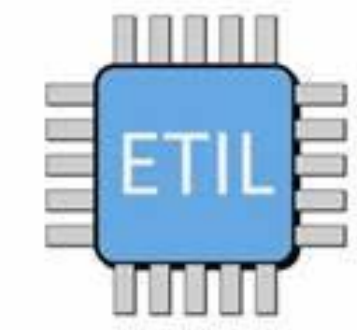
SMART HOME GARDENING SYSTEM

ETI - LABS

Online Project based Internship Program

On

Internet of Things and Machine Learning



TRAINING REPORT

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ABSTRACT

Plant provides us with almost all the basic needs for survival but we are unable to provide plant with its basic needs like water, non-polluted oxygen and as a result plants are unable to survive.

Through our project Smart Home Gardening that is IOT based which sense the requirement of the plant and provide it with water as the soil loses its moisture.

Different soils have different fertility and moisture level so we have soil and moisture sensor used in this to detect the problem.

In our country there are different seasons and each day have different temperature and humidity level, so to check the temperature and humidity for the better health and survival of plant temperature and humidity sensor are used which regularly sends data to the server.

And on the basis of the data provided it will also suggest different kind of plants best suitable for the particular environmental conditions.

INTRODUCTION

PROBLEM STATEMENT

Beginners, who are new to Home gardening, require information and details about the basic conditions for plant growth.

For example-

1. Types of plant growing in a particular weather condition.
2. Seed sowing time.
3. Soil type to use.
4. Watering frequency.
5. Frequency of the compost addition to the soil.

LITERATURE SURVEY

The main functions of the proposed system are:

- Spontaneous temperature, humidity and soil moisture.
- To transfer data over internet through wifi module to server.
- To provide the variety of plants that can be grown on the basis of the data provided.

PROPOSED SOLUTION

A machine which would take data of weather conditions of the area, and the temperature and humidity data of the particular place for the gardening. Then it provides the list of plants which can be grown in the region in 3 categories :-

i) decorative plants

ii) vegetable plants

iii) medicinal plants, which can be grown in houses easily.

The user can select the plant he wants to grow and then the machine provides the basic details of the plant, i.e.-

1. Seed sowing time
2. Soil type to be used
3. Watering frequency
4. Sunlight needed
5. Any other specification for maintenance of the plant.

Further the machine will also provide the user notifications for timeline of plant growth, such as, what should be the average height of the plant grown at the time, time for the flowers to start blooming or in case of any change in the maintenance of the plant along the timeline.

Moreover, the information of each individual's home garden will be collected and stored making the machine learn for more popular plants in the regions and their growth status based on the care provided by the user.

ALGORITHM

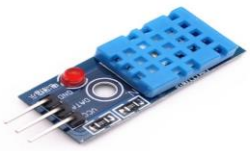
1. Start
2. Import all the required libraries
3. Read the csv file dataframe : dataset1.csv in dataset and dataset2.csv in dataset2
4. Print the head and description of the dataset
5. Print the null values.
6. Split the data into x and y based on the column's data.
7. Divide the data into test and training data in 20% and 80% of total data.
8. Print the train and training data.
9. Now carry out following comparisons:
   a. values in column Temperature LL of dataset <= 20 (store the corresponding rows data t1clas)
   b. values in column Temperature UL of t1clas >= 20 (store the corresponding rows data in tclas)
   c. values in column Humidity LL of tclas <= 97 (store the corresponding rows data h1tclas)
   d. values in column Humidity UL of h1tclas >= 20 (store the corresponding rows data in htclas)
10. print htclas data
11. Now we left merge the two datasets (left merge : dataset+dataset2) and store the merged dataset in merged.
12. Now carry out following comparisons:
    a. values in column Temperature LL of merged <= 20 (store the corresponding rows data t2clas)
    b. values in column Temperature UL of t2clas >= 20 (store the corresponding rows data in t3clas)
    c. values in column Humidity LL of t3clas <= 97 (store the corresponding rows data h2tclas)
    d. values in column Humidity UL of h2tclas >= 20 (store the corresponding rows data in h0tclas)

