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IMPLEMENTATION OF DYNAMIC CAR CHARGING USING IOT

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Abstract: This article integrates a subscription-based strategy with a revolutionary technique to wireless dynamic car charging (WDCC). The system's seamless charging capabilities while vehicles are in motion are intended to meet the growing demand for effective electric vehicle (EV) charging infrastructure. The suggested approach does away with the requirement for conventional plug-in charging stations by wirelessly transferring electricity to EVs via inductive charging technology embedded in highways. Users can use the WDCC service through a subscription-based approach, which eliminates the burden of human intervention and enables convenient and ongoing payment. In addition to guaranteeing income creation for service providers, the subscription model gives EV owners freedom and cost. The suggested WDCC system's technical features, advantages, difficulties, and possible implementation methods are all covered in this study.

Keywords: Wireless dynamic car charging (WDCC), Subscription-based model, Electric vehicles, Inductive charging technology

I . Introduction`

The advent serves more than one purposes. The automobile enterprise has undergone a giant transformation with the shift toward electric powered vehicles (EVs). This fashion is more often than not because of the need to lower greenhouse gasoline emissions and reduce the poor influences of climate change. Automakers are running tougher to create environmentally friendly transportation alternatives as governments round the arena impose stricter legal guidelines to reduce carbon emissions. Among those options, electric powered cars have emerged as a popular alternative for conventional automobiles with internal combustion engines because they offer lower pollution, decrease jogging fees, and better strength efficiency. But in spite of the medical advances and environmental advantages of electric vehicle generation, there are still essential obstacles to their sizeable adoption, especially with regards to the infrastructure needed for charging. The accessibility and availability of charging stations, which immediately affect the convenience of EV ownership, is one among their main concerns. Electric cars' suitability as a realistic form of transportation. Though commonplace in towns, conventional plug-in charging stations have drawbacks such lengthy price intervals, scarcity, and the annoyance of bodily connection.

The EV charging landscape wishes to be revolutionized in order to conquer those problems and expedite the shift to electric powered mobility. One such treatment is wireless dynamic vehicle charging (WDCC), a recently developed technology that does away with the requirement for traditional plug-in charging stations by allowing electric cars to fee whilst they are in motion. With WDCC, EVs can wirelessly receive strength transfers via inductive charging era set up in highways, allowing non-stop charging even as in motion. The capability for this modern method to conquer the drawbacks of traditional charging infrastructure. It has been cited that, based totally on beyond research, there are quite a few additional approaches to climate With the help of this revolutionary approach, the drawbacks of the modern infrastructure for charging might be solved, imparting owners of electrical vehicles with seamless charging reports.

A viable way forward for improving the WDCC services' price and accessibility is to incorporate a subscription-based approach. The adoption of a subscription-based model obviates the necessity for customers to make sporadic payments at charging stations by providing them with easy and affordable subscription plans that grant access to WDCC services. This strategy facilitates the expansion and upkeep of WDCC infrastructure by guaranteeing a consistent cash stream for service providers while streamlining the pricing procedure.

We explore the idea of wireless dynamic car charging in this article, emphasizing how it might be integrated with a subscription-based business model. In an effort to provide readers a thorough grasp of this cutting-edge method of charging electric vehicles, we examine the technical features, advantages, difficulties, and possible implementation techniques of WDCC with subscription. By means of an exhaustive examination of the existing electric vehicle charging infrastructure, the constraints associated with conventional plug-in charging stations, and the prospects afforded by wireless dynamic car charging, our aim is to underscore the revolutionary capacity of this technology in molding the trajectory of transportation in the future. We will examine the current infrastructure for charging electric vehicles in the following sections, emphasizing the shortcomings of traditional plug-in stations. The idea of wireless dynamic car charging will then be presented, along with an explanation of its operational principles and technical foundations. The benefits of integrating a subscription-based model with WDCC will next be discussed, with an emphasis on advantages such increased accessibility, cost-effectiveness, and income creation. We will also discuss the difficulties in implementing WDCC with subscription and provide possible fixes. We will wrap up by providing an overview of the most important findings and outlining potential directions for further study and advancement in the field of wireless dynamic automobile charging.

