



UNIVERSITY OF
PLYMOUTH

PUSL2021 Computing Group Project

Project Proposal

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Smart Agriculture System

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Smart Agriculture System

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G r o u p N o : 1 0 0

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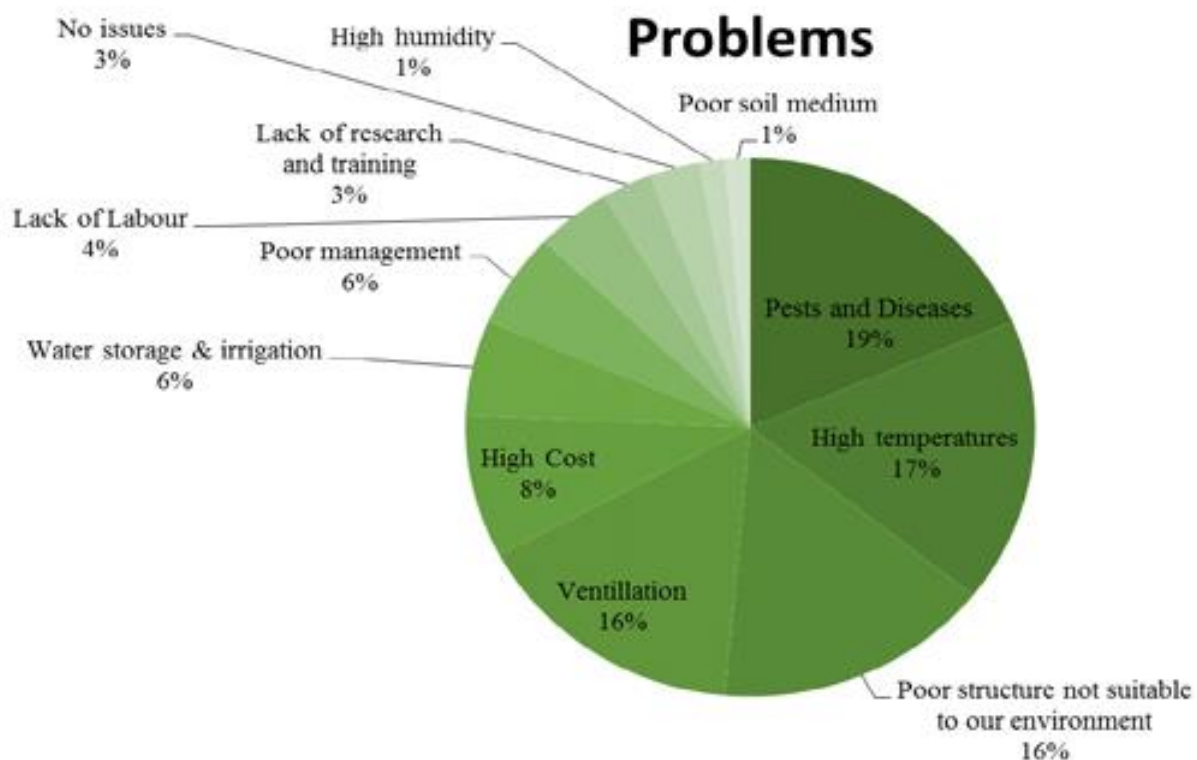
Section 01: Problem Statement

Cultivation, in agriculture, is the caring and growing of plants in a little or, more widely, area. Agriculture has been done in every country since ancient times. But all these processes are done manually by the humans. Now in the current time period, farmers are forced to produce more products using fewer resources in farming. For this problem, a smart farming concept is be the best option.

Greenhouse is a big step in agriculture system. By using greenhouses, farmers can control the necessary sources that a growth of a plant, and also farmers can easily improve the quality of products.

Most of the greenhouses are worked in manually. Because of this, farmers face a lot of problems. The main problem that farmers face these days is the high cost that they spend on labour cost. Large-scale plantations they are having huge greenhouses. These greenhouses cost a lot of manpower. And the other main problem that they are facing is the human errors that happen when watering and fertilizing the plants. By this, the plants can even die or the estimated yield also can not be taken.

Not like in manual, using an automated greenhouse you can control light, heat, humidity and lot of things by automating the system. And also, there will be no effect on the plants, in climate-changers and the labour cost also would be lower.



Section 02: Project Description & Objectives

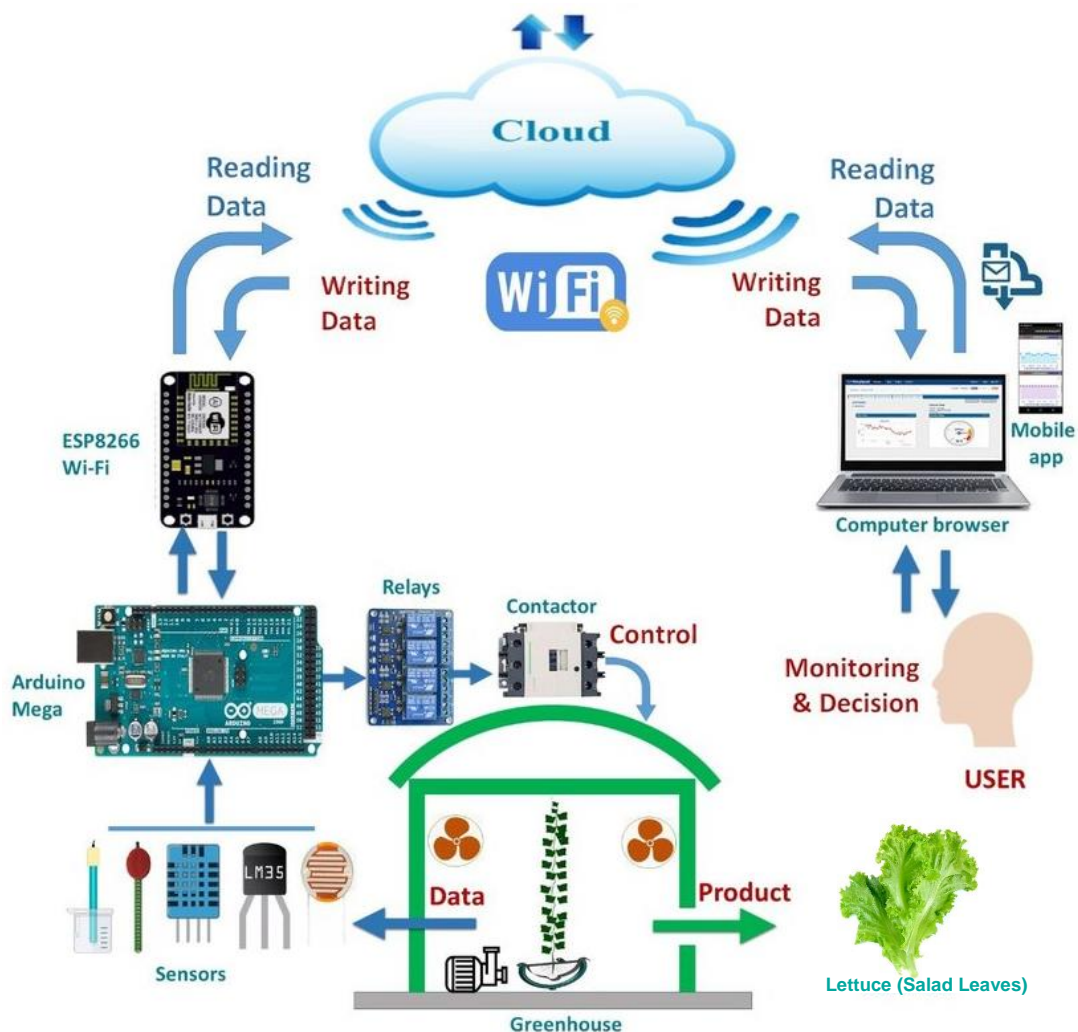
As a solution to the problem above mentioned, we like to present our project as a smart greenhouse. Here we are going to fully automate the greenhouse. And also, we are going to give a prediction about the harvest of the plants.

