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MATRIC NO: 19/ENG08/009
DEPARTMENT: BIOMEDICAL ENGINEERING
COURSE CODE: ENG 224
COURSE TITLE: STRUCTURED COMPUTER PROGRAMMING (ALGORITHM)

QUESTION

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 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.
 - Triggered 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 or Bottom-up design approach of the application.

PDF submission only, no copy and paste and copying from other students as I will not grade such.

Note: Bonus mark will be awarded for clarity and uniqueness.

A. Discuss the application development following the software development cycle.

WHAT IS SOFTWARE DEVELOPMENT

Software development is the process of specifying, designing, programming, testing and bug fixing involved in creating and maintaining applications or other software components. It is also a process of writing and maintaining the source code, but in a broader sense, it includes all that is involved between the conception of the desired software through to the final manifestation of the software, sometimes in a planned and structured process.

WHAT IS SOFTWARE DEVELOPMENT CYCLE?

SDLC provides a well-structured flow of phases that help an organization to quickly produce high-quality software which is well-tested and ready for production use. SDC is a framework that is used to structure, plan and control the process of developing information systems. This can also be regarded as the step to step process involved in software development. The following processes below are known as the software development cycle of process:

1. Conceptualization.
2. Specification and planning.
3. Design.
4. Implementation, Documenting and Coding.
5. Testing and Debugging.
6. Deployment and Maintenance.

1. Identification or Requirement Analysis (Conceptualization); This is best known as identifying the current problem. And what are the current problems? This phase is known as the main focus of the project **which is to develop a software that interacts with an irrigation machine in order to read the temperature of the soil, determine the moisture content, configure its time interval, trigger an alarm if there is no sufficient water available and enable a password for the system.** Meetings are held in order to determine the requirements of the software just like; Who is going to use the system? How will they use the system? What data should be input into the system? What data should be the output of the system?

2.Planning: In this stage of the SDLC, the team determines the cost and resources required for implementing the analyzed requirements. It also details the risks involved and provides sub-plans for softening those risks. In other words, the team should determine the feasibility of the project and how they can implement the project successfully with the lowest risk in mind. The modus of the program are:

I. Detection

ii. Store data received

iii. Transmit data received

The application is designed to automate the irrigation system in dry season.

3. **Design:** Once the analysis is complete, the step of designing takes over, which is basically building the architecture of the project. These steps help remove possible flaws by setting a standard and attempting to stick to it.

ALGORITHM

STEP 1: Start

STEP 2: Install sensors (temperature, soil moisture)

STEP 3: Enter password

 If password is positive,

 Open software

 Else,

 Shut down

STEP 4: Read Temperature, T

STEP 5: Read Soil Moisture, S

STEP 6: Acquire data from sensors

STEP 7: Sensed data input to microcontroller

 If $S < \text{Threshold value}$ and

$T \leq \text{threshold value}$

 Start irrigation

 Else

 Stop irrigation

STEP 8: If tank has insufficient water

 Trigger alarm and pause irrigation

 Else

 Continue irrigation

STEP 9: Store data on server

STEP 10: Transmit to web

STEP 11: Stop

4. **Implementation, development and coding:** Implementation is the part of the process where engineers actually program to code for the software. The actual task of developing the software starts here with data recording going on in the background. Once the software is developed, the stage of implementation

comes in where the product goes through a study to see if its functioning properly. The program is written in high level language including the necessary features.

5. **Testing and Debugging**: The testing stage accesses the software to test if there are any errors or documents bugs. In this stage, we test for defects and deficiencies. We fix those issues until the product meets the original specifications. A dry run is carried out to know the state of the program and bugs are removed. In short, we want to verify if the code meets the defined requirements.

6. **Deployment and Maintenance**: The program is released to farming organizations worldwide. It is updated based on new discoveries about irrigation

2. **CRITICALLY DISCUSS THE HARDWARE AND SOFTWARE FEATURES**

The program has both hardware and software features

HARDWARE FEATURES

SOIL MOISTURE SENSOR: These are devices that estimate the volumetric water content in soil. It is placed into the soil to plant root depth and measure the moisture and tension content. Automated tensiometers can also be used.

SOIL TEMPERATURE SENSORS: is a soil temperature monitoring device. It can measure the temperature of soil to great accuracy.

These sensors provide feedback to the controller to control its operation.

MICROCONTROLLER: A microcontroller also known as MCU and μC is a functional computer system on a chip. Microcontroller is integrated chip that performs controlling function. It also referred as one-chip microcomputer is used to control a wide range of electrical and mechanical appliances.

MONITOR: It is the most type of hardware known, it displays information about to processes and received.

HARD DISK DRIVE: can be found in almost all desktops and laptops. It stores all files for operating system. It uses magnetic storage to record data.

SOLENOID VALVE: Solenoid valves are electromechanical valves that are controlled by stopping or running an electrical current through a solenoid, in order to change the state of the valve. A solenoid is a coil of wire that is magnetized when electricity runs through it

ROUTER: this is a device used for transmitting data from one place to the other.

AUTOMATIC METERING VALVE: These valves are required only in volume-based irrigation system. The volume of water required for the irrigation can be adjusted in these automatic metering valves. These valves can be simple metering valve which shuts off after delivering preset quantity of water or automatic metering valve with pulse output which provides pulses to the controller to count the volume of water.

