Phase 1 Report | Project in Embedded Systems 15hp 1TE721

A FERMENTATION TEMPERATURE MONITORING SYSTEM using Atmel AVR and an ARM single-board computer

Group 1: August Forsman
aufo8456@student.uu.se

Summary

Phase 1 of the project has mainly consisted of

1. Configuring UART drivers for the ATmega328p MCU
2. Setting up 1-Wire communication between the MCU and DS18B20
3. Confirming that the communication works through serial communication between the MCU and Raspberry Pi

The work is finished in time according to the project plan.

Design

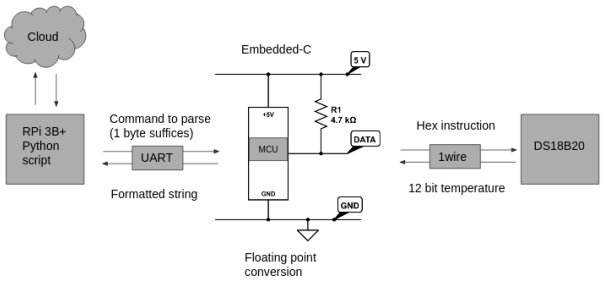

Figure 1: The system design layout

Figure 1 shows a brief sketch of the implementation, where in Phase 1, it is not yet connected to the cloud.

Communication protocols

1-Wire is used as the bus communication system between the sensor and MCU, which is driven by one of the pins. A command example is sending a reset pulse (falling edge followed by a low signal for 480 microseconds) which can be followed by sending a hexadecimal byte (`0x00` to `0xFF`) that can be decoded as an instruction by the sensor.

The Arduino Nano board has a USB to serial chip which allows the Raspberry Pi to send and receive data using a USB Mini-B cable. This is possible through UART (Universal Asynchronous Receiver/Transmitter) and can be configured according to the datasheet by activating the correct registers and setting the transfer speed for the bytes communicated by the two units.

Hardware and development tools

1. Arduino Nano Board (based on an ATmega328p) on a breadboard [1]
2. Maxim Integrated DS18B20 1-wire temperature sensor with a 4.7 kΩ pull-up resistor [2]
3. Raspberry Pi 3B v1.2 running 64 bit Arch Linux ARM [3]
4. The Embedded-C software is developed in Neovim, using the CCLS language server and compiled using the AVR-GCC toolchain through GNU Make

Conclusion

Phase 2 is ready to be implemented. The results in Phase 1 produces live data and can be used in Phase 2. If more data is needed, it is easy to generate dummy-data in order to test tools for time-series analysis in the server.

References

[1] Atmel Corporation, *ATmega328p Datasheet*. [Online]. Available: `https://ww1.microchip.com/downloads/en/DeviceDoc/Atmel-7810-Automotive-Microcontrollers-ATmega328P_Datasheet.pdf` (visited on Feb. 6, 2022).

[2] Maxim Integrated, *Application Note 162*. [Online]. Available: `https://www.maximintegrated.com/en/design/technical-documents/app-notes/1/162.html` (visited on Feb. 6, 2022).

[3] Arch Linux ARM, *Raspberry Pi 3*. [Online]. Available: `https://archlinuxarm.org/platforms/armv8/broadcom/raspberry-pi-3` (visited on Feb. 6, 2022).