

Smart City

System Description

Abstract

This is the template for System of Systems Description (SoSD document) according to the Eclipse Arrowhead documentation structure.

Contents

1 Overview	3
1.1 Significant Prior Art	4
1.2 How This SoS Is Meant to Be Used	4
1.3 SoS functionalities and properties	4
1.4 Important Delimitations	5
2 Security	6
3 References	6
4 Revision History	7
4.1 Amendments	7
4.2 Quality Assurance	7

1 Overview

This document describes the Smart City system of systems (SoS), which provides a more efficient energy consumption using two sensor networks. Street lighting lamps turn on when visibility is low and turn off when visibility improves. The rest of this document is organized as follows. In Section 1.1, we reference major prior art capabilities of the SoS. In Section 1.2, we describe the intended usage of the SoS. In Section 1.3, we describe fundamental properties provided by the SoS. In Section 1.4, we describe delimitations of capabilities of the SoS. In Section 2, we describe the microsystem (abstract level with references to their SysDs) which constitutes the SoS. In Section 3, we describe the security capabilities of the SoS

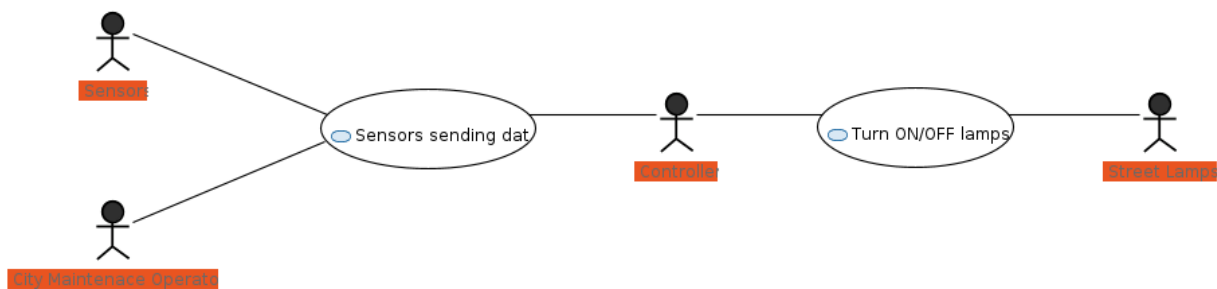


Figure 1: Smart City use case

The rest of this document is organized as follows. In Section 1.1, we reference major prior art capabilities of the SoS. In Section 1.2, we describe the intended usage of the SoS. In Section 1.3, we describe fundamental properties provided by the SoS. In Section 1.4, we describe delimitations of capabilities of the SoS. In Section 2, we describe the security capabilities of the SoS.

1.1 Significant Prior Art

The Smart City SoS is designed with inspiration from contemporary smart systems. The choice of sensors and measurement types used is based on insights from Fundación Endesa. <https://www.fundacionendesa.org/es/educacion/endesa-educacion/educacion/recursos/smart-sensors>

1.2 How This SoS Is Meant to Be Used

The Smart City SoS is intended for cities with an extensive sensor network and robust maintenance practices to ensure optimal sensor performance. Multiple sensors are required to determine the status of each lamp. The network must maintain constant connectivity to the controller.

In a future version, this system could use AI on edge or federated learning to reduce delays and enhance reliability. This system is particularly suitable for busy streets. As a potential improvement, presence sensors could be added in less critical areas to turn off lights when no one is present, further optimizing energy consumption.

1.2.1 SysML/UML block diagram

1.3 SoS functionalities and properties

1.3.1 Functional properties of the SoS

- **Real-Time Decision:** The SoS is capable of analyzing the data of two types of sensors, collected through two distinct sensor networks.
- **Scalability:** The SoS can adapt to different sizes of sensor and lighting networks. Also, thanks to the Service Registry, the Event Handler and the Orchestration, a device can be easily added and communicate.

1.3.2 Configuration of SoS properties

- **Configuration:** System parameters, such as detection thresholds, are variables that can be modified.

1.3.3 Data stored by the individual microsystem

The data consist of CSV files for the sensor networks with all the measurements. The raw data is not stored in the Controller system, only the status of the lamps is stored in an array.

1.3.4 Non-functional properties

- **Security:** The SoS implements security using arrowhead certificates for every system to be registered in the Service Registry. Also, the communication between the systems is made using endpoint and HTTP request.
- **Reliability:** The system is designed to be reliable with redundancy in the measurements and retrying when the connection is down.

1.3.5 Stateful or stateless

- **Stateless:** SoS maintains the state of network connections and traffic patterns in a MySQL database, but the data of the sensors and lamps are only stored in variables.



ARROWHEAD

Document title
Smart City
Date
2025-01-09

Version
X.Y.Z
Status
RELEASE
Page
5 (7)

1.4 Important Delimitations

- **Universal Compatibility:** The SoS must be configured if the sensors have an output that differs from the format in the CSV files.
- **Computing power:** When starting the systems, the laptop's all 4 CPUs go up to 100 percent of usage, this may be difficult for an edge device with less computing power.
- **Sensors accuracy:** If a sensor is malfunctioning or is influenced by external actor, it will distort the decision of turning on or off a lamp.



ARROWHEAD

Document title
Smart City
Date
2025-01-09

Version
X.Y.Z
Status
RELEASE
Page
6 (7)

2 Security

3 References



ARROWHEAD

Document title
Smart City
Date
2025-01-09

Version
X.Y.Z
Status
RELEASE
Page
7 (7)

4 Revision History

4.1 Amendments

No.	Date	Version	Subject of Amendments	Author
1	2023-08- 10	X.Y.Z		Jerker Delsing
2				
3				

4.2 Quality Assurance

No.	Date	Version	Approved by
1	2022-01-10	X.Y.Z	