13. Print h0clas
14. Read the data stored from the sensors in csv file dataframe : 1.csv in df3 and 2.csv in df4
15. Store the value of 3rd row in field1 column of df3 dataframe in a
16. Store the value of 3rd row in field2 column of df4 dataframe in b
17. Now carry out following comparisons:
    a. values in column Temperature LL of dataset <= a (store the corresponding rows data t10clas)
    b. values in column Temperature UL of t10clas >= a (store the corresponding rows data in t0clas)
    c. values in column Humidity LL of t0clas <= b (store the corresponding rows data h1t0clas)
    d. values in column Humidity UL of h1t0clas >= b (store the corresponding rows data in ht0clas)
18. print ht0clas data
19. Now we left merge the two datasets (left merge : dataset+dataset2) and store the merged dataset in merged.
20. Now carry out following comparisons:
    a. values in column Temperature LL of merged <= a (store the corresponding rows data t20clas)
    b. values in column Temperature UL of t20clas >= a (store the corresponding rows data in t30clas)
    c. values in column Humidity LL of t30clas <= b (store the corresponding rows data h2t0clas)
    d. values in column Humidity UL of h2t0clas >= 20 (store the corresponding rows data in h0t0clas)
21. Print h0t0clas
22. End

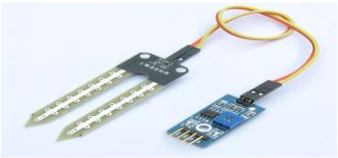
ARCHITECTURE

POWER SUPPLY

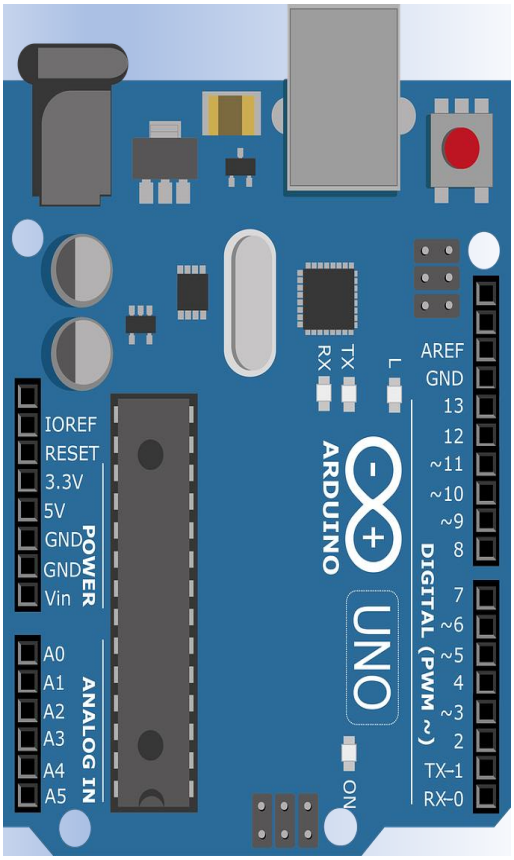
Humidity Sensor



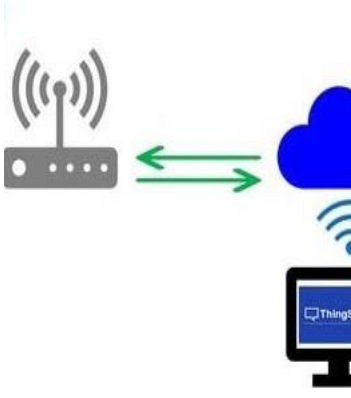
Soil Moisture



Temperature Sensor



OUTPUT



The proposed model consists of sensors to supervise the content of soil moisture. To achieve a proper plant growth by implementing new sensor technologies,

- Frequent updating of status of field and yield parameters, Analytics of better data collection to gather information,
- Optimizing cost and time,
- Record all the information for future reference, and
- Integration of software to improve the productivity.

COMPONENTS

1 The microprocessor : NodeMCU is used and highly preferred in our project for its integrated wifi module facility, makes use of wifi easier without hooking a bunch of extra wires. Plus its more economical.

