VIVA-TECH INTERNATIONAL JOURNAL FOR RESEARCH AND INNOVATION
ANNUAL RESEARCH JOURNAL
ISSN(ONLINE): 2581-7280

"Portable Battery Swapping / Charging Station For 2-Wheeler"

Prathmesh Mandavkar, Vedang Mestry, Pranay Patari
[1](Electrical Engineering, Viva Institute of Technology, India)
[2](Electrical Engineering, Viva Institute of Technology, India)
[3](Electrical Engineering, Viva Institute of Technology, India)

Abstract : *The transition to electric vehicles (EVs) is key to reducing carbon emissions and promoting sustainable transport. However, a major challenge for EV users is the lack of charging options in emergencies. To address this, we propose an Emergency EV Charging Platform that provides immediate assistance to drivers with low battery levels. The platform features a user-friendly Android app, developed using Kodular, allowing users to submit emergency requests with their username, mobile number, and GPS location.*

These requests are stored in a MongoDB database and managed via a Flask admin dashboard for efficient dispatching of support. A spare battery delivery system sends a responder with a battery that includes a Battery Management System (BMS) to track key metrics such as voltage, current, and capacity, which users can view in the app. The system also integrates an Electronic Speed Controller (ESC) and an ESP32 microcontroller for real-time monitoring and optimization. Using a 7.2Ah lead-acid battery as a demo, the platform aims to enhance user confidence in EV technology and promote broader EV adoption.

Keywords - *Battery management, Electric vehicles, Emergency charging, Portable charging, Sustainable mobility.*

I. INTRODUCTION

The transition to electric vehicles is vital for reducing greenhouse gas emissions and addressing climate change. Despite their environmental benefits, EV adoption is hindered by challenges like inadequate charging infrastructure and "range anxiety", where drivers fear battery depletion, especially in emergencies or remote areas. This paper presents the Emergency EV Charging Platform, a system that ensures reliable emergency charging through a user-friendly mobile app, a MongoDB-managed database, and an admin dashboard for swift response. Developed with Kodular, the app allows users to request assistance, which is managed efficiently and dispatched with spare batteries. Additionally, the paper introduces portable battery swapping and charging stations, which significantly reduce downtime for electric two-wheelers, enhancing convenience and promoting EV adoption. These stations, equipped with a Battery Management System, an electronic speed controller, and real-time monitoring via an ESP32 microcontroller, address range anxiety and support sustainable urban mobility. The paper underscores the environmental and market potential of these innovations, advocating for pilot projects and partnerships to refine and expand this transformative approach.

II. LITERATURE SURVEY

The literature survey examines portable battery swapping systems for electric two-wheelers, focusing on technological, economic, and environmental aspects. Smith and Gupta (2022) highlight advancements and the need for standardization, while S. Pargaien et al. (2021) show how swapping stations improve urban mobility by reducing charging times. Patel and Lee (2023) find economic feasibility with long-term cost benefits, and Kumar and Rivera (2020) emphasize environmental gains, including reduced carbon footprints and increased recycling. These studies collectively stress the importance of infrastructure, user acceptance, and sustainability for the adoption of battery swapping systems.

III. METHODOLOGY

The proposed methodology for the Emergency EV Charging Platform is structured into five phases: design, implementation, testing, and deployment. In the design phase, an Android app will be developed using Kodular, focusing on a user-friendly interface to enable quick submission of emergency requests. In the backend development phase, MongoDB will handle user request data, and a Flask-based admin dashboard will facilitate real-time request management for administrators. The integration of hardware components includes a Battery

Management System (BMS) and an ESP32 microcontroller for real-time data monitoring. Comprehensive testing will ensure system reliability, simulating user scenarios to assess performance. Finally, the platform will be deployed, incorporating user feedback for continuous improvement, with marketing efforts to enhance adoption among EV users and stakeholders.

