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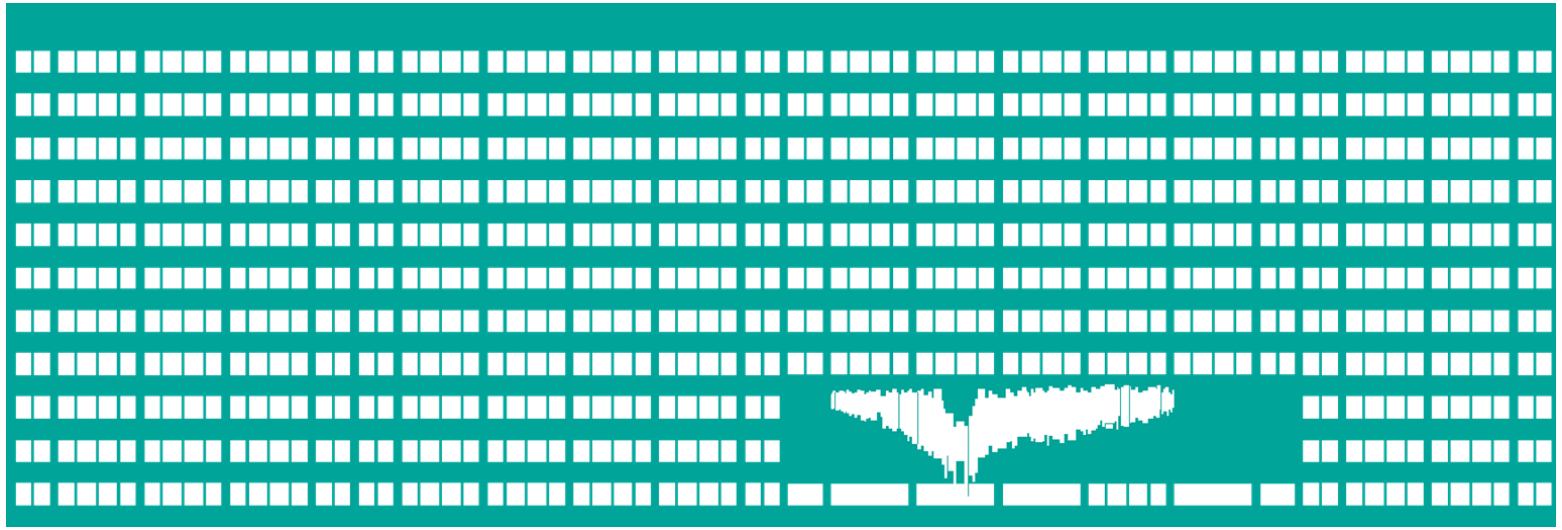

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Development, implementation and experience with IQRF for measuring geotechnical and environmental variables

Radovan HÁJOVSKÝ, Martin PIEŠ, Jan VELIČKA

Who we are

- **A team of academic staff and Ph.D. students at the Department of Cybernetics and Biomedical Engineering**
- **We cooperate with major companies in the Czech Republic**
- **Our goal and vision is to keep up with modern technologies and to develop wireless monitoring systems using IoT technologies**
- **We are able to participate in science and research projects in cooperation with industrial partners, either in the form of research contract or state funds**

