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IoT Based Data Logging System for Solar EV

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Abstract: The growing use of electric vehicle faces challenges in monitoring energy usage, battery health, and solar efficiency. Without proper tracking it becomes difficult to identify performance issues or energy losses. The integration of renewable energy and smart technologies has led to the development of efficient monitoring systems for sustainable transportation. This research presents an IoT-Based Data Logging System for Solar Electric Vehicles (EVs) that enables real-time monitoring and analysis of various parameters such as solar panel voltage, current, temperature, and battery performance. The system employs a microcontroller interfaced with Voltage sensors, Temperature Sensor, Hall Effect Sensor and an IoT module to collect, process, and transmit data to a cloud server. Users can remotely access the logged data through a web or mobile interface for performance evaluation and system diagnostics. Experimental results show that the proposed system provides accurate and reliable data acquisition, allowing for effective energy management, predictive maintenance, and optimization of solar EV performance. The IoT is integrated with solar EVs for cloud-based data storage, continuous performance tracking, and automatic alerts for issues like low battery or overheating. This low-cost and efficient system enhances the reliability, safety, and performance of solar electric vehicle through intelligent data management. environments.
Keywords: IoT, Data Logging, Electric Vehicle (EV), Cloud Computing, Real-Time Data, Energy Management, Sensor Network

INTRODUCTION

The demand for electric vehicles (EVs) has significantly increased due to their ability to reduce pollution and dependence on fossil fuels. However, monitoring the performance and efficiency of these vehicles, especially solar powered EVs, remain a major challenge. Parameters such as battery voltage current, temperature, and solar panel output must be constantly tracked to ensure optimal operation. Traditional monitoring methods are often manual and inefficient. To overcome these limitations, the integration of the internet of things (IoT) provides an effective solution for real- time data acquisition, storage, and analysis. This project aims to develop an IoT- based data logging system that enables continuous monitoring of key parameter in solar EVs, allowing users to analyze performance, detect faults early, and improve the overall efficiency and reliability of the system

EXISTING SYSTEM

The existing IoT-based data logging system for a solar electric vehicle (EV) is designed to monitor, record, and transmit real-time data from various subsystems of the vehicle. Such a system plays a critical role in ensuring the safe operation, efficiency, and performance optimization of a solar EV. By integrating IoT technology, the vehicle's energy production, consumption, and environmental interactions can be tracked remotely, enabling proactive maintenance, performance analysis, and energy management. The block diagram of the system is composed of several interconnected modules: Solar Panel Module, Battery and Power Management Module, Motor Drive Module, Sensor Interface Module, Microcontroller and IoT Module, Communication Module, Data Logging Module, and Cloud Platform Interface.

PROBLEM IDENTIFICATION

Solar-powered electric vehicles are eco-friendly but lack an efficient system to monitor and record real-time data such as battery performance, solar energy utilization, and system efficiency. Without proper data logging and analysis, it becomes difficult to detect faults, manage energy, and improve overall vehicle performance.

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Hence, there is a need for a smart IoT-based solution that can continuously monitor, store, and analyze key parameters to ensure better efficiency and reliability of solar EVs.

PROPOSED SYSTEM

The proposed system is designed to monitor, log, and visualize the critical parameters of a Solar Electric Vehicle (EV), including battery voltage, motor current, temperature, and overall system performance. Fig 3.1 proposed system shows the architecture integrates solar energy generation, battery storage, sensors, a microcontroller, an IoT platform, and a motor/load system to achieve real-time monitoring and remote accessibility At the first stage, the solar panel serves as the primary energy source. The solar panel converts sunlight into electrical energy, which is used to charge the vehicle's battery. This battery acts as an energy storage unit, supplying regulated DC power to the vehicle's motor and the connected electronic components. 10 By incorporating a solar panel, the system ensures sustainable and renewable energy usage, reducing dependency on external electricity sources and enabling eco-friendly transportation.

