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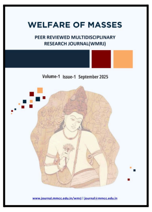

Charging and Control Circuits for Lithium-Ion Batteries in Electric Vehicles: An Overview

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ABSTRACT

The increasing adoption of electric vehicles (EVs) has created a growing need for efficient, reliable, and safe battery charging systems. Lithium-Ion batteries are widely used in EVs because of their high energy density, long cycle life, and fast charging capability. However, their performance and lifespan depend significantly on the charging method employed. This work presents the design and development of an SMPS-based battery charger using the Constant Current–Constant Voltage (CC–CV) charging technique for a 36 V (10S) Lithium-Ion battery pack.

The proposed charger converts a single-phase AC supply into a regulated 42 V DC output with a maximum charging current of 7.5 A. A buck converter controlled by Pulse Width Modulation (PWM) is used to achieve high conversion efficiency, while a MOSFET serves as the primary switching device. A relay driver circuit is incorporated to protect the battery from reverse charging and enhance operational safety. The charging process is controlled by a Raspberry Pi, which continuously monitors battery voltage and charging current and automatically switches from constant-current mode to constant-voltage mode as the battery reaches its rated voltage. This intelligent control strategy improves charging efficiency, reduces overheating, and helps extend battery life.

The charger is designed, modeled, and analyzed using MATLAB/Simulink, followed by converter design, component selection, thermal analysis, and hardware implementation. Simulation and experimental results demonstrate that the proposed charger provides stable operation, improved power quality, high efficiency, and reliable charging performance. The developed system offers a practical, cost-effective, and scalable solution for modern electric vehicle charging applications.

Introduction

In recent years, electric vehicles (EVs) have gained significant attention worldwide due to their potential to reduce carbon emissions, decrease dependence on fossil fuels, and promote sustainable transportation. As the adoption of EVs continues to grow, the demand for efficient, reliable, and safe battery charging systems has increased considerably. However, long charging times and limited driving range, commonly referred to as range anxiety, remain major challenges that hinder the widespread adoption of electric vehicles. [1]

The battery charger is one of the most critical components of an electric vehicle, as it directly affects charging efficiency, battery life, and overall vehicle performance. Most public charging stations provide a single-phase AC power supply, which is converted into the required DC voltage by an onboard Switched-Mode Power Supply (SMPS) charger. In India, commercially available onboard chargers typically have power ratings ranging from 2.5 kW to 3 kW and operate from a 230 V single-phase AC supply. These chargers are designed to provide efficient power conversion while ensuring safe and reliable battery charging. [2]

Lithium-Ion batteries have become the preferred energy storage technology for modern electric vehicles because of their high energy density, long cycle life, low self-discharge rate, and excellent charging performance. However, the efficiency, safety, and lifespan of these batteries depend largely on the charging method employed. [3] Several charging techniques have been developed for Lithium-Ion batteries, including Constant Trickle Charging (CTC), Constant Current (CC), Constant Voltage (CV), and Constant Current–Constant Voltage (CC–CV) charging. Among these methods, the CC–CV charging technique is widely recognized as the most effective because it enables faster charging while minimizing the risks of overcharging, overheating, and battery degradation. [4], [5]

The novelty of this research lies in the design and development of a digitally controlled SMPS-based CC–CV battery charger for a 36 V (10S) Lithium-Ion battery pack using a Raspberry Pi as the main controller. Unlike conventional battery chargers that rely on analog control circuits or dedicated charging integrated circuits, the proposed charger employs a programmable Raspberry Pi to implement an intelligent CC–CV charging algorithm. The controller continuously monitors the battery voltage and charging current and automatically switches between the constant-current and constant-voltage charging modes to ensure safe and efficient charging. Furthermore, the proposed system incorporates a PWM-controlled buck converter with a MOSFET-based switching circuit and a relay driver to provide reverse-polarity protection, thereby enhancing the safety and reliability of the charger.

The complete system is modeled and analyzed in MATLAB/Simulink, followed by hardware implementation and experimental validation. The proposed charger demonstrates improved charging efficiency, better power quality, reliable operation, and enhanced battery protection. In addition, its digital control architecture provides a flexible and scalable platform that can be extended to support advanced Battery Management System (BMS) functions, real-time monitoring, data logging, and IoT-enabled smart charging applications. These features make the proposed charger a practical and cost-effective solution for next-generation electric vehicle charging systems.

