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DEPRTMENT:COMPUTER ENGINEERING

MATRIC NO: 18/ENG02/072

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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.
- 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.

 ANSWERS

A. DISCUSS THE APPLICATION DEVELOPMENT FOLLOWING THE SOFTWARE DEVELOPMENT CYCLE.

The software development cycle to be considered will be the *SPRINKLER TYPE IRRIGATION* system. This irrigation system is water-efficient and can be suitable for different plantings as it uses s fraction of the water and supplies it slowly to the soil allowing it to absorb at its own pace. It involves the planning, analysis, design, implementation, testing and integration and maintenance.
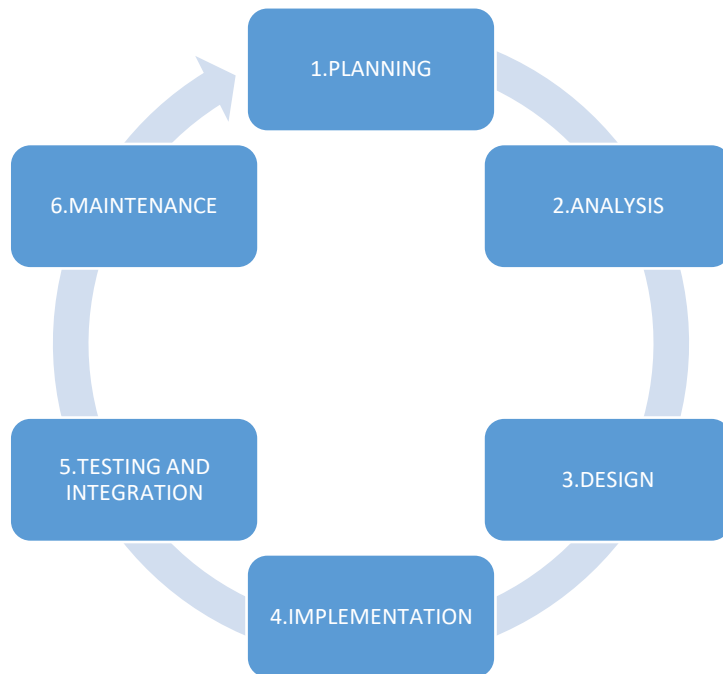
Fig 1: THE SOFTWARE DEVELOPMENT CYCLE

1. **Planning**: an irrigation project is considered feasible if the total estimated benefits of the project exceeds its total estimated cost. Adequate planning of all aspects (organizational, technical, agricultural, legal, environmental and financial) is always essential for feasible irrigation project. The following are what to be considered for the success of the ABUAD irrigation project;

- Suitability of land(with respect to its soil, topography and drainage features) for the purpose of agriculture.
- Favorable climatic conditions for proper growth and yield of the crops.
- Types and locations of necessary engineering works.
- Needs for immediate and future drainage.
- Feasible crops, costs of production and portable crop returns.

2. **Analyzing:** this answers/addresses the following questions,
- Has there been a decline in irrigated areas, change in cropping pattern or in land and water productivity of rice, particularly in the tail-end areas in recent years since external inputs stopped in ABUAD?

- Has water management deteriorated in terms of more water being used, head-to-tail preferential allotment or use?
- What is the current status of water user associations?

3. Design.

Nowadays engineers involved in the design of irrigation systems use tools such as abacuses, graphs, tables provided by manufacturers of materials for irrigation in their catalogs. Are also developed spreadsheets and several companies offer software to design irrigation systems, but these are based on approximate algorithms. Typically, the software will be created for small projects of irrigation systems for public parks and gardening, and will make use of simplifying assumptions valid only for small plants for irrigation. Therefore these instruments and also, the irrigation software proposed by the board of the company are inadequate for professional use and for the design of irrigation systems of large dimensions. In summary, the design of irrigation systems would be now based on:

- Empirical methods slow and laborious which consists of testing, directly in the field, the material to be adopted in the irrigation systems
- Stressful mathematical procedures that consider only standard and unrealistic through the use of simple or sophisticated spreadsheets.
- Irrigation design software; based on approximate algorithms, usually born for small projects of public green.These software based on inaccurate calculation criteria, will be more dedicated to the ABUAD drawing of irrigation systems, rather than a professional complete project equipped with a reliable hydraulic calculation.

