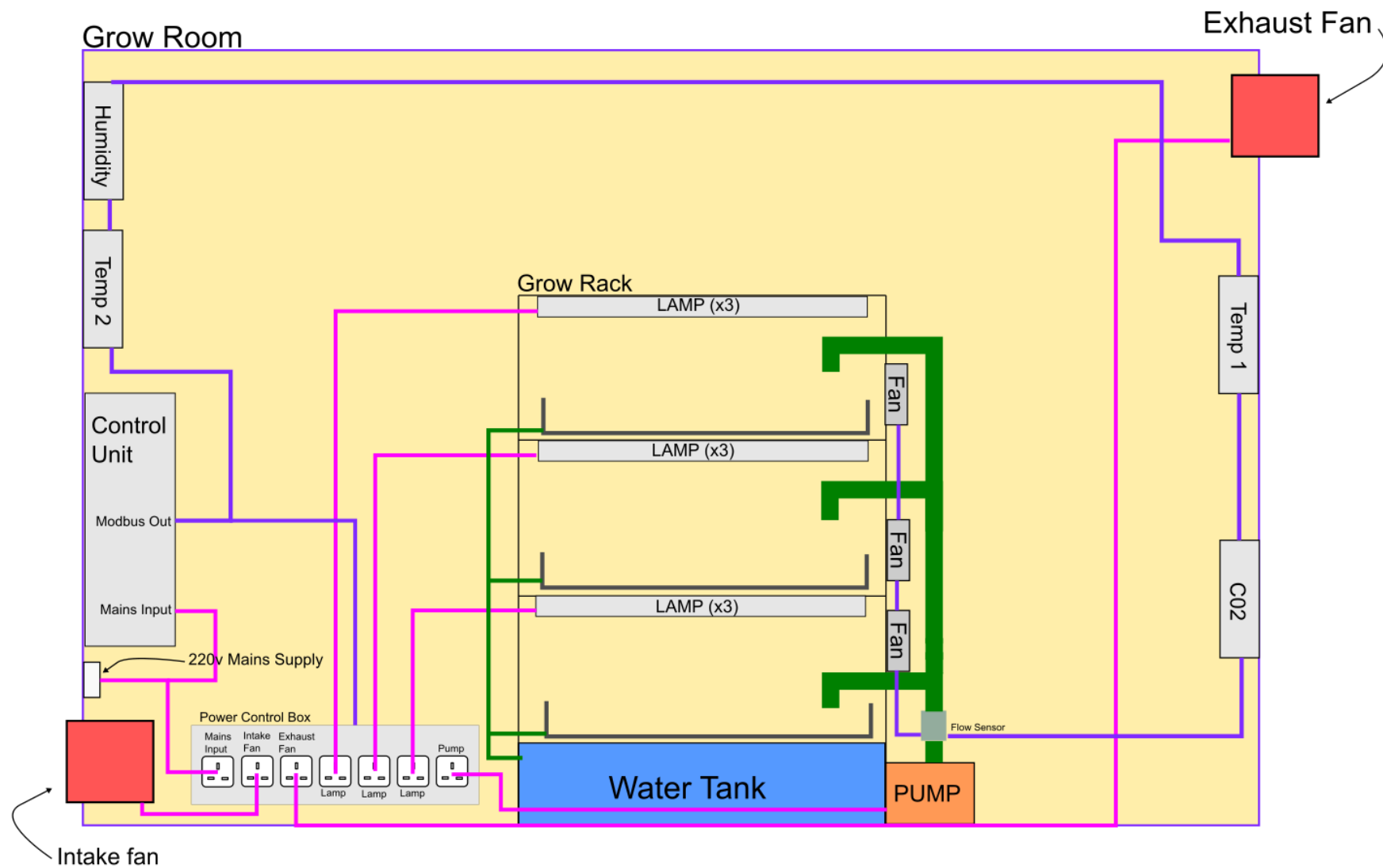# Micro-Greens Hydroponics Controller v1

Inputs:

- C02
- Temperature
- Humidity
- Water flow (for pump)

Outputs (220v):
- ON/OFF control for 3 set of lights (3 lights per level - 3 lights to one socket)
- ON/OFF and SPEED control for 2 duct fans
- ON/OFF control for pump
- ON/OFF control for space heater

Outputs (DC - Low voltage)
- 3 computer fans (12v)

Grow Room

Exhaust Fan

Humidity

Temp 2

Control Unit

Modbus Out

Mains Input

220v Mains Supply

Power Control Box

Mains Input | Intake Fan | Exhaust Fan | Lamp | Lamp | Lamp | Pump

Intake fan

Grow Rack

LAMP (x3)

LAMP (x3)

LAMP (x3)

Fan

Fan

Fan

Temp 1

C02

Flow Sensor

Water Tank

PUMP

Purple = Modbus (with DC power)
Green = Plumbing
Pink   = 220v

The Power Control Box:

To prevent having to runs mains cabling from each mains device back to the controller, it is easier to just have a box with 7-8 sockets on it connected to the modbus network.

A PCB will be made for this box that will take a single mains input and then route that power out to certain sockets (e.g. lamps, pump etc) based on what it receives via modbus from the controller.

Two of the sockets will need special circuitry added to allow for speed control of the intake and exhaust fans. Separate fan controllers could be bought to skip this step but they are quite expensive so adding in this circuitry is probably the way to go.

The rest of the sockets will be just ON/OFF control using a relay to switch on and off the power.

There will be a seperate status detection for the power status of each socket. Basically if the controller tells the power box to turn off a heating element but something goes wrong we need to be able to know that.

Other devices on Modbus network:

This refers to temp, C02, humidity, flow and the PC fans.

Each of those items will have their own PCB with two connectors on it. One is Modbus incoming and the other is for the outgoing. As per the diagram a cable comes out of the controller and goes around to each sensor , in one side and out the other. The network does not need to be a loop, you can have "star points" at any point on the network.

An adapter PCB will also be made up with 3 connectors on it incase we want to break off from the loop and add an extra sensor somewhere.

The modbus cable will be a four core belden and the connectors will be pluggable terminal blocks. It's a nice low cost solution that will make it easy to make new cables and once a cable is made and connectors put on it will be easy to unplug and replug etc. etc.

The Control Box:

The main control PCB should be simple enough due to everything being on the Modbus network as opposed to being directly wired in. The controller at a minimum just needs to work as a bridge between the Modbus network and the cloud. It would also be good to run some basic control algorithms locally like temperature, humidity control etc. which just involves monitoring sensors and switching outputs on or off.

I've decided not to go with the cheap wifi connected microcontroller option. They are useful but not quite reliable enough for an application like this. For example switching on heating elements etc. you want to be sure that it won't crash and leave something like that switched on etc.

A raspberry pi is still an option but I haven't settled on that yet.

Another option is something like this : https://uk.rs-online.com/web/p/iot-development-kits/1244038/
That is pretty much purpose built for an application like this.

The Cloud :

A small virtual private linux server will be sufficient for this purpose. A company called Digital Ocean do ones for 5 dollar per month.

Thingsboard is an open source IOT dashboard platform. The main protocol used to communicate between the local controller and the server will be the MQTT messaging protocol. This will allow for two way communication so sensor values can be collected over Modbus and sent up to the dashboard to be displayed and on that same interface you will be able to change setpoints, switch outputs on and off etc.