2 The DHT 11 or DHT 22 sensor for monitoring temperature and humidity in air : DHT22 is more precise and DHT11 can provide more frequent readings hence, are preferred for our project.

3 Soil moisture sensor : Knowing the amount of moisture content of soil is extremely vital to the dataset of our project and hence cannot be ignored among other groups of sensors.

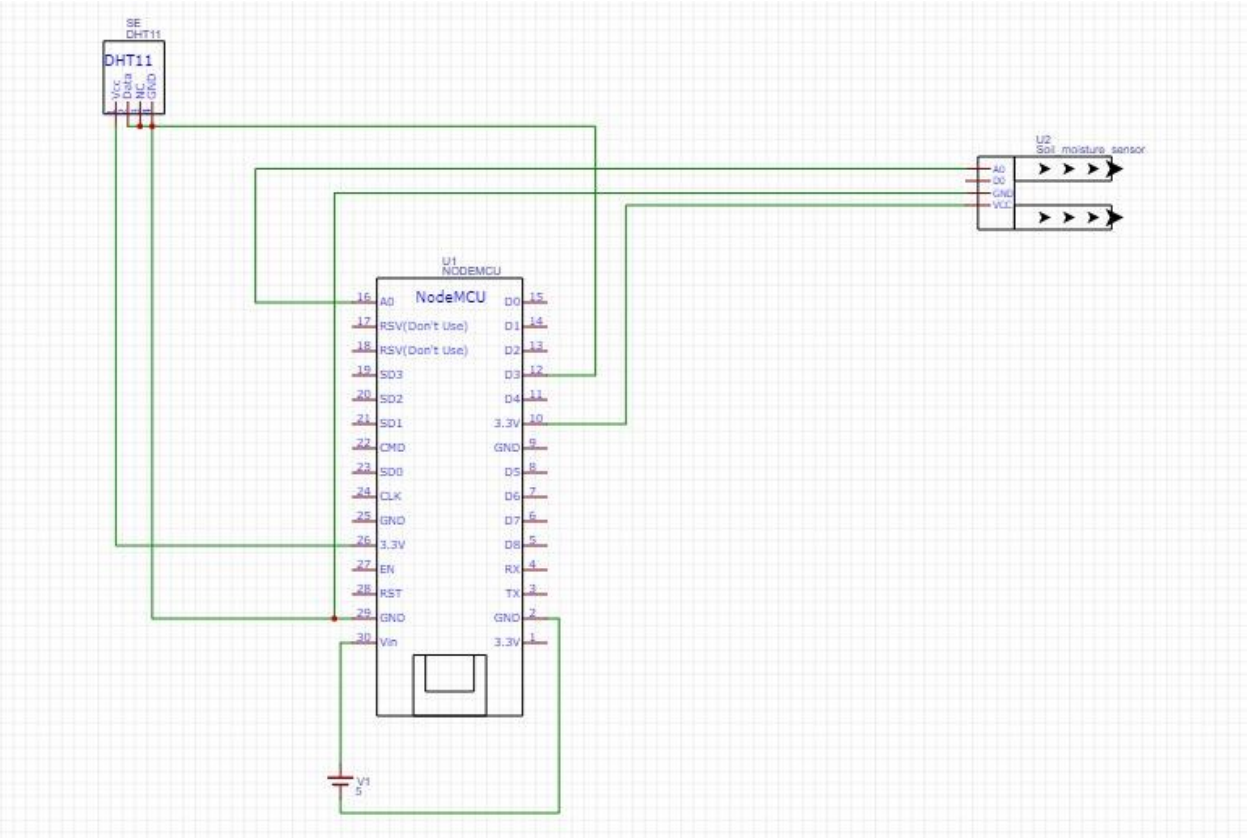
3 we could add a bunch of more sensors that would provide us with valuable data about the surrounding ecology of the plants. like:

a) Air Quality Index (AQI) gas sensor (feeding us with data about content of pollution and other gases in atmosphere)

