

Title :“Managing the Seams Between Electromobility and Power Systems”

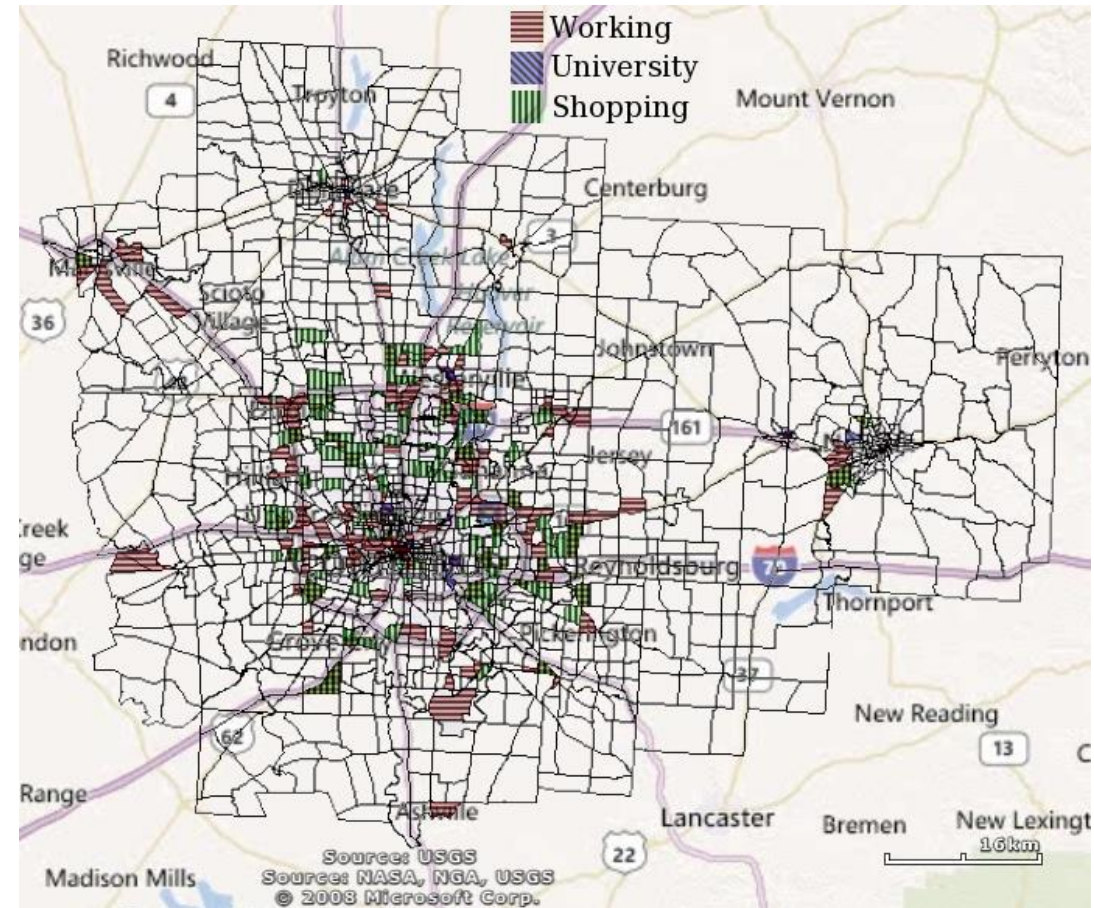
Speaker : Ramteen Sioshansi, Professor in Department of Integrated Systems Engineering

Affiliation : The Ohio State University



Abstract

Electromobility offers the opportunity to increase the efficiency and reduce significantly the environmental footprint of transportation. On the other hand, if the seams and interactions between the transportation and electric infrastructures are not managed well, the adoption and benefits of electromobility solutions can be hampered. This talk will provide an overview of some of the important seams between these two systems and the challenges and opportunities that they present. In particular, the design and layout of charging infrastructure and the management of vehicle-charging loads will be discussed.



