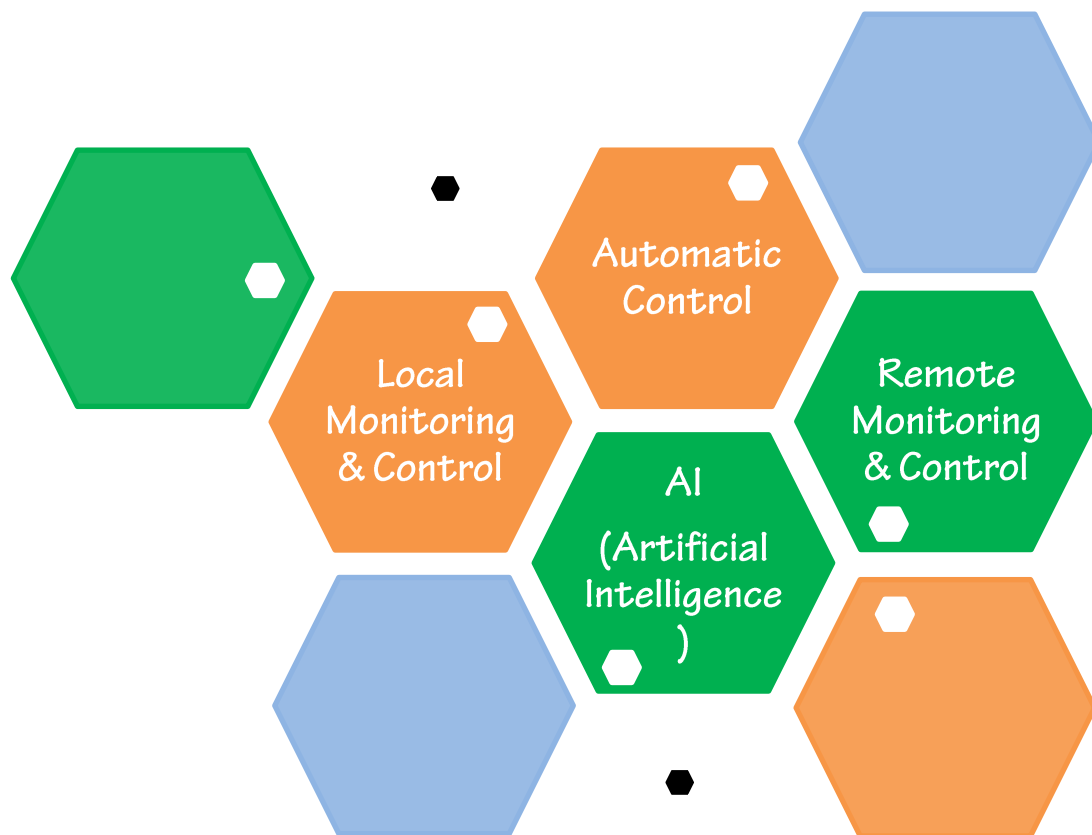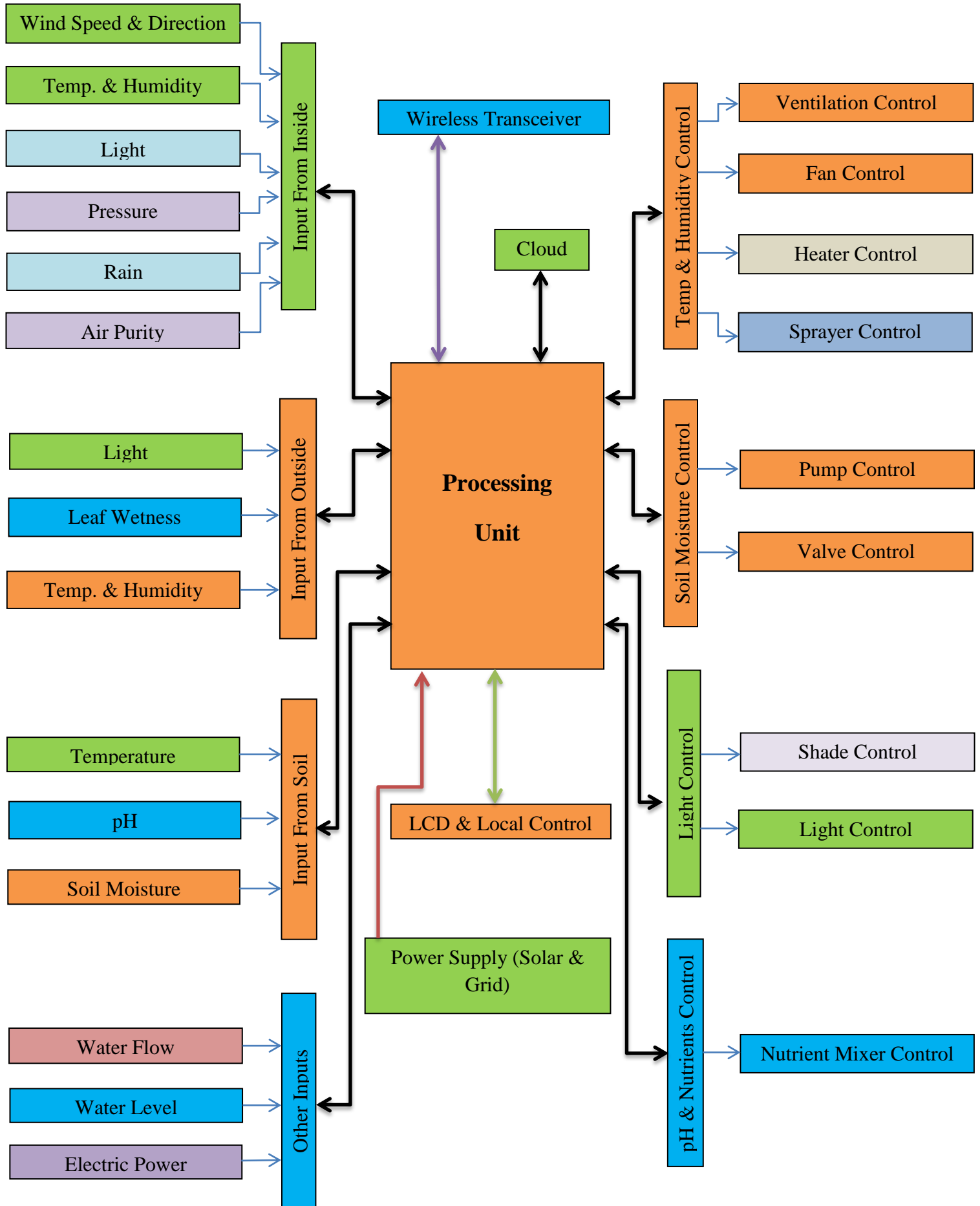# SMART GREENHOUSE