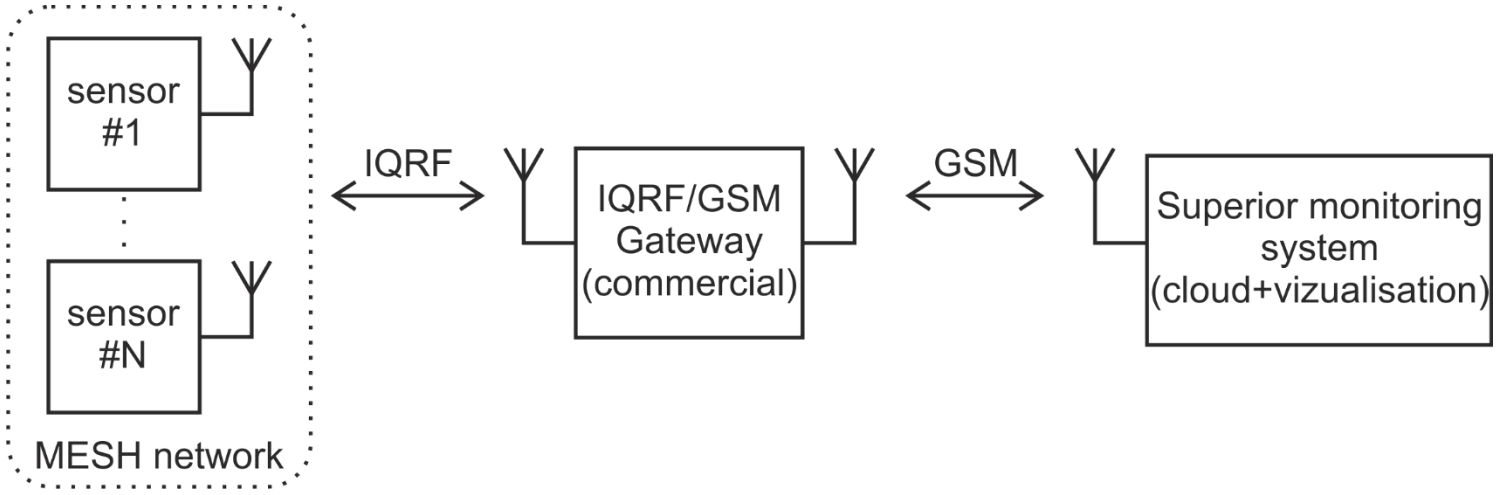
What we can do

- **Work hard**
- **Teaching, transferring experience and knowledge - our main mission**
- **Research**
- **Develop**
- **Implement**
- **Publish**
- **Discuss**
- **Evolve**

What we develop and implement

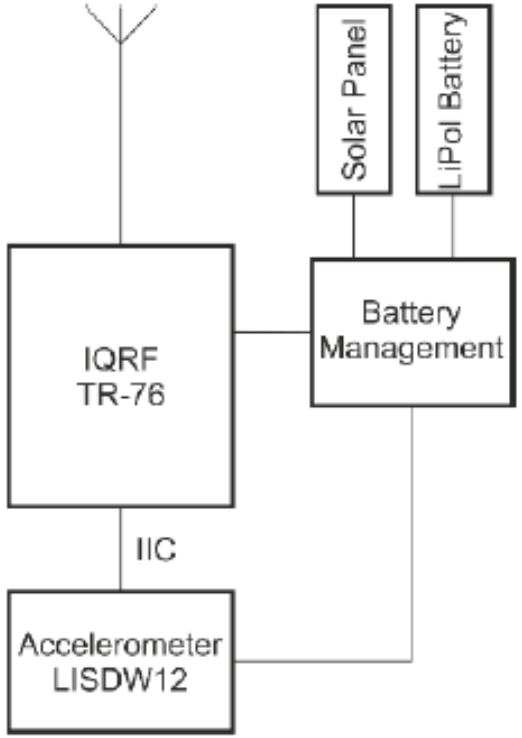
- **Complex wireless monitoring systems for measuring electrical and non-electrical quantities**
- **Wireless sensors for physical-mechanical quantities, geotechnical quantities, environmental quantities**
- **Extensive MESH sensor networks**
- **Wireless sensors based on modern IoT technologies - LoRa, Sigfox, NB-IoT, IQRF**
- **Transmission, processing and visualization of measured data**
- **3D printing and rapid prototyping**

