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Designing Approach of An Automatic Irrigation System

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ABSTRACT—*By reducing the quantity of water and energy wasted, the best irrigation system has recently been researched. Automatic irrigation involves using a device to control irrigation systems so that the water flow may be changed from one bay, or group of bays, to another even when the irrigator is not there. In this work, To determine how moist the soil is, an automated sensing and control device can interact with more than one distinct type of electric valve and soil humidity sensor. Besides having the capacity to operate a node in a wireless sensor network. The use of the new prediction models produced two significant findings. The first is to use less water to irrigate crops during the day as opposed to watering them at night. Secondly, it reduced the energy required to run the irrigation system.*

Keywords**—***Soil Moisture Sensors, Electronics Valves, Automatic Irrigation,wireless sensor network.*

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I. INTRODUCTION

For agricultural reasons, 85% of freshwater inflows were utilized. It is vital to develop technological methods based on technology and science for persistent use of water because as population grows, water consumption will become more specialized[1-6].After a sensor released the soil moisture, the Arduino controller serves as the focal point for the robotic operation[7].Farmers frequently control electric motors by observing the condition of the soil; however, this method may or may not provide accurate indications, making it impossible to determine the appropriate amount of water for effective irrigation and grass growth. To address this issue, moisture sensors are used[8].In general, in [9] irrigation systems are manually operated based on ON/OFF schedule control and a variable ascites system that apply to reduce the dependent on rain.The design of a self-automatic irrigation system is put into practice by ensuring the appropriate water level in order to grow up the plants through the four seasons. These automated ascites plants often ensure the necessary level of water in the places when the grower is gone[10].For irrigation projects, a microcontroller called an 8051 is employed. This microcontroller's drawbacks include signal processing and operation speed that are less to those of an Arduino controller[11].

II. MOTIVATION

The amount of water that may be utilized for agriculture has decreased as a result of climate change and population increase. This is because irrigation water levels decrease as a result of filtration and evaporation. Healthy soil and plants need to be regularly irrigated at the correct times and rates in order to grow the optimum harvests. Furthermore, effective results depend on time and water rates that are appropriate. In large fields, manual irrigation systems frequently fail to control irrigation water. The precision and great efficiency of smart irrigation systems in regulating irrigation water made their usage hence vital. The objective of using water most profitably while maintaining sustainable output levels is also achieved by smart irrigation systems.

III. OBJECTIVES

The purpose of this research is to design andimplement of an Automatic irrigation device. It is an independent sensor, control, and actuator device, designed to be low-cost and have a small footprint. It can be compatible with a wide range of different plants, in addition to the possibility of modifying the old irrigation control units through its compatibility with two types of soil moisture sensors and three types of electronic valve drivers. This allows the module, like traditional watering devices, to control watering.

IV. PROJECT SCOPE

According to our survey, irrigation systems do not consider the amount of energy and water wasted during irrigation.This research focuses on the development of an automatic irrigation system that can sense the amount of water needed for a wide range of plants and then provide water as needed without wasting water. The system will consist of a microcontroller, two soil moisture sensors, and three electronics valves for pumping water.

V. BRIEF METHODOLOGY

To organize automatic irrigation and monitor crops from a distance, the system must have at least three functions, which include: It is sensing soil moisture, knowing the amount of water needed for each type of plant, and providing water for each type through valves. Basically, an automatic watering system It consists of two parts, as follows:

VI. HARDWARE DESIGN

As shown in figure below the hardware design consists of:

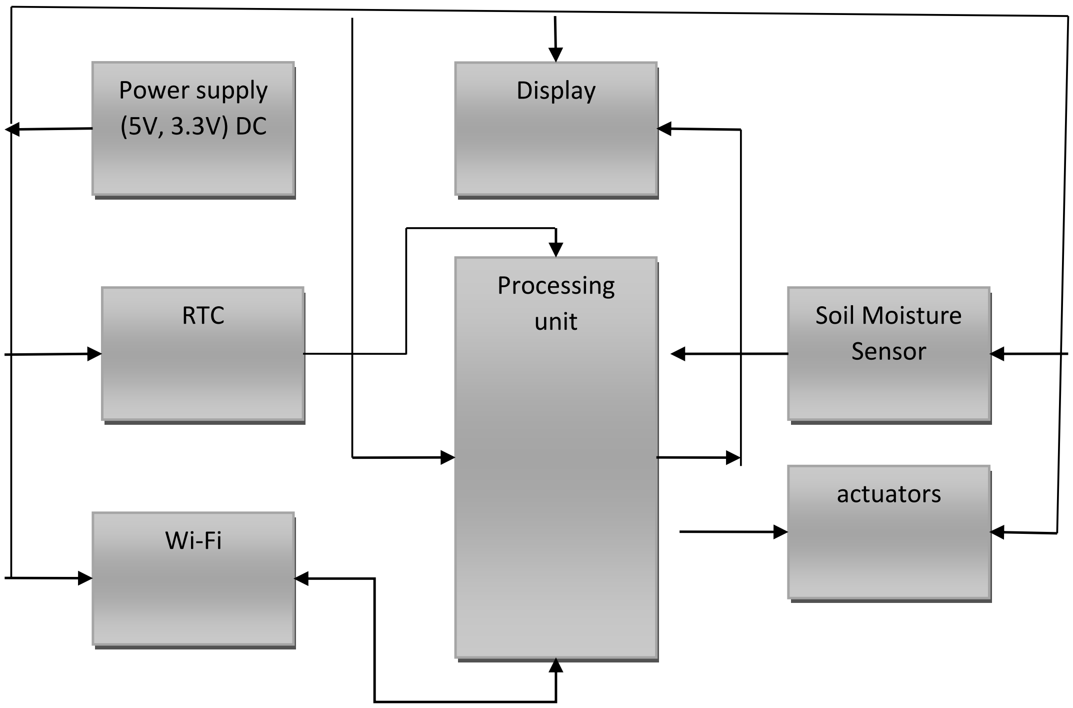

Figure 1. thehardware design of the irrigation system.

To run the remainder of the device elements, the design requires 5 volts and 3.3 volts from the 9-volt dc input. It also includes a processing unit that receives the signal from the sensor and sends instructions to the actuator to open and close the valve. and a display that shows the results of the watering process, the percentage of soil moisture, and the timings. In addition to Wi-Fi, there is wireless device control within the device. There are two types of soil moisture sensors (resistive and capacitive) that can be deployed. Based on the signal from the processing unit, the actuator will open and close the valves.

6.1 Resistive soil moisture sensor

A resistive soil moisture sensor measures the amount of moisture in the soil by exploiting the link between electrical resistance and water content. These sensors have two exposed probes that are put directly into the soil sample, as you can see in figure below.

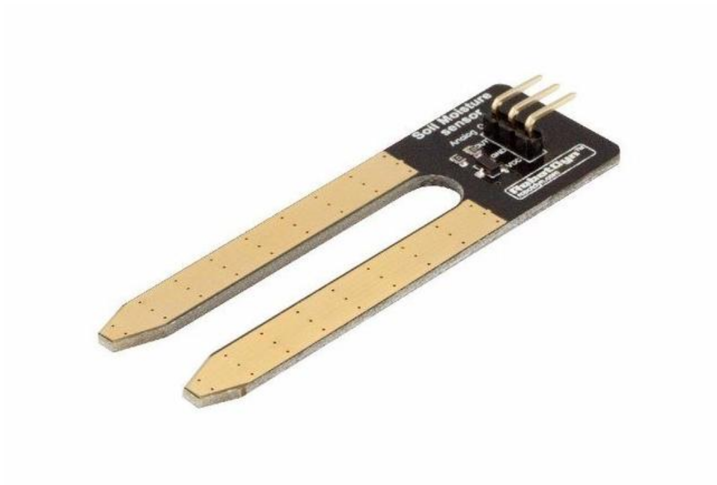

Figure2.Resistive soil moisture sensor

6.2 Capacitive Soil Moisture Sensor

A capacitive soil moisture sensor as shown in figure below measures a change in capacitance to determine moisture content. Capacitance is a measure of how much electrical charge can be held across an electrical potential, The device contains an on-board voltage regulator, allowing it to operate between 3.3 and 5.5V. It works with low-voltage MCUs (both 3.3V and 5V logic).