What is Smart Greenhouse?

The key elements are given below:

The elements in orange colour boxes are essential for a simple and basic smart greenhouse. The elements in green colour boxes convert the basic model into an advanced one.

The measurements of temp, humidity, etc. are done in the local monitoring section. In the automatic section, the system automates the irrigation, humidity control, etc. based on the input measured data with the help of a processing unit. In advanced systems, the data is uploaded to a cloud system. So using internet, it is easy to monitor and control the greenhouse irrespective of the location. The AI (Artificial Intelligence) makes the system into an intelligent one.

Architecture

Input From Inside
- Wind Speed & Direction
- Temp. & Humidity
- Light
- Pressure
- Rain
- Air Purity

Input From Outside
- Light
- Leaf Wetness
- Temp. & Humidity

Input From Soil
- Temperature
- pH
- Soil Moisture

Other Inputs
- Water Flow
- Water Level
- Electric Power

Processing Unit

Wireless Transceiver

Cloud

LCD & Local Control

Power Supply (Solar & Grid)

Temp & Humidity Control
- Ventilation Control
- Fan Control
- Heater Control
- Sprayer Control

Soil Moisture Control
- Pump Control
- Valve Control

Light Control
- Shade Control
- Light Control

pH & Nutrients Control
- Nutrient Mixer Control

Colour Indications

- o Orange Box   : Essential for primary model
- o Green Box   : For second model
- o Blue Box   : For third model (Advanced)
- o Other Boxes   : Optional
- o Green & Blue Line : Wired connection
- o Purple Line   : Wireless connection
- o Red Line   : Power connection
- o Black Line   : Wired/Wireless connection

The above given is the block diagram level architecture of an advanced Smart Greenhouse.

