

Visitor Flow Modelling for Schönbrunn Castle with Beacon

Sketch of Approach

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Security4Things

Survey

- Profile Consortium
- Sensor & IT Technology
- Modelling and Simulation
- Control and Prediction of Flow
- Extensions and Added Values

Consortium



Mathematical Modelling,
Algorithms, Conception,
Software

Security4Things

IoT Technology,
Hardware, LPWAN, BLE

Key Facts SCCH

- Located in Hagenberg/Linz, Austria
- RTO, non-profit
 - bridging industrial needs and academic research
 - focus on data and software science
(a.o. tracking, surveillance, prediction, AI)
 - R&D services
- Key facts
 - founded in 1999 as spin-off from JKU
 - ~60 employees
 - Austrian COMET center



softwarepark
hagenberg

JKU
JOHANNES KEPLER
UNIVERSITY LINZ

COMET

Competence Centers for
Excellent Technologies

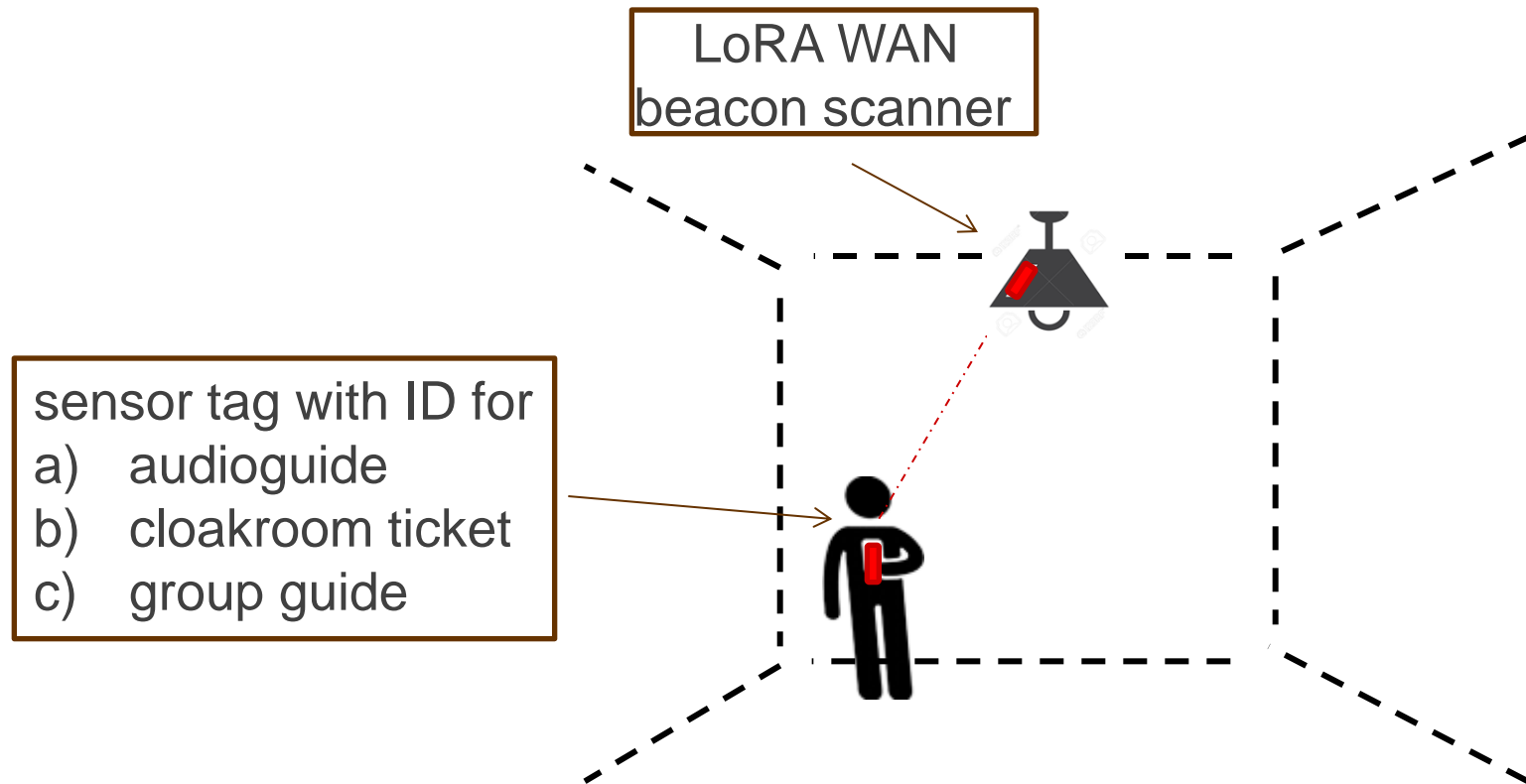
Key Facts Security4Things

- Located in Vienna, Austria
- Startup(eingetragener Unternehmer)
 - IoT startup working with the latest IoT tech
 - focus on IoT protocols, devices, sensors and use-cases (a.o. Security, Tracking, Indoor Localisation, LPWAN, BLE)
- Key facts
 - founded in 2016
 - TheThingNetworks' initiator for Vienna & Cluj-Napoca community, LoRaWan open community
 - Vodafone's partner on NB-IOT
 - ECF member on PBS working group



