SMART BIHAR HACKATHON 2023

PROJECT NAME:-

Smart Monitoring System for Wireless Charging of Evs

TEAM :- ROYAL CODER'S BANKA #RCB

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PROBLEM STATEMENT:-

- ELECTRICITY RESOURCES RELATED PROBLEM

SOLUTION:-

1.Efficient Energy Management: The smart monitoring system analyzes the demand for charging across multiple charging stations and balances the load distribution. It adjusts charging rates based on grid capacity and electricity pricing, ensuring efficient utilization of available energy resources and preventing grid overload.

2.Grid Integration: By integrating with the electrical grid, the system can monitor grid conditions and dynamically adjust charging rates. It can take advantage of periods of low electricity demand or renewable energy availability to prioritize charging, reducing strain on the grid during peak hours and utilizing renewable energy sources effectively.

SOLUTION

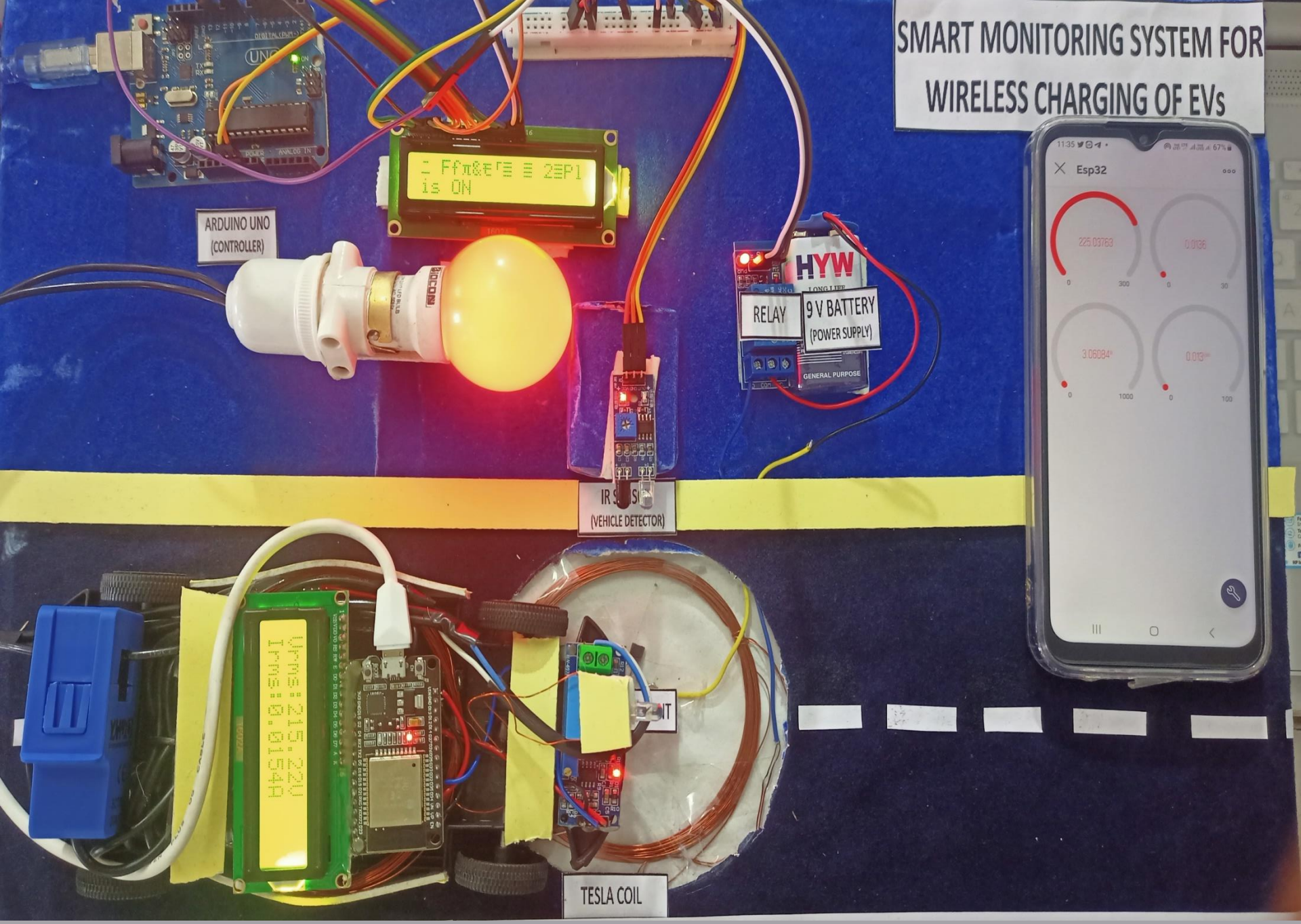
3. **Real-time Monitoring and Control:** The system continuously monitors the charging process, collecting real-time data on charging rates, energy consumption, and infrastructure performance. This information allows for immediate responses and adjustments to optimize energy usage and address any issues that may arise.

4**. Demand Response Capability:** The smart monitoring system can participate in demand response programs, where it responds to signals from the grid operator to temporarily reduce or shift charging loads during times of high electricity demand. This helps to stabilize the grid and alleviate strain on electricity resources.

5. Data-driven Decision-making: By analyzing historical charging data and usage patterns, the system provides valuable insights for operators and policymakers. These insights can inform decision-making processes related to infrastructure planning, capacity expansions, and energy resource management, ensuring the long-term sustainability of the electricity resources.