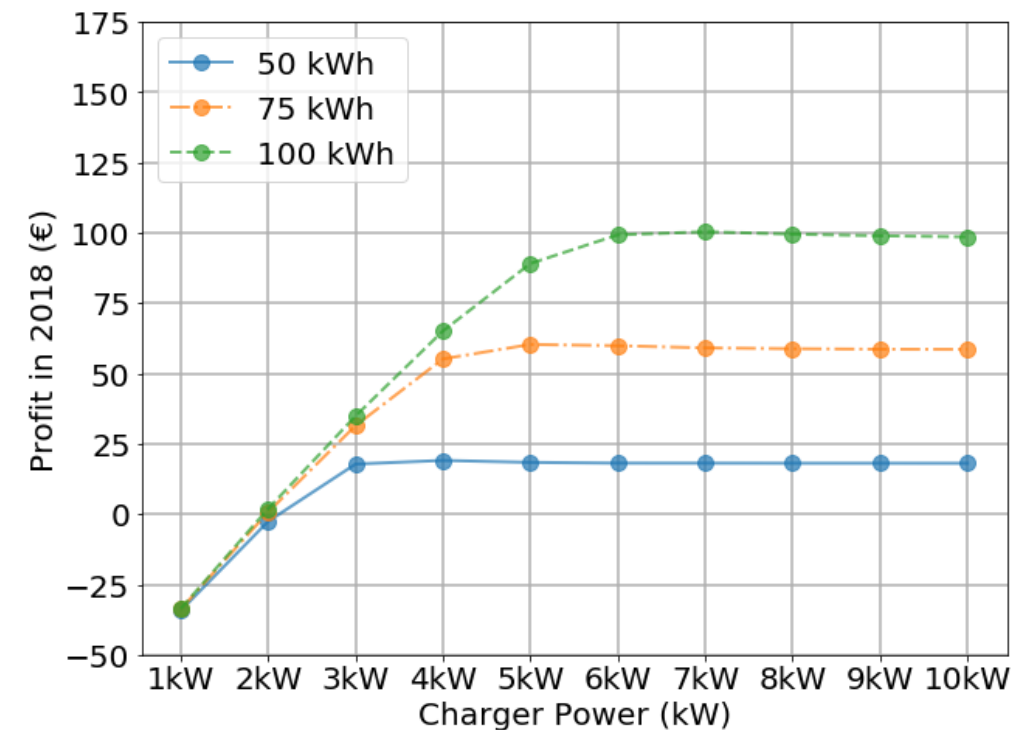
Title : “Reliable Frequency Regulation through Vehicle-to-Grid”

Speaker : Dirk LAUINGER, PhD Student in Optimization under Uncertainty

Affiliation : EPFL

Abstract

Vehicle-to-grid (V2G) aims to increase the low utilization of electric vehicles and hence their competitiveness by making their batteries available to the power grid. Primary frequency regulation, that is, insuring the transmission system operator (TSO) against unforeseen electricity supply and demand mismatches in real-time, is considered to be one of the most valuable applications of V2G. In this paper, we formulate an adaptive robust optimization problem for V2G that maximizes the expected profit from selling primary frequency regulation, while guaranteeing that all market commitments can be met for all frequency deviations in an uncertainty set specified by new EU legislation. We show that the battery charging and discharging decisions are linear functions of the frequency deviations at optimality. This enables us to reformulate the seemingly intractable optimization problem as a concise linear program, which can be solved efficiently. We assess the performance of our model in a rolling horizon backtest based on frequency measurements with a 10 second resolution and French market prices over the years 2015 through 2018. Our results show that the value of providing primary frequency regulation has declined by about 40% after regulatory prices changed in 2016. Depending on the charger and battery size annual profits range from 83€ to 165€ per vehicle in 2018. Contrary to previous literature, we show that profits increase with charger size only up to a certain threshold beyond which they stay constant.



Title : "Charging Infrastructure for Electric Vehicles in urban areas, lessons learned and an outlook"

Speaker : Rick WOLBERTUS Msc, Researcher in Charging Infrastructure for Electric Vehicles

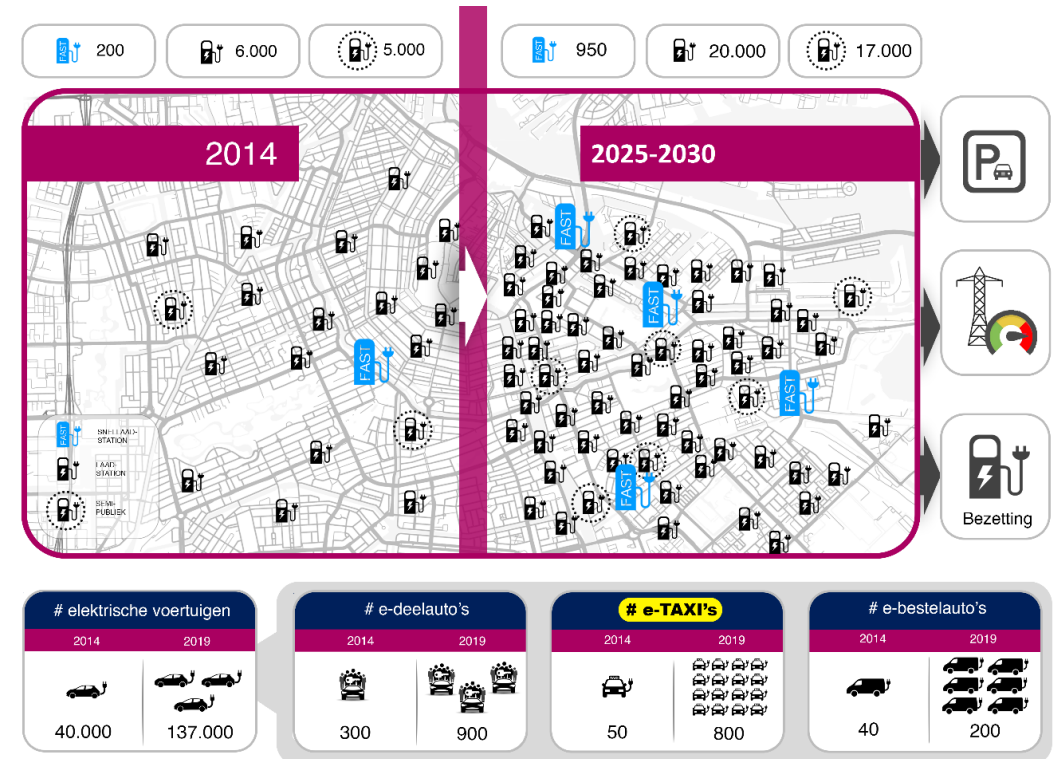
Affiliation : Amsterdam University of Applied Sciences