Literature Review

Abdulkarim Nasir et al. [1] proposed the design of a Constant Voltage–Constant Current (CVCC) fast battery charger for electric vehicles. Their study reviewed several AC–DC fast charging topologies, including PWM rectifiers, NPC Vienna rectifiers, and buck converters. After discussing the limitations of existing charging systems, the authors developed a DC–DC buck converter-based charger employing the CVCC charging technique to achieve efficient and reliable battery charging.

Prasad Vijay Yadav et al. [2] developed a robust Switched-Mode Power Supply (SMPS) battery charger for Lithium-Ion batteries and incorporated several protection mechanisms to improve charging safety. The proposed charger was based on a forward converter topology, with the output voltage regulated through a feedback control system. The authors also presented a detailed simulation model featuring a wide input voltage range, a window comparator, a soft-start circuit using a totem-pole comparator, and a PWM controller for effective converter operation.

H. A. Hidayah and M. Somantri [3] investigated a fast-charging system based on a high-current charging technique. Their design employed a rectifier circuit, a buck converter, and an Atmega microcontroller to regulate the charging process. Experimental results showed that the proposed approach increased the charging current, thereby reducing the overall battery charging time.

Mahesh Sharma [4] presented a microcontroller-based charger for Lithium-Ion batteries and identified the Constant Current–Constant Voltage (CC–CV) charging technique as the most suitable method for Li-Ion battery charging. The proposed charger was implemented using an 89S52 microcontroller, providing accurate charging control and improved battery protection.

L. Chitra et al. [5] proposed two different approaches for charging electric vehicles: Grid-to-Vehicle (G2V) and Solar-to-Vehicle (S2V) charging. Their work demonstrated that EV batteries can be charged either from a conventional single-phase grid supply or through renewable energy generated by photovoltaic solar panels, thereby supporting environmentally friendly charging solutions.

Rutvi T. Vora et al. [6] provided a comprehensive review of charging and control circuits used in electric vehicles. The paper explained the operation of each section of the charging system, from power conversion to battery control, and discussed several charger design approaches suitable for EV applications.

Hidayah H. A. et al. [7] presented the design and implementation of a fast battery charging control system using an Atmega32 microcontroller. The proposed controller dynamically adjusted the charging current according to the battery condition and circuit requirements, resulting in improved charging efficiency and reduced charging time. Experimental results demonstrated that the system significantly increased the charging current while maintaining battery safety and reliability.

Prasad Vijay Yadav et al. [8] developed and experimentally validated an SMPS-based battery charger for Lithium-Ion batteries used in electric vehicles. The charger continuously monitored the battery voltage and gradually reduced the charging current as the battery approached full charge using a PWM controller. This intelligent charging strategy minimized battery stress, improved battery life, and ensured safe and complete charging. The developed prototype demonstrated reliable performance and was found to be suitable for electric two-wheelers.

Abdulkarim Nasir et al. [9] presented the design, simulation, and experimental validation of a Constant Current–Constant Voltage (CC–CV) fast battery charger for electric vehicles. The proposed charger consisted of a three-phase controlled rectifier, a DC–DC buck converter, and a battery charging unit. A Voltage-Oriented Control (VOC) strategy based on direct–quadrature (d–q) control was employed to regulate the rectifier. The charging controller implementing the CC–CV algorithm was modeled and analyzed using MATLAB/Simulink. The hardware prototype was developed using an Arduino Nano microcontroller, a buck converter, and a current sensing circuit, and it was tested with both lead-acid and Lithium-Ion batteries. The experimental results confirmed the effectiveness of the proposed charger in achieving efficient and reliable battery charging.

A review of the existing literature indicates that significant progress has been made in the development of battery chargers for electric vehicles. Most researchers have focused on improving charging efficiency through different converter topologies, charging algorithms, and microcontroller-based control systems. However, many of these studies rely on conventional controllers such as the Atmega series or Arduino platforms and primarily emphasize simulation or prototype development. These observations highlight the need for a more flexible and intelligent charging system capable of delivering efficient CC–CV charging with enhanced control, monitoring, and safety features. This research addresses that need by developing a Raspberry Pi-based SMPS charger that combines digital control, efficient power conversion, and practical hardware implementation for modern electric vehicle applications.

