CREATING
IDEAS

SMART
FARMING

TAKE YOUR FARMING TO THE NEXT LEVEL

Climate change, loss of arable land, ever scarcer resources and a growing world population. There are more and more challenges in food production. New approaches are being sought to meet these challenges. One of them is smart farming.

With our WE line of FeatherWings you can rapidly prototype your own smart farming application. With the help of the Sensor FeatherWing you can measure data points such as temperature and humidity to check if the plants are feeling most comfortable.

This created data can be sent into any cloud using the Calypso Wi-Fi FeatherWing. On Github, we are providing quickstarts and example-code to get data into Microsoft and Amazon IoT platforms. Here, the data can be displayed, stored and analyzed to optimize plant output.

Benefits

Actuators can now be controlled manually or automatically via RPC

✔ Turn on water pump to water the soil if the moisture is too low.
✔ Automatically fertilize the soil.
✔ Change the color and brightness of the LED depending on the time of day and the development of the plant.

CREATE DATA

Sensor FeatherWing

4 sensors connected over shared I²C in Adafruit Feather form-factor

- WSEN-TIDS for temperature sensing
- WSEN-HIDS for humidity sensing

Sensing environmental conditions like temperature and potting soil humidity

SEND DATA

Calypso Wi-Fi FeatherWing

- Wi-Fi-Connection 2.4 GHz
- Easy connection to Smart Devices
- Sending data to the server
- Handling multiple sensor nodes

Sending the collected data from the sensors into the cloud platform

ANALYZE DATA

Azure aws

IoT Platform

- Send data to any cloud for further use
- Create real IoT use cases
- Examples and Sourcecode available on GitHub for Microsoft Azure and Amazon Web Services

LED-CONTROLLING

LIGHTING DEVELOPMENT KIT

Lighting Development Kit

- Regulate LED for best performance
- Dimming 0 - 100%
- Deep Blue, Hyper Red, Far Red and White
- Output up to 30umol/s

M0 Microcontroller Feather

- Receive and send sensor data
- ARM Cortex M0+ processor
- clocked at 48 MHz and at 3.3V logic
- 256K of FLASH

POWER TOOLS

SMART INDUSTRY –
CONNECTED POWER TOOLS

Professional power tools have to perform at high levels and must be able to endure a tough workload. The Industrial Internet of Things enables better management of expensive tools via wireless communication. In conjunction with sensors that monitor appropriate use, new business areas, such as the leasing of equipment, are opening up.

The slim and energy-saving Wi-Fi and Bluetooth modules from Würth Elektronik make power tools capable of communicating. The devices can be linked up anywhere - in the workshop, in the vehicle, or on the construction site. In conjunction with temperature, humidity and motion sensors, the tools become smart. They can transfer data concerning usage and wear to a cloud application for instance. The advantage: maintenance cycles can optimally be scheduled, and rental equipment can be billed based on actual usage. Furthermore, inappropriate use or damage can additionally be detected with the help of sensors.

Benefits

Power tools capture data concerning the usage and share it wirelessly

✓ Access to device data at any time.
✓ Wireless data access prevents penetration of dust and water.
✓ Opportunity to install further systems, e.g. for localization of tools or sensors for drop detection.
✓ Data can be extracted, e.g. via a mobile app.
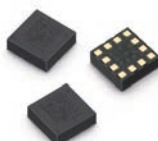

HUMIDITY & TEMPERATURE	**ACCELERATION**	**BLUETOOTH**	**WI-FI**	**CELLULAR**
WSEN-HIDS	**WSEN-ITDS**	**Proteus-III**	**Calypso**	**Adrastea-I**
▪ 16 bit humidity and temperature output ▪ I²C and SPI interface ▪ 2 x 2 x 0.9 mm	▪ 3 axis acceleration ▪ 14 bit output resolution ▪ ±2g, ±4g, ±8g, ±16g ▪ 2 x 2 x 0.7 mm	▪ Bluetooth® LE 5.1 ▪ Nordic nRF52840 ▪ 8 dBm output power ▪ 12 x 8 x 2 mm	▪ IEEE 802.11 b/g/n, 2.4 GHz ▪ +18 dBm output power ▪ 19 x 27,5 x 4 mm	▪ LTE-NB.IoT / Cat.M1 ▪ incl. GNSS ▪ 14 x 13 x 2 mm
Sensing Humidity & temperature of the environment to ensure the vacuum cleaner is used in right operating conditions.	Sensing Acceleration for vandalsim protection.	Connection between the tools, which want to be used in Sync mode: Sync mode one master tool controls the other(s). Meaning, activating this tool via the tool trigger will activate the synchronized tool(s) as well.	Connect the control unit to Internet: Cloud connectivity for status informations, changes to the settings from anywhere in the world.	Connect the control unit to Internet: Cloud connectivity for status informations, changes to the settings from anywhere in the world etc.

DIGITAL TOOLS

POWER TOOLS
IOT CONNECTIVITY

The interconnection of power tools offers various advantages and applications. Especially with battery-powered tools, there is no longer a connection between the tools, which does not allow a synchronized function.
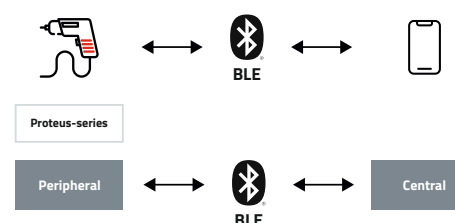
With the help of Bluetooth networking, the various tools can be operated in coordination with each other. For example, a vacuum cleaner starts as soon as the drill is started. Ideally, the various functions can be controlled with the help of an app.

Via a mobile device, it is possible to download the usage and wear data, and as a result to optimally plan the maintenance cycles or, in the case of a rental device, to settle the accounts on the basis of actual usage.
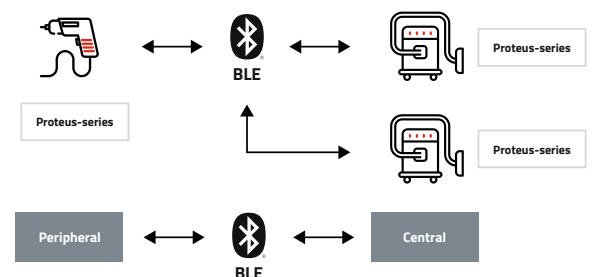
Benefits

✓ Access to device data at any time.
✓ Contactless data access prevents the penetration of dust and water, extending device life.
✓ Installation of further systems, e.g. for localizing the location of the molds or sensors with fall detection. This data can be read out using a mobile app.
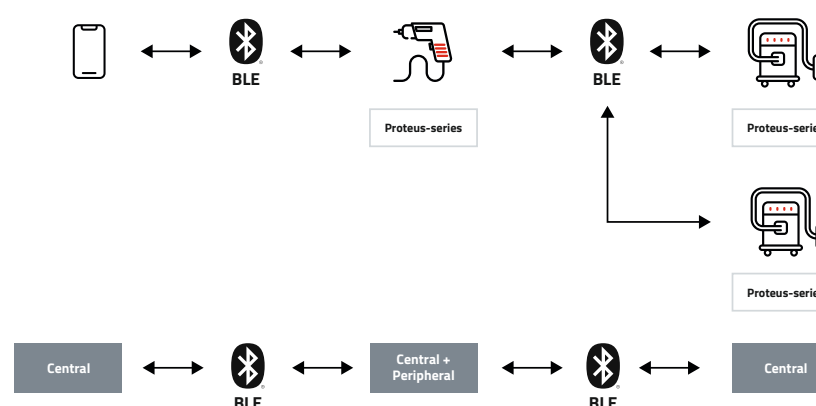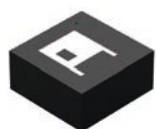

ACCELERATION

WSEN-ITDS

- 3 axis acceleration
- 14 bit output resolution
- ±2g, ±4g, ±8g, ±16g
- 2 x 2 x 0.7 mm

Sensing Acceleration for vandalism protection.

