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DEPARTMENT; MECHANICAL

COURSE; ENG224 (STRUCTURED PROGRAMMING)

CONCEPTUALIZATION

Concept of the software; This software interacts with sensors (with the aid of an Arduino), and other hardware via a web server to achieve an automated irrigation system that can be controlled from anywhere in the world.

SPECIFICATION

SPECIFICATION OF THE SOFTWARE; This software will interact with a;

- Temperature sensor and soil moisture sensor; These sensors reads the temperature and moisture of the soil with the aid of an Arduino so as to determine when irrigation starts and ends.
- Automatic water pump controller circuit; reads the water level in the tanks, and if the water level is below the minimum mark it gives off an alarm.
- Database to store data gotten from the soil moisture and temperature sensor for future purpose soil analysis (that is to determine properties of the soil and to determine whether the soil is still suitable for farming)
- The software is passworded for security

Timing of irrigation; from the data gotten from the sensors; using standard conditions the software calculate when the irrigation starts and ends.

Targeted Platform; Android/iOS and windows/iOS/Linux

Programming Language to be used; C/C++ for the Arduino, Java for the android app, SQL for the web server.

DESIGN

HARDWARE FEATURES

1. Arduino; This is the tool that would be used to control the sensors. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment), which is accessed via a

computer. The Arduino will be programmed to collect input signal of the soil moisture, and to read the temperature of the soil.

2. Temperature Sensor; After calibration the temperature sensor reads the temperature of the soil, sends the signal to the Arduino and then the Arduino sends the data to the software, to calculate the irrigation timing.

3. Soil Moisture Sensor; After calibration the moisture sensor reads signal from the soil and then send data via the Arduino to the software

4. Automatic water pump controller circuit; This detects the water level in the tank, and if the water level is below a certain mark it sends a signal to the software which gives off an alarm, and then refills automatically if no action was taken from the controller. The alarm is for the purpose of monitoring; so that the controller would know how many times irrigation would be performed before water level reaches the minimum mark. And if there is a pipe leakage, it would be easily detected.

Since the software would be installed on a mobile device or a computer, Hardware features used are;

1. Radio/antenna; it enables the operator to be able to connect to the internet.
2. RAM (Read access Memory); This a short-term memory that is used by the software. It helps in loading the software
3. Micro-Processor; it determines how fast the software would be able to run/function.
4. Touch-Screen/Touch-pad/mouse; Touch screen for mobile phones, Touch pad for personal computers, Mouse for desktop computers. This helps the operator to navigate through the software.

SOFTWARE FEATURES

1. Connectivity; The software interacts with the Arduino via a web server (instead of wi-fi or Bluetooth because they are limited by distance). The Arduino sends data to the web server and the software collects data from the server and vice-versa. With this the automated system can be controlled from anywhere in the world.

2. Irrigation Timing; The software calculates the start and end time of the irrigation by using the data gotten from the sensors; for overhead irrigation, it should start before soil reaches 50% of available soil water and for drip irrigation it should start before soil reaches 80% of available soil water.

3. Time Interval for soil moisture and temperature monitoring; The software would be able to control the time interval that the sensors would read signals from the soil. For example, if the time interval is set to 30 minutes then every 30 minutes the sensors will collect data from the soil and if the data gotten shows the need for irrigation the pump would be triggered on and irrigation would start.

