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CIVIL ENGINEERING
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CONCEPT

The system comprises of three sensors: the temperature sensor, moisture content sensor and water level sensor.

The water valve of the irrigation system comes on when the soil moisture content is read to be at its pre-programmed minimum value and closes when it reaches its pre-programmed maximum value.

When the tank's water level reaches about 2ft, an alarm is triggered by the water level sensor which sends an alert via email or sms to the personnel in charge.

All data from the sensor is collected and stored and can be accessed with the use of a ~~passport~~ password.

SPECIFICATIONS

1. Temperature Sensor: this is used to read the temperature of the soil for direct monitoring.

   A general purpose thermistor with a range of -35°C to +60°C will be used. The ideal soil temperature is between 18 - 24°C so and variance can be covered in this range.

2. Soil moisture sensor: This is used to measure the moisture content of the soil and can be used to deduce whether the soil needs water or not. It is placed inside the soil and therefore needs to be protected by conformal coating and made of corrosion resistant material.

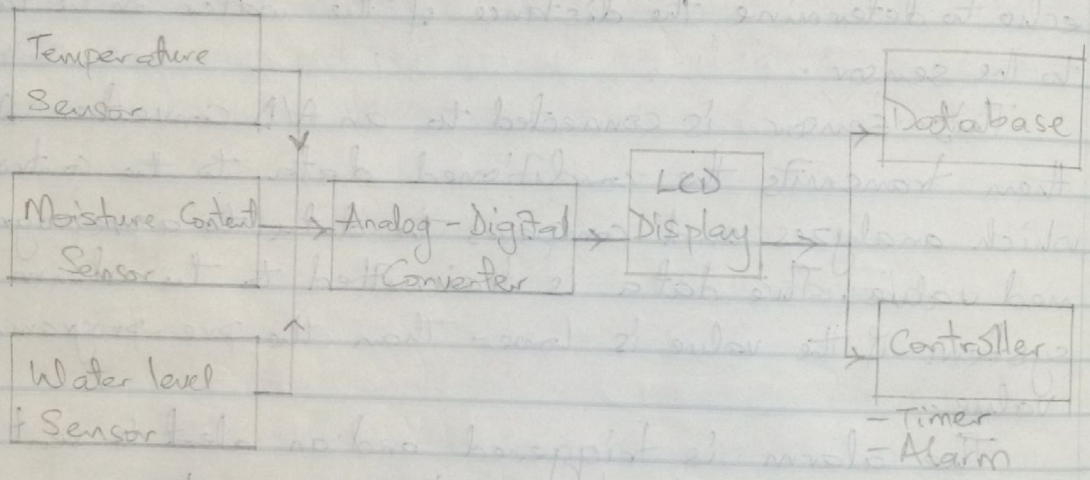
3. Water level sensor: this is used to detect when the water level in the tank is low. This allows the

tank to be refilled on time which maintains the ideal moisture content of the soil.

4. A timer based on the soil's temperature and moisture content will be used to determine when the water valve opens and closes.

5. All data obtained by the sensors is stored in a database which is accessed by a password.

DESIGN



The temperature sensor will be a general purpose thermistor with a range of -35°C to +60°C. It is connected to an A/D Converter.

The Moisture Content sensor is a solid state sensor which uses electrodes to measure the electrical resistance in the soil. More water in the soil reduces electrical resistance and less water increases electrical resistance. After electrical resistance is measured the water content is determined. This sensor is also connected to the A/D Converter.

The conditioned data from the converter is used as a reference for the timer system which controls the water valve. If the moisture content is lower or the temperature higher than the pre-programmed

values, the control system opens the water valve to supply water for a duration. The valve is closed when the pre-programmed maximum moisture content is reached. This method reduces water consumption and also drowning of plants due to overwatering.

The water level sensor comprises of an ultrasonic sensor transducer. It generates high frequency sound waves and evaluates the echo which is received back by the sensor. The sensor calculates the time interval between sending the signal and receiving the echo to determine the distance of the water in the tank to the sensor.

