**1 Description**

The aim of this bachelor thesis is the development of an expansion board for the Raspberry Pi, which enables communication via CAN bus and RS232. In addition, a housing for securely holding the board and the Raspberry Pi is to be designed and implemented using 3D printing. A display and an on/off switch are to be implemented.

Communication with a battery management system is also to be established via the serial interface. The information obtained in this way about the individual cell voltages of a battery system is to be sent via MQTT.

1.1 Minimum requirements

- Requirements analysis

- Definition of the required functions (CAN bus, RS232).

- Selection of components for the CAN and RS232 interfaces.

- Circuit and circuit board design

- Creation of a circuit diagram using suitable design software.

- Layout design of the circuit board in HAT format for the Raspberry Pi.

- Provision of production data (Gerber files).

- PCB production

- Commissioning the production of the board.

- Assembly of the board.

- Commissioning and testing

- Carrying out functional tests of the CAN bus and RS232 interfaces.

- Ensuring error-free communication with the Raspberry Pi.

- Housing development

- Designing a housing using CAD software.

- Creating a 3D print of the housing.

- Testing the accuracy of fit and accessibility of the interfaces.

- Documentation

- Creation of a complete

1.2 Further work

- Programming: Reading out a Pylontech BMS via the serial interface and sending the data (individual cell voltages) via MQTT

- Extension of the circuit board with additional interfaces, e.g. removal of the I2C and SPI interface

- Optimization of the housing design in terms of material efficiency and functionality.

- Development of a software demo for using the CAN bus and RS232 interfaces.

1.3 Excluded topics

- Development of CAN and RS232 stacks for the Raspberry Pi.

- Integration of other protocols outside the defined scope.

**2 Formal requirements**

A number of formal requirements must be met in order to work on the topic.

1. the formal requirements for the registration of the bachelor’s thesis must be met.

2. a processing time of 12 weeks is planned.

A work plan with at least 4 milestones must be submitted at the beginning of the thesis.

Example:

MS1: 01.04.2021: Familiarization is completed.

MS2: 14.04.2021: Recording of all results is completed.

MS3: 21.04.2021: Structure of the work is complete.

MS4: 28.04.2021: Submission of the written paper.

Attention should be paid to compliance with the milestones during processing. If necessary, delays must be agreed with the supervisor.

3. the written paper must meet the criteria for scientific work. These have been announced in the module “Scientific Work” and at the beginning of the internships. The most important documents can be made available if required. Particular attention must be paid to the correct use of citations. Plagiarism will be assessed as an attempt to deceive.

**3 Recommended procedure**

The following procedure is recommended for completing the task:

- Familiarization with the topics of circuit board layout, interfaces of the Raspberry Pi, communication interfaces used, circuit of the “shields” used, MQTT communication, communication with the BMS from PylonTech

- Creation of a work / time schedule for the bachelor thesis

- Creation of a circuit diagram for the adapter board

- After review: Creation of a first board version

- After review: Ordering the circuit board

- Familiarization with the communication with the BMS and programming of the interface communication

- After receipt of the board: assembly and commissioning, if necessary adaptation of the design and new order

- Documentation (ideally this is done in parallel).