Journal of **N**onlinear **A**nalysis and **O**ptimization
Vol. 15, Issue. 1 : 2024
ISSN : **1906-9685**

A REAL TIME - ANDROID BASED MONITORING SYSTEM FOR ELECTRIC VEHICLE

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ABSTRACT

The entry of electric vehicles (EV) into the market represents a major milestone in efforts to achieve sustainable transport. Nevertheless, widespread use of electric vehicles is hampered by such factors as range anxiety, battery management and efficient charging infrastructure utilization. In order address these issues, “EcoTrack” has been developed which is a real time innovative electric vehicle monitoring and management system enhancing electric vehicle driving experience, ensuring road safety and optimizing performance. EcoTrack flawlessly combines modern technologies including temperature sensors, GPS, and current as well as voltage monitors integrated through an advanced mobile application for EV car owners to enjoy. The main features of EcoTrack include real-time temperature monitoring for critical components, GPS-enabled navigation to the nearest charging stations with up-to-date availability information and comprehensive battery current/voltage monitoring for protection against operational extremes. However, the system automatically cools down the vehicle according to current temperature measurements thereby guaranteeing optimal output and durability of the battery unit. Among its key attributes is also a user-friendly mobile app designed specifically for EV owners to enable them track their cars in real time; get their status updated once in a while and control some operations from far away.
Keywords: EV, EcoTrack, Temperature sensors, GPS, Vehicle Tracking

INTRODUCTION

The transition to electric vehicles (EVs) is vital for combating climate change and reducing carbon emissions. EVs offer lower operating costs and reduced reliance on fossil fuels. They have a smaller carbon footprint and typically require less maintenance than traditional vehicles. However, challenges like range anxiety and battery longevity need addressing. Expanding charging infrastructure and advancing battery technology are key. Effective vehicle management systems are also essential for optimizing EV performance.

1.1 BACKGROUND AND MOTIVATION:

The transportation sector heavily contributes to greenhouse gas emissions, prompting a shift towards electric vehicles (EVs). While EVs offer cleaner and renewable energy-powered solutions, challenges like range anxiety and charging infrastructure persist. To address these, a real-time Android-based monitoring system for EVs is developed. It aims to enhance user experience, optimize efficiency, ensure reliability, facilitate charging access, and promote sustainability.

1.2 OBJECTIVES:

1. Real-Time Monitoring: Develop a system for instant EV data collection and analysis, covering battery status, energy usage, speed, and GPS location.
2. User Interface Design: Create an intuitive Android interface with customizable dashboards for easy interpretation of EV data.
3. Range Estimation: Implement algorithms for accurate range predictions, alerting users of limitations and suggesting nearby charging stations.
4. Battery Health Monitoring: Track battery metrics like temperature and charge level, providing tips for longevity and efficiency.
5. Charging Infrastructure Integration: Connect to charging station databases for location, availability, and compatibility information, enabling easy navigation.
6. Energy Efficiency Optimization: Analyze driving behavior to offer personalized tips for eco-friendly driving and maximizing range.
7. Vehicle Maintenance Reminders: Schedule maintenance alerts based on mileage or time intervals to ensure EV reliability.
8. Customization: Allow users to personalize dashboards, notifications, and settings to suit individual preferences.
9. Data Security: Implement robust security measures to protect user and vehicle data, complying with privacy regulations.
10. Scalability and Compatibility: Design for compatibility with various EV models and Android devices to maximize usability.

1.3 SCOPE:

1. Hardware Compatibility: The system's performance may vary based on the user's Android device capabilities.
2. Internet Connectivity: Real-time monitoring depends on internet availability, which may be limited.
3. Range Estimation Accuracy: Factors like driving conditions may affect range predictions.
4. Charging Station Availability: Relies on external databases/APIs, which may not be current.
5. Battery Health Assessment: Professional assessment may be needed for comprehensive battery diagnostics.
6. Regulatory Compliance: Users must ensure compliance with local laws regarding device use while driving.
7. Third-Party Dependencies: System functionality may be impacted by external factors.
8. User Responsibility: Users are ultimately responsible for vehicle operation and safety.

