



International Journal of Innovative Research in Science Engineering and Technology (IJIRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)



Impact Factor: 8.699

Volume 14, Issue 4, April 2025

IOT Based Wireless EV Charging Station

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ABSTRACT: The speedy adoption of electric cars (EVs) has led to the improvement of superior delivery structures presenting cloud-primarily based monitoring and control. This paper explores the combination of IoT-enabled smart charging stations designed for plug-in and hybrid EVs. The machine as it should be predicts battery electricity tiers, manages invoicing procedures, and gives actual-time statistics on the power distribution network. By leveraging facts from producers and charging stations, the platform optimizes charging charges and complements operational performance. Additionally, it helps strengthen buying and selling answers, enabling users to undertake value-effective charging techniques. This technique promotes clever infrastructure, making sure long lasting EV control, advanced charging performance, and reduced operational prices, reaping benefits both businesses and clients.

KEYWORDS: Electric Vehicles (EV) ,Cloud-based Monitoring , Smart Charging Stations , IoT-enabled DC Charging ,Plug-in and Hybrid EVs.

I. INTRODUCTION

As the demand for sustainable transportation grows, India plans to transition to electric motors (EVs) via 2030. This shift aims to reduce reliance on fossil fuels, which might be depleting and make a contribution to environmental pollution. EVs, powered through rechargeable batteries, offer a purifier alternative to gasoline and diesel motors. However, most important challenges avert the giant adoption of EVs: long charging times and limited charging infrastructure in faraway areas. To address these issues, this assignment proposes a solar-powered wi-fi charging gadget that enables vehicles to price even as transferring, casting off the need for frequent stops.

Traditional EVs require committed charging stations where motors must halt for long durations, making them less sensible for lengthy-distance tours. Moreover, growing the battery size to extend the variety makes the vehicle heavier and more expensive. Additionally, charging stations are scarce in rural regions, growing accessibility issues. The wi-fi charging machine overcomes these obstacles with the aid of imparting continuous, on-the-go charging through sun-powered coils embedded in the street.

The gadget uses sun panels to generate DC power, that's stored in a battery thru a fee controller. The DC energy is transformed into AC using a transformer and controlled by way of circuitry. The AC power is then transmitted via copper coils positioned below the street floor. As the EV drives over the receiver coil established below the vehicle alternatives up the magnetic field. This induces modern-day within the receiver coil, that is converted back into DC electricity the usage of an AC-to-DC converter, charging t automobile's battery wirelessly. To save you overcharging, the machine consists of a battery control unit (BMU). The BMU video display units the battery percentage and mechanically cuts the energy delivered once the battery is fully charged. An Atmega microcontroller is used to measure the battery voltage, and the charging frame is displayed on an LCD display screen, supplying real-time remarks to the driver.

This gadget gives several advantages. It permits continuous charging whilst using, extending the car's variety without the need for stops. The use of solar strength makes the system eco-friendly and cost-powerful, reducing dependency on outside strength sources. The embedded copper coils in the street are long lasting and immune to wear and tear, making the machine appropriate for lengthy-term use.

In conclusion, the solar-powered wireless charging machine offers an progressive and sustainable solution for EV charging. It complements comfort, reduces range tension, and promotes greener transportation, making EVs extra sensible and on hand for destiny..

II. RELATED WORK

P. Paul et al. [1] developed an ESP32-based totally wi-fi charging station for electric powered cars, remotely controlled via an Android app. The ESP32 monitored the charging method, accrued information, and supplied actual-time comments. The device was found to be efficient, reliable, and capable of accurate real-time tracking.

D. Mandal et al. [2] developed an ESP32-based wireless charging station for cellular gadgets, able to charge multiple gadgets simultaneously using inductive coils. The ESP32 monitored the charging procedure, collected records, and furnished actual-time dependable, and correct charging performance.

A. Sharma et al. [3] developed an ESP32-based wi-fi charging station for electric powered cars using an inductive energy switch. The ESP32 monitored the charging technique, collected data, and furnished real-time comments. The gadget was green, dependable, and provided correct actual-time monitoring, making sure effective and seamless vehicle charging.

C. Li et al. [4] developed an ESP32-based wireless charging station for wearable devices using inductive power transfer. The ESP32 ensured efficient charging through actual-time monitoring, information collection, and dependable remarks, enhancing charging performance.

This studies extends current fashions by means of specializing in significant drawbacks which includes latency and scalability; therefore, making it a completely promising solution for IoT security even as being computationally efficient.

