

# **Automated Irrigation System Software for ABUAD Farm**



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**18/ENG08/005**

**BIOMEDICAL ENGINEERING  
ENG 224 [CLASSWORK]**

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## A. APPLICATION DEVELOPMENT/DESIGN

### • CONCEPTUALIZATION

In order to design this software, we must first generate suitable ideas and carry out necessary research to ensure the software interacts accordingly with the machine. These ideas must have the following features:

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

The general purpose of this application is to help maintain moisture on ABUAD farm during the dry season and with the above features and more that this software will possess, it will help to combat low humidity in the soil.

This irrigation system will also aid making watering process of the soil easier and more convenient. It will reduce the manpower required for watering process and ultimately lead to less time consumption.

Hence, we must lean towards an irrigation system that will produce benefits such as uniform water distribution and easy operation.

### • SPECIFICATION

The specification of this automatic irrigation software must be precise. Hence, we require the use of a system that has adequate security for data management, one that does not require specially trained person(s) to operate and one which distributes water uniformly and promptly depending on the humidity of the soil. For this reason, we can conclude that implementing a sprinkler irrigation system is the viable choice rather than a drip irrigation system which requires more maintenance.

**\*Further in this presentation, the hardware and software features will be discussed.**

### • DESIGN

In considering the design, we must consider flowcharts and algorithms (which would be displayed further in this presentation) to help us analyze the software better.

In the design stage, we must further observe some processes:

1. Sketching
2. Planning The Work-Flow
3. Prototyping the UI

**① SKETCHING:** This is an ideal method to quickly explore concepts such as navigation, branding, buttons and other necessary elements. This stage will also aid the visual exploration of the users and to quickly evaluate layout choices.



Frame of Irrigation System

The model of the irrigation system is designed with the aid of a solidwork software as represented in the figure above. The design is improved from the current design in which the frame is applied control system, it makes the frame move forward and backward. Besides, the control such as moisture sensor, time and others are applied in this system.

**② PLANNING THE WORKFLOW:** The workflow must be idealistic to the possible various users of the application on the farm. It must include details about the security process (i.e. how to customize password), a guide or manual to using the application, aid to help users who have forgotten their passwords, etc.

**③ PROTOTYPING THE USER INTERFACE:** It is essential that after a blueprint of the software is designed (mild steel with specific dimensions) after which, prototyping must be done including an interactive display. This will greatly result in a better understanding and easy working for the users (i.e. farmers). With the aid of a prototype, we get the opportunity to accurately test and make first degree corrections before implementation commences.



- **IMPLEMENTATION**

During this stage, codes using programming language are employed. Basically, any generic programming language could control an irrigation system given the proper setup. Python would probably be the most plausible route for controlling a simple hardware device. (C or C++ could also be employed).

Also, the necessary Guide User Interface tools are chosen. It should be noted that there are different segments of GUI tools depending on their usage and the platform employed such include Mobile, Computer and Touch-Screen GUI.

- **TESTING & DEBUGGING**

When designing a system, the possibility of logical and syntax errors (bugs) cannot be neglected. Therefore, we must run and test the application in order to locate and eliminate any such errors in order for the application to fulfill all its functionalities.

- **RELEASE & UPDATE**

At this point, the users in ABUAD farm will get the opportunity to access the system and give out necessary feedback. Since the system has gone through all necessary processes before getting to this final stage, it must now be able to read the temperature of the soil, determine the moisture content of the soil, configure time interval for water system, trigger an alarm when water is insufficient and any other feature that is included.

Updates will further be made to the system, based on the user feedbacks.

## **B. THE HARDWARE AND SOFTWARE FEATURES**

### **HARDWARE FEATURES:**

#### **❖ MICROCONTROLLER**

A microcontroller also known as MCU and  $\mu\text{C}$  is a functional computer system on a chip. Microcontroller is integrated chip that performs controlling function. It will be very useful in the operation of the irrigation system. For this project, we would be employing Arduino UNO (a microcontroller).

#### **❖ SOLENOID VALVE**

A solenoid is a coil of wire that is magnetized when electricity runs through it. The solenoid valve makes use of this solenoid in order to activate a valve thus controlling the water flow, air flow and other things with electricity.

Valve is one of the components that need maintenance. The solenoid valve can get damaged after a while. Thus, a replacement of solenoid valve may be needed.

### ❖ **SPRINKLERS**

We already stated that we would be making use of the sprinkler irrigation system (due to its benefits). Therefore in constructing the hardware of this system, the sprinklers are essential.

### ❖ **WATER TANK OR RESERVOIR**

A tank or reservoir must be provided in which users can fill & refill for usage.

### ❖ **PIPE SYSTEM**

A suitable and efficient pipe system must be employed for easy flow of water.