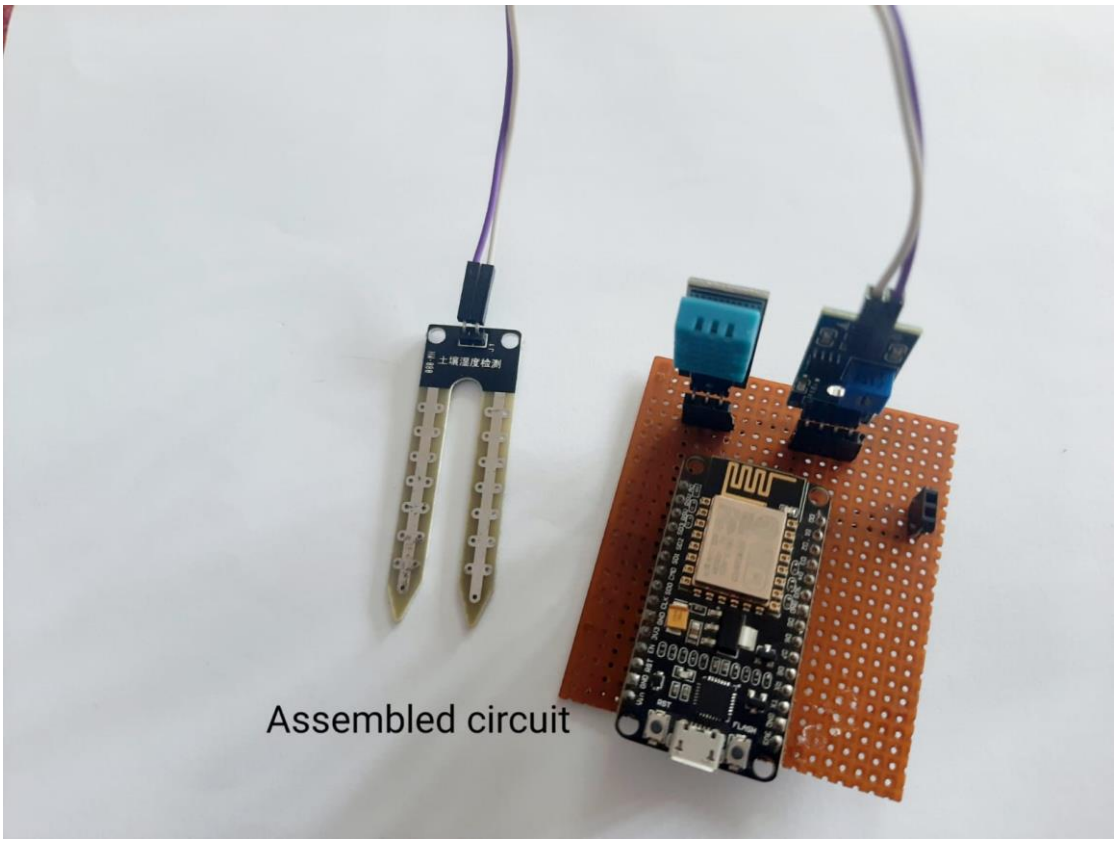
b) Photodiode (Helping with the amount of light available to the plants)