III. DESIGN AND BUILD SPECIFICATIONS

A. Components Required

The mission consists of several essential components. The ATmega328 microcontroller serves as the core, supplying low-value and occasional-strength processing for self-sustaining structures. The Boost converter module is used to step up DC voltage, ensuring green electricity shipping. An RFID reader identifies and tracks gadgets thru radio waves, making it best for authentication functions. A voltage sensor monitors and measures gadget voltage levels, making sure stable operation. Finally, an IR sensor detects infrared radiation, making it beneficial for movement detection and security packages.

- 1)Microcontroller ATMEGA328 -ATmega328 is usually used in lots of initiatives and autonomous systems in which a simple, low-powered, low-fee microcontroller is wanted.
- 2)Wireless Power Transfer Module - A wi-fi strength switch (WPT) module is a device that transmits electric energy from a source to a receiver without the use of wires .
- 3)Boost Converter Module -The raise converter is used to "step-up" an input voltage to a few better stages, required through a load. This precise functionality is achieved by storing energy in an inductor and releasing it to the weight at a higher voltage. This quick be aware highlights some of the more commonplace pitfalls while using enhanced regulators.
- 4)LCD - flat-panel display machine that is commonly visible in Television and laptop screens, which is also utilized by cellular phones currently.
- 5)MOSFET -MOSFET stands for metal-oxide-semiconductor area-effect transistor. It's a form of discipline-effect transistor (FET) that is used as a switch or to make bigger electric signals. MOSFETs are an essential building block of contemporary electronics.
- 6)Solar panel -Solar panels are constructed from numerous man or woman sun cells which are themselves composed of layers of silicon, phosphorus and boron . Solar panels soak up the photons and in doing so initiate an electric powered modern-day.

B. Functional Requirements

1. Wireless Power Transmission

The machine must assist wi-fi energy transfer (WPT) using inductive coupling or resonant inductive coupling to feed EV batteries without bodily connectors.

2. Charging Activation and Deactivation

The gadget has to routinely provoke charging when an EV is parked in a delegated charging spot.

3. Power Regulation and Efficiency

The system has to modify the energy output to make certain safe and green charging without overheating or overcharging the battery.

Block Diagram

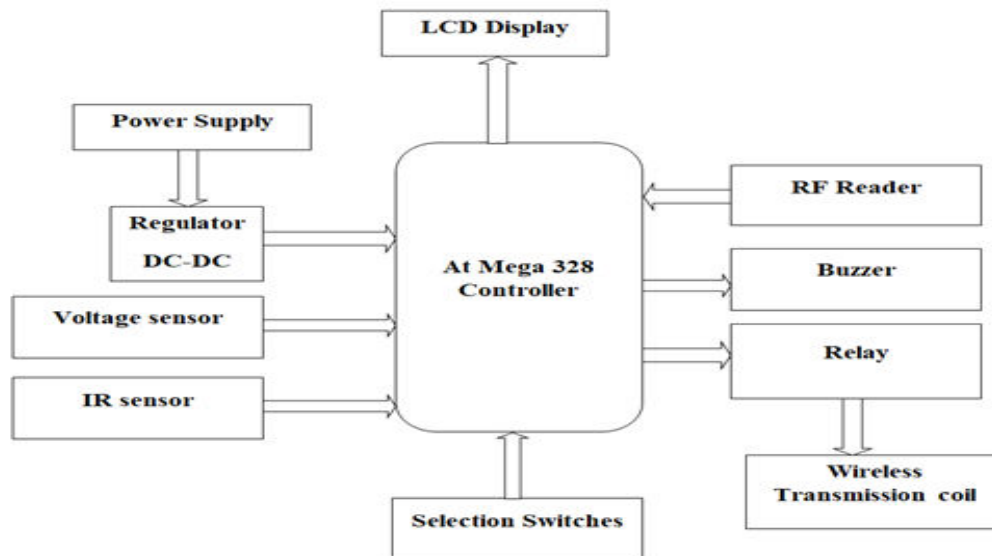


Fig 1 Block diagram of system

Electric motors (EVs) are gaining popularity internationally because of their environmental advantages and decrease journey expenses via the usage of power rather than fuel. However, they face two important challenges: lengthy charging times (1-three hours) and restrained charging station availability in far off regions.

Electric automobiles (EVs) are rapidly gaining recognition due to their environmental blessings and fee-effectiveness, as they reduce fuel dependency by using power, which is notably inexpensive. However, EVs face two fundamental demanding situations: long charging times (commonly 1-three hours) and the dearth of charging stations in far flung regions. To cope with those issues, this assignment introduces a revolutionary wireless EV charging device powered through sun strength. The system offers numerous benefits, consisting of wi-fi charging without physical connectors, the capacity to price cars even as they're in movement, and independence from external strength sources.