Complex wireless monitoring system



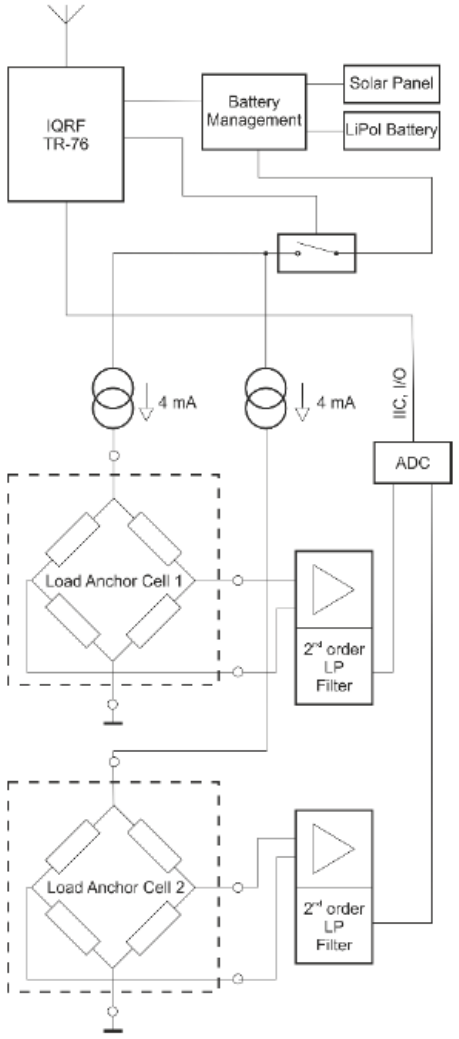
- **System uses a commercial IQRF / GSM gateway**
- **Power supply of the system through a 12 V accumulator, which is charged via the PV panel**
- **Two-way communication with the superior system allows to set the parameters of individual wireless sensors**
- **Asynchronous packets enable almost immediate visualization of alarm states in the superior monitoring system**

Complex wireless monitoring system - sensor 1



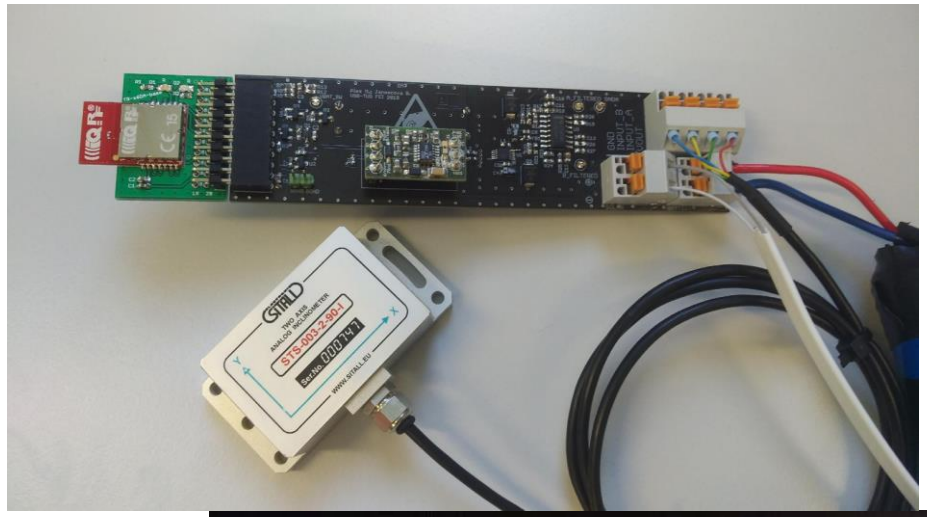
- **Developed several generations of accelerometric sensors**
- **Power supply via 3.2 V LiFePO4 battery with solar charging**
- **Adjustable sensitivity (wireless)**
- **Very low power consumption (up to 1 mA)**

Complex wireless monitoring system - sensor 2



- It allows measuring the load on two dynamometers at the same time
- Power supply via 3.2 V LiFePO4 battery with solar charging
- Adjustable supply current with a dynamometer (1 or 4 mA - hardware)
- Significantly low power consumption (up to 1 mA - when measuring on two dynamometers 9mA for approx. 2 seconds)

