Automatic controlling system of pump based on temperature and moisture conditions along with Monitoring using IOT

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Abstract:

The aim of the project " Automatic controlling system of pump based on temperature and moisture conditions along with Monitoring using IOT"is to use IoT technology to offer an effective irrigation solution for agriculture. The primary controller of the system is an Arduino board, and sensors like the DHT11 and soil moisture sensors are used to measure critical variables including temperature, humidity, and soil moisture. The sensor values are displayed on an LCD screen for farmers to easily monitor. To automate the irrigation operation, a relay and pump are also incorporated into the system. In order to make sure that crops receive water when necessary, the relay triggers the pump when the temperature rises beyond a predetermined threshold and the soil moisture sensor detects dry conditions.

The irrigation system's connectivity and operation are improved with the inclusion of Python code, which sends Moisture and Motor status to gmail. This enables farmers to use their smartphones to monitor the irrigation system. Farmers can obtain up-to-date information about crop conditions and environmental factors affecting them in real-time by uploading sensor data .

Introduction:

A sustainable irrigation system for farmers is what the project " Automatic controlling system of pump based on temperature and moisture conditions along with Monitoring using IOT" aims to solve. Conventional irrigation techniques frequently require human intervention and can cause crops to be either overwatered or underwatered, wasting resources and producing lower yields. This idea offers a creative solution that uses Internet of Things technology to automate and improve the irrigation process in response to these difficulties. The system intends to give farmers real-time insights into soil conditions and water requirements by integrating sensors, controls, and data transfer capabilities, ultimately enabling more accurate and efficient irrigation management.

Arduino microcontrollers, which act as the core processing units for obtaining and processing data from a variety of sensors, are the fundamental component of the suggested system. In order to gather important environmental data, these sensors—which include DHT11 sensors for temperature and humidity monitoring and soil moisture sensors—are placed strategically across the agricultural areas. The device can intelligently decide when and how much water to supply the crops by continuously monitoring these data. By proactively conserving water and fostering healthy crop growth and plant development, this proactive irrigation strategy maximizes agricultural output and sustainability.

Existing System:

Farmers mostly use manual observation and intuition with the current irrigation techniques to figure out when and how much water to give crops. Conventional methods that farmers may employ include visually assessing the moisture content of the soil or scheduling irrigation according to preset times. But these are not precise procedures, and you risk either overwatering or underwatering your crops, which wastes water and doesn't produce the best results. Scalability and productivity are further restricted by the manual nature of these procedures, which necessitates a large labor and time investment. It's also possible that conventional irrigation techniques don't account for changes in weather patterns or soil conditions, which could result in uneven water application and crop stress. All things considered, using traditional irrigation techniques presents difficulties in attaining effective resource use .

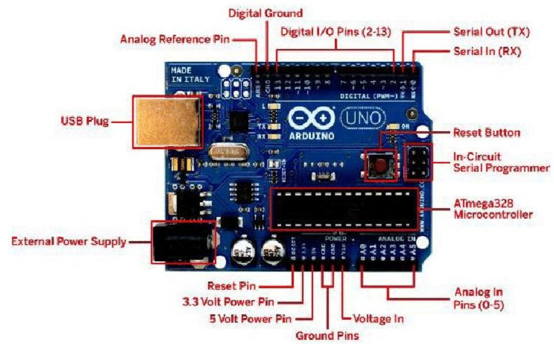
Proposed system:

The project's suggested technique involves setting in place a smart irrigation system that is IoT-based. An Arduino microcontroller is integrated with a number of sensors, including DHT11 and soil moisture sensors, in this system. These sensors enable more precise and accurate irrigation control by providing real-time data on temperature, humidity, and soil moisture levels.The Python code that communicates the moisture and motor status to gmail improve the irrigation system's connectivity and functionality. This makes it possible for farmers to keep an eye on their irrigation system using smartphones.

In addition, the suggested approach makes use of pumps and relay modules to automate the irrigation process in accordance with preset thresholds. The relay initiates the pump to irrigate the crops when the temperature rises above a predetermined threshold and the soil moisture content drops. By minimizing the need for human intervention and guaranteeing that crops receive the right amount of water at the right time, this automation optimizes water use and increases crop output. Overall, the suggested approach provides farmers with data-driven insights and automation capabilities to improve agricultural productivity, making it an economical and clever answer to irrigation management.