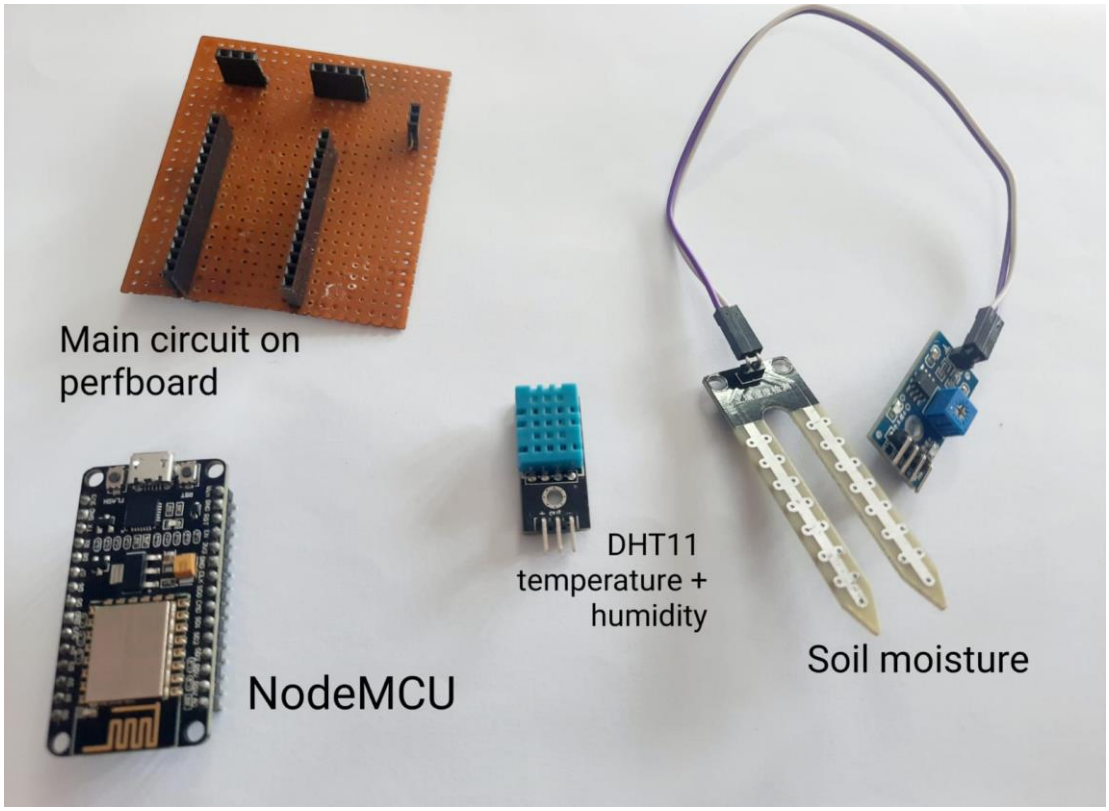
4. A solar panel paired with rechargeable batteries would definitely help keep the hardware run continuosly for long durations without requirement of external electric source hence collecting more wider range of data.

CIRCUIT



HARDWARE CIRCUIT





ARDUINO CODE AND OUTPUT

```
#include <DHT.h>
#include <ESP8266WiFi.h>
String apiKey = "MR8ZOJ0PVCD7YV99";
const char *ssid =  "RSVP";
const char *pass =  "noconnection";
const char* server = "api.thingspeak.com";
#define DHTPIN 0

DHT dht(DHTPIN, DHT11);
WiFiClient client;
void setup()
{
      Serial.begin(115200);
      delay(10);
      dht.begin();

      Serial.println("Connecting to ");
      Serial.println(ssid);


      WiFi.begin(ssid, pass);

     while (WiFi.status() != WL_CONNECTED)
    {
          delay(500);
          Serial.print(".");
    }
     Serial.println("");
     Serial.println("WiFi connected");

}
```

```
void loop()
{

    float h = dht.readHumidity();
    float t = dht.readTemperature();
    float temp = analogRead(A0);
    temp=1024-temp;


        if (isnan(h) || isnan(t))
          {
             Serial.println("Failed to read from DHT sensor!");
              return;
          }

              if (client.connect(server,80))
             {

                  String postStr = apiKey;
                  postStr +="&field1=";
                  postStr += String(t);
                  postStr +="&field2=";
                  postStr += String(h);
                  postStr +="&field3=";
                  postStr += String(temp);
                  postStr += "\r\n\r\n";

                  client.print("POST /update HTTP/1.1\n");
                  client.print("Host: api.thingspeak.com\n");
                  client.print("Connection: close\n");
                  client.print("X-THINGSPEAKAPIKEY: "+apiKey+"\n");
```

```
            client.print("Content-Type: application/x-www-form-urlencoded\n");
            client.print("Content-Length: ");
            client.print(postStr.length());
            client.print("\n\n");
            client.print(postStr);

            Serial.print("Temperature: ");
            Serial.print(t);
            Serial.print(" degrees Celcius, Humidity: ");
            Serial.print(h);
            Serial.print("%, Moisture Sensor Value: ");
            Serial.print(temp);
            Serial.println(". Send to Thingspeak.");
        }
    client.stop();

    Serial.println("Waiting...");
  delay(1);
}
```

