Intelligent systems for food waste management

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- Background
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Research Projects

- 2006 –2007: ITAs UK/US E-defence, $200M,

- 2009 –2010: Education 4.0-5.0. Development of RMAS/PURE, Joint Information Systems Committee, £300K

- 2011-2016: Fashion analytics for JDwilliams , £1M,

- 2017-2019: Industry 4.0-5.0 5.0, £2M
  - Predictive Maintenance lab with BMW mini and UK ports

- 2016-2022, RUC-APS, Horizon 2020, Marie Curie RISE scheme, €2M
  - Agriculture 4.0-5.0

- 2018- present: Sino –Anglo collaborative projects. £ 2M

- 2019 –2023 REAMIT, INTERREG North-West Europe: € 5M

- 2025-present: Proposal for HORIZON-CL6-2025-02-FARM2FORK-04- two-stage

Intelligent system

Key characteristics (Russell & Norvig, 2021) include:

- Sensing / Perception – Collects data from the environment using sensors, cameras, or other inputs.
- Reasoning – Analyses data using algorithms, AI, or models to understand the situation.
- Decision-Support – Chooses and executes actions based on analysis.
- Learning/ Adaptation – Improves performance over time through feedback or experience.
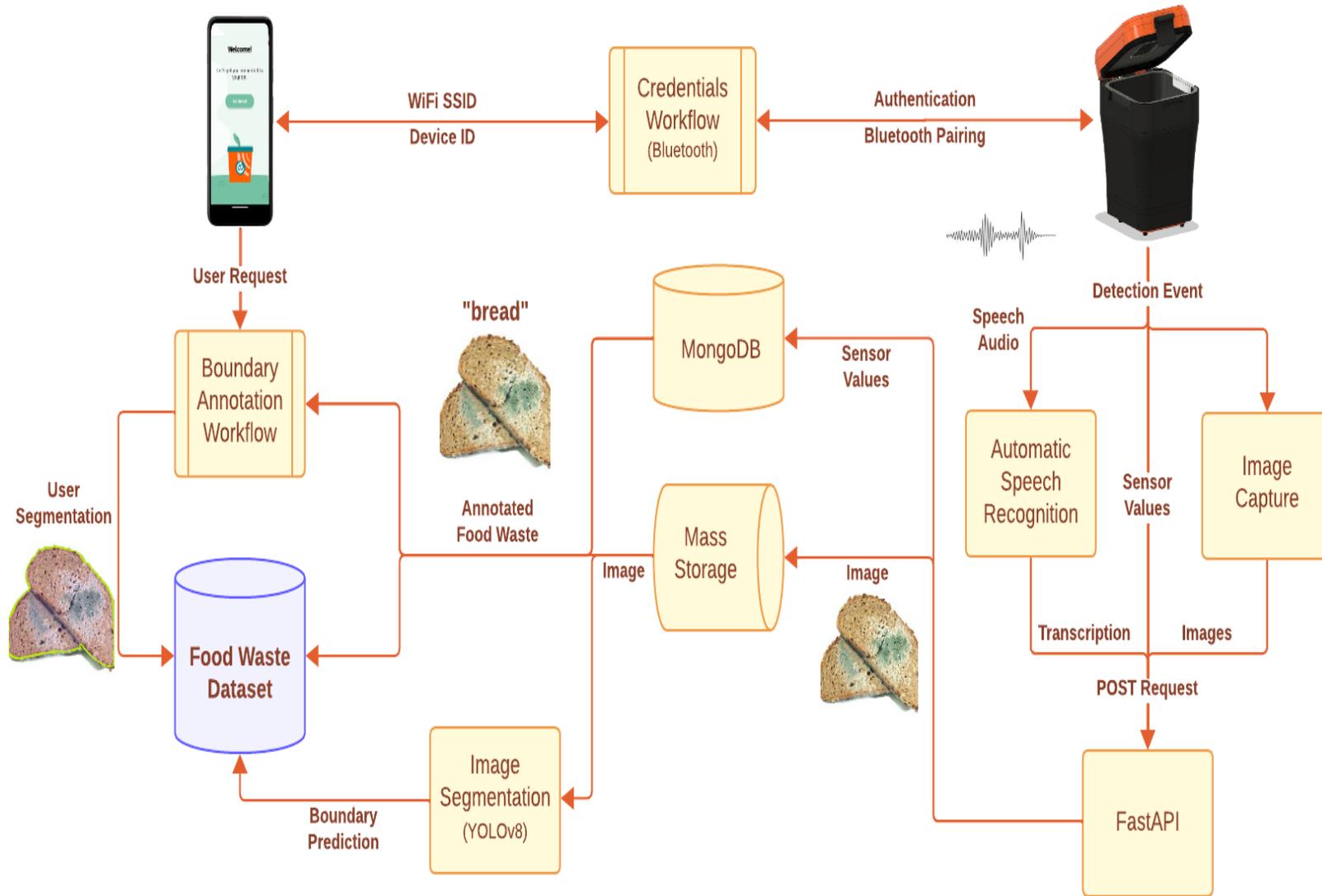
Why Intelligent Systems for Food Waste Management?