We are going to measure the temperature, humidity, and heat pH value and also control the light by using **IoT technology**. Mainly we are going to control the water supply, nutritious and fertilizer supplies to the plant due to the greenhouse is a fully hydroponic system.

And also, farmers can monitor crop growth by the real time **mobile application**. Not only that but also, they get alerted when harm happens to crops by checking if the water level and the fertilizing amount are enough, high or low. Mainly this method will reduce energy costs.

We are using sensors to senses for measuring temperature, to measure humidity and a sensor to check the water levels in the drowns of the greenhouses also we are using other two sensors to check the PH value of water and the electrical conductivity.

By analysing past records, farmers can get a **prediction report**. By using this, they can get an idea about the future harvest which is our main target of this project.



Section 03: Requirements

1. DS18B20 Temp Sensor
2. BH1750 Light Sensor
3. DHT22 Humidity Sensor
4. pH Sensor
5. Water Level Sensor
6. EC Meter Pro
7. Analog TDS Meter
8. GSM Module
9. RTC Module
10. 08 Channel 12V Relay Module
11. Microcontroller (Arduino UNO)

1. DS18B20 Temp Sensor

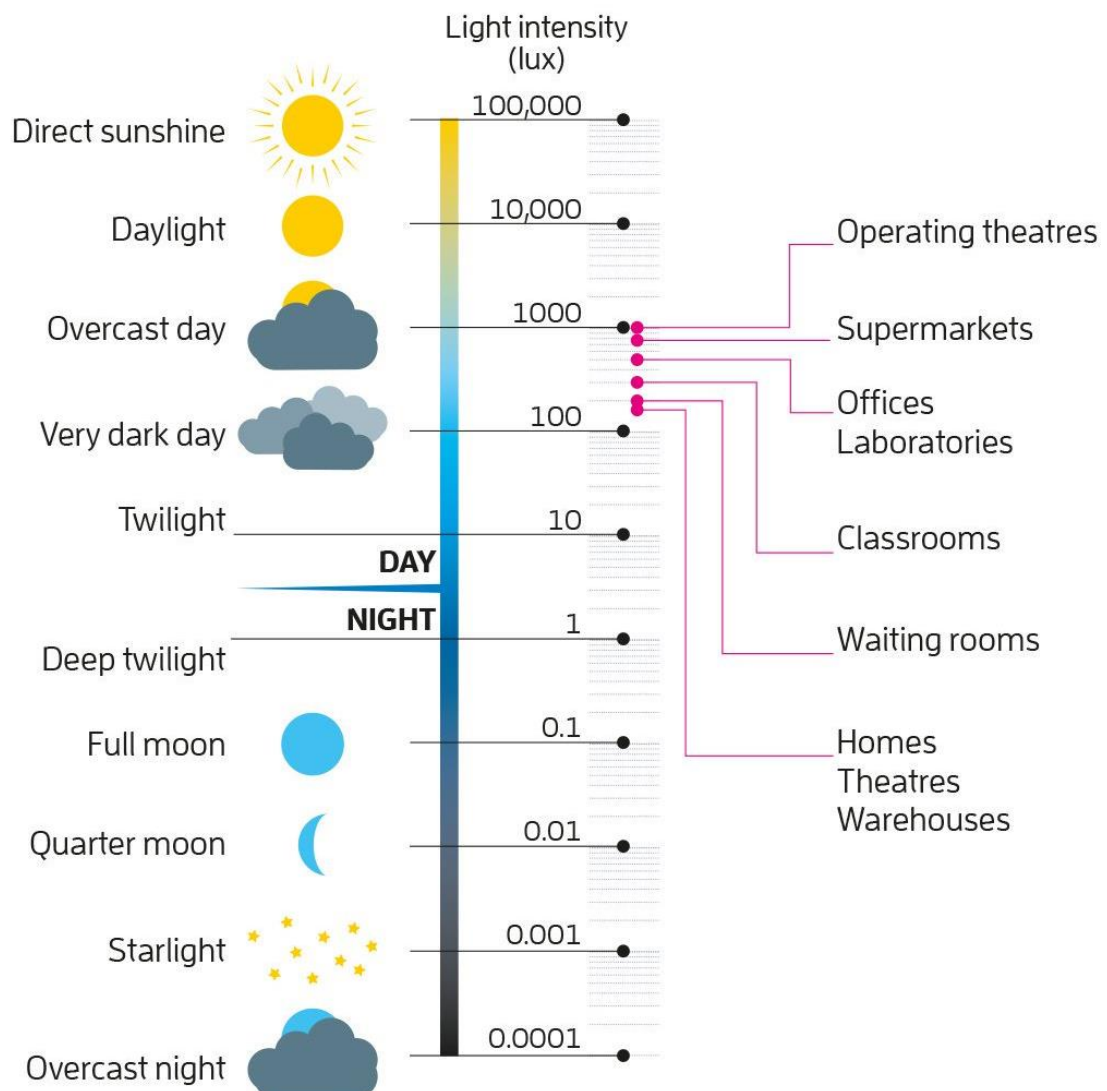
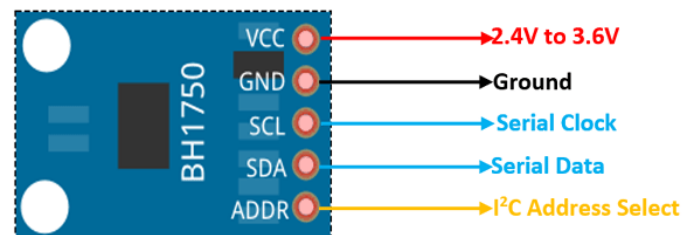
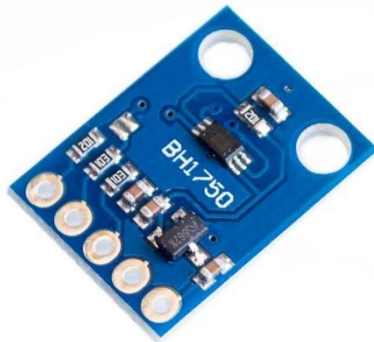
The DS18B20 communicates with a central microprocessor via a 1-Wire bus, which by definition only needs one data line (and ground) for communication. Due to that multiple sensors can be used in one single pin. The DS18B20 can also obtain power straight from the data line (known as "parasitic power"), without the requirement for an external power source. It has unique 64-bit ID burned into chip. This sensor can be used within 3.0V- 5.5V power/data. Temperature can be measured from -55 to 125°C by using DS18B20 sensor and the accuracy is $\pm 0.5^{\circ}\text{C}$. Minimum frequent of measuring data is 750ms. And also, it has 9 - 12 bit selectable resolution.