### ❖ **LIQUID CRYSTAL DISPLAY (LCD)**

LCD is an electronic display module which uses liquid crystal to produce a visible image. The 16×2 LCD display is a very basic module commonly used for displaying alphabets and numeric value. This feature is important for the display of necessary texts and data.

## **SOFTWARE FEATURES:**

In this project we are using Arduino UNO to control the motor. The irrigation system will operate by setting the time and with the assistance of moisture soil sensor to measure the level of soil moisture and the signals to Arduino if watering is required. The motor or water pump supplies water to the plants until the desired moisture level is reached.

### ❖ **SOIL MOISTURE SENSOR**

Irrigation is the most important cultural practice and most labor intensive task in planting/farming operation. Two key aspects of irrigation is knowing when and how much to water the soil. To do this automatically, sensors and methods are available to



determine when plants may need water. It is suggested to use soil moisture sensor to do irrigation. The moisture sensor will be an important element for this project.

### ❖ **DATA MANAGEMENT**

This permits/helps users to add and store data with the use of a text and edit view.

### ❖ **ERROR DETECTOR/ALARM SYSTEM**

This will help inform the user promptly in case of any error in the irrigation system. For instance, if there is a leakage in the pipe system. Also, if the water tank is empty or doesn't have sufficient water.

### ❖ **ACCESS CONTROL**

This is necessary for the users to maintain security over the irrigation system. They are able to do this through a password to control the system.

### ❖ **BIOMETRIC IDENTIFICATION**

This employs the use of optimal scanners that can help to keep track and data of workers that make use of the system.

### ❖ **TIMER**

Overwatering is one of the core causes of plant problems. Therefore, an option will be created for the user to set a timer, in which an alarm will go off after the prescribed time to avoid overwatering.

### ❖ **TEMPERATURE MONITORING/SENSOR**

Most especially in the dry season, the soil becomes less humid, drier and hotter. Therefore, the temperature sensor is essential to help determine if the soil requires moisture or not.

## ❖ HOME SCREEN

Home screen displays names of developers and name of university along with the college logo. Click on button Enter to open main menu screen of software.

## ❖ TITLE SCREEN/LOG IN SCREEN

The title screen describes software and the objectives behind the concept and also requests the log in details of the user. User will come to get overall idea of the software.

**Fig.3** Login screen of software



## ❖ MAIN MENU SCREEN

Main menu screen shows the overview of software i.e. lists of associated screens within the software. The Home, Enter and Exit buttons are provided on this screen. The design process starts with water requirement.

