AI for Good

AI for Good Global Summit 2025

The United Nations' leading platform on Artificial Intelligence to solve global challenges, July 8-11, 2025, Geneva, Switzerland

Workshop on AI readiness – Towards a standardized readiness framework

Trustworthy artificial intelligence for drone-supported autonomous wheelchairs

Prof. Francesco Flammini, Ph.D.

francesco.flammini@ieee.org

idsia Istituto Dalle Molle di studi sull'intelligenza artificiale USI – SUPSI

Scuola universitaria professionale della Svizzera italiana SUPSI

FLORENTINA STUDIORUM UNIVERSITAS

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UN Sustainable Development Goals: Agenda 2030

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REXASI-PRO Project

10 partners from 6 different countries

REXASI PRO

University of Applied Sciences and Arts of Southern Switzerland

SUPSI

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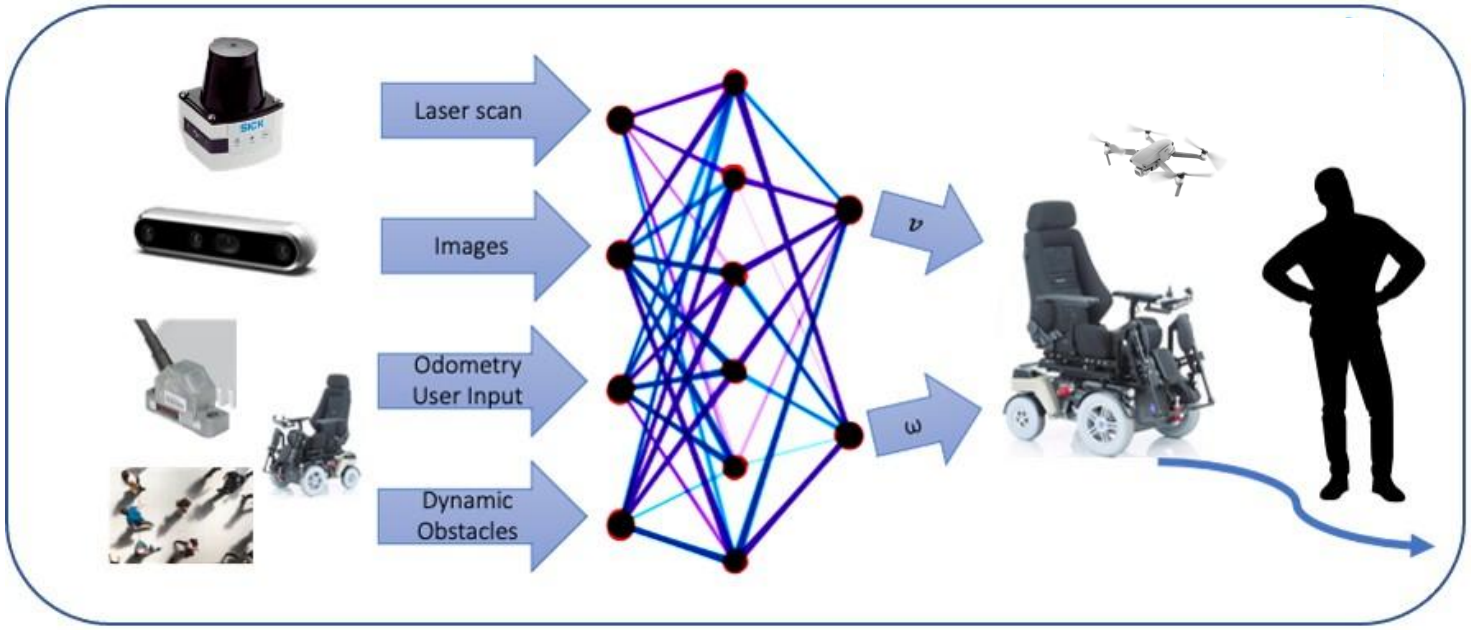
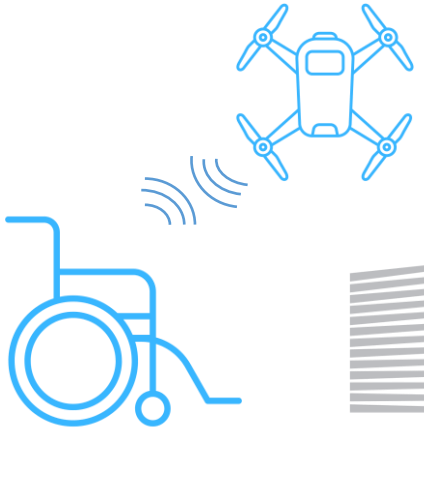
REliable &
e**X**plainable
Swarm
Intelligence for
People with
Reduced
m**O**bility





European Commission

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Federal Department of Economic Affairs, Education and Research EAER
State Secretariat for Education, Research and Innovation SERI