II. Literature Review:

Naoui mohamed 1 et.al explains The various wireless charging **[1]**gadget topologies for EV programs are compiled on this observe. It starts with a brief synopsis of EV topologies and consists of a few facts on the prevalence of wireless charging equipment in enterprise settings. Additionally, it displays numerous coil topologies, mathematical models, and architectures for the WPT in each static (EV parked) and dynamic (EV shifting) modes. Furthermore, this takes a look at presents all of the vital variables and parameters to support the development of a strong mathematical version for the wi-fi charging machine. Additionally, a new popular mathematical version that could function with super accuracy in each dynamic and static modes is proposed by means of the authors of this paintings. **Ahmed A. S. Mohamed et.al explains** This paper offers a comprehensive review of the current state-of-the-art **[2]** in dynamic Inductive Power Transfer (IPT), covering various aspects such as transmitting coils, power supply arrangements, converters, compensation circuits, and control methods. It also discusses ongoing industrial research and development activities in dynamic IPT, including pilot and demonstration projects. Comparative analysis of different compensation circuits and power converter topologies is provided, highlighting their respective features, advantages, drawbacks, and practical applications. The paper concludes by addressing the challenges and opportunities associated with dynamic IPT technology. Overall, this review serves as a valuable resource for researchers, students, and engineers interested in exploring and implementing dynamic inductive charging technology. **Abhishek Waghmode et.al explains** In this paper, **[3]**a wireless power supply method for electric vehicles with multi- guideway power supply mode is presented, the structure and principle of the system are described in detail, the design method and loss of the guideway are analyzed. The function and performance of the power supply mode are analysed.

Mojtaba tajmohammadi et.al explains This paper provides a thorough examination of dynamic Inductive Power Transfer (IPT) **[4]**, exploring key elements like transmitting coils, power supply setups, converters, compensation circuits, and control methodologies. It delves into ongoing industrial research and development endeavors in dynamic IPT, including pilot projects and demonstrations. Through comparative analysis, it evaluates various compensation circuits and power converter configurations, detailing their features, pros, cons, and practical use cases. The paper concludes by discussing the challenges and prospects within dynamic IPT technology. In essence, it serves as an essential reference for those interested in delving into and applying dynamic inductive charging technology. **Dr.Ch. Vijay et.al explains**An introduction to the WEVCS for **[5]**dynamic applications using recently developed technology is given in this paper. We also included the Toll system and node-to-node communication, both of which have been effectively used. Concerns about health and safety have been brought up, and current research and development from a range of public and private organisations is presented in the form of worldwide standards for WEVCS. Here, we've protected a node-to-node that helps you gather facts approximately each vehicle and make certain that no different motors are the usage of the road. Eventually, WPT is used to simulate and research potential future technology. All matters taken into consideration; this newsletter covers the maximum current improvements in the subject of WEVCS.

Alicia triviño et.al explains EVs can now be charged while they are in motion thanks to a promising new technology called dynamic charging. In this discipline, numerous research topics are now being explored, including control, power electronics, and**[6]** coil design. The need for studies based on finite element modelling frequently slows down the design process. In this research, we investigate the application of a reduced model using FEM tools to attain a more precise and expeditious design. A dynamic charge prototype has been designed and implemented using the model. The simulations run 20 times faster using our condensed model than they do using the traditional approach. Given that the features observed and those produced from the modelling are almost identical, the experimental results demonstrate the viability and ease of use of the reduced model. **Atharva Mhadeshwar et.al explains** This project provides an overview of the **[7]**WEVCS and its current research technologies for fixed and dynamic applications. Additionally, a range of core and ferrite forms were shown, which were used in the design of the current wireless charging pad. Concerns about health and safety have been highlighted, as have recent changes in international standards for WEVCS Current research and development from a range of public and commercial institutions have been used to study and evaluate state-of-the-art stationary- and dynamic- WEVCS. Finally, with the use of FEM, emerging future technologies are examined and simulated.

