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# Design and Implementation of Wireless Dynamic Charging on Electric Vehicle with Voice Command Assist and Path Following Features

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**Abstract:** *This paper presents the design and implementation of a dynamic wireless charging car equipped with voice command assist and path following features. The proposed system aims to enhance the convenience, usability, and autonomous capabilities of electric vehicles.The combination of dynamic wireless charging, voice command functionality, and path following technology offers a comprehensive solution for electric vehicles. The proposed car utilizes wireless charging technology, allowing it to charge wirelessly while in motion. Additionally, voice command assist and path following features are incorporated to improve user experience and automate navigation. The paper discusses the design considerations, system architecture, and implementation details of the dynamic wireless charging car with its innovative features. Experimental results demonstrate the effectiveness and feasibility of the proposed system, paving the way for future advancements in electric vehicle technology. While the presented system has exhibited a potential outcome, further research and development are required to overcome technical challenges and ensure its feasibility, efficiency, and safety. However, the proposed system holds promise to revolutionize electric vehicle technology, offering a seamless and autonomous driving experience while providing efficient charging capabilities*

**Keywords:** Dynamic wireless Charging, Voice Command Assist, Path Following, Electric Vehicle, Road Safety

## I. INTRODUCTION

The rapid advancement of electric vehicles (EVs) has revolutionized the automotive industry, the automotive industry is undergoing a transformative shift towards sustainable and technologically advanced solutions by offering a more sustainable and environmentally friendly electric vehicles substituting the traditional internal combustion engine vehicles. Owing to the increasing popularity of electric vehicles (EVs) in the market there is a growing need for innovative features that enhance the user's driving experience by improve convenience, and prioritize safety. In response to these demands, this paper introduces an innovative concept—the dynamic wireless charging car with voice command assist and path following feature.

The dynamic wireless charging technology enables the EV to charge its battery while in motion, eliminating the need for physical contact with charging stations or cables. This feature extends the driving range and eliminates range anxiety, making long-distance travel in electric vehicles more convenient. In addition to dynamic charging, the system incorporates a voice command feature using Bluetooth RC controller app which allows the user to control the vehicle through voice commands. This enables hands-free operation, enhancing safety and convenience during driving. The voice command functionality can control various vehicle operations such as navigation, media, climate control, and charging settings. Furthermore, the system integrates line following technology, which utilizes sensors and computer vision algorithms to detect and track black lines on the road. This enables the EV to autonomously follow the designated path, enhancing autonomous driving capabilities and reducing the driver's workload

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### 1.1 Background

Traditional EV charging methods often require physical connections and can be time-consuming and inconvenient for users. Dynamic wireless charging offers a promising solution by enabling wireless charging while the vehicle is in motion or parked. This technology eliminates the need for conventional charging infrastructure and enhances the usability and accessibility of EVs. Electric vehicles (EVs) are becoming increasingly prevalent in transportation; In the UK, the adoption rate has been staggering, with there being 20 times more registered EVs in 2017 than in 2012 and the move away from conventional fossil-fuelled vehicles is accelerating as advances in related technologies are making EVs financially viable thus It is expected that this trend will continue and this will certainly impose extreme strains on existing power infrastructure.

Electric Vehicles are gaining popularity due to their environmental friendliness and potential to reduce dependence on fossil fuels. Traditional charging methods require physical connection between the vehicle and charging station, which can be inconvenient and limit mobility. Wireless charging technology offers a promising solution by enabling wireless charging while the vehicle is in motion. This technology uses electromagnetic fields to transfer energy between the charging infrastructure and the car's onboard receiver.

### 1.2 Objectives

The primary objective of this project is to explore the integration of dynamic wireless charging technology, voice command assist, and path following features into an electric vehicle. This combination of features aims to address key challenges in EV charging, user interaction, and road safety, ultimately redefining the driving experience. The purpose of this project is to enhance the convenience and efficiency of electric vehicles by integrating advanced technologies.

### 1.3 Dynamic Wireless Charging Technology

Dynamic wireless charging leverages wireless power transfer techniques to recharge the vehicle's batteries. By employing inductive or resonant charging methods, electric energy is transferred between an embedded charging pad on the road and a receiver module in the vehicle. This technology offers the potential for continuous charging while the vehicle is in motion, eliminating the need for frequent stops at charging stations. Wireless charging systems eliminate the need for physical cables and plugs, providing a seamless and effortless charging experience for electric vehicle owners. Dynamic wireless charging takes this concept a step further by enabling charging while the car is in motion. This technology relies on inductive power transfer, where charging pads embedded in the road or charging stations transmit power to receivers installed on the underside of the vehicle.