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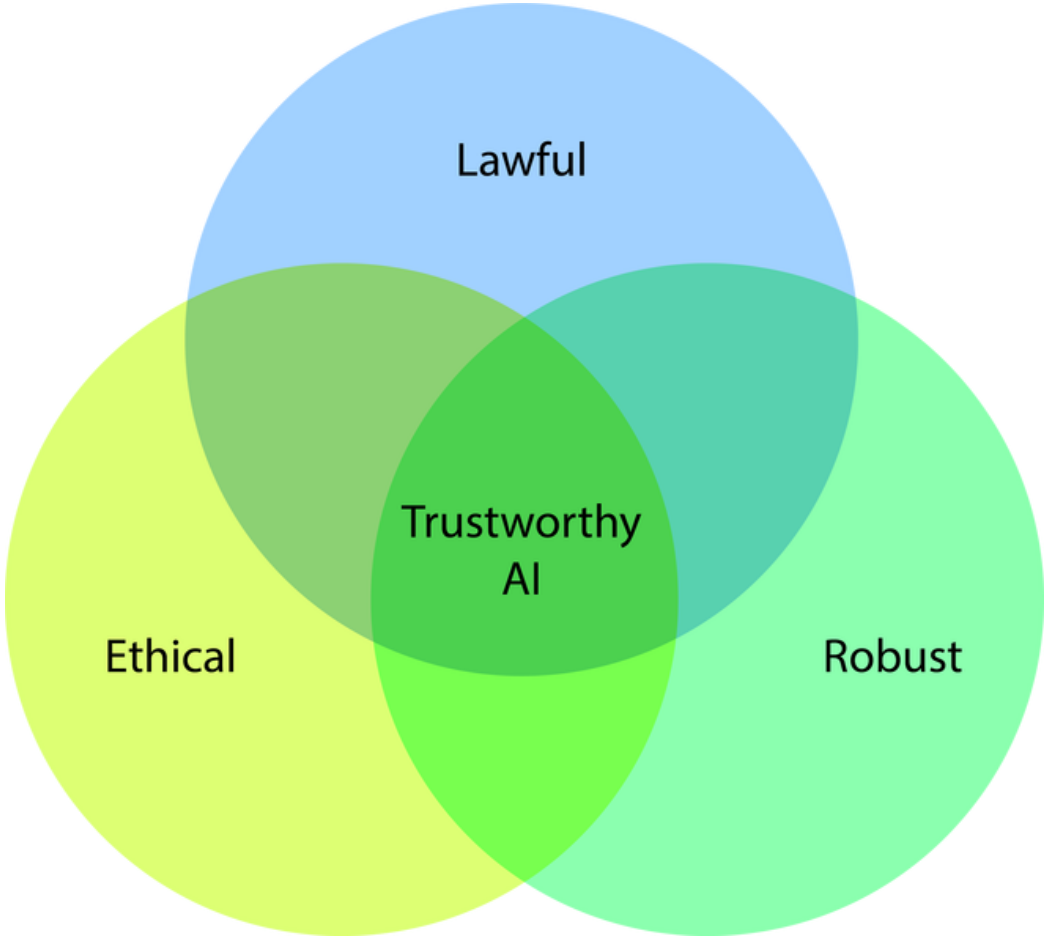
TAS Trustworthy Autonomous Systems
USI/SUPSI IDSIA