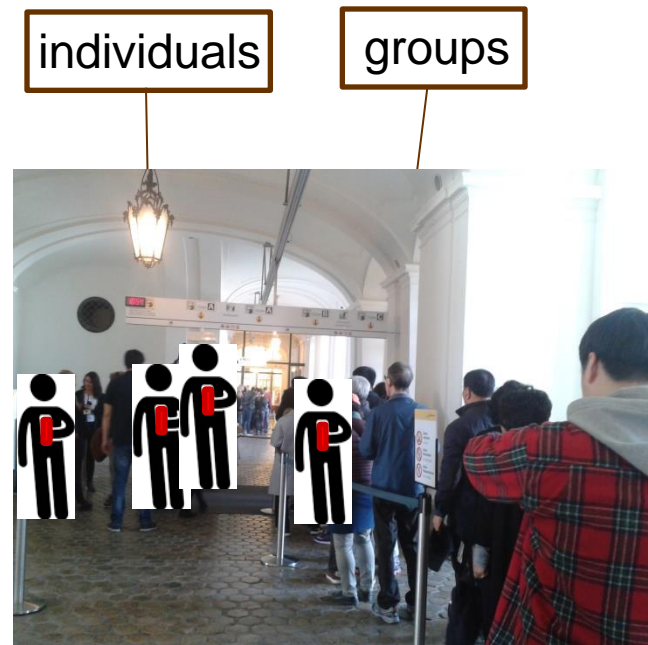
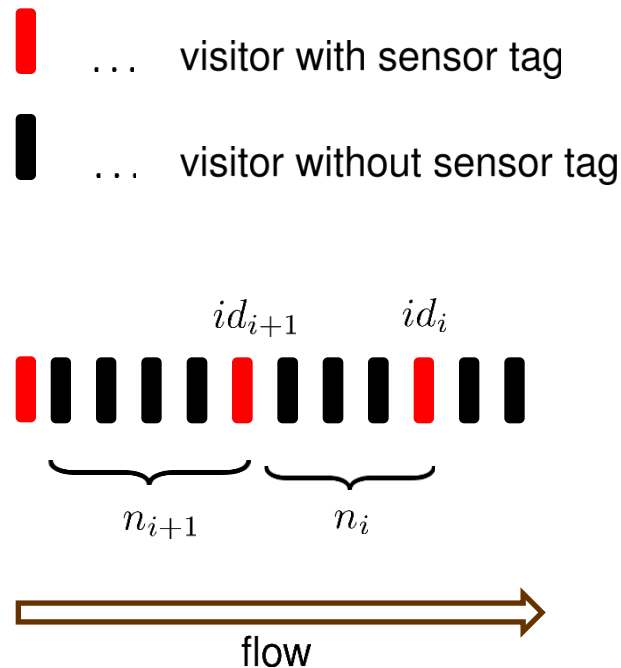
Sensor & IT Technology

- sensor tag using beacon technology, bluetooth low energy (BLE)
- coin battery for up to two years or by power supply (e.g. lamp)
- LPWAN network (LORA WAN)



Modelling and Simulation

- model density of sensor tag IDs (at the entrance)

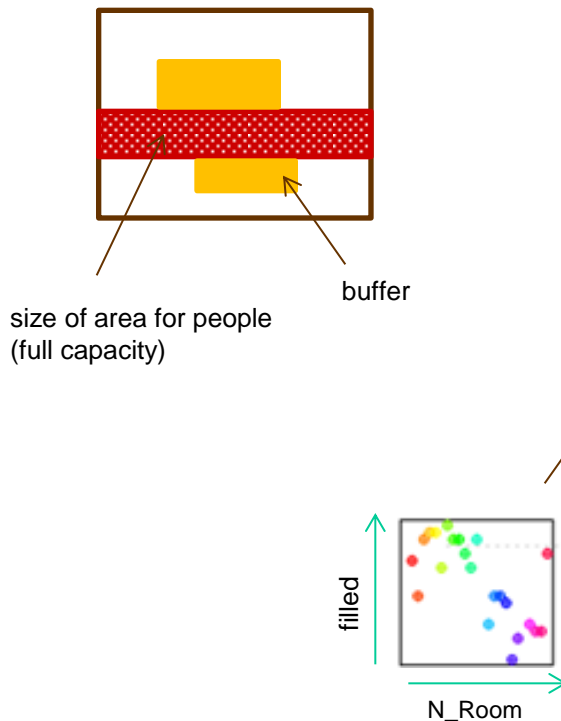


- set up statistical Markov model for simulation and prediction
- apply mathematical optimization for smart scheduling

