Faculty of Engineering and Natural Sciences

CE356 - Software Engineering

Elif Pınar HACIBEYOĞLU

Automatic Irrigation System with Arduino

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Aim of The Project

The main purpose of this project is to create a system that delivers automated watering, allowing farmers, gardeners, and others to save time, money, and energy by using greenhouses, for example. In traditional agricultural land irrigation practices, manual involvement is prevalent. This project demonstrates an arduino-based Automatic Irrigation System approach. With this autonomous watering method, human involvement may be reduced. On-site humidity sensors will be installed. When the concentration of water changes, these sensors detect it and send an interrupt signal to the microcontroller. Soil is one of the most vulnerable sources of soil pH, which is used to characterize the degree of acidity or basis that impacts nutrient availability and, ultimately, plant development. As a result, the system will enable automation, remote control, and increased efficiency. The humidity sensor is linked to the internal ports of the microcontroller through a comparator; anytime there is a change in temperature and humidity in the environment, these sensors perceive the change and send an interrupt signal to the microcontroller, causing the motor to turn on. To notify that the pump is turned on, an audio or visual warning is utilized.

Importance of The Project

Irrigation systems are still operated manually in the present. A concept of automated irrigation is proposed in order to use water efficiently and productively. The sensor-based irrigation system is based on a soil moisture sensor, which measures the amount of moisture in the soil and sends the signal to the Arduino, which then irrigates the crops. The Arduino serves as a microcontroller. This will compare the moisture sensor data to the predetermined moisture levels previously recorded in the system. The Arduino will switch the irrigation system ON/OFF based on the information obtained from the sensors. In addition, a moisture sensor is fitted to determine the soil's water content. An automatic irrigation system is really useful for people who work away from the garden and do not have the opportunity during the day. Automatic irrigation systems may be incredibly cost effective and water conserving if correctly built and coded.

This project uses the Arduino UNO to create a moisture-sensing autonomous watering system in a contained environment. This system uses a soil moisture sensor to read the moisture content of the soil and turns on the motor when the moisture level falls below the specified limit for the designated soil under consideration. When the moisture level exceeds the predetermined point, the system turns off the pump. Maybe, an LCD display will show the motor's status as well as the moisture level.

It is critical for quick advancement in food technology production to meet the ever-increasing demand for food and the ever-decreasing supply of food essentials. Agriculture is simply one source of this. This is an essential topic for human cultures to consider in light of the expanding and dynamic need for food production. Irrigation is the technique of artificially submitting water to dry ground or soil in order to make it conducive for plant development. Furthermore, depending on the soil type, the plant should be watered to improve production and yield.

The microcontroller-based system is programmed to switch the motor on and off dependent on the moisture level of the soil. The system's goal is to use a soil moisture sensor to monitor the moisture content of the soil. The goal is to activate the pump when the soil moisture falls below a specified threshold. The next goal is to use an LCD to display the condition of the soil and the tank.

