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DI INGEGNERIA
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ICT4IA: a glimpse into the future

Research projects available for master's theses

List is **not exhaustive**: check out the
moodle webpage of the M.I.M.E.
for more opportunities

Hands-on projects

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SVRUM

Safety of Vulnerable Road Users' Means

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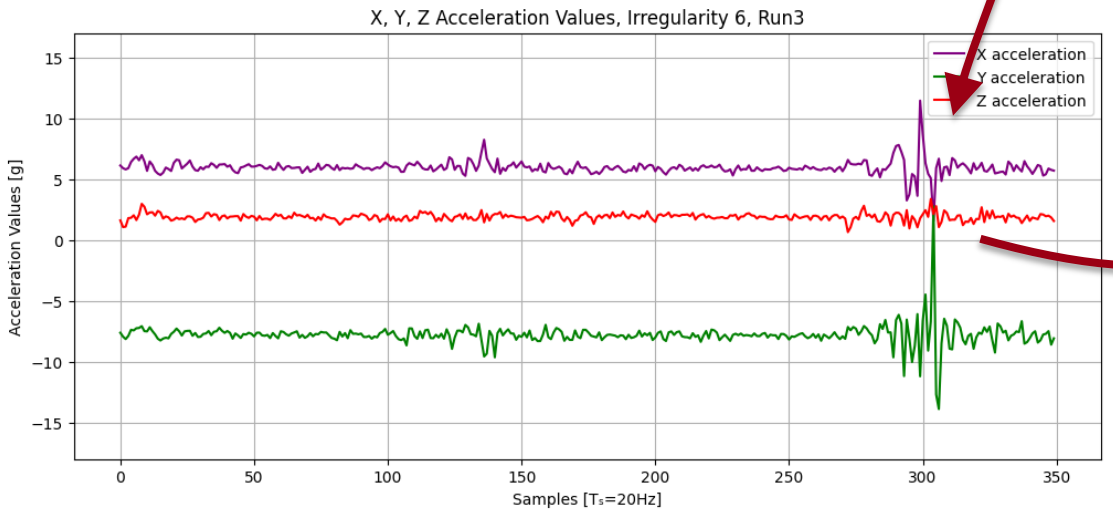
SVRUM Objectives

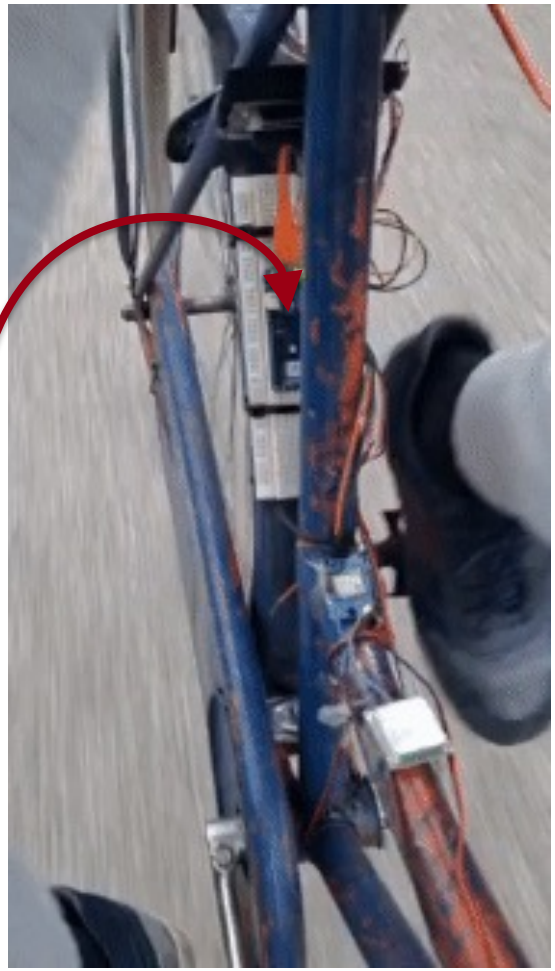
Increase the safety of vulnerable road users (pedestrians, cyclists, skaters, …) by enhancing context awareness and providing warnings, recommendations, etc

Improve urban mobility by favoring the Mobility as as Service paradigm

Collect data of different types to build an up-to-date dynamic map of the urban environment (road and traffic conditions, noise levels, air quality, pollution, temperature, light, VRU mobility patterns, …)