1. Output, Automatic Control Mechanisms

1.1 Temp & Humidity Control

Ventilation control is the most energy efficient method (passive). But it will lead to mixing of internal atmosphere and external atmosphere. So there is a chance to change the CO2 level, temp., etc. So the control action should be based on the comparison between internal and external atmospheric factors. Also the wind speed and direction data helps to control the right ventilation to open. If the external atmospheric factors are not good, then the system goes to other active methods like fan, heater, etc. The positioning of the fan and ventilation has a crucial role in increasing the efficiency of the system.
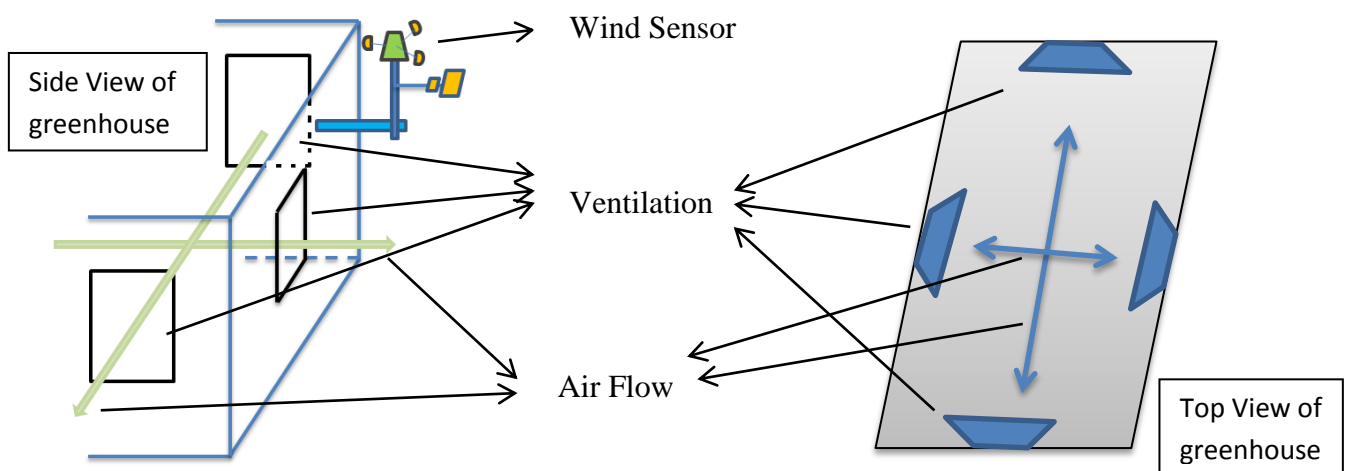