Abstract

Electric vehicles show great promise to increase air quality and decrease emissions especially in urban environments. Charging of these vehicles predominantly happens when the car is parked, preferably overnight. Yet, in many urban environments drivers do not have home charging opportunities and therefore rely on public charging infrastructure to facilitate their charging needs. The four major cities in the Netherlands have been a worldwide exemplar of how to build a public charging network with one of the densest infrastructure available. This research presents the lessons learned from the past years of charging infrastructure roll-out and relies on analysis of a large amount (+8 million charging sessions) data on public charging infrastructure utilisation. It answers questions such as: how is the infrastructure utilised? Which factors play a dominant role in utilisation? Which policies can influence charging behavior? Analysis comes from descriptive, modelling and simulation work.

Secondly, the talk will have an outlook on the next years. Although the roll-out strategy in the past years has been considered a success, there are serious questions about the scalability. How to deal with scaling from 1% of all cars to 100% by already 2030. Is it possible to maintain the same roll-out strategy? Which other roll-out strategies can be considered? We will show results of simulations of charging behaviour in an urban environment and provide policy advice. Additionally we will set an agenda for future work and considerations.



Title : "Tariff design with electromobility and V2G"

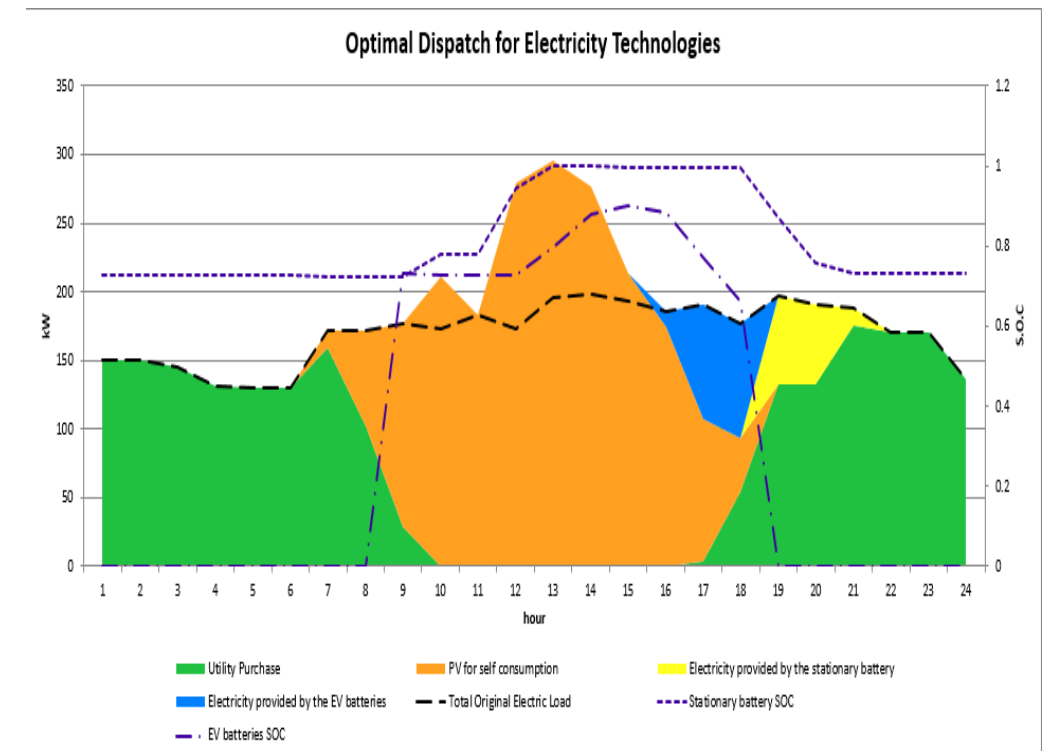
Speaker : Icaro Silvestre FREITAS GOMES, PhD candidate in Shared Energy

Affiliation : VEDECOM/CentraleSupélec/Paris-Sud

Abstract

The current electricity network tariffs are not adapted to recover all the costs of the utility in a scenario with a high penetration of photovoltaic systems and decentralized electricity production for self-consumption, specially when coupled with stationary batteries. This effect will cause the "spiral of death", a classic problem inflicted on the network operator by the penetration of photovoltaic battery systems, in which an increase in tariffs will give more incentives to install those systems and those who do not have PV panels will end up subsidizing those who have.

