Hydroponics controller design spec

# PLC:

The PLC is responsible for the following tasks:

## Hardware:

* Turn on/off lights (x3)
* Turn of/off pump
* Turn on/off heater
* Turn on/off intake fan
* Turn on/off exhaust fan

## Software:

* Communicate with all sensor nodes via Modbus and get sensor readings from each.
* Send these sensor readings to the thingsboard dashboard using MQTT
* Receive control setpoints for temp, humidity, c02 and pressure from thingsboard
* Run control algorithm for each parameter to maintain desired setpoint (which paramaters can be controlled depends on hardware available e.g. dehumidifier. First iteration may just be temperature control and pressure control using the fans.
* Automatically switch on/off the lights at set times
* Get light on/off times from thingsboard
* Automatically switch on the pump for a certain duration and at a certain period (i.e. switch on pump for 2 minutes every hour etc)
* Get pump duration and period from thingsboard
* Control speed of exhaust fan
* Needs to be able to recover from power failure. I.e. on reboot obtain setpoints from cloud etc. and have a fallback plan for if internet is not working etc. Maybe default safety setpoints that will prevent loss of crops.
* A software safety check should be implemented that detects equipment failure. I.e. pump is turned on but no water flow detected etc.

# Sensor Node

* Each node provides temperature, pressure and humidity data at a minimum
* Each node has the option of taking a CO2 or water flow rate sensor
* Can be powered from 12V bus and communicate with master (PLC) via modbus
* Ideally every node would have identical code regardless of what sensors are present

# Thingsboard dashboard

* Displays sensor data from every sensor node as well as room averages etc.
* Allows user to set setpoints for temp, pressure, humidity, CO2
* Allows user to set on/off times for lamps
* Allows user to set on/off times and duration of water pump
* Display plot of exhaust fan speed
* Display plot of on/off times of pump and water flow
* Display plot of on/off times of heater
* Send email alert if parameter goes out of safe range like temp or CO2 or if PLC if offline etc.
* Display latest image taken from webcam