1.2 Soil Moisture Control

Based on the soil moisture data, the system controls the pump and the valve. The valve method is the passive one. Here the overhead water tank provides the necessary water pressure. The system just controls the right valve. It consumes less energy. Otherwise, irrigation done by an active pump.
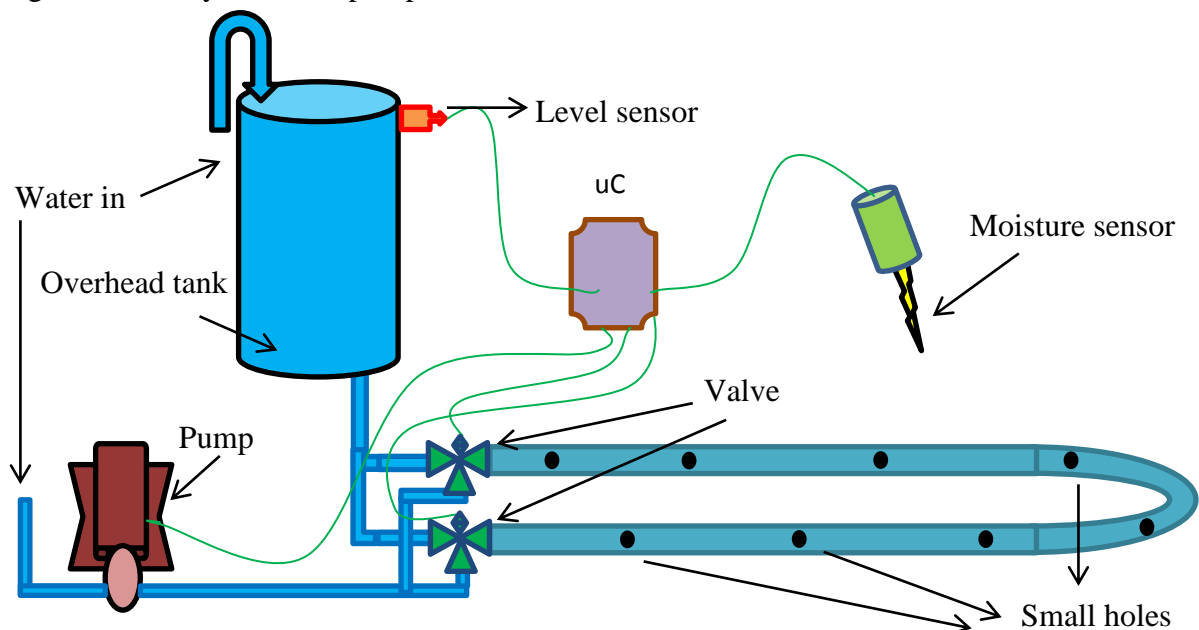
1.3 Light Control

There are two ways to get the light. One is from the Sun and second is by an artificial source like electric bulb. The Sunlight is controlled by a black shade system. The control decision is based on the data from inside and outside of the greenhouse. The priority is for passive source (Sun).
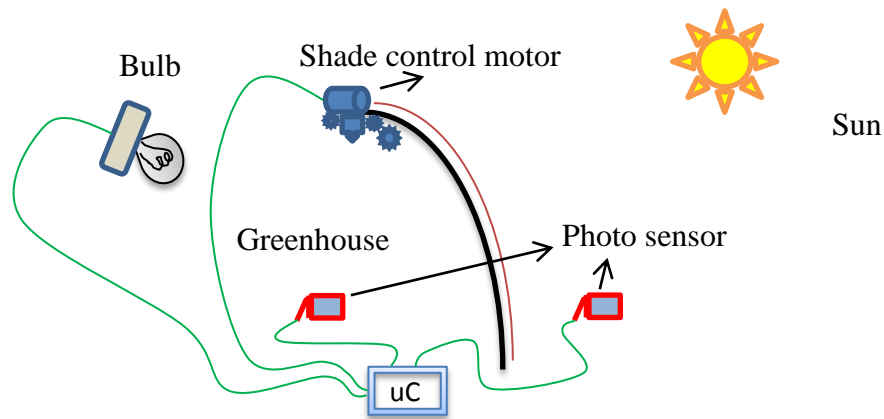
1.4 pH and Nutrient Control