The device comprises a solar panel, battery, transformer, regulator circuitry, copper coils, AC-DC converter, ATmega microcontroller, and an LCD display. The sun panel costs the battery via a fee controller, storing DC energy. This DC strength is then converted into AC using a transformer for wi-fi transmission. The AC contemporary powers the copper coils embedded in the street, creating a magnetic area. As the EV passes over the coils, its receiver coil chooses up the energy through magnetic induction. The acquired energy is transformed back to DC using an AC-DC converter, making it appropriate for charging the EV battery.

An ATmega microcontroller video display units the machine, measuring the input voltage and displaying the real-time information on an LCD display. This dynamic wireless charging solution removes the need for EVs to stop for charging, complements comfort,

IV. METHODOLOGY

Inductive wireless charging for electric powered cars operates based totally on Faraday's regulation of induction. It permits strength transfer via mutual induction among the transmitter and receiver coils. When AC energy is carried out to the transmitter coil, it generates an oscillating magnetic field. This area induces a modern-day within the receiver coil, generating AC electricity output. The induced AC power is then rectified and filtered into DC power to rate the car's battery. The performance of strength transfer depends on elements along with the frequency of the AC signal, the mutual inductance among the coils, and the gap keeping them apart. Smaller gaps and higher frequencies enhance performance, while larger distances reduce it. This device offers a handy and contactless charging solution, getting rid of the want for bodily connectors. Inductive wireless charging is extensively used in EV charging stations due to its reliability and protection, making it a promising technology for destiny electric powered mobility.

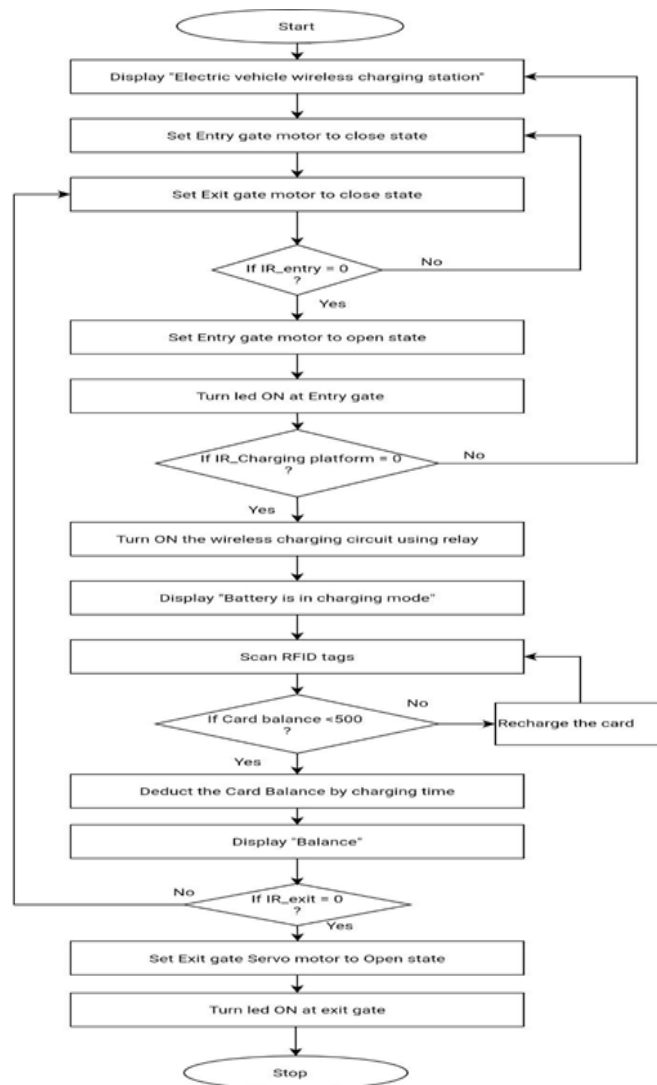


Fig 2 Flowchart of system

V. RESULTS

The following figure showcases After conducting tests based on the simulation, the following results were observed.

