Versatile Sensor Platform

Degree programme: BSc in Micro- and Medical Technology | Specialisation: Sensor technology
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The goal was to develop an ultra-low power device that is capable of adapting to different needs and use-cases. Focusing on low-energy radio transmissions, LoRa and NB-Iot were the technologies of choice. During this thesis, the considered application was consummation tracking for a mobile beverage serving system.

Introduction

During the pre-study, the whole hardware concept was being planned and designed in collaboration with Balluff's employees. The versatile sensor platform consists of a motherboard equipped with two slots for interchangeable add-on boards. The add-on boards are split into two categories:

– Specific hardware, which contains user desired circuitry, sensory frontend, or interfaces for external hardware.
– Communication boards, which are responsible for transmitting the data acquired and for configuration of the device.

In the pre-study three hardware were conceived and assembled:

– SH01: Flowmeter pulse counter
– SH02: Relay-board
– RD01: LoRa wireless communication module
Another person of the Balluff innovation team was in charge of the motherboard.

Objective

The focus during the thesis is to get a prototype working that uses a liquid flowmeter and transmits its data over LoRa. This requires a significant amount of embedded software writing and planning of libraries. The readout and configuring of the device as well as the human interface is another critical point of this work.

Methods

By writing libraries for each add-on board, the final software can be created by a computer scientist without any microcontroller experience. It does reduce the effort of reinitializing the hardware every single time. However, it comes with the cost of having to outline a clear library structure, which is written in C++ to be ready for further microcontroller programming. Another challenge is to make a template project where no modifications need to be made to get an application running in no time.

Outlook

The versatile sensor platform could be a good foundation for mass customization in the field of professional sensor manufacturing. Especially in a big enterprise like Balluff with experts in various domains distributed all over the world. Fast prototyping and testing directly at a customer's site could be a key advantage. The hardware and software interface is predefined, and a new add-on board can be quickly designed using the templates provided, with this reducing the time to market.

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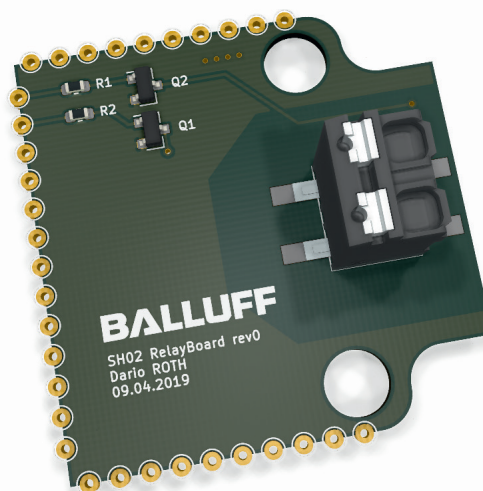Fig. 1: System Overview consisting of the motherboard and two add-on modules

Fig. 2: PCB designed to interrupt a powerline on an IoT node. (referenced as specific hardware in Fig. 1)