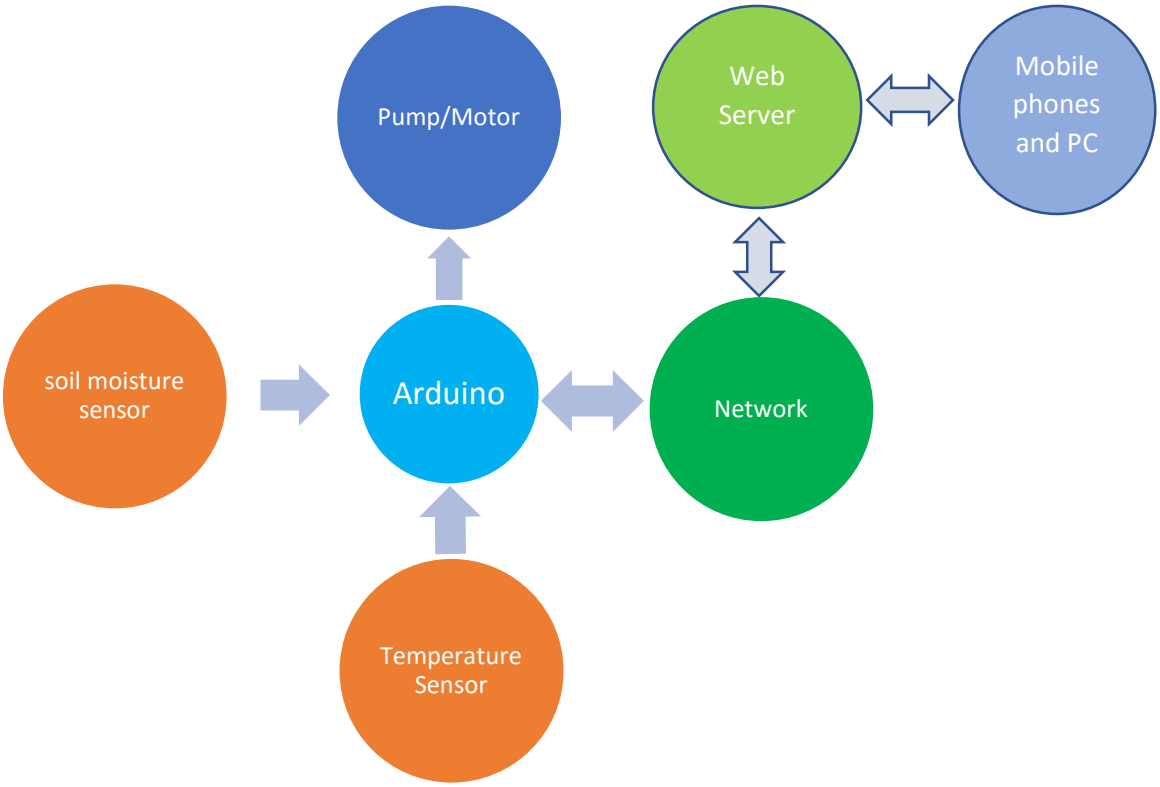
4. End to End Encryption of data being transferred to the web server (Cyber security); In the absence of the farmers, Competitors might try to sabotage the farm by trying to hack data being transferred and not allowing irrigation to take place. Therefore, the data being transferred are secured appropriately to prevent occurrence. Also, the software is passworded