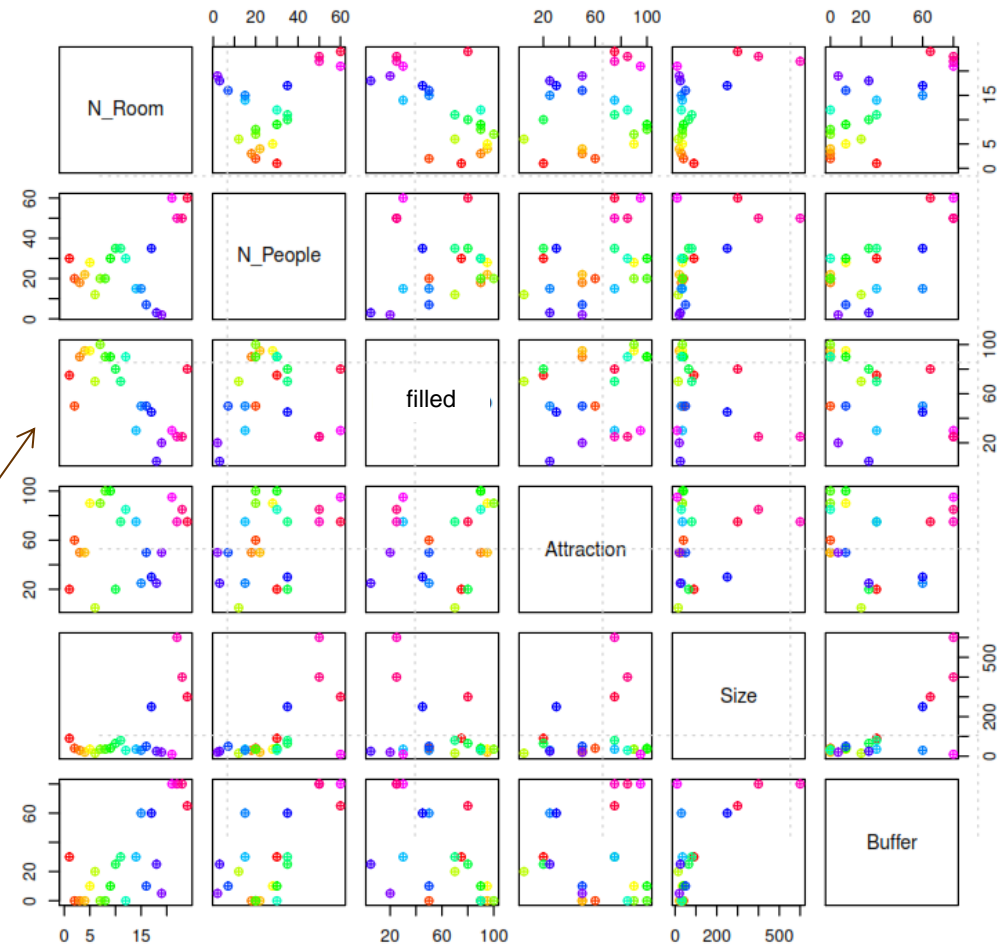
Room Model and Statistics

Room Model

room number („N_Room“, colors)
number of people in room („N_People“)
percentage of filled capacity („filled“)
average stay („Attraction“)
full capacity („size“, red + orange)



Data from an on-site inspection (8. 4. 2017, first 24 rooms)



Control and Prediction of Flow

- real-time visitor flow estimation
 - based on sensor tag localization (room level)
- control of flow based on smart scheduling
 - groups with different profiles (short / long route; thematic routes)
 - design expected optimal schedule for future orders
 - apply mathematical optimization techniques based on expected scenarios
- control of flow on-site
 - Fine-tune scheduling based on flow predictions

Extensions and Added Values

- extend beacon with environmental sensors
 - air humidity etc.
 - helps to protect work of art
- data mining on visitor preferences
 - holding times
 - helps to get automated feedback
 - helps in advertisement (museum shop)
 - anonymous data, therefore no privacy concerns
- extensions
 - Mapping of IDs with App-users possible (personalized content etc)

Rough Cost Estimate

category	€ / unit	comment	sum / €
sensor tags	~30€	1200 audio guides + 800 additional (guides)	~60.000€
relays (LoRA WAN)	~100€	40 rooms + 10 additional	~5.000€
IT infrastructure		server, network	~15.000€
basis-software		database, GUI, communication	~120.000€
		simulation / flow estimation	~120.000€
			~320.000€

Kontakt

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