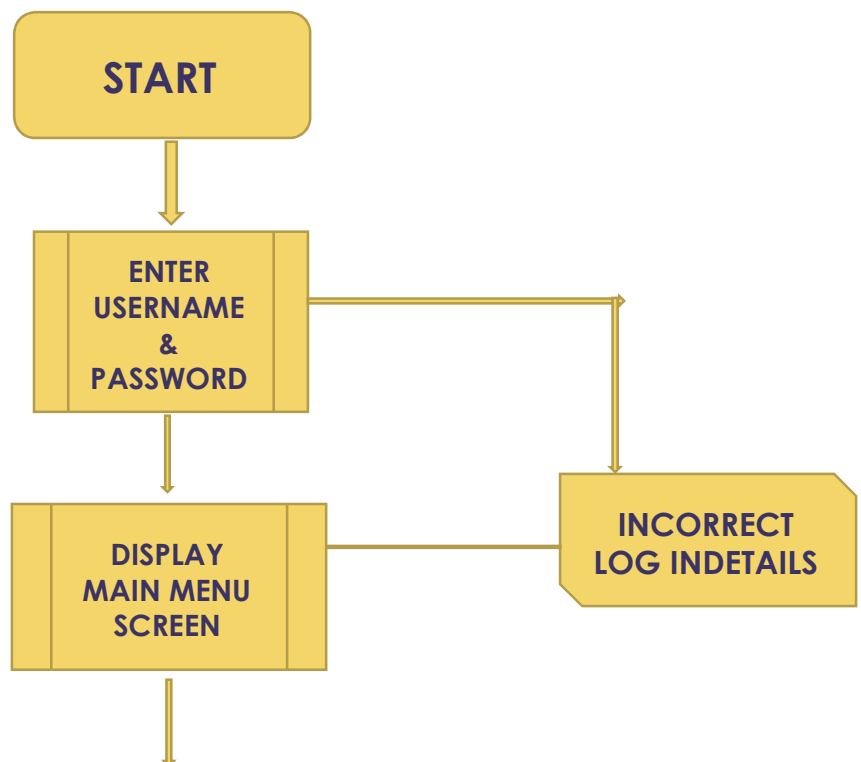
Fig.6 Main menu screen of software



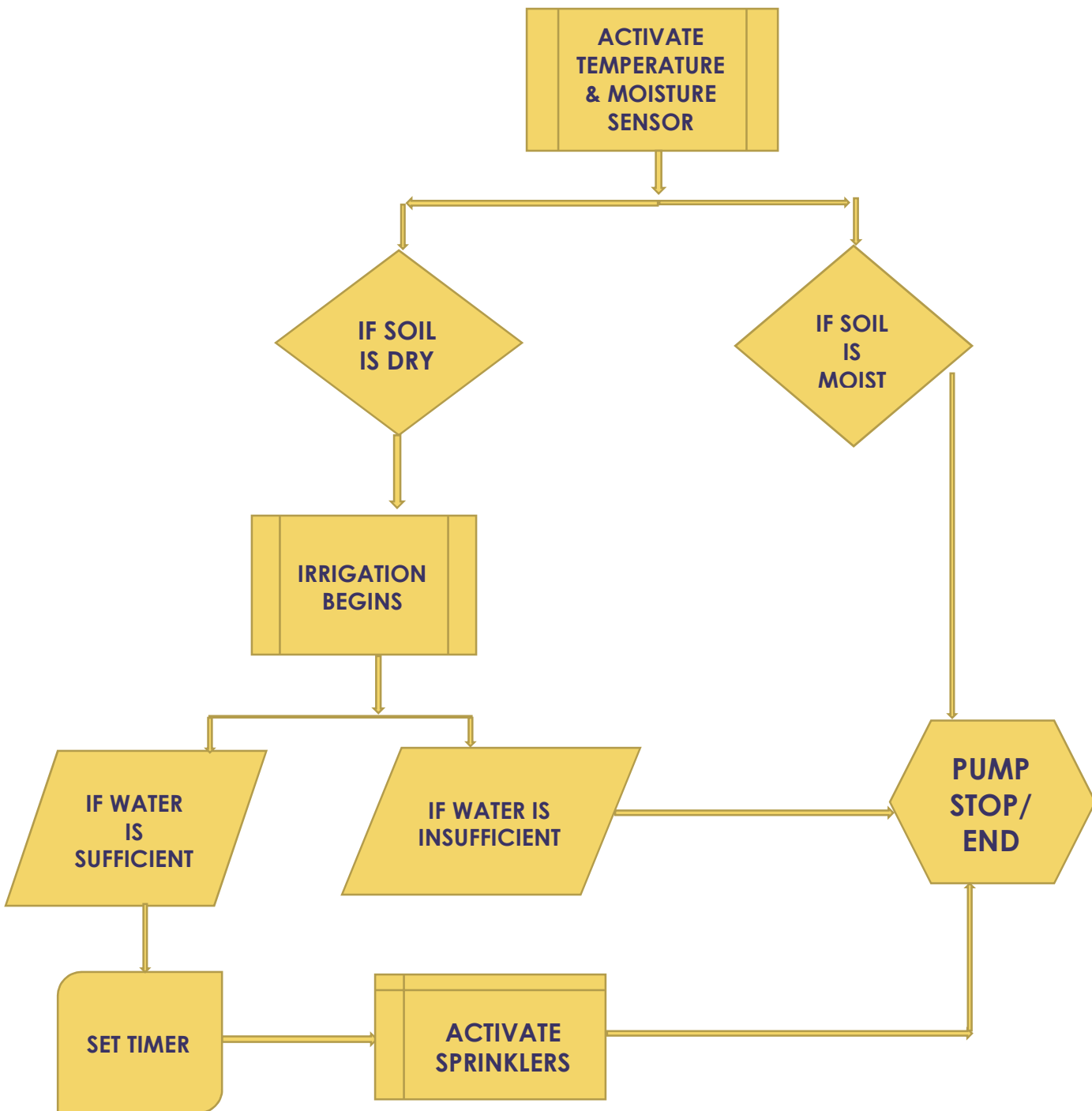
Fig.7 Crop water requirements screen

## C.FLOWCHART & ALGORITHM

### FLOWCHART







## ALGORITHM

**STEP 1:** START

**STEP 2:** ENTER USERNAME AND PASSWORD

**STEP 3:** DISPLAY MAIN MENU SCREEN

**STEP 4:** ELSE

**STEP 5:** IF LOGIN DETAILS ARE INCORRECT

**STEP 6:** DENY ACCESS

**STEP 7:** ACTIVATE TEMPERATURE & MOISTURE SENSOR

**STEP 8:** IF SOIL IS DRY

**STEP 9:** ALLOW IRRIGATION TO BEGIN

- STEP 10: ELSE
- STEP 11: IF SOIL IS MOIST
- STEP 12: SHUTDOWN SYSTEM
- STEP 13: IF WATER IS SUFFICIENT
- STEP 14: SET TIMER
- STEP 15: ACTIVATE SPRINKLERS
- STEP 16: ELSE
- STEP 17: IF WATER IS INSUFFICIENT
- STEP 18: END

## D. TOP-DOWN DESIGN APPROACH OF THE APPLICATION