Requirements List

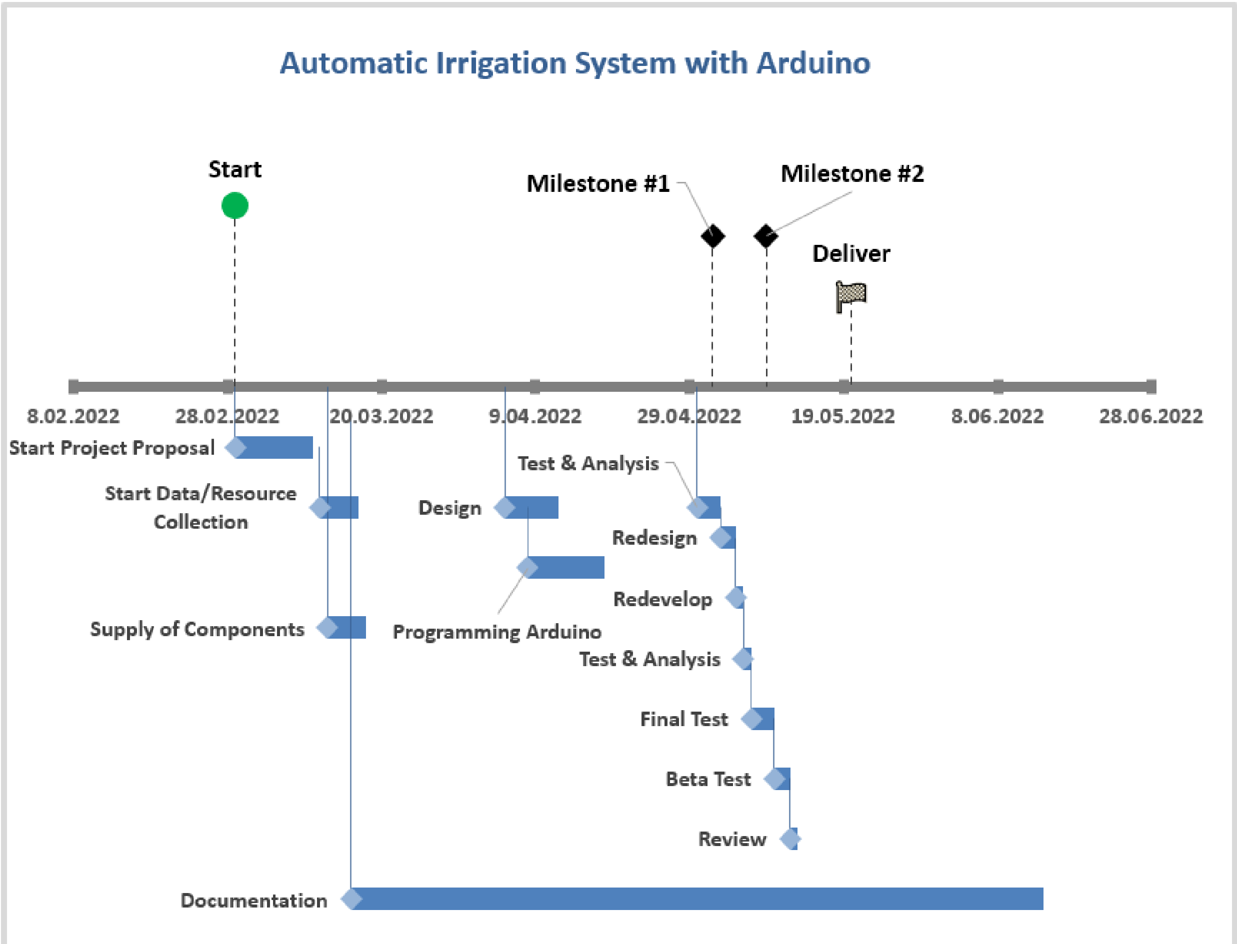
Table 1: Requirements List

Hardware Requirements List

Arduino Uno	The Arduino Uno is an open source microcontroller board which based on the ATmega328P architecture. An Arduino board contain 14 digital input/output pins, 6 analog inputs, a USB connection, and ICSP header, a power jack, a 16MHz quartz crystal and a reset button. The Arduino is the central core of this project as it controls all the hardware that are attached to it.
Soil Moisture Sensor	This sensor is used to detect the moisture level of the soil.
Liquid Crystal Display (LCD)	In this project, the LCD screen will be used to show the moisture level of the soil and the

	pump status set early on the Arduino board by coding.
DC Water Pump	It is used to water the plant by sucking the water from the source and push out the water from the second hole to make the water process complete. It is controlled by the relay module which can be switch on and off automatically based on the signal sent from the Arduino.
Relay Module	It is used to control the on and off of the DC watering pump by opening or closing the electric path that passes to the watering pump. It is controlled by the code from the Arduino.
Resistor	A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines, among other uses.
LED	
Buzzer	A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short).
Pipes	It is used to transmit water from tank to irrigation line.
Breadboard	A breadboard also known as protoboard is a type of solderless electronic circuit building. You can build an electronic circuit on a breadboard without any soldering.

