IoSense Spring School 2019

March 7, 2019

1 Overview

The Spring School of the JU ECSEL project IoSense demonstrates how to engineer innovative products in sensor-actuator networks. The IoSense project[1] focuses on the availability of top innovative, competitive sensors and sensor systems "Made in Europe" for "Internet of Sensor" applications in smart mobility, society, energy, health care and production.

Participants are enabled to build platforms and complements for hardware/software ecosystems so that their future applications in the Internet of Sensors become reality. The IoSense Spring School presents newest sensor technologies as well as ways to create innovations with them, extending the value chain with easy-to-build software for sensor applications.

2 IoSense Spring School

IoSense targets multiple key application areas to help tackle grand societal challenges of our and future generations. Sensor and app-based innovations in areas such as Smart Mobility, Society, Energy, Health and Production, benefit directly from smart sensor-based systems that communicate among themselves, their environment and offer their services to users. A necessity for smart objects and machines are suitable sensors that are intelligently integrated into future products.

IoSense contributions and solutions are realized in different demonstrators, targeting specific application areas.

During the Spring School selected demonstrators provides an overview about the goal and the addressed key application areas. Components are presented from project

[1] www.iosense.eu

experts. Hands-on sessions will focus on integrating sensor components into a software toolbox to showcase the easy-to-use approach on how to build sensor-based applications. The software toolbox is complemented by illustrating the integration of a lean startup inspired process for developing customer centric products and applications.

2.1 Objective

The target of the IoSense Spring School is to show how to engineer innovative products. The goal is to enable IoT ecosystems based on hardware-software platforms and complementing applications for flexible and high-performance data aggregation and processing in sensor-actuator networks. The future technology of IoSense covers

- Innovative sensor and multi-sensor technologies for heterogeneous application areas
- Highlighting new approaches for developing sensors using flexible frontend and backend pilot lines
- Design of sensor and application components for market needs by involving customers early in the development process
- Enabling external parties to build IoT ecosystems with IoSense technology
- Closing the gap between chip manufacturers and application developers for transforming existing value chain approaches

3 Schedule

The IoSense Spring School will be held on March 07^{th}, 2019 and consists of a full day program.

IoSense Spring School The Spring School starts with a key note session. Technical Talks and demonstrator presentations will follow after that.

Agenda:

09:00 Keynote session

10:30 Talk Session 1

11:00 Demo Presentations 1

11:20 Coffee break

11:40 Talks Session 2

12:10 Demo Presentations 2

12:50 Lunch

13:50 Talk Session 3

14:20 Demo Presentations 3

15:00 Poster session

Talks:

Keynote Session:

- **Development of an Integrated Relative Humidity Sensor in the Framework of the IoSense Project** *Frederik Vanhelmont*, AMS, Netherlands
- **Sensor Integration Developments at TU-Delft** *Kouchi Zhang*, TU Delft, Netherlands
- **Prognostics & Health Management for LED-based Applications** *Prof. Willem Van Driel*, Phillips, Netherlands

Talks:

- Session 1: **Time-of-Flight 3D Imaging and its Field of Appplications**, *Norbert Druml*, Infineon Technologies AG Austria
- Session 2: **Security Concepts Applied in the TrustWorSys Demonstrator**, *Thomas Ulz*, TU Graz, Austria
- Session 3: **A Software Toolkit for Complex Sensor Systems in Fog Environments**, *Thang Phan*, TU Dresden, Germany

Demonstrators:

- Session 1:**TrustWorSys: Secured Smart Production** *Reinhard Kloibhofer*, Austrian Institute of Technology, Austria
- Session 2:
  - **AdCon: Value of IoT Sensors in Energy Efficient Buildings** *Prof. Christian Heschl*, Fachhochschule Burgenland, Austria

  - **Smability: Reliable V2X communication** *José M. Sánchez*, Integrasys, Spain
  - **SeFuProTec: Sensor-Aided Manufacturing Processes for Sensor Assembly** *Dr. Jens Müller*, XENON, Germany
- Session 3:
  - **High Throughput Raman Spectrometer — HiThRaSpect** *Harrie Tilmanns*, IMEC, Belgium
  - **Reconfigurable Instrument Control Unit (R-ICU) use-case: Mars Exploration Rovers** *Marcos Martinez*, Thales Alenia Space, Spain

3.1 Sensor integration developments at TU-Delft In this presentation we present the integration work currently ongoing at TU-Delft.