III. Methodology:

A power transmitter and a power receiver make up the wireless power transfer system. An inverter and power wires make up the power transmitter portion. Power is supplied by the inverter, and magnetic flux is produced and current is carried across the power lines. Regulators, rectifiers, and pickup modules make up the power receiver portion. The rectifiers transform ac power into dc, the regulators manage the output voltage that is fed into batteries and motors, and the pickup modules produce power from induced voltage and current. The inverter transforms 60 Hz operational frequency into 20 kHz resonance frequency after receiving power from an electric power company. While constant voltage can be achieved by controlling the inverter, constant current management is preferable when handling variations in load resistance or multi-pickup charging. As a result, the inverter in the OLEV system transforms 60 Hz power to 260 A steady current at a resonance frequency of 20 kHz. The power line modules are situated both beside and beneath the roadway. The subscription unit enables us to check the subscription of the user if the user is subscribed then the user will be able to charge if not they will not be able to charge.

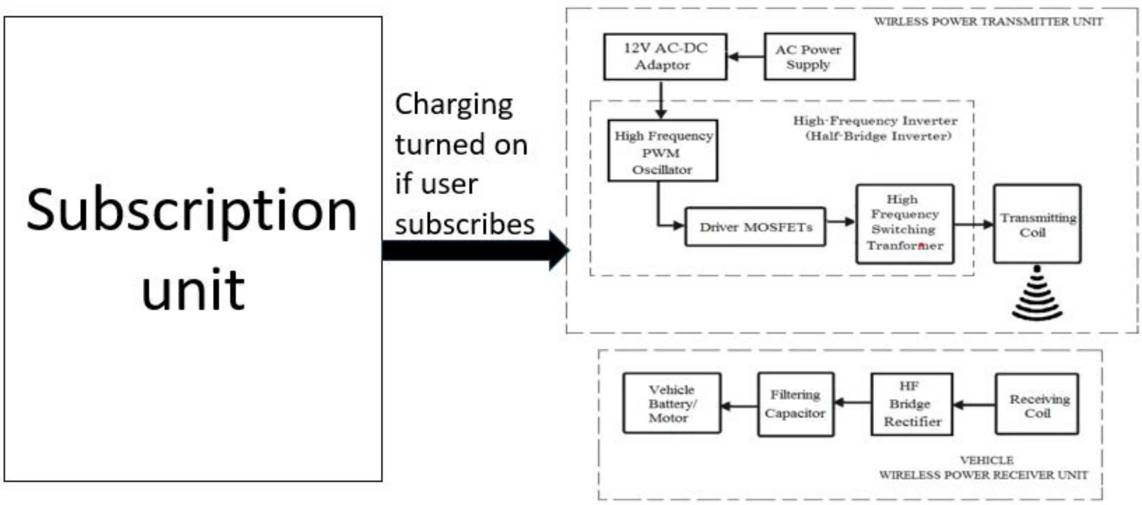

fig 1: block diagram

The block diagram consists of three units, they are Subscription unit, Wireless Power Transmission unit, Wireless Power Receiver unit.

A. **Subscription unit:**

a) **Microcontroller Interface:** The Microcontroller serves as a bridge connecting the car to the wireless charging station. To exchange data and manage the charging process, it communicates with the charging station.

b) **Subscription Verification:** When a car tries to charge, the microcontroller will check if it is a subscribing user or not. This subscription status will be retrieved through a wi-fi module or locally saved on the car.

c) **Authentication Process:** The microcontroller starts an authentication procedure when a car gets close to the charging station. In order to confirm the subscription status of the car.

d) **Charging Authorization:** The charging station authorizes the vehicle to start charging if it has registered. If the charging station confirms , the microcontroller will allow the charging to start, and the registered vehicle can charge.

e) **Denial of Charging:** The charging station refuses to authorise charging of car if the car is not subscribed or if the status of subscription cannot be confirmed. By relaying this information to the car, microcontroller stops the car from starting the charging process.