The different design procedures are seen in the table below.

LIST	Rapidity Of Design	Accuracy of The Result	High Irrigation Efficiency	Quick Data Input	Irrigation Material Data
Empirical methods	YES				
Abacuses and graphs	YES			YES	

		YES	YES		
SbS Procedure (spreadsheet)		YES	YES		
ALTRI SOFTWARE	YES				YES
IRRIPRO	YES	YES	YES	YES	YES

4. **Implementing:** This involves the various things done while installing and ensuring the software performs properly. There are also some factors affecting effective performance. The proposed agricultural system is designed to solve to find an optional solution to water crisis.

5. **Testing and integration:** testing is done to check and prevent problems of the ABUAD irrigation software program; problems like;

Inadequate utilization of wet season rainfall, which leads to restricted cropping opportunities in the next dry season, lack of feedback about actual ABUAD field water status leading to inappropriate responses resulting to ineffective water releases, little use of data collected.

6. **Maintenance:** This deals with the measures put in place to ensure long lasting of the software setup.
- Place cans or rain gauges along the length of a pivot to capture water from the irrigation system.
- Bringing the irrigation system up to proper operating pressure.

B. **CRITICALLY DISCUSS THE HARDWARE AND SOFTWARE FEATURES.**
- **Pumps**: pump choice has a major influence on an irrigation system. Ensuring a perfect pump match can save money in terms of maintenance, energy and water costs.

- **Automatic irrigation controllers**: these are essentially electronic timers that are programmable to turn the irrigation valves on and off at specific times, or under certain conditions.
- **Irrigation emitters**: this is the method through which the water is delivered to the irrigated crop. There are many different choices here, and a specialized irrigation professional will be able to assist me in making the right choice for my particular applications.
- **Solenoid cables and connectors**: these items connect the irrigation controller to the valves. Problems can arise from incorrect or poorly wired systems, and this is where an irrigation professional can assist. Irrigation system sensors are complementary units that attach to an automatic irrigation controller to modify the programmed irrigation cycle. Example, rain sensors and soil moisture sensors to note the amount of moisture content in the soil.
- **Backflow prevention devices**: they allow water flow in one direction only. They are particularly important where the system is connected to a portable water source preventing dirty water from being able to travel into the portable water source.
- The ABUAD irrigation system will be made up of many pipes, on both the delivery side(sprinkler side) and the water supply side. Pipes can be pressurized or non pressurized and there are raft options when it comes to pipe materials.

Other hardware components include; measuring tape, pegs rope, hoe, digger, core sampler, blade, pump, pipes, sprinkler nozzles, fittings, risers, gum, hydrometer apparatus(mortar pestle, glass rod, volumetric flask, beakers and stopwatch