Result And Conclusion

Output:

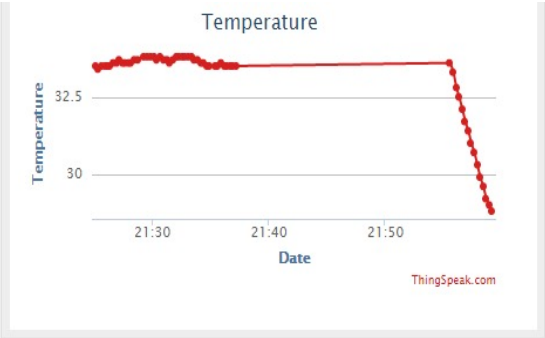
```
Head_____________________________________________________
   S.No.    Category  Humidity LL  Humidity UL  Temperature LL  Temperature UL    Plants
0      1  Vegetables         65.0         70.0               0              10    Garlic
1      2  Vegetables         70.0        100.0              21              30    Radish
2      3  Vegetables         95.0        100.0              15              22   Carrots
3      4  Vegetables         50.0         60.0              15              18   Lettuce
4      5  Vegetables         60.0         70.0              10              30      Peas

Desription_______________________________________________
          S.No.  Humidity LL  Humidity UL  Temperature LL  Temperature UL
count  30.000000    29.000000    29.000000       30.000000       30.000000
mean   15.500000    60.862069    72.068966       15.233333       25.300000
std     8.803408    19.778640    18.828040        8.063042        8.964105
min     1.000000    30.000000    40.000000      -10.000000       -5.000000
25%     8.250000    45.000000    55.000000       13.000000       21.250000
50%    15.500000    60.000000    70.000000       16.000000       27.000000
75%    22.750000    80.000000    90.000000       20.000000       30.000000
max    30.000000    95.000000   100.000000       30.000000       40.000000

Null Values______________________________________________
S.No.            0
Category         0
Humidity LL      1
Humidity UL      1
Temperature LL   0
Temperature UL   0
Plants           0
dtype: int64
```

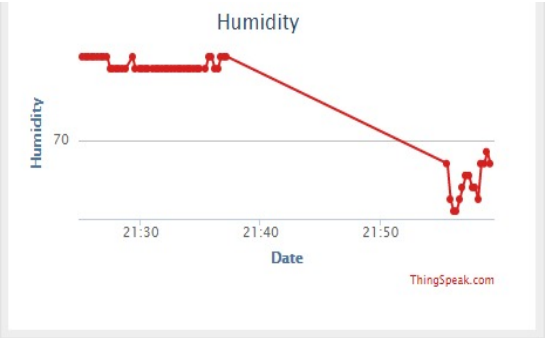
```
Null Values______________________________________________
S.No.            0
Category         0
Humidity LL      1
Humidity UL      1
Temperature LL   0
Temperature UL   0
Plants           0
dtype: int64

Train____________________________________________________
[[ 60.  70. -10.  -5.]
 [ 60.  70.  15.  28.]
 [ 30.  40.  20.  30.]
 [ 60.  70.  23.  29.]
 [ 50.  70.  21.  24.]
 [ 80.  90.  15.  30.]
 [ 65.  75.  20.  25.]
 [ 70.  80.  18.  23.]
 [ 90. 100.  20.  40.]
 [ 30.  40.  13.  27.]
 [ 70. 100.  21.  30.]
 [ 45.  55.  20.  30.]
 [ 80.  90.  15.  20.]
 [ 60.  70.  10.  30.]
 [ 30.  50.  18.  24.]
 [ 60.  70.  30.  35.]
 [ 90.  95.  13.  21.]
 [ 45.  55.  10.  29.]
 [ 30.  50.  17.  27.]
 [ 50.  60.  15.  18.]
 [ 65.  70.   0.  10.]
 [ 90. 100.  25.  35.]
 [ 45.  55.   4.  26.]
 [ nan  nan   9.  11.]]
```