### 1.4 Voice Command Assist

The voice command feature integrated into the car using a Bluetooth RC (Remote Control) controller app allows users to control various functions and operations of the car through voice commands. By utilizing the app's Bluetooth connectivity, the car can receive voice commands wirelessly from a paired smartphone or device, providing a convenient and hands-free interface for controlling the vehicle. By integrating the voice command feature into the car's control system through a Bluetooth RC controller app, users can enjoy a more interactive, efficient, and hands-free experience while operating the vehicle, thereby enhancing convenience, comfort, and safety on the road.

### 1.5 Path Following

Path following is an autonomous driving feature that allows vehicles to navigate along a predefined white path or road markings. The path following system utilizes sensor technologies to enable autonomous navigation. A white line is painted on the road, and the car's onboard sensor detects and follows this line. By analysing the received feedback in real-time, the car adjusts its steering and speed to stay on the desired path. This technology offers a simple and cost-effective solution for autonomous driving in controlled environments

### 1.6 Significance and Potential Impact

The integration of dynamic wireless charging, voice command assist, and path following features holds tremendous potential for revolutionizing the automotive industry. By offering seamless charging experiences, intuitive vehicle

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interactions, and enhanced road safety, these features have the ability to accelerate the adoption of EVs, improve user satisfaction, and contribute to a more sustainable and efficient transportation ecosystem.
In summary, this paper presents the concept of a dynamic wireless charging car with voice command assist and black path following feature. By combining these cutting-edge technologies, the aim is to create an innovative and user-centric driving experience.

## II. LITERATURE SURVEY

1. **"Potential of wireless power transfer for dynamic charging of electric vehicles" by Luke Hutchinson, B. Waterson, B. Anvari, D. Naberezhnykh**
This study reviews current traction battery technologies, conductive and inductive charging processes, and influential parameters specific to the dynamic charging state as well as also highlighting notable work within the field of WPT charging systems. Wireless power transfer offers a viable means of charging electric vehicles whilst in a dynamic state, mitigating issues concerning vehicle range, the size of onboard energy storage, and the network distribution of static-based charging systems.

2. **"Wireless Power Transfer for Vehicular Applications: Overview and Challenges" by D. Patil, M. McDonough, John M. Miller, B. Fahimi, P. Balsara**
This paper reviews recent advances in stationary and dynamic wireless charging of EVs. A comprehensive review of charging pads, power electronics configurations, compensation networks, controls, and standard are presented.

3. **"Voice Recognition system from SPEECH RECOGNITION FOR ROBOTIC CONTROL" , author of Prof. Bhuvaneshwari Jolad and Mohnish Arora.-**
Speaker adaptive systems customize their knowledge to each individual user over time while the system is in use. Small vocabulary systems provide recognition capability for up to 100 words and Large vocabulary systems which provide recognition capability for over 1000 words.

## III. MOTIVATION

The motivation for integrating dynamic wireless charging, voice command assist, and path following features into vehicles arises from the need for sustainable transportation, enhanced convenience, improved safety, and the drive towards technological innovation. By addressing these key aspects, this integration paves the way for a greener, safer, and more enjoyable driving future. The integration of dynamic wireless charging, voice command assist, and path following features in cars is driven by several key motivations. Firstly, there is a pressing need for sustainable transportation solutions to combat the environmental impact of traditional fossil fuel vehicles. Dynamic wireless charging technology offers a convenient and efficient way to charge electric vehicles, reducing reliance on conventional charging infrastructure and encouraging wider adoption of electric mobility. Secondly, enhancing convenience and user experience is crucial in promoting the widespread acceptance of electric vehicles. By incorporating voice command assist, drivers can interact with their vehicles using Bluetooth RC (Remote Control) controller app minimizing distractions and improving overall safety. Lastly, the path following feature addresses the challenges of night-time driving by leveraging advanced sensor technologies and computer vision algorithms to enhance visibility and ensure road safety. By integrating these innovative features, the automotive industry aims to deliver a more sustainable, user-friendly, and safer driving experience.

