

Project Title: Design of Electric Vehicle Charging System

Industry Advisor: Advanced Research Lab for Multifunctional Lightweight Structures (ARL-MLS)

Project ID: ARL-MLS3

Supervisor: Professor Kamran Behdinin

Disciplines Required: ECE (1), ME (1)

Disciplines still needed:

Start Date: Jan. 11, 2021

End Date: Aug. 31, 2021

NDA: yes

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Project Description: In densely populated cities/countries like Hong Kong and Singapore, mass rollout of EV charging station is a key challenge, because of the lack of or limited high voltage power infrastructure in older buildings. Both the Hong Kong and Singapore government has already made commitment towards carbon neutrality by 2050 and mass adoption of EV is central to their strategy. In order to speed-up the rate of adaptation for EV, mass rollout of EV charging points/stations must be done so that can support the growth of EV market. Insufficient EV charging infrastructure are often seen as a key barrier for EV adoption in most market. It has become an urgent societal mission that a smart engineering solution is needed to allow EV charging points/stations to be setup without a huge investment on the existing power infrastructure.

Design a EV charger augmented with battery storage system (including a smart energy management algorithm) to address peak charging demand and to charge up the battery when overall electricity demand is low. The proposed system should also have a user friend interface (mobile App) to inform EV owner when charging has been completed to avoid blockage of the charger for the next available customer. Possible challenges include:

- Safety – battery overheat is a common issue
- Charging speed - EV charging from battery tends to be slow, how can we speed up the charging time?
- Space constrain - design of the EV charger+battery has to be compact due to space limitation (likely solution is to have each EV charger combine with a slim battery than a huge central battery bank located inside the electrical room)
- Cost – to encourage wider adaption, the construction cost of the charger must be at or below current market rate. (consider using as much off-the-shelf component is essential)

Project Deliverables: The EV+battery charging system must be safe, reliable and cost competitive. The design must be suitable for the Hong Kong and Singapore market (Voltage, frequency, standards maybe different from Canada). It should also appeal to the EV owner population as the preferred charging partner of choice due to the superior user interface and overall customer experience (including the “chic” design of the charging station). For the provider of the parking/charging space and electric power provider, the system must be compact enough to be installed in some of the older building which are usually constrained by the available space both at the electrical room and/or at the charging location.