
SENSOR NETWORK PLATFORM KIT

Abstract

The Sensor Network Platform Kit aims at creating a wireless sensor network out-of-a-box for basic low power sensing and data collection applications, e.g. environmental monitoring. Furthermore it provides support and system integration know-how for application projects within NCCR MICS. Today the team is supporting two applications projects: "Permasense" is a typical environmental monitoring application in an extreme outdoor environment where a wireless sensor network is used

to investigate permafrost in the Swiss alps. "Smart Buildings" is an indoor monitoring application to investigate the heat, ventilation, cooling processes in buildings. Furthermore the project takes an active role in the international TinyOS based wireless sensor network community.

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Funding

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Web

www.btnode.ethz.ch/Projects/SensorNetworkPlatformKit

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SENSOR NETWORK PLATFORM KIT

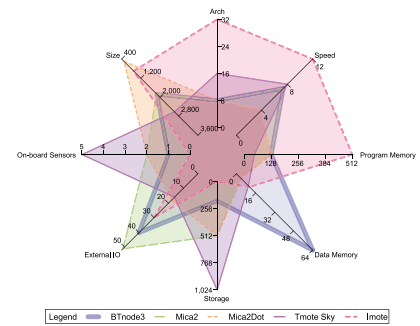


Fig. 1: Design Tradeoffs for Wireless Sensor Network Platforms

Objective

The reality of WSN deployments today is often frustrating. Prominent examples have shown repeated failures on their trial deployments. The reasons for this are manifold and often non-technical: Sometime knowledge is simply drained with people graduating, sometimes poorly developed concepts and planning or an underestimation of the problems. A number of projects within NCCR MICS are targeting real-world wireless sensor network (WSN) deployments. Out of these, many have similar requirements as to the basic hardware and software components and system setup. To facilitate collaboration but moreover to enable a fast and reliable jump-start of new junior researchers, the Sensor Network Platform Kit (SNPK) has been proposed.

The bottom line here is to make current state-of-the-art WSN technology more sustainable – using a mix of industry style R&D and academic research – headed by senior academic staff and complemented by junior technical staff. This will enable us to retain know-how in-house for longer, to devote people to really sit down and work on development projects without the academic pressure to publish, to support fellow researchers in their custom integration needs, but also to explore and understand in-depth future technology.

While a first pre-release of the Sensor Network Platform Kit (SNPK) will consist mainly of state-of-the-art industry components and results of MICS research projects originating from earlier phases, future releases will focus on the system integration of versatile known-to-work components derived directly from NCCR MICS research projects. The SNPK will be supported throughout NCCR MICS partner project with staffed technical support and senior researchers to make use of synergies within such a large research consortium in the evaluation, integration and commissioning phases of NCCR MICS application projects.

Here we follow a strategy of at first supporting a few selected projects that are open and willing to cooperate on a common platform strategy. It is assumed that other/future projects will get attracted to the benefits and resources of the Sensor Network Platform Kit as the project accelerates. Partners in the SNPK will not have to use all components offered by the SNPK but only comply with interfaces to allow them to develop custom solutions that can be integrated with SNPK components.

Target Audience

- Projects that want to implement a low-power wireless sensor network application based on distributed data gathering and delivery to a central location
- NCCR MICS partners that need platform know-how to jumpstart their research
- Projects that want to share/integrate their work with others
- Projects that target a basic environmental sensing application

Technical Summary

The open collaboration targeted by the Sensor Network Platform Kit is a mix of development and support as well as consulting and the maintenance of a knowledge base for in-house projects at ETH Zurich and EPFL. It is built on four pillars of developments, testbed services, knowledge base and staffed support for the affiliated projects.



