PANEL #3

VALENCIA
April 2025

Theme
Challenges on Sensing in Smart Environments

DataSys 2025 & ComputationWorld 2025

Moderator

Prof. Dr. Lasse Berntzen, University of South-Eastern Norway, Norway

Panelists

Dr. Mika Helsingius, Finnish Defence Research Agency, Finland

Dr. Roger Tilley, Sandia National Laboratories, USA

Prof Dr. Jaime lloret Mauri, Universitat Politecnica de Valencia, Spain

Chair Introduction

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- Smart environments:
  - Use of information and communication technology (ICT)
  - Use of sensors
  - Value creation (not necessarily monetary)
- Improve efficiency and quality of operations
- What are the challenges?

Lasse Berntzen

University of South-Eastern Norway

Panelist Position

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Mika Helsingius
FDRA
Finland

❑Challenges on Sensing in Smart Environments

Smart cities and smart buildings have been under development for many years, but there are still many practical challenges.

- **Reliability of data**

  Can we always trust the data? Can someone insert false data? Low computation power limits the use of crypto etc. Can we use different sources in order to compare them and filter out fake information?

- **Data transfer and power**

  How to transfer data from sensors in a safe way? There are LoRa etc., but the bandwidth is limited and larger systems get quite complex. Power consumption and power sources are other challenges which are related to data transfer. LoRa node can run for years on AA battery, if data rates are low.

- **Security and updating sensors**

  According to industry presentations, there can be 50000 sensors in a one large building and some of them might be inside the fixed structures (humidity sensors etc.). How to fix something that breaks? Often firmware updates are not possible, or it is not easy to do it in practice. Even in smart homes?

- **The lack of standardization**

  It seems almost every city has their own system. There are hundreds of different versions. What if someone wants to roam between different cities or create some common tools? The lack of metadata, how to interpret measurements which look similar, but might mean different things?

Panelist Position

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Roger Tilley
Sandia National Laboratories

- **Challenges on Sensing in Smart Environments**
  - **Data Interoperability and Availability**
    - **Being able to make use of devices made by different manufacturers with non-standard communication protocols**
    - **Does it need to be retrieved from a cloud system?**
  - **Data Quality and Processing–**
    - **Noisy data, difficult to analyze and interpret.**
    - **Need to process data in real time.**
    - **Sample sizes can hamper analysis and decision making.**
  - **Data Collection Problem –**
    - **Data too sparse in time and space to provide for better information content for modeling critical phenomena.**
    - **Data is too regular in frequency and the content does not cover adequately critical events.**
    - **Communication in harsh environments**
  - **Sensor Design and Deployment –**
    - **The need for better planning & use of sensors, wireless sensor networks and IOT Systems to cover desired collection area.**
    - **Develop adaptive sampling techniques to increase the quality of collected data.**
    - **Designing for scalability (up or down).**
    - **Cost and energy consumption.**
    - **Reliability and durability in harsh environments.**

Panelist Position

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Jaime Lloret
Universitat Politecnica de Valencia

- **Still many issues to solve**
  - **Need of new physical sensors sensing new types of environmental parameters**
  - **Need of devices with more computing capacity to allow running complex deep learning techniques**
  - **Need of ultra-low power consumption devices.**
  - **Need of ultra-low consumption wireless technologies.**

Chair Comments

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- Low-cost microcontrollers and sensors
- The emergence of makers
- Democratization of hardware development

Some specific challenges and solutions

1. Renewable power sources
2. Communication challenges
3. Reliability of sensors
4. Privacy concerns

Lasse Berntzen

University of South-Eastern Norway