INTRODUCTION

- The smart monitoring system for wireless charging systems of Electric Vehicles (EVs) utilizes three key components: ESP-WROOM-32, Blynk app, and Wi-Fi.
- ESP-WROOM-32: The ESP-WROOM-32 is a popular Wi-Fi module that acts as the central control unit in the monitoring system. It enables wireless communication and connectivity with the charging pad, data acquisition unit, and user interface. The ESP-WROOM-32 collects, processes, and analyzes charging data, controls the charging process, and facilitates data transmission to the Blynk app.
- Blynk App: The Blynk app serves as the user interface for the smart monitoring system. It provides a user-friendly platform to view real-time charging information, receive notifications and alerts, and interact with the system. The Blynk app enables remote monitoring and control of the wireless charging process, enhancing user convenience and control.



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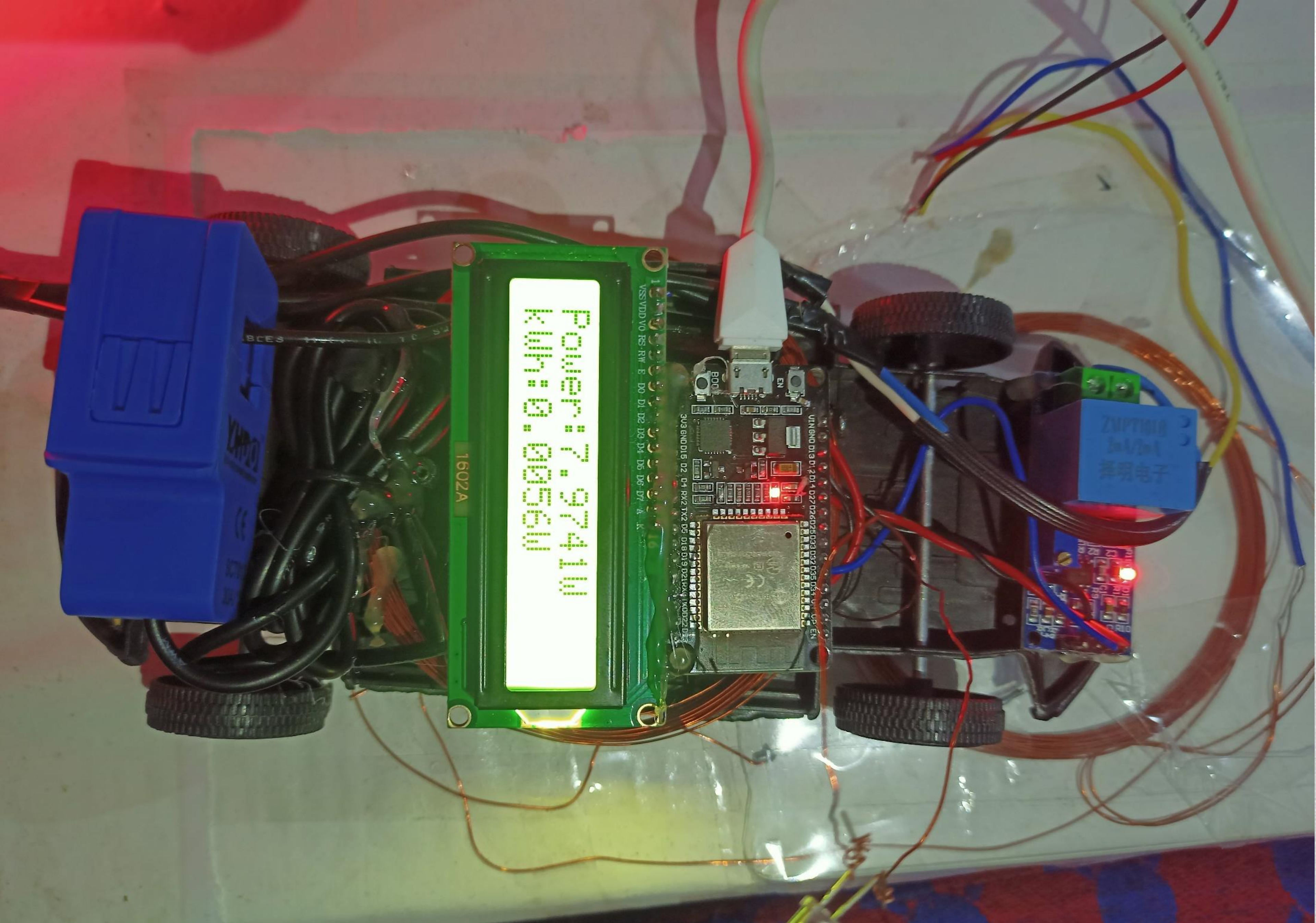