The latter effect is called cost-shifting and raise issue of fairness regarding costs reallocation. Electric vehicles can play an important role in providing services to the electric power grid (if V2G enabled) and in attenuating the negative effect of increasing tariffs caused by photovoltaic panels. As the general electricity consumption would increase, the utility could recover its costs and the tariff would tend to decrease for all customers as well as the cost shifting. To assess the problem we use: DER-CAM, a known mathematical model that formulates the microgrid design problem as a Mixed Linear Integer Program (MILP); the capital and operational costs of the distributed energy resources; real consumption data from commercial and industrial buildings from California main cities; various time-of-use tariff schemes (capacity or volume based) from the local retailer Southern California Edison. The preliminary results of this Californian study case show the counterbalancing effect of EVs and PV on grid cost recovery that can attenuate network costs recovery shortfall. Moreover, capacity based tariffs dramatically reduces the cost-shifting, meanwhile volumetric based tariffs can push EV development forward and minimize the private cost for the microgrid owner. Future steps will include more building simulations with different demand profiles to verify the robustness of the results.



Title : “Market acceptance of shared electric mobility in Germany”

Speaker : Dr. Uta BURGHARD, Researcher in Social Sciences

Affiliation : Fraunhofer Institute for Systems and Innovation Research ISI

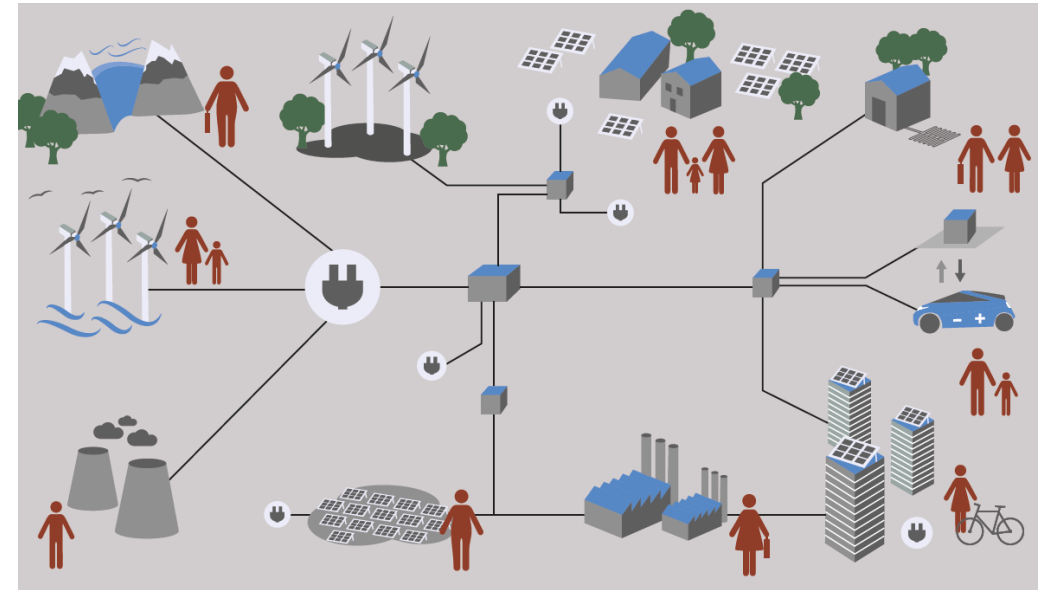
Abstract

Electric vehicles (EVs) in combination with new mobility services such as car sharing or ride sharing have the potential to decarbonise passenger transport and to alleviate some of the negative local impacts of motorized transport. However, current market shares for EVs and new mobility services in Germany are still small. In this context it is often discussed that social acceptance of the transition to an electrified transport sector - in addition to techno-economic factors - plays a role.

For the analysis we apply the social acceptance concept (socio-political, market and local acceptance) with a focus on market acceptance, which describes the (potential) market success of an innovation. For this presentation market acceptance is analysed in the perceptions and the usage behavior of EV-sharing-concepts.

Results of a literature review show that there exists a lot of knowledge about acceptance especially in the group of private car users, but only to some extent for users of new mobility services with EVs. In this context, we present first results of a representative survey (n=3000 respondents) on the acceptance of new mobility services (car- and bikesharing, E-scooter-sharing and ridesharing) in major cities in Germany. The results point to a general openness towards the concepts; the intentions of use, however, are still at a rather low level.

However, for a transition towards an electric transport system a deeper systemic understanding of social acceptance, i.e. the perspective of further actors beyond the end users, is necessary. The presentation shows where the potentials for further acceptance research on (shared) electric mobility lie.



Title : "Motorized individual mobility in commuting trips: modal preference or constrained mode choice? A machine learning approach"

Speaker : Rémy LE BOENNEC, Research fellow in Economics and Sustainable Development