Timeline



Milestone #1: Test & Analysis

Milestone #2: Final Test

Roles

Table 2: Roles

Group Members	***Role***
Samet ŞAHİN	Full Stack
Ömür İsmet KÜÇÜKÇINAR	Tester and Coding
Abdullah Emin ESEN	Research and Coding

Design

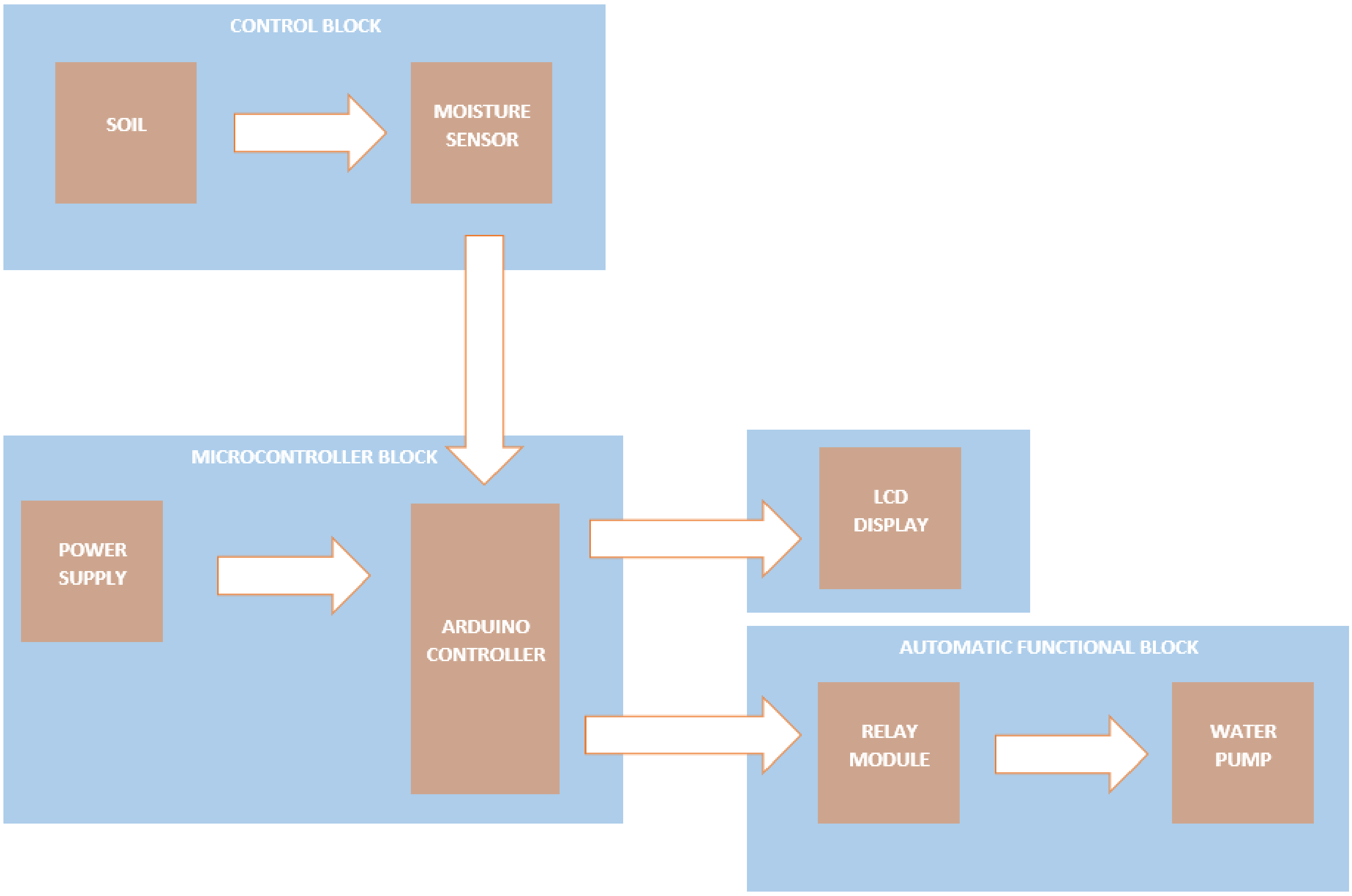


Figure 1: Functional Block Diagram

- **Control Block**

  This block is made up of one soil moisture sensor that collects data from the soil. It is determined by the moisture level of the soil whether to send a high or low voltage to the microcontroller to indicate whether the soil is wet or dry. When the soil is moist, it sends a low output voltage; when it is dry, it sends a high output voltage. This sensor is wired directly to the Arduino microcontroller.

- **Microcontroller Block**

  The Arduino Uno microcontroller serves as the project's core hardware in this block. It receives data from the soil moisture sensor and processes it according to the needs programmed into the microcontroller.