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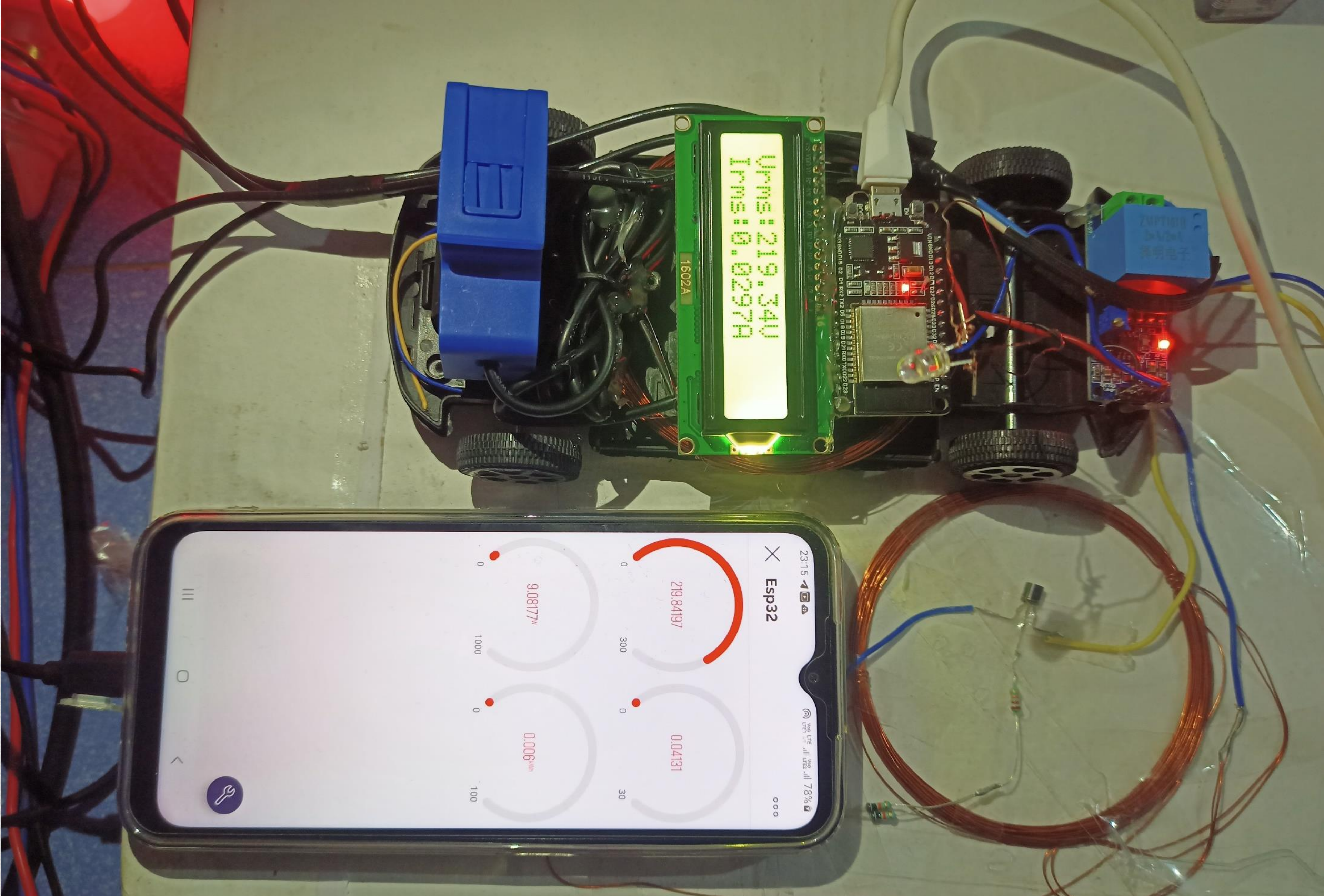

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INTRODUCTION

- **Wi-Fi: Wi-Fi connectivity is a crucial element in the smart monitoring system. It enables seamless communication between the ESP-WROOM-32, Blynk app, and other components of the system. Wi-Fi connectivity allows for real-time data transmission, remote monitoring, and seamless integration with other smart devices or systems.**
- **These components work together to create an efficient and user-friendly smart monitoring system for wireless charging systems, optimizing the charging process and enhancing the overall EV charging experience.**

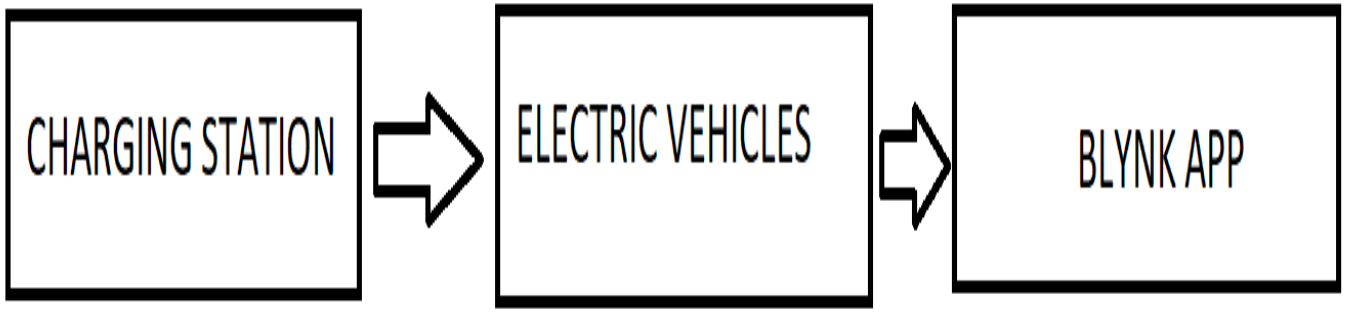
INTRODUCTION

- **The objective of the project is to create a Battery Management System (BMS) that offers valuable charging time and other relevant information to the electric vehicle driver. The BMS will utilize the ESP-WROOM-32, Blynk app, and Wi-Fi connectivity to monitor and optimize the charging process. By integrating the BMS with the wireless charging system, the driver will have access to real-time data such as charging status, battery level, and estimated charging time. This information empowers the driver to make informed decisions, plan their charging schedules, and ensure efficient utilization of the charging infrastructure. Ultimately, the objective is to enhance the user experience and facilitate convenient and optimized charging for electric vehicles.**

