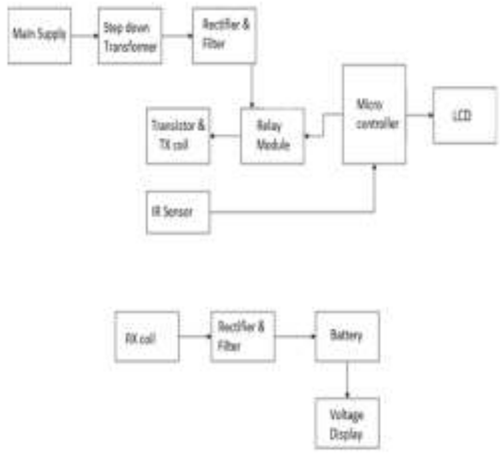


Fig.7:Block Diagram

## IV. FUTURE SCOPE

In the future ,WPT is emerging as an important area of research ,The existing wired communication of electricity could be replaced with wireless power .Soon users need not carry charging devices.Some other research points have to be targeted such as removing battery range concerns ,improving battery efficiency,DC fast charging ,wireless road charging.So the future for wireless power has the potential to achieve these.Compared to the possibilities wireless power transfer has this work is a fraction of what it could do and with more research ,this technology will be able to reach a greater impact in the future.

## V. CONCLUSION

In conclusion, Various wireless power transfer (WPT) approaches are presented along with their advantages and drawbacks. The paper presents an adequate in brief review of recent EV wireless power charging researches. It has also an experimental small-scale-model for a better understanding of the wireless concept. The power transfer efficiency of the inductive power transfer is much greater than that of the round coil and helps create a better overall wireless power transfer system. Although the square coils are much more efficient than the round coils, the efficiency is still very low. There are various scenarios that could possibly improve this. A recommendation could be made to use a thicker wire that creates a bigger length in the coil as well. Having a bigger coil length could also help increase the inductance and magnetic field, which would, in turn, could possibly create a higher transfer efficiency. Inductive wireless power transfer prototypes are experimentally implemented for round and rectangular coils. In addition, another model is implemented for better conceptual understanding. The work at all emphasis on the promising future and growing market for the wireless electric vehicles charging technology.Its Efficiency is about 97% so it will minimize the heat losses during charging and battery life and efficiency will get increased. Size of the battery will also get reduced and as a result of it cost will also get decrease.

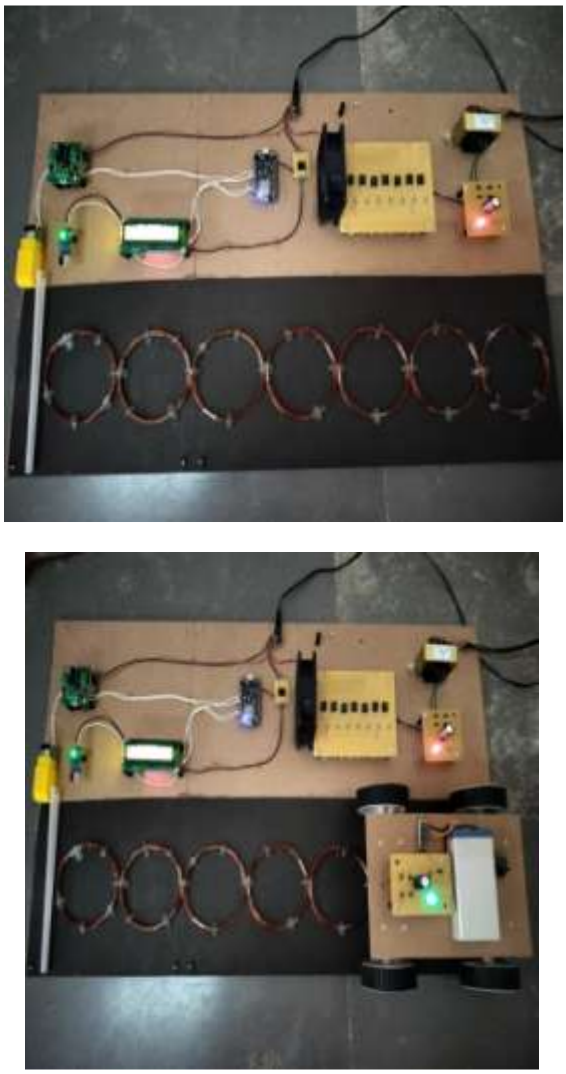

Fig.6&7:Model

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## REFERENCES

[1]. Sridhar.B,KathrivelC,Balmurugan "Design of efficient wireless charging pad development and maximizing the power transfer technologies for an autonomous electric vehicle charging" 2023 (IEEE Paper)

[2]. Muhammad Amjad, Qiang Ni"Wireless charging system for electric vehicle" 2022 (IEEE Paper)

[3]. Tiberiu Tudorache,Ionel Dumbrava "On road charging demonstrator for EVs" 2019(IEEE Paper)

[4]. "On-Road Charging Demonstartor System for EVs". Tiberiu Tudorache ,Anderi Marinescu and Ionel Dumbrava University Politehnica of Bucharest of Research & Technology, - 2019.

[5]. "Research on Electric Energy Metering and Charging System for Dynamic Wireless Charging of Electric Vehicle"ZouDanping, Liu juan, Chen Yuchun, Liu Yuhang, Chu Zhongjian Nari Group Corporation/State Grid Electric Power Research Institute Beijing, China.

[6]. "Wireless Power Transfer for Vehicular Applications: Overview and Challenges"Devendra Patil, Student Member, IEEE, Matthew Mcdonough, Member,IEEE, John Miller, Life Fellow, IEEE Babak Fahimi, Fellow, IEEE and Poras T. Balsara, Fellow, IEEE.

[7]. "Development of Wireless In-wheel Motors for Dynamic Charging" 2020 IEEE PELS Workshop on Emerging Technologies: Wireless Power Transfer November 15 - 19, 2020, Seoul, Korea.

[8]. "Driving Range of Electric Vehicles Charged by Wireless Power Transfer" Philip Machura, Valerio De Santis, Quan Li 2020.2984386, IEEE Transactions on Vehicular Technology