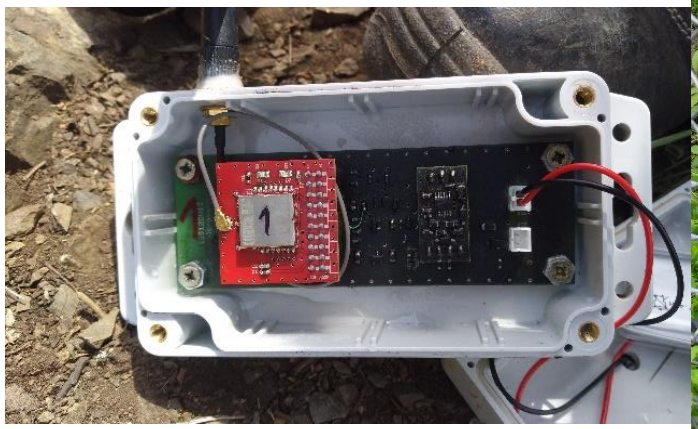
Other wireless sensors

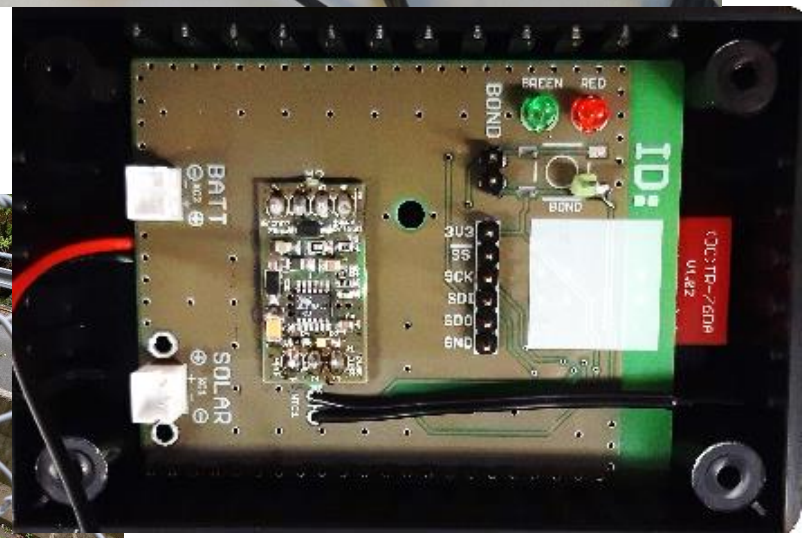


Measuring devices with wireless data transmission:

- accelerometer,

- dynamometer,
- Environmental quantities (temperature and relative humidity, precipitation),
- Carbon monoxide(CO),
- Methane (CH_4),
- Temperatures,
- Dustiness.

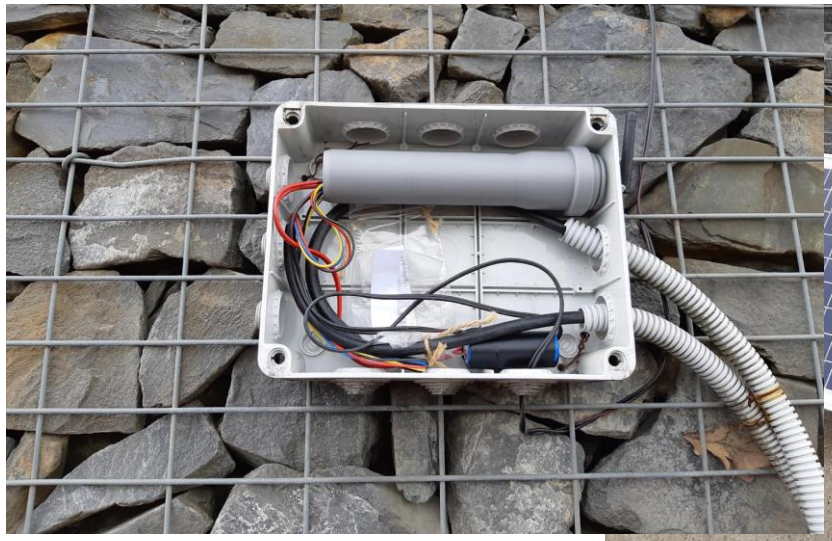




Our results

Mokré Lazce – dynamometer installation

- **Monitoring of 4 dynamometers using two wireless sensors**
- **Continuous operation from March 2019 until now**



Our results

Zbraslav – installation of accelerometric sensors

- First 4 2nd generation sensors, then 2 3rd generation sensors

Our results

Mining dump Hevika

- Monitoring of low and high temperatures (up to 300 ° C)