C. SUPPORT YOUR ANSWER WITH FLOW CHART AND AN ALGORITHM.

```
           ┌─────────┐
           │  Start  │
           └────┬────┘
                │
     ┌──────────┴──────────┐
     │ Check temperature/  │
     │      humidity       │
     └──────────┬──────────┘
                │
     ┌──────────┴──────────┐
     │     Sent value      │
     └──────────┬──────────┘
                │
     ┌──────────┴──────────┐
     │    Display value    │
     └──────────┬──────────┘
                │
           ┌────┴────┐
           │   End   │
           └─────────┘
```
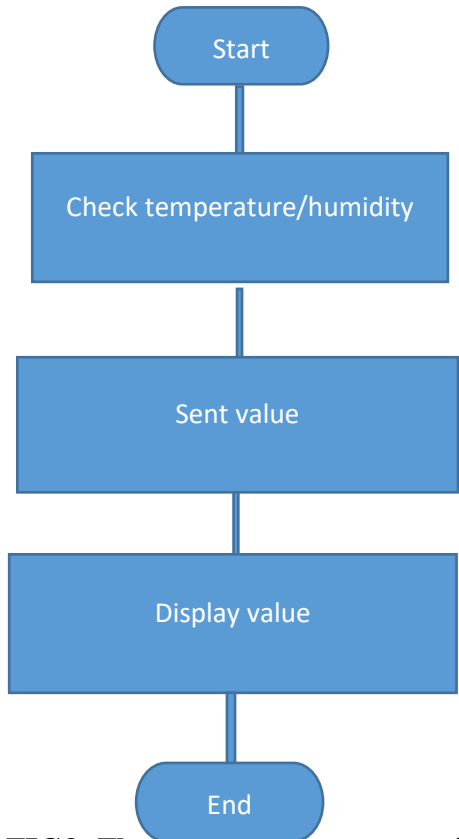
FIG3: Flowchart of temperature/humidity sensors.

```
           ┌─────────┐
           │  Start  │
           └────┬────┘
                │
     ┌──────────┴──────────┐
     │     Send value      │
     └──────────┬──────────┘
                │
     ┌──────────┴──────────┐
     │      Display        │
     └──────────┬──────────┘
                │
           ╱─────┴─────╲
          ╱ Less than   ╲
          ╲    30%      ╱
           ╲─────┬─────╱
                 │ Yes
     ┌───────────┴─────────┐
     │    Motor gets on    │
     └───────────┬─────────┘
                 │
           ┌─────┴─────┐
           │    End    │
           └───────────┘
```
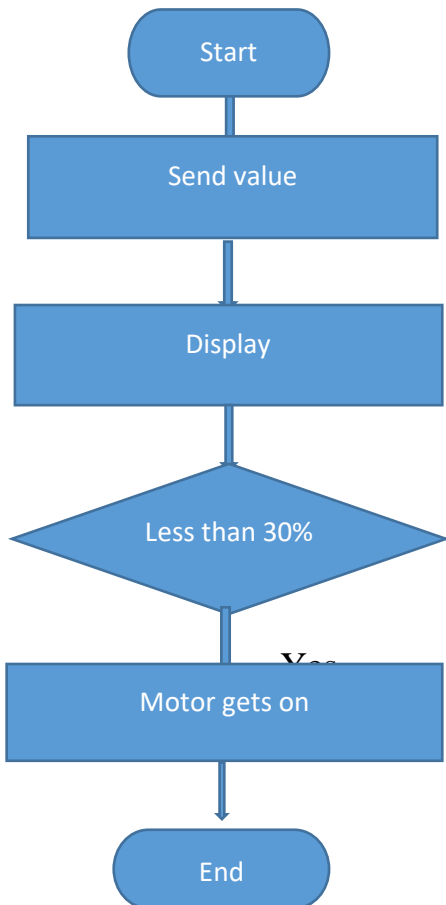
Soil moisture sensors will measure the water content in soil. Moisture in the soil is an important component in the atmospheric water cycle. Sensor module outputs a high level of resistance when the soil moisture is low. It has both digital and analog outputs for reading. Digital output is simple to use, but it is not as accurate as analog output based on moisture level motor gets turn off/on automatically.

```
                    ┌──────────┐
                    │  Start   │
                    └────┬─────┘
                         │
              ┌──────────▼──────────┐
              │  Acquire moisture   │
              │  content reading    │
              └──────────┬──────────┘
                         │
              ┌──────────▼──────────────────┐
              │ Send all sensors measured   │
              │ data to cloud               │
              └──────────┬──────────────────┘
                         │
```

(Dry) yes   no (wet)