Table 1: Types of Chargers

Specifications/Parameters	**Level 1**	**Level 2**	**Level 3**
Working Voltage	110/120V	208/220/240V	AC 3-Phase,400V
Current Capacity	12-16Amp	12-80Amp	<125Amp
Power Output	3.6KW	7.6KW	50-1000KW
Range	2-5 Miles/hrs.	10-30 Miles/hrs.	50-100 Miles/hrs.
Charging Time	10-12 hrs.	4-8hrs.	30min-2hrs.

Comparison of different ac/dc topologies for fast dc chargers

Popular converter topologies used in EV battery chargers are PWM converters, NPC converters, Vienna converters and Buck type converters.

Pulse Width Modulation Converter (PWM): PWM converter controls the output voltage or current by adjusting the width of pulses. It also converts average power delivered to the load. Such devices are used in inverters and DC TO DC converters.

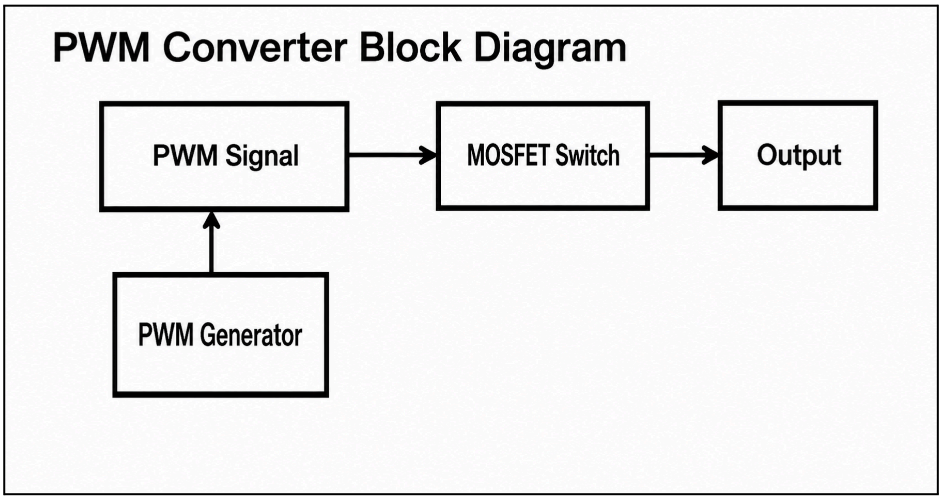

Figure 1: PWM convertor block diagram

PWM Devices use MOSFETS or IGFETS as a high speed switching devices where the duty cycle decides the average output voltage. Higher duty cycle means MOSFET is ON for a longer time on the other hand lower duty cycle means MOSFET is ON for a shorter duration. In this way the duty cycle controls the output voltage. Hence PWM converts are used in DC to DC converters.PWM converters are highly efficient and they have precise control over output voltage and current. They are also able to minimize the harmonic distortions in the output waveform.

Neutral Point Clamped Converter (NPC) : This design is suited for higher voltage output. Clamping diodes allows to handle higher input voltages. Hence they are specially used in medium and high voltage applications. For battery vehicles they are used in onboard chargers.

Vienna Converters:

Vienna converter is a popular 3 phase AC to DC converter. It is a unidirectional 3 phase PWM rectifier. They are highly efficient and able to produce very low harmonic distortion. In AC switching circuits the Vienna rectifier is used as a boost converter. In Electric Vehicle chargers Vienna converts are used in vehicle to grid (V2G) technology.

Buck type Converters:

Buck converter is a DC to DC converter which converts high input to a low voltage output. Switching devices used to reduce the voltage are Diode, Capacitor, Inductor, MOSFETS etc. by Buck converters.