The system calculates the correct amount of nutrients required for the plants based on the soil data and it mix the nutrients at the correct proportion in water and use for the irrigation. It will reduce the fertilizer usage.
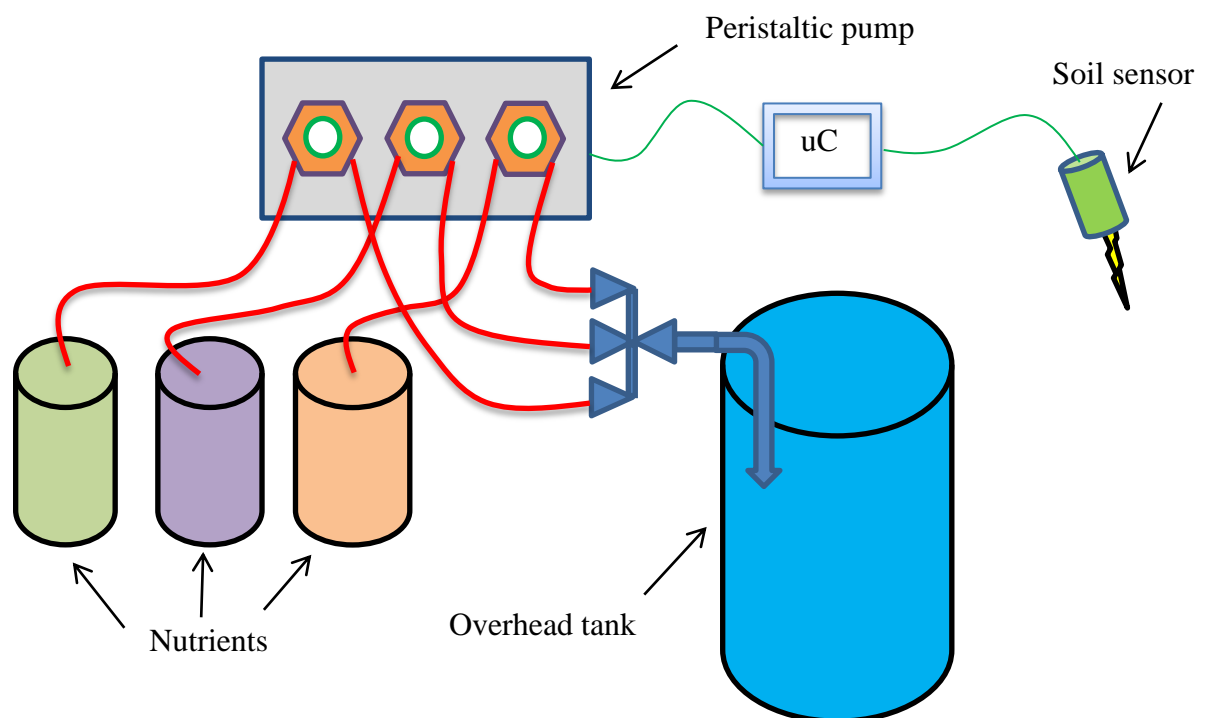

1.5 Other Automations

The system is capable of automatically controlling the water pumping to the overhead tank. Also there are lots of security systems like alarms, door lock, etc.