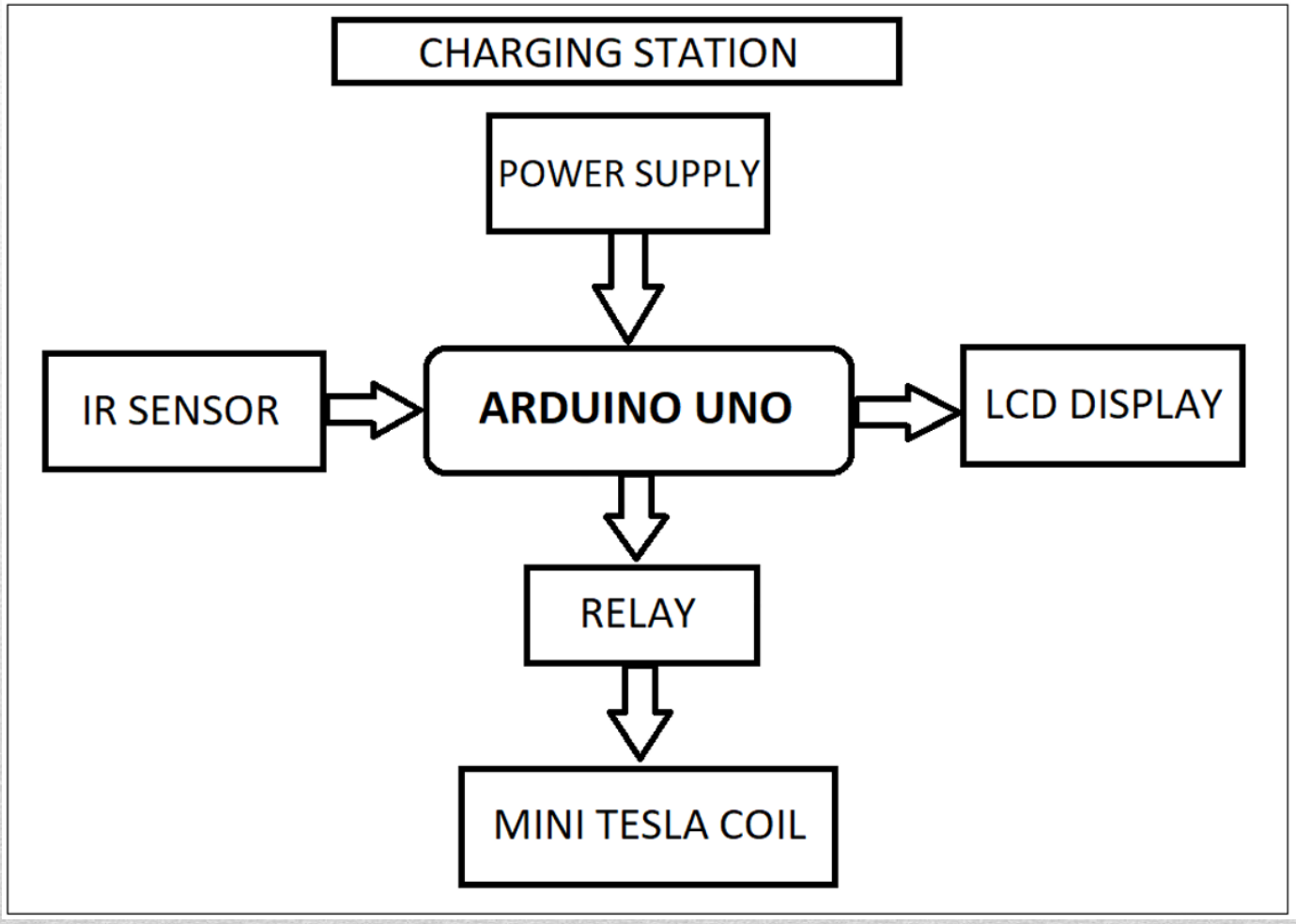
INTRODUCTION

- A Battery Management System (BMS) is of utmost importance in electric vehicles (EVs) due to several key reasons. Firstly, the BMS ensures the safe and efficient operation of the vehicle's battery pack by monitoring critical parameters such as voltage, current, temperature, and state of charge. This helps prevent overcharging, over-discharging, and excessive temperature, which can lead to battery damage or safety hazards. Secondly, the BMS optimizes the battery's performance and extends its lifespan by balancing the individual cell voltages and managing charge and discharge cycles. Lastly, the BMS provides crucial information to the driver, such as remaining range, battery health, and charging status, enabling better range planning and overall vehicle management.