Diode is a unidirectional device which flows current when it is forward biased. The capacitor provides stable voltage by reducing ripples. The inductor stores the energy when it is ON and reduces the output voltage and increases the output voltage when it is OFF. Thus provides constant voltage at the output. MOSFET is a very fast device to make input voltage ON and OFF maintains the output voltage constant also. Efficiency for buck regulators is about 90% **or more.**

DESIGN OF FAST CHARGING CIRCUIT

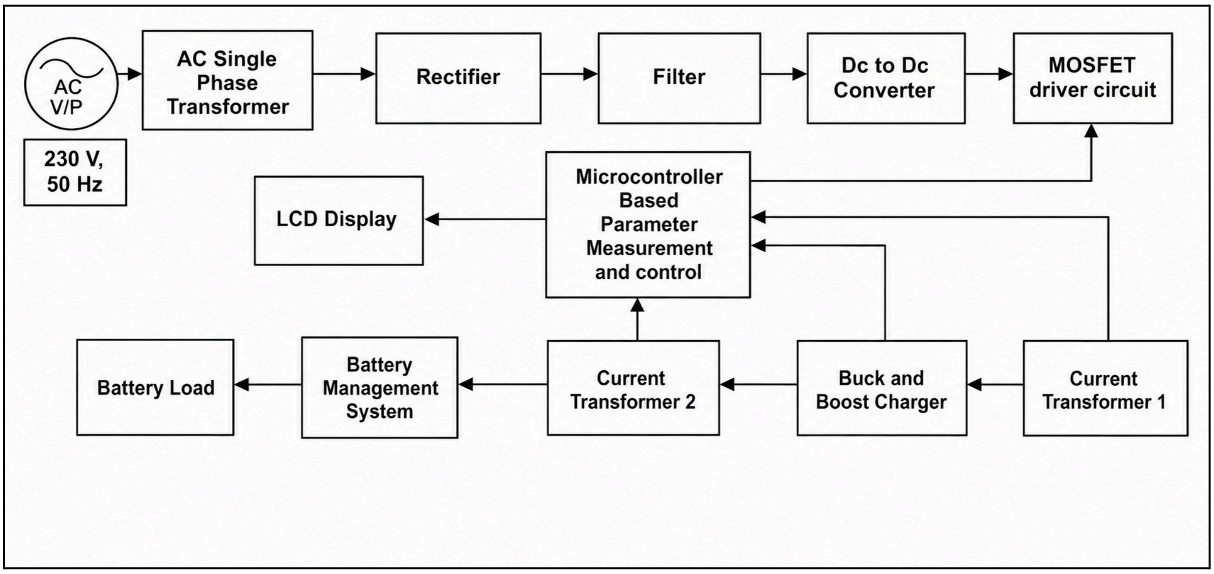

Figure 2: Block diagram of fast charging circuit

Buck Converter Circuit

Buck converter circuit converts DC-DC voltage which is variable. This circuit uses Pulse Width Modulation (PWM) technique which is nothing but a continuous ON/OFF switch and duty cycle to control the speed of switch.

MOSFET Driver Circuit

MOSFET driver circuit communicates between the microcontroller and a buck converter acts as a separator between power circuits with control circuit. Which protects the microcontroller from voltage behind the buck converter.

Relay Circuit

The relay circuit connects and disconnects the voltage from the voltage source to the battery fast charging circuit set by the microcontroller. Input of relay circuit is adjusted from voltage and current sensors.

Voltage detector

This voltage divider circuit works for voltage divider or voltage sensor circuit, because microcontroller system cannot accept voltage more than 5 volts and the circuit can measure larger DC voltage of 48V – 54V to 0V – 5V.

Current sensor circuit

The current sensor works for a safety and monitoring current which is flowing towards battery charging circuit.

Selection of Microcontroller

The Microcontroller is the brain of the battery charging system. One can select suitable microcontroller like PIC, Arm, Arduino, Atmega 32, 89S52, Raspberry pie etc. Prior choice is made as the role of Microcontroller is very vital.

