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DEPARTMENT: MECHATRONICS

COURSE CODE: ENG 224

AUTOMATION SOFTWARE FOR ABUAD FARM

The software development cycle includes:

1. Conceptualization

A software application which interacts and automates the irrigation system of the ABUAD farm, Ado Ekiti to solve problems faced during the dry seasons. The software through the machine would be able to:

- Read and display the temperature of the soil.
- Determine and display the moisture content of the soil.
- Configure time interval for the water system based on the above.
- Trigger an alarm when the water level in the tank falls below a specified value
- Enable password so that only authorized personnel can access the system

2. Specification

The specification of the system would be addressed in two parts, hardware features and software features, as discussed below.

Hardware features

i. Digital Thermometers: to measure and record the temperature of the soil at specified intervals and send the recorded values to the PLC for adequate processing.

ii. Programmable Logic Computer (PLC): To withstand the harsh industrial conditions of the farm and work hand-in-hand with the thermometer and alarm to receive and store their feedback.

iii. Central hub: A remote designation where the database is going to be stored and all the major controls would emanate from.

iv. Tensiometers: to be placed at strategic areas in the farm to measure and record the moisture content of the soil at specified intervals and send the recorded values to the PLC for adequate processing

v. Alarm system: to sound an alarm whenever the average moisture of content of the soil falls below 60 and the temperature of the soil above 27^{o}C.

vi. Pipes: to deliver water to the sprinklers placed at strategic positions on the farm from the reservoir tank

vii. Sprinklers: to spray water on the root zone of plants when activated by the software

viii. Reservoir tank: to store water until it needs to sprayed on the plants

Software features

i. Geographic Information System (GIS) Control: to store and manipulate any data sent to the central hub in terms of geographic and spatial arrangement in different areas of the farm.

ii. Multiple data entry control: This is to ensure all data entered and stored into the data base is organized appropriately with no duplications for easy access when necessary.

iii. Statistical analysis ability: This is to enable the software draw up graphs and tables based on the inputted data. Agricultural scientists and statisticians would be able to make accurate predictions about the behavior of the sol based on these.

iv. Graphical user interface (GUI): This feature would take care of what users would see on the software and how they are able to interact with the system. It would control data entry, data sharing, data analysis display and result display.

v. Access control: This is to enable that only authorized personnel are able to access and configure the system. This would be achieved by assigning usernames and passwords to these authorized personnel and requiring them to fill them in before they can access the data.