LITERATURE SURVEY

2.1 Electric Vehicle Monitoring Systems:

Electric vehicles (EVs) are gaining momentum globally as eco-friendly transportation options. Yuvaraj et al. (2018) Electric vehicle monitoring systems play a vital role in optimizing EV performance and enhancing user experience. Monitoring systems are essential for maximizing EV efficiency, reliability, and sustainability. They address challenges Elmer P. et al (2019) like range anxiety, battery health, and charging infrastructure accessibility.

Electric vehicle monitoring systems include real-time data collection, intuitive interfaces, range estimation algorithms, battery health monitoring, charging infrastructure integration, energy efficiency tools, maintenance reminders, and data security measures. Sunita Patil et al. (2020)

Benefits:

Monitoring systems enhance user experience, improve energy efficiency, increase reliability, facilitate charging access, and promote sustainable driving habits.

Implementation Challenges and Solutions:

Challenges include hardware/software compatibility, internet connectivity, accuracy of estimations, and reliance on third-party data. Solutions involve addressing compatibility issues, improving internet access, enhancing accuracy algorithms, and ensuring data reliability.

Case Studies:

Successful implementations by automotive manufacturers, technology firms, and research institutions offer insights into best practices and lessons for future deployments.

2.2 Real-time Monitoring Techniques:

1. Introduction:

Real-time monitoring's definition and importance for quick data analysis in various industries. [4] Vijay S. Sherekar and Raju R. (2016)

2. Sensor Technologies:

Overview of common sensors like temperature, pressure, accelerometers, etc., their uses, and limitations.

3. Data Acquisition Systems:

Explanation of data acquisition systems types and functionalities, such as standalone data loggers and SCADA systems. Yonghua et al. (2011)

4. Communication Protocols:

Comparison of communication protocols like Ethernet, Wi-Fi, Bluetooth, etc., in terms of speed and reliability.

5. Data Processing and Analysis:

Explanation of techniques like signal processing, statistics, and machine learning for extracting insights.

6. Visualization and Dashboard Design:

Importance of visualization, techniques for designing effective dashboards, and showcasing best practices.

7. Fault Detection and Diagnosis:

Overview of techniques like anomaly detection and pattern recognition for real-time fault diagnosis.

8. Case Studies and Applications:

Presentation of real-world applications across industries, highlighting benefits. Lu, Languang, et al. (2013)

9. Challenges and Considerations:

Identification of challenges like data latency and cybersecurity, with strategies for mitigation. Karmore, Swapnili P et al. (2014)

10. Future Trends:

Exploration of emerging trends like edge computing and IoT integration, discussing potential impacts.

3 EXISTING AND PROPOSED SYSTEM:

Eco Track represents a cutting-edge solution aimed at revolutionizing the electric vehicle (EV) industry by offering a comprehensive real-time monitoring and management system. Rauniyar et al. (2017) In response to the challenges hindering the widespread adoption and optimal utilization of electric vehicles, EcoTrack integrates advanced technologies and features to address key concerns such as range anxiety, battery management, charging infrastructure awareness, safety, reliability, and overall user experience.

1. Real-Time Monitoring: EcoTrack provides instant insights into battery status, energy consumption, vehicle range, and charging status.
2. Range Anxiety Mitigation: Advanced algorithms accurately estimate remaining range and offer proactive notifications and recommendations to alleviate range anxiety.
3. Battery Management: Sophisticated features monitor battery health, temperature, and charging cycles to maximize lifespan and efficiency.
4. Charging Infrastructure Awareness: Integrates with charging station databases, offering real-time info on nearby stations for simplified trip planning.
5. Safety and Reliability: Monitors vehicle diagnostics, detects anomalies, and alerts users to potential issues, prioritizing safety.
6. User Experience Enhancement: Intuitive interface and customizable dashboards empower informed decision-making for EV owners.

Benefits:

1. Increased Confidence in EV Ownership: Addressing concerns boosts confidence in EV ownership.
2. Optimized Performance and Efficiency: Real-time monitoring and recommendations maximize range and minimize energy consumption.
3. Enhanced Safety and Reliability: Focus on safety reduces the risk of unexpected breakdowns or maintenance issues.
4. Convenient Charging Experience: Access to real-time charging station info simplifies the charging process while on the go.

