On Board Fast Charger for Electrical Vehicle Using Dual Inverter

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Abstract - **This framework presents another battery charger incorporated with the drive arrangement of an electric vehicle. This work proposes an incorporated charger in light of the double inverter to empower fast electric vehicle charging from the AC or DC lattice without extra DC/DC converters. Reproduction studies exhibit usefulness of consistent current - steady voltage control and energy adjusting of double Li-particle battery packs. Or on the other hand the control arrangement of the battery charger, we propose the utilization of the immediate power hypothesis and a sliding mode regulator for the charger input flows. At long last, to check the way of behaving and attributes of the proposed coordinated battery charger and control framework, a few tests are be introduced.**

Keywords: Power grid, Fossil-flue, PV distribution.

I. INTRODUCTION

The importance of electrical vehicles (EV) has been hugely increased, year after year. Certainly, their role is critical to answering the problem of the greenhouse effect [1]. Indeed, in accordance with the International Energy Agency, in 2018 the global stock of electric passenger cars exceeded 5 million, which has increased 63%, taking into consideration the previous year. The electric vehicle supply equipment (EVSE) consisting of a rectifier, LC filter, and high-power DC/DC converter, is commonly taken off-board to minimize weight and cost of the vehicle. Alternatively, a mobile fast charger developed by Andromeda Power LLC can be stored entirely in the cargo area. Although this offers charging where an AC or DC outlet is available, the equipment compromises the weight and size of the vehicle. In summary, fast charging equipment is costly as an off-board charger and bounded by the physical limitations of the vehicle as an on-board charger.

II. METHODOLOGY

DC charging is an attractive option over AC level charging due to its potential to charge the electric vehicle from $0-80\%$ in less than an hour the electric vehicle supply equipment (EVSE) consisting of a rectifier, LC filter, and high-power

DC/DC converter, is commonly taken off-board to minimize weight and cost of the vehicle.

Although this offers charging where an AC or DC outlet is available, the equipment compromises the weight and size of the vehicle.

In summary, fast charging equipment is costly as an off-board charger and bounded by the physical limitations of the vehicle as an on-board charger. Although two inverters are required, there is marginal increase in cost because each DC/AC stage is rated for half the total processing power.

The dual inverter facilitates power transfer between two isolated DC sources and the open-end winding of the motor via differential connection of two voltage source converters.

From previously proposed applications of the dual inverter for all-electric vehicles, the energy source is either a split-battery pack or a battery and floating capacitor bridge.
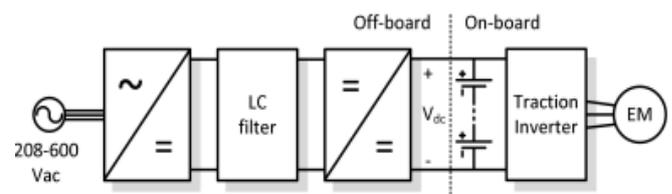
(a) Conventional fast charger

The average model of the dual inverter is developed for identical energy storage integration, as in the case of the split battery pack.

The battery currents, i1 and i2, are derived from power balance. Although power flow is bidirectional, this work identifies Vdc as the input and V1 & V2 as outputs solely for unidirectional charging.

$$V_{1i} = d_{1i}V_1$$

$$V_{2i} = d_{2i}V_2$$

Where i = {a, b, c} for 3 interleaved DC/DC stages. Applying KVL to any arbitrary phase (assuming lossless), the voltage conversion ratio is

$$V_{dc} = V_1 d_{1i} + V_2 d_{2i}$$
$$V_{dc} = (V_1 + V_2)d$$
$$\frac{V_1 + V_2}{V_{dc}} = \frac{1}{d}$$

Here d1i = d2i = d for a system with identical line losses and storage capacity. Notice the conversion ratio is similar to that of the boost converter, suggesting V1+V2 > Vdc to enable boost operation. In this system, the DC microgrid voltage is commonly regulated at 380V, and each string of EV battery cells spans from 300V to 500V.

Next, the DC bus current is derived as the zero-sequence component of the stator currents:

$$i_{dc} = i_{sa} + i_{sb} + i_{sc}$$

Output currents i1 and i2 can be derived from power balance

$$V_1 i_1 = V_1 d_1 (i_{sa} + i_{sb} + i_{sc})$$
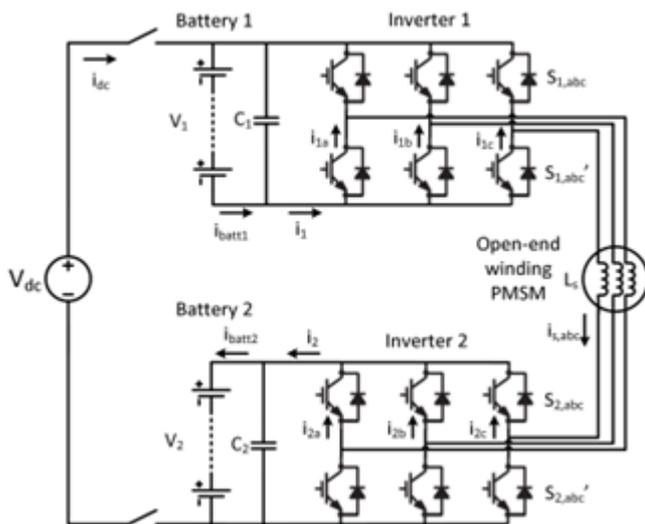$$i_1 = i_{dc} d_1$$
$$i_2 = i_{dc} d_2$$

