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Fast Battery Charger For Electric Vehicle With Solar Energy

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Abstract: The paper goes through the fundamentals of fast EV battery charging equipment as well as difficulties related to charging installations for road electric vehicles. The findings of the study are based on the prospect of EV charging stations being unified in smart networks, which connect the main grid with distributed power plants, renewable energy sources, stationary electrical storage devices, and electric loads. The study will look at the characteristics of several types of DC storage devices that will be used in stationary and on-board applications. A user-selectable charging current rate is illustrated in its simplest form. The ultra-fast DC ev battery charging architecture was also given special examination, as it appears to be a viable solution to the problem.
Keywords: PWM, Buck/boost, Charge controller, Mosfet.

I. INTRODUCTION

In recent years, electric automobiles (EVs) and hybrid electric vehicles (HEVs) have been developed to fulfil the rising demand for energy and to address the issues that everyone has in maintaining a clean and green environment. Unlike typical internal combustion engines (ICEs) or older technology-based vehicles, EVs are fueled by rechargeable batteries using renewable energy from wind, solar, grid, hydro, thermal power plants, or other renewable energy sources. Li-ion batteries are the most popular choice for EVs among all battery types due to a number of enticing characteristics like as high power density, low emissions, and long service life. With all types of Li-ion batteries, a proper charge / charging schedule is crucial for human and environmental safety. The battery management system (BMS) for electric vehicles must choose a charging strategy. Protecting batteries from harm, extending service life, and improving performance requires an efficient and efficient charging mode with well-selected CC and CV parameters. On the other side, making the incorrect choice of a long charging time will negatively impact the EV's ease of use, customer adoption, and battery life. Overcharging, on the other hand, can result in severe power loss and battery performance degradation, as well as permanent battery damage. As a result, charging becomes a crucial consideration while creating an EV's control system. High power loss also indicates that power conversion in battery charging is less effective, which must be taken into account. Finally, both the battery environment and internal temperatures may surpass the maximum permissible charge, accelerating the ageing process and, in severe situations, causing explosions or fires. Thus, when developing a battery charging process, battery charging time, power loss, and temperature rise are all significant elements to consider. EVs are a better option these days because they provide an alternative to fossil fuels.

However, poor selection shortens the life of electric vehicles and creates a slew of new problems, primarily owing to the interaction and integration of these vehicles with the current power infrastructure. Furthermore, in order for no or low-polluting automobiles to have a large market distribution, they must have travel ranges and recharging periods comparable to regular oil-based fuel vehicles. As a result, electric vehicles (EVs) require battery packs with large energy storage capacity and low costs. In this regard, lithium-ion batteries are a superior option, as they have demonstrated a great deal of promise in recent years in terms of supplying electric vehicles with improved acceleration and range.

In today's fast-paced world, new lithium compound technologies are emerging that allow for a specific energy of 180 Wh/kg and a maximum charging rate of 6 C, 1C, lowering charging periods to 10 minutes. Typical low-power charging modes are ideal for replenishing battery packs in 7 to 8 hours during the night, ensuring low grid power requirements. Batteries may be charged in 20 minutes using high-speed chargers. In fact, current research show that in 80 percent of cases, the daily travel range is less than 5 km. Slow recharging would be acceptable for most users, ensuring a range of 100 to 150 kilometres during daylight hours. Longer journeys would necessitate frequent electric service stations along the way, capable of supplying a large quantity of electricity, supplied with a configurable rapid charging rate to the battery packs, in order to achieve filling times comparable to oil-based fuel cars. As a result, the battery pack may be charged in a matter of minutes, however a power range of 20 kW (for small city EVs) to 250 kW (for heavier cars) would be necessary.