BLUETOOTH

Proteus-III

- Bluetooth® LE 5.1
- Nordic nRF52840
- 8 dBm output power
- 12 x 8 x 2 mm

Connection between the tools, which want to be used in Sync mode: Sync mode one master tool controls the other(s). Meaning, activating this tool via the tool trigger will activate the synchronized tool(s) as well.

HUMIDITY & TEMPERATURE

WSEN-HIDS

- 16 bit humidity and temperature output
- I²C and SPI interface
- 2 x 2 x 0.9 mm

Sensing Humidity & temperature of the environment to ensure the vacuum cleaner is used in right operating conditions.

Communication Tool - Smartphone

Communication Tool - Peripheral Devices

Communication Smartphone - Tool - Peripheral Devices

SMART
HELMET

WEARABLES –
SMART HELMET

In the case of motorcycle accidents, it is of crucial importance to receive medical aid as soon as possible, as the collision might severely hurt internal organs. A smart helmet that can detect a crash and send an emergency alarm automatically could thus be a lifesaver.

Acceleration sensors and LTE mobile radio modules including localization (GNSS) by Würth Elektronik can be used to implement safety applications. In case the sensor system detects the movement pattern of a collision, an emergency call will automatically be sent or predefined persons could be contacted.

Benefits

A helmet which is able to communicate and to collect data can increase safety and comfort of the biker.

✔ The condition in the helmet can be measured via additional integrated sensors, for example temperature and humidity. The driver is alerted in time and thus protected from overheating.
✔ In addition, a communication interface for radio contact between driver and passenger can be implemented.

HUMIDITY & TEMPERATURE

WSEN-HIDS

- 16 bit humidity and temperature output
- I²C and SPI interface
- 2 x 2 x 0.9 mm

Measuring environmental conditions in the helmet to avoid overheat in summer time or wetness in the helmet due to leakage while siginficant rain.

ACCELERATION

WSEN-ITDS

- 3 axis acceleration
- 14 bit output resolution
- ±2g, ±4g, ±8g, ±16g
- 2 x 2 x 0.7 mm

- Impact detection and initiationg the radio module to setup an emergency call.
- Impact detection to gather information for the doctors for the grade of injury.
- Concussion detection

BLUETOOTH

Proteus-III

- Bluetooth® LE 5.1
- Nordic nRF52840
- 8 dBm output power
- 12 x 8 x 2 mm

Connection from helmet to mobile to download. Data from helmet like head movement, specific vibrations, etc.

CELLULAR

Adrastea-I

- LTE-NB.IoT / Cat.M1
- incl. GNSS
- 14 x 13 x 2 mm

Communication from Master Gateway at construction site to central server.

AUTOMATED GUIDED VEHICLES

SMART INDUSTRY –
## AUTOMATED GUIDED VEHICLES

Automatic Guided Vehicles (AGV) or Autonomous Mobile Robots (AMR) are vitally important for flexible intralogistics concepts. While GNSS can be used for navigation outdoors, robots in factories and warehouses need different orientation techniques.

Key factors for the navigation of AMRs are wireless communication and acceleration sensors for inertial navigation. Würth Electronic does not only offer sensor and radio modules but also supports various communication protocols. Orientation via anchor point antennas distributed on the factory or warehouse floor as well as transmission of orders and status updates can be realized, e.g. with Bluetooth, Wirepas Massive Routing Mesh, or WE-ProWare Flooding Mesh.

Benefits

**Autonomous Mobile Robots –
autonomous but well connected**

✔ Communication with intralogistics vehicles can be realized over a variety of protocols - even proprietary solutions might prove to be a good solution.
✔ With wireless communication, all kinds of information can be shared, e.g.battery charge status, transport weight, or condition of wear parts.
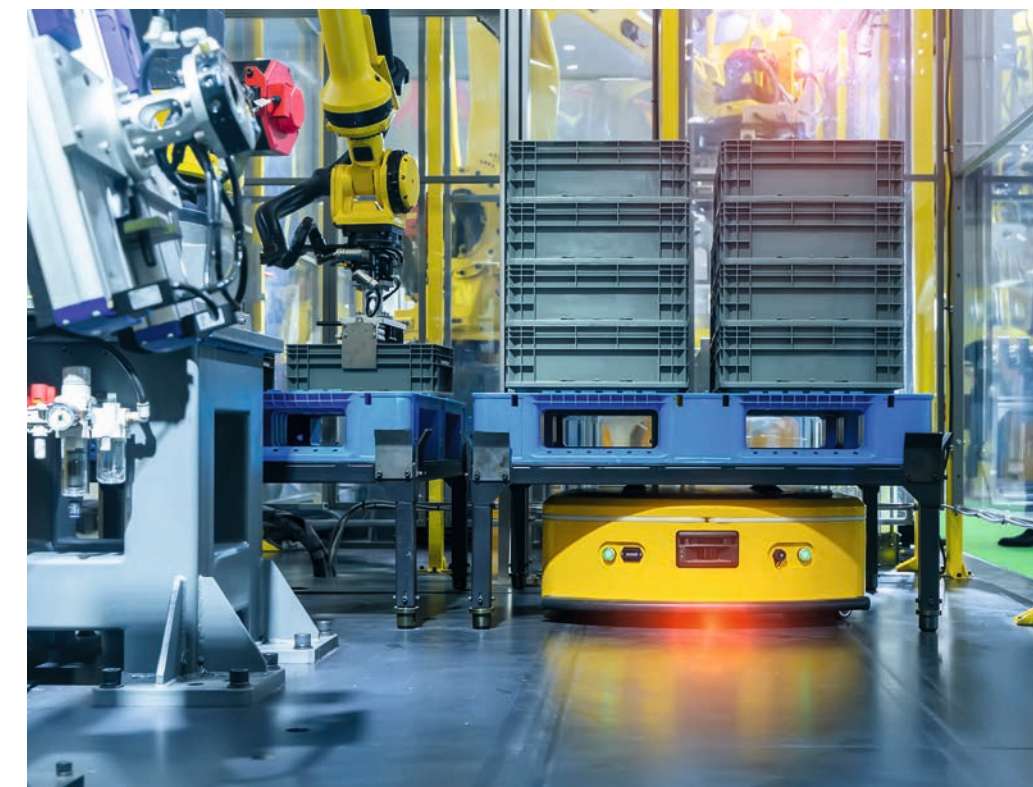
PROPRIETARY	BLUETOOTH	ACCELERATION	WIREPAS
Tarvos-III	**Proteus-III**	**WSEN-ITDS**	**Thetis-I**
▪ 868 MHz	▪ Bluetooth® LE 5.1	▪ 3 axis acceleration	▪ Wirepas routing mesh protocol, 2.4 GHz
▪ RF Pad / PCB Antenna	▪ Nordic nRF52840	▪ 14 bit output resolution	▪ +6 dBm output power
▪ 14 dBm output power	▪ 8 dBm output power	▪ ±2g, ±4g, ±8g, ±16g	▪ 8 x 12 x 2 mm
▪ 27 x 17 x 3.8 mm	▪ 12 x 8 x 2 mm	▪ 2 x 2 x 0.7 mm	
Sub-GHz radio communication in industrial environment offers reliability.	Find a specific robot selected using the function "Direction Finding" to navigate the user to the tool.	Sensing movement or crash detection.	Find a specific robot selected using Wirepas Positioning Engine.
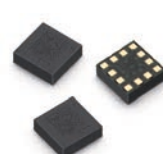
CONSTRUCTION LIGHTING