https://tas.idsia.ch

https://rexasi-pro.spindoxlabs.com/

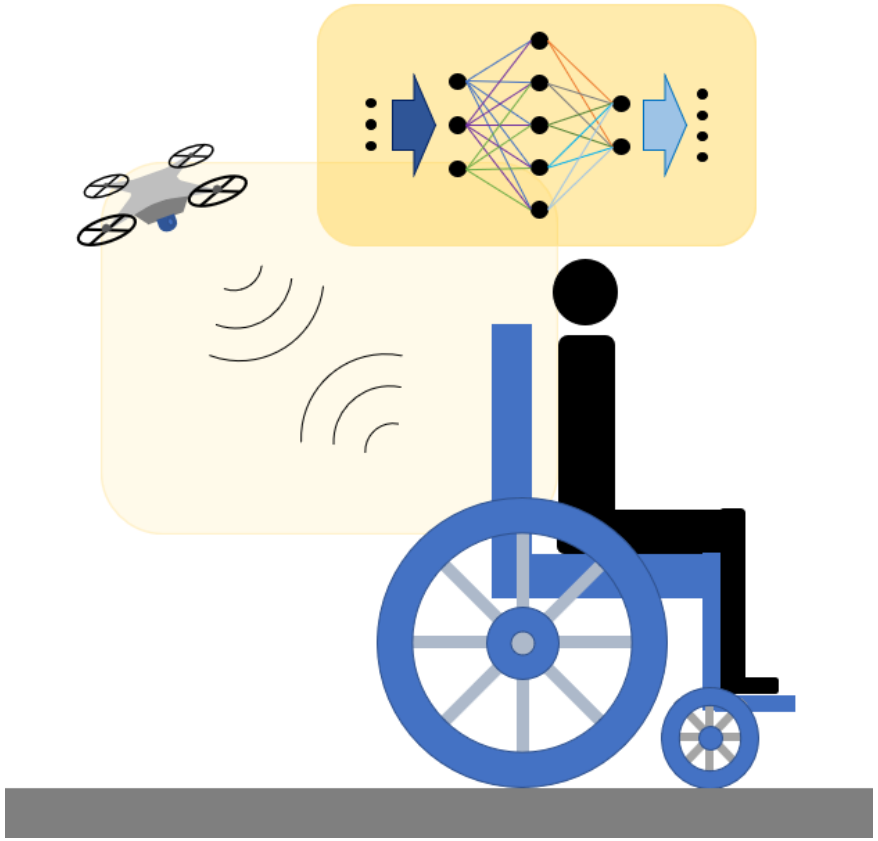
Trustworthy AI for safe autonomy

human-centric, explainable, responsible, etc.

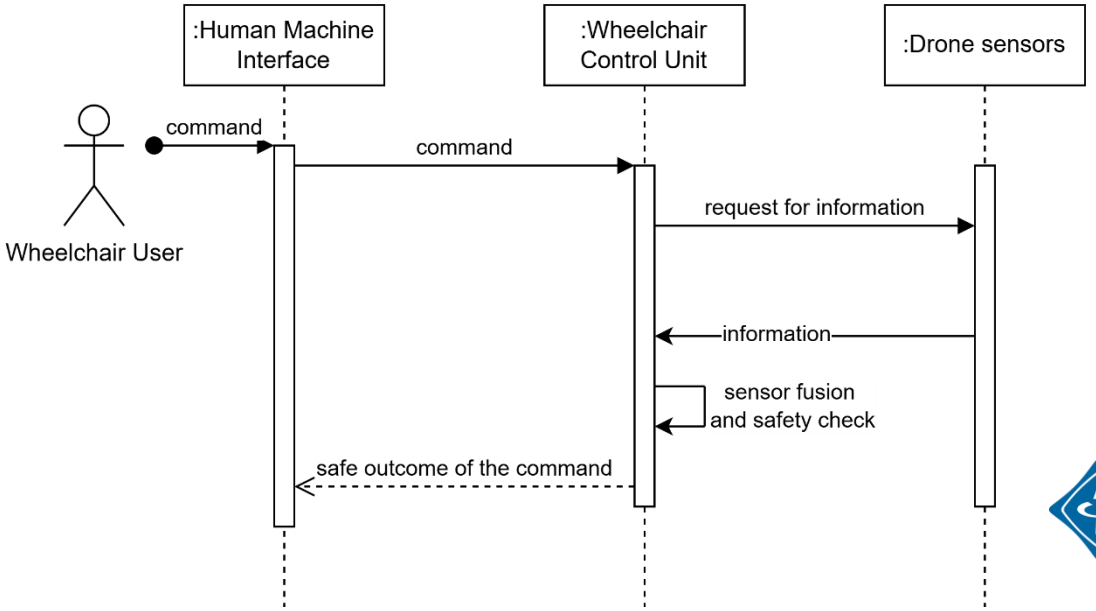


https://ec.europa.eu/digital-single-market/en/news/ethics-guidelines-trustworthy-ai

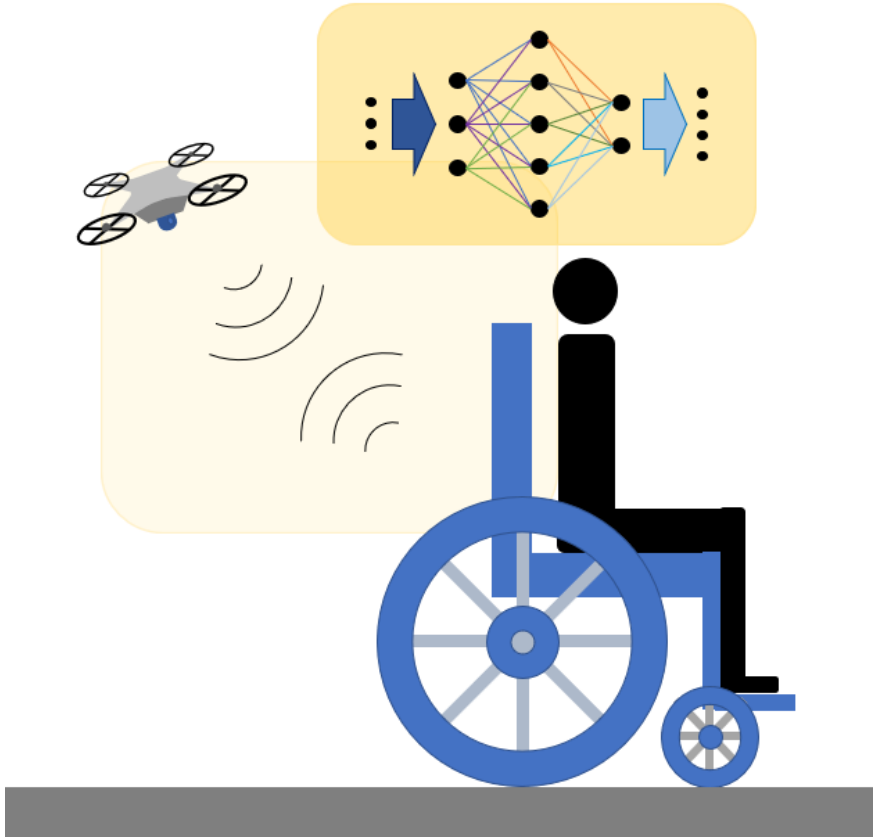
Trustworthy event detection using smart-sensors