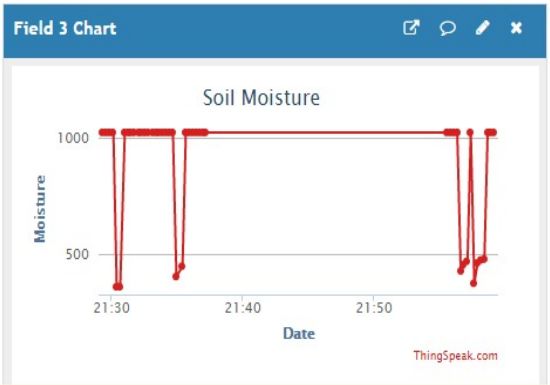
```
 [ 30.  50.  18.  24.]
 [ 60.  70.  30.  35.]
 [ 90.  95.  13.  21.]
 [ 45.  55.  10.  29.]
 [ 30.  50.  17.  27.]
 [ 50.  60.  15.  18.]
 [ 65.  70.   0.  10.]
 [ 90. 100.  25.  35.]
 [ 45.  55.   4.  26.]
 [ nan  nan   9.  11.]]
['Gotu Kola' 'Rose' 'Lavender' 'Ginger' 'Tomato ' 'Money plant' 'Chilli'
 'Begonia' 'Mint' 'Aloe vera' 'Radish' 'Rosemary ' 'Potato ' 'Peas'
 'Jade Plant' 'Adenium' 'Brinjal' 'Lemon' 'Coriander' 'Lettuce' 'Garlic'
 'Fenugreek' 'Bougainvillea' 'Hyacinth']

Test_____________________________________________
[[ 95. 100.  15.  22.]
 [ 60.  70.  15.  21.]
 [ 40.  50.   4.  29.]
 [ 85.  95.  18.  20.]
 [ 50.  60.  18.  30.]
 [ 80.  90.  25.  40.]]
['Carrots ' 'Thyme' 'Snake Plant' 'Marigold' 'Curry leaf' 'Tulsi']

Plants___________________________________________
    S.No.    Category  Humidity LL  Humidity UL  Temperature LL  Temperature UL    Plants
2       3  Vegetables         95.0        100.0              15              22  Carrots
23     24   Medicinal         90.0        100.0              20              40      Mint


Plant Description________________________________
      Plants  Humidity UL  ...                                        Timeline                            Special Care Points
2   Carrots         100.0  ...  Carrots germinate after 6-8 days. After few da...  Keep the plant in full sun. and keep the soil ...
23      Mint         100.0  ...  After 6-8 days the old leaves fall off and new...  During intial plant growth do not let the soil...

[2 rows x 13 columns]
```

```
[[ 95. 100.  15.  22.]
 [ 60.  70.  15.  21.]
 [ 40.  50.   4.  29.]
 [ 85.  95.  18.  20.]
 [ 50.  60.  18.  30.]
 [ 80.  90.  25.  40.]]
['Carrots ' 'Thyme' 'Snake Plant' 'Marigold' 'Curry leaf' 'Tulsi']

Plants___________________________________________
    S.No.    Category  Humidity LL  Humidity UL  Temperature LL  Temperature UL    Plants
2       3  Vegetables         95.0        100.0              15              22  Carrots
23     24   Medicinal         90.0        100.0              20              40      Mint


Plant Description________________________________
      Plants  Humidity UL  ...                                        Timeline                            Special Care Points
2   Carrots         100.0  ...  Carrots germinate after 6-8 days. After few da...  Keep the plant in full sun. and keep the soil ...
23      Mint         100.0  ...  After 6-8 days the old leaves fall off and new...  During intial plant growth do not let the soil...

[2 rows x 13 columns]

Plants___________________________________________
    S.No.     Category  Humidity LL  Humidity UL  Temperature LL  Temperature UL       Plants
1       2   Vegetables         70.0        100.0              21              30       Radish
16     17  Decorative          80.0         90.0              15              30  Money plant
24     25    Medicinal         80.0         90.0              25              40        Tulsi


Plant Description________________________________
         Plants  Humidity UL  ...                                        Timeline                            Special Care Points
1        Radish        100.0  ...  After 7 days leaves grow upto 1.5 inches tall ...  Keep the plant in partial shade. Keep the soil...
16  Money plant         90.0  ...  After 25 days of sowing the stem in the soil t...  Keep the plant away from direct sunlight and k...
24        Tulsi         90.0  ...  After 7 days the seeds start to germinate. Aft...                       Keep the plant in full sun.

[3 rows x 13 columns]
```