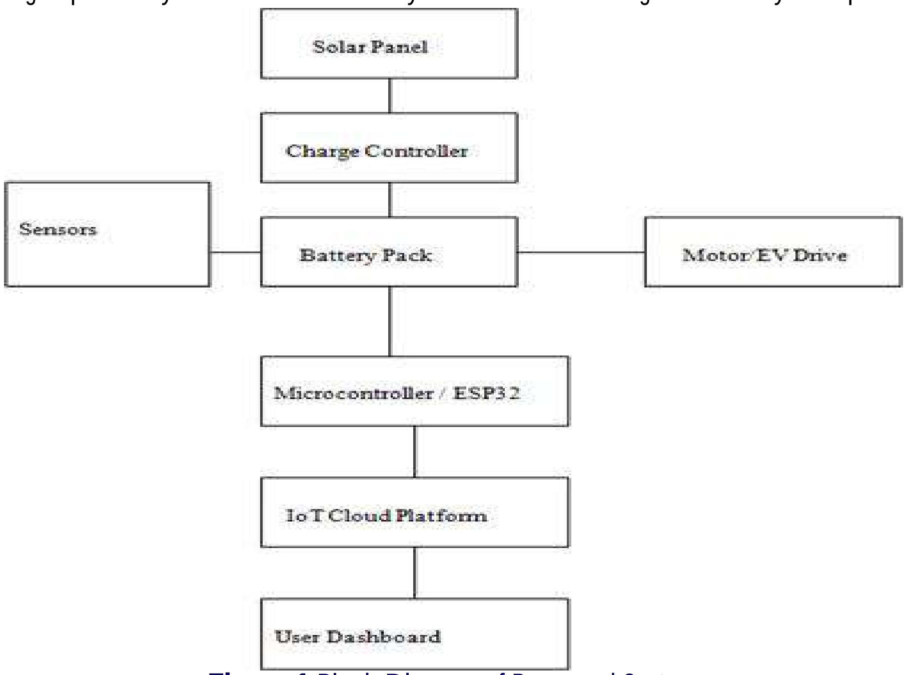

Figure.1 Block Diagram of Proposed System

Next, the sensors play a crucial role in collecting real-time operational data. The voltage sensor monitors the battery voltage to prevent overcharging or deep discharge, ensuring the longevity of the battery. The current sensor, typically an ACS712 Hall-effect sensor, measures the current drawn by the motor, enabling load analysis and system safety monitoring. The temperature sensor (such as LM35 or DHT11) continuously checks the motor or battery temperature to prevent overheating and ensure optimal operating conditions. These sensors are interfaced with the ESP32 microcontroller, which acts as the central processing unit of the system. The ESP32 microcontroller is selected due to its built-in Wi-Fi and Bluetooth capabilities, allowing seamless integration with IoT platforms. It reads data from the sensors, performs signal conditioning if necessary, and processes the raw data into meaningful values. Additionally, the ESP32 displays real-time parameters on a local LCD display, providing immediate feedback for on-site monitoring. The microcontroller then transmits the processed data to an IoT platform, such as Thing Speak or Blynk, using its WiFi module. This enables remote monitoring, data logging, and visualization through mobile or web applications. The IoT platform receives the data and provides graphical representations, analytics, and historical logs. Fig 3.2 Iot Based Logging System For EV Shows users can monitor battery health, motor performance, and environmental conditions remotely, allowing for timely maintenance and efficient energy management. Finally, the motor/load system utilizes the stored battery energy to drive the vehicle. The sensors continuously monitor the electrical and thermal parameters during operation to ensure safe and efficient functioning.

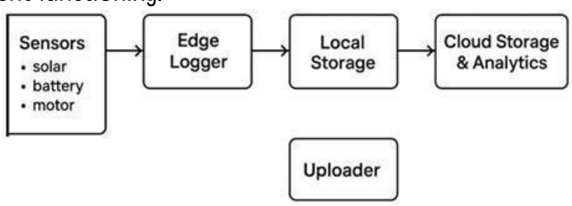

Figure 2- Block diagram for proposed system

SIMULATION AND RESULT

In the simulation environment, software tools like Proteus or Tinker cad are used to simulate the electronic circuitry involving the ESP32, sensors, and LCD display, ensuring accurate hardware-level validation. MATLAB/Simulink models the MPPT control algorithm, battery charging dynamics, and energy flow within the solar EV setup, while Allspice analyzes the performance of the power converter and charge controller.

These combined simulations help verify the efficiency of power generation, charging stability, and reliability of IoT-based data logging. Overall, the simulation validates the system's capability to achieve efficient energy management, continuous performance tracking, and smart data communication essential for the advancement of solar-powered electric vehicle validates the proposed system as a reliable, low-latency, and efficient solution suitable for real-world sports score monitoring applications.

SIMULINK

IoT-Based Data Logging System for Solar EV represents the integration of renewable energy generation, data monitoring, and IoT- based analysis in a single system. in the solar panel serves as the primary energy source, converting sunlight into DC power.

