Proactive Adaptation of Behavior for Smart Connected Objects

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Introduction

- Waste management in Smart Cities is a key concern nowadays due to the increasing population number.
- Consequences of an inadequate waste management in urban areas as defined by the ***2030 Agenda for Sustainable Development***:
  - Health risks – SDG3
  - GHG emission – SDG13
  - High costs
- Data generated by sensors in the waste management infrastructure needs proper **interpretation** in order to get relevant **information** and **recommendations**.
- IoT systems must act autonomously in order to prevent undesired events. Hence, proactively adapt their behavior.

Research questions

- What are the theory **tools** and **technologies** that can be applied to obtain proactive adaptation of behavior?
- How can these tools be used to address the aforementioned **waste management** issues?

Methodology

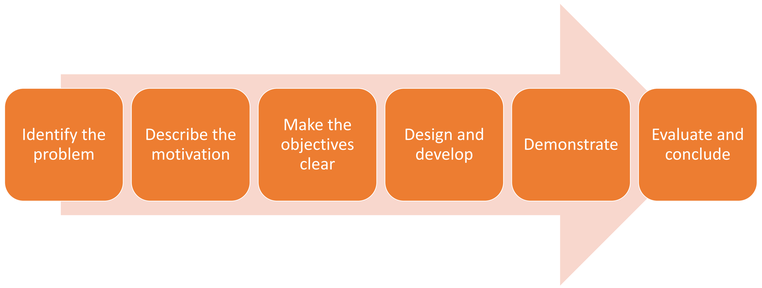


Figure 1. Design Science Research Methodology

Background

- A system adapts in a **reactive** way when it acts to a situation **after** it has happened.
- **Proactive** adaptation deals with the **prediction** of a future undesired event based on real-time data and with **decision making** regarding the predicted event **before** it occurs.
- This way, undesired events are avoided.

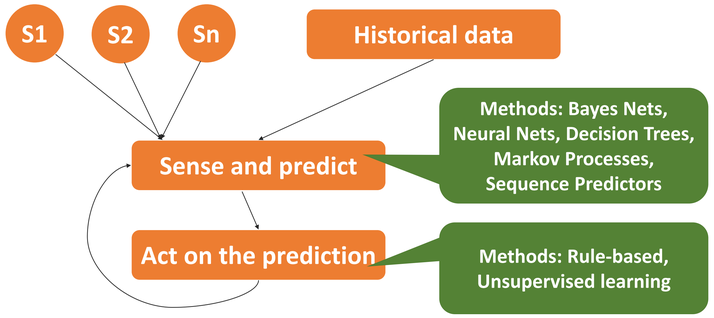


Figure 2. Conceptual representation of a proactively adapting system

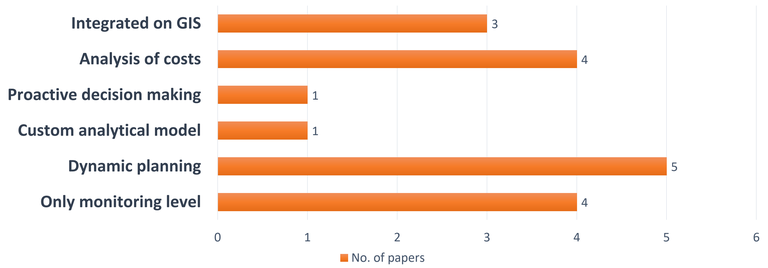
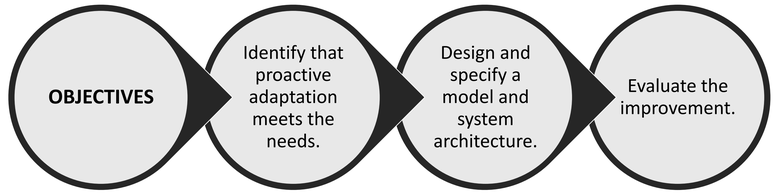


Chart 1. Features of the overviewed waste management solutions

Related work

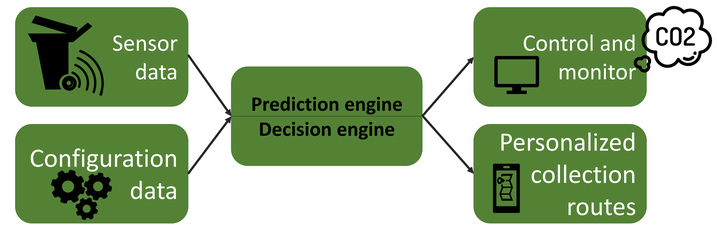
- In waste management, dynamic routing and scheduling, compared to static policies, are proved to optimize **costs** and **service quality**.
- However, few works adopt proactive features in their solutions (Chart. 1). They usually deal with the demand in a static form, without considering **unexpected events** or **limitations.**



Next steps

- ❑Apply context prediction and optimization methods (**ML**, **Probability theory, Bayes Nets, etc**.) to predict **the bins' fill rate.**
- ❑Create the model and apply **decision methods to optimize:**
  - **Fuel consumption**
  - **Bin overfill rate**
- ❑ **Answer:** which adaptation methods are more suitable for specific scenarios?
- ❑Evaluate the following by running simulations.
  - Prediction accuracy
  - Decision performance
  - Solution performance in comparison to other works
  - Green metrics: **GHG emissions; bin overfill amount;**

Architecture & expected outcome



- A data-driven enabler system for waste management that proactively addresses the city needs.

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References