Results so far…





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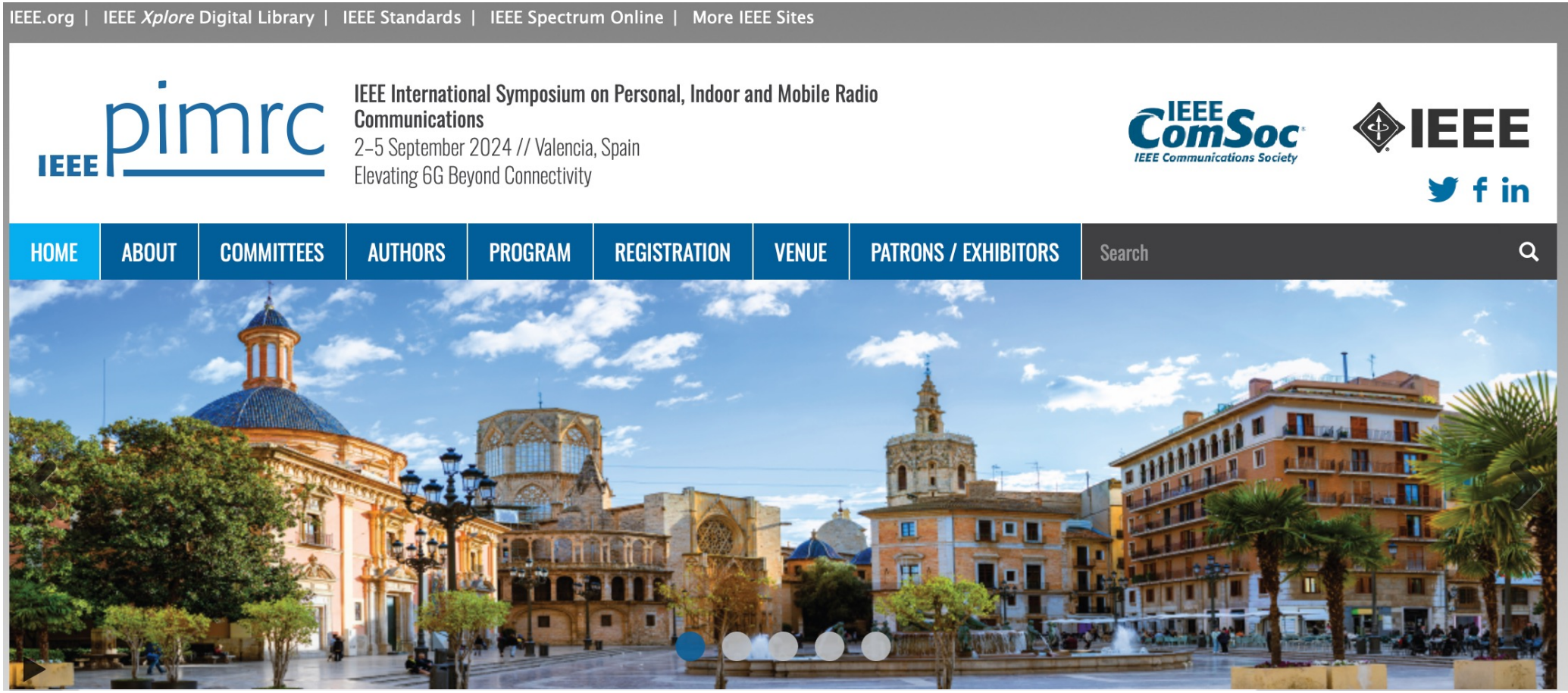


Next steps…

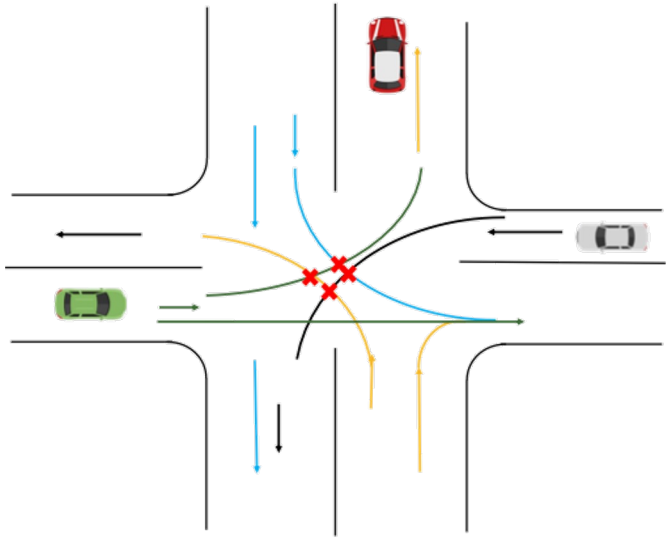
- Project “RIDGE”: Road Irregularities Detection and GEographical mapping
  - Collaborative road surface irregularities mapping (e.g., bumps, potholes, sands, slippery, cobblestones, …)
- Project “DAVE”: Detection of Approaching Vehicle
  - Detects approaching vehicles and activates visual warning systems (display warning signs, front/rear flashing lights)
- Project “SAM”: SVRUM Air-Quality Mapping
  - build dynamic and cooperative maps of air quality in town

Drive the ducks!