Existing power infrastructure may not be specifically designed to meet this massive rise in energy demand. As a result of this, the widespread distribution of EVs necessitates an assessment of the potential implications of auto charging on the national power grid, as well as the selection of the appropriate charging techniques among a variety of options. These strategies should consider the number of vehicles that must be recharged during the day and night, the appropriate integration with the RESs and the EVs feature to supply power back to the grid, in this case the operational load (V2G concept), and provide a few support services, such as high power and performance a copy of the archive Furthermore, the amount of power and the behaviour of EV owners must be considered while evaluating charging options. In this context, the EV integration agent (sometimes shortened as aggregator) plays a crucial role between EV owners and the electricity market, DSO, and transmission system operator, primarily by controlling EV charging / discharge rates. The role of EV integration agent is supported by the fact that each EV owner does not have control over the power transaction between his car and the power grid, owing to their low power output (usually a few kW).
Furthermore, the integration agent simplifies charging smart automobiles. Some research suggests using the latest Internet of Things (IoT) technologies to share battery status monitoring parameters across players such as manufacturers, marketers, and users. The goal of this research was to create a state-of-charge (SoC) monitoring device and to investigate how temperature affected the SoC during an electric golf cart test. The research offers a real-time Battery Monitoring System (BMS) based on the coulomb calculation method of SoC measuring and MQTT as a communication protocol based on messages. The suggested BMS is implemented in hardware by utilising appropriate sensor technology, a central processor, interface devices, and the Node-RED environment. Another thesis demonstrates the designs of an electric bike battery management system based on IoT technologies. Effective monitoring of battery pack status information, as well as effective real-time transfer of battery status and location information in the monitoring area, can be achieved with the creation of appropriate software and computer hardware to satisfy the needs of battery management units for real-time battery monitoring.
The following are the main contributions to this project: The suggested three-purpose work takes into account battery charging time, power loss, and especially the growth in battery temperature, which is critical for the safe and efficient operation of electric vehicles, particularly in others. high power situations where the temperature differential between high and interior temperatures can be significant Both the CC and CV categories may be completely examined using meta-heuristic approaches to handle the problem of temporal variation and nonlinear optimization, and the adopted thermoelectric model also contributes to accuracy by taking into account the combination of hot battery and electrical conduct.
All of this can contribute to the development of dependable and authentic EV charging techniques. A few heuristic approaches for exploring the current profile of a good battery charger by reducing the activity of the three objectives are explored and compared, with the modified TLBO outperforming other analogues. Charging current profiles with varied values can be achieved by modifying the weights in the three-purpose function, which has the added benefit of meeting the needs of different battery applications. The fundamental blocks contain an avr controller that controls the internal function of the ic pwm cycle based on the charging current level that is specified. LCD display of battery voltage and current in real time. Current and voltage sensors are used to measure battery value parameters.
Built-in ADC function for converting analogue battery parameters to digital for display. DC to DC converter for altering battery and current voltage based on PWM supplied battery. The DC source from which the battery will be charged

