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ENG224 assignment

A.

CONCEPTUALIZATION OF SOFTWARE:

This is the first part in the software program development, this is when we examine the problem and understand the requirements of the program. The program addresses:

1. The software should be able to accept data from the sensors measuring soil temperature and soil moisture content and water level from tank
2. The problem should be able to control the water system, regulating the water flow.
3. The problem is supposed to be able to process the data from the sensors and decide on the most appropriate time to water the plants

SPECIFICATION:

We would be breaking the software into working modules

1. Data input system: There would have to be a sector of the program that communicates with the sensors, regularly collects the data and sends it to be processed.
2. Data processing system: This module constitutes to codes dedicated to processing the data and understanding the implication of the data. This would aid the computer in making the most appropriate decision.
3. Hardware control module: This contains codes that communicate with other hardware in the system telling them what to do and when to do it. This would precisely be the watering system, this module tells the watering system when to water the plant. Included in this hardware would be the alarm system.
4. Front end/ UI : Despite the autonomy of the system, regular human check is required. This creates an interface to communicate with the user and allows for easy interaction between the autonomous irrigation system and the human user, more like a middleman that creates a clear understanding between the two parties.

RESEARCH/DESIGN:

To create efficient software we would have to understand the environment and other factors involved. This would aid in the in the design of the program. The research involves

- Understanding the plant types and the appropriate soil temperature and soil moisture content for proper growth for the plant
- Since there is no specification on plant types in the question we would take the general ideal soil temperature for plant which is in the range of (65 - 75)F
- For the soil moisture we would be considering the data from KS-D1 soil moisture meter.

Soil type	Irrigation not needed (%)	Irrigation needed (%)
Clay	80 - 100	60 - 80
Medium (Loamy)	88 -100	70- 88
Coarse (sandy)	90 - 100	80 -90

- Sensors are also researched. In this case we would look for sensors considering the accuracy, precision and durability.

The design

- Involves interpreting the information from the research to determine how the software will operate.
- Using the above information we are going to design the program to waters the plants when the temperature goes above 75F

IMPLEMENTATION:

This when a team is assembled to build the whole system.

TESTING AND DEBUGGING:

A field test is required over a virtual simulator test because of the Practicality involved in this project. After the field test the program is adjusted based on errors noticed during the field test.

INTEGRATION AND UPDATE:

This is the full integration of the system into the ABUAD farm and subsequent updates are done. Due to the back-tracking(ability to learn from errors) nature of Neural networks in machine learning, I would recommend subsequent updates include Artificial Intelligence therefore making the system truly autonomous.

B.

The hardware features:
1. Soil temperature sensor: This sensor takes in soil temperature reading. To measure the soil temperature ideally we can use a soil temperature gauge and some transducers, but there more sophisticated/efficient sensors like the THERM200 by vegetronix. The probe of such sensors are placed 1- 2 inches into the soil.
2. Moisture content sensor: The work of this sensor is to measure the soil's moisture content and feed it to the software. The data is used in making decision. While doing research online the FC-28 moisture sensor was heavily recommended. It contains two probes that measure the volumetric content of water in soil and gives the data both in analog and digital.
3. Water-level sensor: This is sensor measure the water level of the tank used in watering the plant. This is to ensure that there is always sufficient water. The data from is send to the program and if the program identifies that the water level in the tank is low it sounds an alarm. The most recommended senor for this is the AquaPlumb Tank Water Level Sensor.
4. Actuators: This is a component that is responsible for moving and controlling a mechanism or system, like opening valves. The actuators take in electrical signals from our program and convert them into mechanical motion in this case opening the water valves.
5. Computer/microcontroller: This is the hardware that carries out all the computational work and decision-making. It is where our program is run. In most autonomy jobs microcontrollers would be used but considering the vastness of the ABUAD farm a microcomputer would be most efficient.
The software features:
The software basically collets data from the soil temperature sensor and Moisture content sensor and then analyses this data to determine if the ground requires more water or not. If it requires water it calculates the amount of water required by the plant and then sends signal to the actuator at the water valves telling it how much water to let out. The software also sounds an alarm when the water in the tank reservoir is insufficient.

C.

Algorithm using custom data and custom functions:
Key:
CHECK: checks the water level
OPEN_VALVE: Releases a specified amount of water
SOIL_VOLUME: The volume of the region covered by a sensor (Moisture content senor)
1. START
2. CHECK (WATER LEVEL)
3. READ (SOIL_TEMP, SOIL_MOISTURE)
4. IF SOIL_TEMP > 75 OR SOIL_MOISTURE< 60:
5. AMOUNT = 80 – SOIL_MOISTURE
6. FINAL_AMOUNT = AMOUNT * SOIL_VOLUME
7. OPEN_VALVE (FINAL_AMOUNT)
8. ELSE:
9. CONTINUE
10. STOP
Flowchart:

D. The drop down approach of the application