Role of Raspberry Pi:

In the provided setup (ev_charger_ui.py running on a Raspberry Pi with I²C peripherals ADS1x15 and MCP4725, Kivy touchscreen UI, and GPIO control), the Raspberry Pi functions as the real-time supervisory controller: it executes the charging algorithm (control loop) implemented in ev_charger_ui.py, acquires analog measurement data via the ADS1x15 ADC over I²C (using smbus/smbus2), computes control actions (current/voltage set points, charge-phase transitions, and fault responses), and issues actuation commands through the MCP4725 DAC and GPIO (via RPi.GPIO) to the power stage (relays/MOSFET drivers). It also provides the human–machine interface through the Kivy application, logs telemetry and events for diagnostics, and enforces safety by monitoring thresholds (overvoltage, overcurrent, and temperature) and initiating immediate shutdown sequences when limits are exceeded. In short, within this programmatic configuration the Pi is the deterministic measurement–decision–actuation platform that integrates sensor input, control output, UI, and safety interlocks to manage the charger's operation.

EV Battery Charging Topologies

Various charging topologies are used to transfer electrical energy efficiently from a source to a load.

Linear Charging Topology

This method directly connects the power source to the load through a resistor or linear regulator. Voltage regulation is achieved by controlling current flow. Although simple and inexpensive, it has low efficiency due to significant power losses and is suitable only for low-power applications.

1. **Buck Converter**
Reduces a higher input to a lower output voltage. Duty cycle controls the switching of the circuit. Converter offers high efficiency and accurate voltage regulation, making it widely used in battery chargers and portable electronic devices.

2. **Boost Converter**
Increases a low input voltage to a higher voltage output. Energy is stored in an inductor and released to the load, enabling voltage amplification. Common applications include photovoltaic systems, LED drivers, and energy storage units.

3. **Buck-Boost Converter**

This topology can either increase or decrease voltage depending on operating conditions. Its flexibility makes it suitable for battery charging systems, voltage regulators, and applications with varying input voltages.

4. **Resonant Converter**

Resonant converters use resonant circuits to achieve efficient power conversion with reduced switching losses and electromagnetic interference. They are commonly employed in high-power systems such as EV chargers and renewable energy converters.

5. **Inductive or Wireless Charging**

Transfers energy through electromagnetic induction between transmitter and receiver coils. It eliminates physical connectors and is widely used in consumer electronics and some EV charging applications.

6. **Bidirectional Charging**

Bidirectional systems allow energy flow in both directions. They support energy storage, grid interaction, and Vehicle-to-Grid (V2G) applications, enabling electric vehicles to both draw power from and supply power to the grid.

EV Battery Technology

Always battery performance is affected by vehicle range, efficiency, and overall cost. Hence efforts are focused on developing advanced battery technologies suitable for EV applications. The main battery types used in EVs are lead-acid, nickel-based, and lithium-ion batteries.

Lead-acid batteries are inexpensive, reliable, and safe, making them suitable for certain high-power applications. However low energy density, heavy weight, and limited lifespan are some common limitations seen in the Lead-Acid batteries.

Nickel-based batteries, particularly Nickel-Metal Hydride (NiMH) batteries which have higher power capability and efficiency over 90%. Limitations include high self-discharge rates, generate heat during operation, and require additional control systems, increasing their overall cost and complexity.

Lithium-ion batteries are the most widely used energy in electric vehicles. The advantages are high energy density, low self-discharge, fast-charging capability, long cycle life, and excellent efficiency. Common lithium-ion chemistries include Lithium Nickel Manganese Cobalt Oxide (NMC), Lithium Nickel Cobalt Aluminum Oxide (NCA), and Lithium Iron Phosphate (LFP). Modern lithium-ion batteries can achieve energy densities around 200 Wh/kg and power densities up to 5000 W/kg. [17]

Table 2: Comparison of Batteries used in EV’s

Sr.no	Battery Type	Energy Density Wh/Kg	Cycle life	Round trip Efficiency	Power density/Charge Speed	Cost
1	Lithium-Ion	150-250	1000-5000	85-95	High supports fast charging	Moderate
2	Lead-Acid	30-60	200-1500	270-90	Low-Moderate	Low
3	Flow Batteries	20-50	10000+	265-85	Moderate	High
4	Super Capacitors	25-10	500000	290+	Excellent	High
5	Sold State Batteries	300-500	22000-10000	290-98	Moderate High	High
6	Hydrogen Fuel Cells	30	1000-5000	40-60	Long duration storage	Very High