2. Other Features

2.1 Power supply

The system is powered from both solar and grid. The priority is for solar panel. The solar panel is an automatic one, which automatically tracks the sun. It will increase the energy capturing capacity. There is a battery provided for backup purpose.
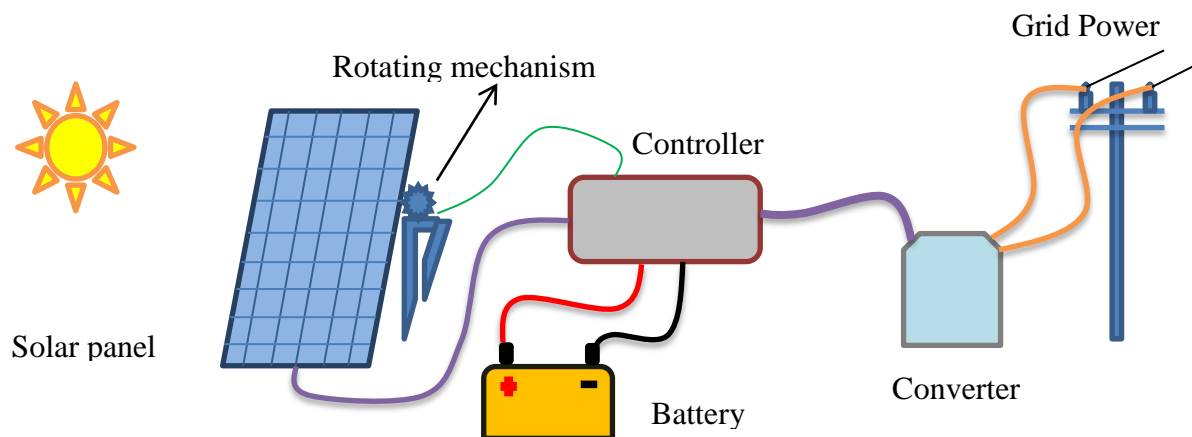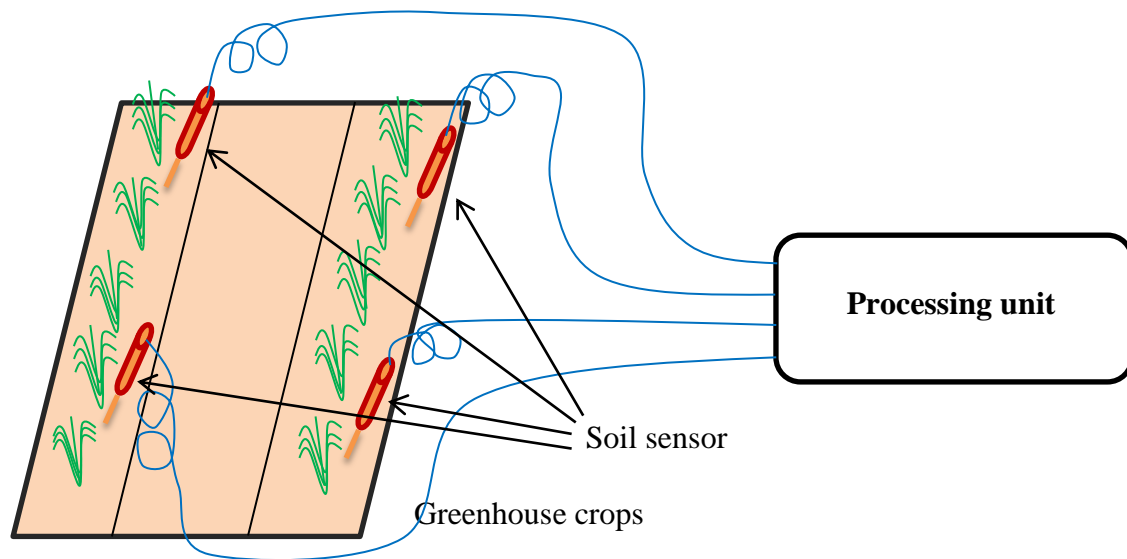