Kouchi Zhang, TU Delft, Netherlands

The research addresses compact and complex system integration and reliability. The major research activities are 3D wafer level integration; advanced packaging level integration (SiP); control and interface engineering of complex systems; design for component, product and complex system reliability; fast reliability qualification and testing. As one of the leading research groups for system integration, our group develops generic technologies for micro/nanoelectronics systems. In the presentation we will give an overview of the past and future work and our view on the relevance to the semiconductor industry.

3.2 Prognostics & Health Management for LED-based Applications

Prof. Willem Van Driel, Philips, Netherlands

Philips Lighting's revenue is largely influenced by the change from component supply to systems, solutions and services. Reliable products start with understanding the physics-of-failure by using accelerated test approaches such as (H)ALT. Classical reliability approaches using such test approaches combined with failure analysis are used in order to obtain conservative bounds from the failure models and predict failure rates on a system level. A next step is to use data analytics on our installed base and here one could actively retract (working) products from the market, analyze them and determine there (degraded) performance. This allows us to move into the prognostics (PHM) regime where a detailed understanding of failure mechanisms, usage scenarios, technology and design come together. In the presentation we show our road towards prognostics and demonstrate PHM work being done in the different professional Lighting application segments: Public Lighting, Office & Industry Lighting and Retail Lighting.

3.3 Time-of-Flight 3D imaging and its field of appplications

Norbert Druml, Infineon Technologies AG, Austria

Time-of-Flight is a widely used depth perception technology. Typically, infrared light is emitted by a LED or laser and the time until the light is reflected from the scenery is measured. There are direct and indirect measurement principles. The indirect approach evaluates the distance by means of the phase shift between the emitted and received signals with the help of photonic mixing devices (PMD). If integrated together with a strong illumination unit, such Time-of-Flight cameras can perform range measurements of up to 50m. Recently, these PMD-based solutions became quite famous thanks to miniaturization improvements and their low computational performance requirements, which enabled the integration into small embedded devices such as smart phones. In this talk, the basic working principle of Time-of-Flight 3D imaging will be presented. Furthermore, the latest and most promising fields of applications (such as secured face-unlocking) will be shown.

3.4 AdCon: Value of IoT Sensors in Energy Efficient Buildings

Prof. Christian Heschl, Fachhochschule Burgenland, Austria

The increasing decentralised energy supply with PV and wind power plants necessitate enhanced demand side flexibilities with intelligent communication between energy consumer and provider. In this context, smart buildings in smart grids are designated key enablers to align the energy demand with the volatile energy production for grid stabilization. However, due to the constricted construction timelines, the economic viability pressure and the higher complexity of such integrated energy systems, risk of unnoticed control errors arises. In particular, HVAC systems are difficult to analyse during actual operating phase as a result of the dynamic load behaviour and the individual occupancy requirements. Hence, this presentation details an Open Platform Communication (OPC) / Building Automation and Control Network (BACnet) system which has been developed to combine data from a resident building automation system within the Living Lab ENERGETIKUM and data from IoT wireless sensor networks installed therein. The IoT sensors are deployed to extract the missing key data, which offer additional diagnostic information about building protection aspects and the performance of HVAC components. The skimmed diagnostic data is designed to be fed into Building Information Modelling (BIM) and Computer Added Facility Management (CAFM) tools. This aids in automated fault detection and system optimization during the construction and utilization phase of buildings.