SMART INDUSTRY – INTELLIGENT MOBILE CONSTRUCTION LIGHTING

Mobile lighting at construction sites, especially on expressways, pose a great risk to the workers, if these lights are shifted by unobservant road users. Sensors and a communication mesh provide additional safety.

The lamps and warning beacons for road construction have sensors for detecting strong movement impulses (impact) as well as for location detection. The lamps are interconnected via a mesh network and report any change in location within a centimeter range. This eliminates the need for regular checks along the site to ensure that all luminaires are still in the right position. The interconnection of the luminaires can be realized with a Wirepas Massive Routing Mesh, or WE-ProWare Flooding Mesh by Würth Elektronik.

Benefits

Smart lamps form a mesh and control their own position

✓ Luminaires equipped with GNSS and acceleration sensors report any change in location.
✓ Further advantages are the constant control of all functions, such as battery charge level, set brightness, or even environmental factors, e.g. temperature and humidity.

Central Master Gateway

The Central Master Gateway is equipped with WSEN-HIDS, WSEN-ITDS sensors, Thetis-I and Adrastea-I module.

HUMIDITY & TEMPERATURE	**GNSS**	**CELLULAR**	**ACCELERATION**	**MESH**	**PROPRIETARY**
WSEN-HIDS	**Erinome-I**	**Adrastea-I**	**WSEN-ITDS**	**Thetis-I**	**Thyone-I**
▪ 16 bit humidity and temperature output ▪ I²C and SPI interface ▪ 2 x 2 x 0.9 mm	▪ GPS, GLONASS, GALILEO, BEIDOU ▪ Integrated Antenna ▪ 18 x 18 x 6.4 mm	▪ LTE-NB.IoT / Cat.M1 ▪ incl. GNSS ▪ 14 x 13 x 2 mm	▪ 3 axis acceleration ▪ 14 bit output resolution ▪ ±2g, ±4g, ±8g, ±16g ▪ 2 x 2 x 0.7 mm	▪ Wirepas routing mesh protocol, 2.4 GHz ▪ +6 dBm output power ▪ 8 x 12 x 2 mm	▪ 2.4 GHz ▪ Smart antenna selection ▪ 8 dBm output power ▪ 12 x 8 x 2 mm
Sensing Humidity & temperature to be aware of true local weather conditions.	Localization of each single unit in case of theft or finding all owned units.	Communication from Master Gateway at constrcution site to central server.	Impact or location movement detection.	Connecting hundreds of devices to extend the range and without having the need to add LTE with recurring costs to each device	Use a remote control connected wirelessly to the lamps and adjust settings.
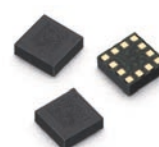
TIME SYNCHRONIZED
SAFETY LIGHTING

TIME SYNCHRONIZATION LIGHTING

Runway firing requires the highest reliable synchronized lighting. Reducing the wiring lowers installation costs and improves the degree of scalability.

Easy integration of new windmills into the existing park requires a reliable and secure bidirectional radio communication to increase Green Energy sector.

Würth Elektronik offers a variaty of GNSS Moduls not only for localization but also for time synchronization. In combination with globally accepted radio standards like Wi-Fi, Bluetooth, WE-ProWare, NB-Iot and LTE Cat. M the far distance management of machines, meaning remote monitoring and controlling, gives you dependend on the application either worldwide or locally enclosed access to your devices. In both cases highest security requirements can be fulfilled.

Predictive and curative maintenance can be triggered by intelligent digital sensors giving you the status of the environmental conditions in- and outside the housing and provides protection against natural destruction and exceptional failures.

Data can be made acessable through secure cloud connectivity.

Benefits

- ✔ Save kilometers of wiring
- ✔ Easy installation and extension
- ✔ Scalability
- ✔ Individual lights control
- ✔ Microsecond accuracy synchronization

GNSS

Erinome-I

- GPS, GLONASS, GALILEO, BEIDOU
- Integrated Antenna
- 18 x 18 x 6.4 mm

Time Synchronization between different lights.

Time Stamping for Events.

CELLULAR

Adrastea-I

- LTE-NB.IoT / Cat.M1
- incl. GNSS
- 14 x 13 x 2 mm

Far distance maintenance access – remote control.

PROPRIETARY

Setebos-I

- Bluetooth® LE 5.1 & WE-ProWare 2.4 GHz
- 8 dBm output power
- 12 x 8 x 2 mm

Triton

- 2400 MHz
- RF Pad / PCB Antenna
- 14 dBm output power
- 27 x 17 x 3.8 mm

Proprietary for secure Mesh connection of the lighting network. Combined with Bluetooth for individual lighting configuration.
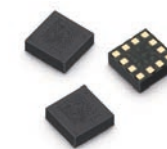
HUMIDITY & TEMPERATURE

WSEN-HIDS

- 16 bit humidity and temperature output
- I²C and SPI interface
- 2 x 2 x 0.9 mm

Environmental condition tracking within the lights. Recoginzing exceptional conditions like penetrating moisture.

ACCELERATION

WSEN-ITDS

- 3 axis acceleration
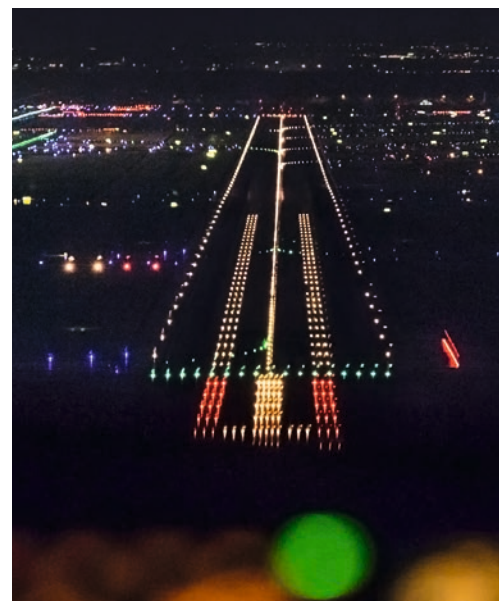- 14 bit output resolution
- ±2g, ±4g, ±8g, ±16g
- 2 x 2 x 0.7 mm

Detection of shock and mechanical influence and stress, like bird pecking.