B. **Wireless power transmitter unit:**
A switching mode power supply (SMPS) adapter is used to convert power initially drawn from a regular 220V AC outlet to direct current (DC) While laying the foundation for later stages of system operation, this adapter need to convert a 220V AC input to a more manageable 12V DC output An A -powered high-frequency pulse-width modulation (PWM) oscillator is used. The PWM switching pulses required to generate metal oxide semiconductor field effect transistors (MOSFETs) are generated by this oscillator and by acting as conductors these MOSFETs enable a high frequency transformer to be switched. PWM signals control the switching g process, resulting in alternating current (AC) formation. The high frequency converter is required to operate the transmitter. This transformer uses a ferrite core to efficiently convert DC current to high-frequency AC current. Its special winding with multiple taps allows precise control of current flow during switching. A high-frequency AC voltage is then generated by passing the AC output of the transformer through a half-bridge inverter for additional cleaning. Transmission coil made of copper diffusers is important in the transmission system. It interfaces with high-frequency AC power supplied by a well-located inverter. The design of the transmitter coil allows the electrical current to be efficiently converted into electromagnetic waves at a specific frequency. These waves are transmitted wirelessly, traveling in space until they are picked up by the receiving coil, which is conveniently located within range of the transmitter

a) **AC Power Supply:** The supply for the wireless power transmitter is taken from AC220v source.

b) **12v AC-DC Adapter:** (SMPS) Switching Mode power supply is used here to convert AC to DC. Here the input of the SMPS is 220v AC and output will be 12v DC.

c) **High Frequency PWM Oscillator:** High Frequency oscillator is designed using KA3525 IC. The IC circuit generates PWM switching pulses for driving the MOSFETs. The oscillator produces a PWM frequency of 65 KHz range. Here two separate PWM pulses PWM1 and PWM2 are produced which are supplied to the two MOSFET gate. Each PWM pulses are 90 degrees out of phase, which result in alternative switching of each MOSFETs.

d) **Driver MOSFETs:** Here, two driving MOSFETs are used to modulate the high-frequency converter. The two ends of the transformer primary are connected to the "Drain" pins of the two MOSFETs. When the MOSFET is turned ON, current flows in the main winding of the transformer. Half of the primary is turned ON by one MOSFET and the other half is turned ON by the other MOSFET. In both cases, the MOSFET on the other hand converts the primary of the converter into an AC square wave.

e) **High Frequency Transformer:** Here the DC-AC conversion takes place in the high-frequency switching transformer. Unlike normal transformer, the core of the HF transformer is made of ferrite which makes it capable of operating at higher frequencies. Due to high frequency switching the losses in conversion is very lower than normal transformer. Here the HF transformer converts DC current into a high-frequency AC current. The primary of transformer has three tappings, one is centre tap for DC current input and other two tapings for return path of the current through MOSFETs during switching. The secondary output will be HF AC current, which is given to the transmitter coil.

C. **Wireless power receiver unit:**

Receiver has a receiving coil which has same resonant frequency of the transmitter coil. So when placed near the transmitter coil it will pick up the electromagnetic field and converts it into the high frequency AC current. Output of receiver coil is given to a high frequency rectifier which converts HF AC to DC voltage output. A capacitor filter at the output of rectifier filters the ripple in DC and gives a stable DC output voltage. A DC output is produced at the output of receiver which is used to power any DC loads. The electrical power flows from the power transmitter coil inside the platform to the receiving coil inside the bottom of the electric vehicle. Electrical charging is done once the resonant frequency of both the coils matches and the vehicle charged automatically. When the vehicle is moved the charger goes to the power saving mode and cut off the charger coil.