IV. FIGURES AND TABLES

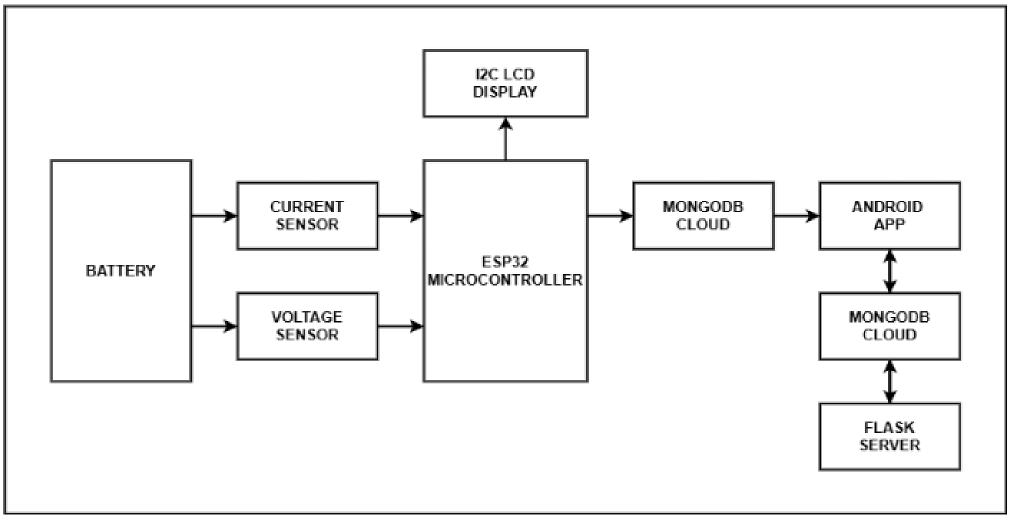

Fig. 1 Block Diagram of System

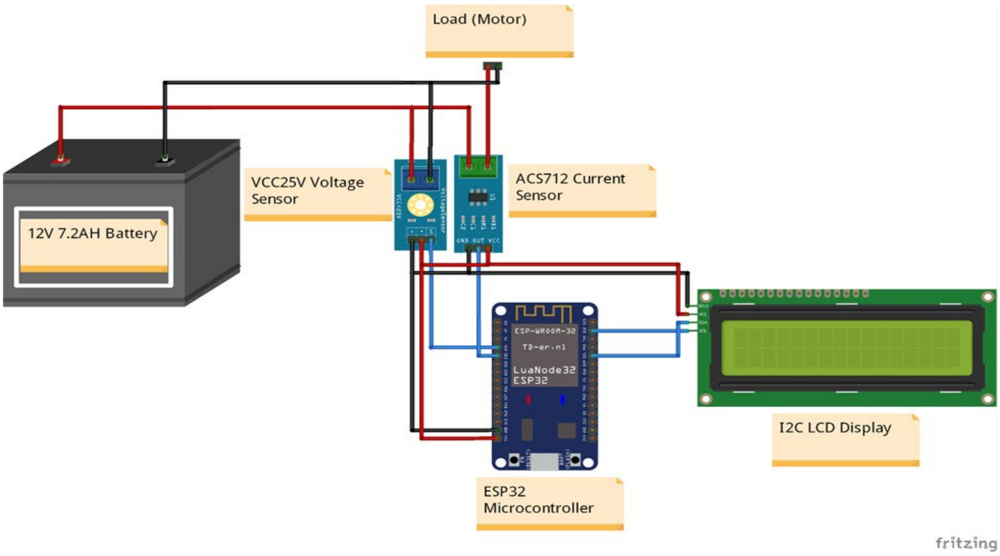

Fig. 2 Circuit Diagram

Table

Sr No.	Component	Specifications
1.	Battery	12V, 7.2Ah
2.	Voltage Sensor	Model: VCC25V, Input Voltage: 0-25V, Output: Scaled to 0-5V for ESP32 input
3.	Current Sensor	Model: ACS712, Current Range: ±5A, ±20A, ±30A (depending on model), 5V supply
4.	ESP32 Microcontroller	Dual-core 32-bit processor, Wi-Fi/Bluetooth, 160-240 MHz, 36 GPIO pins, 3.3V
5.	I2C LCD Display	Size: 16x2 characters, Interface: I2C, Operating Voltage: 5V

6.	MongoDB Cloud	NoSQL, multi-region, encrypted, auto-scaling
7.	Android App	Kodular, Android 5.0+, real-time features, REST API
8.	Flask Server	Python-based, WSGI, secure with JWT, scalable

