SMART IRRIGATION SYSTEM

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Abstract

In this study we propose a smart irrigation system that will water our plant automatically or manually based on our commands. In our proposed system, irrigation decisions are dynamically changed in response to changing environmental conditions and according to particular crop. We are measuring three environmental factors:soil moisture, temperature and humidity. In manual mode, we determine when to water and when to stop according to our need. In automatic mode, the motor turns on or off based on predefined sensor threshold values.

Keywords
Smart irrigation, Soil moisture, Humidity and temperature, Bluetooth Module

1 Introduction

In India, agriculture is the need of most of the Indians' livelihood and one of the main sources of income. Also it has a major impact on the economy of our country. But as per the current scenario, consumption of water in the processes of agriculture is increasing day by day that may lead to the problem of water scarcity. Nowadays, farmers are struggling hard in the agriculture departments and the task of irrigation is becoming quite difficult for them. The lack of regularity in their work and negligence lead to an unacceptable amount of wastage of water. Similarly, if they even forget to switch ON the irrigation system, it again leads to the damage of crops. The effects of the applied amount of irrigation water, irrigation frequency and water use are particularly important. To improve water efficiency there must be a proper irrigation scheduling strategy. Looking at these aspects, we have developed smart irrigation system which measures the moisture of the soil and automatically turns on or off the water supply system.In this project we have a soil moisture sensor which is used for sensing the moisture level,whether the soil is dry or wet. We have DHT22 temperature and humidity sensor to measure these parameters. After collecting data from these sensors we will set threshold values for particular plant, and our machine will do the rest.

2 Smart irrigation system Components required

Arduino Uno
Soil moisture sensor
DHT22 Temperature and Humidity sensor
Bluetooth Module HC05
DC Motor pump
Jumper wires.
L293d IC
Breadboard

3 SMART PLANT IRRIGATION SYSTEM

The proposed irrigation learning model is implemented in an prototype IoT system. This system has following main parts. The first one is the sensors and actuator part, which acquires sensor data from the environment. Besides, it actuates the water pump motor when the system decides. The second part is the end user part in which a mobile device can send manual irrigation requests. At first we set our model at manual mode, we can switch modes through mobile application at any time.

3.1 Sensors and Actuator Part

We connect all sensors and motor actuators to an edge device, named as Arduino. This device acquires data from the environment, timestamps them, and decide if plant needs water or not

based on threshold value predefined by user. If any irrigation decision is made from the server, it actuates the related motor and irrigation process starts, and after reaching to threshold value it stops automatically.

3.2 System User Part

We can interact with server part through mobile phone as we establish Bluetooth module in our model, where we can set how we are going to operate irrigation weather automatically or manually. In manual mode we can start or off watering through mobile only.