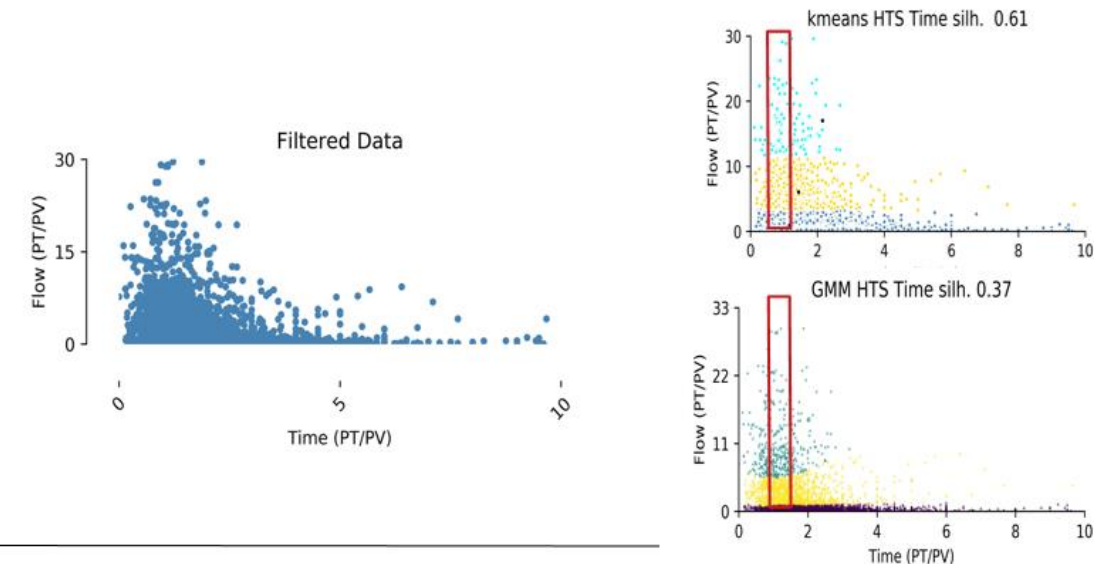
Affiliation : Institut VEDECOM



Abstract

In the Ile-de-France Région, France, the modal share of car in commuting trips is 42% (Source: Global Transport Survey, 2010), a much lower figure than the national average (70%). We use an original predictive tool that relies on multi-source input data to estimate the flows, modes, and socio-demographic characteristics of mobility users. We focus on commuting, as the recurrence of such trips theoretically enhances modal shift towards more sustainable transport modes on the long term. From the output data predicted by the tool, we elaborate, for all origin-destination couples (O-D) between municipalities in the Ile-de-France Région ($n = 1286^2$), an original indicator of the relative performance of public transport in relation to car. We measure this indicator as compared travel times: for each O-D couple, we compare the predicted travel time to the modal share of car, also predicted by our tool. We thus identify three groups of municipalities:

- A first group whose respective modal shares of car and public transport are consistent with the modal performance indicator: comparable travel times between car and public transport are correlated with respective modal shares close to the Ile-de-France average;
- A second group whose residents seem more favorable to public transport than suggested by the modal performance indicator, as predicted travel times appear to be in favor of car;
- A third one, with the opposite conclusions. A more detailed territorial analysis focuses, in a second time, to cross these three groups of municipalities with the following typology of territories: Paris (central city), other municipalities of Greater Paris, rest of the Ile-de-France Région. We assume that mobility issues remain specific, within the Ile-de-France, to each type of area.



Title :“The role of the intelligent infrastructure in the development and deployment of autonomous vehicles”

Speaker : Fawzi NASHASHIBI

Affiliation : AutoKAB

Abstract

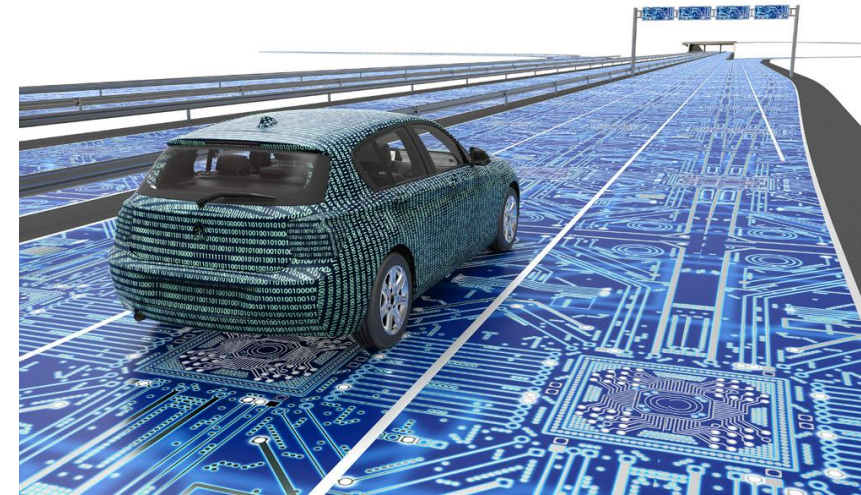
Seen as a technological jewel, the autonomous vehicle is above all an element that will revolutionize the transport ecosystem. While some consider that full autonomy of an AVs requires total independence from other road users and full robustness and resilience to infrastructure deficiencies, others believe that deeper integration of vehicles and infrastructure will increase AV sensitivity to infrastructure conditions and inconsistencies, while at the same time granting additional layers of robustness, making AVs arguably safer and more efficient.

Certain physical infrastructure elements such as lane markings, signage, and signals can be designed to facilitate AV perception and interpretation. Infrastructure can also act as a distributed sensor network, supporting data sharing and providing information to vehicles. And some technologies are already moving the infrastructure in this direction.