V. CONCLUSION

The Emergency EV Charging Platform offers numerous advantages, including instant access to emergency charging, real-time monitoring via the ESP32 microcontroller, and the safety of a Battery Management System, ensuring a secure and reliable charging process. It minimizes range anxiety, encourages EV adoption, and provides a seamless user experience through a user-friendly Android app. The platform is scalable, cost-effective, and offers flexibility, making it ideal for EV drivers, fleet operators, emergency services, and long-distance travelers. Additionally, it supports sustainable transportation by integrating with government and municipal services, commercial charging networks, and electric vehicle fleets, ensuring uninterrupted service and promoting green energy initiatives. By addressing key challenges in the EV ecosystem, this platform plays a critical role in advancing the widespread use of electric vehicles and contributing to a more sustainable future.

Acknowledgements

We shall be failing in our duty, if we will not express our sincere gratitude to all those distinguished personalities with the help of whom we have successfully completed our project. My deep gratitude to **Dr. Arun Kumar**, PRINCIPAL, VIVA INSTITUTE OF TECHNOLOGY, who always been playing a great role in all round development of the student. My deep gratitude to **Prof. Bhushan Save**, THE HEAD OF ELECTRICAL DEPARTMENT and our project coordinator **Prof. Rahul Abhyankar** and our project guide **Prof. Bhushan Save** for his valuable guidance, advice and constant aspiration to our work, teaching and non-teaching staff for their kind support, help and assistance, which they extended as and when required.

REFERENCES

[1] Kadlag Sunildatta Somnath, Mukesh Kumar Gupata "Review Paper on Electric Vehicle Charging and Battery Management System" Proceedings of Internationa Conference on Communication and Information Processing (ICCIP) 2019, Published: July 2019 doi - http://dx.doi.org/10.2139/ssrn.3416669 .

[2] R Nicolò Daina , Aruna Sivakumar, John W. Polak "Electric vehicle charging choices: Modelling and implications for smart charging services" Published: August 2017 doi: https://doi.org/10.1016/j.trc.2017.05.006 .

[3] Emmanouil D. Kostopoulos, George C. Spyropoulos, John K. Kaldellis - "Real-world study for the optimal charging ofelectric vehicles" Published: November 2020 doi: https://doi.org/10.1016/j.egyr.2019.12.008.

[4] Xu Xiao, He Molin, Paraskevi Kourtza, Adam Collin, Gareth Harrison and Sasa Djokic "Component-Based Modelling of EV Battery Chargers" Published in: 2015 IEEE Eindhoven PowerTech Publisher: IEEE DOI: 10.1109/PTC.2015.7232690

[5] Morris Brenna, Federica Foiadelli, Carola Leone, Michela Longo "Electric Vehicles Charging Technology Review and Optimal Size Estimation" Published: 02 October 2020 Journal of Electrical Engineering & Technology DOI - https://doi.org/10.1007/s42835-020-00547-x

[6] A. Haripasad, I. Priyanka, R. Sandeep, V. Ravi & O. Shekar. "Battery Management System in Electric Vehicles" International Journal of Engineering Research &Technology (IJERT) – Vol.9 Issue 05, May 2020, doi: 10.17577/IJERTV9IS050458

[7] Thota Venkata Pruthvi, Niladri Dutta, Phaneendra Babu Bobba & B Sai Vasudeva. "Implementation of OCPP Protocol for Electric Vehicle Applications" ES3 Web of Conferences – January 2019, doi:10.1051/e3sconf/20198701008

[8] Viet T. Tran, Danny Sutanto, Kashem M. Muttaq "The State of The Art of Battery Charging Infrastructure for Electrical Vehicles: Topologies, Power Control Strategies, and Future Trend" 2017 Australasian Universities Power Engineering Conference (AUPEC) – Nov 2017,doi: 10.1109/AUPEC.2017.8282421

[9] Nadim Sakr, Daniel Sadarnac, Alian Gascher "A Review of onboard integrated chargers for electric vehicles" 16th European Conference on Power Electronics and Applications-August 2014, doi: 10.1109/EPE.2014.6910865

[10] Balakumar Balasingam , Mostafa Ahmed and Krishna Pattipati. "Battery Management Systems - Challenges and Some Solutions" Energies -MDPI – Published: 2 June 2020, doi: 10.3390/en13112825