upper and lower modules are labeled "1" and "2", respectively. The EV battery pack consisting of n-strings is split evenly between a pair of 2-level voltage source inverters. Each n 2 battery strings have the same number of cells per string, thus maintaining the same voltage as the combined battery pack. The AC side is connected to the open-end winding of the electric motor such that the inductors are shared between the two switch networks. The novelty of the dual inverter integrated charger is that differential connections can be leveraged for EV charging. The DC contact pins taps off the high-side of module 1 and low-side of module 2. Power can be fed from the AC grid via off-board rectifier or directly from the DC micro grid without a DC/DC intermediate stage.
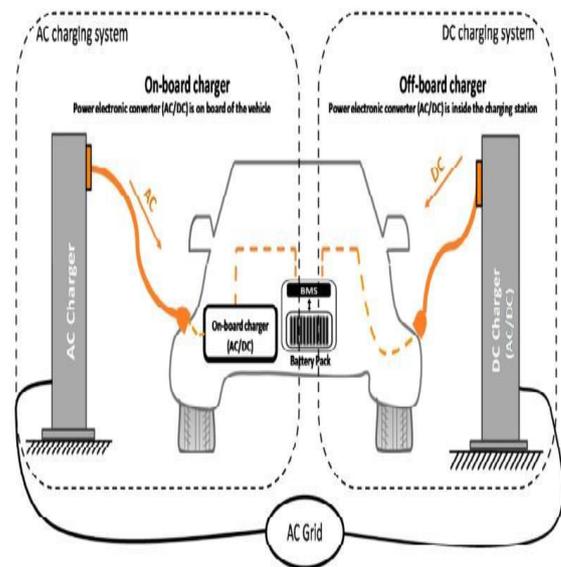

Figure: On board fast charger diagram

On-board charger (OBC) is used in an electric vehicle (EV) or hybrid electric vehicle (HEV) to charge the traction battery. The On-Board charger system described in the material below converts the AC input from the grid to a DC input which charges the battery.

Off-board chargers, which supply a DC to the vehicle battery, must communicate with the vehicle in order to supply the battery with the correct voltage and current. This is particularly the case with no dedicated chargers as used in public charging stations, which should be able to supply vehicles with varying battery voltages and chemistries.

These concern requirements for diagnostic systems implemented on a serial data link layer, which allows a tester to control diagnostic functions in and on vehicle electronic control unit.

Figure: Proposed dual inverter charger

The proposed DC charger is shown in fig. For the purpose of this paper, switches, voltage and current quantities for the