3.5 Smability: Reliable V2X Communication

José M. Sánchez, Integrasys, Spain

Autonomous vehicles which are driving in different contexts like highways, urban environments, and rural areas, managing the quality for the entire data processing chain of sensor- and actuator-based autonomous systems is increasingly complex. Because the communication platform is responsible for all the information exchanges, system performance largely depends on communication reliability. Although wireless communication standard considered to be a promising for enhancing transportation safety and efficiency, IEEE 802.11p and ITS-G5 Vehicle to Vehicle (V2V) communication is still unreliable because of the complicating factors of high vehicle speed and harsh radio environments. Performance is still unreliable because of its sensitivity to shadow fading in complex and changeable real-world environment due to its high working frequency and customized physical layer settings. The presentation focused on affordable planning and testing of reliable V2X communication network based on platform with real vehicles and simulators.

3.6 SeFuProTec: Sensor aided manufacturing processes for sensor assembly

Dr. Jens Müller, XENON, Germany

Due to factors such as miniaturization of products, increased cycle time and process precision existing process technologies in electronics, assembly and manufacturing need distinctly increased usage of implemented sensors to meet future requirements. This requires integrating and characterizing sensor functions for process technologies and using multiple types of sensors such as temperature, pressure/vacuum, mass, optical detection, force. In this presentation, we will demonstrate the integration of sensors in high precision crimping processes and sensor aided dispensing.

3.7 A Software Toolkit for Complex Sensor Systems in Fog Environments

Thang Phan, Technische Universität Dresden, Germany

Recently, Internet of Things (IoT) is becoming an important factor of our daily life. The rapid increase of IoT devices requires an IoT system which has ability to connect the various devices in different locations, process a huge amount of data with low latency. A new concept, known as fog computing, is emerging to offer a great opportunity to deploy such system. How to create IoT applications in fog computing is a challenge with developers, because it requires dealing with heterogeneous sensors/IoT devices and system architecture. In this talk, we present a software toolkit to facilitate developing complex sensor applications in fog computing. Our solution supports modular application architecture and employ docker, a containerized virtualization, for deployment. Therefore, the flexibility of the system is consolidated. Our toolkit abstracts low-level details and provides tools to simplify application implementation. Through use-case demonstrations, we illustrate the potential of our toolkit.