## IV. METHODOLOGY

Proposed Block Diagram of Dynamic Charging using Wireless Power Transfer Technology on Electric Vehicle having Voice Command Assist and Path Following Features is shown in Fig. 1

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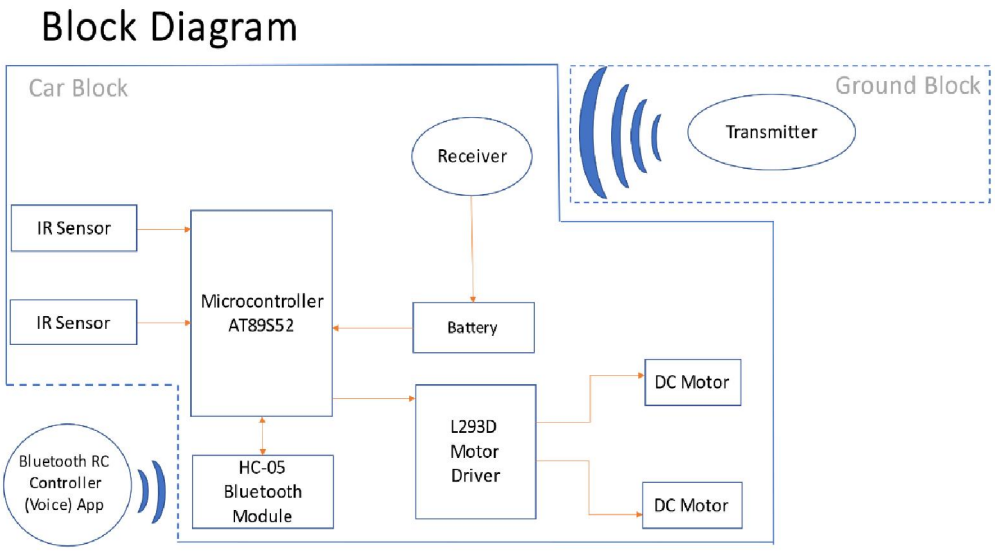


Fig. 1 Block Diagram of the Proposed System

### 4.1 IR Sensors

Infrared ray sensors can be utilized in electric cars to detect and follow a line on the ground enabling the vehicle to autonomously navigate along a predetermined path.The path can be a black line on white surface or vice-versa, the line follower is a self-operating robot that detects and follows a line that is drawn. By utilizing infrared ray sensors for white line following, electric cars can achieve autonomous navigation capabilities, enhancing their functionality and usability.

### 4.2 DC Motors

The operation of a DC motor relies on the interaction between a magnetic field and electric currents. A brushed DC motor consists of a commutator and brushes that convert a DC current into an armature coil to an AC current. The Brushless DC Motor (BLDC) motor offers excellent power density as compared to other motors, higher torque, reduced operational and mechanical noise, elimination of electromagnetic interference and offers excellent efficiency. Hence, this motor is the most popular in EV application.DC motors in electric vehicles offer several benefits, including high torque capabilities, quick response times, and efficient operation. They provide the necessary power for propulsion and enable precise control over the vehicle's speed and acceleration. Furthermore, their compact size and versatility make them suitable for various EV applications.

### 4.3 L293D Motor Driver

The L293D motor driver is a popular integrated circuit (IC) used in electric vehicles (EVs) to control and drive DC motors. In an electric vehicle application, the L293D motor driver IC is commonly used in conjunction with a microcontroller or a dedicated control module. The microcontroller or control module receives input signals from the driver, such as throttle commands or steering inputs, and processes them to generate the appropriate control signals for the motor driver. These control signals determine the motor's speed, direction, and braking actions.

### 4.4 AT89S52 Microcontroller

The AT89S52 microcontroller is a widely used 8-bit microcontroller from the 8051 family, developed by Atmel (now Microchip Technology). The microcontroller operates at a high clock frequency, typically up to 33 MHz, enabling fast execution of instructions and responsive control of the EV's functions. The microcontroller offers a range of input/output (I/O) ports, including general-purpose I/O pins, serial communication ports (UART), and other specialized interfaces such as SPI and I2C. In an electric vehicle, the AT89S52 microcontroller can be employed as the central control unit, responsible for monitoring and controlling various functions, including motor control, battery management, sensor data acquisition, human-machine interface, and communication with external systems.