URL: <https://www.dfrobot.com/product-1354.html>



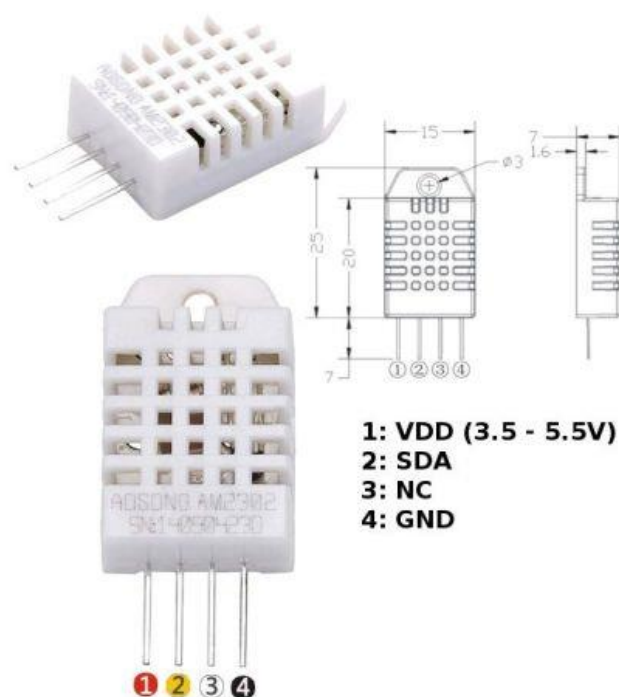
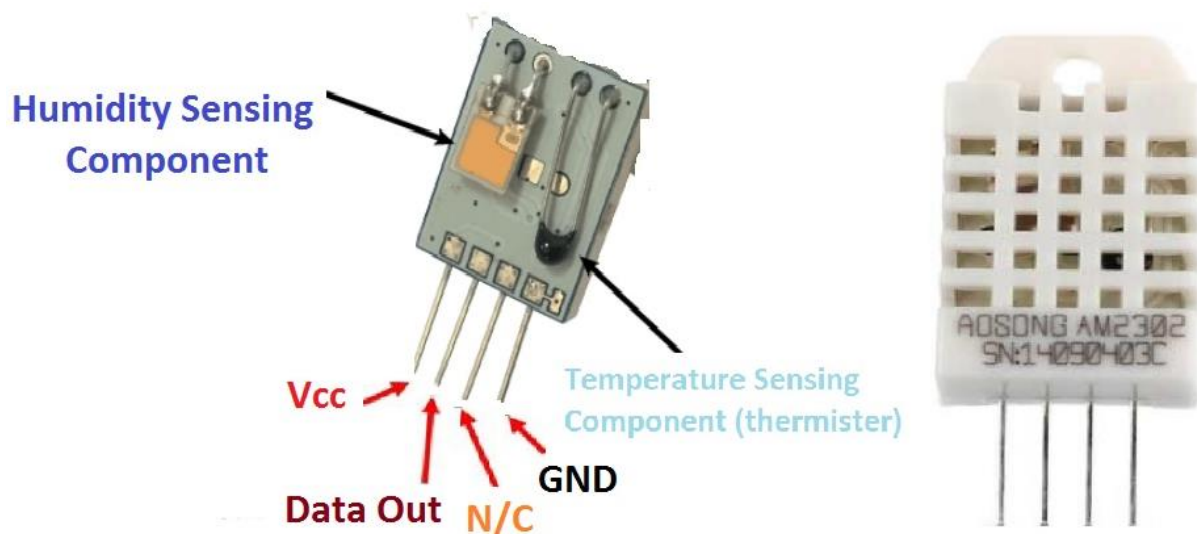
2. BH1750 Light Sensor

BH1750 is a digital ambient sensor which has a I2C interface. This can detect wide range of light intensity at high resolution. Able to measure from 0 Lux to 65,000 Lux. BH1750 module has an in built 16-bit AD converter which is capable of giving a direct digital signal. Due to that there is no need of complicated calculations or any additional circuits. This sensor directly outputs the light intensity in Lux/Lx unit. BH1750 can be operated between 3.3V to 6.0V.