4 Aurdino Code

```
#include "DHT.h"
#include <SoftwareSerial.h>

#define DHTPIN 13
#define ledPin 7

int sensor_pin = A0; // Soil Sensor input at Analog PIN A0
int output_value ;

#define DHTTYPE DHT22
DHT dht(DHTPIN, DHTTYPE);
int data = 0;
void setup() {

  // put your setup code here, to run once:

  pinMode(7,OUTPUT);
  pinMode(ledPin, OUTPUT);


     Serial.begin(9600);
     dht.begin();
     digitalWrite(ledPin, LOW);

   Serial.println("Reading From the Sensor ...");
   Serial.begin(9600); //default baud rate for bt 38400


   delay(2000);

}



  // put your main code here, to run repeatedly:

 void loop() {

  output_value= analogRead(sensor_pin);

output_value = map(output_value,550,10,0,100);

  Serial.print("Mositure : ");

  Serial.print(output_value);

  Serial.println("%");

    // Reading temperature or humidity takes about 250 milliseconds!
  // Sensor readings may also be up to 2 seconds 'old' (its a very slow sensor)
  float h = dht.readHumidity();
  // Read temperature as Celsius (the default)
  float t = dht.readTemperature();
  // Read temperature as Fahrenheit (isFahrenheit = true)
  float f = dht.readTemperature(true);

  // Check if any reads failed and exit early (to try again).
  if (isnan(h) || isnan(t) || isnan(f)) {
    Serial.println(F("Failed to read from DHT sensor!"));
    return;
  }

  // Compute heat index in Fahrenheit (the default)
  float hif = dht.computeHeatIndex(f, h);
  // Compute heat index in Celsius (isFahreheit = false)
  float hic = dht.computeHeatIndex(t, h, false);

  Serial.print(F("Humidity: "));
  Serial.print(h);
  Serial.print(F("%Temperature:"));
  Serial.print(t);
  Serial.print(F("C"));
  Serial.print(f);
  Serial.print(F("F Heatindex:"));
```

```
76  Serial.print(hic);
77  Serial.print(F("C"));
78  Serial.print(hif);
79  Serial.println(F("F"));
80
81   if(output_value<=10){
82      if(h<=50){
83          digitalWrite(7,HIGH);
84       }else{
85          digitalWrite(7,LOW);
86       }
87     }else if(output_value<=50){
88      if(t>25){
89          digitalWrite(7,HIGH);
90       }else{
91          digitalWrite(7,LOW);
92       }
93     }else{
94        digitalWrite(7,LOW);
95       }
96   //bluetooth working in this
       loop
97  if(Serial.available() > 0){ //
      Checks whether data is
      comming from the serial port
98    data = Serial.read(); // Reads
        the data from the serial
       port
99
100          if (data == '0') {
101            digitalWrite(ledPin,
                 LOW); // Turn LED
                 OFF
102            Serial.println("LED:␣
                 OFF");
103            }
104              else if (data == '1'
                   ) {
105                digitalWrite(
                     ledPin, HIGH);
106                Serial.println("
                     LED:␣ON");
107
108              }
109  }
110}
111   delay(1000);
112
113}
```

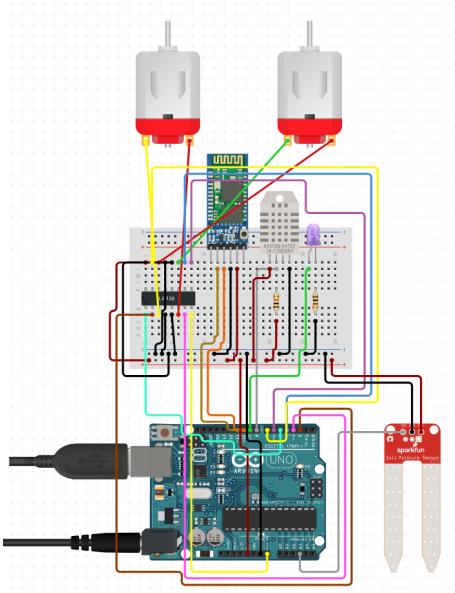

Figure 1: circuit diagram.

5 Results

This technology is recommended for efficient automated irrigation systems and it may provide a valuable tool for conserving water planning and irrigation scheduling which is extendable to other similar agricultural crops. Maximum absorption of the water by the plant is ensured by spreading the water uniformly using a motor. So there is minimal wastage of water. This system also allows controlling the amount of water delivered to the plants when it is needed based on types of plants by monitoring soil moisture and temperature. This project can be used in small area or in plant nursery where human effort needs to be minimized. Many aspects of the system can be customized and fine tuned through Bluetooth application for a plant requirement

6 Future aspect of our project :

We believe that our model will be more advanced because within the model We will use four different supervised machine learning methods to evaluate the success of our irrigation model,namely KNN, LR, GBRT and GNB approach in our IoT solution. Our aim will be that the suggested system can learn the watering habits of various plants. We aim to develop a smart irrigation model that mimics the unstructured decision process of the human-controlled irrigation, done by agronomists. This model au-