2.2 Local control and Monitoring

There is an LCD screen and push buttons switches (or touch screen) for monitoring and control the whole system. The LCD shows all the measured data and through the settings menu, it is easy to change the controller set points. Also there are manual control (mechanical) facilities in the output of the system to override at the event of system failure.
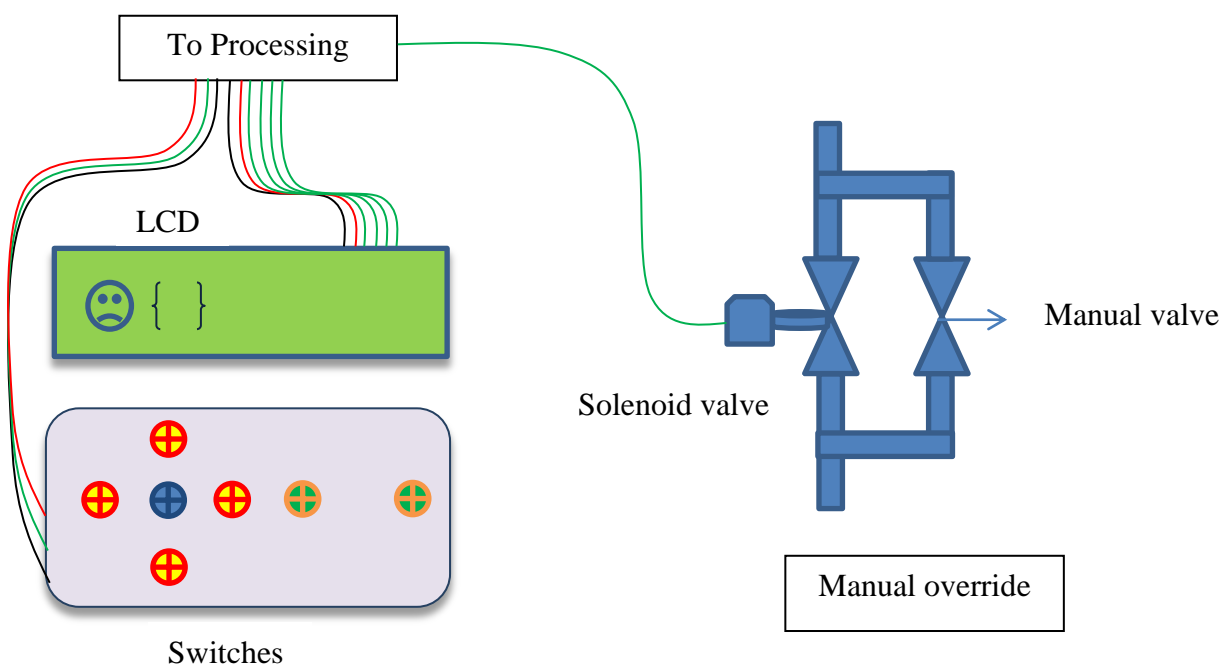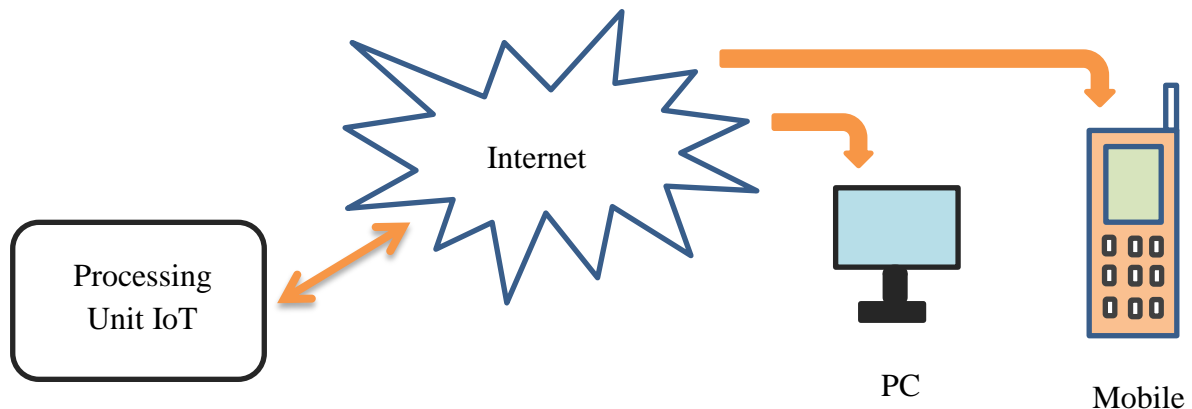
2.3 Sensors

