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Embedded Smart Plant Irrigation System

2nd Computer & Systems Engineering Department

Team Members {1}

- Omar Hussein
- Emad Rabie
- Mohamed Ahmed
- Khaled Ayman
- Ahmed Shaban

Introduction

Project Overview

The Plant Irrigation and Climate Control System is an innovative and practical solution designed to help gardeners and plant enthusiasts maintain optimal growing conditions for their plants. This system leverages the power of an Arduino Nano (ATmega328) microcontroller to monitor soil moisture, temperature, and humidity, allowing for precise control of a water pump and a fan. By ensuring that plants receive the right amount of water and regulating the environmental conditions around them, this project aims to promote healthier, more productive vegetation.

Purpose of the Project

The primary purpose of this project is to automate the process of plant care, making it easier for individuals with busy schedules or those who may lack the expertise to maintain an ideal plant environment. By monitoring soil moisture levels and climate parameters, this system ensures that plants receive water when they need it and that temperature and humidity stay within the desired range. This project's goal is to create a hands-off, efficient, and sustainable solution for plant care.

Key features of this Smart System include

Password Protection

Users have the option to set a secure password (Four Integers at least) to control system access. They can also from menu list enter number 1, change the password as needed but under constraints for enhanced security.

Add Plant Configuration

Users can easily add and configure plant-specific constraints and requirements, customizing watering schedules to suit each plant's individual needs. This flexibility ensures that your garden or agricultural plot receives optimal care tailored to your beloved plants.

System Activation

The system can be started with a simple command. This feature streamlines the irrigation process and fire protection, allowing users to initiate watering or fire response based on their preferences and the environmental conditions.

LCD Display

The system employs an LCD display that provides real-time information, including date, system status, and fire alerts, making it easy to monitor and manage your plant irrigation and fire protection setup.

Program Reset

A convenient reset option is available, ensuring that users can quickly return the system to its default settings in case of any issues.

System Description

The Plant Irrigation and Climate Control System is designed to create and maintain optimal growing conditions for plants. This section provides an in-depth explanation of how the system operates, from data acquisition to decision-making and control.

Data Acquisition

The system collects data from multiple sensors to gain insights into the environment surrounding the plants. Key sensor components include:

Soil Moisture Sensor

The soil moisture sensor measures the moisture content in the soil. It provides analog sensor readings that reflect the soil's moisture level. The sensor's probe is inserted into the soil, and the Arduino reads these values through an analog pin.

Temperature and Humidity Sensor

The DHT11 sensor measures temperature and humidity in the vicinity of the plants. It provides digital readings for temperature and humidity.

Control Logic

The system's Arduino sketch includes control logic that processes the sensor data and makes decisions on when to activate the water pump and fan. The key components of the control logic are:

Soil Moisture-Based Watering

The soil moisture sensor data is used to determine the need for watering. The control logic checks if the current soil moisture reading is below a predefined threshold. If the moisture level is too low, the system activates the water pump to irrigate the plants.

Climate Control

The temperature and humidity sensor data is analyzed to manage the environmental conditions. The system can use this information to control the fan for temperature regulation:

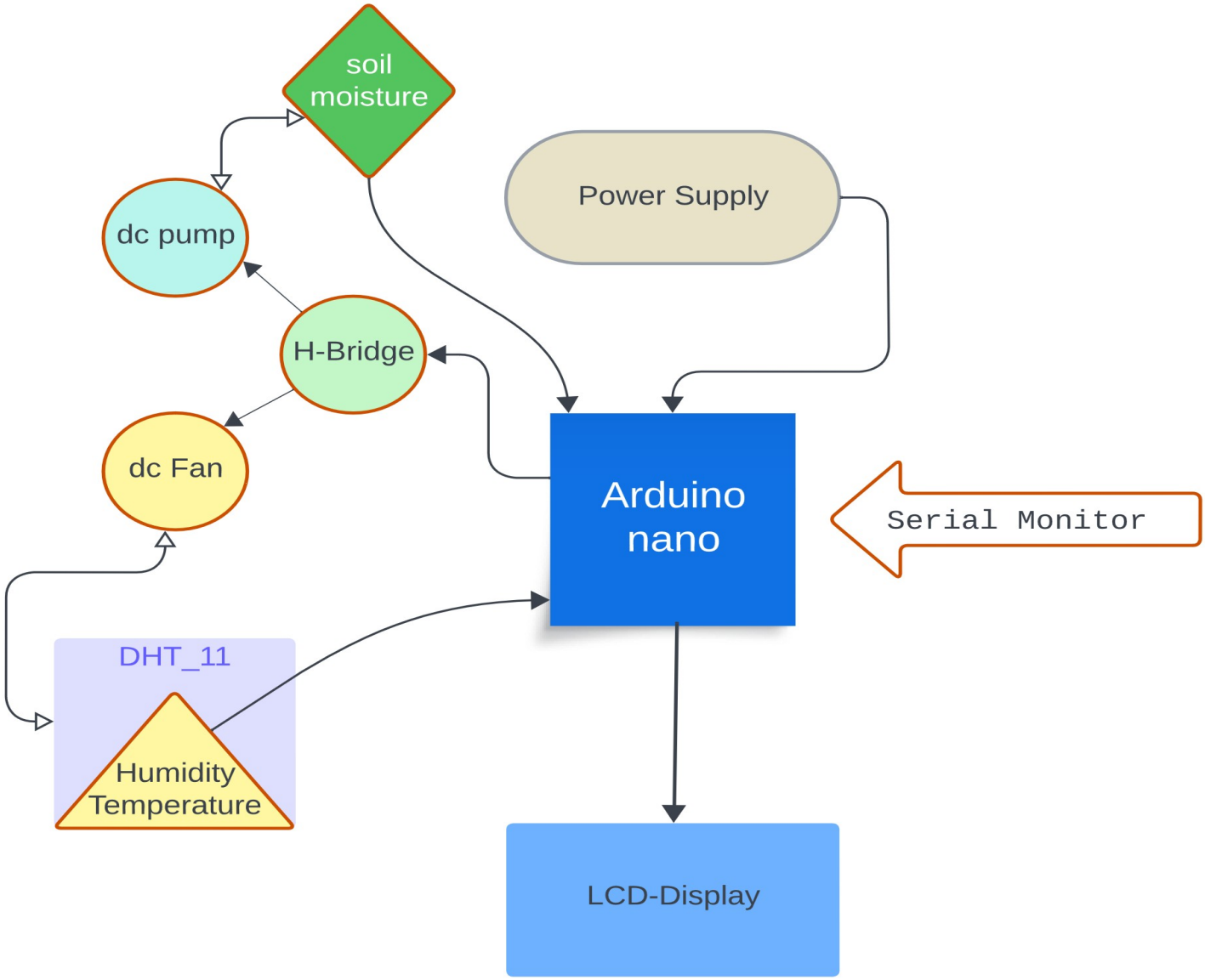
Cooling with the Fan: When the temperature rises above a set threshold, the system activates the fan to reduce the temperature by increasing air circulation.

Safety Mechanisms

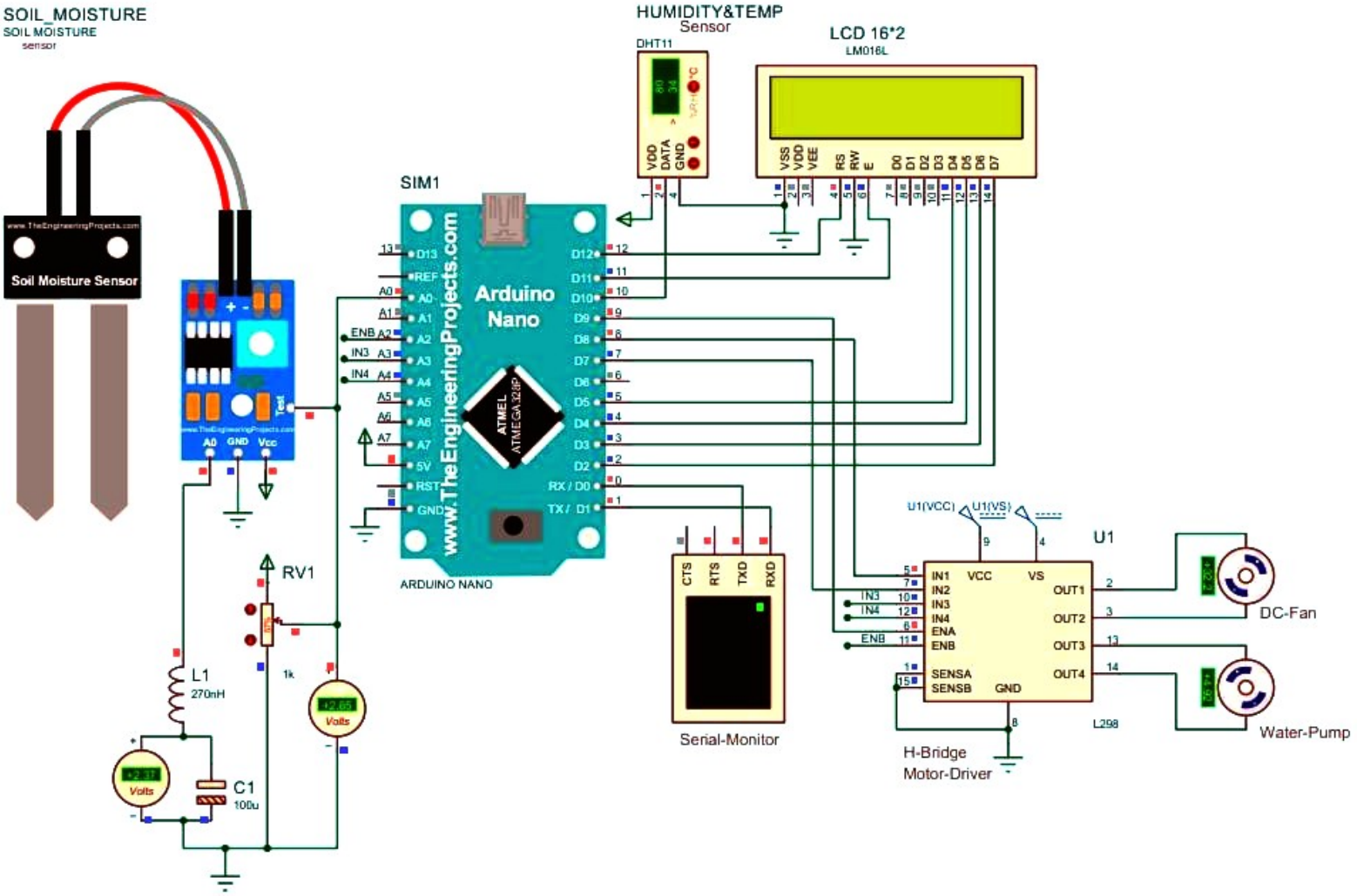
The system includes safety features to prevent over-watering and protect components from overuse or malfunction:

Maximum Watering Duration: To prevent over-watering, the system has a predefined maximum watering duration. If the system runs for this duration and the soil moisture threshold hasn't been met, it will suspend further watering.

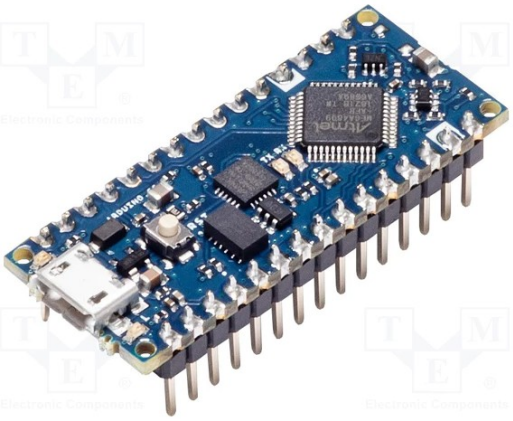
Diagram


soil moisture
Power Supply
dc pump
H-Bridge
dc Fan
Arduino nano
Serial Monitor
DHT_11
Humidity
Temperature
LCD-Display

Simulation


SOIL_MOISTURE
SOIL MOISTURE
sensor
Soil Moisture Sensor
A0 GND Vcc
HUMIDITY&TEMP
Sensor
DHT11
VDD DATA GND
LCD 16*2
LM016L
VSS VDD VEE RS RW E D0 D1 D2 D3 D4 D5 D6 D7
SIM1
Arduino Nano
www.TheEngineeringProjects.com
ATMEL ATMEGA328P
ARDUINO NANO
RV1
1k
L1
270nH
C1
100u
Volts
CTS RTS TXD RXD
Serial-Monitor
U1(VCC)
U1(VS)
U1
IN1 IN2 IN3 IN4 ENA ENB SENSA SENSB
VCC VS GND
OUT1 OUT2 OUT3 OUT4
L298
H-Bridge
Motor-Driver
DC-Fan
Water-Pump

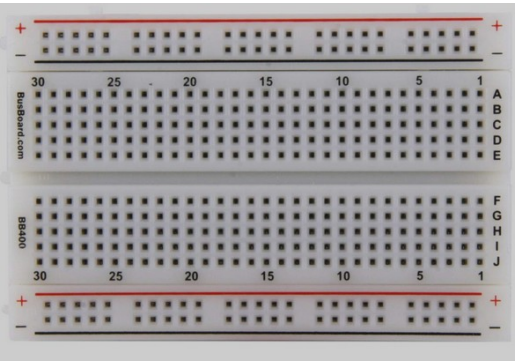
Hardware Components



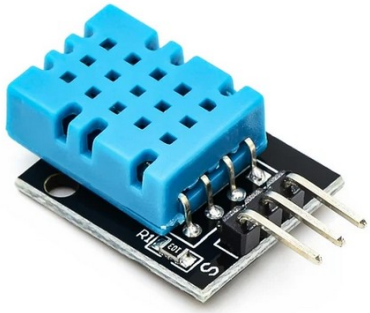
Arduino NANO Kit

USB Cable

LCD 1602



Breadboard

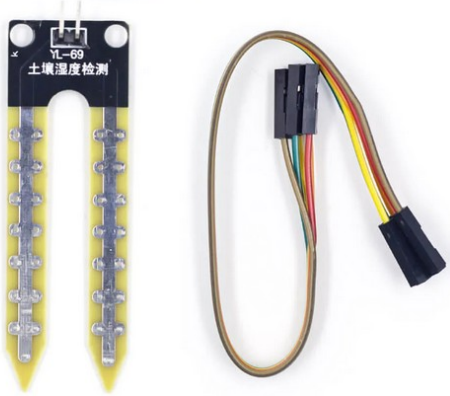


Temperature & Humidity Sensor (DHT1
Module “KY-015”

5V-DC-Fan

5V-DC-Pump

Bridge L298 Module



Soil Moisture Detection
Humidity Sensor Module

https://github.com/