ANALYZE DATA

▲ Azure

aws

IoT Platform

- Send data to any cloud for further use
- Create real IoT use cases
- Examples and Sourcecode available on GitHub for Microsoft Azure and Amazon Web Services

INTELLIGENT
COFFEE MACHINE

SMART HOME – INTELLIGENT COFFEE MACHINE

Coffee machines are popular and in daily use. Modern machines allow creative compositions of personalized coffee variants. At the same time, leasing models are increasingly based on so-called wet hours or actual consumption – smart solutions are required.

Humidity and temperature sensors as well as Bluetooth, WiFi and cellular modules from Würth Elektronik: Equipped in this way, a coffee machine can become a smart device. With the help of integrated humidity and temperature sensors, it is possible to control the machine's optimal functioning. A change of the machine's values indicates a malfunction, which means that the need for maintenance can be displayed at an early stage or reported directly to a service center. In leasing, a billing system can be realized through live data transfer to the cloud. Convenient for the user: By using a mobile app, each user can design his or her personal coffee and preset, e.g. the amount of coffee, milk, or water.

Benefits

Coffee pleasure with pay per use

- ✓ With the connection to the Internet, a technician can get access to usage and consumption data at any time. The supplier of coffee, cocoa powder or milk will be on site only if necessary. This saves resources and protects the environment.
- ✓ Personalized coffee preferences can be adjusted via smartphone.
- ✓ Instead of paying a fixed monthly fee, the customer only pays for actual consumption.

HUMIDITY & TEMPERATURE	BLUETOOTH	WI-FI	CELLULAR
WSEN-HIDS	**Proteus-III**	**Calypso**	**Adrastea-I**
▪ 16 bit humidity and temperature output ▪ I²C and SPI interface ▪ 2 x 2 x 0.9 mm	▪ Bluetooth® LE 5.1 ▪ Nordic nRF52840 ▪ 8 dBm output power ▪ 12 x 8 x 2 mm	▪ IEEE 802.11 b/g/n, 2.4 GHz ▪ +18 dBm output power ▪ 19 x 27,5 x 4 mm	▪ LTE-NB.IoT / Cat.M1 ▪ incl. GNSS ▪ 14 x 13 x 2 mm
Measuring Humidity and Temperature ensures an optimal funtion and taste.	Connect to mobile App to preset your personal coffee or also as service interface for the technician.	Live data transfer to the cloud platform within a Wi-Fi network.	Live data transfer to the cloud platform from anywhere.

SMART HOME – WIRELESS ALARM SYSTEM

WIRELESS ALARM SYSTEM

Older houses often have many weak points and are particularly vulnerable to burglary. However, retrofitting wired security devices is expensive and laborious. Manufacturers should therefore also offer radio-based alarm systems.
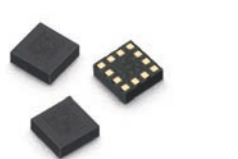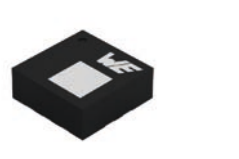
The development of retrofittable alarm systems with wireless technology depends on the right combination of radio technologies. For the control system, a connection to the Internet or to the mobile network is required. For connecting the sensors, radio frequencies in the sub-GHz and the 2.4 GHz range can be used, whereas both short and longer distances have to be bridged. Due to security reasons, the use of a long-established but not publicly known radio protocol, such as WE-ProWare by Würth Elektronik, is very advantageous. Intelligent sensor technology can detect the opening of windows or doors by measuring the change in barometric pressure, temperature or humidity and trigger a silent alarm.

Benefits

Proprietary radio protocol – a security advantage

✓ By intelligent combination and utilization of highly sensitive Würth Elektronik sensors, the opening of windows and doors can be detected without equipping the doors themselves with sensors.
✓ A wide range of Würth Elektronik radio modules allows variants for different spatial conditions.
✓ Arming and disarming of the alarm system can be executed via mobile devices if an internet connection via Wi-Fi or cellular module is established.

PROPRIETARY		WI-FI	BLUETOOTH	CELLULAR	COMBINED	HUMIDITY & TEMPERATURE	ACCELERATION	ABSOLUTE PRESSURE
Tarvos-III	**Thyone-I**	**Calypso**	**Proteus-III**	**Adrastea-I**	**Setebos-I**	**WSEN-HIDS**	**WSEN-ITDS**	**WSEN-PADS**
• 868 MHz • RF Pad / PCB Antenna • 14 dBm output power • 27 x 17 x 3.8 mm	• 2.4 GHz • Smart antenna selection • 8 dBm output power • 12 x 8 x 2 mm	• IEEE 802.11 b/g/n, 2.4 GHz • +18 dBm output power • 19 x 27,5 x 4 mm	• Bluetooth® LE 5.1 • Nordic nRF52840 • 8 dBm output power • 12 x 8 x 2 mm	• LTE-NB.IoT / Cat. M1 • incl. GNSS • 14 x 13 x 2 mm	• Bluetooth® LE 5.1 & WE-ProWare 2.4 GHz • 8 dBm output power • 12 x 8 x 2 mm	• 16 bit humidity and temperature output • I²C and SPI interface • 2 x 2 x 0.9 mm	• 3 axis acceleration • 14 bit output resolution • ±2g, ±4g, ±8g, ±16g • 2 x 2 x 0.7 mm	• 26 – 126 kPa • 260 – 1260 mbar • 24 bit output resolution • 2 x 2 x 0.8 mm
The flooding mesh network of the WE-ProWare offers hundreds of alarm sensors to be connected secure and reliable.		Connecting the alarm system main console to the local Wi-Fi.	Accessing the alarm system settings from a mobile device in a short range.	Connecting the alarm system main console to the cellular network.	Interconnecting all sensors through the WE-ProWare mesh, while offering mobile device access through Bluetooth in one device.	Measuring local room temperature & humidity simultaneously.	Recognizing movement of particular inventory like expenisve art.	Measuring local room air pressure to monitor unforeseen window openings e.g. during a burglary.

VANDALISM PROTECTION

SMART BUILDING – VANDALISM PROTECTION

Electronic devices such as motion detectors or video cameras for surveillance purposes which are installed in public or easily accessible areas are particularly at risk. Criminals will always try to destroy these devices first. Therefore, the intentional destruction of such electronic devices must be detected and reported immediately.

To be able to detect any tampering with a surveillance device, a sensitive 3D acceleration sensor and a radio module should be integrated. With the high-quality and power-saving components from Würth Elektronik, solutions can be developed that immediately sound the alarm, if someone tampers with a surveillance camera or motion detector.