BLOCK DIAGRAM



BLOCK DIAGRAM



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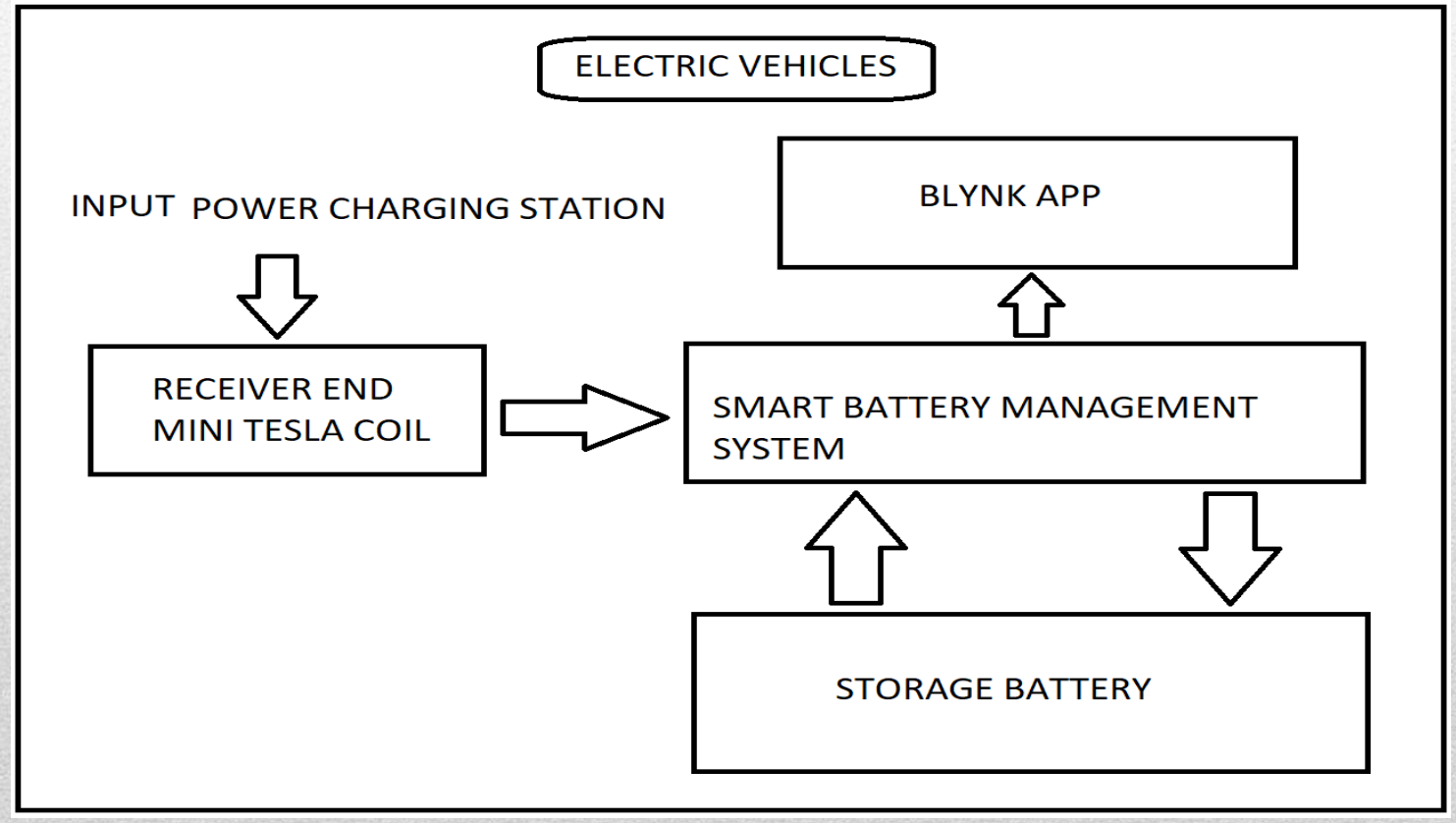
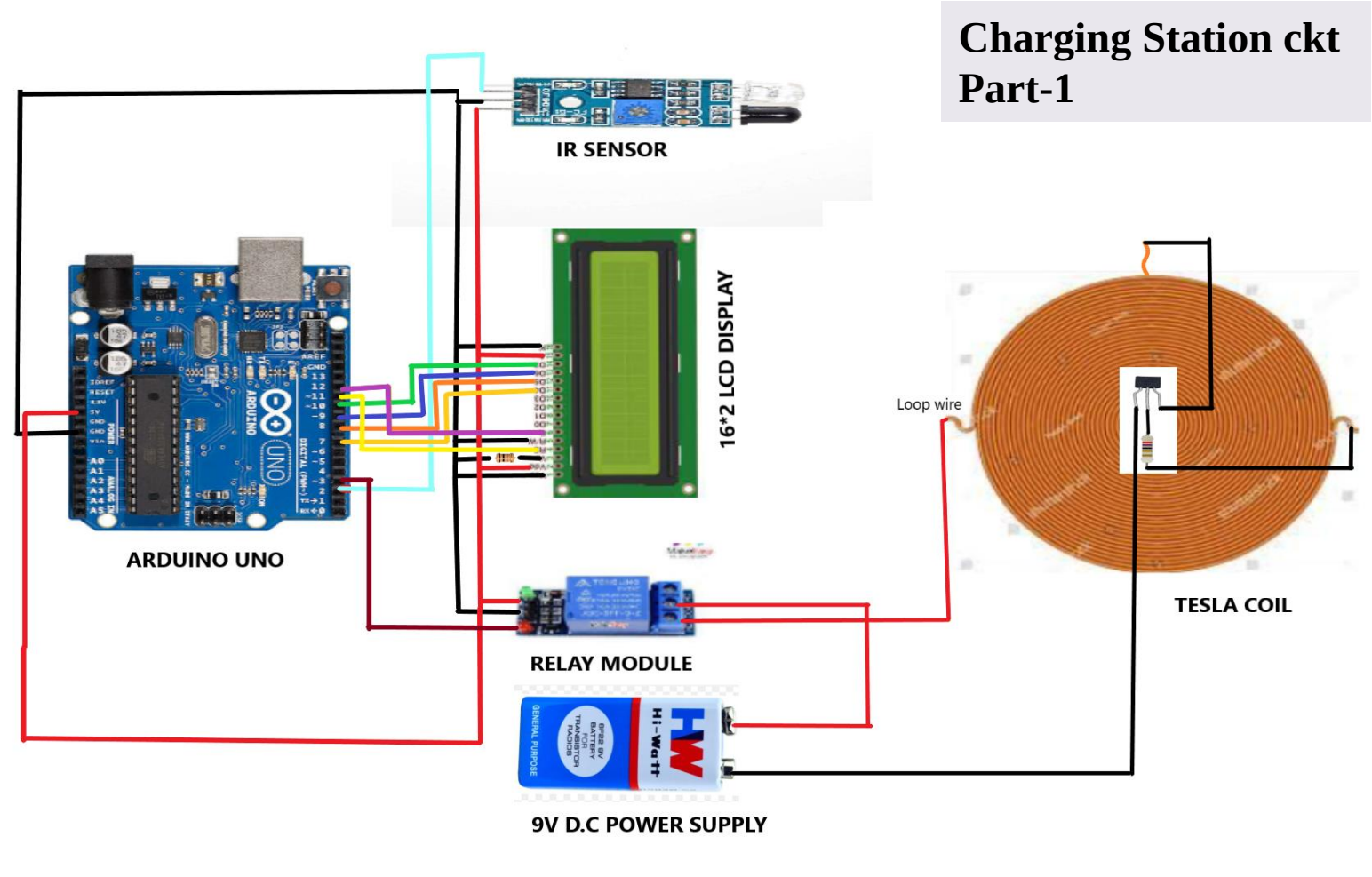
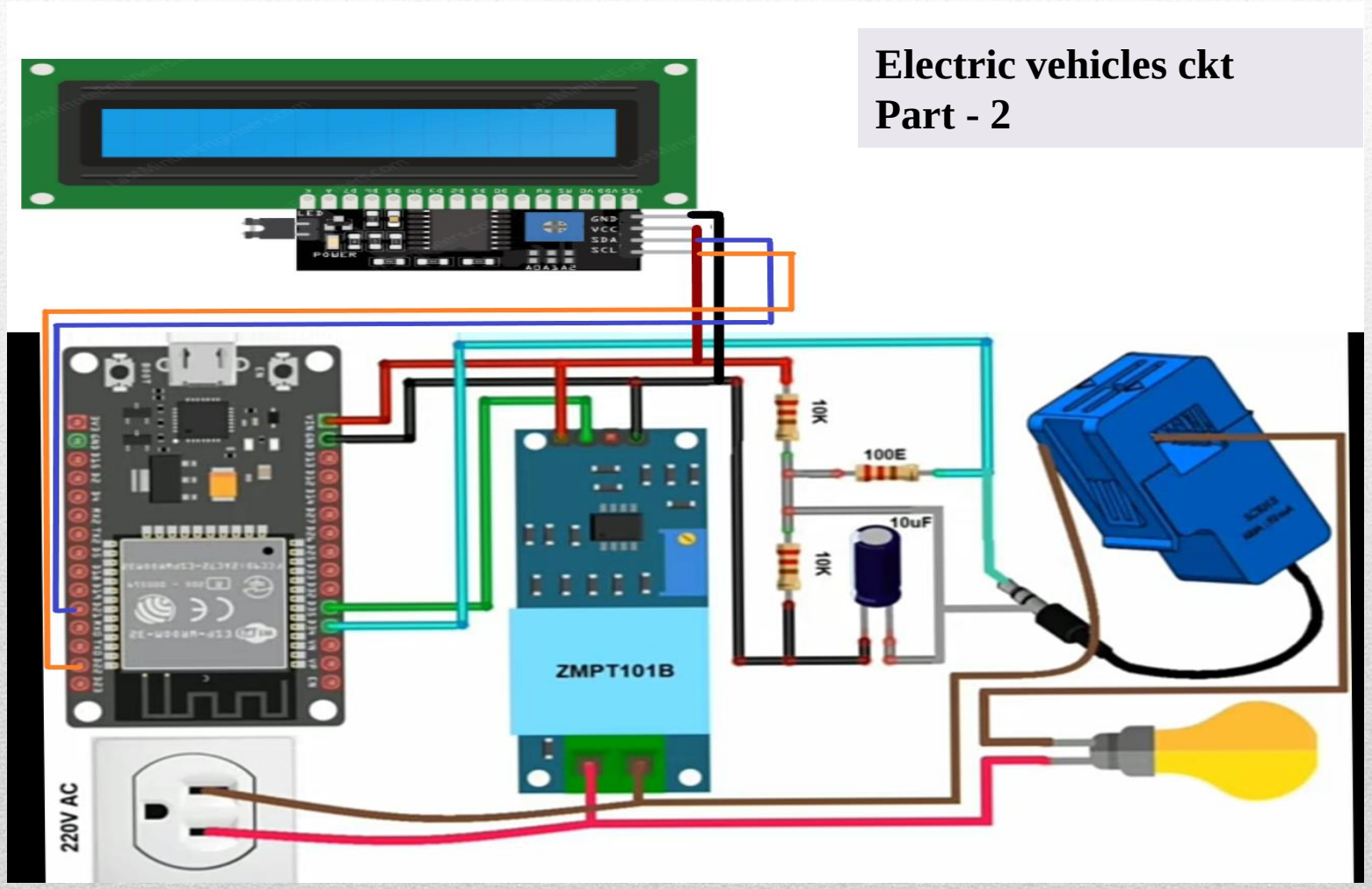