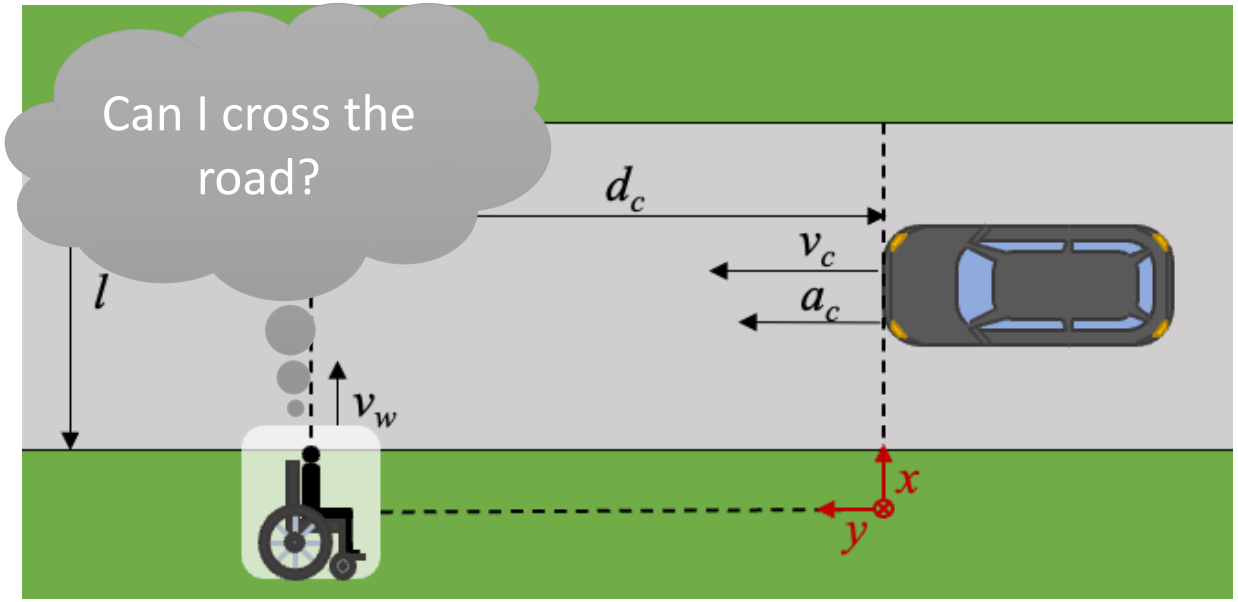


- Information fusion from redundant and diverse sources to make safe decisions
- Sources include smart-sensors using *Deep Learning*