This sensor is connected to an A/D converter which then transmits the conditioned data to the controller which analyzes and compares the data to a preprogrammed value. The data is transmitted to the alarm system if the value is lower than the pre-programmed value.

The alarm is triggered and an alert is sent via email or sms to the appropriate personnel

All data obtained from the sensors is transmitted to a database which can only be accessed via password

All the programming for the software is to be done in any high level language.

IMPLEMENTATION.

The moisture sensor is placed in the soil while the water level sensor is placed at the top of the tank

The temperature sensor is placed in an adequate location to efficiently read the soil's temperature.

All components are tested before full implementation

TESTING AND DEBBUGGING

A system response test is carried out to determine the time taken for the system to irrigate samples of different soil types with different levels of dryness at different temperatures.

A test is also carried out to determine the efficiency of the water level sensor and alarm.

All programs are tested for errors and appropriately debugged to ensure smooth running of the software.

RELEASE & UPDATE.

The irrigation system is fully installed in the farm and all its components are monitored periodically to note any required replacement of parts to ensure the system remains operating at optimal levels.

ALGORITHM FOR TIMER ACTIVATION

1. Start
2. Read Temperature, Moisture Content
3. Read Pre-programmed Minimum moisture Content (P_1)
4. Read Pre-programmed maximum moisture Content (P_2)
5. If Moisture content $> P_1$
   The timer remains off and water valve is closed
   Else ✱ moisture content $< P_1$
   The timer comes on and water valve is opened
   while $P_1 \leq$ Moisture Content $< P_2$
   Water valve remains open
   End while
   while moisture content $\geq P_2$
   Timer turns off and water valve is closed
   End while
6. Stop

ALGORITHM FOR WATER LEVEL ACTIVATION

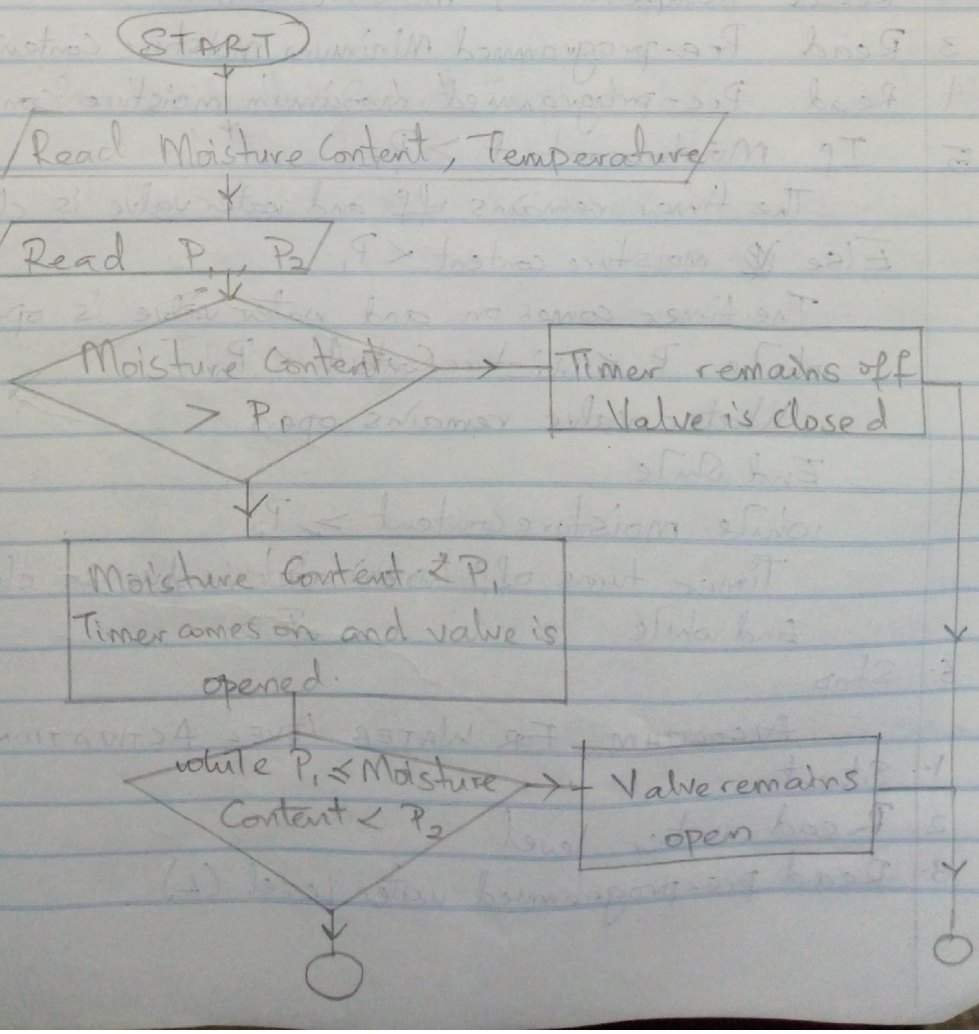
1. Start
2. Read water level
3. Read pre-programmed water level (L)

