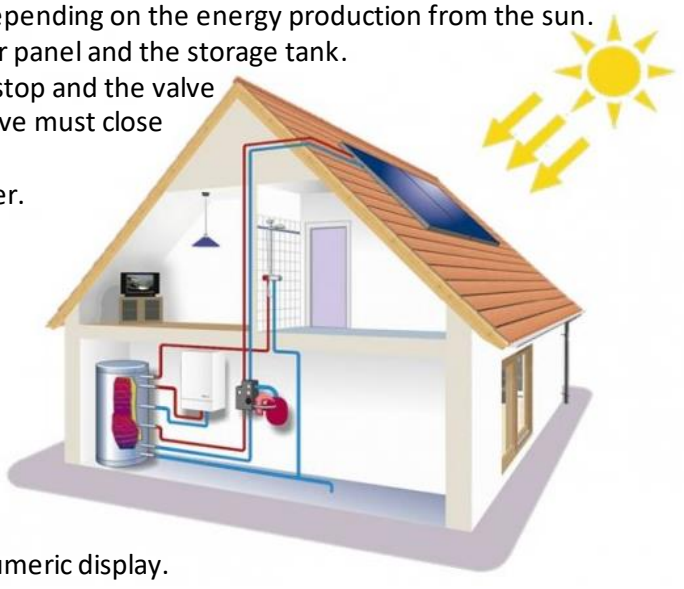
Assignment 4: Solar panel control

Design and implement a (simplified) solar heating control system (using your Arduino with VIA-shield). The device measure temperature in a solar panel and controls a valve (using a servo motor) and a pump (LED). The servo open and close the district heating depending on the energy production from the sun. The pump (LED) circulates the brine between the solar panel and the storage tank.
When temperature drops below t_{low}, the pump must stop and the valve open. When the temperature rises above t_{high}, the valve must close and the pump start.
The setpoints, t_{low}, and t_{high} are configurable by the user.



You should use the already implemented drivers for:

- ✓ Keys
- ✓ LEDs
- ✓ Display
- ✓ Analogue thermometer
- ✓ Matrix keyboard.

Requirements:

The current temperature must be displayed on the numeric display.
Pressing *switch 1* change the numeric display to t_{low}. LED 1 turns on (2 and 3 off).
Pressing *switch 2* change the numeric display to t_{high}. LED 2 turns on (1 and 3 off).
When the numeric display show t_{low}, or t_{high} the user can enter a new value on the matrix keyboard and save it by pressing '#' or cancel by pressing '*'.
Pressing *switch 3* change the numeric display to current temperature. LED 3 turns on (1 and 2 off).
LED 6 must be on if the valve is open and off if the valve is closed.
LED 7 must be on when the pump is running and off when it is not (you do not connect a real pump).

Optional:

- ➢ Servo driver, using PWM (see datasheet on last page). Study how to configure Fast PWM in the MCU datasheet. Notice that the shield pin-connectors for servos are connected to MCU Timer 5 (see shield diagram).
  The servo must turn clockwise when the t_{high} trigger point is reached and counterclockwise when the t_{low} setpoint is reached.
- ➢ Use a Timer to return to current temperature in the numeric display 5 sec. after t_{low}, or t_{high} have been shown/changed.

Hardware:

Arduino with VIA-shield (borrowed for this course)
Matrix keyboard (from your Arduino set)
Servo motor (from your Arduino set)

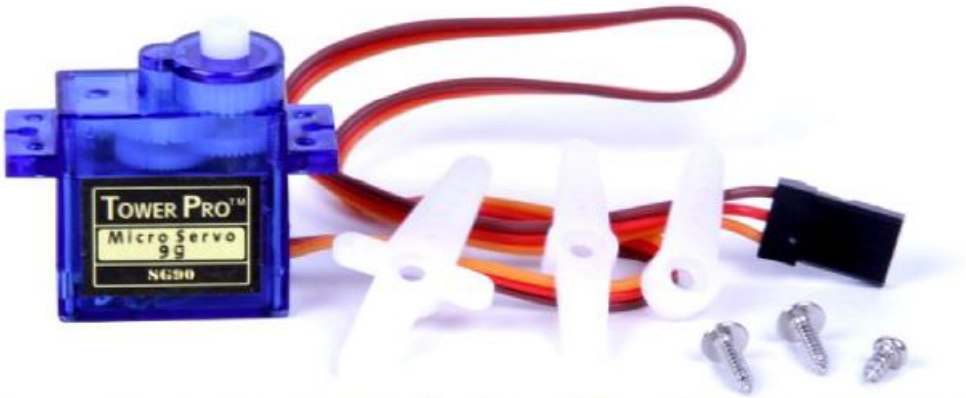
Documentation

Inline comments.
UML class and activity diagrams.

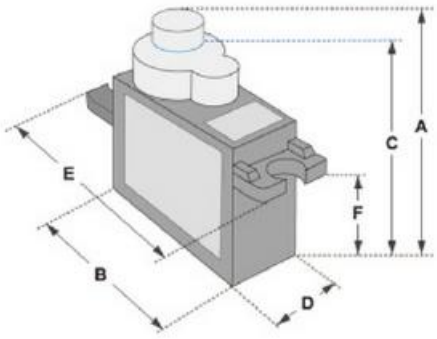
What to hand-in:

Alle source files and diagrams.
This assignment could be discussed at the exam, and you must show and explain your solution on request.
You are welcome to work together with a classmate, but you will both be expected to know all details about the entire system.

SERVO MOTOR SG90 **DATA SHEET**



Tiny and lightweight with high output power. Servo can rotate approximately 180 degrees (90 in each direction), and works just like the standard kinds but smaller. You can use any servo code, hardware or library to control these servos. Good for beginners who want to make stuff move without building a motor controller with feedback & gear box, especially since it will fit in small places. It comes with a 3 horns (arms) and hardware.



Dimensions & Specifications
A (mm) : 32
B (mm) : 23
C (mm) : 28.5
D (mm) : 12
E (mm) : 32
F (mm) : 19.5
Speed (sec) : 0.1
Torque (kg-cm) : 2.5
Weight (g) : 14.7
Voltage : 4.8 - 6

Position "0" (1.5 ms pulse) is middle, "90" (~2ms pulse) is middle, is all the way to the right, "-90" (~1ms pulse) is all the way to the left.