Requirement specification project in Computer systems engineering I

Background

The application developed in this project is developed for the purpose of training the students of the course Computer systems engineering I to develop an embedded system, hardware as well as software. The work is documented by the student, initially by a functional specification developed based on this document but also later, based on the implementation, in form of a diagram and schematics of the hardware.

Description

The system developed in this project is an autopilot, similar to what is found in ships and air planes. Based on the difference between the compasses reading (the measured value) and on a manually entered desired heading (the reference value) a servo is controlled to compensate the heading of a ship.

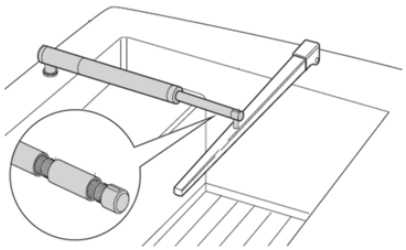

Figure 1: Tiller pilot, one type of auto pilot that control the rudder of a sailboat.

The desired heading is entered on a keypad along with other settings and displayed on the LCD screen associated with the system.

The main components of the system are:

- A microprocessor based (ARM7) development board (Olimex SAM7-Pxxx)
- A digital compass (I2C)
- A Position servo (PWM)
- 12 keys keypad
- A graphical display (truly)
- System software

Definitions

Heading – the direction the ship is going to in relation to the magnetic north pole.

Requirements for pass (grade 3)

Definition: Configurable desired heading through the keypad.
Purpose: To be able to adjust the desired heading.

Definition: Based on the difference between the desired heading and the compass reading, adjust the rudder (the servo) to compensate for the difference.
Purpose: To allow the user to follow the operations of the auto pilot.

Definition: Present the desired heading, the current heading (from the compass) and the difference on the display.
Purpose: The main operations of the auto pilot.

Definition: Send the desired heading, the current heading (from the compass) and the difference on a serial communication link (RS232). The data shall be sent each second.
Purpose: For remote logging.

Definition: Start and stop the system based on the buttons. This routine must make use of hardware interrupts.
Purpose: Allow the user to operate the system.

Definition: Signal the operation of the system with the LED
Purpose: Allow the user to operate the system.

Definition: Documentation of the most important data structures and modules of the software.
Purpose: For documentation and examination purposes.

Definition: Make a chart (block diagram, flow chart, or other graphical description of the system).
Purpose: For documentation and examination purposes.

Requirements grade 4 (in addition to all of the requirements of grade 3)

Definition: Present the desired heading, the current heading (from the compass) on the graphical display using a graphical representation of a ship with.
Purpose: To graphically present the information to the user.

Definition: Present the desired heading, the current heading (from the compass) as a time graph on the graphical display. The time range should be selectable by the last 128 seconds or the last 128 minutes (1 second per pixel or I minute per pixel).
Purpose: To graphically present the information to the user.

Requirements grade 5 (in addition to all of the requirements of grade 4)

Definition: A test specification shall be written and handed in, the specification are the basis of the systematic system test.
Purpose: To allow the system developers to verify the system operation and verify that the system implementation meets this specification.