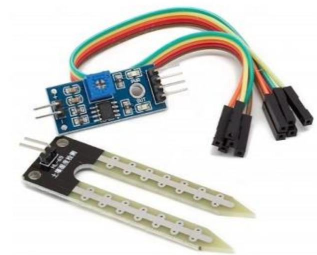
Hardware Requirments:

1. **Arduino UNO**



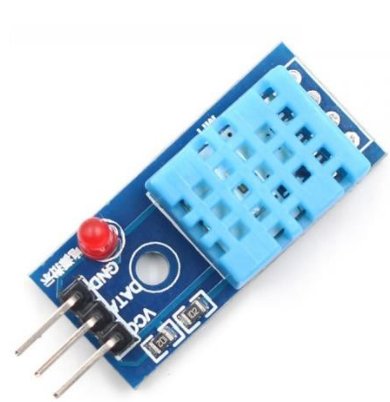
The Arduino Uno, which features an Atmega328 microcontroller, 14 digital I/O pins, 6 analog pins, and a USB interface, is a very useful addition to the world of electronics. Using the Tx and Rx pins, serial communication is also supported.

2.Soil Moisture Sensor



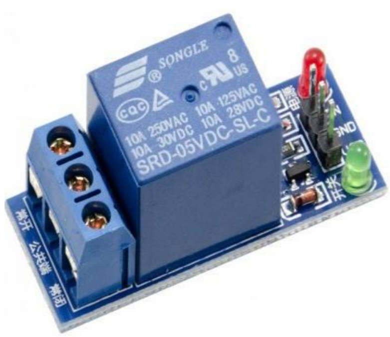
For measuring the volumetric content of water in the soil, one type of sensor utilized is the soil moisture sensor. Elimination, drying, and sample weighting are required for the straight gravimetric dimension of soil moisture. Instead of using direct measurements, these sensors use indirect methods that rely on the dielectric constant, electrical resistance, interaction with neutrons, and replacement of moisture content in the soil.

3.DHT11 SENSOR (TEMPERATURE/HUMIDITY)



A simple, inexpensive digital temperature and humidity sensor is the DHT11. It measures the ambient air using a thermistor and a capacitive humidity sensor before emitting a digital signal on the data pin (no analog input pins are required). Although it is pretty easy to operate, time is crucial in order to capture data. This sensor's only true drawback is that it only provides fresh data every two seconds.

4. Relay



Relays are electromagnetic switches that are used in situations when multiple circuits need to be controlled by a single signal or to turn a circuit on and off using a low power signal. The majority of high-end industrial application equipment rely on relays to function properly. Relays are basic switches that can be turned on and off physically or electrically.

5. DC Motor Pump

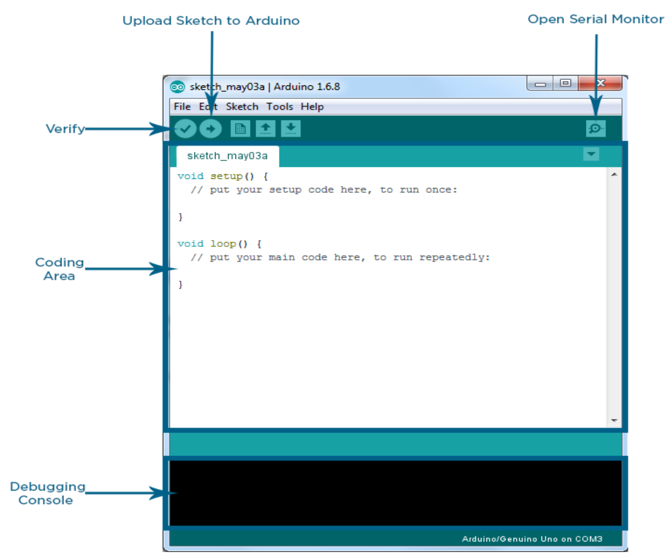
DC driven pumps transfer water in a number of ways by using direct current (DC) from a motor, battery, or solar power. Usually, motorized pumps require 6, 12, 24, or 32 volts of DC electricity to function. Photovoltaic (PV) panels with solar cells—which generate direct current when exposed to sunlight—are used in solar-powered DC pumps.

7. LCD

The technology used in scratch pad displays and other smaller PCs is called LCD (Liquid Crystal Display). Similar to gas-plasma and light-producing diode (LED) innovations, LCDs enable presentations that are far more slim than those made using cathode beam tube (CRT) innovations. Because LCDs operate by blocking light rather than emitting it, they use a great deal less electricity than gas and LED displays.

Software Requirements:

Arduino IDE:

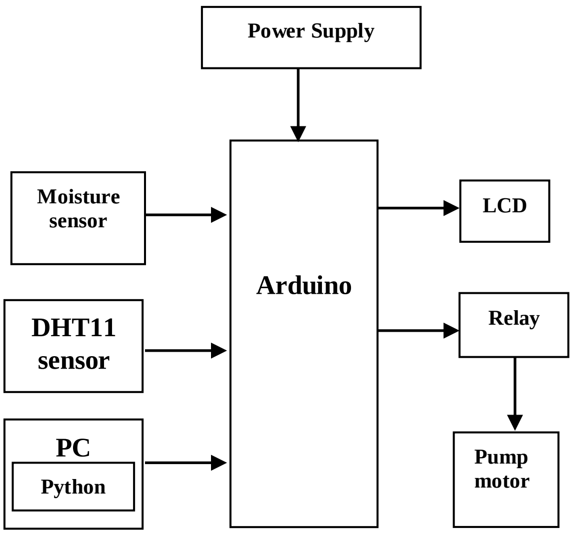


The official software released by Arduino.cc, known as the Arduino IDE (Integrated Development Environment), is primarily used for authoring, compiling, and uploading code to the Arduino device. This program is available as open source and can be installed quickly to begin compiling code while on the go. It is compatible with almost all Arduino modules.