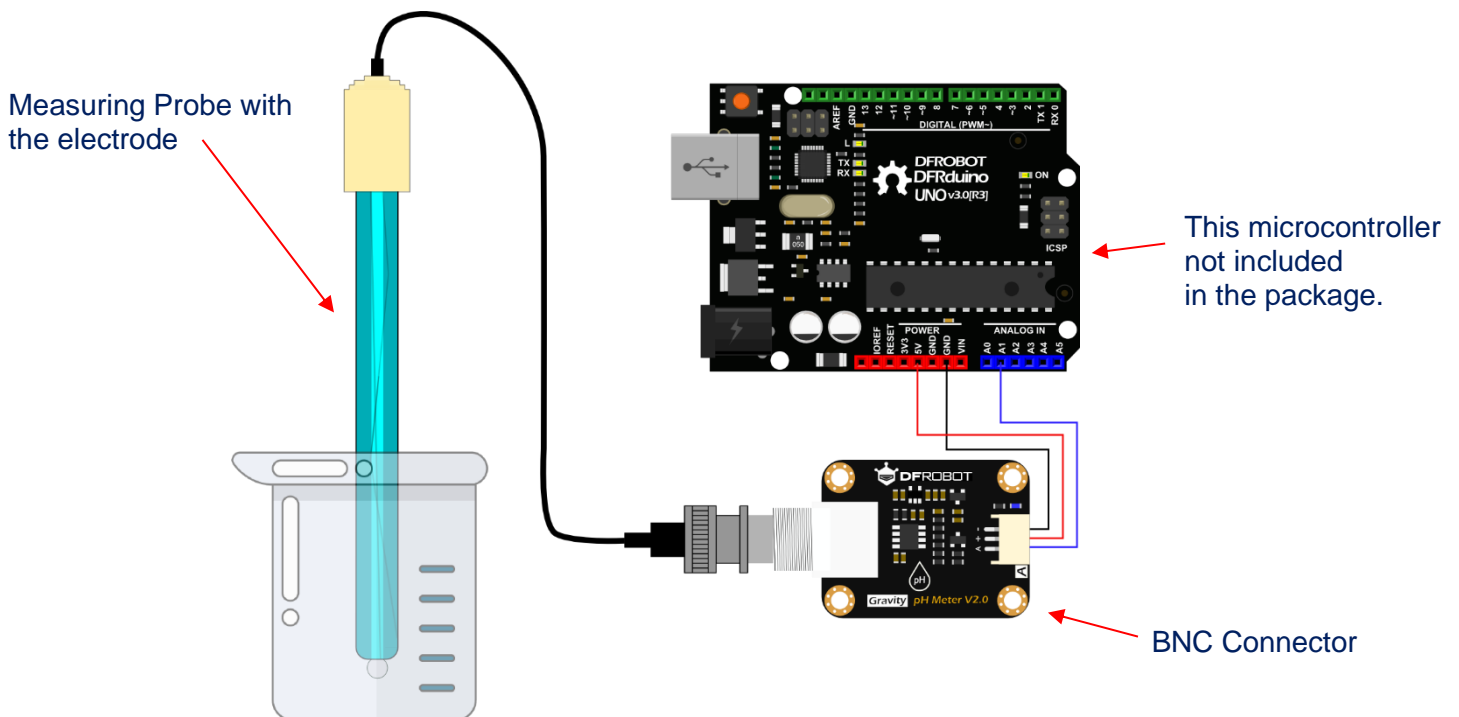
3. DHT22 Humidity Sensor

It is consisting of humidity sensor and thermistor. DHT22 sensor can measure the surrounding air and sends the digital signal from the data pin via single bus. No need of analogue input pins. Readings of the sensor can be up to 2 seconds frequent. DHT22 is working up with 3V-5V. This sensor has 0 – 99.9% relative humidity (RH) and -40°C - 80°C operating range. And also, the accuracy is up to 2 - 5% RH and $\pm 0.5^{\circ}\text{C}$.



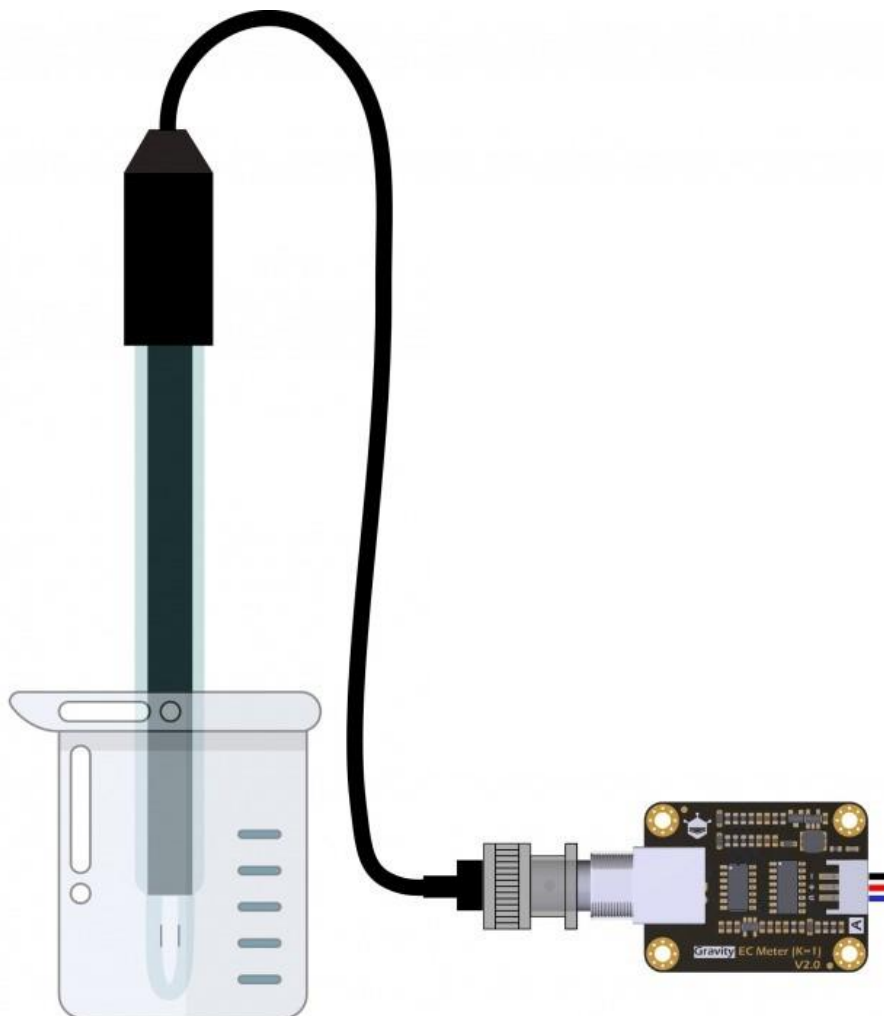
4. Analog pH Sensor/ Meter Pro Kit V2

Analog pH sensor is used to measure the index of hydrogen ion concentration in a liquid, also known as the pH level. This pH sensor is working up with 3.3V – 5.5V including the gravity connector (measuring probe) and the BNC connector. Range of 0 – 14 pH can be measured with 0.1pH accuracy in 25°C liquid environment. The measuring probe can be used between 1°C to 60°C liquid state. This Analog pH Sensor/ Meter Pro Kit V2 has an industrial type of probe which could be suitable for long term online monitoring. Response time is < 60s. Long life up to 7*24 hours > 0.5 years as the data sheet provides. Also, the calibrations should be done in every half an year to keep the measuring probe a long time.