CIRCUIT DIAGRAM



CIRCUIT DIAGRAM

Electric vehicles ckt
Part - 2



Installation

Step 1: Components Required To build this project, you will need the following components:

a) **ESP-WROOM-32 development board (e.g., devkit module)**

b) **Blynk app installed on your smartphone**

c) **Wi-Fi router / Mobile hotspot**

d) **Relay module**

e) **Voltage sensor module**

f) **Current sensor module**

g) **Jumper wires**

h) **Breadboard (optional)**

i) **Arduino IDE software**

j) **Mini Tesla Coil**

k) **Basic kit (e.g., Transistor, resistor, Capacitor & led)**

l) **Power Source AC**

m) **Mobile Charger 5v**

n) **Chassis**

Installation

Step 2: Setting Up Arduino IDE Download and install the Arduino IDE software on your computer if you haven't already. Connect the ESP-WROOM-32 board to your computer via USB and make sure the necessary drivers are installed.

Step 3: Installing Required Libraries Launch the Arduino IDE and go to "Sketch" -> "Include Library" -> "Manage Libraries." Search for and install the following libraries:

a) **BlynkSimpleEsp32.h**

b) **EmonLib.h**

c) **Wifi.h**

d) **Wire.h**

e) **WifiClient.h**

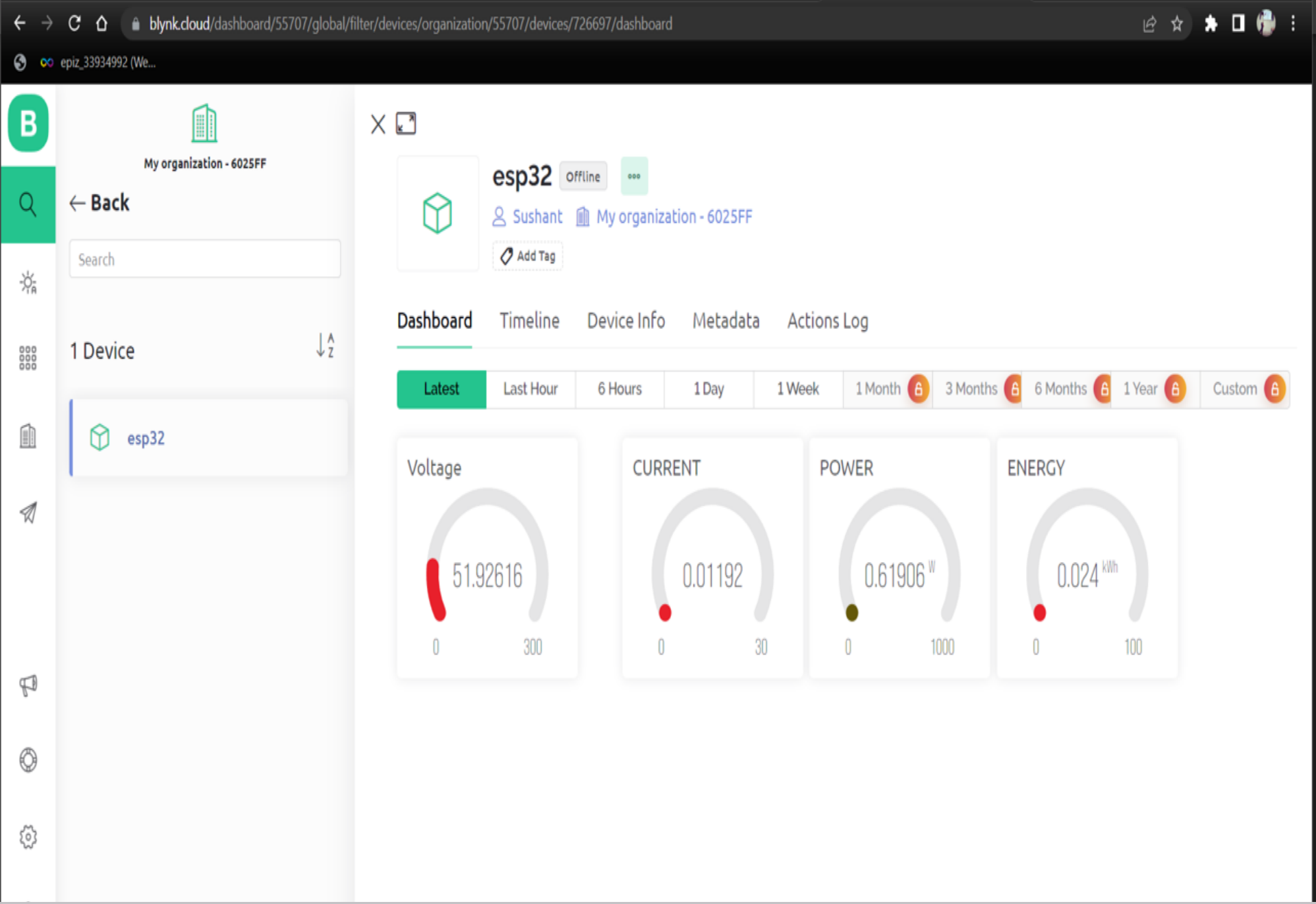
f) **LiquidCrystal_I2C.h**

Step 4: Blynk App Setup

a) **Download and install the Blynk app from the App Store or Google Play Store.**

b) **Create a new Blynk account and log in.**

c) **Create a new project in Blynk and note down the generated Auth Token.**



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Installation

Step 5: Circuit Connections

1. Connect the ESP-WROOM-32 board to your computer via USB.

2. Connect the VCC and GND pins of the BMS module to the 3.3V and GND pins of the ESP-WROOM-32 board, respectively.

3. Connect the TX and RX pins of the BMS module to the RX and TX pins of the ESP-WROOM-32 board, respectively.

4. Connect the SDA and SCL pins of the voltage and current sensor modules to the respective SDA and SCL pins of the ESP-WROOM-32 board.