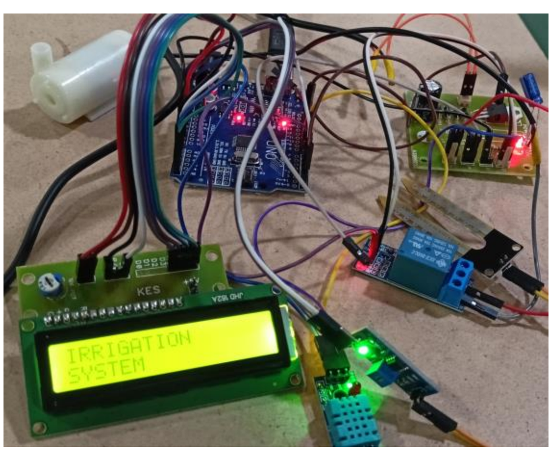
Python IDLE:

Data from a soil moisture sensor linked to an Arduino UNO is read using Python programming. To read the data from the sensor and interact with the Arduino board, we have to use a serial connection. In order to read analog or digital sensor data for this, we can directly interact with the GPIO pins. Libraries like smtplib are utilized to communicate serially with Arduino.

Block Diagram:



Hardware Design:



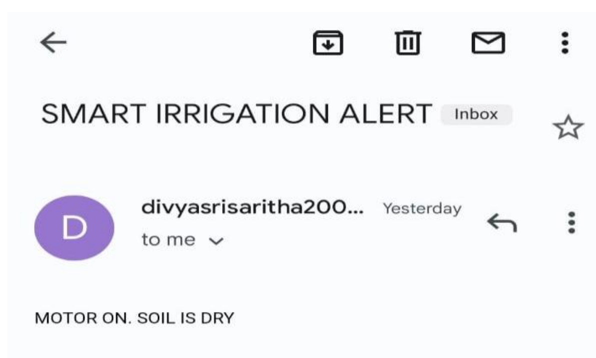
Hardware setup

Turn on the motor if the temperature is higher than 34C and the soil moisture content is 1 (dry). Also, the motor will turn on if the temperature rises over 34C and the soil moisture content is 0 (wet).

The motor will be turned off if the temperature drops below 34°C and the soil is wet (0°). Moreover, the motor turns on if the temperature drops below 34°C and the soil moisture content is 1 (i.e., dry).

Implementation:

Gmail Notification



Farmers will receive a Gmail notification about Moisture and motor status using Python code.

Python programming is used for irrigation system to improve its connectivity and functionality. The code communicates the moisture and motor status to gmail. This allows farmers to keep an eye on the irrigation system using their smartphones.

APPLICATIONS

1. Precision Agriculture Optimization: By giving farmers exact control over irrigation, the system makes sure that crops get the proper amount of water at the right time. Increased yields, better crop health, and less water waste are the results of this precision.
2. Water Conservation: The system can save a lot of water by preventing overwatering and waterlogging by continuously monitoring soil moisture levels and meteorological conditions. This is especially important in areas where there is a drought or a shortage of water.
3. Cost Reduction: The technology lowers farmers' operating expenses by intelligently automating tasks and allocating resources effectively. Farmers may reduce labor costs and water expenditures by doing away with manual work and optimizing water utilization, which will increase overall profitability.

Conclusion:

In conclusion, the Internet of Things-based intelligent irrigation system offers a revolutionary approach to contemporary agriculture, tackling major issues that confront farmers all over the world. Through the utilization of cutting-edge technologies like automation, data analytics, and sensor networks, the system provides agricultural irrigation management with previously unheard-of levels of sustainability, efficiency, and precision. Farmers are able to optimize water use, reduce resource waste, and increase crop output by using real-time monitoring of soil moisture, weather, and crop health.

Moreover, farming methods are made more convenient and flexible by the system's capacity to remotely monitor and control irrigation operations. Using internet-enabled equipment, farmers can remotely access vital information and control their irrigation systems, enabling them to react quickly to shifting crop needs and environmental conditions. In addition to increasing operational effectiveness, this remote accessibility helps farmers better balance their workload and make deft decisions while they're on the go.

Furthermore, implementing IoT-based smart irrigation technology is a big step in the direction of environmentally conscious and sustainable agriculture. Through water conservation, less chemical runoff, and improved soil health, the system helps to mitigate the negative effects of climate change while supporting agricultural ecosystems' long-term survival. As agriculture develops further in response

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