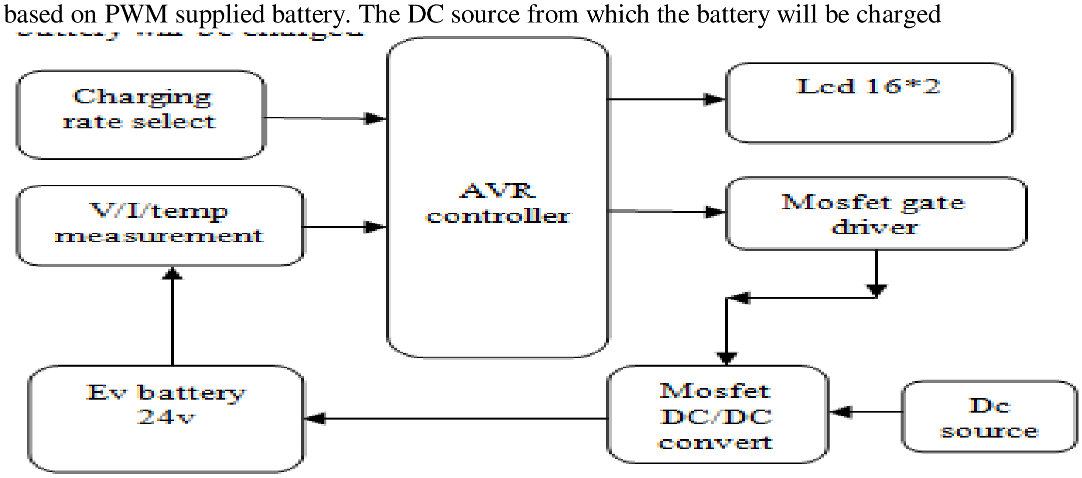

Figure 1. Basic block diagram

Lithium-ion batteries are commonly regarded as one of the most effective energy sources for electric vehicles. Getting a full battery charge while considering the different aspects of safe, efficient, and dependable operation is a huge but difficult task.

The three-purpose function is initially created in this paper for battery charging on a specified scale. Then, a revised charging technique was presented to improve the current profile of the consultant-current-constant-voltage (CC-CV) charger, allowing for better transaction between three competing yet critical battery management objectives. To be more specific, an integrated thermoelectric battery model was initially introduced. Temperature regulates charging to prevent heat from escaping from batteries. Then, a three-dimensional function is suggested that incorporates three goals: charging time, power loss, and temperature rise (both internal and exterior). Teaching-learning-based-optimization (TLBO) and particle swarm optimization (PSO) are heuristic methods used to increase the performance of the three objectives, and their development performance is equivalent. The weight impacts of various phrases on purpose work are investigated. As illustrated in the block diagram, the test results suggest that the proposed charging approach may provide the needed effective power supply, existing configurable profiles, and the acceptable trade-off between conflicting objectives. Furthermore, the suggested standard charging system is easily adaptable to other types of batteries.

Charant Current Constant Voltage (CC-CV) charging is recommended for Li-Ion batteries. This approach comprises charging the battery with constant power until a certain power limit is achieved, and then progressively decreasing the charge to ensure that the stable voltage of 4.2v is not exceeded. The battery dosage used is 24v 10amp lithium ferro phosphate. When the current restriction reaches a normal 50..150 mA, charging is turned off. For security considerations, Extra Payment Terms (EoC) were employed. This incorporates EoC detection that is both timely and energy-based. When you connect the battery, the charger checks the voltage at the terminals and limits the charging status by %. The figure is used to determine the remaining volume and charging time. When one of these values is achieved, charging is turned off. The current charging level is determined by the user. Batteries are commonly regarded as one of the greatest sources of electricity for electric vehicles. Getting a full battery charge while considering the different aspects of safe, efficient, and dependable operation is a huge but difficult task.

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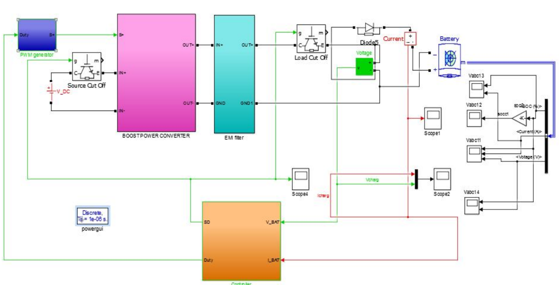

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Figure 2. Simulation

Continuous current / constant voltage (CC / CV) mode is an efficient approach to charge lithium batteries. We use the current to charge the lithium battery if it is nearly empty. We must ensure that the current charge is less than the battery-acceptable charger's current capacity. When the battery voltage increases somewhat as a result of consistent charging, the charger will ensure that the charging voltage is set to "continuous voltage" and reduce the charging current. This condition will be terminated once completely charged.

We need a product that converts and controls a particular amount of DC power to a different DC level for this project. There are numerous DC / DC converters that may accomplish this, including colour converter converter, boost converter, buck-boost converter, and converter. The colour converter is a flexible converter that switches on and off the electronic voice on a regular basis, and it is a voltage converter that decreases when the output voltage is less than the input voltage. The boost converter is similar to the back converter except that it functions as a step-by-step converter rather than a step-down converter. Its output voltage exceeds its input voltage. The output voltage of a buck-boost converter might be higher or lower than the input voltage. As for the buck-boost converter, the output voltage can be higher or lower than the input voltage. Finally, the cuk converter is similar to the buck-boost converter; the output voltage may be greater or less than the input voltage. The difference between buck-boost is that the converter output has a polarity drop.