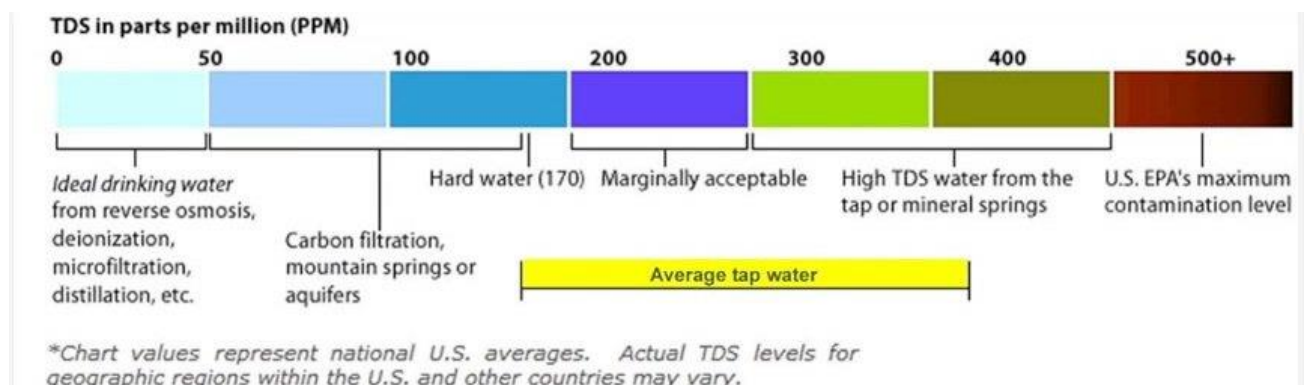
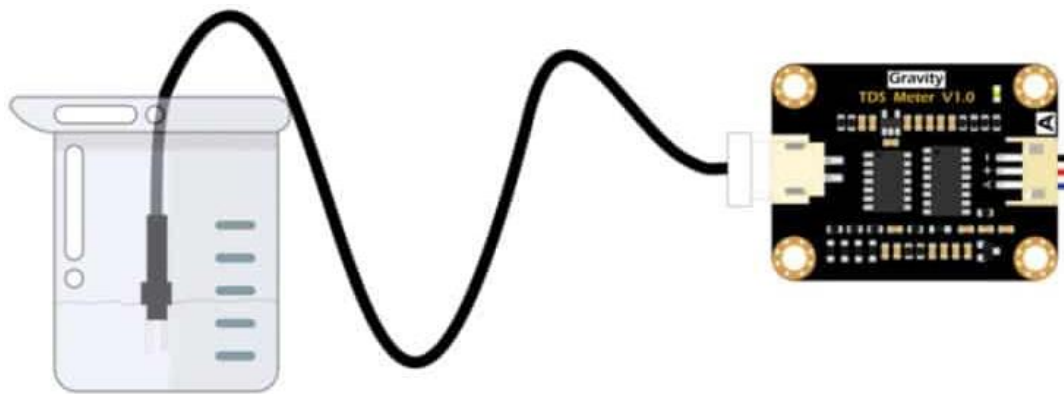
5. EC Meter Pro

EC Meter Pro Kit can be used to measure the Electrical Conductivity of a liquid, which is also known as the EC. This sensor module can be used within 3.3V – 5.0V. Output signal voltage is between 0-3V. Due to the use of an industrial grade probe, this sensor is suitable for long term online monitoring system. Long life up to 7*24 hours > 0.5 yrs. *This could be change with the use of the probe and the water quality. This can measure 1 – 2200 $\mu\text{S}/\text{cm}$. Operating temperature is between 1-50°C. Maximum pressure resistance is up to 0.5MPa. Waterproof level of the probe is IP68.



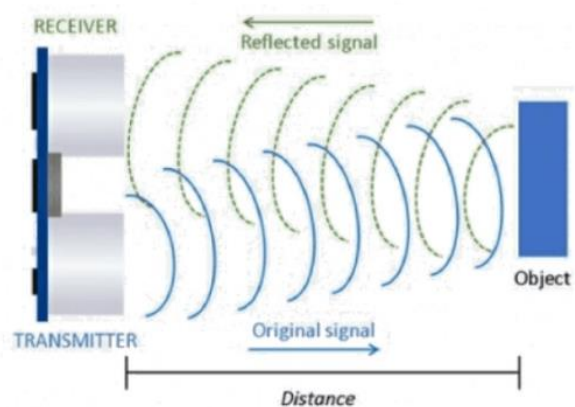
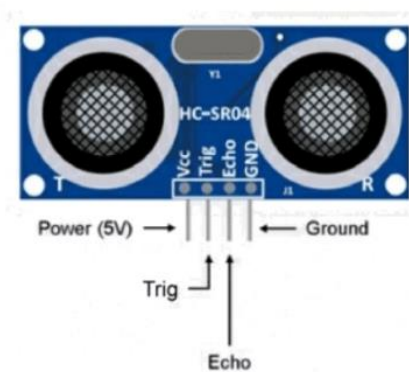
6. Analog TDS Meter

TDS meter kit can be used to measure the TDS value of the water, which is called as Total Dissolved Solids. TDS indicates how many milligrams of soluble solids which has been dissolved in one litre of water. Operating voltage is between 3.3V to 5.5V and working current is 3-6mA. Output voltage is 0 – 2.3V. TDS measurement range is between 0-1000ppm with 10% F.S. at 25°C. Interface of the module is PH2.0-3P. Probe Electrode interface is XH2.54-2P and it consists of 2 needles. TDS probe is waterproof, and it could be immersed in the water for a long-time online monitoring.