DUCKIETOWN

duckietown testbed

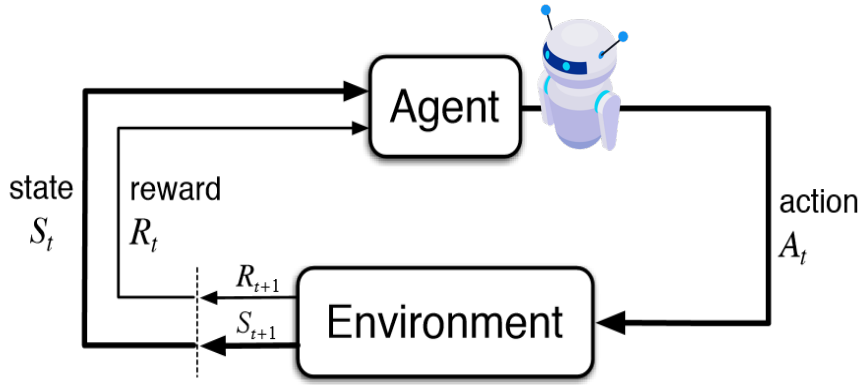
Design, plan, implement and perform experiments to drive small wheelly ducks along a planned path



Theoretical projects

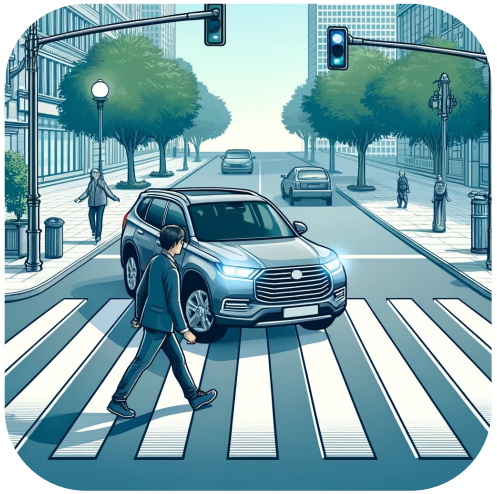
Reinforcement learning & communication

- With RL an **AI agent learns** an optimal strategy for actions through **trial-&-error**
- The agent needs to **observe the state** of the system under control and the effect of its actions to learn



- If the agent is remote, observations need to be delivered through a communication channel
  - Transmissions can be costly, limited by the channel capacity, subject to eavesdropping, …
- Challenges:
  - Which observations are *more important* to transmit?
  - What transmission strategy should be adopted to limit information leakage to eavesdropped?
  - How much resources shall I use for RL training, taking them away from users

Effective communication



Technical problem: transmit the message "as is"

Effective problem: transmit the **meaning** of the message

Efficient problem: transmit the **meaning** of the message

Blind Aloha protocol

- Blind Aloha is as legacy multichannel

  Aloha but without feedback…

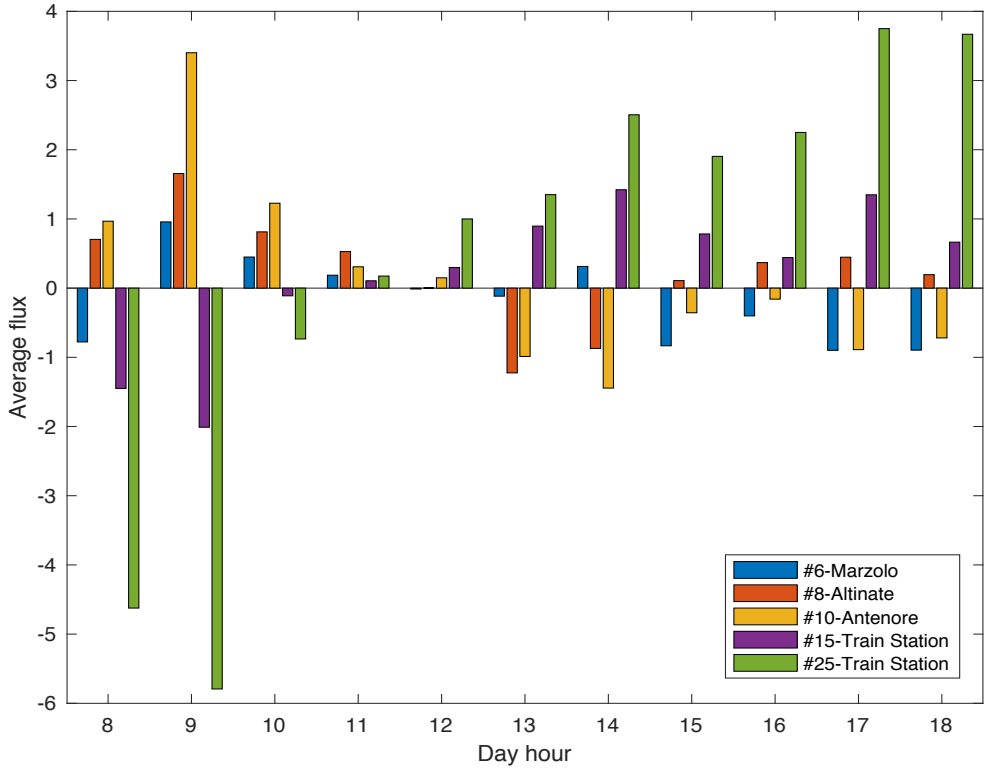
Shall I stay or Shall I go?

After transmission, nodes keep using the same channel with probability p, and to pick an idle one with probability 1-p

- What's the optimal strategy? No-one knows… yet…

MaaS: Mobility as a Service

Optimization of “sharing” services



Planning of on demand shuttle buses

That's all folks!

- Well, not really… check out moodle webpage of the M.I.M.E.