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Course Title: Structured Programming

Course code: ENG 224

Software Development Cycle

The following are the steps you use in designing building and developing application software

- **CONCEPTUALIZATION**
  A major challenge that the Afebabalola university Ado-Ekiti farm experiences during the dry season is due to the irrigation system. As an Engineer, It is my responsibility to always take note of the happenings around me and offer preferred solutions. A solution to this problem would be an automated irrigation system.
  An automated irrigation system refers to the operation of the system with no or just a minimum of manual intervention beside the surveillance. Almost every system (drip, sprinkler, surface) can be automated with help of timers, sensors(for soil moisture) or computers or mechanical appliances. It makes the irrigation process more efficient and workers can concentrate on other important farming tasks. The irrigation system is tested under different temperatures and humidity levels of different plants under normal and wet conditions

- **SPECIFICATION**
  The automated irrigation system would be divided into modules
  1. Hardware
  2. Software, in order to properly expatiate on how the system would work

HARDWARE

- Sensor (Temperature and Moisture) for automation of the irrigation system
  The use of soil moisture sensor is to limit the water content to the particular areas. Throughout all the values obtained in wet and normal conditions are proved to be intuitive.
  A temperature sensor is an electronic device that measures the temperature of its environment and converts the input data into electronic data to record, monitor, or signal temperature changes.
- Sprinkler
  Sprinkler system is also an irrigation based system, where it uses sprinklers, sprays or guns are on the tubes. The water flows through the tubes and at some ends there are sprinklers to sprinkle the water in those areas. The sprinkler will be activated only when the temperature and humidity sensor at the root zone exceeds the threshold value.
- Pipe System
  A piping system is generally considered to include the complete interconnection of pipes, including in-line components such as pipe fittings and flanges. These are in order to put in place adequate means of transportation of the water in the farm during use of the automated irrigation system
- Water reservoir
  This is an open-air storage area (usually formed by masonry or earthwork) where water is collected and kept in quantity so that it may be drawn off for use.
  It is an artificial lake where water is stored. Most reservoirs are formed by constructing dams across rivers. A reservoir can also be formed from a natural lake whose outlet has been dammed to control the water level. The dam controls the amount of water that flows out of the reservoir.
- ALARM
  The component parts of an alarm system work together to detect, and alert an audience about any fault in the irrigation system

SOFTWARE

Graphic user interface including

- Access control e.g. password
- Dialog box
- Push button
- Text view
- Edit view
- Error detection
- Timer

ACCESS CONTROL

Access control in the automated irrigation system regulates who or what can view or use resources of the system. It is a fundamental concept in security that minimizes risk to the system. The act of accessing may mean consuming, entering, or using. Permission to access a resource is called authorization; in this case the means of authorization would be a password

DIALOG BOX

This is small area on a screen in which the user is prompted to provide information or select commands.

PUSH BUTTON

This is the button that performs specific action when clicked on.

TEXT VIEW

Text View is simply a view that is used to display the text to the user and optionally allow us to modify or edit it.

EDIT VIEW

It allows you to create a view in which the nodes are editable, and new nodes can be created.

TIMER

This is used to monitor different time intervals of the water based system

ERROR DETECTION

This is put in place in order to identify any defects in the system and automatically activate alarm in order to trigger audience to the problem