It is expected that this digital infrastructure will become the cyberphysical backbone for AVs: using an Internet of Things approach, it will be capable of sensing the environment and sharing useful information with vehicles. A constant exchange of information between vehicles and the infrastructure will facilitate the updating of digital maps in real time and can facilitate the identification of nonconformities and road hazards, establishing a virtuous cycle of data sharing that benefits the safety and mobility of both drivers and the public at large.

Finally, with the introduction of AVs, the infrastructure will have to accommodate new driving behaviors and traffic patterns.

In this presentation, we will address the role and benefits of the infrastructure in the development and the deployment of AV's. We will give examples of successful national and international research projects in relation with the AV-Infrastructure cooperation. We will finally address the future challenges in relation with the development of the coming intelligent infrastructure.



Title : “Lane markings-based localization”

Speaker : Marc REVILLOUD, Researcher in the field of autonomous vehicles

Affiliation : VEDECOM Institute



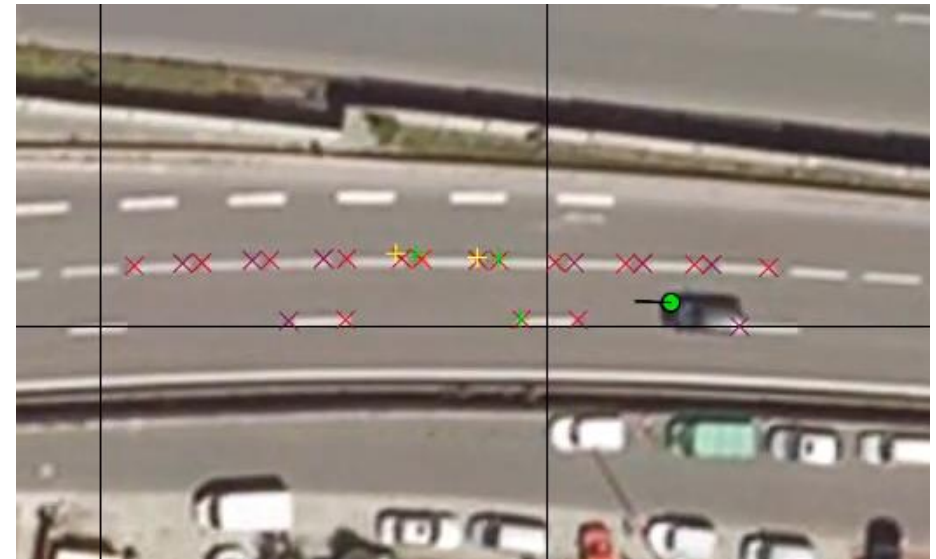
Abstract

This presentation focuses on optimization technics such as empty vehicle redistribution and ride-sharing for PRT (Personal Rapid Transit) and aTaxi (autonomous taxi) services. The focus is kept on passenger service and operator cost.

The methods of empty vehicle redistribution can be divided into two main groups: reactive redistribution strategies (where the call for a vehicle is made at the moment of passenger arrival) and proactive redistribution strategies, sending empty vehicles to meet predicted demand (in the near future). We present a new redistribution algorithm called index-based redistribution (IBR) and evaluate combinations of different reactive and proactive algorithms using a test case in Paris Saclay, France (20 stations). A combination of Simple Nearest Neighbors and IBR is shown to be promising. Its results outperform the other methods tested in peak and off-peak demand, in terms of average and maximum passenger waiting times as well as station queue length.

The inclusion of multi-matching (multiple assignment) algorithms on the same network shows that while Greedy+Hungarian multi-matching algorithms improve upon the well-known Hungarian method in both empty run time and in average waiting time, the one-step mixing shows superior results. All three multi-matching algorithms outperform the single matching algorithms tested.

The addition of ride-sharing improves the results obtained for the rush hour for every strategy evaluated.



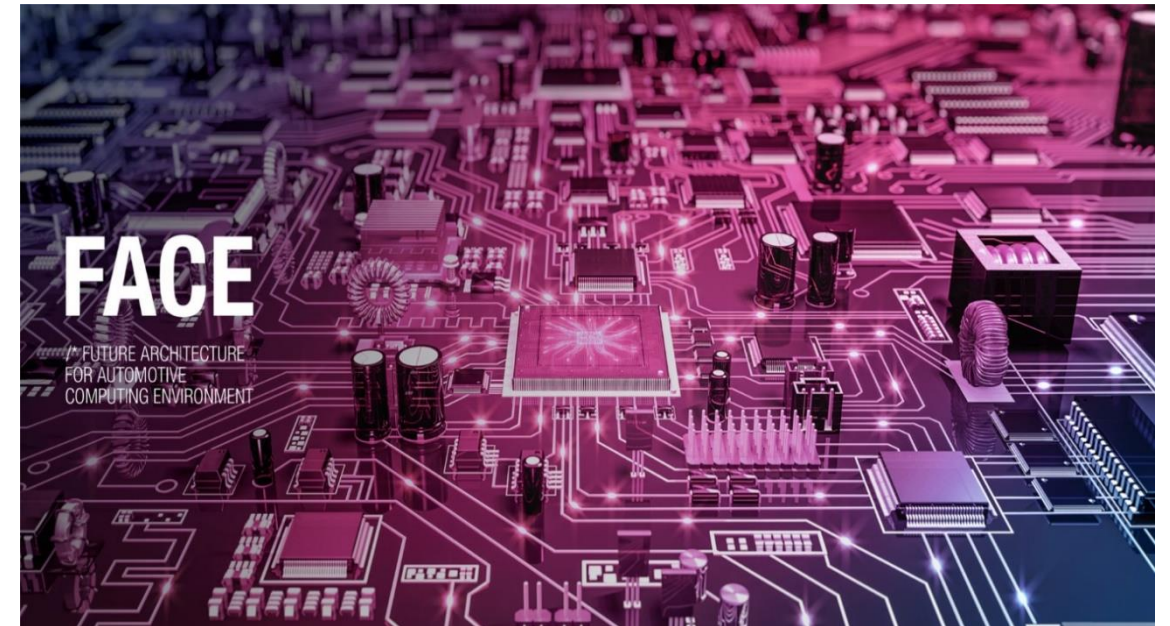
Title : “Modular and Open Real-Time Platform for Future Automotive Computing Environment”