Reference scenario: road crossing



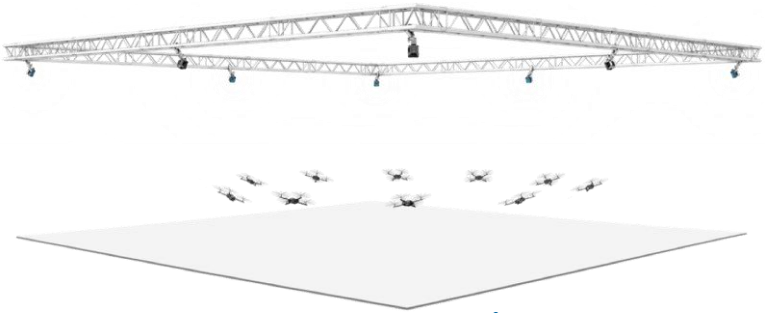


Laboratory environment for dataset collection

Laboratory environment

- Cheaper
- Safer
- Easy to set up
- Reproducibility
- Ground truth

OptiTrack



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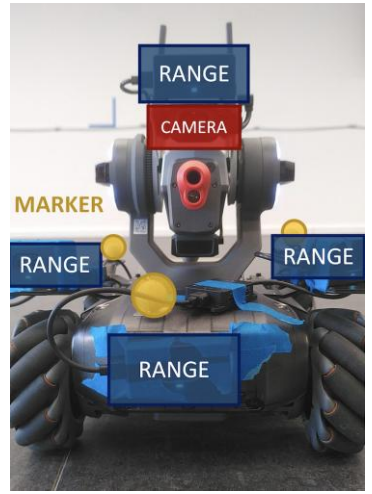
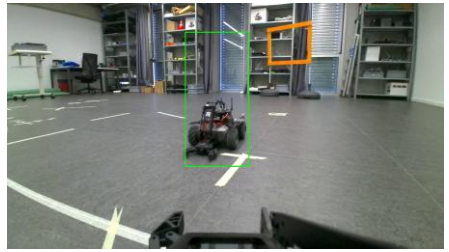
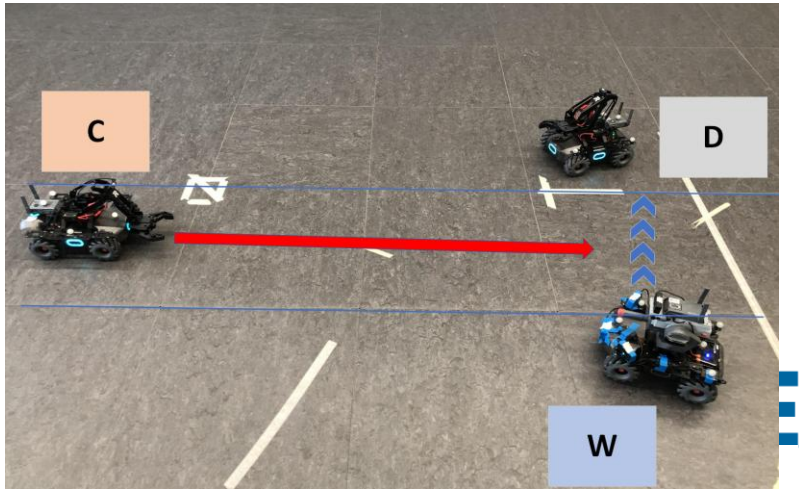
Instrumentation of the robomasters

- Data recording through three sensors:
  - RM_{Drone} videocamera
  - $RM_{Wheelchair}$ videocamera
  - $RM_{Wheelchair}$ range sensor unit

- Information fusion to compute the danger function can be implemented at multiple levels: object detection, tracking, and decision fusion
- Artificial vision for obstacle detection & tracking
  - YOLO v5 (initial tests)
  - YOLO v8 customised (current tests)