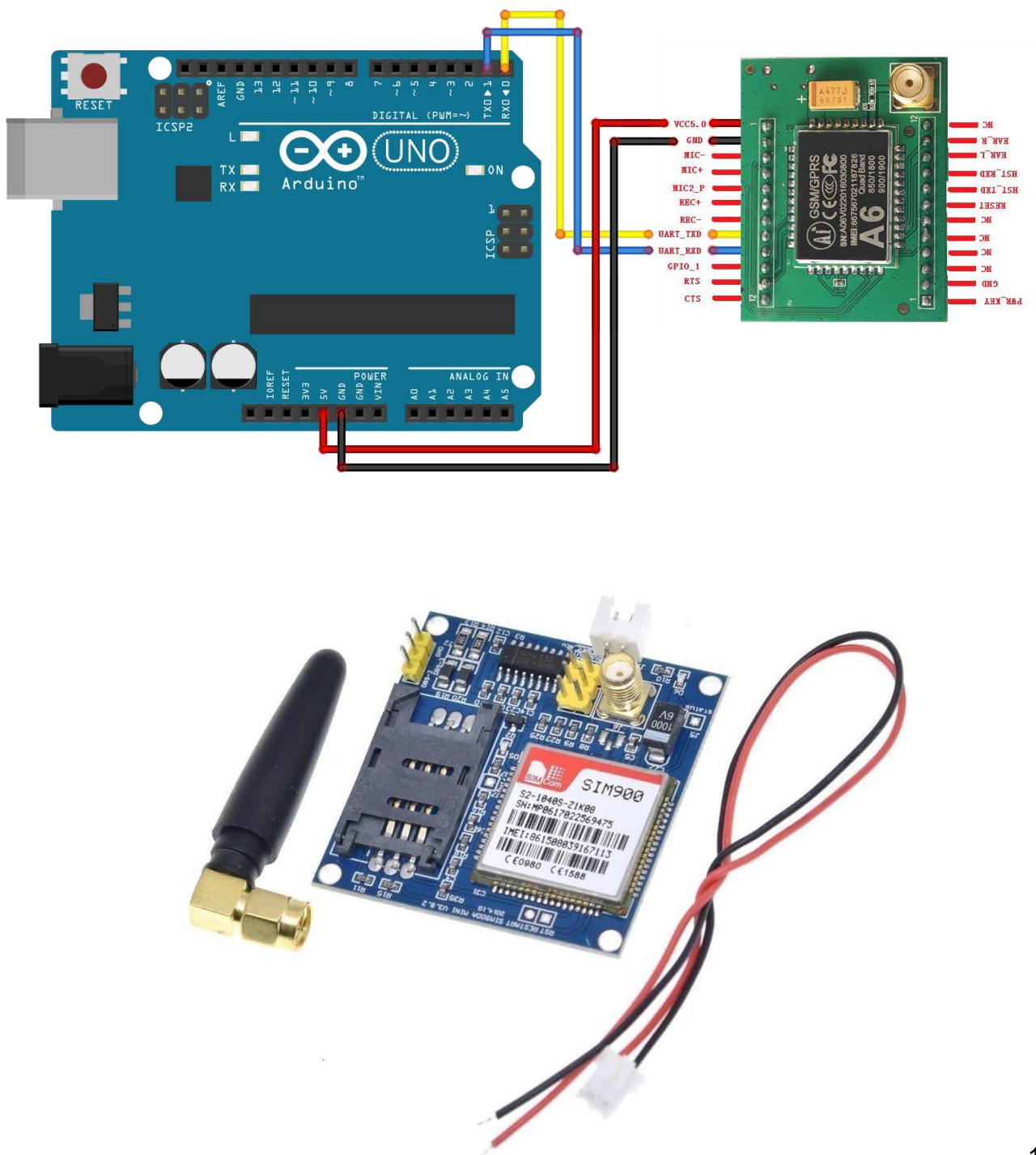
7. Water Level Sensor

This is a waterproof and ultrasonic sensor which is working with 3.0V to 5.5V. Operating range of this sensor is 20cm-600cm and its operating current is about 30mA. Detecting angle is up to 75°. Operating temperature is between -20°C - 70°C.



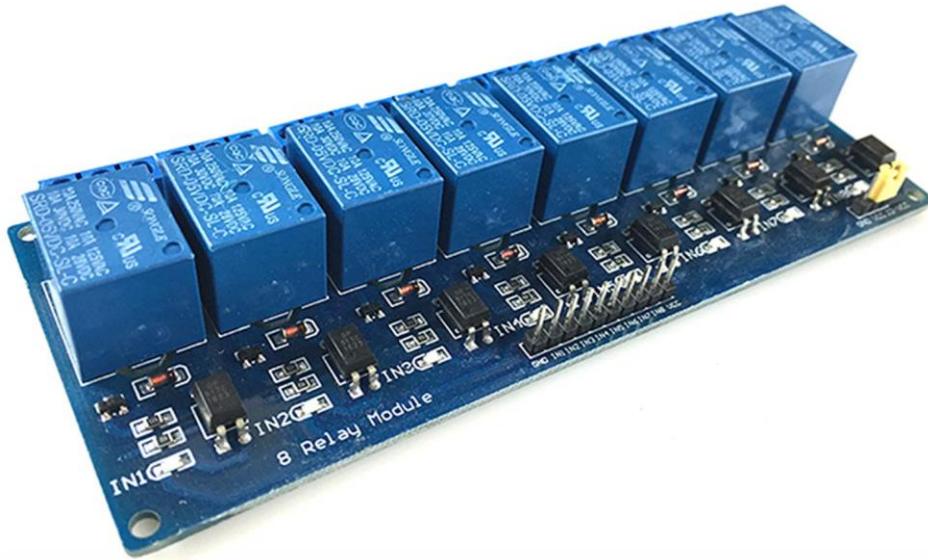
8. GSM Module

GSM module allows the microcontroller to mainly connect to the internet. Furthermore, it can send and receive text messages (SMS), and it can make voice calls and receiving voice calls by using this GSM module. GSM module is functioning with the use of a SIM card for the connection as the network operator. It is operating with 5V(700mA - 1000mA) power supply.



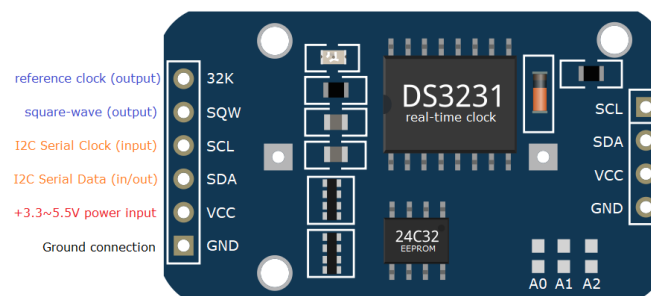
9. 08 Channel 12V Relay Module

This relay module is working with 5V DC power supply. It consists with 08 channels (08 Relays). Functioned by an optocoupler and it has opt0-isolated inputs. Current per relay is up to 20mA and switching current is up to 10A. It has 8 digital I/O pins. This relay module uses to control the high voltage devices by using microcontroller or by using the low signal.



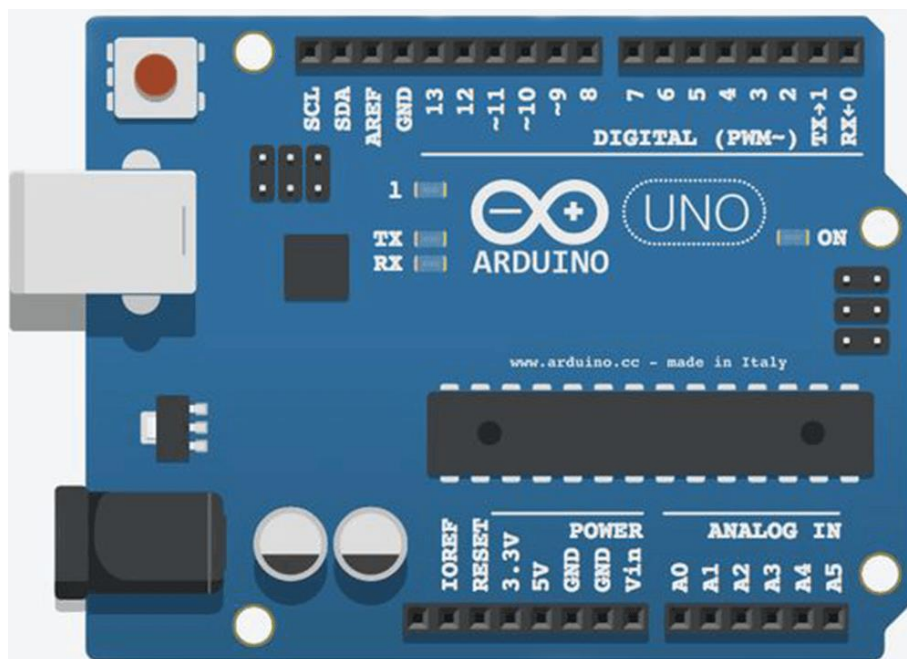
10. RTC Module

DS3231 RTC (Real Time Clock) Module is used to simply get the time and the date to the system. It has a battery setup which is used to run the module even if the external power source is absence. RTC module operated with 3.3V to 5.5V and it uses the I2C technology to transfer the data (I2C address – 0x68). Timing range between 1970 – 2100 with the 0.3024s/1 day(± 3.5 ppm) accuracy rate.