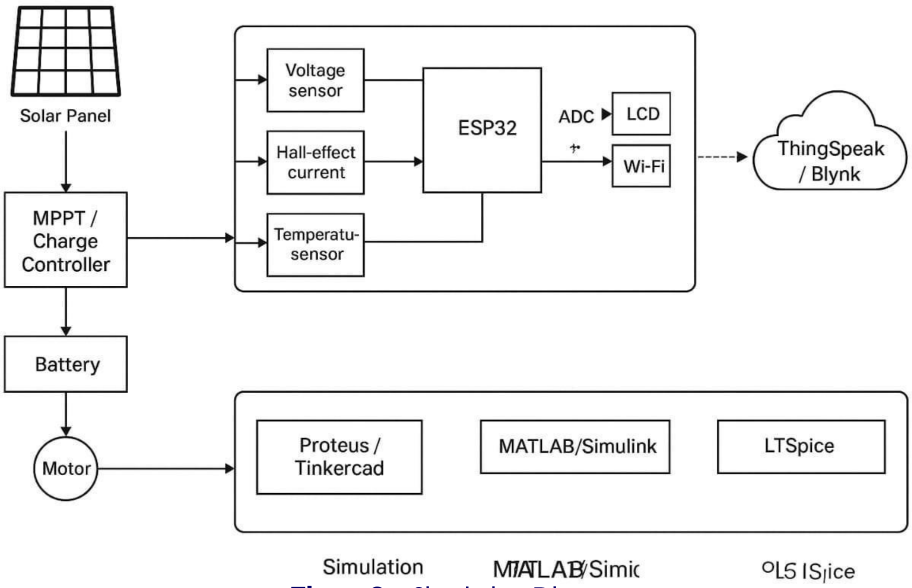

Figure3 – Simulation Diagram

The Simulation Diagram Showed this energy is fed to the MPPT (Maximum Power Point Tracking) or charge controller, which ensures optimal power extraction from the solar panel and regulates the voltage. The battery stores the generated energy and supplies it to the electric motor that powers the vehicle. Various sensors, including voltage, Hall-effect current, and temperature sensors, are used to monitor the system's performance in real time. These sensors send analog signals to the ESP32 microcontroller, which processes the data through its ADC interface. The ESP32 displays the measured values on an LCD screen for local observation and simultaneously uploads the data to cloud platforms like Thing Speak or Blynk using its inbuilt Wi-Fi connectivity. power management, and smart monitoring through IoT technology. In this setup, the solar panel acts as the main source of energy by converting sunlight into DC power. This power is optimized through an MPPT (Maximum Power Point Tracking) or charge controller, which ensures efficient utilization of solar energy and maintains a stable supply to the battery**.** The stored energy in the battery is used to drive the electric motor, which powers the vehicle.

RESULT

The simulation of the proposed DC-DC converter-based EV charging system was successfully performed using appropriate sensors and control components. The results obtained from the simulation confirm the proper functioning and coordination of each module in the system. The solar panel voltage was monitored using the INA219 voltage sensor, which recorded an average simulated value of 18.7 V within the typical range of 0–24 V DC. This indicates a stable charging voltage supplied to the system. The battery charging current, measured through the ACS7 Hall-effect current sensor, showed an average value of 2.1 A, which confirms effective charging performance under normal operating conditions. ic vehicle 33°C,which lies within the safe operating range (25–60) C). This demonstrates that the charging process occurs without overheating or thermal stress on the battery.

Parameter	Sensor Used	Typical Range	Output(Simulated)	Description
Solar Panel Voltage	Voltage Sensor (INA219)	0-24V DC	18.7 V (average)	Indicates charging voltage
Battery Current Hall- Effect	Current Sensor (ACS7)	0-5 A	2.1 A (average)	Shows current during charging
Battery Temperature	Temperature Sensor(LM35)	25-60°C 33°C	(normal condition)	Reflects stable operation
Moter Load Current	ACS712	0-5 A	1.8 A	Load current varied motor speed
Cloud Date Update	(ESP32)Think Speak	-	Successful	Data transmitted and displayed on IOT dashboard

The motor load current, sensed by the ACS712 sensor, was measured as 1.8 A, reflecting proper load management and variation in motor speed during operation. This ensures efficient energy conversion from the solar source to the motor load. Finally, data acquisition and cloud connectivity were validated through the ESP32 module integrated with the Think Speak IoT platform. The data transmission and display were successfully achieved, enabling real-time monitoring of system parameters through the IoT dashboard. Overall, the simulation results demonstrate that the designed system performs efficiently with stable voltage, current, and temperature readings. The communication between sensors and the IoT platform was reliable.

CONCLUSION

The IoT-Based Data Logging System for Solar Electric Vehicle (EV) has been successfully designed and simulated, proving the effective integration of renewable energy with IoT technology. The system monitors key parameters such as battery voltage, motor current, temperature, and power consumption in real time through an LCD display and cloud platforms like Thing Speak/Blynk. Using the ESP32 microcontroller, accurate sensor data acquisition, display, and IoT data transmission were achieved. Simulation results showed stable and reliable monitoring under varying conditions. The system enhances efficiency, safety, and performance by preventing overcharging, overheating, and overcurrent. Overall, the project demonstrates that IoT integration improves smart vehicle monitoring, energy management, and predictive maintenance. The system is efficient, scalable, and suitable for real-world solar EV applications, contributing to sustainable and intelligent transportation.