5. Connect the IN1 pin of the relay module to a digital pin (e.g., D1) of the ESP-WROOM-32 board.

6. Connect the VCC and GND pins of the relay module to the 3.3V and GND pins of the ESP-WROOM-32 board, respectively.

7. Connect the NO (normally open) pin of the relay module to the charging circuit of the electric vehicle.

Installation

Step 6: Arduino Code Copy the following code and paste it into the Arduino IDE.

Replace the placeholders "<WIFI_SSID>", "<WIFI_PASSWORD>", and "<BLYNK_AUTH_TOKEN>" with your Wi-Fi network credentials and Blynk Auth Token, respectively.

Step 7: Uploading the Code

1. **Select the correct board and port from the "Tools" menu in the Arduino IDE.**
2. **Click the "Upload" button to upload the code to the ESP-WROOM-32 board.**

Step 8: Blynk App Configuration

1. **Open the Blynk app on your smartphone.**
2. **Add two Value Display widgets (V0 and V1) to the project screen.**
3. **Edit each widget and set the input format to "Voltage" for V0 and "Current" for V1.**

Installation

Step 9: Testing the System

1. **Power up the BMS module and the ESP-WROOM-32 board.**
2. **Open the Blynk app and ensure it is connected to the Wi-Fi network.**
3. **You should now see the voltage and current readings on the Blynk app.**
4. **When the voltage exceeds the threshold set in the code, the relay will turn on, indicating that charging is in progress.**

Conclusion

1. **Real-time Data Collection:** The system collects real-time data from charging stations, sensors, and energy meters within the wireless charging infrastructure.
2. **Data Transmission and Communication:** Collected data is securely transmitted to a centralized server or cloud-based platform using reliable communication protocols.
3. **Data Analysis and Monitoring:** The system analyzes the collected data to monitor charging station availability, track charging session status, monitor energy consumption, and detect any anomalies or faults in the system.
4. **User Interface and Mobile/Web Applications:** A user-friendly interface, such as mobile apps or web portals, allows EV owners to access real-time charging information, including status, estimated completion time, and notifications.
5. **Energy Management and Optimization:** The system optimizes energy consumption and load balancing across charging stations by analyzing charging demands, grid capacity, and electricity pricing. It adjusts charging rates and distributes the load to prevent grid overload and maximize energy resource utilization.
6. **Predictive Maintenance:** Continuous monitoring and analysis enable the system to identify potential faults or performance degradation. It generates maintenance alerts and schedules proactive repairs or replacements to minimize downtime and ensure charging station reliability.
7. **Security and Authentication:** Robust security measures, such as user authentication and encrypted communication protocols, safeguard against unauthorized access and ensure the safety of the charging process and data privacy.
8. **Reporting and Insights:** The system generates comprehensive reports and insights based on the collected data. These reports help operators make data-driven decisions, optimize charging operations, and plan for future expansions.

Future Enhancements

1. **Dynamic Power Routing:** Implementing dynamic power routing capabilities would enable the system to optimize the wireless power transfer between the charging station and the EV in real-time. This would involve adjusting the power transfer parameters based on factors such as battery state of charge, charging speed preferences, and grid conditions. It would result in more efficient and customized charging sessions.
2. **Vehicle-to-Grid Integration:** Expanding the monitoring system to include vehicle-to-grid (V2G) integration would allow EVs to not only receive power but also feed power back into the grid during peak demand periods. The system would monitor the energy flow in both directions, enabling EVs to serve as distributed energy resources and provide grid stability and support.
3. **Artificial Intelligence and Machine Learning:** Integrating artificial intelligence and machine learning algorithms into the monitoring system can enable it to learn from historical data and make intelligent predictions and optimizations. This could involve predicting charging demand, analyzing charging patterns, and recommending optimal charging strategies based on individual EV owner preferences and usage behaviors.

Future Enhancements

4. **Swarm Charging Optimization:** Swarm charging refers to a concept where multiple EVs in close proximity coordinate their charging schedules to maximize charging efficiency and grid utilization. The monitoring system can facilitate swarm charging by intelligently grouping nearby EVs and synchronizing their charging sessions. This reduces the peak demand on the grid and improves overall charging efficiency.

5. Advanced Cybersecurity Measures: As wireless charging systems become more prevalent, ensuring robust cybersecurity measures becomes increasingly important. Future enhancements would involve incorporating advanced encryption techniques, intrusion detection systems, and anomaly detection algorithms to protect against cyber threats and ensure the integrity and privacy of data.

6. Integration with Smart Grid Infrastructure: Integrating the monitoring system with smart grid infrastructure would enable seamless communication and coordination between charging stations, EVs, and the grid. This integration would allow for real-time demand response, load forecasting, and grid optimization to achieve a more balanced and sustainable energy ecosystem.

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