MAIN MEMORY (RAM): This unit helps to store data that is currently being processed. It stores data and helps for easy retrieval of data when needed for analysis

The 'relay' systems are made responsible for turning on or turning off the pump(s), as per the precise soil requirements at any time.

SOFTWARE FEATURES

Smart irrigation Software Program

Database Security: This is concerned with protecting the contents of the database from malware functions which can cause damages like data leakage and interruption. It also helps to prevent data manipulation and data loss.

Reports – Advanced system report capabilities based on logged data

Sensor Graphs – Display soil moisture, temperature, and EC from logged sensor data

Water Restrictions – Easily configure water restrictions to comply with local ordinances

User Interface: User interface allow the user to inter act with the system by sending information to the controller by presenting information to user about the system.

I/O Interface Devices: These devices provide the logical communication link between the controllers and the controlled device systems.

3. SUPPORT YOUR ANSWER WITH A FLOWCHART AND AN ALGORITHM

ALGORITHM

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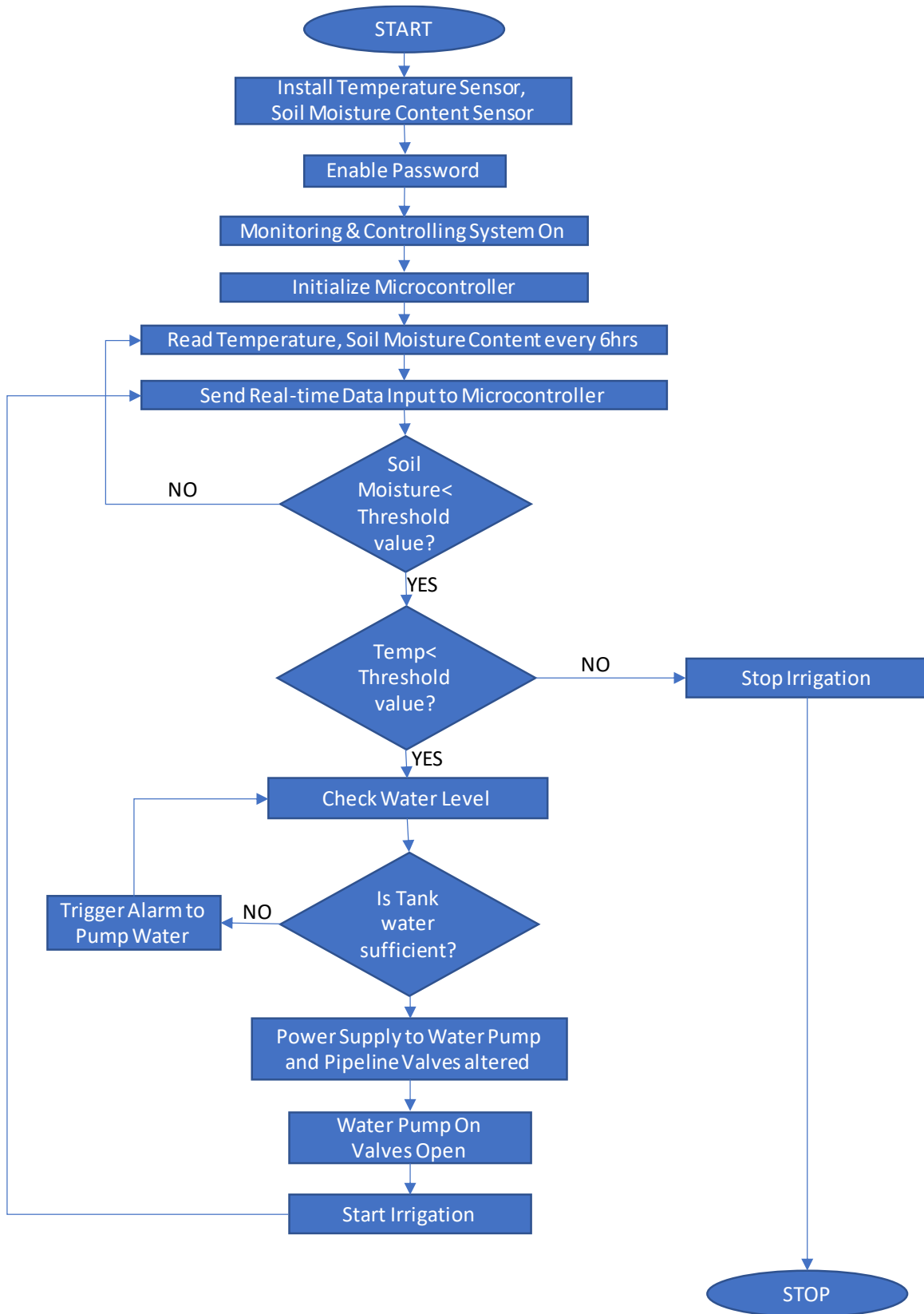
Continue irrigation

STEP 9: Store data on server

STEP 10: Transmit to web

STEP 11: Stop

FLOWCHART



TOP-BOTTOM DESIGN