- The challenge
  - ~30% of food produced globally is wasted, with households as a major contributor (FAO, 2024; UNEP, 2025)
  - Food waste drives unnecessary GHG emissions, resource loss, and economic costs (EEA, 2024; Bux & Amicarelli, 2024
  - Traditional awareness campaigns alone show limited long-term behavioural impact (European Commission, 2024; Hebrok & Heidenstrøm, 2024)
- The opportunity
  - Intelligent systems enable real-time monitoring, prediction, and intervention (Zampieri et al., 2024; IEEE Smart Systems Initiative, 2025)
  - Shift from reactive waste handling to preventive, data-driven management (JRC & DG RTD, 2024; European Commission, 2025)

Research Needs

- Advancing intelligence
  - Hybrid AI models combining technical and behavioural data (JRC, 2025)
  - Explainable AI to build user trust (European Commission, 2024; JRC, 2025)
- Integration & governance
  - Interoperability with smart homes and city systems (JRC & DG RTD, 2024)
  - Data governance, privacy, and ethical AI considerations (European Commission, 2024)
- Policy and uptake
  - Alignment with Farm to Fork, Circular Economy, and Green Deal goals (Horizon Europe Strategic Plan 2025–2027)
  - Living labs and large-scale pilots for real-world validation (European Commission, 2025)
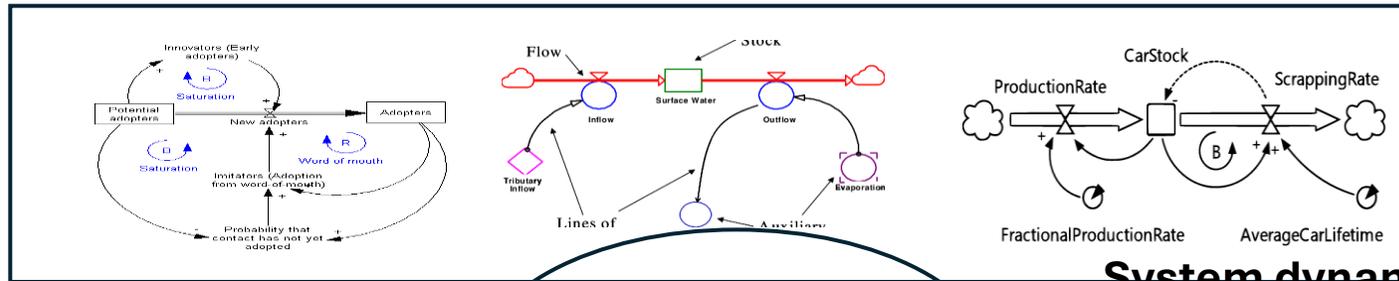
Smart Waste bin
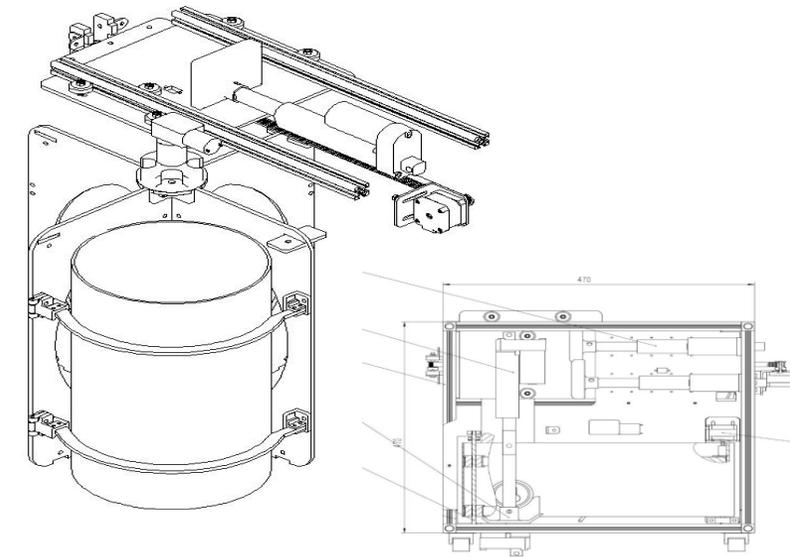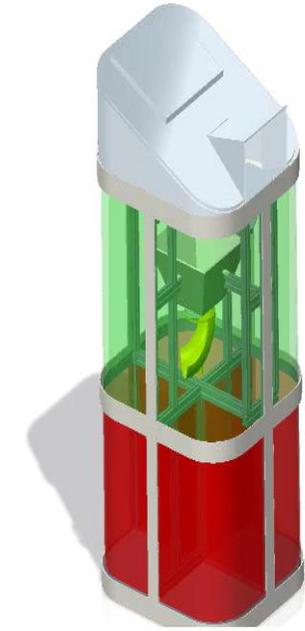
Intelligent food waste bin system
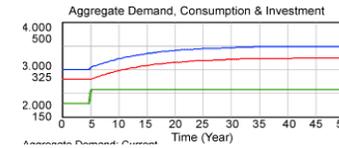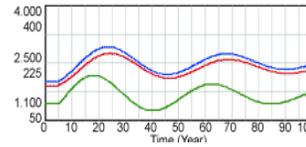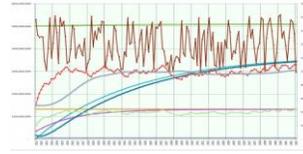
Policy development

System dynamic models

Intelligent Analytics

Cloud data management

Senser based waste bins

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