

NAME	DAVIES EDWIN TAMUNOBOMA
MATRIC. NUMBER	19/ENG09/021
DEPARTMENT	AEROSPACE ENGINEERING
COURSE CODE	ENG 224
COURSE TITLE	STRUCTURED COMPUTER PROGRAMMING 2
DATE	11/5/2020

TASK

One of the major challenges of ABUAD farm, Ado Ekiti during the dry season is the irrigation system of the farm. The board of the company decided the best way to resolve the problem is to automate the system. As a software developer for ABUAD farm, you are mandated to develop a software that interacts with the machine. The software through the machine must be able to:

- Read the temperature of the soil.
- Determine the moisture content of the soil.
- Configure time interval for the water system based on the above.
- Trigger an alarm if there is no sufficient water in the tank for the irrigation.
- Enabled password for the system.

- A. Discuss the application development following the software development cycle.
- B. Critically discuss the hardware and software features.
- C. Support your answer with a flowchart and an algorithm.
- D. Draw the Top-down and Bottom-up design approach for the application.

SOLUTION

1. UNDERSTANDING THE SPECIFICATIONS

The application to be developed is required to have the following features

- The ability to read the temperature of the soil through the machine
- The ability to determine the moisture content of the soil through the machine
- The ability to configure the interval for the water system based on the above
- The ability to trigger an alarm if there is no sufficient water in the tank for the irrigation
- Include password protection for the system

2. SYSTEM ANALYSIS

The application's functionality involves sending and receiving electronic signals from all the hardware components of the irrigation system. These hardware components are the parts of the system that carry out all the necessary physical actions required to successfully irrigate the farm. They are tabularly listed below, along with their respective functions.

HARDWARE COMPONENT	FUNCTION
Thermometers	Reads the temperature of the soil
Soil moisture sensor	Reads the moisture content of the soil
Electric pump	Pumps water through pipes into the spraying hoses

- Thermometers:

Because of the large size of the farm, it is possible to have variations in soil temperatures at different locations and so, only one thermometer reading will not be sufficient to deduce the temperature of the farm's soil. For this reason, a bunch of thermometer readings are required; throughout the land area of the farm, there will be many thermometers put in place, which will all individually be at a specific average distance from other adjacent thermometers. The average temperature value from all the thermometer reading will then be used as the soil temperature.

- Soil moisture sensors:

Just as in the case of soil temperature, it is possible to have variations in soil moisture content. For this reason, not only one, but many soil moisture sensors are required. They will likewise be evenly distributed throughout the land area of the farm.

- Electric pump:

The job of the electric pump is simple; it will convey water at high pressure from the water storage facility or water plant into the hoses on the farm. The hoses are made up of a series of sprinklers which sprinkle water all over the farm, covering all its land area.

3. PROBLEM ANALYSIS

Each of the hardware listed above will undergo periodic exchange of electronic signals with the program being developed. First of all, the program will receive and store all the soil temperature values measured by the thermometers. With these values, the program will calculate and store the average value of the soil temperature. Furthermore, the program will also do the same for the soil moisture content values. With these two averages, the program will configure the electric pump, instructing it to release the right amount of water at the right pressure, if any is needed. The exact amount and pressure of water to be released for any derived values will be set by configuration the processor. Every time the programs runs a periodic maintenance of the farm, it will tabularly store all the data involved, including the date, time, average soil temperature, average soil moisture content, amount of water released, pressure of water released as shown below.

MAINTENANCE SERIAL NUMBER:	
DATE:	
TIME:	
AVERAGE SOIL TEMPERATURE:	
AVERAGE SOIL MOISTURE CONTENT:	
AMOUNT OF WATER RELEASED:	
PRESSURE OF WATER RELEASED:	