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### 4.5 HC-05 Bluetooth Module

The HC-05 Bluetooth module is a commonly used wireless communication module that enables Bluetooth connectivity in various applications, including electric vehicles (EVs). The module supports Bluetooth 2.0 protocol, which provides a stable and efficient wireless connection with compatible devices. It operates in the 2.4GHz frequency range and has a typical communication range of up to 10 meters. The HC-05 module can enable wireless control and monitoring of the EV's systems through a mobile app or a Bluetooth-enabled device. This allows users to interact with the vehicle, adjust settings, and receive real-time information.

### 4.6 LM7805 IC: Voltage Regulator

The LM7805 IC is a voltage regulator integrated circuit widely used in electric vehicles (EVs) to provide a stable and regulated 5-volt power supply. The LM7805 IC operates as a linear voltage regulator, which means it uses a pass transistor and a feedback mechanism to maintain a constant output voltage despite changes in input voltage and load conditions. The LM7805 IC serves as a reliable voltage regulator in electric vehicles, delivering a regulated 5-volt power supply to critical components and circuits. Its ease of use, availability, and proven performance make it a popular choice for maintaining stable power in EV systems.

### 4.7 Crystal Oscillator

A crystal oscillator is an electronic component commonly used in electric vehicles (EVs) to generate precise and stable clock signals for timing and synchronization purposes. It is based on the principle of piezoelectricity, where a crystal material vibrates at a specific frequency when an electric field is applied. Common frequencies used in EV applications include 4 MHz, 8 MHz, 16 MHz, and higher.

### 4.8 Bluetooth RC (Remote Control) Controller App

The Bluetooth RC (Remote Control) Controller App is a mobile application that allows users to control electronic devices remotely using Bluetooth communication. The app utilizes speech recognition algorithms and natural language processing techniques to interpret the spoken commands accurately. The user can speak commands such as "start the engine," "forward," "turn left," "stop," and many more. Once the voice command is recognized and processed, the app converts it into corresponding control signals and transmits them via Bluetooth to the car's onboard receiver. The receiver decodes the signals and triggers the appropriate actions.

## V. HARDWARE DESIGN

Below are the Schematic Designs of the proposed system designed using KiCad EDA

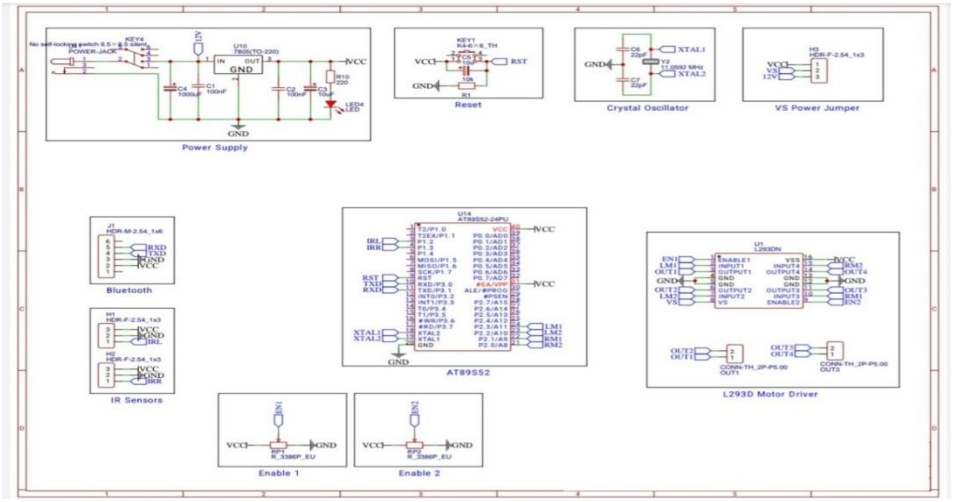


Fig. 2 Schematic Design of the System comprising of a voice command and line following dynamic charging car

