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Technik & Architektur FH Zentralschweiz

# Key Success Factors for Future IoT Systems

Matlab Expo, Bern, 23 May 2019



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# LIVING IN THE FUTURE. TODAY.

### **Drivers for Future IoT Systems**



Megatrends: Sustainability, Demographics, Lifestyle & Digitization Drive Change



### **Application Context:**

- Mobile & Autonomous systems
- Wearables & Health
- Social Media
- Smart Environments
  - Home, Building
  - City
  - Industry 4.0

### **Drivers for Future IoT Systems**



Megatrends: Sustainability, Demographics, Lifestyle & Digitization Drive Change

#### **Technological Development**

- Ubiquitous Connectivity
- Software & Cloud Computing
- Machine Learning
  - Speech & Image Recognition
  - Learning & Generalization
- Energy harvesting & longer battery life
- New Sensors
- Privacy & Security
- Device Lifecycle





The future of IoT will be driven by the applications we choose & this will create new engineering challenges



Source: iStock

#### **iHomeLab**

#### Swiss Think Tank and Research Centre for Building Intelligence

#### **Smart Energy Management**

- Load Management and integration of Renewables
- Decentral Energy measurements, Smart Metering & Load Recognition

#### **Active Assisted Living**

- Enabling elderly people a longer, active & independent lifestyle
- IoT applications for higher Quality of Life

#### Safe Building Intelligence

- Private, individualized support by intelligent buildings
- Digitalisation, Privacy & Data Security

#### **Visitor Center**

- 250 Events / 2500 3500 Visitors per year
- Up to 25 Visitors per visit (15-60 min.)







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### **17 years of Application Oriented Research in IoT**



#### **Collaboration Modes**

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#### Innosuisse (KTI) Projects

- Industry Collaboration

#### **EU Consortia**

- Industry & Academia

#### **Research Contracts**

- Industry Partners
- BfE, EdF

#### **Student Projects, Theses**

- Industry, Investigation

#### iHomeLab Partners

- Partnership

### iWalkActive: Personal Mobility for the elderly









#### **Relaxed Care: Connecting People**





#### **Home4Dem:**

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#### Activity Based Profiles – Dementia Detection



### **Research Tool: iHomeLab Multi-Sensor**



Sensor Fusion & input for Machine Learning Algorithms

- Low-Power universal sensor system
  - PIR-Sensor
  - Humidity
  - Temperature
  - Luminosity
  - Air Pressure
  - VOC (Volatile Organic Components)
  - Acceleration / Vibration
  - Door Contact Sensor
  - Magnetometer
  - Sound Pressure
  - Distance Sensor



### **Energy Aware IoT Study**

#### Energy Savings through Distributed Intelligence



#### **Energy awareness:**

- Current energy use

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- Forecasted energy use

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- Flexibility
- Control inputs

Enables coordinated energy savings at large scale

# IoT Ecosystems: Creating Caring Communities



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### **EU Project BUTLER – Location, Context, Security**





### Successful design of IoT Systems

Key is mastering complexity and ensuring acceptance by users



- Context
- Communication M2M, H2M

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- User acceptance
  - Design
  - Trust
  - Quality of Service
- Design Parameters
  - Connectivity
  - Localization
  - Energy supply
  - Intelligence
  - Interaction

### **iHomeLab IoT Development Process**

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#### Open development environment, Results validated in the field





- Design Thinking

- Early user involvement
- What's the real need?
- Value Proposition Engineering

- Agile SW Development

- Field Trials

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- Design Thinking

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- What's the real need?
- Value Proposition Engineering

#### - Agile SW Development

- MVP\* to prove prototypes
- Sharing information supports innovation & efficiency

#### - Field Trials

\* Minimum Viable Product

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- Design Thinking

- Early user involvement
- What's the real need?
- Value Proposition Engineering
- Agile SW Development
  - MVP to prove prototypes
  - Sharing information supports innovation & efficiency
- Field Trials
  - Validation in the real environment
  - Handover to users and project partner

### **IoT Applications are Context-Embedded**





Sources: Context: pxhere.com, Ecosystem: pixabax.com, Device: pixabay.com: Components: Own Photo & Screenshot

### **Digital Twins provide structure**







#### **Digital Twins**

#### Model Based Systems Engineering structures the IoT Design Process

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**Digital Twins** 

### **Tools & Simulation based Validation increases** efficiency and agility

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**Digital Twins** 

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# The future of IoT will be driven by the applications we choose & this will create new engineering challenges





### The alternative is a world of IoT Hackers....



# iHomeLab – Living in the future, today

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