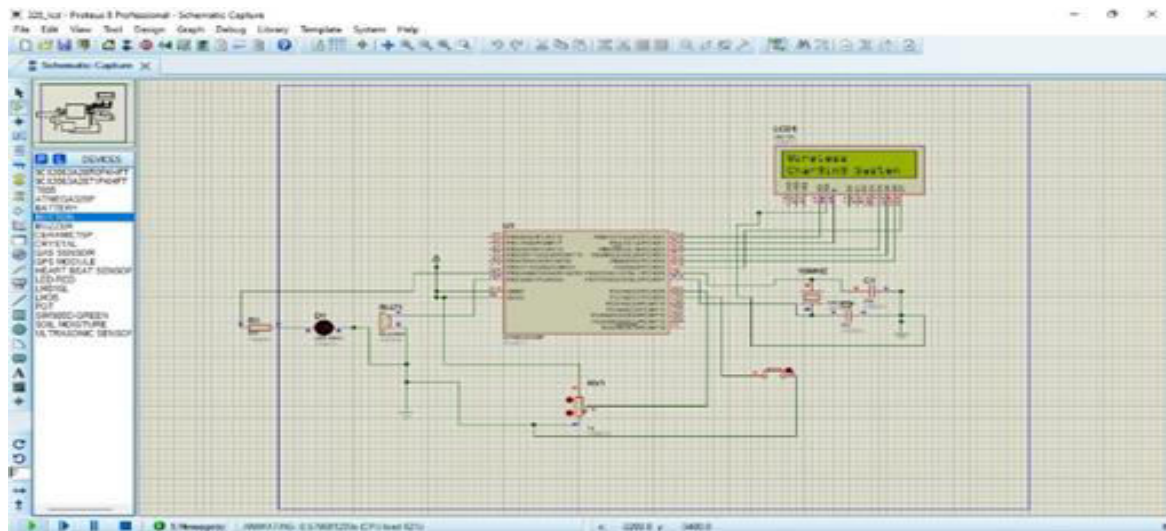


Fig 3 Result of Project

The wireless EV charging gadget efficiently demonstrates the feasibility of charging electric motors even as shifting on the street. The project efficaciously implements wireless power transmission the use of inductive coupling, in which copper coils embedded in the road create a magnetic discipline that induces present day in the vehicle's receiver coil. This modern is transformed into DC power to charge the EV battery. The device operates independently of the usage of solar power, with sun panels charging a battery that substitutes strength to the wireless charging coils. This makes the machine self-maintaining and green, decreasing reliance on outside strength resources. Additionally, the undertaking ensures green AC-DC strength conversion with minimal losses throughout transmission. The ATmega328 microcontroller measures and displays the charging voltage in actual time on an LCD, imparting stay comments at the charging reputation. The system additionally offers computerized activation, detecting the car's presence and initiating charging without guide intervention. During trying out and simulation, the wireless charging device proved stable and dependable, with effective strength switching over short distances. Overall, the project validates the idea of dynamic wi-fi EV charging, imparting a continuous charging experience while riding. It highlights the capability for sun-powered, wi-fi charging infrastructure to enhance the performance and comfort of electrical automobile transportation..

VI. CONCLUSION

Transportation is a key thing in a country's improvement, and electric powered vehicles (EVs) are the destiny of the transportation enterprise. This task pursuits to design and implement a wi-fi charging system for EVs, making charging greater green and convenient. Additionally, a battery control unit (BMU) could be developed to screen the battery percent and mechanically cut the energy delivered when the battery is fully charged, stopping overcharging. The battery voltage could be measured via a microcontroller and displayed on an LCD. The challenge involves studying numerous wi-fi charging techniques and choosing the maximum appropriate components to create a value-powerful prototype. This solution aims to beautify EV charging infrastructure by improving safety, performance, and reliability, making it a promising innovation for sustainable transportation.

VII. FUTURE SCOPE

Wireless charging for electric powered motors (EVs) gives several advantages but additionally comes with positive limitations, together with strength loss because of air transmission. In destiny, those losses need to be minimized or eliminated to enhance efficiency. One good sized benefit of this system is its capability to lessen gasoline fees by

means of utilizing sun electricity for strength era. Since sun strength is renewable and considerable, it appreciably lowers the operational fees of EVs, making them extra in your price range and sustainable. The proposed system now not only improves charging comfort, but also showcases the efficiency and scalability of wireless energy transmission in the future transportation era.

As EV adoption increases, wireless charging stations can comprise RFID-based payment systems and automated access and exit gates to lessen congestion and streamline operations. This innovation will offer self-provider talents, making the system faster and greater efficient. Additionally, wireless energy transmission has destiny applications past EVs, together with wireless charging for cell devices and different digital gadgets, offering broader technological capacity. This system paves the way for clever, automatic charging infrastructure, making EVs more sensible and reachable. It additionally serves as a precious reference for researchers operating on wi-fi energy transmission and sustainable transportation answers.

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