11. Microcontroller (Arduino UNO)

Arduino Uno is a microcontroller which use the ATmega328P integrated circuit(chip). It consists of 06 analog in pins, 14 digital input/output pins (i/o pins). And it has USB connection, a power supply jack with 12V external power supply. Microcontroller acts as the brain of the IoT platform due to it does all the functions and execute the programmes that given into that. Operating voltage is 5V and recommended input voltage is 7V-12V. DC current per i/o pi is about 20mA and the DC current of 3.3V pin is 50mA. ATmega328P chip has 32KB flash memory (0.5KB is used by bootloader). Clock speed is 16MHz.



Section 04: Finance

No	Item Description	Price*1	Quantity	Net Price
01	DS18B20 (Temperature Sensor)	\$7.50	01	\$7.50
02	BH1750 (Light Intensity Sensor)	\$4.50	02	\$9.00
03	DHT22 (Humidity Sensor)	\$8.90	02	\$17.80
04	pH sensor (Pro Kit V2)	\$29.50	01	\$29.50
05	TDS Meter	\$11.80	01	\$23.60
06	Ultrasonic Sensor (Water Level Sensor)	\$16.00	01	\$16.00
07	Microcontroller (Arduino Nano)	\$19.90	01	\$19.90
08	RTC Module	\$6.90	01	\$6.90
09	12 Relay Module (8 Channel)	\$5.99	01	\$5.99
10	GSM Module	\$11.29	01	\$11.29
			Total Quantity	Total Cost
			12	\$147.48 (LKR 54,157.84)