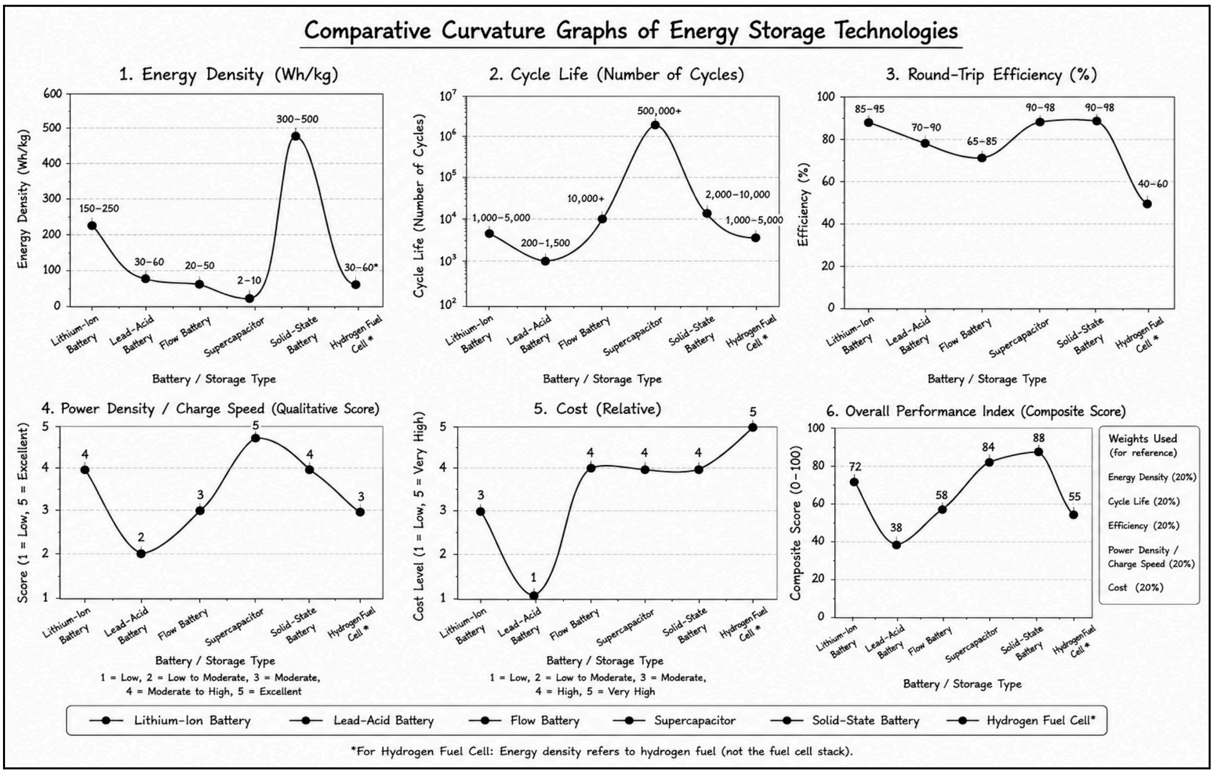

Figure 3: Comparative curvature graphs of energy storage technologies

Battery Charging Methods

1. Constant Voltage Charging (CV)

In this method, the charger maintains a fixed output voltage throughout the charging process. At the beginning, the battery draws a relatively high current, which gradually decreases as the battery approaches its fully charged state. Once fully charged, the battery can remain connected to the charger at a float voltage level to offset natural self-discharge and maintain charge.

2. Constant Current Charging (CC)

Constant current charging supplies a steady current to the battery regardless of its terminal voltage. This method is simple and inexpensive however excessive charging can generate heat and shorten battery life. Therefore, charging should be stopped when the battery reaches full capacity. This technique is commonly applied in nickel-based batteries.

3. Constant Current–Constant Voltage Charging (CC–CV)

This method gives the combined benefits of both CV and CC methods. Charging begins with any fixed current, allowing the battery voltage to rise steadily. When a predetermined voltage threshold is reached, the charger switches to constant voltage operation. During this stage, the charging current gradually decreases until the battery is fully charged. This provides fast charging while minimizing the risk of overcharging. This method is widely adopted in lead-acid and lithium-ion batteries.

