# Rock Monitoring 2024 – LoRa Gateway

**Mass movements such as landslides and rockfalls are a major hazard, especially in Switzerland, where 6% to 8% of the country is considered unstable. A project at BFH uses motion sensors to detect such movements at an early stage. A solar powered LoRa gateway for data tunneling and a user interface for monitoring the measurements were developed for this system.**

## Concept

The Rock Monitoring System includes a sensor node, a gateway and a server based user interface. The sensor node uses an extensometer and up to three accelerometers. The gateway provides various interfaces such as LoRa, LTE, WLAN, Ethernet and Bluetooth. The sensor nodes access the gateway via LoRa and the gateway tunnels the data to the server. In order to make the data accessible to the end user, a graphical user interface was developed which can be accessed through a web application.

## Hardware

The custom PCB was designed to be modular and suitable for various applications such as placement in very cold areas without a power connection, as well as indoors with the option of connecting it to the power grid using WLAN or Ethernet for communication. A special housing was also developed for this purpose, which was produced as a prototype using FDM technology.

## Firmware

To ensure broad usability, the gateway's firmware was designed to tunnel various data types from sensor nodes to the server. It was crafted generically to allow different nodes to transmit their data seamlessly through the gateway. This approach maximizes compatibility and functionality, ensuring efficient data flow regardless of node type. Additionally, the modular code architecture thorough documentation enhance maintainability and reliable operation.

## Frontend

The Frontend of the Rock Monitoring System provides an intuitive interface for accessing and visualizing data. As a web application, it allows real-time monitoring of sensor nodes through interactive graphs. Users can also adjust settings like measurement intervals and SMS alert configurations.

## Results

A very flexible and universally applicable LoRa Gateway with web application has been developed, on which the Rock Monitoring and other LoRa projects can be built on.
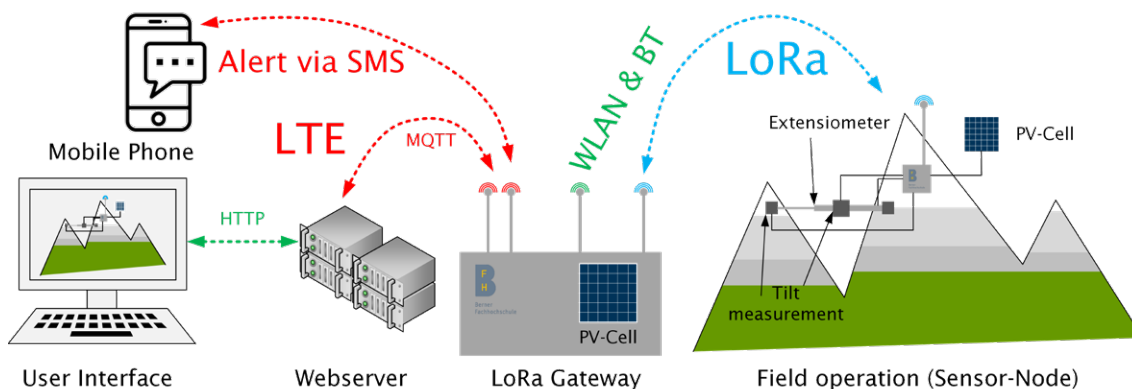


Hardware overview

Jonas Brülhart
Embedded Systems

Nicola Janis Stettler
Embedded Systems

Tobias Zaugg
Embedded Systems



**Block diagram of the overall system**