- Tilt monitoring

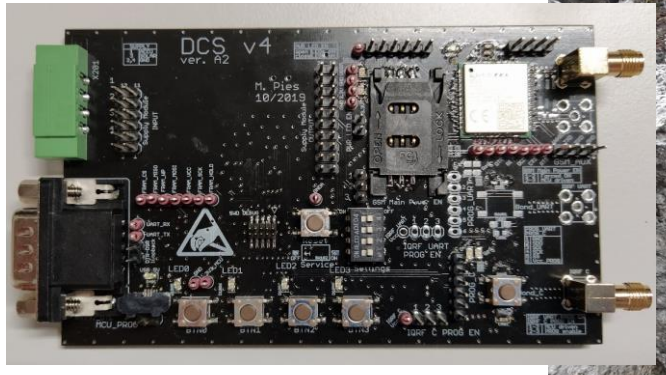
- Monitoring of carbon monoxide concentration

Our results

Dlouhé Stráně

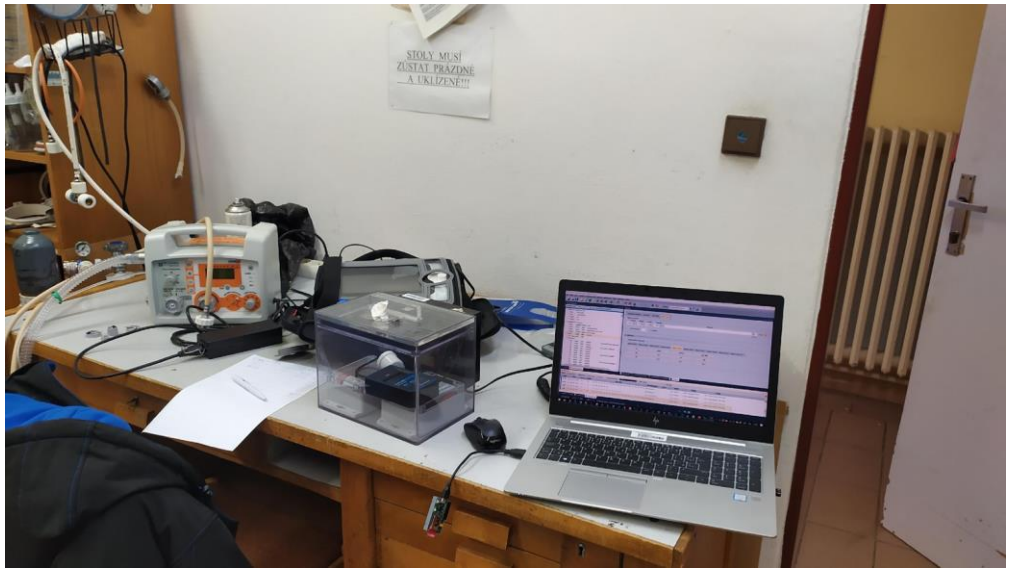
- Monitoring of cracks in rocks masive

- Installation of 3 LVDT sensors with a range of ± 0.5 mm



Our results

- Due to the situation Covid-19 developed a wireless sensor for measuring the concentration of O_2 on covide units
- Deployed at the ICU of the Ostrava University Hospital
- Measurement of O_2 concentration in a room during oxygen therapy - the threat of an explosion - has already occurred abroad in several cases
- The solution is protected by an utility patent



Our experience

- **Everything cannot be subject to price**
- **Commercially available sensors and solutions - only partially, there is no complex solution, including visualization, alarm conditions, etc.**
- **Unfortunately theft**
- **Development - what is new today, will not be produced tomorrow**
- **Lack of gifted students willing to work on real problems -> motivation through scholarships**

Plans for the future

- **Continue to develop wireless monitoring systems**
- **Keep up with modern technologies**
- **Minimize the energy consumption of monitoring systems**
- **Continue to develop your own IoT hub**
- **Continue successful cooperation with industrial partners**
- **Trying to get R&D projects**
- **Transfer experience from practical commitment to teaching studentů -> motivation of students that what they learn can be used in practice**

Thank you for your attention

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