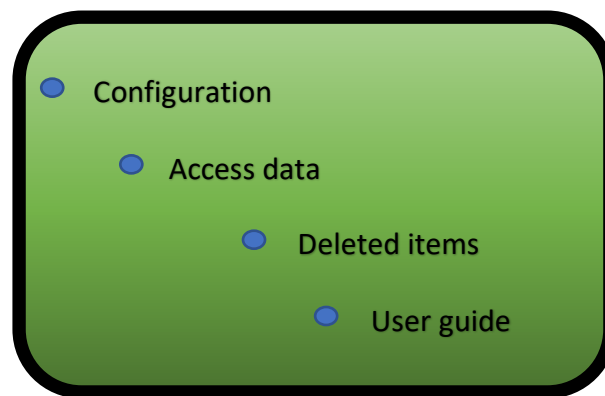
Notwithstanding, before the user can configure the processor or access the measured and calculated data stored on it, they must key in an 8-digit access code, already preset by the delegated person in charge of the irrigation of the farm.

4. SOLUTION DESIGN

The program will be user-friendly and easy to operate. It will be set up on a special desktop computer system in the control room, specifically for the control of the irrigation system, from which configurations can be made, and data can be accessed. The first page that will be displayed by the computer will be a request for the 8-digit access code as shown below.



After the code is successfully keyed in, it will display a bunch of options including configuration, data access, etc. as shown below.



5. TESTING AND DEBUGGING:

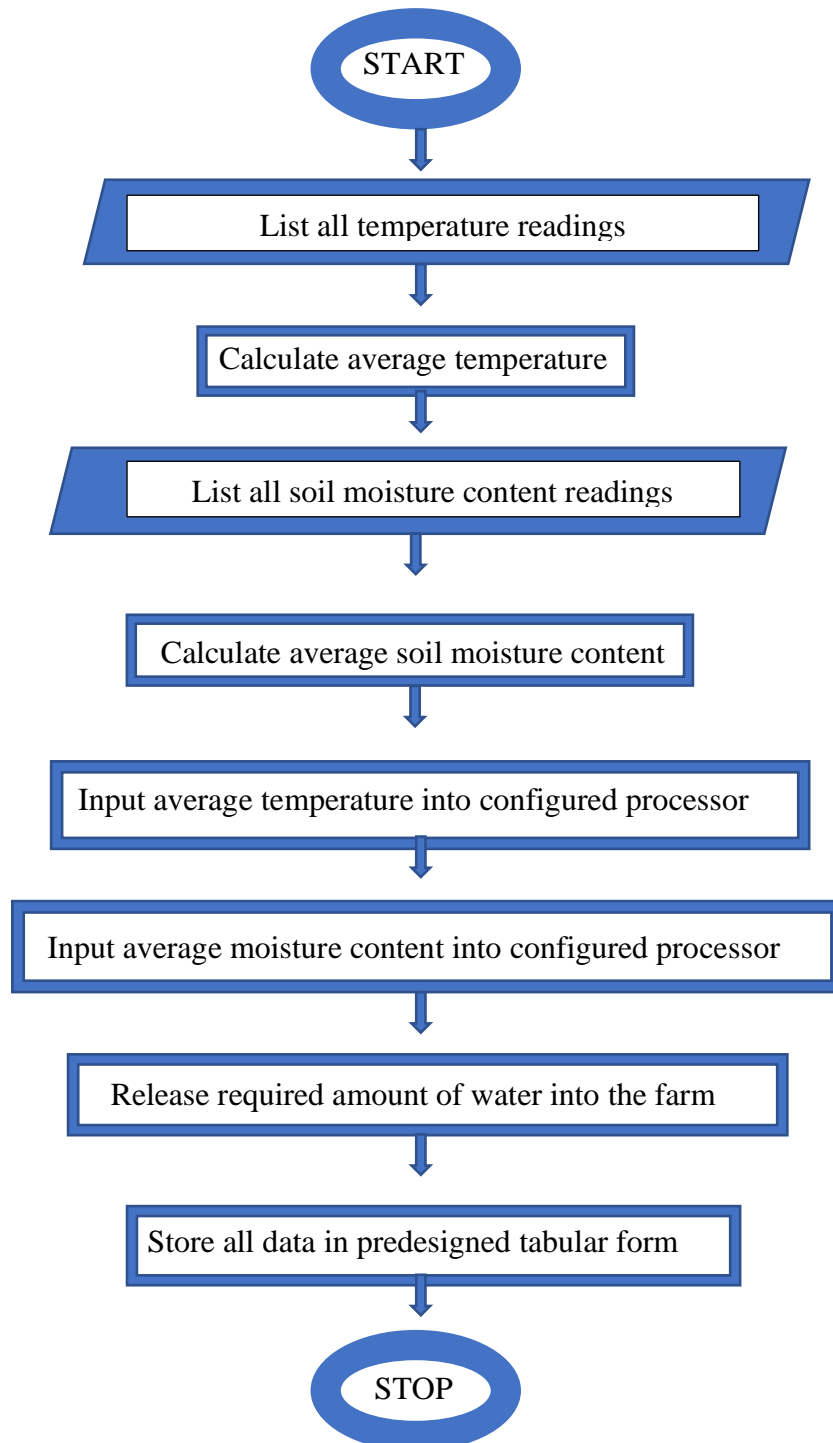
The program will use test data, which will include:

- Test during the day time
- Test at night time
- Test in all seasons of the year
- Test for possible leakage in pipes
- Test in cold conditions
- Test in hot conditions
- Test for effectiveness of sprinklers

6. INSTALLATION:

As already mentioned in the solution design, the program will be installed on a special computer in the control room, specifically set aside for the control of the irrigation of the farm, only accessible after the correct 8-digit code is typed in.

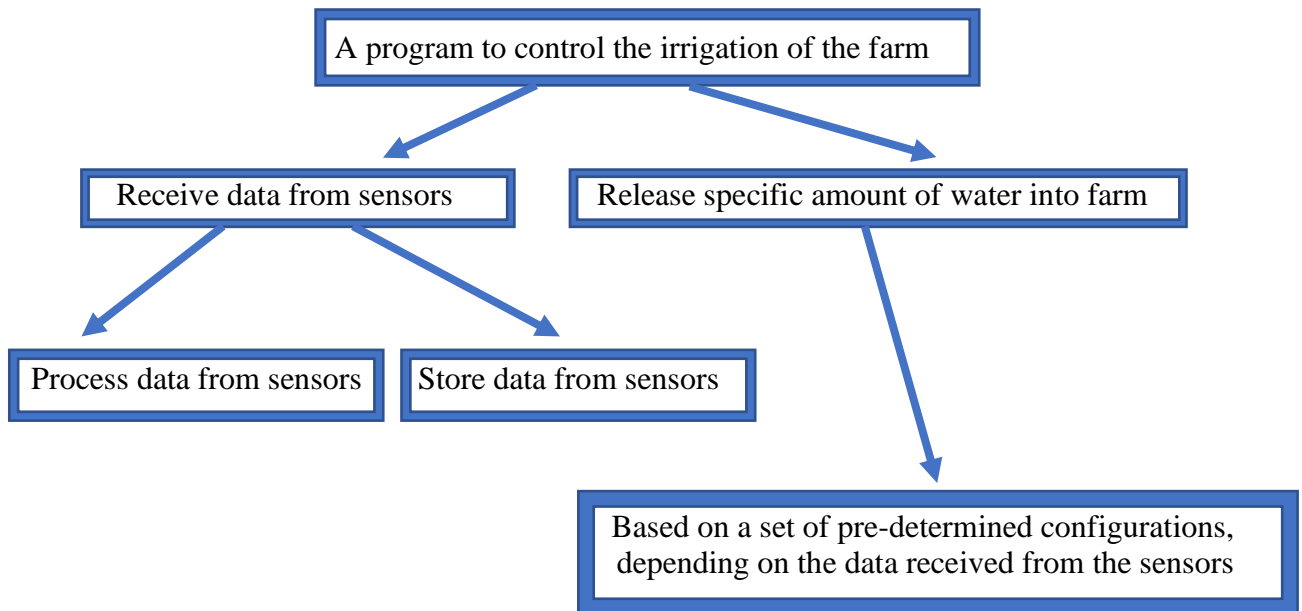
FLOWCHART OF PROGRAM OPERATION DURING ONE PERATION:



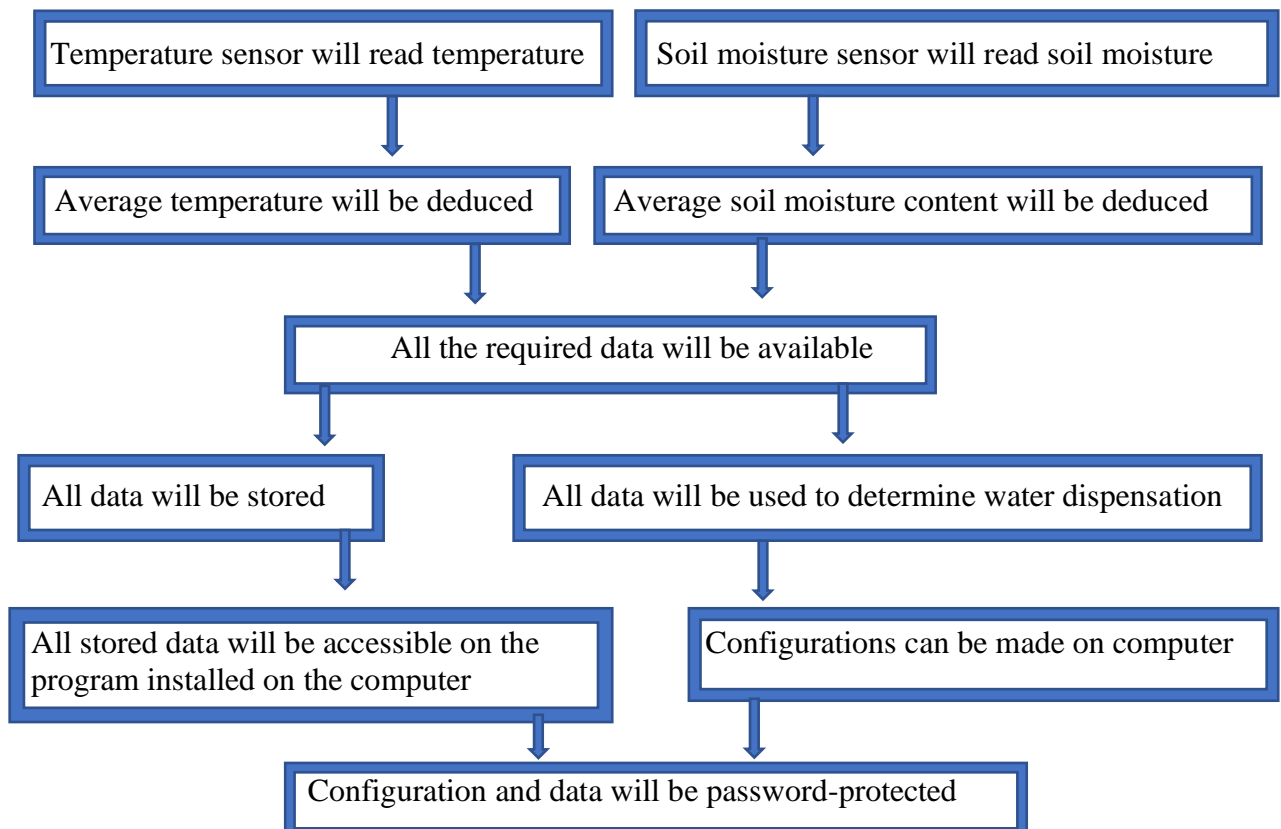
ALGORITHM

START
LIST ALL TEMPERATURE READINGS
CALCULATE AVERAGE TEMPERATURE
LIST ALL SOIL MOISTURE CONTENT READINGS
CALCULATE AVERAGE SOIL MOISTURE CONTENT
INPUT AVERAGE TEMPERATURE INTO CONFIGURED PROCESSOR
INPUT AVERAGE MOISTURE CONTENT INTO CONFIGURED PROCESSOR
RELEASE REQUIRED AMOUNT OF WATER INTO THE FARM
STORE ALL DATA IN PREDESIGNED TABULAR FORM
STOP

TOP-DOWN DESIGN



BOTTOM-UP DESIGN





Final program will contain
all these features as a whole