

# Assignment Embedded Computer Architectures 1

The assignment for the course Embedded Computer Architectures 1 consists of 2 parts. The first part consists of creating the firmware for data acquisition in a physical embedded system. The system consists of a microprocessor board, an actuator, and a sensor. The collected data will then be processed in the second part, where the computation needs to be optimized depending on the chosen platform.

## PART 1: Data Collection on a RISC-V Board

In Part 1, a Sparkfun board containing a RISC-V microprocessor is chosen as the acquisition platform. On top of the board, a shield handles the connection and voltage shifting to a step motor and an ultrasound sensor. The motor rotates the sensor from left to right (and from right to left), collecting up to 65 positions and ranging them from 3cm to 3m. The goal is to develop this system's firmware so that it is capable of finding the 3 closest objects within its range and giving their positions and distances. It should also stream the ranging data of its entire arch of rotation (a sweep) to a server via UART.

### Goals:

Three main implementation objectives:

- Setup sensor acquisition
- Setup motor sweep
- Find the 3 closest positions

With the evaluation objectives:

Accuracy and precision, within the ranges:

- $15\text{cm} > \text{distance} < 1\text{m}$
- $1\text{m} > \text{distance} < 2\text{m}$
- $2\text{m} > \text{distance} < 3\text{m}$

Sweep time without any object in range (in ms)

**Accuracy and precision are defined in the slides.**

The results will have to be presented in week 3. Furthermore, Part 1 has to result in a report which describes the implementation, the calculated accuracy and precision, and the measured sweep time. The report has to be handed in in week 4

## Requirements for the presentations

- 5 minutes presentation only addressing key aspects (note that all other students have become experts in the time being)
- Send the code to us up to 1 hour before the presentation. It will be tested live during the presentation.
- Just one person sends the code, the same that signed off the board.
- The presentations have to be sent to the lecturers in PDF afterwards.

### **Requirements for the reports**

- The report should be written In English
- It should contain a table of contents
- Pages should be numbered.
- PDF format
- 11 point font
- Part 1: maximum 3 pages

### **Grading the assignment**

The final mark for the assignment will be:  $0.3 * \text{grade for part 1} + 0.7 * \text{grade for part 2}$