Speaker : Dr. Raphaël DAVID, Strategic Program Manager

Affiliation : CEA

Abstract

With the advent of connectivity services, cars are entering in our digital world. Among the numerous impacts of this situation, the mindset change in the way customers are considering their cars is a true game changer. As the vehicle is becoming smarter we expect it to be always up to date and integrate latest features and technologies. This agility is however moving away from current Electrical and Electronical (EE) architectures capabilities that are inherited from 35 years of incremental innovations. The CEA, in cooperation with the Alliance Renault-Nissan-Mitsubishi, has developed a modular and real-time computing platform to face the challenges of future connected and autonomous vehicles. By jointly designing Hardware platform, embedded software and tools we show that we are in a position to open this platform to application providers and to manage applications cohabitation. We leverage on an innovative Model of Computation and Communication to formally express interactions between functions, and embedded monitors to verify at runtime that communication contracts are satisfied. In this talk, we come back retrospectively on the design processes that allowed us to revolutionize the way car makers will design EE architectures for future smart vehicles. We will cover the three pillars of the project to highlights key features of the solution, both from hardware, software and tools points of view. Finally, we conclude the talk with open discussions regarding the mutation of the supply chain and the way new players may jump in the automotive industry.



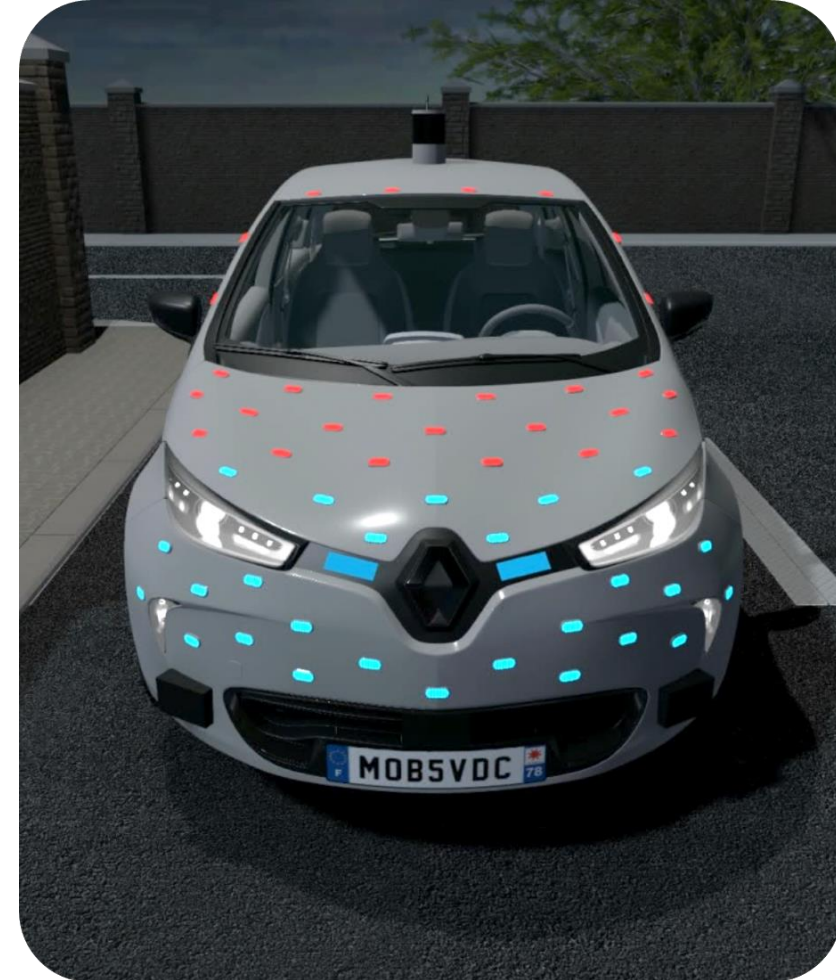
Title : “External HMI of communication and autonomous vehicles: a pedestrian’s study”

