**CHAPTER TWO**

LITERATURE REVIEW

2.1 BACKGROUND

Agriculture is considered as the background of any country’s economy. Many techniques have been put in place to increase the yield of agricultural produce. Water is the most important factor in determining the yield. The life of the plant greatly depends on the amount of moisture present in the soil. It also regulate the temperature through process of transportation. When the water provided by the farmer is not enough, it leads to the decease of the plant.

The control of greenhouse plants simply by ventilation and regulation of heat has been an old practice, unknowingly, this practice has hindered other factors affecting the growth and health of the plants. However, the use of microcontroller (microprocessors) couple with some sensors has now made it easier and efficient to regulate some of the basic factors affecting the growth of plants in the greenhouse. Factors like temperature, soil moisture, light intensity etc.

2.2 THEORETICAL FRAMEWORK

2.2.1 SENSORS

A sensor is a device that detect and measure a physical quantity from the environment and concerts it into electronic signals. These quantities could be soil moisture, motion, temperature, light intensity/level, humidity, motion detection etc. The output of these sensors are usually current, voltage or charge.

2.2.1.1 SOIL MOISTURE SENSOR

The soil moisture sensor measures the amount of water present in the soil. The soil moisture probe consists of multiple sensors which measures electrical resistance, dielectric constant etc. The probes are insensitive to soil salinity ant therefore will not corrode over time as the conductivity probe would do.

The probes are rugged, small and consumes low amount of power. Their result are accurate in under 1 second. They have rating as follows: Power: 3mA at 5V DC, Operating temperature: -40°C to +60°C, Dimension 0.089m x 0.018m x 0.007m (active sensor length 0.005m)([Rana Biswas, 2015](#_ENREF_3)).

It also measures the Volumetric Water Content (VWC) which is mathematically shown in the equation below

Θ = Vw / Vt

Where θ = Volumetric Water Condition

Vw = Volume of water

Vt = total volume (soil volume + water volume)

2.2.1.2 TYPES OF SOIL MOISTURE SENSOR

The major types of soil moisture sensors are categorized into two groups: Those that gives soil water content and those that gives soil water tension. These sensors differs according to the technology used in their manufacture([R. Toy Peters, 2011](#_ENREF_2)). The types of soil moisture sensors are listed below:

2.2.1.2.1 Electrical Conductivity Probe Sensor

These are sensors whose probes/electrodes are in direct contact with the soil([A.J, 1990](#_ENREF_1)). Water in its pure form cannot conduct electricity, thus, the polarity is defined according to the amount of impurities present in the water. As a result, the larger the volume of water, the more ions and the better the conduction.

The amount of current passing through the probes is directly proportional to the soil moisture. Therefore, moist soil allows more current to pass through while dry soils allow less current thereby supporting ohms law which says the conduction is inversely proportional to the resistance.

The advantages of using electrical conductivity probe sensors are as follows:

1. They are readily available
2. They are easy to install
3. They are easy to calibrate
4. They are cheap

2.2.1.2.2 Dielectric Sensors

2.1.2 MICROCONTROLLER

The Microcontroller has been familiar with is the heart of any hardware design. The microcontroller / microprocessor is the brainbox of the system, its responsibilities includes reading the parameters from the sensors and making it available in any form of output be it internet, LCD display etc.

REFERENCES

A.J, C. (1990). Feedback Control for Surface Irrigation Management. *ASAE publication*, 04-90.

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