Abstract

There are currently different ways to measure the transportation of bed load, the most common one, and the one used by the Swiss Federal Institute for Forest, Snow and Landscape Research (WSL) being the mounting of geophones in the river bed. There are several disadvantages to this, the main ones being the costs involved and the necessary structural measures. Additionally, the IT infrastructure becomes rather complex, since the geophones are connected by one wire each to an industrial, rugged PC. The goal of this project is to plan, design and implement a bus-system with MEMS-accelerometers and provide a prototype that’s simpler and more cost-efficient than the usage of geophones.

All used devices are based on the ARM Cortex-M4 microcontroller. The system implemented consists of two types of devices, the data logger and the sensor units. The data logger mainly processes and stores the data received from the sensors. Additionally, the logger acts as a bus master and configures all the connected devices by sending them unique identifiers, thusly enabling a proper logging of the received messages. The sensor units are composed of a MEMS-accelerometer and a microcontroller that processes the measurements from the MEMS, packaging the data depending on the detail level specified by the user, effectively reducing the traffic on the bus and the workload for the data logger. The detail level can be set dynamically by the user to either log the basic data of an impact, the detailed data of an impact (two levels of details are possible) or to send unprocessed raw data over a certain time range.

Since the whole system will be installed in rivers it should be very stable and self-sustaining. Once configured, the settings for each sensor can be stored on the SD-card of the logger and, if a reset should occur, will be read automatically and send to the sensors. The usage of a CAN-bus guarantees the error free transmission of the measured data.

The build prototype fulfils the expectation concerning the simplification of the system and the resource usage of the system and therefore could be used as a basis for a final product.