REFERENCES

1. D.T.T. Loan, D.Q.Trung and M.H.Thuan, “Research and design an electric car charging station using solar energy integrating an IoT technology monitoring system,”J. Military Sci. Technol., vol. 96, pp. 107-115, 2024.
2. V.Radha Krishna, K.Vijaya, M.Hrishithi, V. Richa Sanjitha and P. Varshitha, “Smart Solar-Powered Battery System for EV for IoT Voltage Monitoring,” Int. J. Res. Appl. Sci. Eng. Technol. (IJRASET), vol. 11, issue X, 2023.
3. P.P.Narwade and V.V.Kulkarni, “Smart Solar Charge- An IoT Based EV Monitoring System,” IJRASET, vol. 13, issue IX, Sept. 2025. [4]. S. Badgire, G. Suryawanshi, R. Jadhav, V. Tathe and B. G. Sherkhane, “IoT Based Smart Electric Vehicle,” IJRASET, 2025.
4. M.H.Marulasiddappa, O.Divyashree, T.R.Jhansi and S.Radha, “IoT-Based Solar Power Monitoring,” Int. J. Eng. Res. Tech. (IJERT), vol. 11, issue 05, 2023.
5. J.Lianda, A.Hadi, A.Adam, H.Amri and G.Eviani, “IoT Based Battery Capacity Monitoring System on Solar Panels in Electric Vehicle,” in Proc. Int. Conf. Applied Science & Technology on Eng. Science (iCAST-ES 2023), 2024.
6. M.U.Akhtar and M.T.Iqbal, “Development and Evaluation of an Arduino-Based Data Logging System Integrated with Microsoft Excel for Monitoring On-Grid Photovoltaic Systems,” Eur. J. Electr. Eng. Comput. Sci., vol. 8, no. 3, 2024.
7. T.Naikwade, R.Gawade, A.Mane, R.Bandal and S. V. Patil, “IoT Based Smart Solar Energy Monitoring System with Wiping Mechanism,” IJERT, vol. 11, issue 04, April 2022.
8. A.Abinash,K.Yogesh Dinagar, “IoT Based Solar Energy Monitoring and Smart Metering,” IJERT, vol. 12, issue 02, Feb. 2023. [10].V. Hardas, S. Ingole, S. Sheikh and S. Kale, “Solar Panel Monitoring System Using IoT,” IJRASET, 2022. 36
9. J.Gawai, A.Jichkar, S.Kurzekar and G. Wadekar, “IoT-Based Smart Solar Energy Monitoring System,” Int. J. Electr., Electronics & Comp. Sys. (IJEECs), vol. 14, no. 1, 2025.
10. R.Delfianti, V.A.Tazayul, B.Mustaqim, F.Nusyura and C. Harsito, “Internet of Things (IoT) Based Electrical Power Monitoring System for Solar Power Plants Using Telegram Application,” Vokasi Unesa Bull. Eng. Technol. Appl. Sci., vol. 2, no. 3, pp. 428-443, Aug. 2025.
11. S.Gautam, “IoT Based Real Time Monitoring of Solar Power Plant,” J. Adv. Res. in Signal Proc. and Apps., 2025.
12. S.SathiyaPriya, P. Priya and R. Ashok, “IoT Based Solar Panel Tracking System With Weather Monitoring,” IJSART, vol. 11, issue 10, Oct. 2025.
13. P.Rahul Charith, G.Rajeev, G. Shashi Kumar, S. Chandra Shekhar and V. Kumaraswamy, “Solar Powered Wireless Charging with EV BMS and Charge Monitoring,” Iconic Research & Engineering Journals, vol. 8, issue 11, pp. 574- 578, May 2025.
14. R.Nanwatkar, D.Watvisave, A.Bagde, S.Sabale and S.Mutalikdesai, “Solar Energy Conservation Using Wireless Sensor Network-Based Street Light Monitoring for Charging Hybrid Electric Vehicles,” Int. J. Intell. Sys. & Apps. in Eng. (IJISAE), vol. 12, no. 3, pp. 1177-1186, 2024.
15. B.J.and M.T.I.(supervisor), “Open Source Data Logging and Data Visualization for an Isolated PV System,” Electronics, vol. 8, no. 4, 424, 2019.
16. M.P.Tellawar and N.Chamat, “An IoT based Smart Solar Photovoltaic Remote Monitoring System,” IJERT, vol. 8, issue 09, Sept. 2019