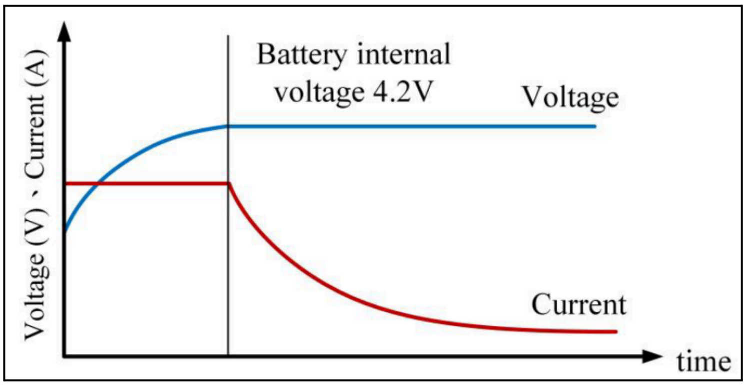

Figure 4: Constant Current–Constant Voltage Charging topology

CONCLUSION

The proposed charger is designed based on the **Constant Current–Constant Voltage (CC–CV)** charging strategy, which is widely recognized as the most effective and reliable method for charging lithium-ion batteries used in electric vehicles (EVs). Initially, the charger operates in the constant-current mode, supplying a controlled charging current until the battery voltage reaches the predefined threshold. Subsequently, it automatically switches to the constant-voltage mode, where the charging voltage is maintained at a constant level while the charging current gradually decreases until the battery is fully charged. A **Pulse Width Modulation (PWM)** signal generated by the microcontroller drives the MOSFET to regulate the charging current with high precision. Voltage and current sensors continuously monitor the battery parameters and provide real-time feedback to the microcontroller. Based on these measurements, the microcontroller dynamically adjusts the PWM duty cycle to maintain the desired CC–CV charging profile. Furthermore, the charger operates in coordination with the **Battery Management System (BMS)** to monitor battery voltage, current, temperature, and overall battery condition. This integrated control approach enhances charging efficiency, prevents overcharging and overheating, extends battery lifespan, and ensures safe, reliable, and efficient operation throughout the charging process.

REFERENCES

[1] Nasir, A., M. S. Hamad, and A. K. Elshenawy. "Design and development of a constant current constant voltage fast battery charger for electric vehicles." 4th International Conference on Modern Research in Science, Engineering and Technology. 2021.

[2] Yadav, Prasad Vijay, et al. "Design of Robust &Efficient SMPS for Charging of Lithium Ion Battery used in Electric Vehicle."

[3] Hidayah, H. A., and M. Somantri. "Design of Battery Charging Control System (Fast Charging) on Electric Vehicle based on Atmega32 Microcontroller." IOP Conference Series: Materials Science and Engineering. Vol. 384. No. 1. IOP Publishing, 2018.

[4] Maheysh Sharrma. “Microcontroller Based Li-Ion Battery Charger.” International Journal for Multidisciplinary Research (IJFMR) E-ISSN: 2582-2160 Website: www.ijfmr.com ● Email: editor@ijfmr.com IJFMR230610712 Volume 5, Issue 6, November-December 2023.

[5] L.Chitra, M.Prabhu Raj, B. Keerthivaishnavi, G. Madhusowmiya, P. Rathna Praveen. “Design of Charge Controller for Electric Vehicle.” International Journal of Recent Technology and Engineering (IJRTE) ISSN: 2277-3878 (Online), Volume-8 Issue-6, March 2020.

[6] Rutvi T. Vora, Ruturaj R. Desai, Kaushik S. Shendage, Prof. Amit Kumar Patil. “Designing of Battery Charging and Controller Circuit for Battery Operated Electric Vehicle (2Wheeler.” International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 08 Issue: 07 | www.irjet.net p-ISSN: 2395-0072, July 2021.

[7] Sharanyadas “Microcontroller Based Smart Battery Charger.

[8] Kadam Jyoti Gopinath1, Padyar Omkar Chandrakant2, Dawal Vinayak Raghunath3. “Smart Charging System for Electric Vehicles.”

International Journal of Research Publication and Reviews, Vol 5, no 4, pp 8360-8366, www.ijrpr.com ISSN 2582-7421,April 2024.