3.1 METHODOLOGY

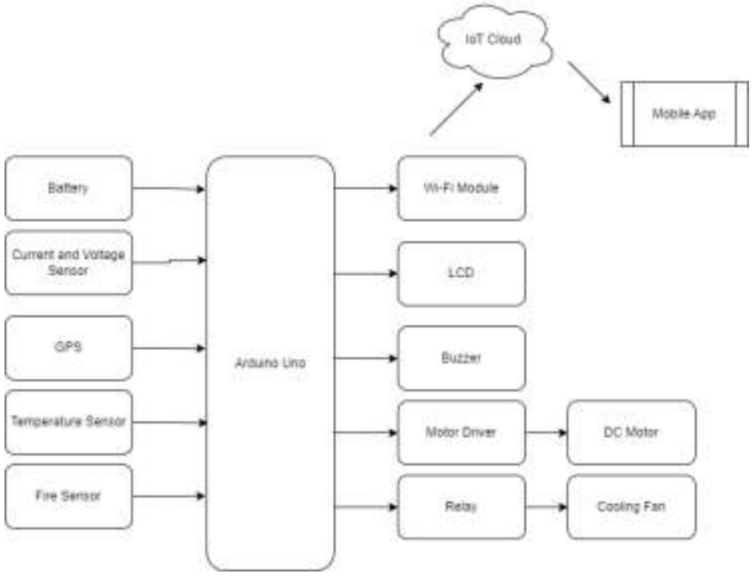
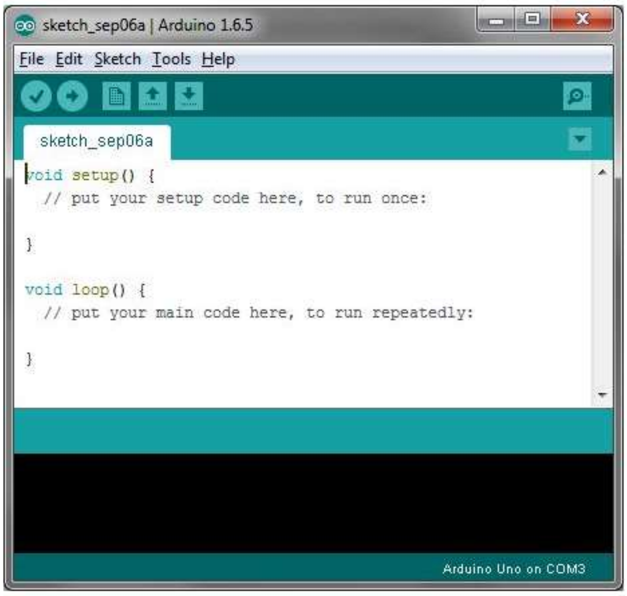


Fig 3.1 Block Diagram

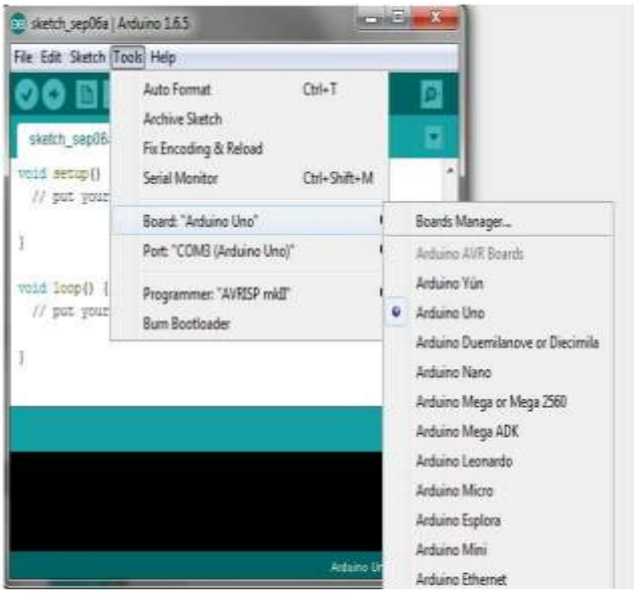
3.2 WORKING:

Step 1: Sensor Data Collection
Temperature, voltage, and current sensors gather continuous data from the battery, motor, and cooling system.
Step 2: Onboard Processing
The onboard system analyzes sensor data to evaluate battery health and vehicle status.
Step 3: Communication with Cloud Server
Processed data is securely sent to the cloud server for storage and analysis.
Step 4: Cloud-Based Analysis
Advanced algorithms in the cloud provide insights into battery health and performance.
Step 5: Mobile App Interface
Users access real-time info on battery status and charging infrastructure via the mobile app.
Step 6: Real-Time Alerts
Eco Track sends alerts for high temperatures or malfunctions and suggests optimal charging strategies.
Step 7: Charging Station Locator
The app identifies nearby charging stations and provides availability and speed details.
Step 8: Remote Control
Users can remotely initiate charging or adjust energy settings through the app.
Step 9: Navigation and Planning
Integrated GPS helps users plan routes with charging stops based on real-time data.

SOFTWARE REQUIREMENTS: Arduino IDE



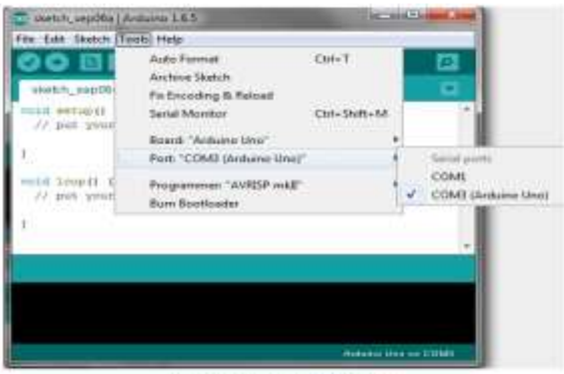
Arduino IDE Default Window



Arduino IDE: Board Setup Procedure

Fig:3.1 Arduino IDE Default window

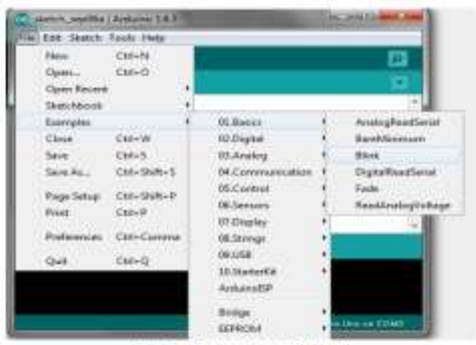
Fig:3.2 Arduino IDE Board Setup Procedure



Arduino IDE: COM Port Setup

Fig:3.3 Arduino IDE COM Setup

Upload Button:



