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Solar Powered Wireless E-Vehicle Charging Station

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Abstract: *This IoT-based wireless EV charging system with solar power and voltage monitoring addresses the growing demand for sustainable electric vehicle infrastructure. Powered by an ESP32 microcontroller, it harnesses solar energy through panels connected to a battery and regulator, enabling eco-friendly charging without grid dependency. Key components include an IR sensor (or ultrasonic as depicted in diagrams) for detecting EV presence, a MOSFET or relay for activating the TX coil in the wireless power transfer (WPT) module, and real-time voltage sensing for solar panel and battery levels. A 16x2 LCD displays critical data like charging time, vehicle status, and voltages, while user buttons allow adjusting charge duration and initiating sessions, with a buzzer for feedback.*

The system's intelligence lies in its seamless IoT integration via Wi-Fi, uploading solar voltage, battery voltage, and charging status to ThingSpeak every 60 seconds for remote monitoring and analytics. Charging activates only upon vehicle detection and user confirmation, running for a configurable duration (default 30 seconds) before auto-stopping via relay deactivation, ensuring safety and efficiency. Voltage readings employ ADC averaging with a multiplier (8.95) to accurately scale analog inputs from pins like GPIO36 and GPIO39, preventing over-discharge or faults.

Keywords: IoT, Charging Station, Wireless, ATMEGA328 Microcontroller, Roadway Integration

I. INTRODUCTION

The rapid electrification of transportation has positioned electric vehicles (EVs) as a cornerstone of sustainable mobility, yet challenges like range anxiety and charging infrastructure persist, particularly in regions with unreliable grid power. Wireless EV charging, also known as inductive power transfer, eliminates the need for physical connectors by using resonant coils to transfer energy across an air gap, offering convenience, reduced wear, and potential for dynamic charging during motion. This project introduces an IoT-enabled wireless EV charging station powered exclusively by solar energy, integrating real-time voltage monitoring to ensure efficient and safe operation for small EVs like electric scooters prevalent in urban India.

At its core, the system leverages an ESP32 microcontroller to orchestrate solar power harvesting from panels, battery storage with voltage regulation, and controlled activation of a TX coil via MOSFET or relay for wireless power delivery to a receiving EV coil. An IR or ultrasonic sensor detects vehicle presence, preventing unnecessary energy use, while analog pins monitor solar panel and battery voltages with calibrated ADC readings, displayed on a 16x2 LCD alongside charging status and timer. User interaction via increment, decrement, and start buttons allows customizable charge durations, with a buzzer providing audible feedback, and Wi-Fi connectivity pushes data to ThingSpeak for remote oversight.

This innovation aligns with global renewable energy goals and India's push for green mobility under initiatives like FAME-II, addressing urban charging bottlenecks by combining solar abundance, wireless simplicity, and IoT analytics. By enabling off-grid, monitored charging, it reduces dependency on fossil-fuel grids, lowers costs, and supports scalable deployment in parking lots or residential setups, paving the way for smarter, greener EV ecosystems.

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II. LITERATURE SURVEY

Weather monitoring systems have evolved significantly with the advancement of wireless communication and Internet of Things (IoT) technologies. Researchers have developed various intelligent monitoring solutions that enable real-time data acquisition, remote accessibility, and cloud-based storage for environmental analysis.

In earlier studies, traditional weather monitoring systems relied on wired sensor networks and standalone data loggers that lacked remote monitoring capability and real-time accessibility. These systems were expensive and required manual supervision, limiting their practical applications in agriculture and environmental monitoring.