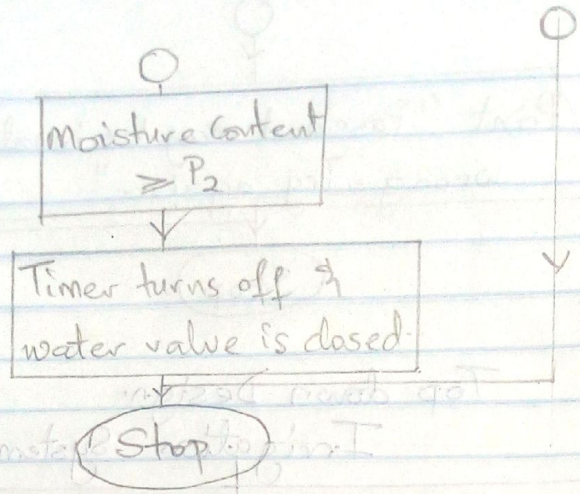
4. If water level is greater than L
   Alarm is not activated
   Else water level $\leq$ L
   Alarm is activated
   Print "Water level is low, refill tank"
5. Stop

ALGORITHM FOR DATABASE PASSWORD

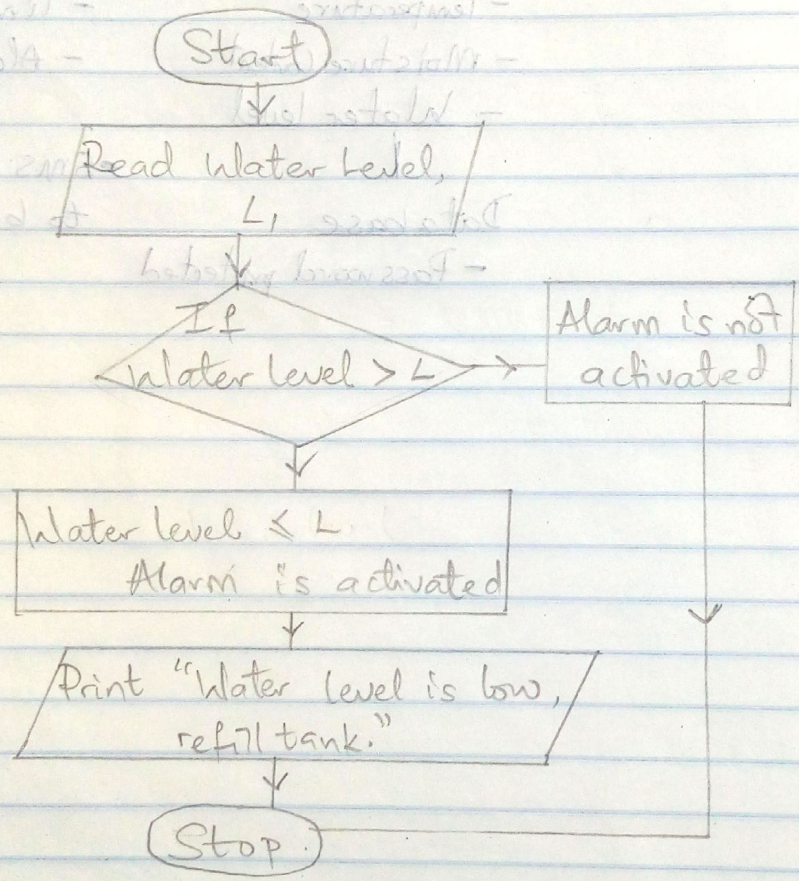
1. Start
2. Get Password
3. If Password is authenticated
   Allow access to data
   Else
   Print "Password may be invalid or wrong. Try again."
4. Stop