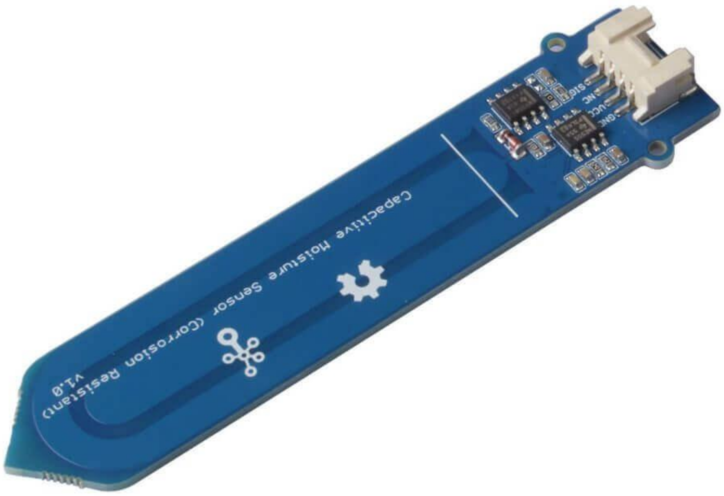

Figure3. Capacitive soil moisture sensor.

6.3 Solenoid Valve

An electrically operated valve is a solenoid valve. A solenoid, an electric coil with a moveable ferromagnetic core (plunger) at its middle, is a component of the valve. The plunger seals up a tiny aperture in the rest position. A magnetic field is produced by an electric current flowing through the coil. The plunger is forced upward by the magnetic field, opening the valve. The fundamental idea behind how solenoid valves open and close is this.Designed for electrical binary signals with a maximum voltage of 24 V DC, 220 V AC, or 22 mA, as used in control engineering. Low power usage of around 0.1 W.

VII. SOFTWARE DESIGN

The device works according to the flowchart to read the soil moisture value from the sensor, then display this reading. The processing unit compares the reading from the soil moisture sensor with the threshold value in order to decide whether to open or close the valve.

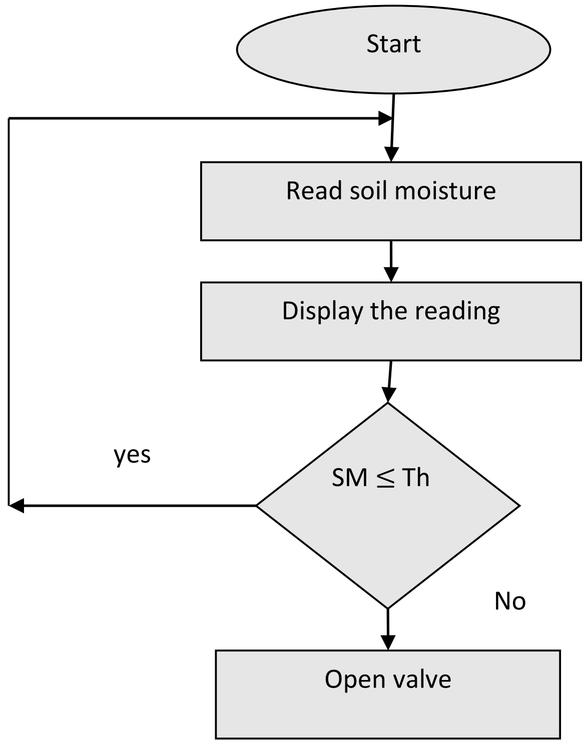

Figure 4. the system flowchart

VIII. CONCLUSION

The aim of this paper was to reduce the waste of water used for irrigation of agricultural crops, as well as the amount of electrical energy used. An automatic irrigation device was designed and put into place as a way to solve this problem. The proposed design satisfies several engineering design constraints, such as economy or energy, and water savings.

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