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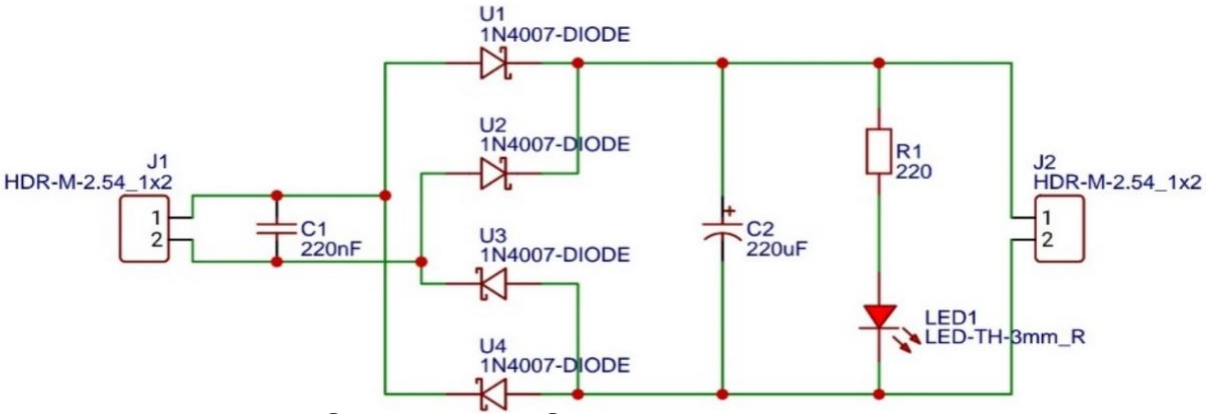


Fig. 3 Schematic Design of Wireless Power Transmitter

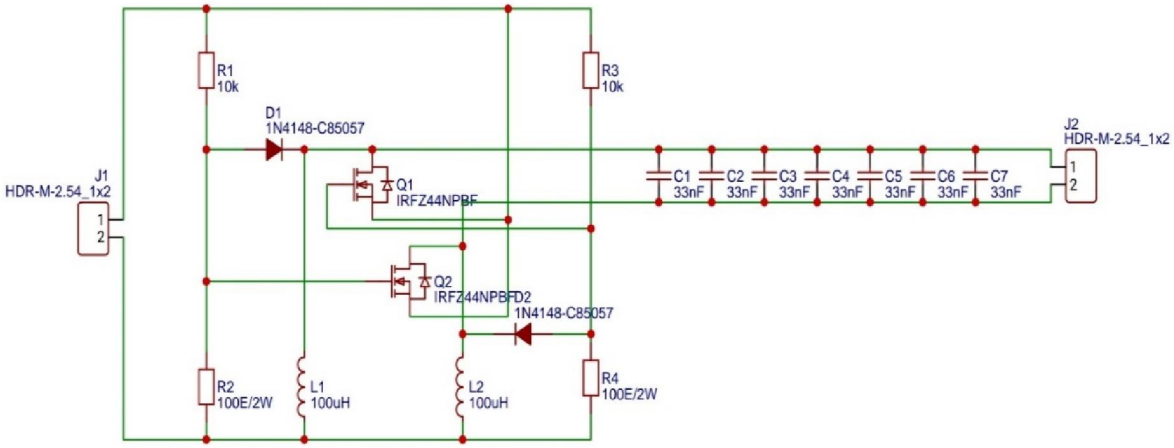


Fig. 4 Schematic Design of Wireless Power Receiver

## VI. CONCLUSION

In conclusion, the integration of dynamic wireless charging, voice command assist, and path following features in cars marks a significant advancement in the automotive industry. These features address key challenges in sustainable transportation, user convenience, safety, and technological innovation. Dynamic wireless charging eliminates the limitations of conventional charging methods, providing a convenient and efficient solution for electric vehicle owners. Voice command assist enhances the driving experience by enabling intuitive and hands-free interactions with the vehicle, promoting safety and reducing distractions. The path following feature enhances visibility and road safety, particularly during night-time driving, through advanced sensor technologies. The successful of these features in cars not only propels the adoption of electric vehicles but also sets a new standard for integration convenience, safety, and sustainable mobility. Future research and development in these areas will further refine and optimize these features, opening up new possibilities for the future of automotive technology. The integration of these features in cars has the potential to revolutionize the driving experience. It promotes the wider adoption of electric vehicles, improves user satisfaction, and contributes to a safer and more sustainable transportation future.

As technology continues to advances, further research and developments are needed to enhance these features and address any existing limitations. Additionally, it is essential for manufacturers, policymakers, and infrastructure providers to collaborate and invest in the necessary infrastructure to support dynamic wireless charging.

It's worth noting that dynamic wireless charging technology is still in the research and development phase, and several technical and infrastructure challenges need to be addressed before it becomes widely available. However, it holds promise as a potential solution to enhance the convenience and viability of electric vehicles.

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