Data Driven Free Floating Electric Car Sharing Design

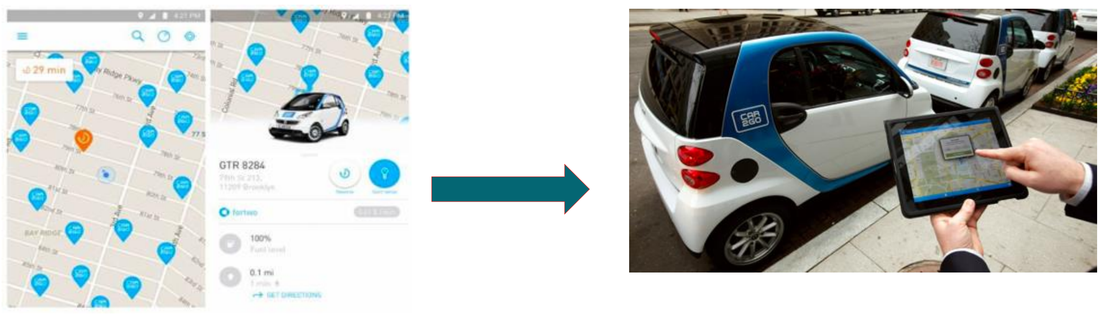
Michele Cocca

Danilo Giordano, Luca Vassio and Marco Mellia

Dipartimento di Elettronica e Telecomunicazioni, Politecnico di Torino

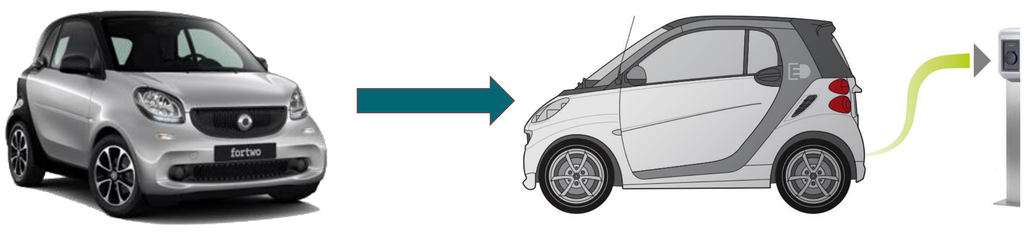
Motivation

The **Free Floating Car Sharing (FFCS)** is a popular car rental model where users rent cars through a **smartphone** picking and dropping them everywhere with minutes-based fares. **Optimizing** this system and using **electric vehicles** bring improvements in terms of **noise, pollution**, **traffic** and **parking** availability.



Addressed problem

- Collect and analyze past data of **usage of FFCS**
- Combine a FFCS approach with an **Electric Vehicles** (EVs) fleet
- Use **real data** to built a open-source simulator
- Identify **users' discomfort** metrics and best **charging policies**
- Find and validate a smart and cheap **charging stations placement**

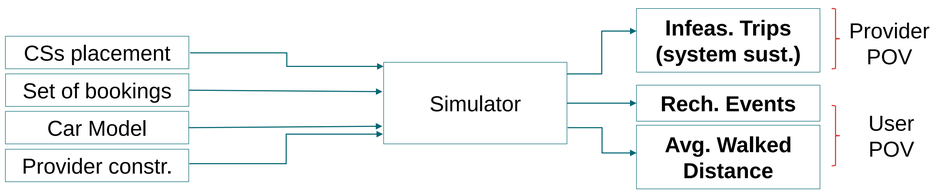


Data and simulator

Data collected from Car2go and Enjoy:

Booking	Parking
Car plate	Car plate
Starting & final position	Position
Duration	Duration
Travelled distance	

28 Million trips collected in 1 Year on 26 cities.

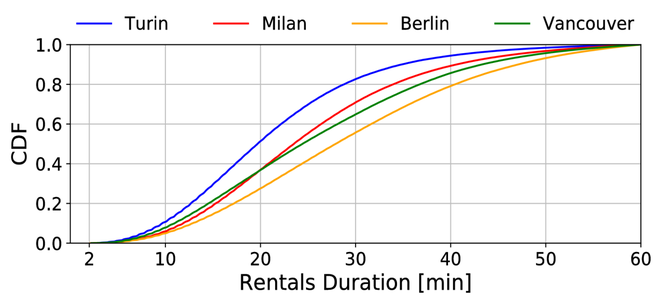


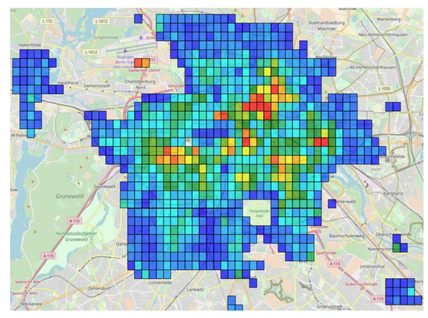
Electric car simulated:

- Autonomy 136 km (17.6 kWh)
- Linear consumption: 0,13 kWh/km

Data analysis

Users' **driving** and **parkings** habits from real data

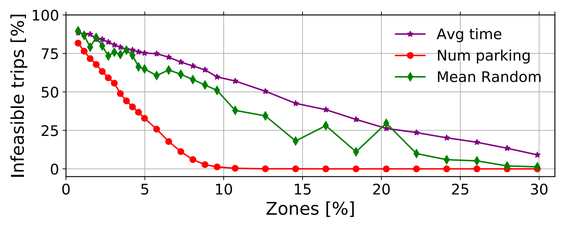


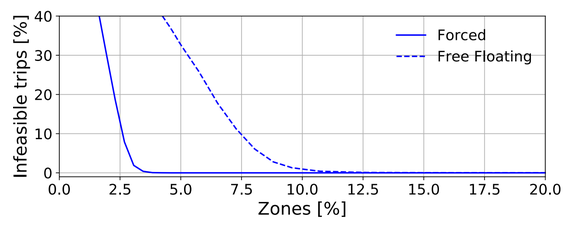


Num parkings per day

Electric FFCS design results

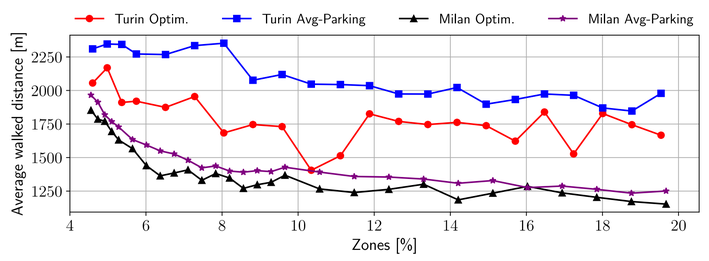
Electric FFCS Simulator → study different charging stations placement. Given a number of charging stations, measure **infeasible trips**: trips not completed due to discharged battery. Car is charged either when booking ends within 250 m from a charging station (Free Floating), or when battery state of charge goes below a threshold (Forced policy).





- Few charging stations in the **most used** zones make the system sustainable
- The Forced policy improves the performances

Further optimize the placement by looking at **users' comfort** metrics, like the **average walked distance** by users (Forced policy).



Conclusions and future work

- Improvement of placement algorithm of charging stations
- Trips characterization and demand forecast merging other datasets
- Study on pricing policies implemented on a blockchain technology