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Matric No: 18/ENG05/058

Course code: ENG224

Software Development Cycle for Automated Irrigation System

Conceptualization: Afe Babalola University farm also known as ABUAD farm has been using the regular manual irrigation system and its proving to be not so efficient anymore. The manual irrigation is not robust enough to cover the wide expanse of land that ABUAD farm has and so the board of directors of ABUAD farm have decided to go into automated irrigation. Automated irrigation is a whole lot easier and doesn't need a lot of manpower as compared to manual irrigation. Automated irrigation's effectiveness is more pronounced during the dry season when there is little to No rainfall which therefore threatens the survival rate of the plants

Analysis: Automated irrigation refers to the operation of the system with no or minimal manual intervention. The objective of this work is to see how human control could be removed from irrigation and also to optimize the use of water in the process. The method employed is to continuously monitor the soil moisture level to decide whether irrigation is needed, and how much water is needed in the soil. Almost every component of the system can be automated using timers, sensors probes, alarm triggers and computers. Although automated irrigation is expensive, its efficiency rate is high therefore enabling the farm workers to face more important tasks.

Design: To automate the irrigation system, some hardware and software components are needed:

Sensors are used to check the temperature of the soil, humidity of the soil, and water level in tank reservoirs. Alarm systems and SMS API (short message service application programming interface) will send messages to the authorized user.

In ABUAD farm, for every 1km radius a minimum of 10 sensors will be installed to cover the expanse of land so as to closely monitor the temperature and humidity round the farm. The alarm system has different sound effects for every critical condition.

System should also have different levels of authorization and password for different users to control access levels

Normal user

Visitor user

Administrative user

Power user

Implementation: The software languages that can be used are various in number which include python, java etc. It is also important that the software program is compatible with the existing

irrigation system but some hardware parts might need some upgrade. The software application is implemented using the above designs as well as the software language.

Testing and debugging: During testing, the bugs and errors in the automated irrigation system setup are found and corrected. UX tools are used to track how the users interact with the system.

Maintenance and release: The application is release to ABUAD farm once all the specifications have been met and the system can be updated from time to time as new technologies are being made.

Hardware features

- Alarm system which has different sounds for each critical level in the irrigation system
- Temperature sensor probes is used to measure the amount of heat or coldness in the soil
- Humidity sensor probes
- Water level sensor probes uses sonar(sound) to read the depth of water and can trigger the alarm system if critically low

The probes will have RFID chips to communicate the moisture content and heat content in the soil at different areas of the farm.

Software features

-SMS API (short message service application programming interface) this enables the users to receive text messages about the irrigation system in instances of critical conditions

-Authentication system to set up the login, password and access pass

- Configuration to setup different critical levels of each of the sensor probes.

Algorithm

Step 1: start

2: input password for system login

3: read water level in tank

4: if water level is >40%, read the temperature of the soil

5: else trigger alarm to refill tank

6: if soil temperature is $<65^{o}$ F

7: read soil humidity level

8: else trigger alarm to notify user

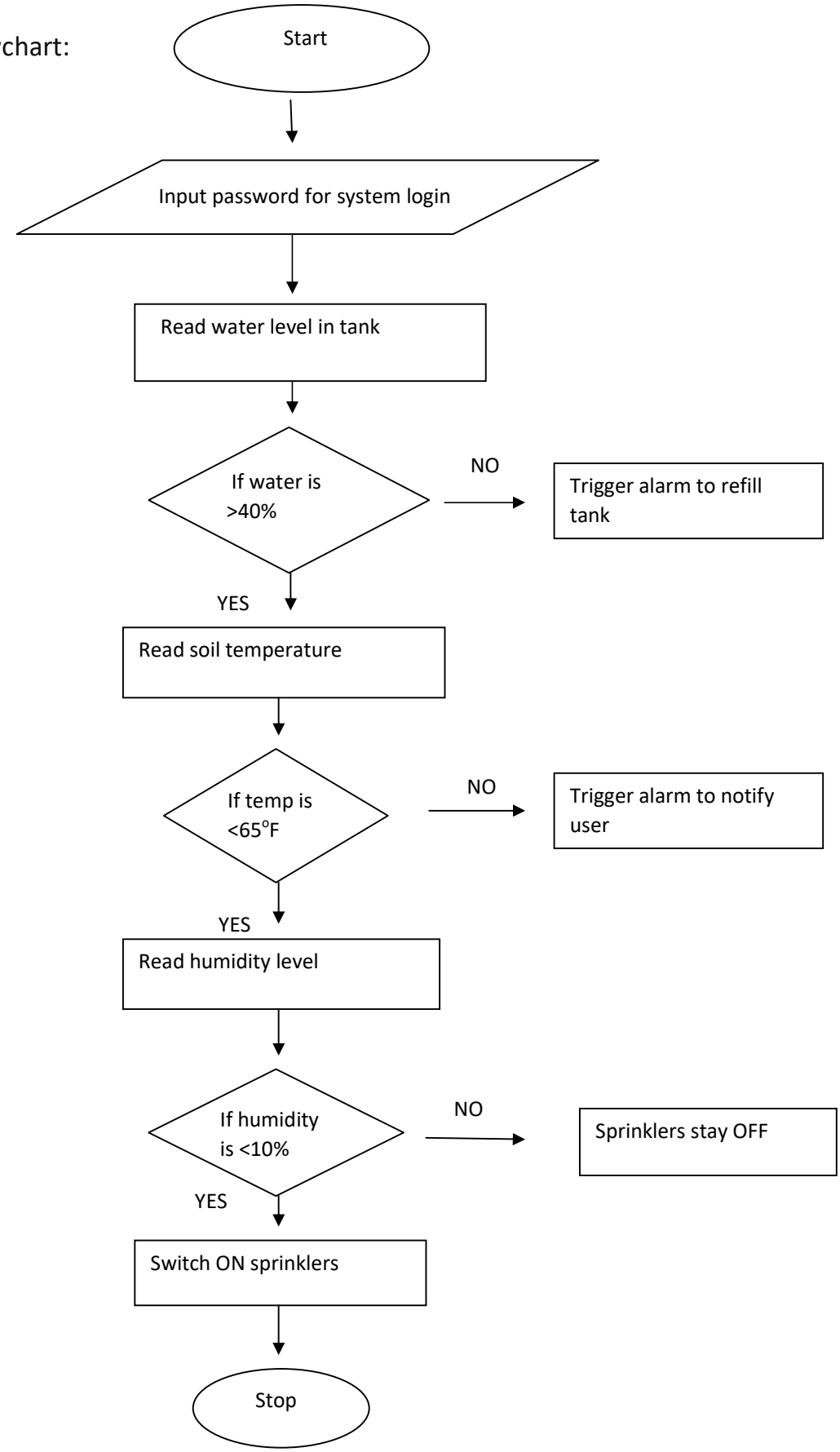
9: if soil humidity is <10%

10: switch ON sprinklers to water the soil

11: else sprinklers remain OFF till humidity level is >10%

12: stop

Flowchart:


Start
Input password for system login
Read water level in tank
If water is >40%
NO
Trigger alarm to refill tank
YES
Read soil temperature
If temp is <65°F
NO
Trigger alarm to notify user
YES
Read humidity level
If humidity is <10%
NO
Sprinklers stay OFF
YES
Switch ON sprinklers
Stop