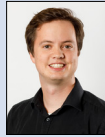




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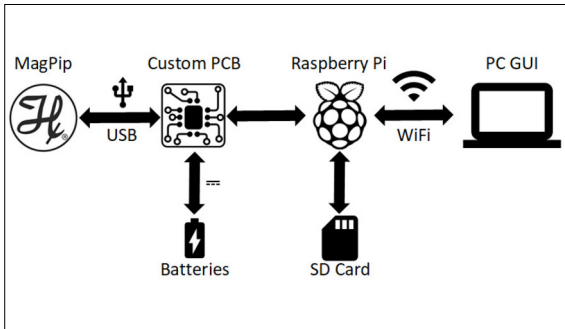
Subject Area

Embedded Systems

Project Partner

Hamilton Bonaduz AG, Rapperswil, SG

## Wireless Analyzer

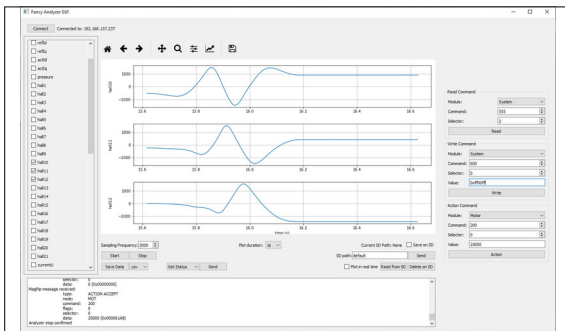


Block diagram of the project  
Own presentation

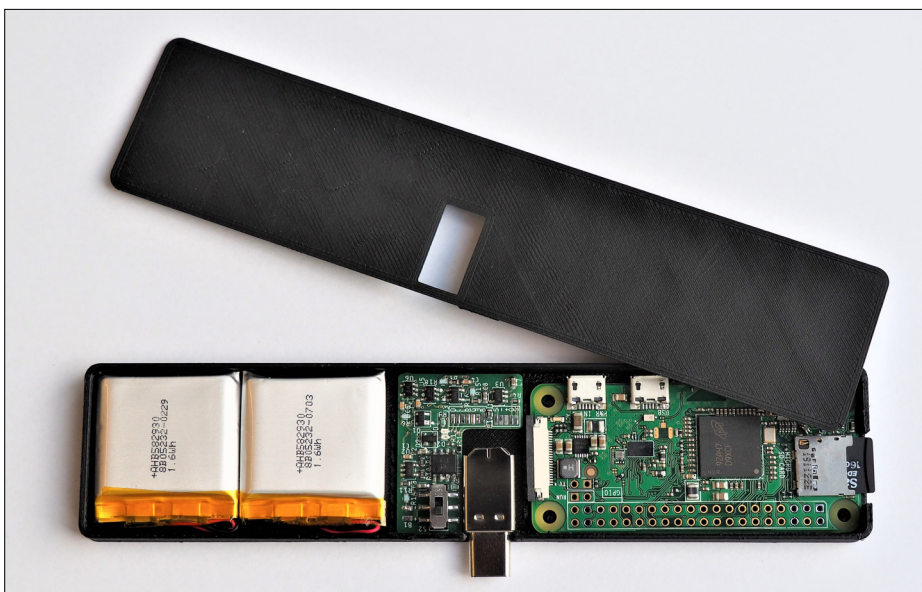
**Introduction:** Hamilton Bonaduz AG today uses a wired USB 2.0 High-Speed analyzer link to debug and maintain their newest high performance liquid handling system, the MagPip. A wireless device that plugs into the USB-C port of the MagPip robot could replace the wired link to a host PC. Due to the high dynamics of the robot, strict dimensional and weight restrictions must be followed. The device must be battery powered and rechargeable using the USB-C plug. A bidirectional communication link between the PC and the MagPip needs to be engineered.

**Approach / Technology:** The Raspberry Pi Zero W, a miniature computer combining USB 2.0 host capability with a Wi-Fi antenna turned out to be the best-suited solution to guarantee the required data rates. It features the BCM2835, a powerful 1GHz processor able to handle all data streams. Furthermore, the Raspberry offers an SD-card interface. To ensure maximum performance, the firmware is written in C, while the application (GUI and drivers) on the host PC is programmed using Python. A custom-made PCB contains the external circuits for power management and the USB-C plug.

**Result:** The final product is able to process and transmit up to 35Mbit/s over a PC-hosted Wi-Fi Direct connection while continuously ensuring bidirectional communication of all types (analyzer data, Raspberry and MagPip commands). The 155x35x8 mm large device weighs less than 50g and features a total battery capacity of 900mAh, which allows a nominal run-time of approximately 2.5 hours. Several custom-made commands have been implemented to configure the streamlined firmware on the Raspberry. On the PC side, the developed driver ensures processing of data and establishes the wireless link. It is possible to save the analyzer data on the SD card and send it to the host PC later on. A GUI provides an easy-to-use interface between the wireless analyzer and an operator. It can be used to communicate with the MagPip and the Raspberry, while the received analyzer data can be displayed in nice plots.



The PC GUI for displaying the analyzer data and sending commands to control the MagPip and the Raspberry  
Own presentation



The Wireless Analyzer with the batteries, the custom PCB with USB-C plug and the Raspberry Pi Zero W  
Own presentation