- IOT based temperature , soil moistures and humidity measurement system provides an economical and safe system.
- This is very useful for the detection of agricultural-related parameters.
- In this setup, the sensors first senses the environment and then the values are uploaded within the stipulated time period through the ESP-8266 Wi-Fi system.
- Then, from the cloud, the humidity,soil moisture and temperature standards are measured using one ThingSpeak platform from anywhere.
- The results of temperature , soil moistures and humidity will store on thingSpeak cloud.
- This proposed system can provide a convenient method for effective monitoring of temperature , moisture of soil and humidity in real time.







- And then based on the value of temperature , soil moistures and humidity, the list of plants which can be grown in that particular environment is provided.
- It also provides the basic details of the plant such as :-
  - Seed sowing time
  - Soil type to be used
  - Watering frequency
  - Sunlight needed
  - Any other specification for maintenance of the plant
- This system is very helpful for the beginners, who are new to Home gardening.

Implementation

The proposed solution can be used by the users in building their home gardens. The information about the plants is collected from various sources and best tips will be compiled into the dataset. This dataset will support the user in building their gardens by providing them information on following:

1. Soil mixture ratio at germination and transplantation time.
2. Steps to be followed during germination.
3. Water required by the plants during different times.
4. Compost adding frequency.
5. Uses of the plant user will be growing.
6. Timeline of the plant, which will contain information on transplantation time, flower blooming time, harvesting time, etc. for various plants.
7. Special care tips for the various plants.

Each information will come with the set of instructions which the user need to follow in order to grow the plants in their beautiful home gardens, covering beauty, organic vegetables or fruits and medicinal purposes.

In the future development of the project we can also prepare an algorithm to provide user a notifications along the growth timeline of the plant. Providing them the instructions that it is about the time for the transplantation, compost addition, harvest time or any other certain change in the plant care of various plants.

The user can also record the progress and development of its garden.

Pricing List

Pricing of the components used			
1	NodeMCU	Main Microprocessor to be programmed	Rs 270
2	DHT11	Temperature and humidity sensor	Rs 80
3	LM393	Soil moisture content sensor	Rs 70
4	Power source	Solar panel paired with battery pack	Rs 320
5	Perfboard/Breadboard	To make connections for the project	Rs 20 - 160

Future Scope

- IoT based system can be extended for controlling extraordinary electronic and electric devices from remote locations.
- Moreover, the system also can be extended:
  - by adding a solar panel for power supply instead of the regular electric supply.
  - can also collected the data through GSM to their cell phone and updating the user for timeline of plant growth, such as:
    - what should be the average height of the plant grown at the time
    - What should be the time for the flowers to start blooming or in case of any change in the maintenance of the plant along the timeline.
- In the future, the extensive Arduino system can put into practice as agriculture automation system and weather-based fertilizer flower and monitor the value of the plants' growth via the mobile application.

- IoT based systems are a vital step in sympathetic, relevance growth, accomplishment, and serve as a construction block for a numeral of practical modernization technique controller.
- We can also include a sensor like gas, infrared, ultrasonic sensors based on their requirements. Moreover, it is possible to control the relay, actuators through internet once a sensor values are going above/below predetermined values.

REFERENCES

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- https://en.wikipedia.org/wiki/Internet_of_things.
- http://www.ardumotive.com/iot-wifi-temp-andhumidity