5. Database; would be used to store data gotten from the sensors which can be used for soil analysis.

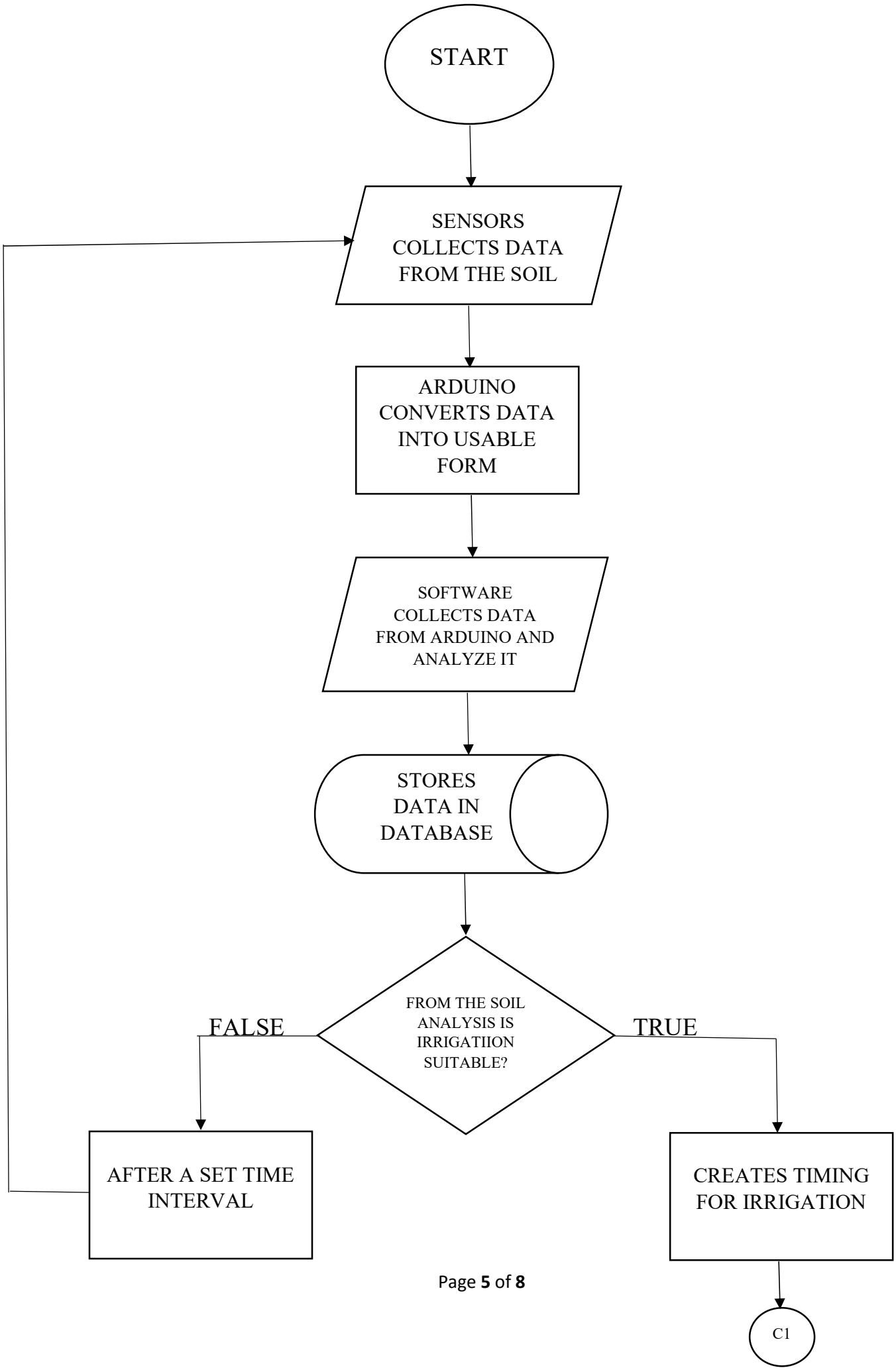
DESIGN PROCESS;