- **Automatic Functional Block**

  The automated watering element of the system is housed in this block. The automated function is controlled by two main pieces of hardware: a relay module and a DC watering pump. A relay is a sort of automated electric switch that uses an electromagnet to switch from OFF to ON or vice versa. The switch controls the electric signal that is transmitted to the water pump. When the moisture level falls below a particular threshold, Arduino sends a signal to the relay module, allowing power to flow through the water pump and water the plant. When the system detects an appropriate amount of water in the soil, the relay closes the electric line, and the water pump immediately stops pumping water.

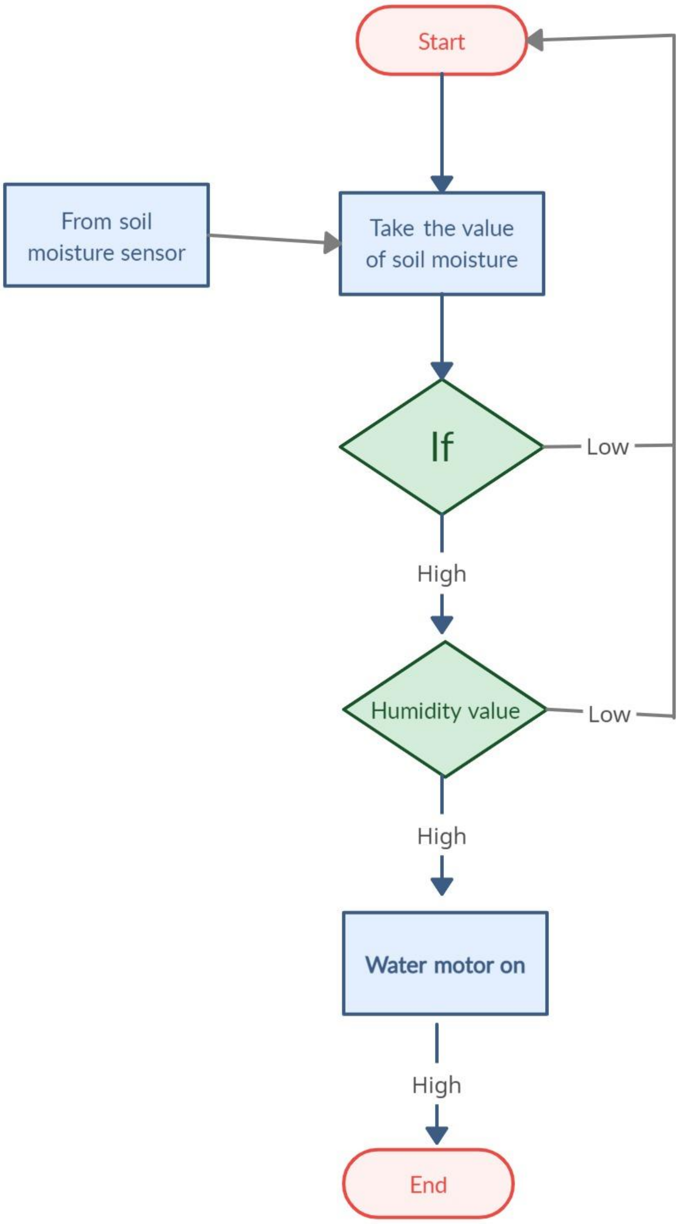


Figure 2: UML Activity Diagram

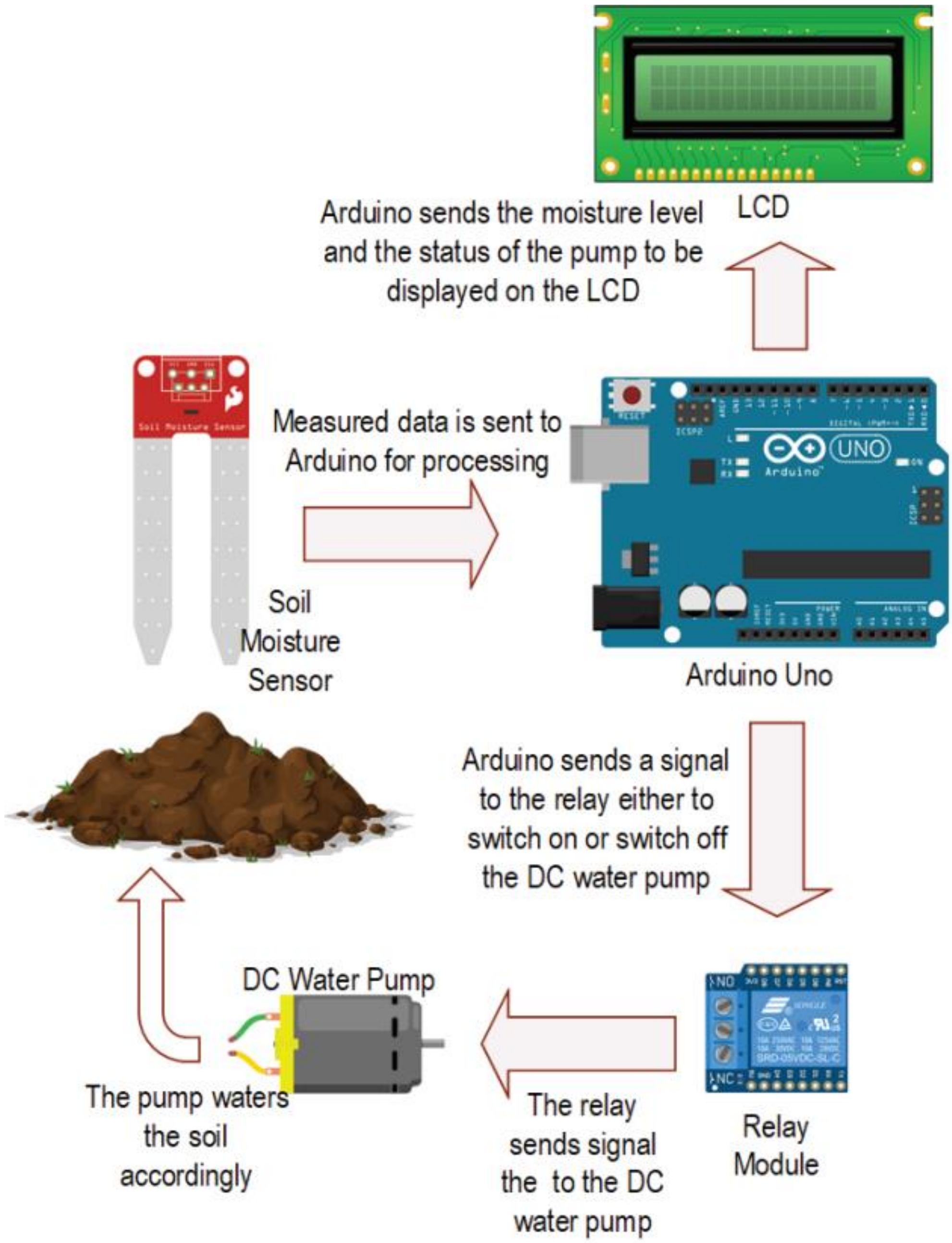


Figure 3 System Architecture

Figure 3 depicts the automated irrigation system's system design. The technique is presented in Figure. 3 to begin with the soil moisture sensor. The sensor detects the amount of moisture in the soil and sends the measured data to Arduino for processing. The moisture level and the state of the DC pump are then communicated from Arduino to the LCD screen to be shown. At the same time, the data will be relayed to a relay, which will trigger the water pump to turn on or off.

Testing

We will calculate the resistances of various soil types to measure and adjust the base value of the pump to be commissioned. Soils with a high water content will have lower resistivity than soil with less water.

Table 3: Testing

Test Cases	***State***	***Relay Switch Connect***	***Water Pump Action***
Over Wet	OFF	Open State	Pump will not run
Optionally Wet	OFF	Open State	Pump will not run
Optionally Dry	ON	Closed State	Pump will run
Fully Dry	ON	Closed State	Pump will run

The soil moisture sensor must be capable of distinguishing between wet and dry soil by displaying the percentage on the LCD display panel. If the soil is dry, the percentage displayed should be low; if the soil is moist, the percent displayed should be high. Table 3 tabulates the results collected from the relay under various test settings. The results illustrate the outputs of the relay during the soil moisture test. The operation of the water pump is regulated by the relay action, and its operation is dependent on the status of the soil moisture, as indicated in table 3.

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