The protocols were specifically adapted for the selected application: after the initialization phase by the off-board charger, the vehicle's charge control unit controls the charging process of the off-board charger. Contrary to the standard communication according to ISO 14230 where the server and the client are fixed during all the session, their roles are definitively reversed after the initialization phase.
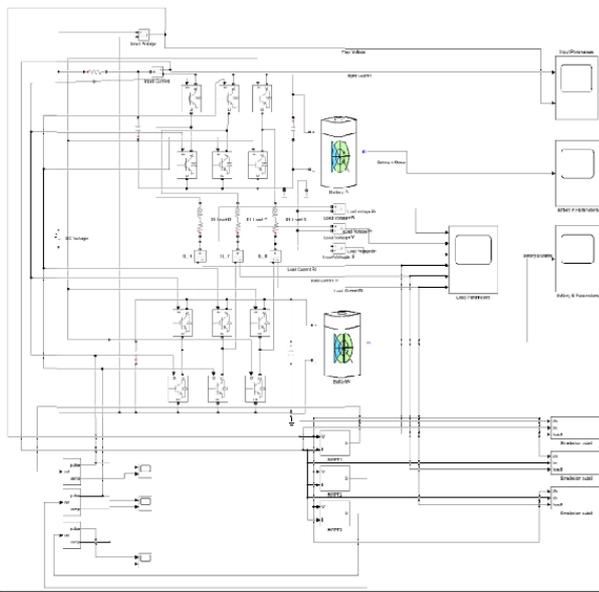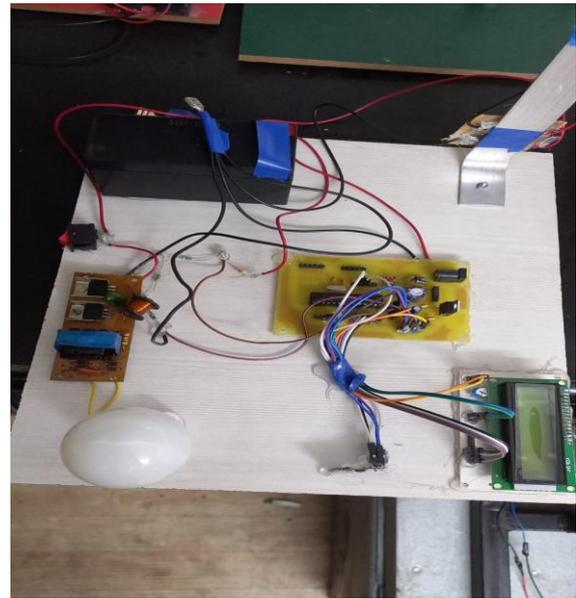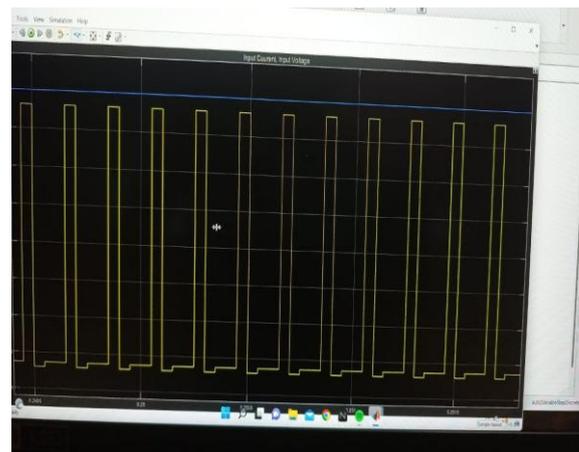

Figure: Simulation Diagram

Figure: System Output

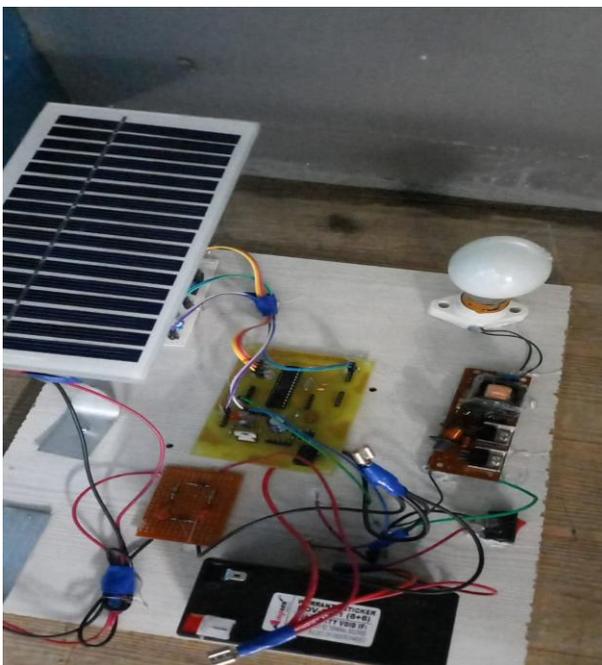**Figure: Project Implementation**
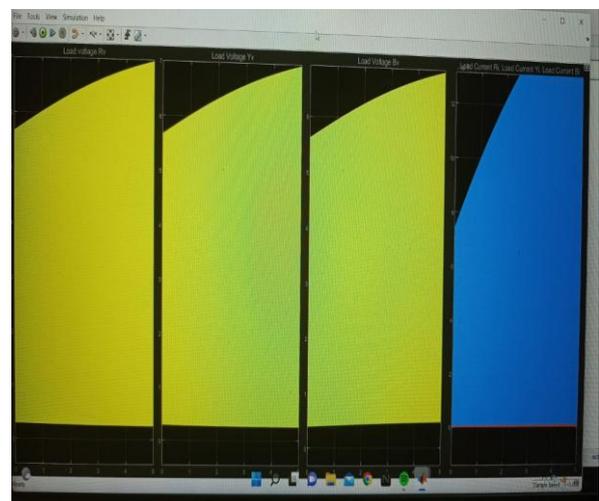

Figure: Output In wave Form

Figure: Output screen

III. RESULTS AND CONCLUSION

This work proposes a fast-charging method which leverages high-current traction drive and existing power train components in the dual inverter drive, thus enabling rapid charging functionality without additional equipment. Though a second converter is required, higher motor voltages and lower currents may be utilized. Furthermore, conventional charging equipment typically contributes to additional inductors and cooling units in the vehicle. The proposed integrated charger based on the dual inverter has been demonstrated to enable charging in a wide voltage range.

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