Benefits

Protect the protecting devices

✔ An alarm quickly puts burglars into flight, and you are alerted yourself. With an internet connection, a direct emergency call can also be sent.
✔ In addition to the main function of motion detection or image recording, cost-effective secondary functions for surveillance are available, e.g. measurement of temperature, humidity and atmospheric pressure.

WI-FI

Calypso

- IEEE 802.11 b/g/n, 2.4 GHz
- +18 dBm output power
- 19 x 27,5 x 4 mm

Connect the camera to the internet for remote control functions.

HUMIDITY & TEMPERATURE

WSEN-HIDS

- 16 bit humidity and temperature output
- I²C and SPI interface
- 2 x 2 x 0.9 mm

Sensing Room or Outdoor temperature & Humidity.

ACCELERATION
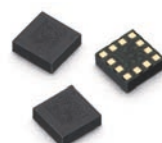
WSEN-ITDS

- 3 axis acceleration
- 14 bit output resolution
- ±2g, ±4g, ±8g, ±16g
- 2 x 2 x 0.7 mm

Sensing Acceleration for vandalism protection. Tamper detection is the ability of a device to sense an active attack to the device and the threat of the attack should initiate an event (e.g. alarm, shutdown of the device).

IOT-WASHING MACHINE

SMART HOME – IOT-WASHING MACHINE

Smart homes need smart washing machines. Only a washing machine which is connected to the Internet of Things can be controlled remotely and switched on, for example, when there is a surplus of energy from the house's solar panels. Really smart machines come with excellent sensors.

Manufacturers who make their washing machines "intelligent" are opening up completely new business models. Machines that receive commands and provide feedback wirelessly can be sold as components of smart home concepts. If absolute pressure, differential pressure, temperature, and acceleration sensors are used to monitor the correct operation of a washing machine, leasing models can be developed, in which the customer only pays for actual use, for example in a laundromat or communal laundry. At the same time, the machine automatically reports the need for maintenance, for example, when its vibration behavior changes the material.

Benefits

Laundry becomes more sustainable

- ✓ Do not own, just use. Smart IoT machines are perfectly maintained machines – leasing becomes an attractive option for customers as well as for manufacturers.
- ✓ Robust and durable sensors from Würth Elektronik for long-lasting smart machines.
- ✓ Intelligent sensors, such as the differential pressure sensor, detect blocked filters.
- ✓ Personalized washing programs via mobile app and Bluetooth control.

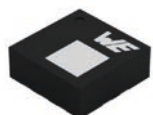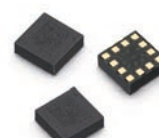| ABSOLUTE PRESSURE	HUMIDITY & TEMPERATURE	DIFFERENTIAL PRESSURE	TEMPERATURE	ACCELERATION	BLUETOOTH	WI-FI
WSEN-PADS	**WSEN-HIDS**	**WSEN-PDUS**	**WSEN-TIDS**	**WSEN-ITDS**	**Proteus-III**	**Calypso**
▪ 26 – 126 kPa ▪ 260 – 1260 mbar ▪ 24 bit output resolution ▪ 2 x 2 x 0.8 mm	▪ 16 bit humidity and temperature output ▪ I²C and SPI interface ▪ 2 x 2 x 0.9 mm	▪ 15 bit digital output ▪ Analog & I²C interface ▪ 13.3 x 8 x 7.55 mm	▪ Silicon based digital temperature sensor ▪ High accuracy (up to ±0.25 °C typ.) ▪ Fully calibrated 16 bit temperature output	▪ 3 axis acceleration ▪ 14 bit output resolution ▪ ±2g, ±4g, ±8g, ±16g ▪ 2 x 2 x 0.7 mm	▪ Bluetooth® LE 5.1 ▪ Nordic nRF52840 ▪ 8 dBm output power ▪ 12 x 8 x 2 mm	▪ IEEE 802.11 b/g/n, 2.4 GHz ▪ +18 dBm output power ▪ 19 x 27,5 x 4 mm
Measuring the water level through pressure in the waching cabine.	Measuring humidity & temperature in the drum while drying process.	Measuring the pre- and post-pressure of a filter to detect filter contamination.	Measuring the temperature in the drum while drying process.	Monitoring and analyzing a possible unbalance of the washing drum.	Bluetooth connectivity for mobile control or as technician interface.	Connecting the washing machine to the Internet.

REPLACING
LC DISPLAYS

MOBILE CONNECTIVITY – REPLACING LC DISPLAYS

LCDs are often used to indicate the status of devices, machines, and factory equipment. A little LCD Monitor on a machine looks elegant but it is not necessarily a sensible solution. LCDs age faster under harsh conditions and are wasteful in applications where they only need to be read a few times a year. Better: wireless data retrieval.

Anyone who provides machines or industrial plants with Liquid Crystal Displays should always consider whether such a display is necessary at this point, especially because every person who comes to the machine today carries a device with much higher display quality. With the industrial grade Bluetooth, WiFi and cellular modules from Würth Elektronik, it is easy to replace LC displays and output information to a mobile device app instead.
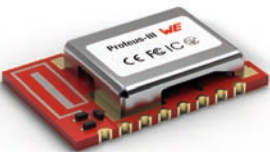
Benefits

Use your phone to check the machine

✓ Access is possible from anywhere, and system updates can be transmitted easily online by the manufacturer.
✓ Access to the data can be ensured via NFC or LE authentication.
✓ The use of cost-intensive displays can be avoided.

BLUETOOTH

Proteus-III

- Bluetooth® LE 5.1
- Nordic nRF52840
- 8 dBm output power
- 12 x 8 x 2 mm

Make use of the screen from a mobile device while saving the cost of an integrated LC display in the machine.

WI-FI

Calypso

- IEEE 802.11 b/g/n, 2.4 GHz
- +18 dBm output power
- 19 x 27,5 x 4 mm

Using the Wi-Fi direct function to use a responsive website instead of Bluetooth.

CELLULAR

Adrastea-I

- LTE-NB.IoT / Cat.M1
- incl. GNSS
- 14 x 13 x 2 mm

Connect an off-site machine to the internet through a cellular network. Save the LC display cost and lower the amount of possible damageable components.

REPLACING SWITCHES

MOBILE CONNECTIVITY – REPLACING "OLD FASHIONED" SWITCHES

Rotary switches on control units were a sensible solution for a long time. Furthermore, there was always the risk of unauthorized use. The more modern and secure approach: make the control unit addressable via radio. Or even make it an IoT device.

The ubiquity of smartphones and the widespread use of Wi-Fi networks open up the possibility of dispensing with rarely used switches on control units. With the slim Bluetooth LE and Wi-Fi modules from Würth Elektronik, you can make your control unit capable of wireless communication. The big advantage: Access can be restricted by secure authentication. And where a connection already exists, it can also be used to update the control unit, or for management via the Internet.

Benefits

Use your phone to activate the switch

- ✓ Avoid external changes of the control unit.
- ✓ Authentication necessary for changes.
- ✓ Mobile device can update the control unit's main functions.
- ✓ Wi-Fi: Cloud connectivity for status information, changes of settings from anywhere in the world etc..