FLOWCHART 1

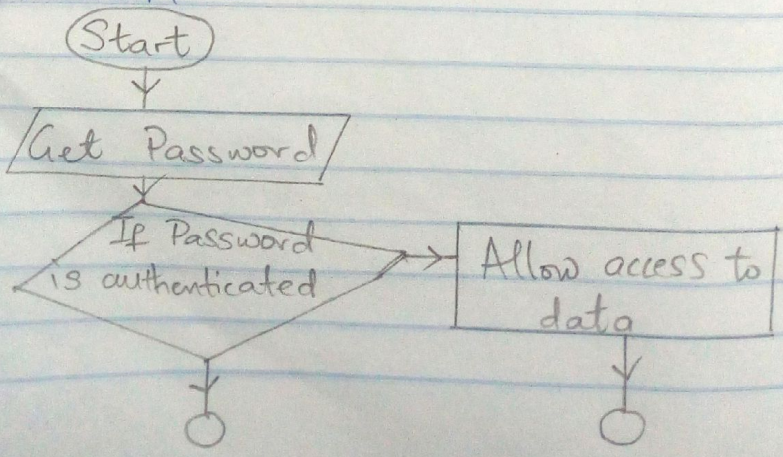


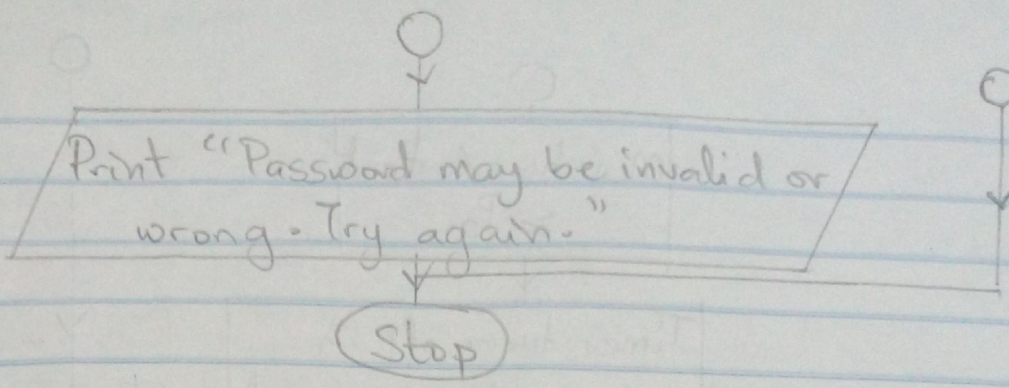


FLOWCHART 2



FLOWCHART 3





Top down Design.

Irrigation System

- Power Supply
- Sensing unit
  - Temperature
  - Moisture content
  - Water level
  - Database
    - Password protected
- Control Unit
  - Timer
  - Alarm
    - SMS or email to be alerted.