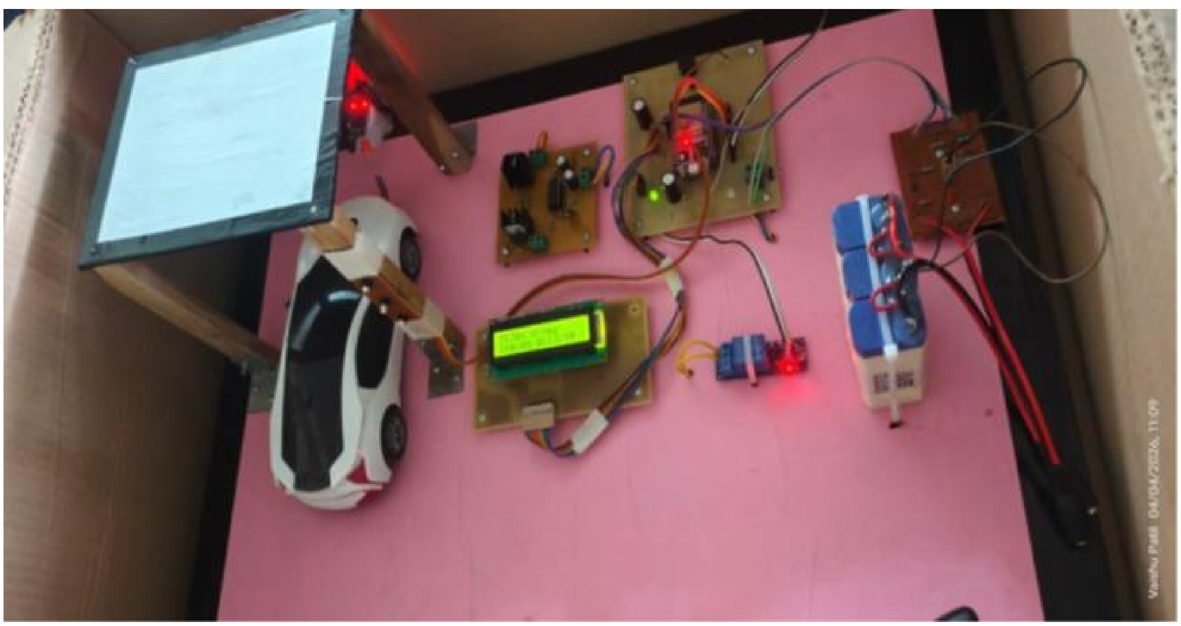
With the introduction of IoT technology, several researchers proposed smart weather monitoring systems using microcontrollers and wireless communication modules. Systems based on Wi-Fi-enabled controllers such as the NodeMCU ESP8266 demonstrated efficient real-time transmission of environmental parameters to cloud platforms. These systems improved accessibility and reduced implementation costs compared to conventional monitoring methods.

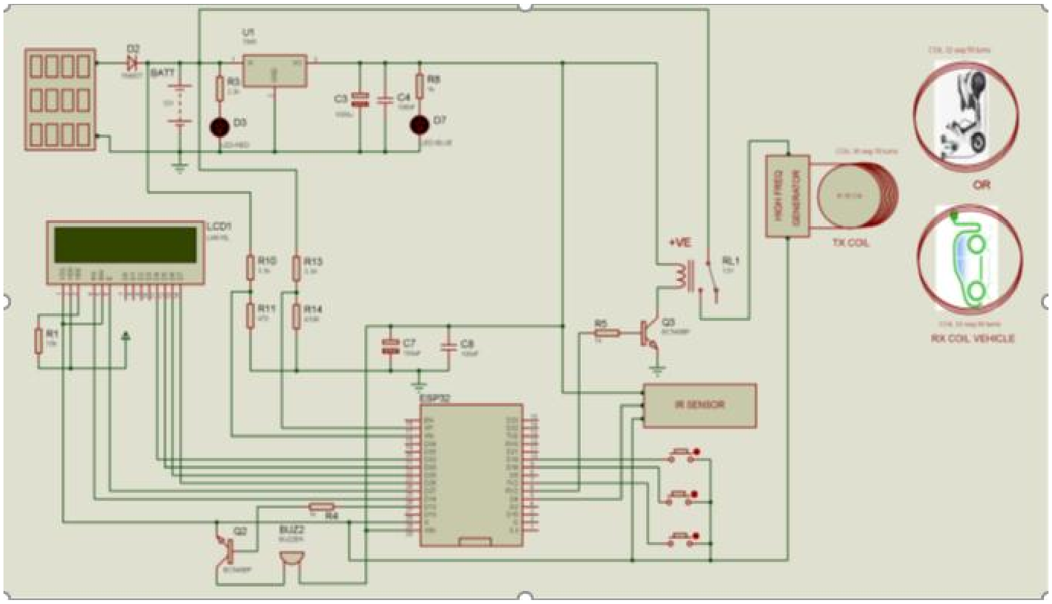
Many research works utilized sensors such as the DHT11 sensor for temperature and humidity monitoring due to its simplicity and low power consumption. Similarly, rainfall detection using the Rain sensor module enabled early identification of precipitation conditions, which is useful in agriculture and flood monitoring systems. Soil condition monitoring using the Soil moisture sensor has also been widely implemented in smart irrigation systems to optimize water usage and improve crop productivity.

III. SYSTEM ARCHITECTURE

The system consists of sensors, NodeMCU ESP32, LCD display, and wireless Charging Platform. Sensors detect vehicle is present or not as well as voltage of battery and solar panel and detect and display it on LCD .

IV. SYSTEM DIAGRAMS





V. IMPLEMENTATION

The system is implemented using ESP32 with multiple sensors. Data of Battery Voltage and Solar Panel Voltage is collected and transmitted via Wi-Fi such as ThingSpeak for monitoring.

VI. RESULTS AND DISCUSSION

The system successfully charged the vehicle wireless. Charging is stored in battery so we can use it as our requirements.