BLUETOOTH

Proteus-III

- Bluetooth® LE 5.1
- Nordic nRF52840
- 8 dBm output power
- 12 x 8 x 2 mm

Replace the rotary switches with BT-LE and connect to Mobile device. Avoid external changes to the control unit. Advantages like Authentifi-cation needed for changes. Mobile device can update control unit main functions.

WI-FI

Calypso

- IEEE 802.11 b/g/n, 2.4 GHz
- +18 dBm output power
- 19 x 27,5 x 4 mm

Connect the control unit to Internet. Cloud connectivity for status informations, changes to the settings from anywhere in the world etc.

CONNECTED LIGHTING

Building automation is a great way to make indoor living more comfortable while saving energy. Lighting, heating, and ventilation systems only become really smart when they are adequately interconnected.

Sensors for humidity, temperature or CO_2 are needed to measure indoor air quality, as are connections to heating and ventilation systems, automatic window opening and shading systems. WiFi is suitable for connecting the gateway to the Internet for remote control, while mesh networks such as WE-ProWare are state of the art for interconnecting all sensors and actuators, light switches, and air conditioners.

Benefits

Mesh networks to control the ambience

- ✔ Smart lighting and air-conditioning serve our well-being.
- ✔ Connected lighting and room conditioning can be used to save energy.
- ✔ With a connection to the Internet, the system can additionally be managed by a mobile app.

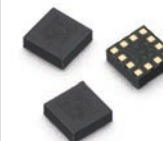| COMBINED	WI-FI	HUMIDITY & TEMPERATURE	TEMPERATURE	ACCELERATION	ABSOLUTE PRESSURE
Setebos-I	**Calypso**	**WSEN-HIDS**	**WSEN-TIDS**	**WSEN-ITDS**	**WSEN-PADS**
▪ Bluetooth® LE 5.1 & WE-ProWare 2.4 GHz ▪ 8 dBm output power ▪ 12 x 8 x 2 mm	▪ IEEE 802.11 b/g/n, 2.4 GHz ▪ +18 dBm output power ▪ 19 x 27,5 x 4 mm	▪ 16 bit humidity and temperature output ▪ I²C and SPI interface ▪ 2 x 2 x 0.9 mm	▪ Silicon based digital temperature sensor ▪ High accuracy (up to ±0.25 °C typ.) ▪ Fully calibrated 16 bit temperature output	▪ 3 axis acceleration ▪ 14 bit output resolution ▪ ±2g, ±4g, ±8g, ±16g ▪ 2 x 2 x 0.7 mm	▪ 26 – 126 kPa ▪ 260 – 1260 mbar ▪ 24 bit output resolution ▪ 2 x 2 x 0.8 mm
Interconnecting all sensors through the WE-ProWare mesh, while offering mobile device access through Bluetooth in one device.	Gateway connection from Mesh to the Internet.	Measuring local room temperature & humidity simultaneously.	Measuring room temperature.	Recognizing movement of particular inventory like expenisve art.	Measuring local room air pressure to monitor unforeseen window openings e.g. during a burglary.

INTELLIGENT IRRIGATION

CONNECTIVITY – INTELLIGENT IRRIGATION

A green garden is the jewel of any private or public building. But irrigation should be managed wisely. Especially in times of water scarcity, only as much water as necessary should be fed into the sprinkler system. With connectivity and sensors, sprinkler systems become intelligent.

A smart water pump detects when it is the right time to water the garden – based on wirelessly connected soil moisture sensors, the time of day, and maybe even from data about the availability of water resources like a cistern. By using several intelligent water pumps, gardens or parks can also be partially irrigated. Developers of irrigation systems should consider using humidity sensors and connectivity solutions like WE-ProWare Flooding Mesh or Wirepas Massive Routing Mesh to offer smart solutions which help their customers to save water.

Benefits

Mesh networks to control sprinklers

✔ An internet connection and cloud service can further enhance the benefits of a smart irrigation system.
✔ The user can analyze statistics on water consumption and watering times via a smartphone.

WI-FI

Calypso
- IEEE 802.11 b/g/n, 2.4 GHz
- +18 dBm output power
- 19 x 27,5 x 4 mm

Connect the central water pump to the Internet.

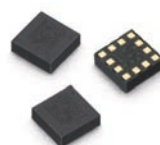**HUMIDITY & TEMPERATURE**

WSEN-HIDS
- 16 bit humidity and temperature output
- I²C and SPI interface
- 2 x 2 x 0.9 mm

Sensing outdoor humidity and temperature directly at the required planting bed.

ACCELERATION

WSEN-ITDS
- 3 axis acceleration
- 14 bit output resolution
- ±2g, ±4g, ±8g, ±16g
- 2 x 2 x 0.7 mm

Sensing Accelaration for vandalism protection. Theft protection in case of movement.

MESH

Thetis-I
- Wirepas routing mesh protocol, 2.4 GHz
- +6 dBm output power
- 8 x 12 x 2 mm

Connecting hundreds of intelligent water sprinkler through a battery-saving routing mesh

KEYLESS ENTRY

KEYLESS ENTRY VIA BLUETOOTH AND AN APPROPRIATE APP

Who does not know it - forgot the key and locked out. Furthermore, they are uncomfortable in the pants or get lost in the handbag.

With the help of a unique assignment via Bluetooth and the appropriate app, such door opening systems are both secure and comfortable using a mobile device.

Benefits

- ✔ Fingerprints can also be stored or a numerical code can be used.
- ✔ The systems can also be protected by an acceleration sensor to trigger an alarm in the event of damage, for example.

BLUETOOTH

Proteus-I/-II

- Bluetooth® LE 4.2
- Bluetooth® LE 5.0
- Nordic nRF52832
- 3 dBm output power
- 11 x 8 x 2 mm

Connect to Mobile Device and connect Keys to Keypad.

ACCELERATION

WSEN-ITDS

- 3 axis acceleration
- 14 bit output resolution
- ±2g, ±4g, ±8g, ±16g
- 2 x 2 x 0.7 mm

Sensing Acceleration for vandalism protection, e.g. tamper detection

AIR FILTERS

CONNECTIVITY – AIR FILTERS

Equipping public buildings such as schools with air filtration devices to prevent infection, has burdened facility managers with an additional maintenance task. Manufacturers of such equipment would do well to simplify maintenance and operation – only a properly working air filter will protect.

The more air filters are in use, the more important remote maintenance becomes. Differential pressure and humidity sensors can be used to monitor the status of the filters. An internet gateway and a cloud application make remote maintenance convenient. Wi-Fi modules can be integrated to connect the devices to the gateway. A particularly flexible solution is an 868 MHz radio module with the proprietary radio protocol WE-ProWare. Additionally, this allows the bridging of longer distances than with Wi-Fi, if necessary.

Benefits

Proprietary network for remote maintenance

- ✓ WE-ProWare offers the possibility to customize functions by using simple commands.
- ✓ Unlike other sub-GHz standards, there are no license fees involved.