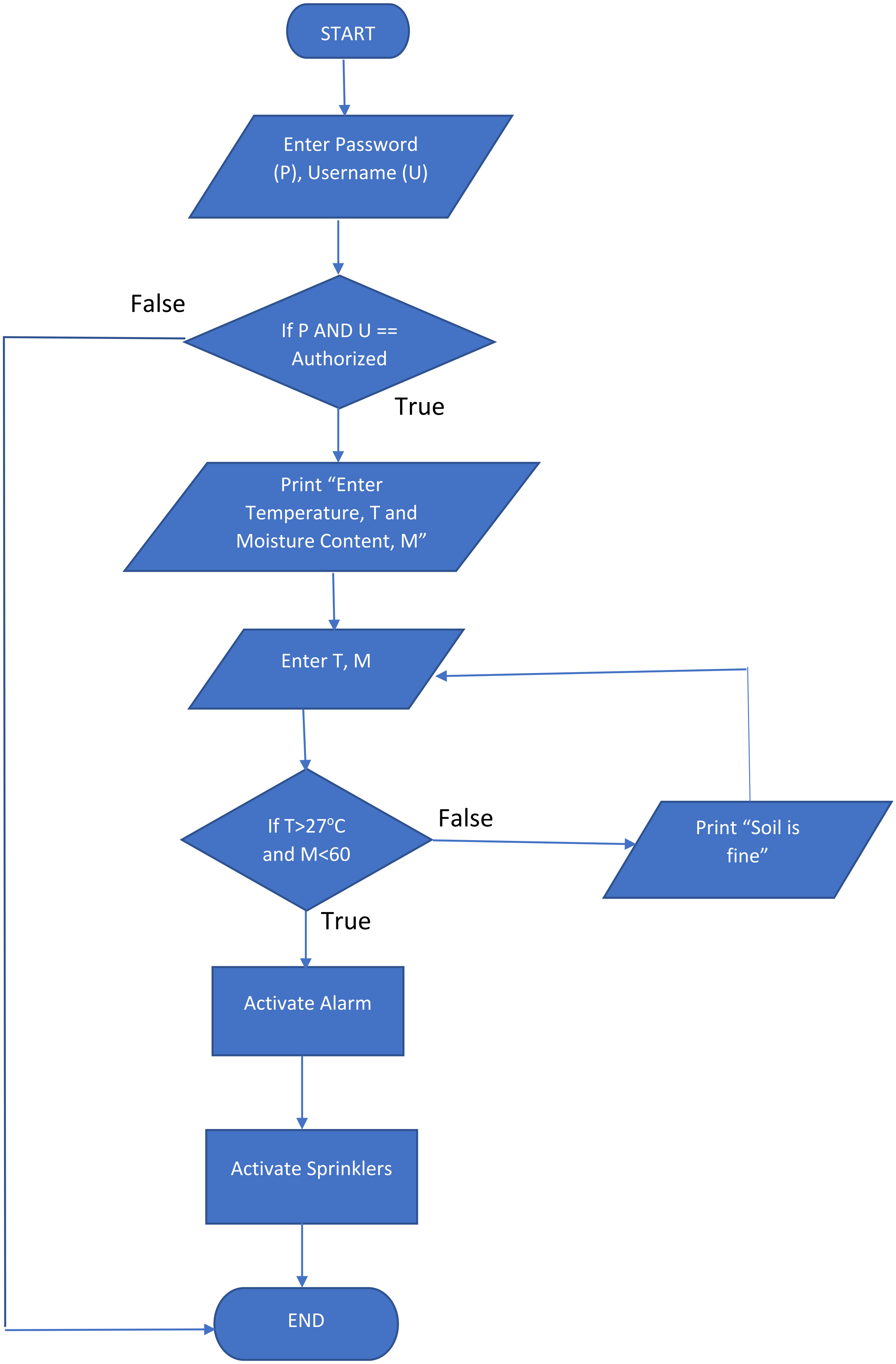
3. Design

The design of the software would be explained using both an algorithm and flowchart, alongside a Top-Down design approach, as shown below.