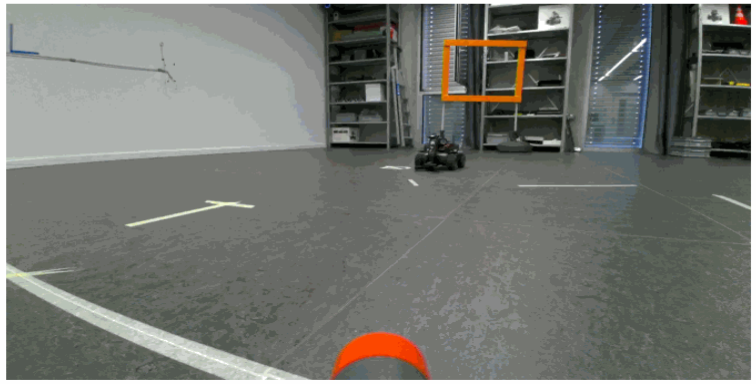




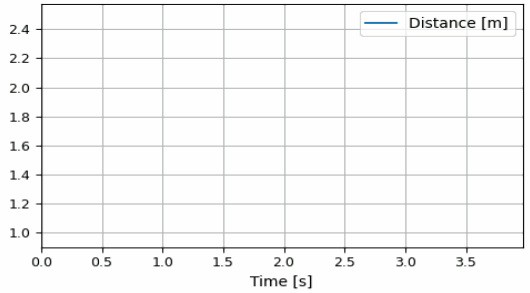
Real-Time «Danger Function» Evaluation

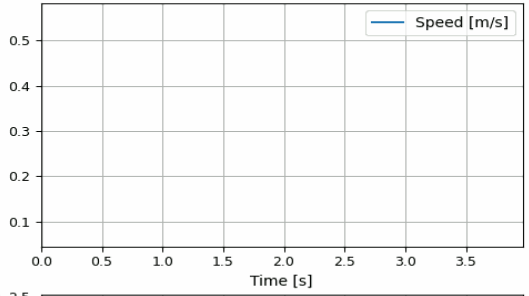
RM_{Drone} Camera

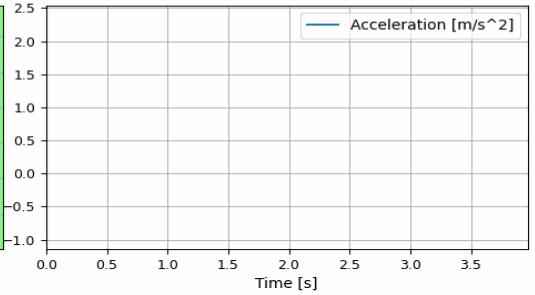
$RM_{Wheelchair}$ Camera



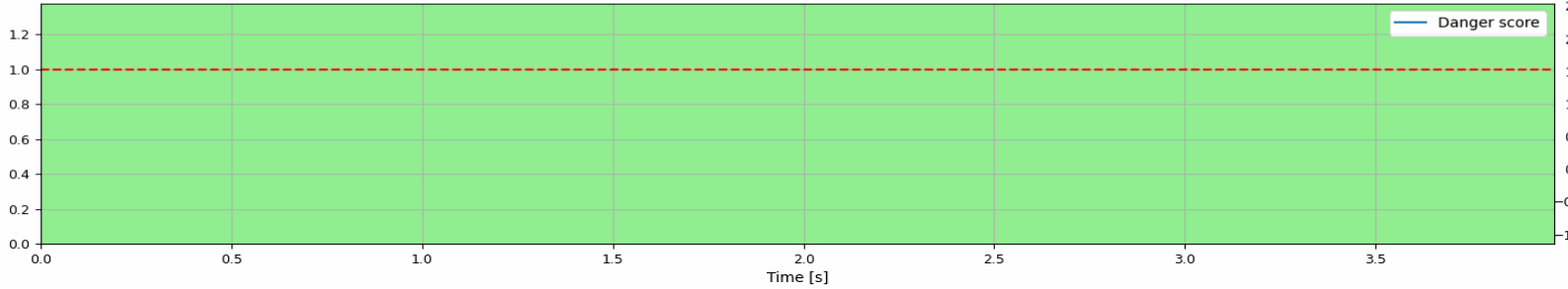
Obstacle Kinematics







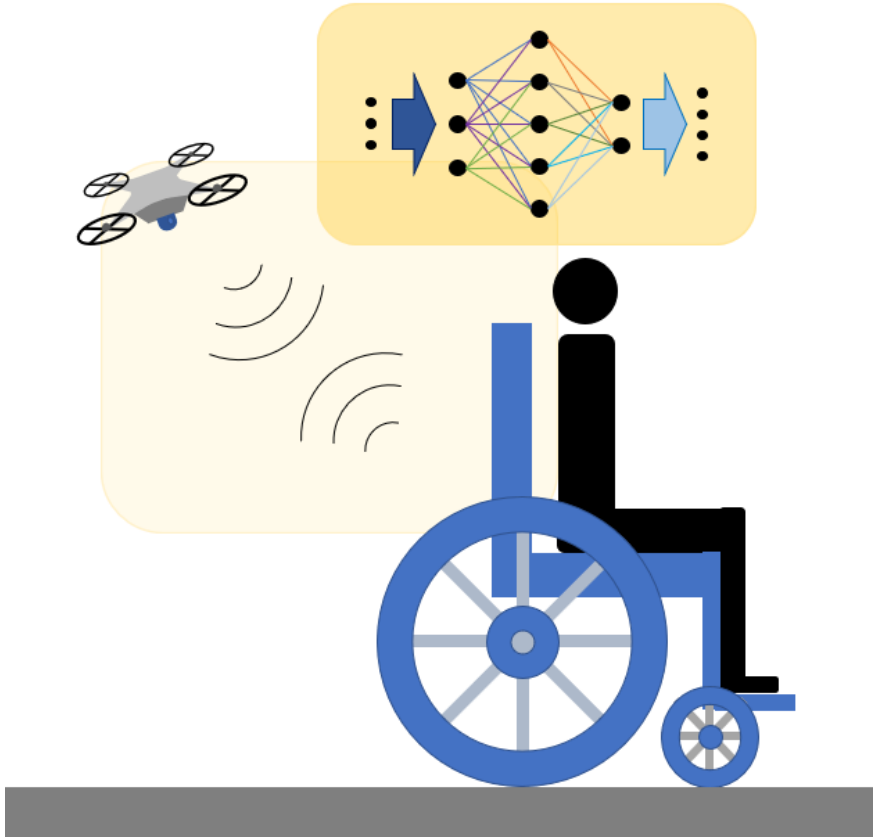
Danger evaluation from sensors fusion

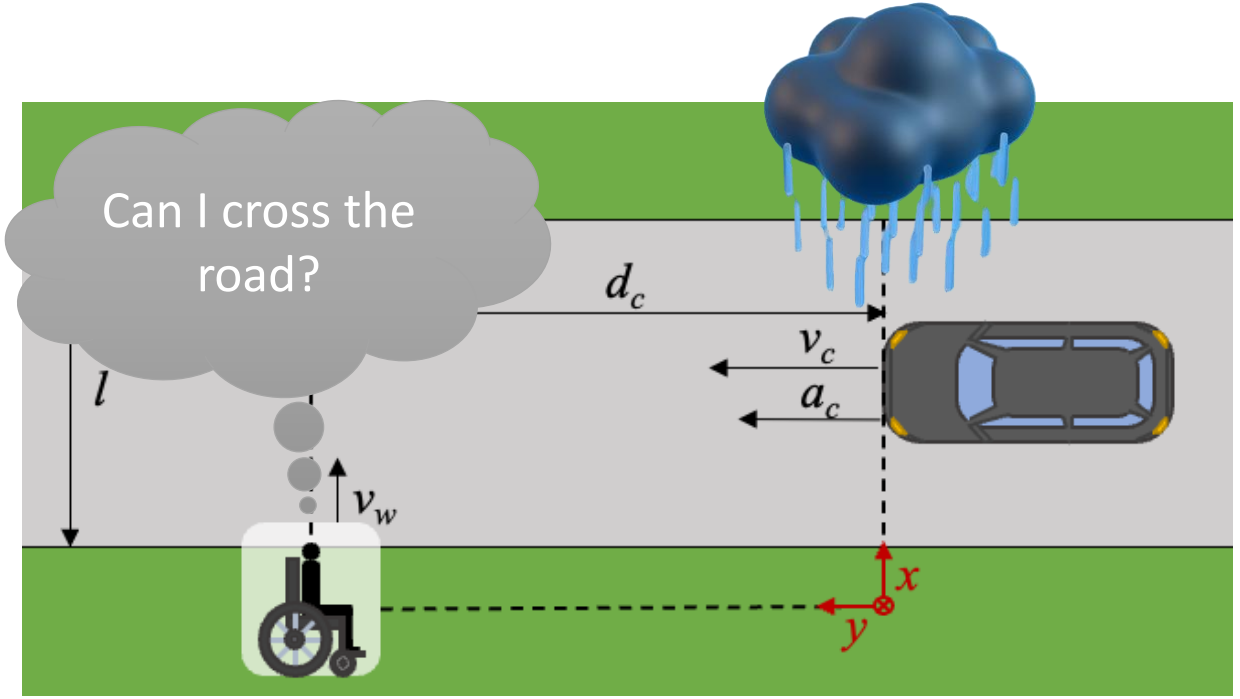


Safe crossing

Dangerous crossing

Robustness against adverse weather conditions





Testing against environmental conditions

Adverse weather conditions are simulated using **synthetic filters**

