ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

TIK
Technische Informatik und Kommunikationsnetze
Computer Engineering and Networks

Prof. L. Thiele

Master Thesis:

A Voice-activated Wireless Patient Monitoring System

The Schweizer Muskelgesellschaft organizes annual summer camps for people suffering from muscular dystrophy. Most of the patients require 24-hour assistance from nursing staff. This is, however, often complicated by the lack of necessary infrastructure in the general-purpose buildings where the summer camps take place. For example, a nurse call system, as it is typically found in hospitals, needs to be installed prior to each camp, allowing the patients to alert a nurse remotely of their need for help during the night. Because some patients are unable to press the button of a typical nurse call system, we are designing a solution that allows to call for help by voice. To be portable and easy to install, our solution relies on low-power wireless communications and several embedded hardware components.

This master thesis deals with the acquisition of voice data at the patient. To this end, you will connect an electret microphone typically used in cell phones, an audio codec that encodes the analog output of the microphone as digital signals, and an ARM Cortex-M4 based microcontroller that processes the audio signals. The ARM runs FreeRTOS, a popular real-time operating system for embedded devices implemented in the C programming language.

You will start by implementing a device driver for FreeRTOS to receive signals from the audio codec via I^2S. For an increased efficiency of the data transfer, you will exploit the ARM's direct memory access (DMA) support and employ some sort of buffer management. You will debug your driver using a mixed-signal oscilloscope, verify its functioning by streaming incoming data to the serial port, and evaluate its performance through a series of measurements.

Afterwards, depending on your skills and interests, you will (*i*) design a printed circuit board (PCB) that hosts the microphone, the audio codec, and the ARM and provides a header connector to attach other devices; or (*ii*) implement a device driver that forwards the audio data from the ARM to a second embedded device via I^2C. This second device features a low-power wireless radio and is responsible for transmitting the audio data towards an access point where the nursing staff receives the alert.

We offer:

- the possibility to contribute to a real-world project that aims at improving people's lives;
- hands-on experience in state-of-the-art embedded hard- and software development;
- competent guidance and supervision throughout the thesis project;
- free coffee and a warm working environment.

We expect:

- passion for working with low-level software, hardware components, and an oscilloscope;
- basic knowledge of embedded, real-time systems and the C programming language.

Interested? Please do not hesitate to contact us:

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