The objective of this project is to create an automated temperature control sub-system of a working aquaponics system.

# Input

* 3 Air sensors (inside greenhouse)
* 2 Air sensors (outside greenhouse)
* 2 Water sensors
* 2 Float sensors (measure water level, inside sump tank)
  + **FloatHigh**: Measures a high point in the sump tank to check for overflow
  + **FloatLow**: Measures a low point in the sump tank to prevent emptying the tank

# Output

* 1 Fan
* 2 Water pumps (inside sump tank)
  + **P1**: Regulates the water inside our system
  + **P2**: Turns on manually to water plants outside the system. Will be turned on automatically too
* 1 Liquid Crystal Display (LCD)
* 1 SD card
* Serial output

# Functionality

## Regulating Water temperature

The sump tank contains two pumps, one for circulation and one for sending water to plants outside the system. It is linked with another tank which is outside the greenhouse. That tank has water in much lower temperature than the system's water.

If the circulation pump is turned off for long enough, the sump tank will raise its level and start sending water to the external tank. When the external tank reaches a level a pump starts sending colder water into the aquaponics system. Turning the external tank's pump on/off is not part of the system that will be implemented.

## Regulating Air temperature

The air temperature will be controlled by a fan. When the fan turns on it sends warm air outside the greenhouse and sends colder outside air in.

## Logging

The system will log all measurements on an SD card.

# Design

Will measure temperature (can also measure humidity but from 3 air sensors and calculate their average. The final temperature that will be used to decide whether to start a pump will be calculated among other cached values. We will always store 20 values in an array (including current average of 3 temperatures). With every loop of our application we will calculate the average of those 20 values and use the result as internal air temperature (AirTemperature). The same will be done for water temperature (WaterTemperature).

The pumps and fan will work in the following way:

**Fan**: When airTemperature >= airTemperatureThreshold then fan turns on for interval FanInterval (i.e. on for FanInterval seconds and off for FanInterval seconds), until airTemperature < airTemperatureThreshold.