a) **Half bridge Inverter:** Half bridge inverter circuit driver consists of a high-frequency switching transformer and two MOSFETs. The switching transformer primary is connected to two MOSFETs and secondary is connected to transmitting coil. The half bridge inverter converts input DC voltage into a high frequency AC voltage.

b) **Transmitting Coil:** The transmitter coil is designed with windings of copper coils which convert the high frequency oscillating electrical current into electromagnetic waves resonating at a particular frequency.

c) **Receiving Coil:** The receiver coil receives electromagnetic waves from the transmitter antenna and converts back into high frequency electrical output.

d) **HF Bridge Rectifier:** High Frequency (HF) bridge rectifier consists of fast switching rectifier diodes which converts HF AC voltage from the receiving coil into a DC voltage.

e) **Filtering Capacitor:** The filtering capacitor filters the waves generated in the rectifier and processes them into a smooth stable DC voltage output that can be used to drive the vehicle motor or for battery charging purposes.

IV. Results and discussion

The results of this study show that combining wireless dynamic auto-charging with a subscription-based workflow presents a strong argument to overcome the problems of infrastructure supporting electric vehicle charging Technological advantages, . operational efficiency, cost, availability, with its combined environmental and sustainability features, electric transport has the potential to accelerate adoption and open the door to a more equitable transportation future and it is permanent.