Buck Converter was picked for this project since its premise is simpler than the others. In addition, the backpack converter boosts current. In general, baker converters in solid state should have the following properties: an intermittent and continuous current inductor, a zero central inductor voltage, a zero current capacitor current, and, most crucially, a zero power given to the load. the same as the power supplied to the relevant component's source The power loss in the incorrect portions should also be reimbursed to the account.

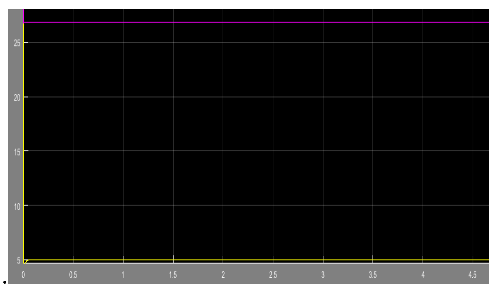

Figure 3 result current 5amp, voltage 25v

The CC CV algorithm and how it works in our system was one of the project's highlights. As previously stated, the PWM approach is ideal for maintaining a CC CV. This method was based on voltage calculated power and power from a DC / DC converter, followed by comparing power at each time and recording the maximum power by modifying the system's activity cycle per pwm. Before implementing this approach, Matlab software was used to simulate the complete system and test the code. Because of its capacity to copy and encrypt a single file, Matlab software was chosen. The code was written step by step using a flowchart algorithm.

Model for DC-DC converter simulation. Due to the extremely fast voltage exchange rate, the input capacitor is required to stop the input voltage. The instantaneous power produced by a solar panel, grid, or any other source is computed by multiplying the output current and current across the DC / DC converter. This process is carried out in a loop to replicate and generate several power readings: P1, P2,... Pn, Pn + 1. If the new power, Pn + 1, exceeds the prior Pn value, the operational voltage is compared. The activity cycle drops if the new Vn + 1 voltage is greater than the old Vn voltage; otherwise, the activity cycle increases. Otherwise, if the new power is less than the previous value and the new voltage is more than the previous voltage, the activity cycle increases; otherwise, it decreases. Changing the operating cycle will cause the operating voltage and power to be recalculated, resulting in a higher power output. For faster charging, the output can be adjusted to 25 amp. The simulation results show a continuous current output of 5 amps and a voltage detection of 25 volts, which may be varied based on the charging level chosen. One of the most important aspects of this project was the CC CV algorithm and how it was implemented on our system. As previously stated, the PWM approach is used to preserve the CC CV. This approach was based on the electrical power computed with voltage and current from the DC/DC converter, and it then compared the power at each time and tracked the maximum power by adjusting the system's duty cycle via pwm.

To build this approach, Matlab software was used to simulate the entire system and test the code before putting it into practise. Because of its ability to simulate and code in a single file, Matlab software was chosen. The code was written step by step using the algorithm's flowchart.

The DC-DC converter simulation model The input capacitor is required to maintain the input voltage due to the peak current requirement of switching power supplies. The instantaneous power produced by the solar panel, grid, or any other source at any one time was estimated by measuring and multiplying the output voltage and current across the DC/DC converter. This function was called in a loop, resulting in many power readings: P1, P2,... Pn, Pn+1. The operational voltage is compared if the new power, Pn+1, is greater than the prior value, Pn. If the new voltage Vn+1 is larger than the prior voltage Vn, the duty cycle is reduced; otherwise, it is increased. Otherwise, if the new power is less than the previous value and the new voltage is more than the previous voltage, the duty cycle will be increased; otherwise, the duty cycle will be decreased. When the duty cycle is changed, the operating voltage changes and the power is calculated again, resulting in the maximum power point. For quick charging, the output current can be increased to 25 amp. The simulation results show that the output current is 5 amps constant and the voltage is 25 volts, which may be changed based on the charging rate.

