

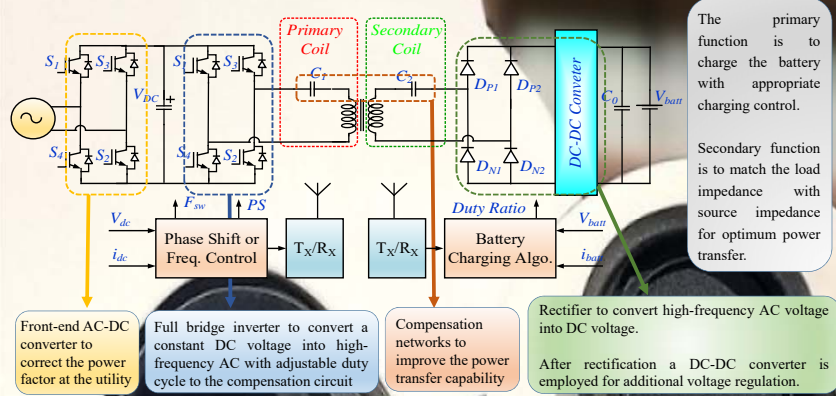
Project Objectives

Qatar General Electricity and Water Corporation (Kahramaa) is planning to set up 400 electric car charging stations by the end of 2022 to encourage the use of electric and hybrid vehicles in Qatar.

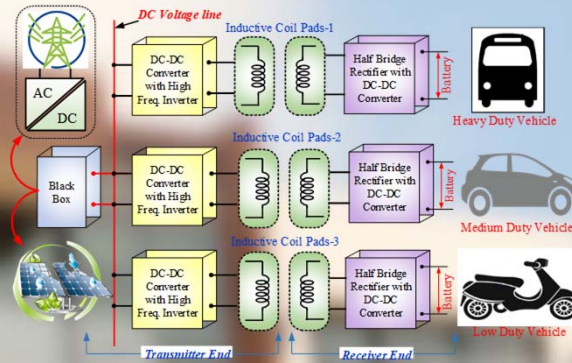
ABSTRACT

The proposed fast charging system is capable to simultaneously charge the three different duty electric vehicle (small, medium, heavy) at the same time. The size and weight of the proposed system is reduced by operating at the higher switching frequency. The load (battery) dependency and system efficiency are eliminated and improved resp. by adopting the series-series compensation network in the proposed system. The CC-CV charging algorithm is adopted to charge the battery and PI controller with additional controlling loop is developed to remove the overshoot of the current during the CC to CV transition.

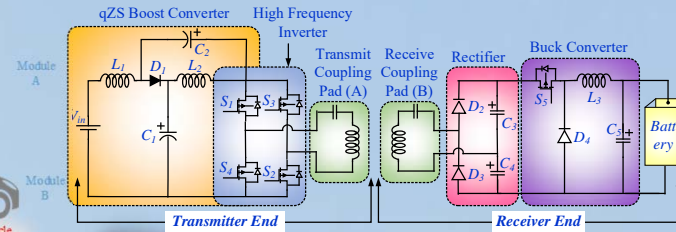
Basic Structure of Wireless EV Charging System



Block Diagram of Proposed Wireless EV Charging System



Block Diagram of Proposed Wireless EV Charging System



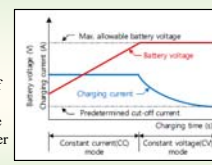
1. CC-CV mode achieve with simple control
2. qZSI used for boosting the input supply
3. Single stage conversion process
4. Voltage doubler rectifier used with less components.
5. Series-Series Compensation

Resonant Inductive Power Transfer

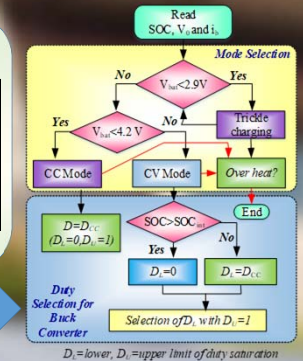
- ✓ Uses at least two tuned resonant tanks which resonate at the same frequency.
- ✓ The primary functions of the resonant circuits include:
 - Maximizing the transferred power,
 - Optimizing the transmission efficiency,
 - Controlling the transmitted power by frequency variation,
 - Matching the transmitter coil impedance to the generator
- ✓ The advantages of RIPT over IPT:
 - Increased range up to 40 cm,
 - Reduced EMI, higher frequency operation.
 - Higher efficiency.

Constant Current & Voltage Method

- Widely Acceptable
- Simple in control
- Battery voltage is controlled at cut off voltage.
- Increase battery life as compared to other charging algorithm.
- Suitable for Li-I



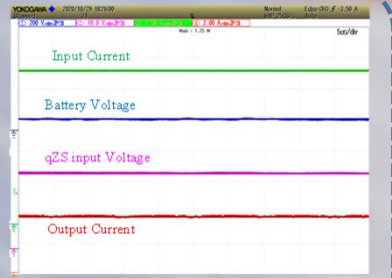
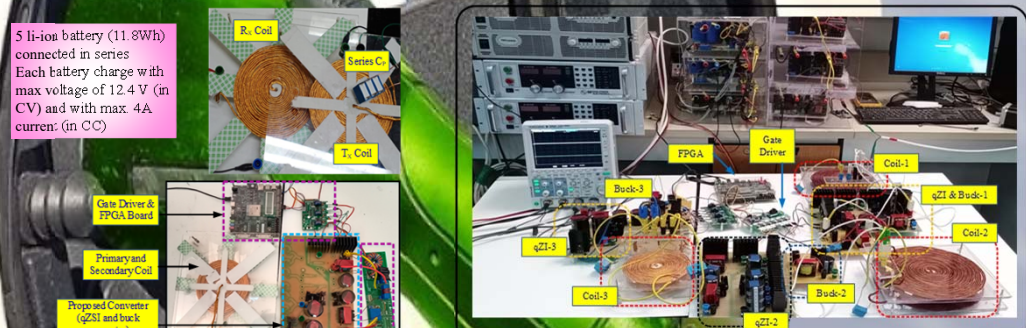
Battery Charging Algorithm



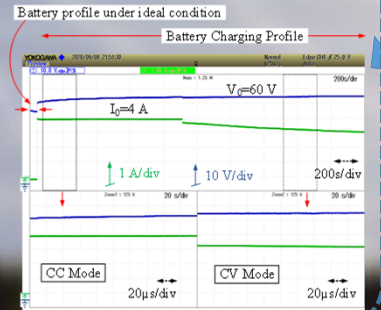
Flowchart for selection of charging modes of EV along with CC and CV control modes

The voltage and current transient during the CC to CV transition is overcome by applying additional control loop

Experimental Validation



Battery charging profile in CC-CV mode



The proposed system is tested with 444Wh power battery in both CC and CV modes.

CONCLUSION

- ✓ The proposed wireless power transfer fast charger has been demonstrated to show the charging of EV in both CC and CV modes.
- ✓ The detailed control technique is developed to achieve the desired response.
- ✓ Battery current transients during charging mode shift is eliminated by controlling the PI controller.
- ✓ Simulation results validate the performance of the proposed qZSI based charger.
- ✓ Suitability of this proposed converter is successfully demonstrated by smooth charging mode change (without transient) and low tracking ripple thereby making the system accurate as well as robust.
- ✓ The experimental results shows the feasibility and controllability of the proposed system