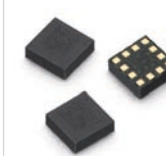| WI-FI	PROPRIETARY		HUMIDITY & TEMPERATURE	ACCELERATION	DIFFERENTIAL PRESSURE
Calypso	**Tarvos-III**	**Telesto-III**	**WSEN-HIDS**	**WSEN-ITDS**	**WSEN-PDUS**
▪ IEEE 802.11 b/g/n, 2.4 GHz ▪ +18 dBm output power ▪ 19 x 27,5 x 4 mm	▪ 868 MHz ▪ RF Pad / PCB Antenna ▪ 14 dBm output power ▪ 27 x 17 x 3.8 mm	▪ 915 MHz ▪ RF Pad / PCB Antenna ▪ 14 dBm output power ▪ 27 x 17 x 3.8 mm	▪ 16 bit humidity and temperature output ▪ I²C and SPI interface ▪ 2 x 2 x 0.9 mm	▪ 3 axis acceleration ▪ 14 bit output resolution ▪ ±2g, ±4g, ±8g, ±16g ▪ 2 x 2 x 0.7 mm	▪ 15 bit digital output ▪ Analog & I²C interface ▪ 13.3 x 8 x 7.55 mm
Using the Wi-Fi direct function to use a responsive website instead of Bluetooth or simply connect the filter directly to the internet.	Connecting several Air filter in large building with each other through a mesh network. Sub GHz because of LongRange and sending data through walls.		Sensing Room temperature & Humidity.	Sensing Acceleration for vandalism protection, e.g. tamper detection.	Measuring the pre- and post-pressure of a filter to detect filter contamination.

WEIGHTING SYSTEM

CONNECTIVITY – WIRELESS WHEELS WEIGHTING SYSTEM

Agriculture, biogas plants, haulers and industrial enterprises - there are many areas of application for a mobile axle load scale. When driving over it, the load on each single wheel of the vehicle is weighed separately. The measured values must then be merged.

In the case of mobile axle load scales, the weighing program calculates the total weight via the weighed axles. For this purpose, the individual scales must be linked by radio. Using a mesh network between the scales, the data can be collected and sent to a mobile device. Software in an mobile App can calculate the center of gravity of the load. Connecting the networked scales to the Internet and equipping them with GPS modules makes the management of the stock of these devices as simple as possible.

Benefits

Mesh-network of wheel scales

✔ WE-ProWare is ideal for individual mesh-networks of devices.
✔ Localization of scales and Internet-based management facilitates leasing business models.

WI-FI	**COMBINED**	**GNSS**	**ACCELERATION**
Calypso	**Setebos-I**	**Erinome-I**	**WSEN-ITDS**
▪ IEEE 802.11 b/g/n, 2.4 GHz ▪ +18 dBm output power ▪ 19 x 27,5 x 4 mm	▪ Bluetooth® LE 5.1 & WE-ProWare 2.4 GHz ▪ 8 dBm output power ▪ 12 x 8 x 2 mm	▪ GPS, GLONASS, GALILEO, BEIDOU ▪ Integrated Antenna ▪ 18 x 18 x 6.4 mm	▪ 3 axis acceleration ▪ 14 bit output resolution ▪ ±2g, ±4g, ±8g, ±16g ▪ 2 x 2 x 0.7 mm
Connecting the scale gateway to the Internet.	Mobile App Connectivit Sending weight data through mobile App.Mesh between 4 scales for each wheel.	Localization of each single scale.	Sensing Acceleration for vandalism protection or to avoid theft.
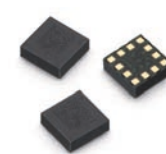
CONTAINER TRACKING

SMART INDUSTRY - CONTAINER TRACKING

Even during the pandamic, there were more than 150 Million containers shipped during 2021. It has never been as important to know, where your containers are, as it is at the moment! Due to shortages of materials, the bottle necks on asian harbors and during an pandemic, it is crucial to be aware of what happens with your products and where they are.

With the Wirepas Mesh Network communication protocol every device can be used as wireless router and can act as a repeater for other nodes. With WE sensors it's possible to monitor the environmental conditions of your parts just in time, any time. The GNSS modules allow to follow the tracked container and give you an excat location of your parts.

A network out of thousands of nodes, i.e. containers, increases the scale of the whole network and following the distance to bridge. Wirepas Massive offers a so called Positioning engine which is helpful to locate containers even inhouse.

Benefits

✓ Localization with GNSS
✓ Monitor the conditions with environmental sensors
✓ Build up a mesh Network with wirepas modules

MESH

Thetis-I

- Wirepas routing mesh protocol, 2.4 GHz
- +6 dBm output power
- 8 x 12 x 2 mm

Building a huge network of sensor nodes with a robust wireless Mesh.

GNSS

Erinome-I

- GPS, GLONASS, GALILEO, BEIDOU
- Integrated Antenna
- 18 x 18 x 6.4 mm

Tracking the containers precise location.

HUMIDITY & TEMPERATURE

WSEN-HIDS

- 16 bit humidity and temperature output
- I²C and SPI interface
- 2 x 2 x 0.9 mm

Measuring container internal or outdoor temperature and humidity.
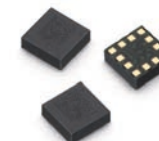
CELLULAR

Adrastea-I

- LTE-NB.IoT / Cat.M1
- incl. GNSS
- 14 x 13 x 2 mm

Connecting the container tracking to the cellular network and the location can be tracked wherever the container is on the globe.

ACCELERATION

WSEN-ITDS

- 3 axis acceleration
- 14 bit output resolution
- ±2g, ±4g, ±8g, ±16g
- 2 x 2 x 0.7 mm

Sensing Acceleration and impacts to have the information available when a container starts moving or in case a huge damage to the load has occured.

LIFESTOCK MONITORING

HOOK STRAP FOR ANIMALS

In the course of more ecological and sustainable lifestock farming it is necessary to monitor the environmental and health conditions of the animals.

Acceleration sensors and LTE mobile radio modules including localization (GNSS) by Würth Elektronik can be used to implement monitoring applications. In case the sensor system detects the movement pattern of an animal, an alarm signal will automatically be sent or predefined persons could be contacted if an abnormal behavior is detected. humidity sensors can be used to monitor the status of the environment.

Wi-Fi modules can be integrated to connect the hook strap to the gateway Bluetooth LE To read out the measurements via smartphone.Data can be collected and finally send to the cloud using AWS or Azure.

Benefits

- ✔ Reduce costs for the veterinary and drugs
- ✔ Optimize the environmental conditions
- ✔ Minimizing the ecological impact
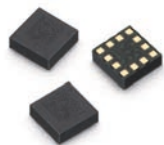- ✔ Track the animals

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HUMIDITY & TEMPERATURE

WSEN-HIDS
- 16 bit humidity and temperature output
- I²C and SPI interface
- 2 x 2 x 0.9 mm

To measure the environmental conditions.

ACCELERATION

WSEN-ITDS
- 3 axis acceleration
- 14 bit output resolution
- ±2g, ±4g, ±8g, ±16g
- 2 x 2 x 0.7 mm

Activity tracking of the animal.

