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**CONCEPTUALIZATION:** the concept of this software is to be able to tackle the dry seasonal unproductivity in the farm by determining the temperature of the soil and level of moisture content through its acidity and alkalinity also timing the irrigation system to produce water to water the plants and giving alerts when the water level is high or low

**SPECIFICATION:** From the product description, a machine system has already been built to carry out the various. This design paper is majorly focused on building the software operational system of the machine system earlier designed as well as the interaction between the components (I.e. software and hardware)

#### **DESIGN**

The design would display the features of the automated sprinkler which include the access control, time schedule and watering and feedback (water refill) mechanism via algorithms and flow charts. It is designed in such a way that the water reservoir is checked before and after irrigation to enable refill if necessary.

#### **IMPLEMENTATION**

The programming language to be used in this agro software is a high-level language, preferably c++ as it's the most suitable high-level language to use with respect to the software's algorithm.

#### **HARDWARE FEATURES**

1. Arduino; This is the tool that would be used to control the sensors. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE computer. The Arduino will be programmed to collect input signal of the soil moisture, and to read the temperature of the soil.
2. Temperature Sensor; After calibration the temperature sensor reads the temperature of the soil, sends the signal to the Arduino and then the Arduino sends the data to the software, to calculate the irrigation timing.
3. Soil Moisture Sensor; After calibration the moisture sensor reads signal from the soil and then send data via the Arduino to the software

4. Automatic water pump controller circuit; This detects the water level in the tank, and if The water level is below a certain mark it sends a signal to the software which gives off an alarm, and then refills automatically if no action was taken from the controller. The alarm is for the purpose of monitoring; so that the controller would know how many times irrigation would be performed before water level reaches the minimum mark. And if there is a pipe leakage, it would be easily detected.

#### SOFTWARE FEATURES

Irrigation Timing; The software calculates the start and end time of the irrigation by using the data gotten from the sensors; for overhead irrigation, it should start before soil reaches 50% of available soil water and for drip irrigation it should start before soil reaches 80% of available soil water.

Time Interval for soil moisture and temperature monitoring; The software would be able to control the time interval that the sensors would read signals from the soil. For example, if the time interval is set to 30 minutes then every 30 minutes the sensors will collect data from the soil and if the data gotten shows the need for irrigation the pump would be triggered on and irrigation would start.

End to End Encryption of data being transferred to the web server (Cyber security); In the absence of the farmers, Competitors might try to sabotage the farm by trying to hack data being transferred and not allowing irrigation to take place. Therefore, the data being transferred are secured appropriately to prevent occurrence. Also, the software is passworded Database; would be used to store data gotten from the sensors which can be used for soil analysis.

Algorithm

START

Wc=Critical water level for a refill

Read Wa

If Wa > Wc

    Mi= Ideal moisture content of the soil for crop

Read Ma

If Ma < Mi

    Print "Irrigation in progress"

    Flows sensors come on

    Sprinklers come on for 15 minutes

Else

Go back to start of program

Th= Upper limit of ideal temperature range of the soil

Tl= Lower limit of ideal temperature range of the soil

Read Ta

If Tl  $\geq$  Ta or Ta  $\geq$  Th

    Print "Irrigation in progress"

    Flow sensors come on

    Sprinklers come on for 15 minutes

Else

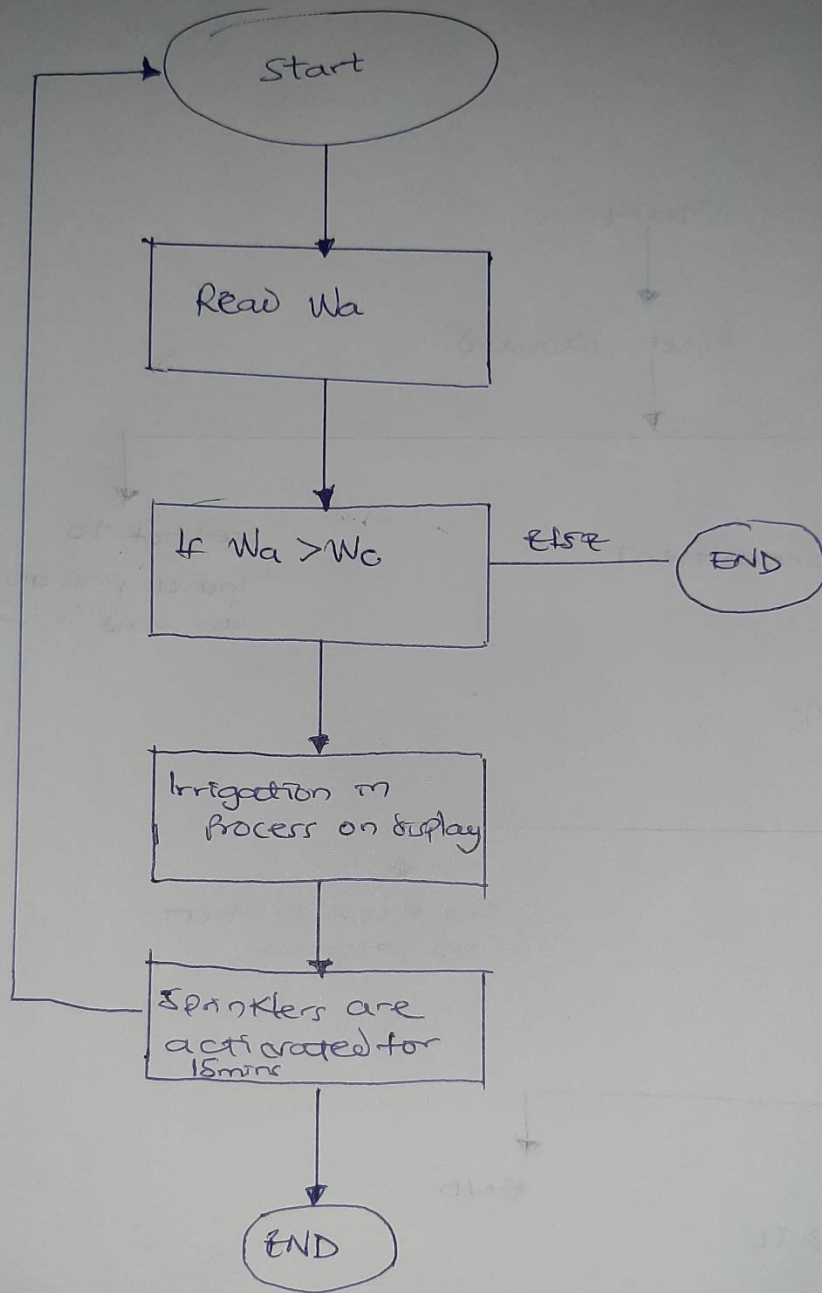
Go back to the start of program

Else

Trigger alarm for water tank refill and mobile notification.

Stop

**FLOWCHART**



## TOP TO DOWN APPROACH