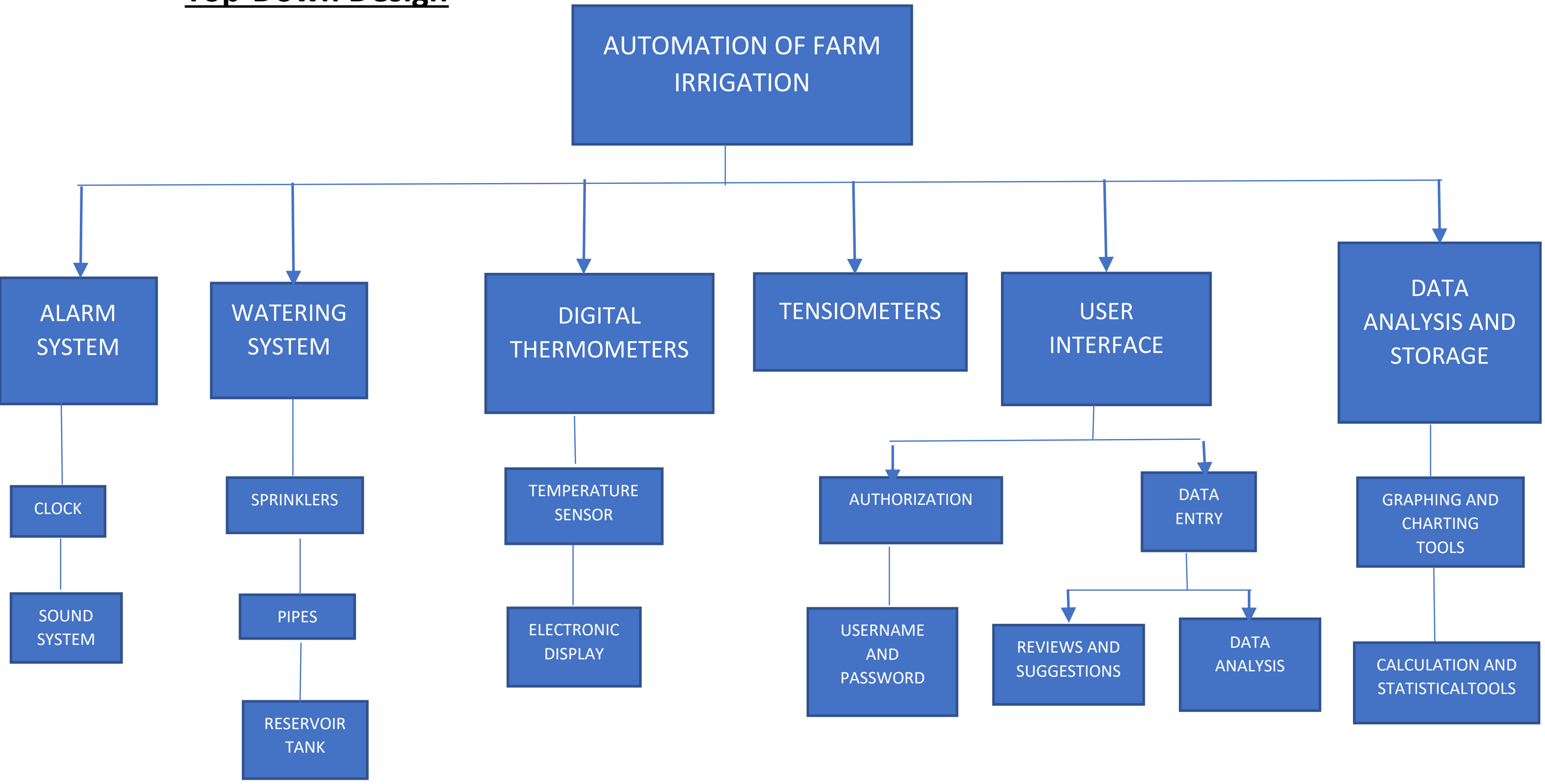
Algorithm

```
1.  Start
2.  Enter password, P and username, U
3.  If P AND U == Authorized
4.  Print “Enter Temperature, T and Moisture content, M”
5.  Else
6.  Print “Invalid username and password”
7.  While Password AND Username == True
8.   Enter T, M
9.   If T > $27^{o}$C AND M < 60
10. Activate alarm
11. Activate sprinklers
12. Else
13. Print “Soil is fine”
14. Go to line 8
15. End
```

Flowchart


START
Enter Password (P), Username (U)
False
If P AND U == Authorized
True
Print “Enter Temperature, T and Moisture Content, M”
Enter T, M
If T>27°C and M<60
False
Print “Soil is fine”
True
Activate Alarm
Activate Sprinklers
END

Top-Down Design



4. Implementation

The software designs would be implemented using appropriate programming languages such as HTML, CSS and JavaScript to give it its outlook and Ruby on Rails language for the working of the software.

5. Testing and Debugging

Although the software would be tested at every stage of its development. A final integrated testing would be carried out to fix any final bugs that may have been missed before it is deployed for consumer use.

6. Deployment, maintenance and update

This is to ensure that the software is in use on the farm to alleviate the problems being faced while using real time interfacing to fix bugs as they appear. Reviews would also be gotten from the users, so that the software would be updated when and where necessary.