MC>1&<

No

MC>=40

(mc) is high – moist or wet

W<5   NO PUMP CAN START

W>5&<=   Pump 1&4 ON

W>7&<-10   Pump 1,2,&4 ON

W>10&<-   PUMP 1,2,3&4 ON

STOP
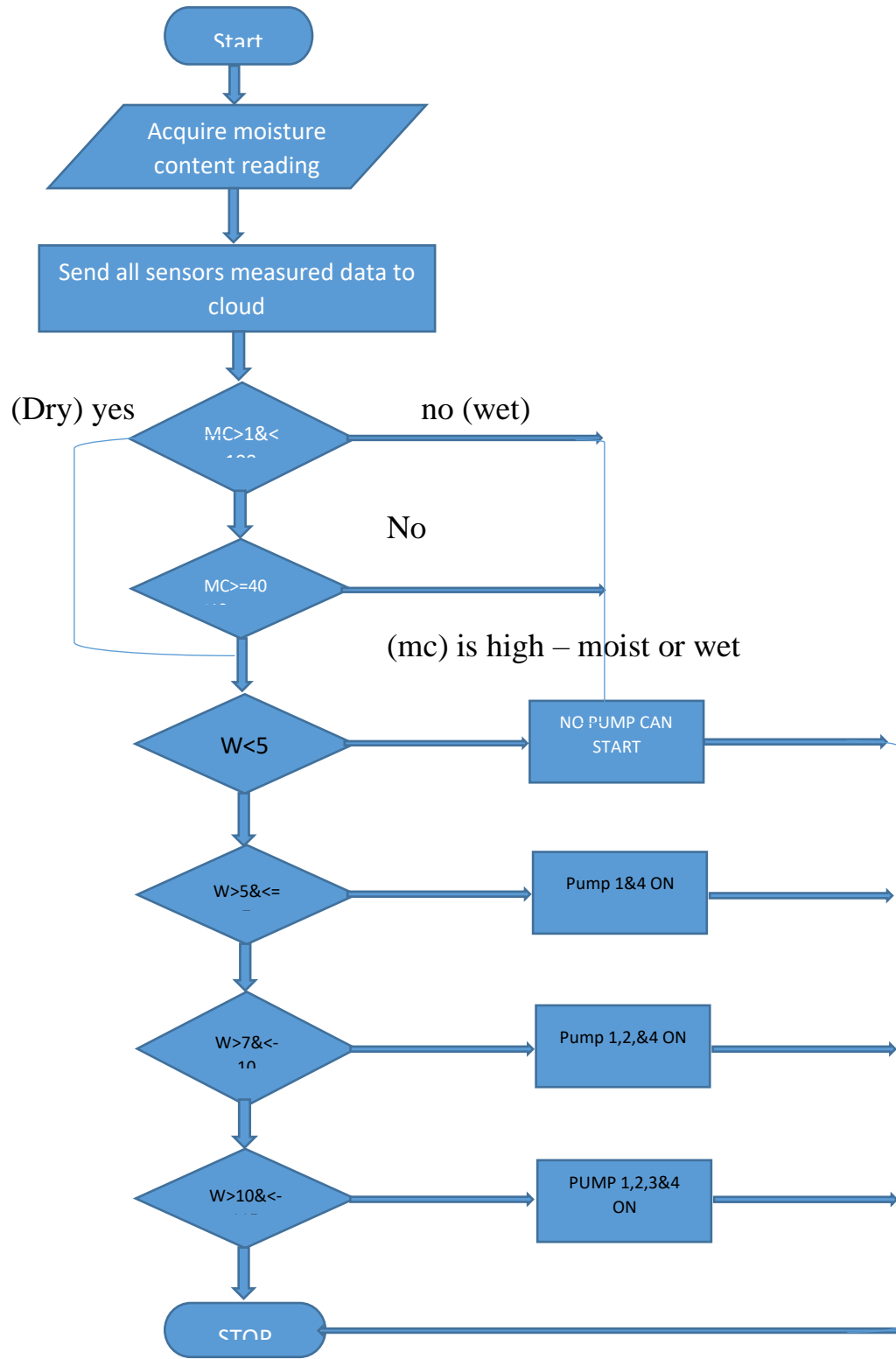
AN ALGORITHM FOR THE PROCESS:

Step1: start

Step2: input Q, S, L, N

Step3: calculate d = pow ((((1.59*Q*n)/ ((pow (5,0.5))*(1.7854))), 0.375

Step3: calculate R =0.5*d

Step4: calculate V= ((pow (R, 0.667))*(pow(S, 0.5)))/n

Step5: calculate A=Q/V

Step6: calculate p=3.5708*d

Step7: Is Q<4.2

Step8: calculate B = 1.25 + 0.5*d

Step9: calculate B = 0.6 + 0.5*d

Step10: calculate B = 1.25 + 0.53*d

Step11: calculate N=50*P*L

Step11: calculate C=0.0061*P*L/0.034

Step12: calculate M=0.0289*P*L

Step13: calculate Z=115*P*L

Step14: Print D,R,V,A,P,B,N,C,M,Z

Step15: Stop

D. DRAW THE TOP-DOWN OR BOTTOM UP DESIGN APPROACH OF THE APPLICATION.

IRRIGATION

hardware

software

irrigation devices

soil monitoring equipement

user interface