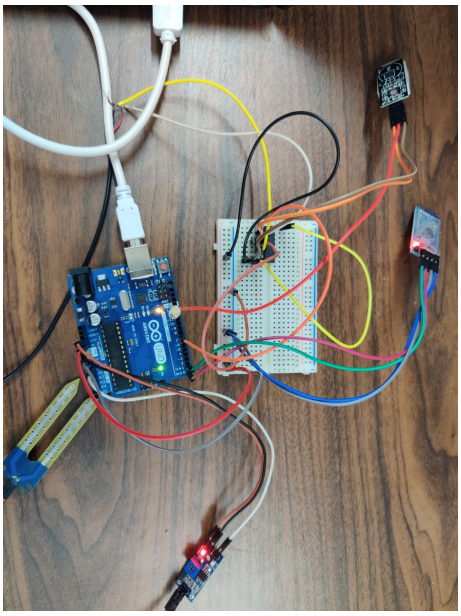

Figure 2: Working model.

```
MOTOR: OFF
MOTOR: ON
Mositure : -41%
Humidity: 49.60%  Temperature: 28.90°C 84.02°F  Heat index: 29.48°C 85.07°F
Mositure : -42%
Humidity: 49.60%  Temperature: 28.90°C 84.02°F  Heat index: 29.48°C 85.07°F
Mositure : -43%
Humidity: 49.50%  Temperature: 28.90°C 84.02°F  Heat index: 29.47°C 85.05°F
Mositure : -42%
Humidity: 49.50%  Temperature: 28.90°C 84.02°F  Heat index: 29.47°C 85.05°F
Mositure : -40%
Humidity: 50.80%  Temperature: 29.00°C 84.20°F  Heat index: 29.76°C 85.56°F
Mositure : -30%
Humidity: 50.80%  Temperature: 29.00°C 84.20°F  Heat index: 29.76°C 85.56°F
Mositure : -37%
Humidity: 50.80%  Temperature: 29.00°C 84.20°F  Heat index: 29.76°C 85.56°F
MOTOR: OFF
```

Figure 3: Sensor Output.

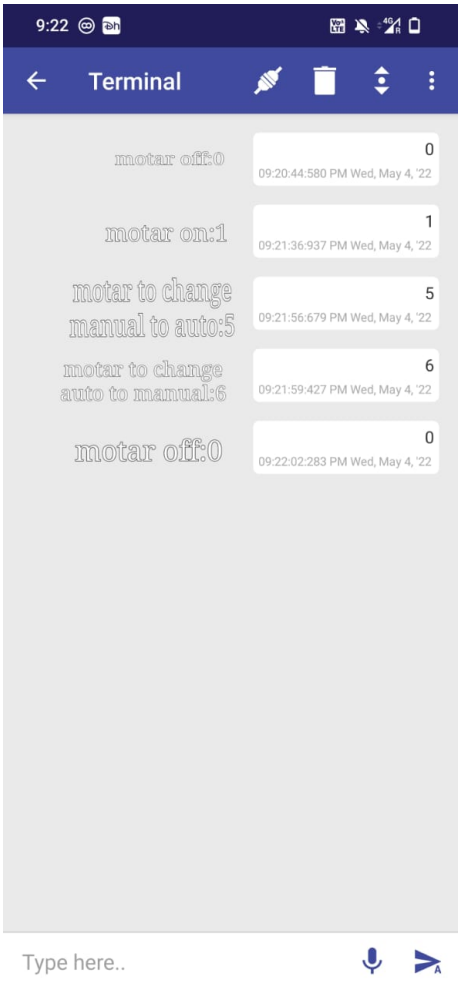

Figure 4: Mobile Application.

tonomously adapts itself to a defined irrigation habit with an enhanced learning method by considering the plant's characteristics. It uses a machine learning approach for revealing the mathematical connections of the environmental variables needed in the determination of the irrigation habit and enhances its learning procedure as the amount of irrigation data accumulates in the system.

Conclusions

A Smart Irrigation and Monitoring System have been proposed so as to reduce wastage of water and to automate the irrigation structure of large areas of crops. The system mainly monitors the behavior of soil moisture and see how it contributes to evaluate the needs of water in a plant. The system uses IoT. It compares actual values obtained from sensors with a threshold value that has been fed to the system for analysis. The farmer he also can choose to turn on the water pump with a button click i.e. option of manual control is made available. Moreover, the system has a web app and is helpful if ever the farmer wants to see the statistical sensor data and assess the change in sensor readings throughout a time period. In the present era, the farmers use irrigation technique through the manual control, in which the farmers irrigate the land at regular intervals. This process seems to consume more water and results in water wastage. Moreover in dry areas irrigation becomes more difficult. Hence we require an automatic system that will precisely monitor and control the water requirements in the field. Installing Smart irrigation system saves time and ensures judicious usage of water.

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