Automated Irrigation System

Proposed Software Design for ABUAD Farm

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OBJECTIVES OF THE SOFTWARE

- To read the temperature of the soil.
- To determine the moisture content of the soil.
- To configure time interval for the water system based on the above.
- To trigger an alarm if there is no sufficient water in the tank for the irrigation.
- To enable password for the system for added security

APPLICATION DEVELOPMENT

This involves the process of the software development cycle from the conceptualization of the software used to control the automated irrigation system till the point of release and future update.

1. Conceptualization
2. Specifications
3. Design
4. Implementation
5. Testing and debugging
6. Release and update

Development Cycle

1. **Conceptualization/Analysis:** During the dry season, irrigation plays an important part in the crop growth and yield. This lack of rain during the dry season means that farmers have to be more conscious of their farmland to prevent water deprivation in the soil. Sometimes, farmers may not be sure of when and how much water to supply to the plants at various time intervals. It will be quite strenuous for the irrigation team to determine the conditions of the farmland at every instant. Also water level of the tank may be too low sometimes and the crucial supply of water needed will be slowed down in order to fill the reservoir. Although the tank water level will be regularly checked, due to man's natural flaws, that might not always be the case. The distribution of the water is another key aspect of irrigation that needs to be dealt with. Farmers have to ensure that *each* crop and its surrounding soil gets sufficient water which will help not just by providing enough water for growth but also to cool the surrounding area during very hot conditions.

   A smart irrigation system will be able to eliminate all these problems and facilitate regular supply of water needed from the reservoir of ABUAD farm during nor only the dry season but also the raining season if necessary. This way there will be optimal use of water supply and improvement in crop growth. This means that the farmers will worry less about the state of the soil and when to

irrigate because the system will help handle that. Human error will be eliminated and resources (water and electricity) will be managed more effectively.

The pump will be actuated automatically and the smart sprinklers will spray the water over the farmland. Sensors and relays installed in the farm will help in gathering info on when and when not to irrigate the land. All this will be controlled by a microcontroller which will be programmed by software which will be developed following the objectives of the system stated in the cover page.

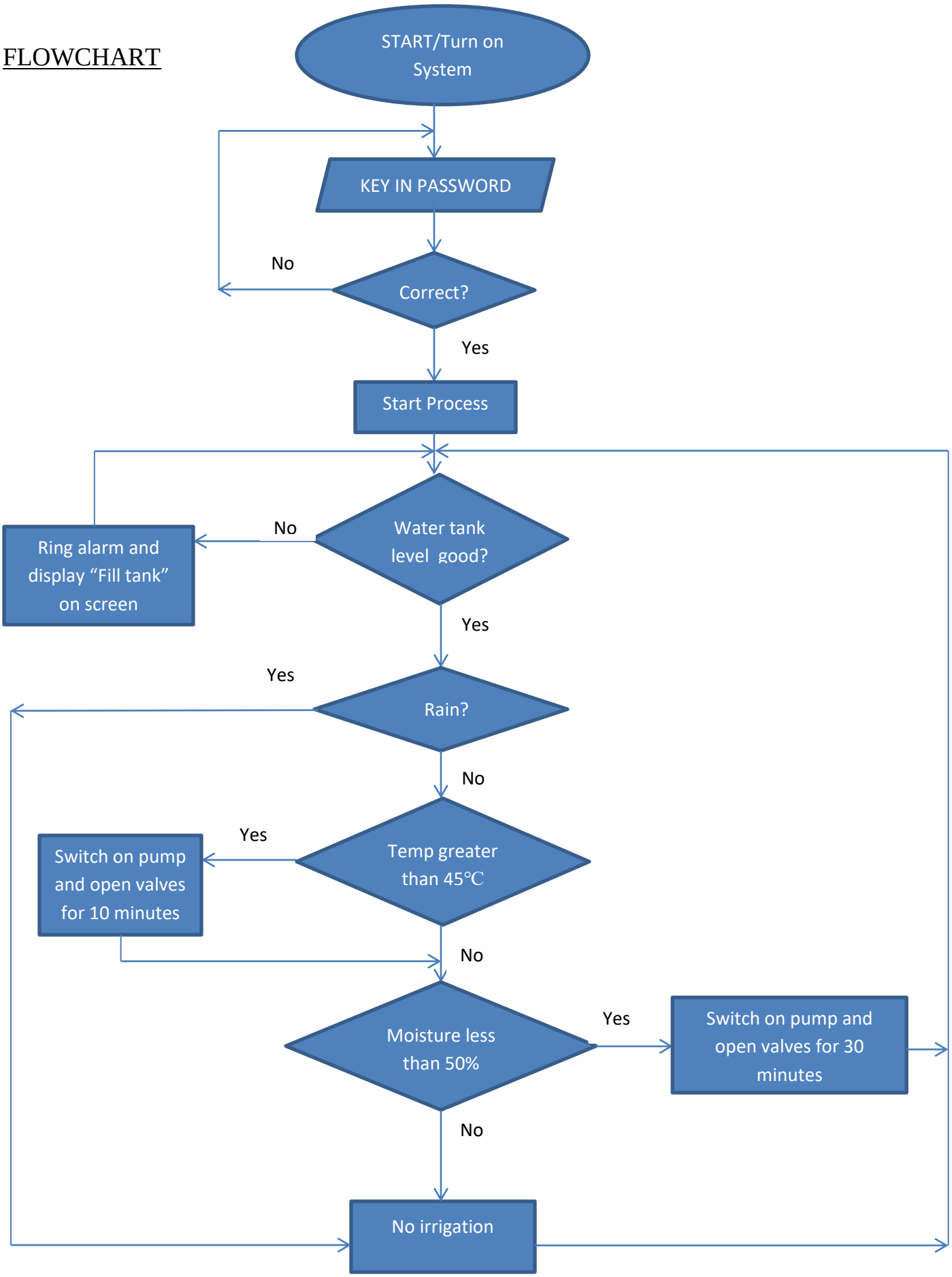
2. **Specifications**: This includes the characteristics of the software and the descriptions of the various actions that the irrigation system software will initiate.