Speaker : Natacha METAYER, Ergonomics Researcher

Affiliation : Institut VEDECOM

Abstract

Researches on autonomous vehicles increase for several years. One of the research scopes is the presence of an external HMI of communication (eHMI) on autonomous vehicles to indicate their intentions to other road users. To reduce both financial and time costs while testing user’s understandability and acceptance, we used virtual reality technologies for this study. We tested three eHMIs to observe pedestrian’s crossing behaviour and to collect their feelings about different types of vehicles (i.e., conventional vehicle with driver, autonomous vehicles without eHMI and autonomous vehicles with eHMI). Our study confirms the importance of setting up eHMIs. Indeed, they influence the decision of the pedestrians to cross the road. The proportion of pedestrians who cross in front of autonomous vehicles is greater for the vehicle equipped with eHMI than the vehicle without eHMI. In 10% of cases, pedestrians used circumvention strategies when they are faced to vehicle without eHMI. Furthermore, this behaviour appeared in particular when there is no protected infrastructure (e.g., pedestrian crossing). Moreover, if our objective data failed to determine whether one eHMI is preferable to another, the subjective data on the participants’ preferences provide some interesting thoughts for further researches.



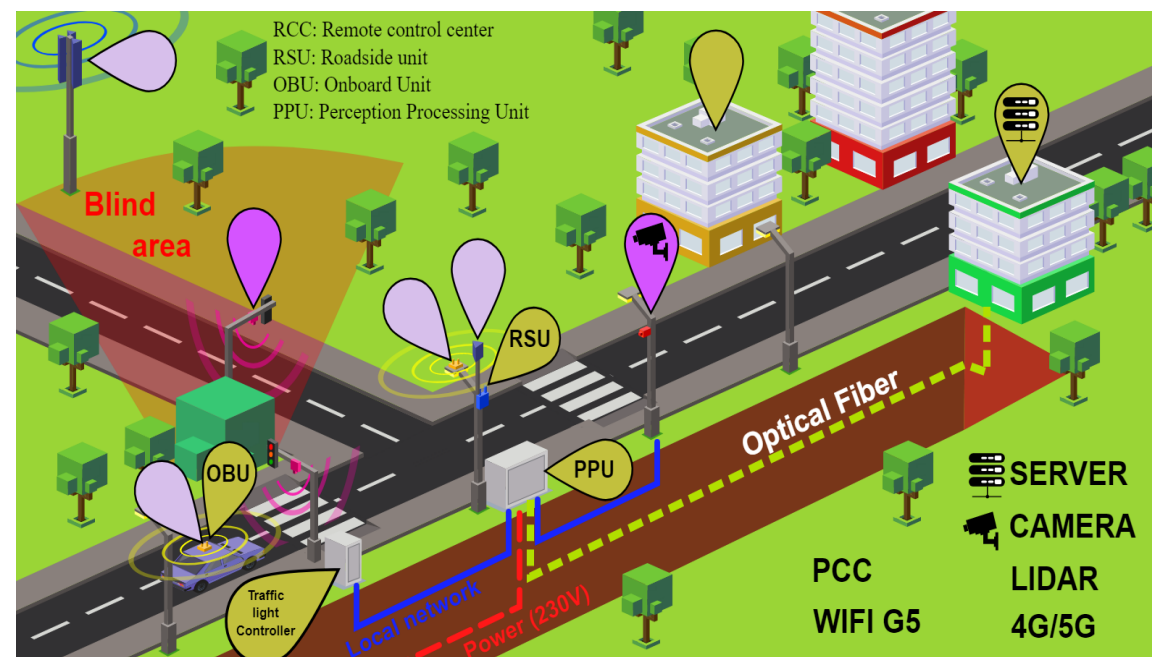
Title : "Enhanced perception and roadside infrastructure for autonomous vehicles : EVAPS study case"

Speaker : Nassima FRISSA, Infrastructure Research Engineer for autonomous vehicles

Affiliation : Institut VEDECOM

Abstract

The perspective of an « autonomous car providing mobility services » is undoubtedly attractive. But a main issue has to be considered: Its environment. Autonomous cars need to fulfill many requirements: They need to have driving programs as reactive and flexible as needed in today's mobility environment, they also need to be safer than a 'standard' vehicle or shuttle and they need to deliver better performances than today's high level service buses. Ultimately, autonomous cars need to be irreproachable on every aspect if they want to be attractive. In order to do that, embedded sensors are not enough. A wider perspective is required by integrating the enhanced perception and the roadside infrastructure. It helps the autonomous car to increase its vision compared to standard vehicles making it possible to anticipate and avoid dangers. As the environment is full of obstacles (pedestrians, cars, animals...) and as the visibility cannot always be guaranteed, it is logical to think about including the roadside infrastructure in the entire autonomous mobility system creating by that the "enhanced perception". In order to test this hypothesis, the EVAPS project has been launched. The aim of the project is to develop intelligent mobility disruptive services to cover peri-urban journeys. It implies an experimentation involving the interaction between both autonomous electric cars and shuttles with an equipped infrastructure in suburban area. Therefore, this presentation will first focus on the whole concept of Roadside infrastructure and Enhanced Perception, then this presentation will mention examples of some specific equipped sub-urban areas and the logic behind those choices in the EVAPS project.



Source : Poster EVAPS, Mobilité@Vedecom le 11/04/2019
Création : Edouard Dupin, MOB03