[9] 1Dr. S Parthasarathy, Mr. 2N S Rajesh Kumar, 3Mr. M R Raj Kumar, 4Mr. B Sakthigrish. "Design and Development of Onboard Charger with Smart Monitoring System for Battery Electric Vehicles." ISSN: 2455-2631, IJSDR | Volume 8 Issue 4, April 2023.

[10] Vikram Goud Madaram Babu Thanikanti c,d a , Pabitra Kumar Biswas a , Chiranjit Sain , Praveen Kumar Balachandran a e,f,* Department of Electrical Engineering, National Institute of Technology Mizoram, Aizawl, 796012, India b b , Sudhaka. "Review article Advancement of electric vehicle technologies, classification of charging methodologies, and optimization strategies for sustainable development- A comprehensive review." ScienceDirect Heliyon journal,10 (2024). ScienceDirect Heliyon journal.

[11] Le DucTai, Kunal Sandip Garud ,Seong-Guk HwangandMoo-YeonLee." A Review on Advanced Battery Thermal Management Systems for Fast Charging in Electric Vehicles." Batteries 2024, 10, 372. https://doi.org/10.3390/batteries10100372 h.

[12] Mohammad Waseem , G. Sree Lakshmi , E. Sreeshobha , Shahbaz Khan. "An Electric Vehicle Battery and Management Techniques: Comprehensive Review of Important Obstacles, New Advancements, and Recommendations." Journal Pre-proof P-ISSN CN E-ISSN 2097–3047 61–1528/TK PII: DOI: S2772-6835(24)00038-September 2024.

[13] Camilo Suarez, Wilmar Martinez." Fast and Ultra-Fast Charging for Battery Electric Vehicles – A Review."01october 2019

[14] Pranjal Barman, Lachit Dutta Pronamika Buragohain, Sushanta Bordoloi, Swapna Bharali, Anamika Kalita, Brian Azzopardi. "Renewable energy integration with electric vehicle technology: A review of the existing smart charging approaches." journal homepage: www.elsevier.com/locate/rser.Accepted 28 June 2023.

[15] Jayaprakash Suvvala Ali Elrashidi, Sathish Kumar K, Dhananjayulu, Hossam Kotb. "Review article Integration of renewable energy sources using multiport converters for ultra-fast charging stations for electric vehicles: An overview." Science Direct, Heliyon journal, 10 (2024).

[16] Charging and Discharging of Electric Vehicles in Power Systems: An Updated and Detailed Review of Methods, Control Structures, Objectives, and Optimization Methodologies Saleh Aghajan-Eshkevari 1 , Sasan Azad 1,2 and Somayeh Asadi 3 1 , Morteza Nazari-Heris 3,* , MohammadTaghiAmeli1,

[17] Sithara S. G. Acharige Md. Enamul Haque, Mohammadtaufiqul Arif, Nasser Hosseinzadeh And Amanmaungthanoo, Kazi N. Has. "Review of Electric Vehicle Charging Technologies, Standards, Architectures, and Converter Configurations". IEEE, Digital Object Identifier 10.1109/ACCESS.2023.3267164, May 2024.

[18] Md. Tanvir Shaheda,b,∗, A.B.M. Harun-ur Rashid. "Review Article Battery charging technologies andstandards for electric vehicles: A state-of-the-art review, challenges, and future research prospects." Science Direct Energy Reports journal, June 2024.

[19] F.M. Nizam Uddin Khana,∗, Mohammad G. Rasula, A.S.M. Sayemb, Nirmal Mandal. "Maximizing energy density of lithium-ion batteries for electric vehicles." 7th International Conference on Renewable Energy and Conservation, ICREC 2022, Science Direct Energy Reports 9, 2022.

[20] Pulkit Kumar, Harpreet Kaur Channi Gurpartap Singh, Sehijpal Singh, Raman Kumar, Issa Farhan Dyab , Asha Rajiv, Bharti Kumari , Jasmina Lozanovi. "A comprehensive review of vehicle-to-grid integration in electric vehicles: Powering the future." Science Direct Energy Conversion and Management: X journal, Published by Elsevier Ltd. December,2024.