   Functional Specifications

   - The moisture content and temperatures at various time intervals will be measured and displayed on an LCD screen.
   - The rain sensors will check if there is rainfall. If so, the system will not irrigate the ABUAD farm.
   - If the moisture content sensor read a dry value with less than 50% moisture or the temperature sensor reads a temperature greater than 45℃ and the rain sensor reads no rain, the valves will open and the pump will run, distributing water to the sprinklers and spraying the water for 30 minutes.
   - An alarm will ring if the water level sensor reads a water level in the tank that is too low for irrigation.
   - A manual override switch will enable the farmer to switch of the system when it's not needed.
   - A password will be inputted to be able to access the system.
   - If there is a leakage, the LCD screen will indicate such problem.
   - The software will be easy to use and all the information will be displayed on the screen after the password is keyed in.
   - The LCD screen will be located at the control room where the farmer can go to check on the system.

3. **Design:** This includes the tasks and sub-tasks that the software will perform. An algorithm and flow chart is used to describe the software design.

FLOWCHART


START/Turn on System
KEY IN PASSWORD
No
Correct?
Yes
Start Process
Water tank level good?
No
Ring alarm and display "Fill tank" on screen
Yes
Yes
Rain?
No
Yes
Temp greater than 45℃
Switch on pump and open valves for 10 minutes
No
Moisture less than 50%
Yes
Switch on pump and open valves for 30 minutes
No
No irrigation

Algorithm for The Automated Irrigation System

1. Start
2. Temperature , moisture content, water level = 0
3. Read temperature, moisture content, water level, password
4. If Password is correct

   Turn on system

   Else

   Don't start system
5. Fetch temperature, moisture content and water level from sensors
6. Check water level
7. If Water level is low sound water level alarm

   Else

   Turn on rain sensor
8. Check for rain
9. While there is no rain

   Check temperature
10. If Temperature is greater than 45℃

    Turn on pumps and open valves for 10 minutes

    Else

    Check moisture content
11. If moisture content is less than 50%

    Turn on pumps and open valves for 30 minutes

    Else

    No irrigation
12. Stop

4. **Implementation:** The Software will be based on a c program which will be coded using code blocks. The micro controller used is based on C and C++ programming languages. The coding is done based on the requirements set during the specifications stage. The source code which will be developed will then undergo a series of testing using data from regular working conditions.
5. **Testing and Debugging:** In this stage, a serious of tests will occur in order to check for bugs in the software to prevent any problems in the future. Any defects found are checked and the program is adjusted. The testing will involve using a small area of land to test the entire system and not the software alone. The relays and sensors are installed for a small area and the measurements of the temperature and moisture content are collated by the sensors put in the land and sent to the microcontroller through the wiring. The water level sensors also detect if the water level is enough for the irrigation. All the sensors used will be testing for their accuracy and durability under intense conditions.
6. **Release and update:** The product will finally be deployed and made available after all initial testing is complete. The debugging process will continue and be implemented in future updates. Those updates could also include new subtasks that could make the system more smart and efficient.

HARDWARE AND SOFTWARE FEATURES

The subsystems in that wake up the software and hardware will include;

- Power supply
- Sensing/ measurement systems (sensors and timer)
- Control unit (microcontroller, control room)
- Pumping and water supply systems (pumps, control valves, sprinklers, pipes)

The program will include the control code that will be programmed into the microcontroller and tell it what to do with the information gotten from the sensors installed in ABUAD farm. This microcontroller will play an important role in controlling and enabling the irrigation of the farm and also gathering the information needed to make that decision. A timer will work with the microcontroller to stop the process after the set time limit

The moisture content sensor works closely with the control unit and constantly provides it with data regarding the moisture the soil possesses at every instant in the soil. This sensor does its job by examining the di-electric constant of soil surfaces to determine the volumetric water content in the soil. It could either initiate the irrigation by sending its data to the microcontroller or terminate it if the moisture level is less than 50%. Then

The temperature sensors used advanced resistance temperature detector components to measure the soil temperature.

The relay system helps in turning on/off and opening or closing the valves. They are actuated by the microcontroller based on the instructions it that has been programmed. Sprinklers are also strategically placed in the farm to evenly distribute the water.

An alarm has been attached in the system which will ring when the water level is too low for irrigation. In that case the tank has to be filled before the water is supplied.

DESIGN APPROACH FOR THE APPLICATION (BOTTOM-UP APPROACH)