

Innovations for autonomous sensor technology

Synchronized acquisition of dynamic data with wireless sensors

Autonomous and wireless IIoT sensor networks

With miniaturized IIoT platforms, data can be acquired at almost any desired location. Data from different sensor nodes can be fused and processed in a central evaluation. But one paramount factor in dynamic applications is ensuring the synchronized acquisition of the data.

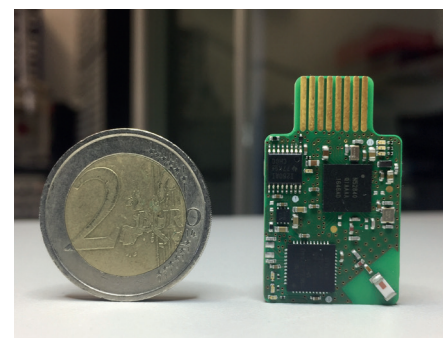
Fraunhofer IZM has developed an algorithm that can ensure synchronicity to the tenths of a millisecond, even for data sourced from different sensors and even when the data is transmitted wirelessly. Possible applications include the monitoring of dynamic workflows in process automation or machine diagnostics and maintenance.

Synchronized wireless sensor network **Active Innovations:**

The solution developed at Fraunhofer IZM relies on a synchronized, wireless sensor network based on modular and adaptable wireless sensor nodes.

Data is shared and synchronized via a dedicated Bluetooth protocol. This makes it possible for the first time to perform measurements with high spatial and temporal resolution, using all of the advantages of wireless sensor technology.

- Wireless, stand-alone sensor-actuator platform with dual-core Cortex-M4 processor
- Modular, scalable sensor system
- Bluetooth v5.1 interface allowing synchronized data acquisition down to tenths of a millisecond
- Miniaturized (36 mm x 26 mm) for easy integration into applications
- Desktop and mobile device apps for data analysis and processing



Modular, scalable sensor system with Bluetooth v5.1 interface

Sensor nodes are synchronized automatically after the system is powered up for the first time. Synchronization is achieved within a few seconds after the network has been set up and remains accurate to the tenths of a millisecond.

Sensor data is transmitted wirelessly via the same radio interface. The system uses the 2.4 GHz frequency band and operates with the latest Bluetooth 5 radio standard. Other radio protocols, such as ZigBee or Thread, can also be implemented.

Sensor platform with modular configurability

The sensor network is part of Fraunhofer IZM's self-sufficient and miniaturized SWARMY-V2 sensor-actuator platform. The system can be supplemented with further specific sensors.

Acquisition of sensor data:

- Acceleration
- Yaw rate
- Humidity
- Magnetic field strength
- Light intensity
- Temperature
- Distance
- Atmospheric pressure

The platform can be individually configured in terms of hardware and software components, depending on the data rate or power consumption requirements.

The system is powered by USB-rechargeable batteries. The platform is also equipped for inductive (wireless) charging with the Qi standard.

The simple scalability of the sensor system allows it to be used in different network sizes and adapted to the respective application.

You would like to get to know our solutions for sensor nodes and embedded microsystems?

Contact us!

Fraunhofer IZM: Invisible - but indispensable. Nothing works anymore without highly integrated microelectronics and microsystems technology. The basis for their integration into products is the availability of reliable and cost-effective assembly and interconnection technologies.

Fraunhofer IZM, a world leader in the development and reliability assessment of electronic packaging technologies, provides its customers with customized system integration technologies at the wafer, chip, and board level. The research done at Fraunhofer IZM helps make electronics more reliable and provides customers with reliable data about the durability of electronics.

Advantages of the sensor-actuator platform:

- Acquisition of data with high spatial and temporal resolution
- Sensor data synchronized down to tenths of a millisecond
- Custom, modular configuration
- Expandability with external sensors
- Easy scalability

Fraunhofer IZM offers consulting services to optimize the design and configuration of the components.

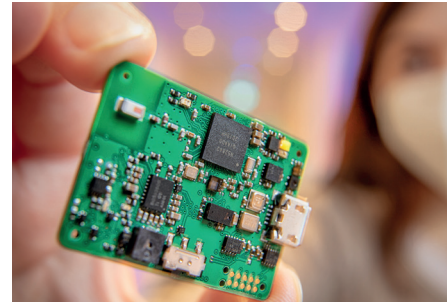
To visualize, record, and store the data on a GUI, a desktop application and an app for mobile devices are available.

Data Processing Software:

- Python desktop app for Windows, macOS, and Linux
- Android app for tablets and smartphones

Sensor Actuator Platform Applications:

- Spatially distributed measurements e.g. in industrial plants, agriculture, or traffic engineering
- Simultaneous measurement of dynamic quantities, e.g. in fluid dynamics or vibration measurement technology
- Tracking of spatially variable parameters, e.g. rate of propagation
- Fast realization of spatially and temporally variable sensor jobs



The current platform version SWARMY-V2 can acquire sensor data and adjust its measurement direction flexibly.

Project Status (03/2023):

- Industrial application within the SWARMY V2 sensor-actuator platform
- Application in swarm robotics research

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More information



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