# AI-based Sensing for IOT Building Applications

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### Agenda

- 1
- Drivers & Sensing Functions of Smart Buildings
- 2 Human Sensing in Smart Buildings
- 3 AI-based Embedded IoT



## Drivers & Sensing Functions of Smart Buildings



## Smart buildings & smart homes driving forces

Stakeholder driving forces

## Environmental driving forces

**Comfort and Convenience** 

**Safety and Security** 

Optimize operating and capital costs

Safer and Greener Today and Tomorrow



**Energy conservation** 

Reduce carbon footprint "decarbonization"

**Maximize equipment lifetime** 

## Demand based controlled buildings is a strong lever for energy, CO2 and opex reduction



## In EU, buildings are responsible for about **40% of the EU's energy consumption**, and **36% of greenhouse gas** emissions from energy<sup>[2]</sup>

#### Table: Classes of building control from BS EN 15232<sup>[5]</sup>





In Germany alone, about 22 million tons of CO<sub>2</sub> saving potential through demand based heating & cooling room control <sup>[3]</sup>

#### Sources:

[2] - https://ec.europa.eu/commission/presscorner/detail/en/ip 20 1835 [3]- Infineon calculation using BS EN 15232



## Sensor solutions enabling energy efficiency, safety and convinience



#### IoT Sensors



## Human Sensing in Smart Buildings



### Human Sensing in Smart Building



## Counting





Tracking







## Vital Sensing





## AI-based Embedded IoT

## AI-based Embedded IoT





## **AI-based IoT Applications**







## Explainable AI, Incremental & Federated Learning

eXplainable AI (XAI):

- Creating human-understandable justification to the AI decisions in favorable and unfavorable scenaros
- > Known Methods (post-hoc):
  - Layerwise Relevance Propagation (LRP),
  - Local Interpretable Model-Agonastic Explanation (LIME),
  - Class Activation Mapping (CAM, Grad-CAM) etc.
- Identify data discrepancies and enabling the model to improve performance





#### Some References

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