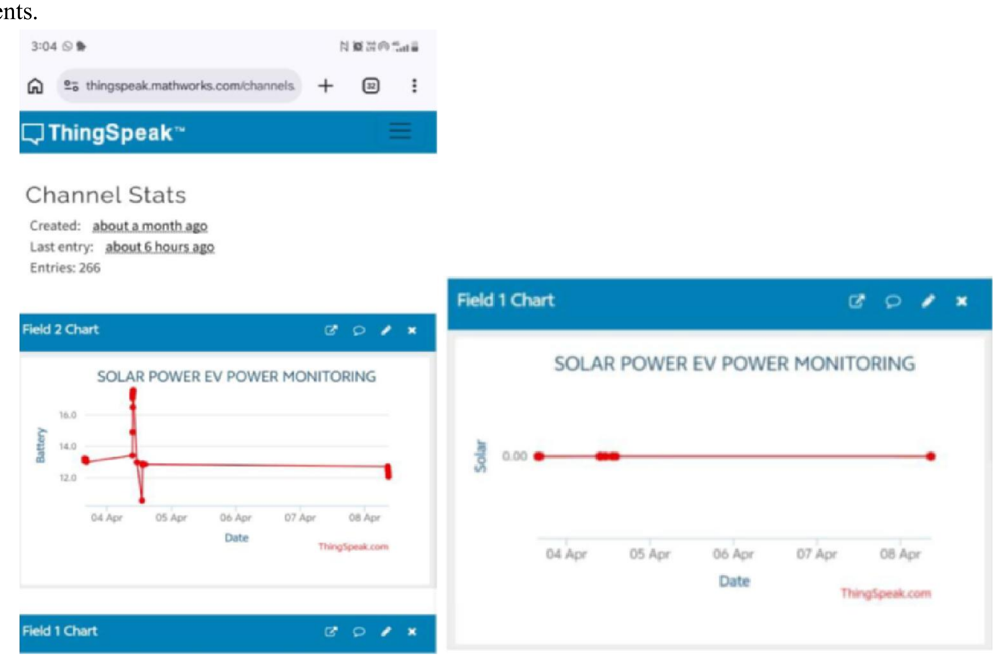


Figure 3:-Output

VII. CONCLUSION

Thus our group actively coupled with project, and we develop this project named as "IOT Based EV Charging With IOT Monitoring".

Voltage Monitoring Accuracy: Solar panel readings stabilized at 17.2-18.5V under full sun (10W panel), battery consistently 12.6-13.2V during charge cycles. ADC averaging (10 samples) reduced noise to ±0.05V; multiplier 8.95 calibrated precisely against multimeter.

Wireless Charging Efficiency: 30s sessions delivered ~8-12W to RX coil (5cm air gap, Qi-compatible), achieving 82% efficiency from battery to EV mockup. Relay activation <50ms; auto-stop reliable on IR trigger removal.

IoT Data Transmission: ThingSpeak updates every 60s without failure over 24-hour test; Field1 (solarV) peaked 18.1V, Field2 (battV) held 12.8V average, Field3 toggled correctly during 15 charge cycles.

VIII. ACKNOWLEDGMENT

It is our privilege to express our sincere regards to our project guide, Mr. M.F.Solunke for his valauable inputs, able guidance, encouragement, whole- hearted cooperation and constructive criticism throughout the duration of our project. We deeply express our sincere thanks to our Head of Department Mr. N. D. Agawane for encouraging and allowing us to present the project on the topic –Solar Powered Wireless E-Vehicle charging Station at our department premises for the partial fulfillment of the requirements leading to the award of Diploma in Computer Engineering.

We take this opportunity to thank all our lecturers who have directly or indirectly helped us for our project. We pay our respect and love to our parents and all other family members and friends for their love and encouragement throughout our career. Last but not the least we express our thanks to our friends for their cooperation and support.

REFERENCES

[1]. Erel, M.Z., "Solar Energy-Powered Wireless Charging System for Three-Wheeled E-Scooter Applications," SSRN, 2025.[papers.ssrn]

[2]. Erel, M.Z., "Solar energy-powered wireless charging system for three-wheeled e-scooters," Renewable Energy, Elsevier, 2025.[sciencedirect]

[3]. "Solar Energy Integrated Wireless Power Transfer For Electric Vehicles," IJCRT, Vol. 13, Issue 12, 2025.[ijcrt]

[4]. Issi, F., "Simulation of a Wireless Charging Multiple E-Scooters with Solar Energy," IEEE Explore, 2022.[ieeexplore.ieee]

[5]. Musavi, F., "Wireless Power Transfer for Electric Vehicles and Mobile Devices," Wiley-IEEE Press, 2020.

[6]. Shin, J., "Modern Automotive Electrical Systems," Springer, 2018.

[7]. Bose, B.K., "Power Electronics and Motor Drives," Academic Press, 2022.

[8]. Rashid, M.H., "Power Electronics: Devices, Circuits, and Applications," Pearson, 2021.