3.8 High Throughput Raman Spectrometer — HiThRaSpect

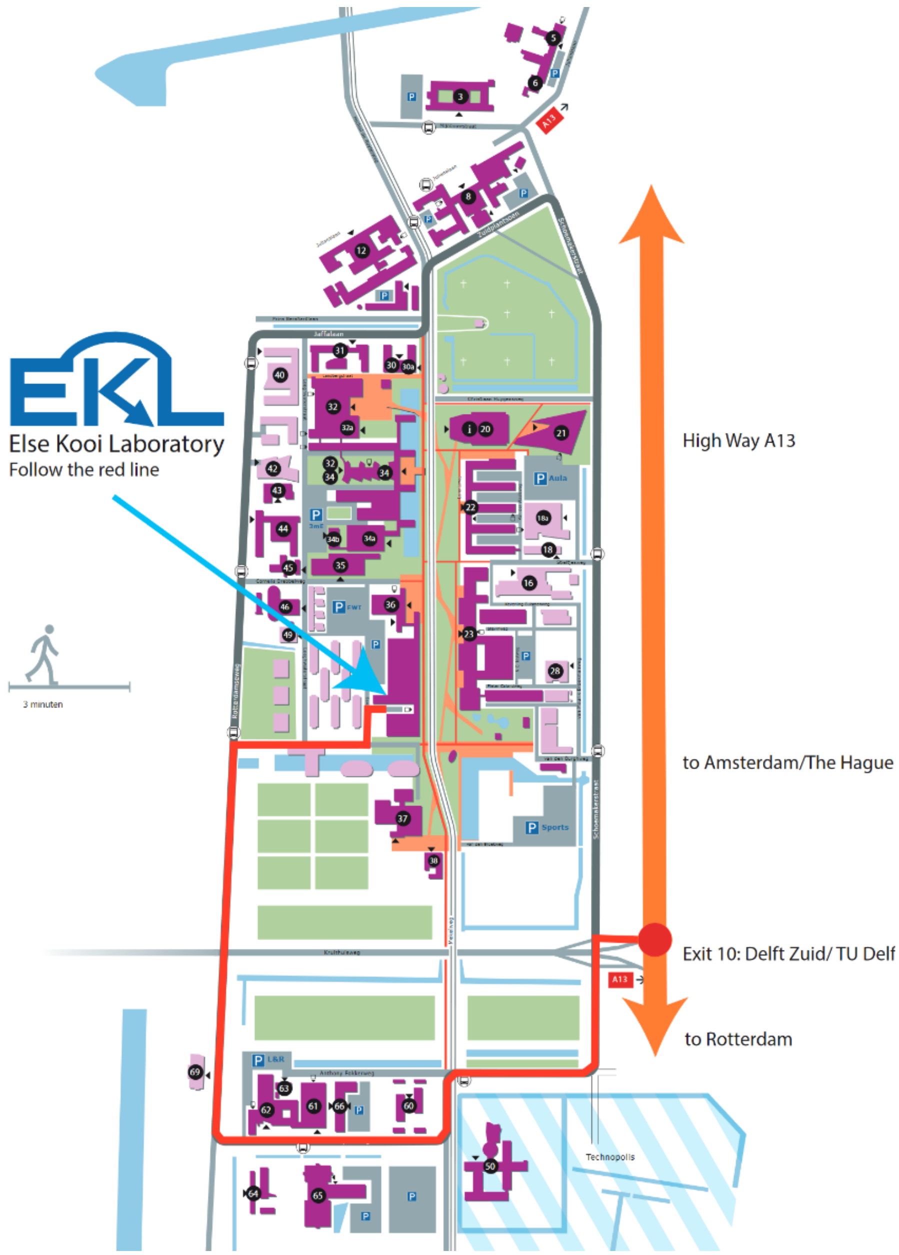
Harrie Tilmanns, IMEC, Belgium

The HiThRaSpec demonstrator aims at a state of the art demonstration of an integrated Raman spectrometer which can be used in a diverse set of speciation analysis applications. The conceptual build-up of the high throughput Raman spectrometer is described and its principle of operation is explained. The spectrometer is classified as a (spatially) Fourier Transform Spectrometer and does not contain any moving parts. The heart of the instrument is the photonics-based spectrometer chip, monolithically integrated with the image sensor (used for the detection). The basic photonics process flow, implemented as a post processing module on top of e.g. CMOS image sensors, is described. The spectrometer chip is complemented with discrete optics (e.g.,

specifically designed collection optics) and readout electronics to define the Raman instrument. Examples of Raman measurements for various samples/species using a laboratory prototype are presented, clearly showing the device functionality.

4 Location

The IoSense Spring School will take place TU Delft, Feldmannweg 17, 2628 CT Delft, The Netherlands Building EWI (36) Room: EKL Colloquium room – EKL 01.180 (1st floor).


EKL
Else Kooi Laboratory
Follow the red line
High Way A13
to Amsterdam/The Hague
Exit 10: Delft Zuid/ TU Delf
to Rotterdam
3 minuten
Technopolis
P Aula
P Sports
A13

5 Short Facts

Date: March 7, 2019

Intended audience: IoSense project members and interested third parties with relevant backgrounds

Estimated number of participants: 40-50

Equipment: Projector, internet connection

Event Web page: `http://iosense.eu/index.php/project/iosense-spring-school19/`

Address: TU Delft, Feldmannweg 17, 2628 CT Delft, The Netherlands Building EWI (36) Room: EKL Colloquium room – EKL 01.180 (1st floor).

Registration Fee: Zero €

Registration Procedure: For registration write an email to: mariam.zia@tu-dresden.de

Deadline to register: Jan 31^{st} 2019

The project IoSense is funded by the European Union within the ECSEL Joint Undertaking programme and is co-founded by grants from Austria, Belgium, Germany, Netherlands, Slovakia, Spain. It is coordinated by Infineon Technologies Dresden GmbH, Königsbrücker Str. 180, 01099 Dresden, Germany. Project Coordinator: Dr. Oliver Pyper e-Mail: iosense@infineon.com

The IoSense Spring School is organized by TU Delft and TU Dresden.