Fig. 2: The Permasense projects uses wireless sensor network technology to monitor permafrost and global warming in the Swiss alps

Developments

- Low-power Wireless Sensor Network application based on a MSP430 platform (Tmote Sky) and state-of-the-art software and tools (TinyOS-2.x)
- Peer-to-peer backend data gathering based on the Global Sensor Network platform (EPFL)
- Testbed and validation methodology based on the Deployment-Support Network (DSN) and continuous integration support (Cruisecontrol)

Deployment and Testing Services:

- Installation and maintenance of a number of DSN based testbeds with up to 50 nodes per setup. (ETHZ and Siemens)
- Automated building and testing of software

Knowledgebase and Technology Transfer:

- Central repository, documentation and knowledge base
- Sensor Network Museum
- NCCR MICS working group 2
- TinyOS core and testbed working group

Staffed Support

- Staffed support for NCCR MICS affiliated projects (2 engineers and 1–2 student helpers)

Outreach and SNPK Collaborations

Although only started in late 2006, the Sensor Network Platform Kit has already gained significant acceptance in the community. The team has taken up mandates with two affiliated NCCR MICS projects where the support team is contributing with (i) custom design-in services for hard- and software, (ii) delivery and installation of WSN testbeds, (iii) testbed services as well as (iv) general consulting.

The “Permasense” project targets environmental monitoring in an extremely hazardous outdoor environment. The wireless sensor network to be deployed on the highest alpine peaks monitors the effect of permafrost and global warming. In order to achieve the required unattended lifetime of the system (~1–3 years) and to be able to cope with the severe climatic conditions (-40 to +65 degrees C, snow and ice, rockfall) a custom hardware was designed based on off-the-shelf components and SNPK technology. To be able to sustain, the system undergoes rigorous testing performed on the Deployment-Support Network at ETH Zurich prior to deployment on e.g. the Matterhorn and the Jungfraujoch.

“Smart Buildings” is an indoor monitoring application to investigate the heat, ventilation, cooling processes in buildings. The collaboration with architects and civil engineers will give them insights into processes poorly understood today that often make even modern buildings highly inefficient and hard to maintain. The application is a key showcase and driver for the core SNPK technology developed with a live demo installation in buildings at the ETH Höggerberg campus.

Furthermore the SNPK team takes an active role in the international WSN community and TinyOS Alliance where we are member in several and chairing one working group contributing to the ongoing consolidation and standardization work. In the future we expect to reach out to an even broader community with the components and technology developed within the Sensor Network Platform Kit.

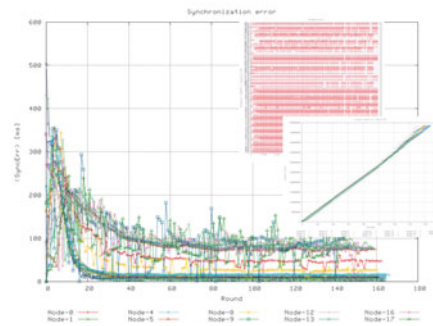
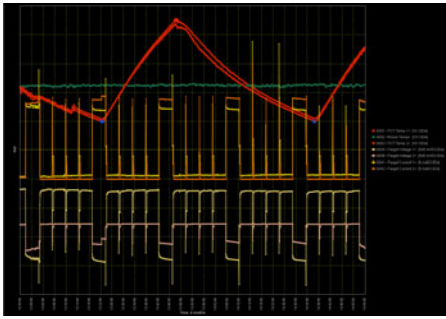


Fig. 3 and 4: Rigorous testing of WSN application using custom developed testbeds for long-term logging and performance characterization

Partners

K. Aberer (EPFL)
 Moteiv Corp. (USA)
 Shockfish SA (Lausanne)
 Art of Technology AG (Zurich)
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Permasense

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Smart Buildings

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 T. Gross (ETH Zurich)
 M. Morari (ETH Zurich)

Recent Publications

K. Aberer, G. Alonso, G. Barrenetxea, J. Beutel,
 J. Bovay, H. Dubois-Ferriere, D. Kossmann,
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 K. Martin and P. Blum
**Deployment Support Network –
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 Proc. 4th European Conference on Wireless
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 M. Yücel and L. Thiele
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