Arduino IDE: Loading Blink Sketch

Fig:3.4 Arduino IDE Loading Blink Sketch

OUTPUT

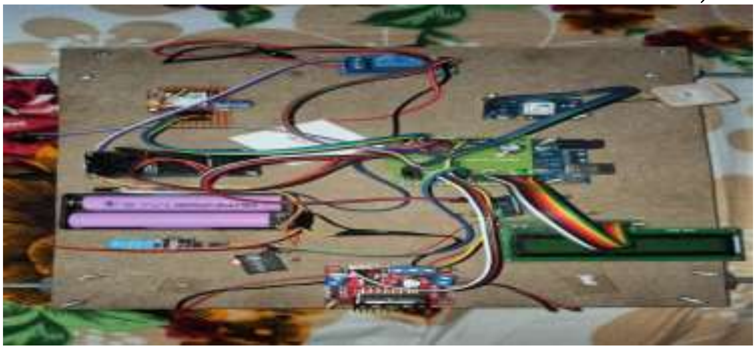


Fig. 4.1 Output

1. GPS Integration: Use GPS to track where the electric car is and find nearby places to charge it. Also, help plan the best routes considering how much battery the car has and what the driver prefers.
2. GSM Communication: Install a system that allows the electric car to talk to a central system using a mobile network. This helps send messages like alerts and notifications to the car's owner and allows them to control some car functions remotely.
3. Data Monitoring: Put sensors in the car to check its power, temperature, and other important things. Show this information to the driver on their phone so they can see how the car is doing in real-time.
4. Charging Station Integration: Use GPS to find charging stations nearby. Also, give details about these stations like if they're free, how fast they charge, and if they work with the driver's car.
5. Alerts and Notifications: Make the car able to tell the driver if something important happens, like if it's too hot or if someone tries to mess with it. These messages can come through the phone or text messages.
6. Battery Management: Tell the driver how healthy the car's battery is, how many times it's been charged, and how much power it has left. Give advice on how to take care of the battery better.
7. Remote Control: Let the driver do some things with the car from far away, like starting or stopping charging, or changing the temperature inside. This is done through an app on the phone.

Fig:4.2 Display outputs on LCD display

Fig:4.3 Message when battery over temperature with location

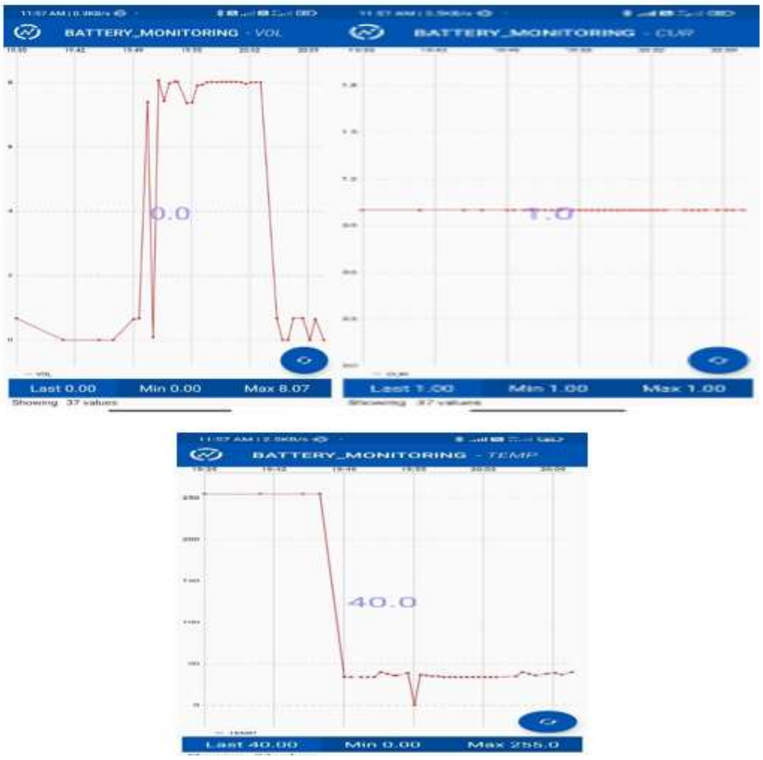


Fig:4.4 Outputs on App

5 CONCLUSIONS:

Our Android-based EV monitoring system offers real-time data tracking, remote control, and a superior user experience. Leveraging Android devices, it provides drivers with insights on performance, battery status, and charging needs. Features like GPS tracking and remote diagnostics enhance efficiency and safety. Investing in such innovative solutions is crucial for sustainable transportation growth. Future enhancements may include AI-driven predictive maintenance, ML-based charging optimization, and augmented reality interfaces. Compatibility with wearables and smart home systems will boost versatility. Continuous updates and collaboration will drive EV technology forward.

5.1 FUTURE SCOPE:

Creating an Android-based monitoring system for electric vehicles offers many benefits like real-time data tracking, remote control, and improved user experience. By leveraging Android devices, drivers gain insights into their vehicle's performance, battery status, and charging needs. Features such as GPS tracking and remote diagnostics enhance efficiency, safety, and convenience. As electric vehicle demand grows, investing in such solutions is crucial for sustainable transportation.

Future enhancements could include AI for predictive maintenance, ML for charging optimization, and augmented reality interfaces. Expanding compatibility to wearable devices and smart home systems would enhance versatility. Continuous updates and collaboration ensure the system stays innovative, driving electric vehicle technology forward.

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