The sensor placing is one of the most difficult tasks in the whole system assembling. If the sensor is placed in the wrong position then it will leads to malfunctioning of the system. Consider the example of moisture sensor. If we use only one soil moisture sensor for the whole greenhouse irrigation then, most probably it will leads to a malfunction. Because, by any chance if the moisture content in the place near to the sensor only is high (other places are dry), then it will close the irrigation valve. But in reality the moisture content in other places are not high. This will create a risk towards the crop. So the credibility of the input data can be increase by using different sensors at different positions. Then by doing some math, it will easy to find the real soil condition. This is applicable for other sensors also.
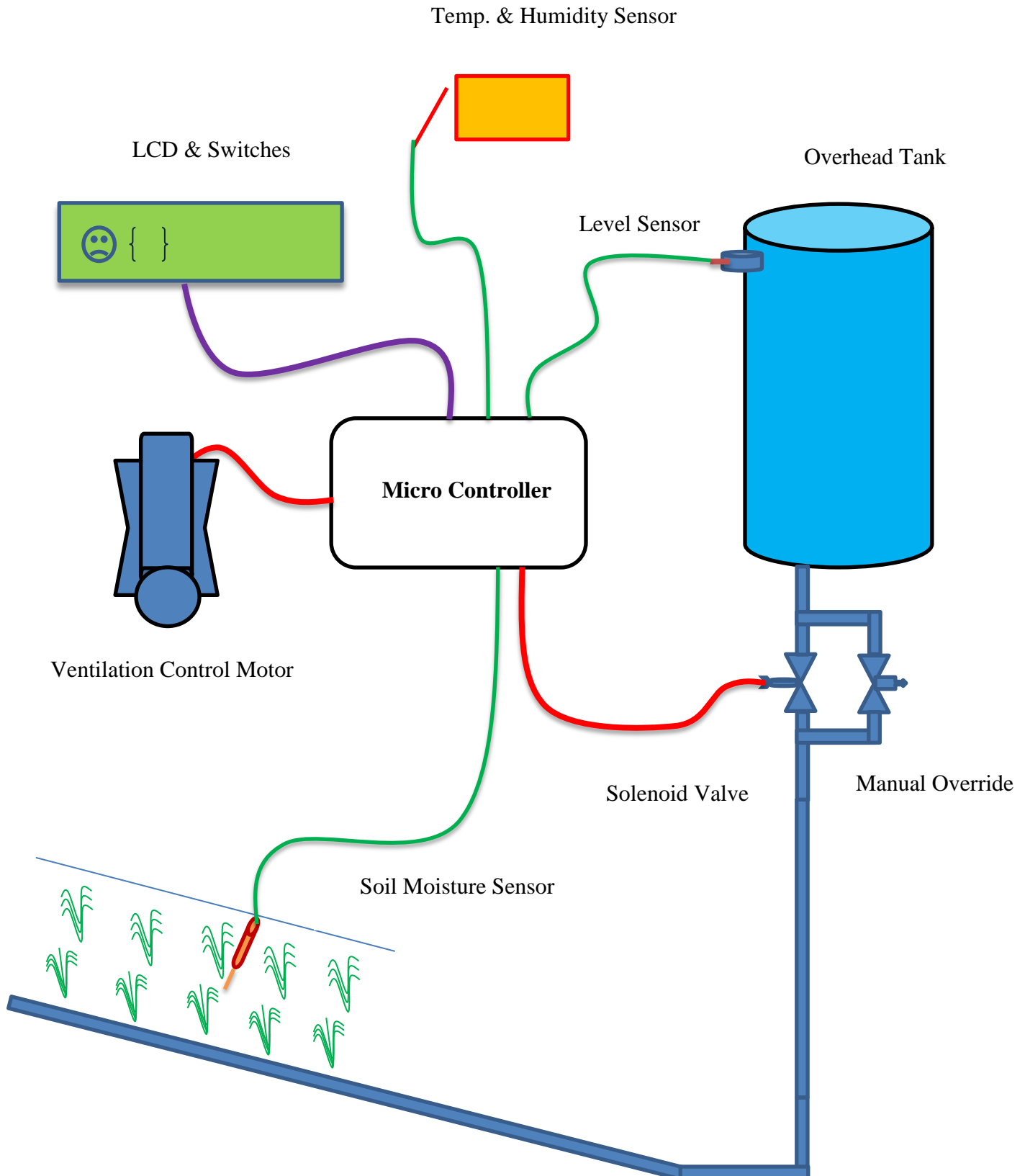
2.4 Remote Control and Monitoring

The IoT technology is a forward looking technology. By adding the IoT features to the system, it will become more flexible. The data is first send to a cloud, and then it is easy to access the data through internet irrespective of the user location. Also through the IoT technology, it is possible to control the system through internet.

3. 1st Experimental Model (Basic)

This is 1st model with basic automation features of the Smart Greenhouse. It is easy to add more sensors and features to the system. So starting from low level is very effective in designing. Based on the effectiveness of the system we can upgrade or modify the system (trial and error method).

Temp. & Humidity Sensor

LCD & Switches

Overhead Tank

Level Sensor

Micro Controller

Ventilation Control Motor

Solenoid Valve

Manual Override

Soil Moisture Sensor

THANK YOU

*All the contents are my own, not copied from anywhere.