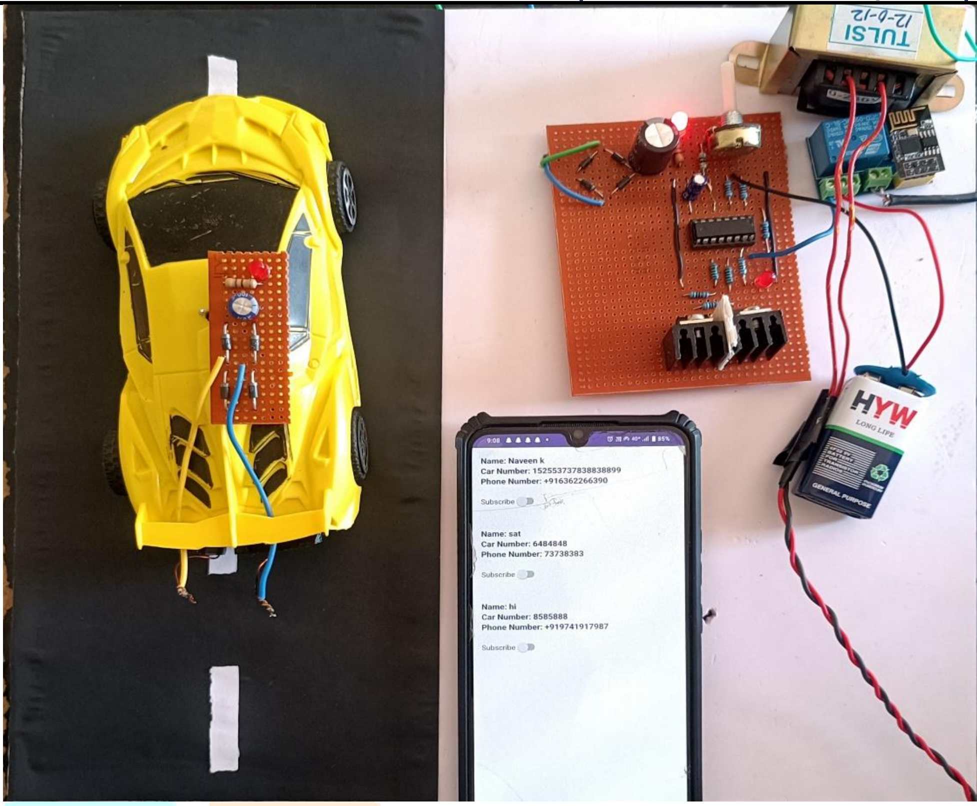

fig 2: before subscription dynamic charging is not enabled

Installing a wireless charging pad in a designated parking space or area is the standard procedure for subscription-based wireless auto charging. Users typically have to register their car and provide payment details to the service provider before they may subscribe. After subscribing, customers can park their plug-in hybrid or electric car over the charging pad in the approved area, and the charging process will start on its own. In addition to possible extras like remote charging status monitoring, customer assistance, and session scheduling, the subscription usually grants access to the infrastructure for charging.

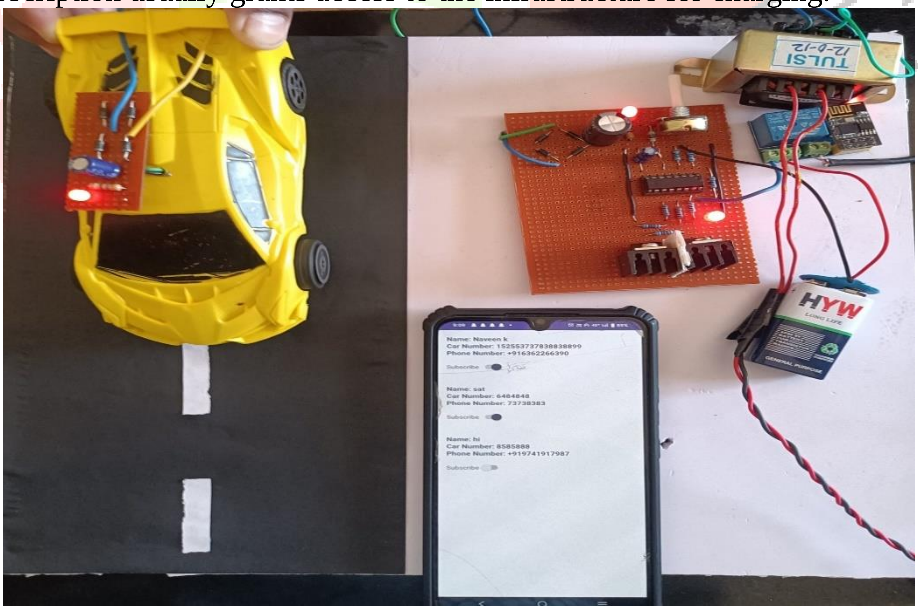

fig 3: after subscription dynamic charging is enabled

The ability of WDCC with subscription to improve operational efficiency in electric car charging is one of its main advantages. WDCC reduces overall charging durations and increases vehicle uptime by permitting continuous charging while cars are in motion, doing away with the requirement for protracted charging stops at stationary stations. When it comes to long-distance travel and commercial fleets, where downtime reduction is crucial, this operational efficiency is especially beneficial. Furthermore, EV owners are guaranteed a hassle-free charging experience by the smooth integration of WDCC with subscription, which raises user satisfaction and adoption rates. The car receives 60mWatt power and the range is up to 120mm.

V. Conclusion

This This paper concludes that in order to charge electric cars wirelessly, the revolutionary approach to electric vehicle (EV) charging infrastructure that comes with integrating wireless dynamic car charging (WDCC) with a subscription-based model. Through the use of inductive charging technology built into roads, WDCC makes it possible for electric vehicles to charge smoothly while driving, doing away with the requirement for conventional plug-in charging stations. The use of a subscription-based business model simplifies the charging procedure even further, increasing the affordability and accessibility of electric transportation. It is impossible to overestimate the potential of WDCC with subscription to completely transform the EV charging scene, even in the face of obstacles related to infrastructure development, interoperability standards, and regulatory frameworks. The Stakeholders, including government agencies, automakers, and infrastructure suppliers, may work together to fulfil the goal of an electric and sustainable transportation future.

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