BLUETOOTH

Proteus-III
- Bluetooth® LE 5.1
- Nordic nRF52840
- 8 dBm output power
- 12 x 8 x 2 mm

Connect from smartphone to the hook strap to transfer datas from the cow.

GNSS

Erinome-I
- GPS, GLONASS, GALILEO, BEIDOU
- Integrated Antenna
- 18 x 18 x 6.4 mm

Localization of the cow.

CELLULAR

Adrastea-I
- LTE-NB.IoT / Cat.M1
- incl. GNSS
- 14 x 13 x 2 mm

Cloud connection for datas and alarm.

WI-FI

Calypso
- IEEE 802.11 b/g/n, 2.4 GHz
- +18 dBm output power
- 19 x 27,5 x 4 mm

Cloud connection for datas and alarm.

ANALYZE DATA

Azure
aws

IoT Platform
- Send data to any cloud for further use
- Create real IoT use cases
- Examples and Sourcecode available on GitHub for Microsoft Azure and Amazon Web Services

PESTICIDE MONITORING

CONTROLLED PESTICIDE SPRAY SYSTEM

In this country local laws govern and limit usage of pesticide. In order to comply with environmental laws, a black box on the tractor monitors the amount of pesticide dispensed on the land allocated to the farmer. This way the amount of sprayed pesticide is controlled and overdosing is avoided.

In the pump box of the sparying installation mounted on the tractor, a radio module receives data from the spray nozzles. Every nozzle is fitted with differential pressure sensors monitoring an equal flow, and their radio module transmits in the correct time slot the flow figure. In the central unit the metrics are computed in order to match the volume of pesticide to the surface on which the tractor has covered.

To refine the calculation, GNSS can be added to match the volume to the land surface, and NB-IoT / LTE-M can be implemented in case the governing authority requests that the data should be stored on a server.

Benefits

Quick win of using a radio module or a sensor

- ✔ Closed & reliable control loop of the dispensing system
- ✔ Local and global access to any connected system in order to monitor & control pesticide usage
- ✔ Each spray nozzle for the pesticide can be controlled individually
- ✔ Saving the lives of many small creatures

DIFFERENTIAL PRESSURE	CELLULAR	PROPRIETARY		ACCELERATION
WSEN-PDUS	**Adrastea-I**	**Tarvos-III**	**Telesto-III**	**WSEN-ITDS**
• 15 bit digital output	• LTE-NB.IoT / Cat.M1	• 868 MHz	• 915 MHz	• 3 axis acceleration
• Analog & I²C interface	• incl. GNSS	• RF Pad / PCB Antenna	• RF Pad / PCB Antenna	• 14 bit output resolution
• 13.3 x 8 x 7.55 mm	• 14 x 13 x 2 mm	• 14 dBm output power	• 14 dBm output power	• ±2g, ±4g, ±8g, ±16g
		• 27 x 17 x 3.8 mm	• 27 x 17 x 3.8 mm	• 2 x 2 x 0.7 mm
Measuring & Monitoring an equal dispensing across different nozzles.	Enabling direct cloud access through cellular technology makes predicitive maintenance real.	Collecting and sending data from sensor nodes in the pesticide spray system and transmitting those values to the cellular gateway For US customers, the 868 MHz radio module can be replaced by its 915 MHz pin- and software compatible counterpart, Telesto-II.		Predictive Maintenance means checking the system if there are any notices of spraying arms unbalance.

PEDESTRIANS AND TRAFFIC SAFETY

SMART SAFETY BARRIERS

Road side safety barriers ensure safety of pedestrians and traffic during construction and in case of accidents. Often these cones get displaced posing a threat to human life. Retrofitting these barriers with sensors ensures early detection of displacement thereby saving human lives.

An acceleration sensor can be used to detect a fall of a safety barrier and a positioning system accurately determines the position and timing of the barrier. This data can be transmitted via cellular link to a data platform. A cloud platform can be further used to analyse and notify the operator to take corrective action when necessary.

Benefits

✔ Using highly integrated intelligent sensors from WE, it is possible to accurately detect falls.
✔ The highly accurate GNSS modules can detect slightest change in position of the barrier.
✔ Cellular module ensure cost effective connectivity from anywhere.
✔ Mesh networking between the barriers opens up a lot of possibilities for lighting control, traffic management and active signalling.

ACCELERATION
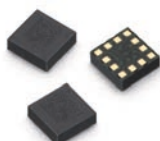
WSEN-ITDS

- 3 axis acceleration
- 14 bit output resolution
- ±2g, ±4g, ±8g, ±16g
- 2 x 2 x 0.7 mm

Sensing Acceleration for vandalism protection.

GNSS

Erinome-I

- GPS, GLONASS, GALILEO,BEIDOU
- Integrated Antenna
- 18 x 18 x 6.4 mm

Localization of each single unit in case of theft or finding all owned units.

CELLULAR

Adrastea-I

- LTE-NB.IoT / Cat.M1
- incl. GNSS
- 14 x 13 x 2 mm

Connect the control unit to the internet: Cloud connectivity for status informations, changes to the settings from anywhere in the world etc..

ANALYZE DATA

Azure

aws

IoT Platform

- Send data to any cloud for further use
- Create real IoT use cases
- Examples and Sourcecode available on GitHub for Microsoft Azure and Amazon Web Services
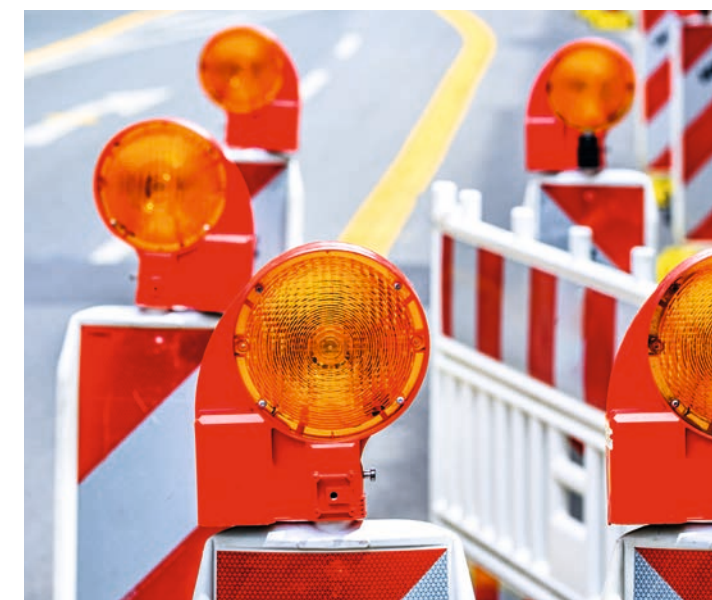
COMBINED

Setebos-I

- Bluetooth® LE 5.1 & WE-ProWare 2.4 GHz
- 8 dBm output power
- 12 x 8 x 2 mm

Interconnecting all sensors through the WE-ProWare mesh, while offering mobile device access through Bluetooth in one device.

CREATING
IDEAS