



NILE

Requirements

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ME 407
Robotics Preliminary Design
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1.0 Problem Statement:

Conventional agricultural methods overcompensate plant and soil needs through wasteful watering practices and excessive application of pesticides and fertilizers, leading to substantial environmental damage. This damage takes on various forms, including pollution via runoff, soil depletion, and the extinction of local pollinators.

2.0 Definitions

2.1.0 Soil health

Soil health represents a myriad of measurable parameters relating to the soil's ability to provide water and nutrients to the plants (SHI, 2020). For the scope of this project these parameters include:

2.1.1 Soil Moisture

An indicator of soil water saturation, the ratio of air to water within the soil.

2.1.2 Soil pH

An indicator of mineral and nutrient content in the soil. Early identification of soil pH problems is important to diagnose long-term nutrient deficiencies.

2.1.3 Soil Temperature

2.2.0 Plant health

Plant health consists of a variety of conditions that either inhibit or assist in the growing and continued life of the plant. For the scope of this project these parameters include the following.

2.2.1 Water consumption

The average water requirement for a given plant at a specific stage of development.

2.2.2 Nutrient needs

The various minerals and organic compounds consumed by a plant throughout its growth stages.

2.2.3 Physical health

The physical health of a plant consists of the integrity of its fruit, foliage, stems, and root systems.

2.3 Growing zone

The growing zone is defined as the three-dimensional soiled volume from the surface to a depth of 5 centimeters.

2.4 Parasite

A parasite is any unwanted plant that directly, or indirectly derives some or all its nutritional requirements from the growing zone.

2.5 Application Efficiency

Application efficiency is a measure of how well an irrigation system performs when it is directed to deliver a specific amount of water. $AE = \frac{\sum \text{Water Consumption per Plant in the Growing Zone}}{\sum \text{Water Input to the System}} \times 100\%$

2.6 Ingress protection level IP55

An enclosure that provides protection against ingress of dust such as not to interfere with the satisfactory operation of the equipment. In addition, the enclosure must ensure water projected by a 6.3 millimeter nozzle from any direction shall have no harmful effects. (IEC, 2013)

3.0 Requirements

3.1 The system shall be capable of measuring the water saturation for the soil at any point within the growing zone.

3.2 The system shall be capable of measuring the pH-level of the soil at any point in the growing zone.

3.3 The system shall be capable of measuring the temperature of the growing zone.

3.4 The system shall be capable of irrigating crops within the growing zone with a field application efficiency greater than 90%.

3.5 The system shall be capable of supplying the nutrients needed to maintain plant health within the growing zone.

3.6 The system shall be capable of exterminating parasites from any point in the growing zone.

3.7 The system shall be capable of determining the location of plant foliage, plant stems, and parasites within the growing zone.

3.8 The system shall be capable of being certified to an ingress protection level of IP55.

3.9 The system shall be capable of communicating plant health, soil health, and the detection of parasites to the end user.

4.0 Sources

International Electrotechnical Commission. (2013). *IEC 60529, Edition 2.2*.

Soil Health Institute. (2020, March 20). *North American Project to Evaluate Soil Health Measurements*. <https://soilhealthinstitute.org/north-american-project-to-evaluate-soil-health-measurements/>