DESIGN

- Algorithm

Step 1: Start the Automated irrigation system

Step 2: Input username and password

Step 3: If password is valid

Step 4: Authorize access

Step 5: Grant access

Step 6: Activate/Acquire data from sensors

Step 7: If soil moisture => Threshold value
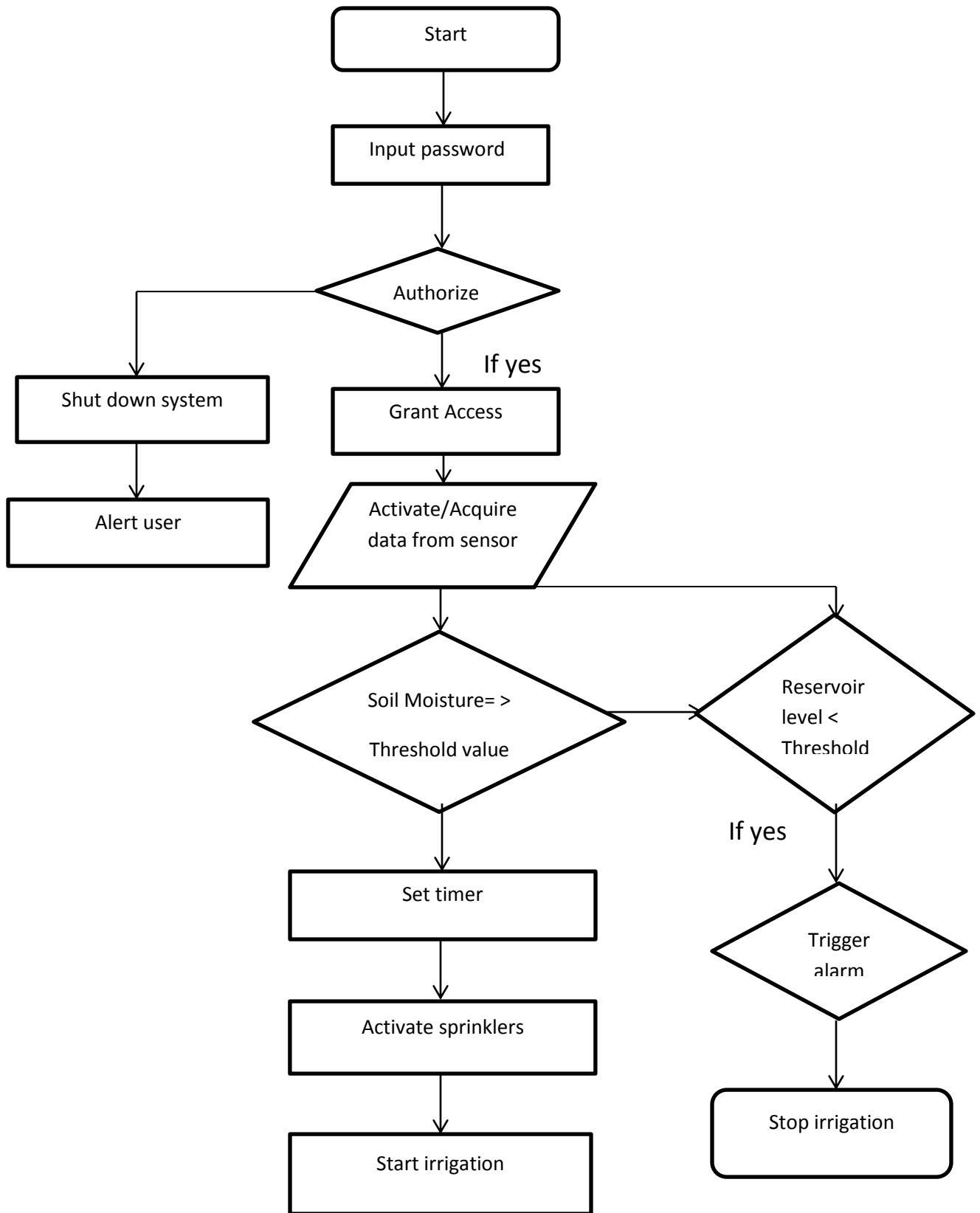
Step 8: Set timer

Step 9: Activate sprinklers

Step 10: Start irrigation

Step 11: Else

Step 12: If reservoir level < Threshold value

Step 13: Trigger alarm

Step 14: Stop irrigation

```
                          ┌─────────────────┐
                          │      Start      │
                          └────────┬────────┘
                                   │
                                   ▼
                          ┌─────────────────┐
                          │ Input password  │
                          └────────┬────────┘
                                   │
                                   ▼
                              ◇ Authorize ◇
                             /            \
                            /              \ If yes
                           ▼                ▼
              ┌─────────────────┐   ┌─────────────────┐
              │ Shut down system│   │  Grant Access   │
              └────────┬────────┘   └────────┬────────┘
                       │                     │
                       ▼                     ▼
              ┌─────────────────┐   ╱Activate/Acquire╲
              │   Alert user    │   ╲data from sensor ╱
              └─────────────────┘   └───────┬───────────┐
                                            │           │
                                            ▼           ▼
                              ◇ Soil Moisture= >      ◇ Reservoir
                                Threshold value ◇       level <
                                          │             Threshold ◇
                                          │                  │ If yes
                                          ▼                  ▼
                              ┌─────────────────┐      ◇ Trigger
                              │    Set timer    │         alarm ◇
                              └────────┬────────┘          │
                                       │                   ▼
                                       ▼           ┌─────────────────┐
                              ┌─────────────────┐  │ Stop irrigation │
                              │Activate sprinklers│ └─────────────────┘
                              └────────┬────────┘
                                       │
                                       ▼
                              ┌─────────────────┐
                              │ Start irrigation│
                              └─────────────────┘
```

IMPLEMENTATION

An automated irrigation system is done by using the microcontroller and sensors such as temperature and soil moisture and humidity sensor. For example, The QWT23 sensor is used to measure the temperature and humidity of a root zone of plants in dry and wet conditions.
C++ on Code blocks is used in programming the system software needed for the automated irrigation system

TESTING AND DEBUGGING

Testing is a process of finding bugs or errors in a software product that is done manually by tester or can be automated. Debugging is a process of fixing the bugs found in testing phase. Programmer or developer is responsible for debugging and it can't be automated. Testing and debugging involves fixing and testing errors and checking performances. The program can be test initially by the programmers to identify bugs if there are any before launching it to the public. The errors in the program are tested out at different stages using step tools and diagnostic data such as step in, step out, break point. The release date and updates are based on user feedback

RELEASE AND UPDATES

The automated irrigation system software is estimated to launch on the 30th of October, before the next dry season, where by real data of the workings of the system and the progression in the farm would be checked an recorded in order to keep track of its effectiveness.

TOP DOWN DESIGN

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                    ┌─────────────────────────────┐
                    │ Automated irrigation system │
                    └─────────────────────────────┘
                       /                        \
            ┌──────────────┐              ┌──────────────┐
            │   Software   │              │   Hardware   │
            └──────────────┘              └──────────────┘
```

- Software
  - GUI
    - Text view
    - Edit view
    - Push button
    - Dialog box
  - Timer
  - Sensor drivers
- Hardware
  - Sprinkler
  - Water reservoir
  - Sensors (moisture, temperature, humidity)
  - Pipe system
  - Alarm