EVCHIP

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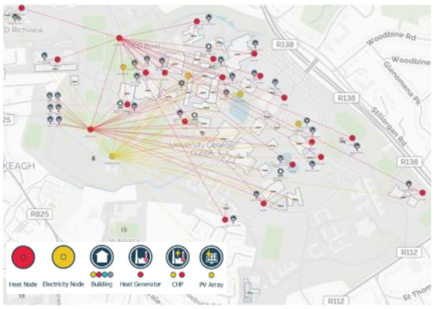
Electric Vehicles Charging Platform for Community Demand Response Aggregators

"EV charging optimisation systems for shared premises is a game changer for the full decarbonisation of our society"

This project explores the potential for an aggregated electric vehicle (EV) charging optimisation algorithm, in a campus facility, that accounts for building energy consumption, vehicle operation and parking, grid constraints and wholesale electricity pricing. Researchers are working on a suite of modelling approaches to predict how centrally optimised EV charging could provide suitable charging volumes at competitive rates for drivers, while balancing facility-level electricity requirements and minimising grid impacts. Controllable EV charging, integrated with building energy management, can balance facility-wide energy consumption by unlocking the inherent flexibility associated with battery-operated cars.

The workplan aims to develop a shared data repository with building consumption data and parking usage patterns. UCD has developed an energy simulation model of the campus (see figure). The model has been calibrated with available building energy consumption data and used to evaluate the grid impacts from different levels of EV penetration: 25, 50, 75, and 100%. A detailed analysis has revealed some asset overloading; note that transformers and lines were specified for the existing base load and did not consider the proximity to car parking spaces.



Mitigating the risk of grid congestion can be attained by controlling the number of EVs charging, at any given time, according to the grid assets‘ available capacity (once the critical building load has already been served). The results showed that uncontrolled charging at a workplace setting will strongly correlate with commuter behaviour and, in extension, will add to the morning electricity demand peak. However, given that most commuters are expected to be parked for up to 8 hours, and that the duration of a charging event is often less than that, there is motivation to limit certain charging events until the network can serve them.

Another working strand of the project concerns the development of forecast models for the estimation of EV parking times. Note that the specific behaviour of parking lots in shared premises substantially differs from the one in general street parking lots. In campus-like facilities (Universities, large industries, etc) we can observe regular parking patterns which are associated with the particular behaviour of staff and visitors during working hours. These regular patterns can be an advantage when performing event predicitons and therefore, facilitate optimal EV charging plans. The objective of the developed method was to predict the parking slot occupancy duration in a given parking lot. Differently for many state of the art approaches, that want to predict if a giving parking lot will be free in a next period of time, the novelty here is the focus on the occupancy duration for each car and slot.

Two different datasets were selected to develop the prediction model: the parking dataset of CNR Pisa Area and the one from the campus in the University of Paraná, Brazil. After a preliminary data gathering and data cleansing, the datasets were normalised and merged with the images from different cameras positioned along the perimeter of the area. The images of the parking patterns where analysed by an image recognition software developed by the CNR, enabling to identify the status of the parking slots (Occupied/Free) with a 5-minute resolution. The accuracy of a preliminary set of results was assessed using different classification algorithms. As expected, parking areas with longer parking times and lower standard deviations were more accurately predicted.

Project Duration

17.11.2019 - 17.11.2021

Project Budget

Total Budget: € 342,524,000.-

Funding: € 342,524,000.-

Project Coordinator

University College Dublin (Ireland)

Project Partners

- National Research Center (Italy)

Project Website

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ERA-Net Smart Energy Systems Joint Call 2018

This project has been awarded funding within the ERA-Net SES Joint Call 2018 for transnational research, development and demonstration projects. EUR 33.4 Mio of funding have been granted to 23 projects from 16 regions and countries.

ERA-Net Smart Energy Systems

Smart Energy Systems ERA-Net

This project has received funding in the framework of the joint programming initiative ERA-Net Smart Energy Systems. The initiative has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreements no. 646039 and no. 755970.

Main Objectives

The objective of the EVCHIP project is to explore and validate a business model for the commercial value of EV charging service aggregation.
(*) Under the research plan proposed, researchers will create electricity network models based on the representation of parking premises charging points. Such models will be used to assess the maximum potential penetration of EVs, thus proving an indicator for mitigating solution costs. The models will be developed utilising the historical data available from the building energy management system installed on the premises.
(*) In parallel to the assessment phase, a set of novel predictive algorithms for the forecast of energy load of the premise, parking occupancy profiles and user behaviour patterns will be developed and tested with public or collected datasets. Researchers will develop an optimisation algorithm for controllable bi-directional load, integrating the predictive machine learning models to establish a prototype for an on-demand service provider for the platform.
(*) The results of the optimisation algorithm will be aggregated and used to validate the software in a transnational context. During the development and test phase, the researchers involved in the project will publish the empirical results in top journals and conferences. Furthermore, they will communicate key findings amongst the immediate participant communities, throughout the SEC network, and within the ERA-Net Knowledge Community.

Expected Main Results

The EVCHIP projects intended impact is three-fold:

(1) validate and promote an integrated business model for demand response using aggregated controllable EV charging;

(2) engage the communities involved with the individual university participants including staff, students, and building managers, as well as a broader network of stakeholders through the Sustainable Energy Communities programme;

(3) promote and advance research in smart energy systems.

Joint Programming for Flourishing Innovation from Local and Regional Trials towards a Transnational Knowledge Community

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