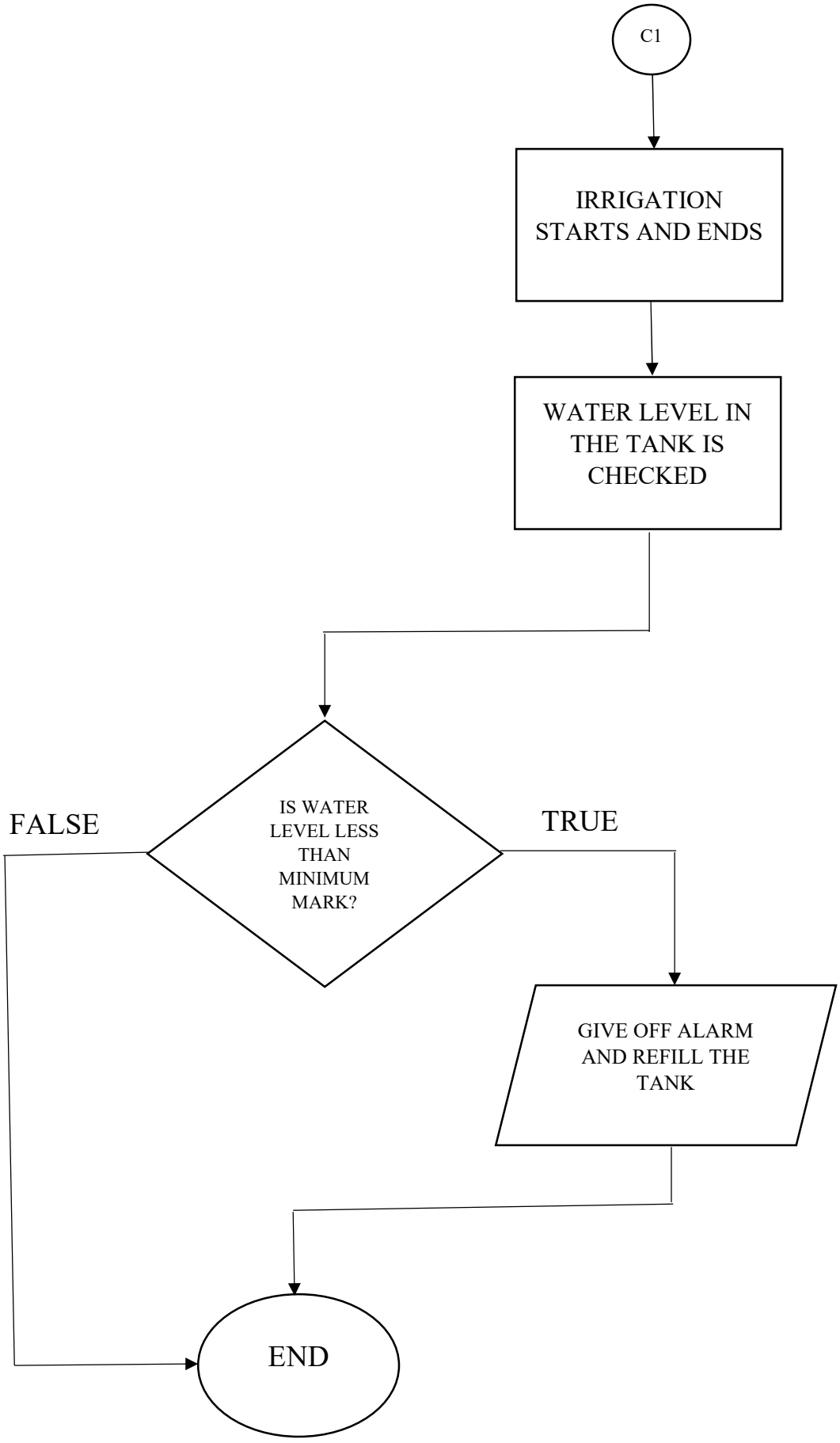
1. Calibration of sensors; Sensors are calibrated so that they can give out accurate and precise data.
2. Connection of Sensors to Arduino; A proper Arduino would be chosen from the Arduino series and then the sensors would be connected to the Arduino so that we can have more control of the sensors.
3. Connection of Arduino to the software; The Arduino is connected to the software so that data can be transferred over a web-server.
4. Storing of soil analysis data to a database which can be used later to determine whether the soil is still suitable for farming and for other analysis.
5. Setting conditions (using conditional statements) to determine when the irrigation starts and ends.

BRIEF DESCRIPTION OF HOW THE AUTOMATION WOULD WORK



Below is the flowchart for the automated system


START
SENSORS COLLECTS DATA FROM THE SOIL
ARDUINO CONVERTS DATA INTO USABLE FORM
SOFTWARE COLLECTS DATA FROM ARDUINO AND ANALYZE IT
STORES DATA IN DATABASE
FROM THE SOIL ANALYSIS IS IRRIGATIION SUITABLE?
FALSE
TRUE
AFTER A SET TIME INTERVAL
CREATES TIMING FOR IRRIGATION
C1


C1
IRRIGATION STARTS AND ENDS
WATER LEVEL IN THE TANK IS CHECKED
IS WATER LEVEL LESS THAN MINIMUM MARK?
FALSE
TRUE
GIVE OFF ALARM AND REFILL THE TANK
END

ALGORITHM

Step 1; Start.

Step 2; Get temperature and soil moisture of the soil from Arduino via the sensors.

Step 3; Software collects data from Arduino and stores in the database.