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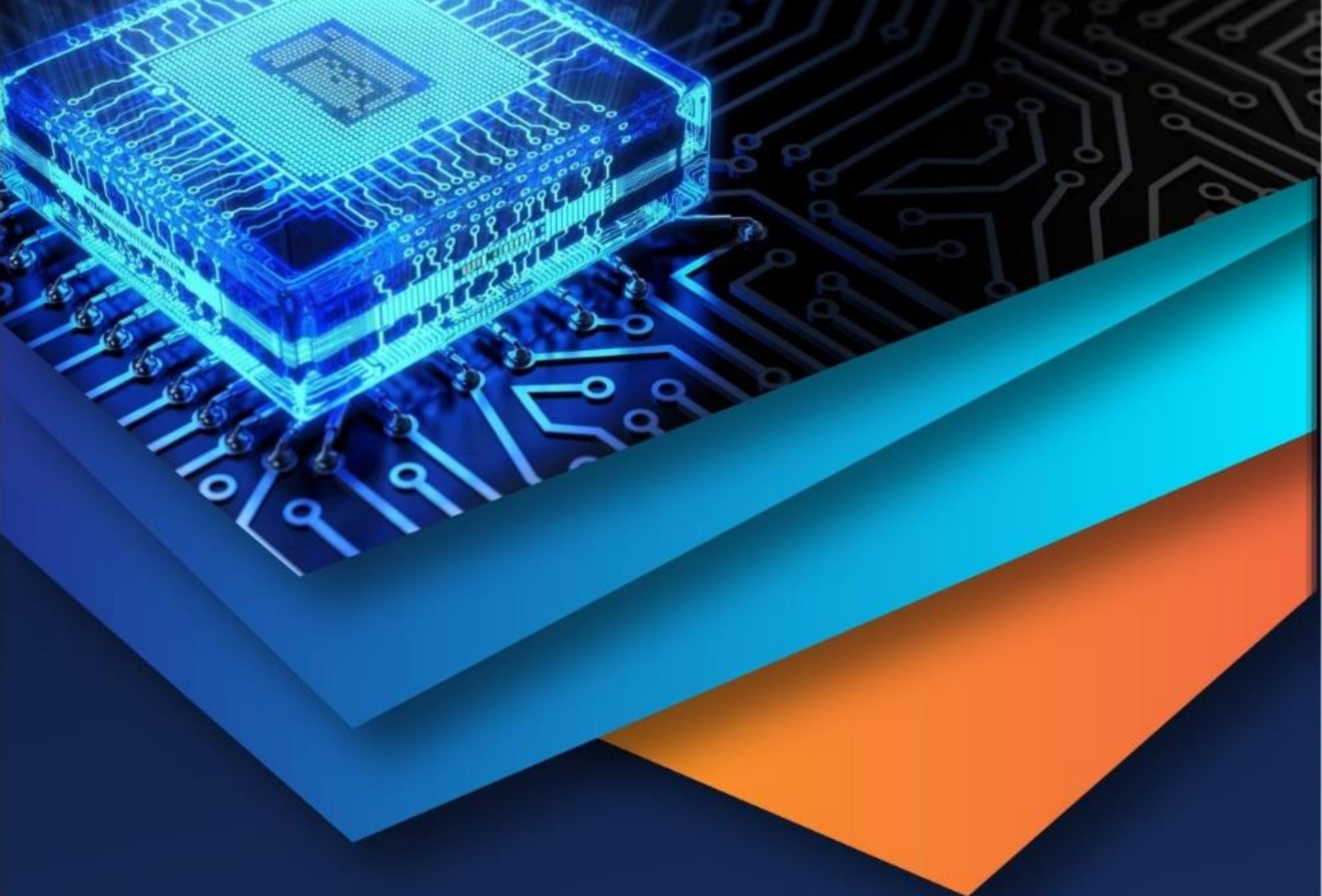

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