Section 05: Appendix

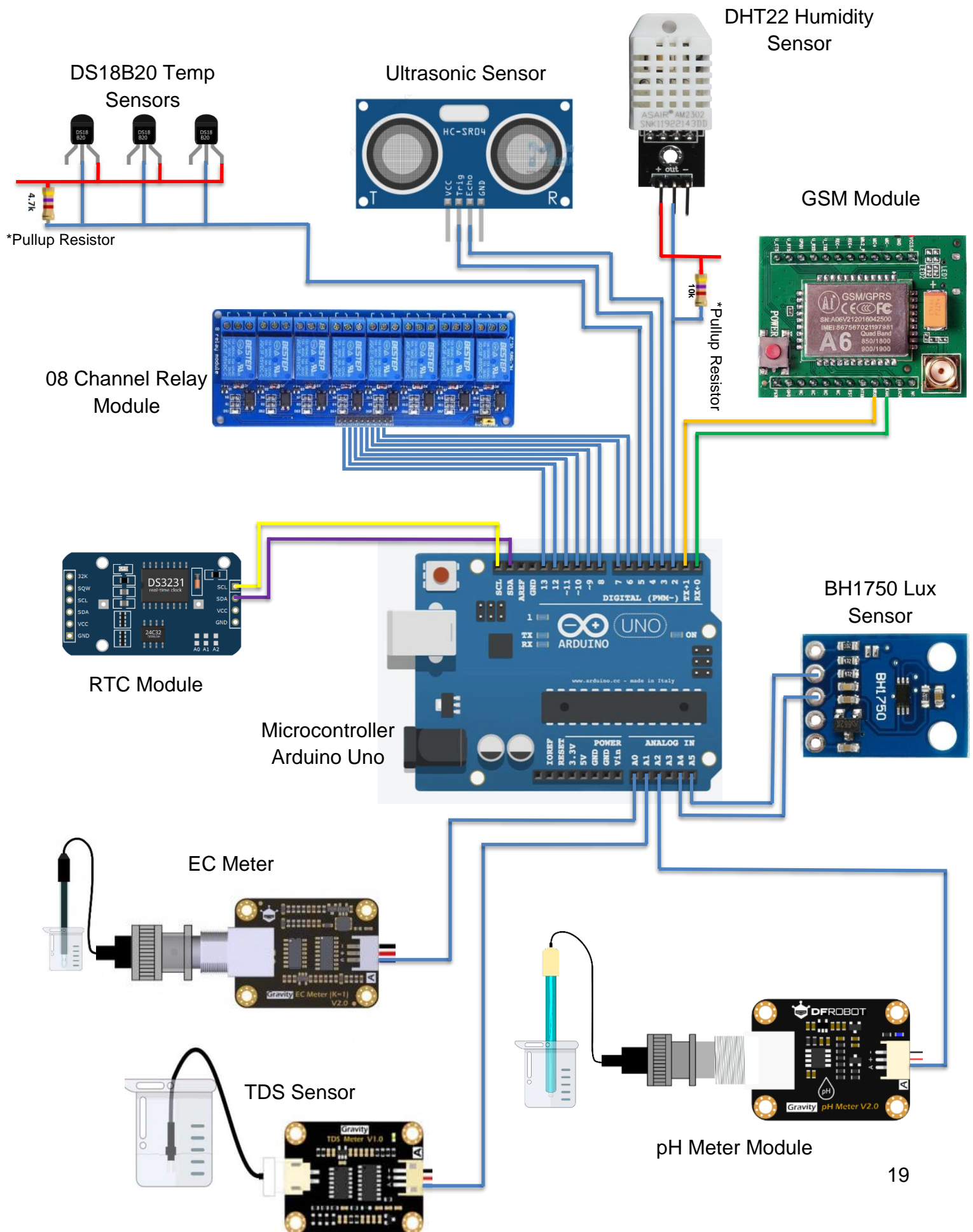




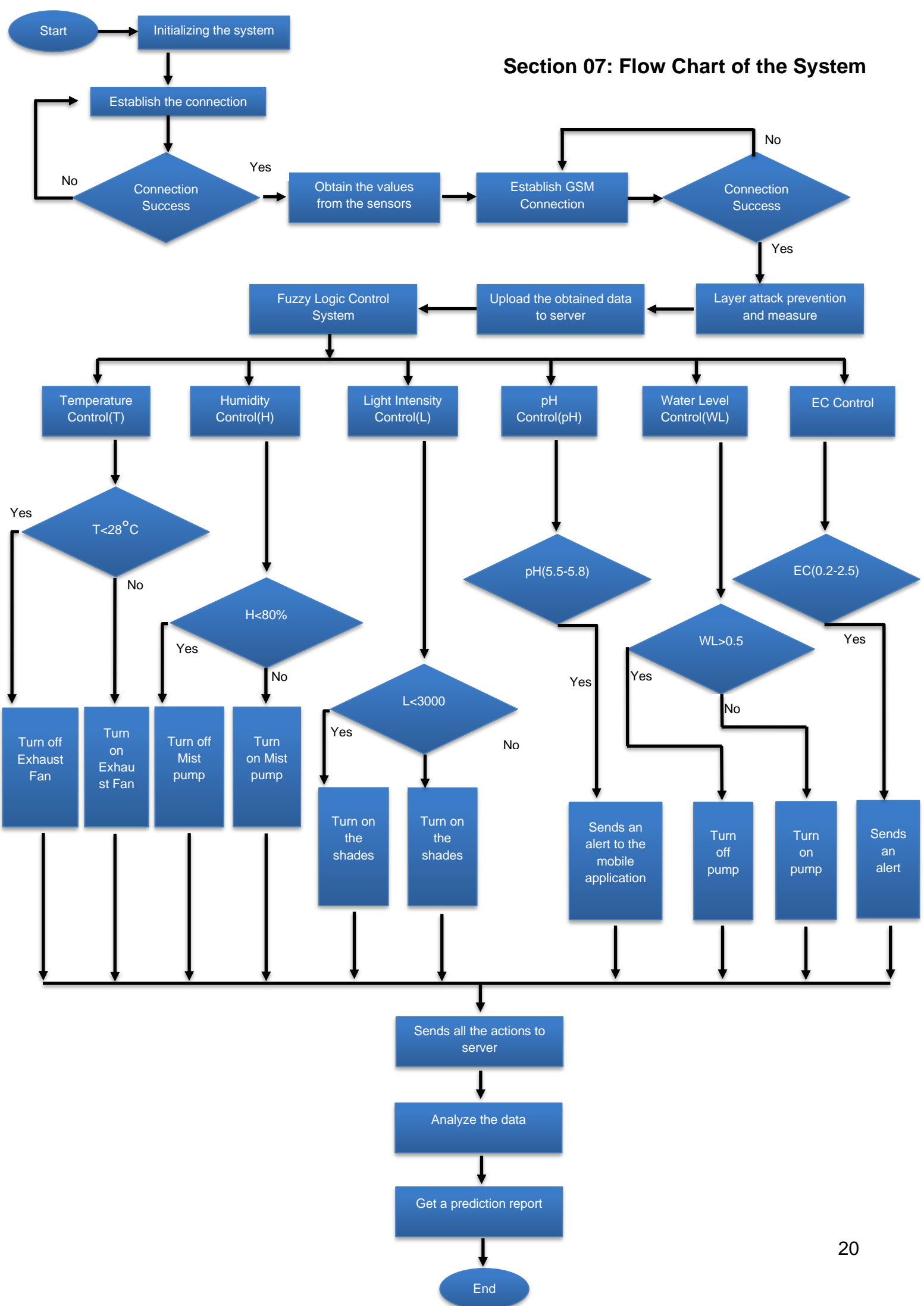
Location:

Silk AgTech Park, Matale
<https://bit.ly/3DsE9Ky>

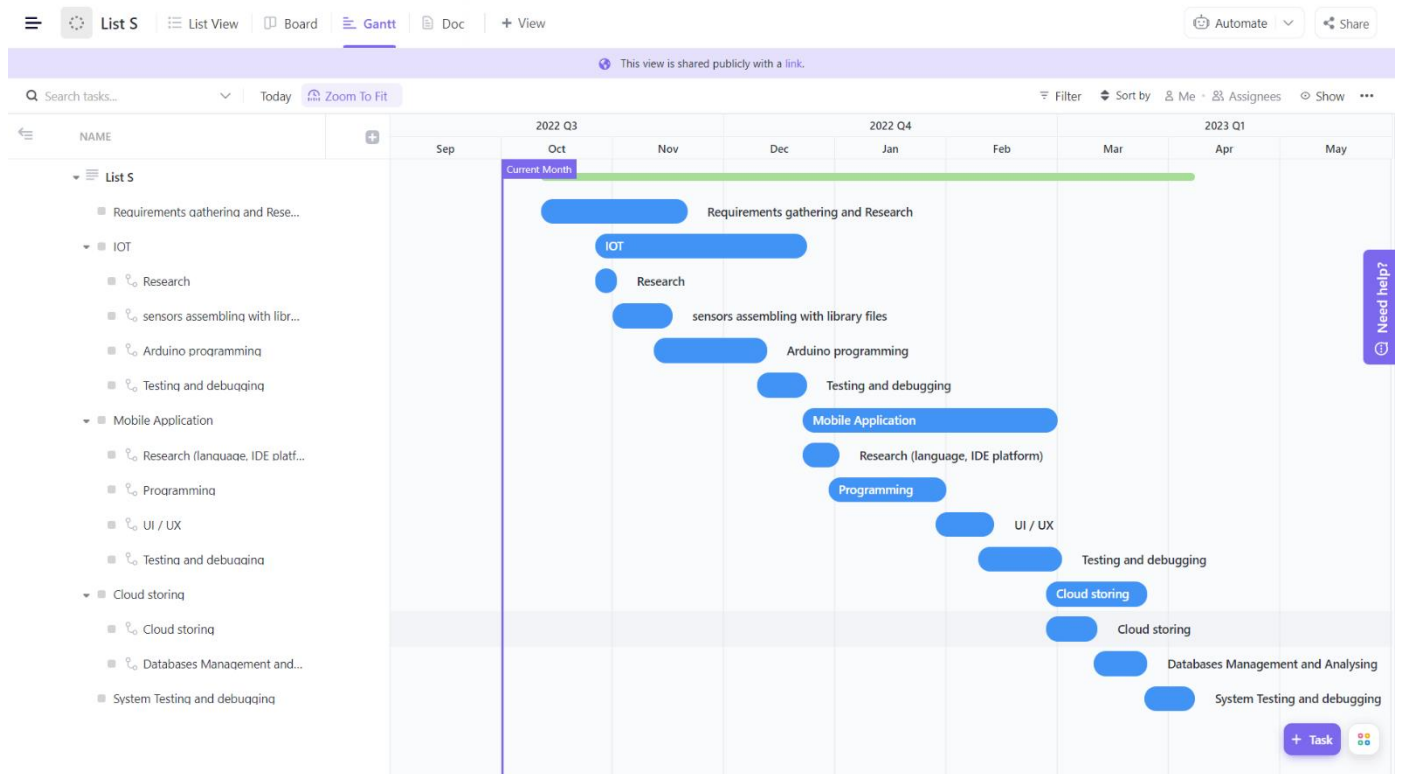
Section 06: Wiring Diagram of the System



Section 07: Flow Chart of the System



Section 08: Time Frame



Gantt Chart Link:

<https://sharing.clickup.com/36988679/g/h/138tr7-123/1c7afa3ffb47365>

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