Step 4; if data collected == standard condition for irrigation

Software calculate irrigation time range

Irrigation starts and ends

If water level <= minimum water mark

Alarm starts

Water automatically refills

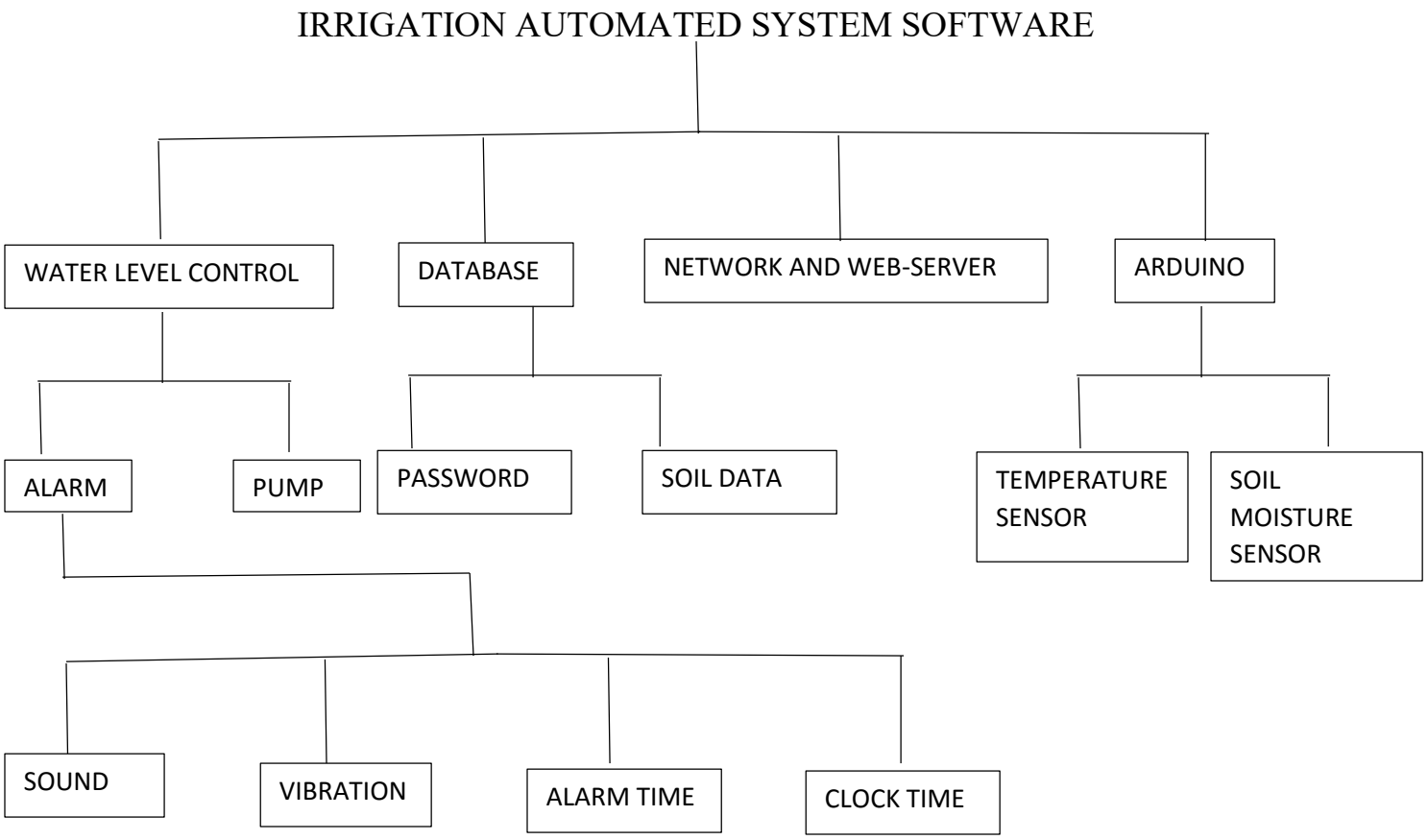
Else do not refill

Else After a set time interval return to step 2

Step 5; Stop

BELOW IS THE TOP DOWN DESIGN APPROACH

TOP DOWN DESIGN APPROACH



IMPLEMENTATION; The software is implemented using High Level Language; Java, C and SQL.

TESTING AND DEBUGGING; The software is tested by the operator under several conditions and bugs noticed during the test are debugged.

RELEASE AND UPDATE; After being tested severally and no bug is found, it is released. In case of upgrade of hardwares in the future, the software is updated.