Application of those filters cause a **degradation in obstacle detection and tracking performance (RMSE, Accuracy, F1 score)**

Sensor fusion significantly improves results if performance do not differ significantly among sensors

Light

Rain

Fog

Night

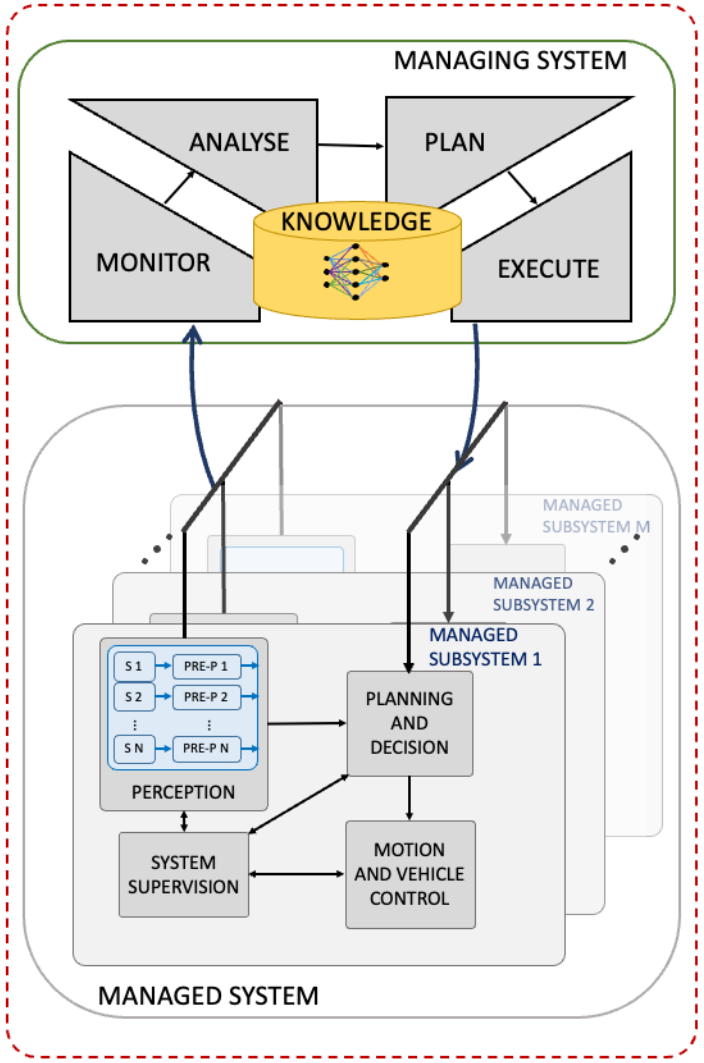
https://github.com/UjjwalSaxena/Automold--Road-Augmentation-Library

F. Corradini, C. Grigioni, A. Antonucci, J. Guzzi and F. Flammini: "Experimental Evaluation of Road-Crossing Decisions by Autonomous Wheelchairs against Environmental Factors". *8th EAI International Conference on Intelligent Transport Systems* (EAI INTSYS 2024).

Application of autonomic computing to the case-study

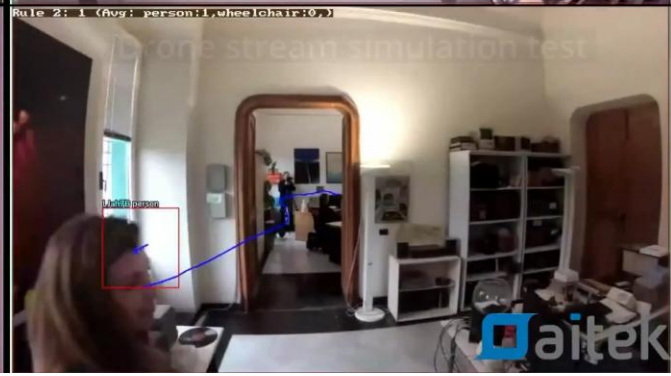
- **MAPE-K** feedback loop
  - Monitor: data processing, resampling of sensor info
  - Analyse: danger function evaluation
  - Plan: best action based on quantified risk
  - Execute: actions sent to the Managed Subsystem
  - Knowledge shared over all phases using explainable probabilistic formalisms (e.g., DBN)

- Focus on **Perception**:
  - Multiple technologies for redundance and diversity
  - Diversity by Hardware, Software and Perspective



Real prototypes

REXASI PRO



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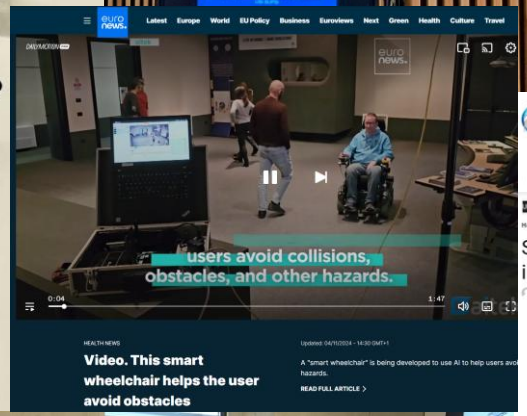
Press interest and awards

Fondation Dalle Molle
Pour la qualité de la vie



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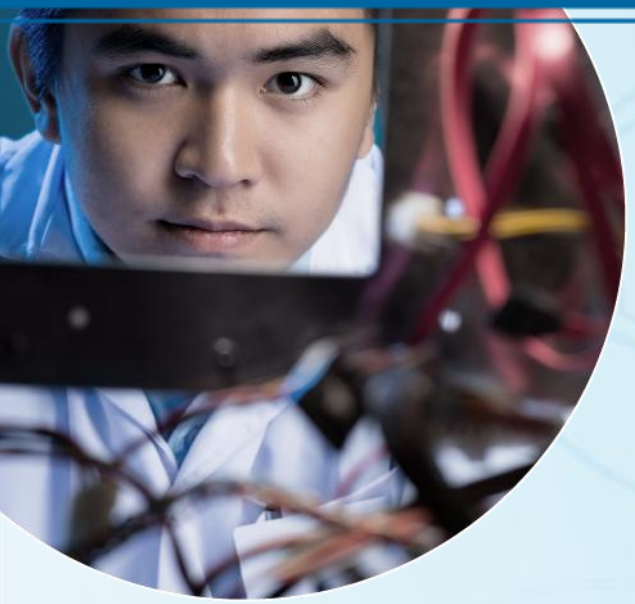
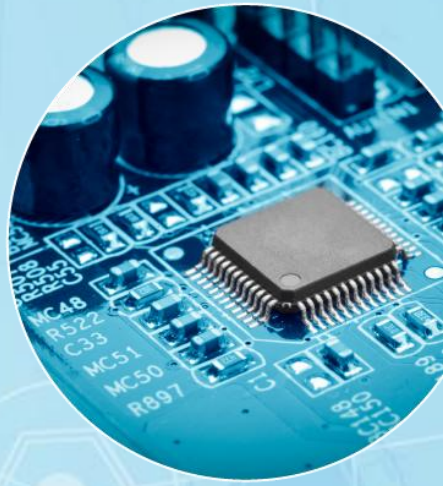
- C. Grigioni, F. Corradini, A. Antonucci, J. Guzzi, F. Flammini: “Safe Road-Crossing by Autonomous Wheelchairs: a Novel Dataset and its Evaluation“. In: Ceccarelli, A., Trapp, M., Bondavalli, A., Schoitsch, E., Gallina, B., Bitsch, F. (eds) Computer Safety, Reliability, and Security. SAFECOMP 2024 Workshops. SAFECOMP 2024. Lecture Notes in Computer Science, vol 14989. Springer, Cham.
- F. Corradini, C. Grigioni, A. Antonucci, J. Guzzi and F. Flammini: “Experimental Evaluation of Road-Crossing Decisions by Autonomous Wheelchairs against Environmental Factors“. In: Proceedings of to the 8th EAI International Conference on Intelligent Transport Systems (EAI INTSYS 2024). Springer, Cham.
- S. Perone, L. Faramondi, S. Guarino, R. Setola, M. Nobili, F. Flammini: “Cybersecurity for Safety: Risk Assessment of Autonomous Cyber-Physical Systems”. In: 2024 IEEE International Conference on Cyber Security and Resilience (CSR), London, United Kingdom, 2024, pp. 652-657.



"There is nothing permanent except change"

Heraclitus



Thank you for your kind attention!

Questions?