FABRICATION OF IOT BASED SOIL MOISTURE SMART MONITORING SYSTEM

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**Abstract:**

Plant monitoring is seen as one of the most important tasks in any farming or agriculture-based environment. With the inception of Ambient Intelligent systems, there have been a rise in ambient intelligent based devices - Smart Homes [1] and other similar technologies involving RFID has evolved over the past few years [2]. Integration of such an ambient intelligent system with plant monitoring makes farming easier. In this paper, we discuss about the implementation of a smart plant monitoring system which makes use of the concept ambient intelligence with the use of .Net Gadgeteer which, proactively handles the plant monitoring system. The given implementation works along with a cloud-based server and a mobile based device (ideally Android/iOS device) which helps the user to control and see the status of the plant which is being monitored by the hardware device. The given circuitry detects changes in the moisture, temperature and light conditions in and around the plant, and performs a machine-based curation on the plant by providing necessary irrigation and illumination for the plant. Machine curation is also integrated with active weather forecasting systems which are deployed in the cloud-based server using which advanced machine curation is performed. For user-based curation, the Android device provides user an option to override a machine curated operation. The main advantage of IoT is to monitor the agriculture by using the wireless sensor networks and collect the data from different sensors which are deployed at various no des and send by wireless protocol. By using IoT system the smart agriculture is powered by Node MCU. It includes the humidity sensor, temperature sensor, moisture sensor and DC motor. This system starts to check the humidity and moisture level. The sensors are used to sense the level of water and if the level is below the range then the system automatically stars watering. According to the change in temperature level the sensor does its job. IoT also shows the information of humidity, moisture level by including date and time. The temperature level based on type of crops cultivated can also be adjusted.

**Keywords**: IoT, Soil, Moisture and Temperature sensors, Relay, Arduino Mega 2560, Thing Speak

**Introduction:**

Plants are considered to be the major source of the survival and helps to purify the air filled with pollutants. Many feel responsible to plant a tree and some consider it as a hobby. planting a tree is not just burying a seed ball in the soil, it has many factors to be considered. Some plants need more care for an efficient growth. There are some plants which are grown only for showcase purposes and homemade agriculture. The required environment must be provided to the plant and should be watered time to time to make the photosynthesis happen. We also know that one kind of soil or nutrient is not sufficient to all the plants to grow better. Each plant has its characteristics to gain a high yield. One of the largest livelihood providers in India is Agriculture. Agriculture plays an essential role in supporting human life. The rise in population is proportional to the increase in agriculture production. Basically, Agriculture production depends upon the seasonal situations which do not have enough water sources. To get beneficial results in agriculture and to overcome the problems, IoT based smart agriculture system is employed. Global and regional scale agricultural monitoring systems aim to provide up-to-date information regarding food production. In IoT-based smart farming, a system is built for monitoring the crop field with the help of sensors like light, humidity, temperature, soil moisture, etc. The farmers can monitor the field conditions from anywhere. IoT-based smart farming is highly efficient when compared with the conventional approach. The proposed IoT based Irrigation System uses ESP8266 Node MCU Module and DHT11 Sensor. It will not only automatically irrigate the water based on the moisture level in the soil but also send the Data to Thing Speak Server to keep track of the land condition. Due to the recent advances in sensors for the irrigation systems for agriculture and the evolution of WSN and IoT technologies, these can be applied in the development of automatic irrigation systems. The system will determine the parameters that are monitored in irrigation systems regarding water quantity and quality, soil characteristics, weather conditions, and fertilizer usage and provide an overview of the most utilized nodes and wireless technologies employed to implement WSN and IoT based smart irrigation systems.

To overcome all these problems, we are going to set a monitoring machine. This can be defined as a system which not only monitors the growth but also gives alerts when there is a defect in the growth or proving a suitable environment. This type of system can be created with the help of Internet of Things (IOT).

IOT is basically defined as the phenomenon where the system or a device is functioned with the help of internet. Here the system works on IOT with the help of the following sensors as shown in Fig

In India 83% of water is consumed by agriculture. If there are no plan for the usage of water in farms, then it causes wastage of water. So, we need a system which will efficiently supply water. Arduino Uno is a microcontroller along with the moisture, temperature and humidity sensor can monitor soil content and accordingly it irrigates the field as when needed. The proposed system uses microcontroller ATMEGA328P on Arduino Uno and IOT which enable farmers to remotely monitor the status of motor installed on the farm by getting approximate information from sensor thereby, making the farmers' work much easier as they can do other farm activities. And mostly this technique is driven by electrical power and on/off scheduling controlled.

**Statement of the Problem:**

* One of the major problems facing agriculture for farming is the lack of time and more usage water.To address this problem, we have developed Iot smart plant monitoring system.These device are designed to perform a variety of tasks, To save water,reduce human interventation and provide water to crop, reducing the need for multiple device. This project deals about the plant monitoring mechanism which gives information about the temperature, pressure, humidity. This can be done by using various sensors like temperature pressure humidity sensing sensors. This will be enhancing the growth of plant.

**Review of Literature:**

* Aishwarya K S et.al, proposed a system which helps the plant growth and hydroponics (fish growth at same time. This system shows the importance of nutrients essential for fish waste. IoT based model is developed and Arduino acts as the heart of the entire system. Major advantage of this is to control the cost of plant growth and increase the food quality
* Shrinidhi Rajagopal et.al, proposed an article which shows the importance of automatic watering of plants at regular interval of time. This system is based on Internet of things and describes the object-oriented designs [6].

**Objectives of the study:**

* To save water and reduce human intervention in the agriculture field
* To get the output of soil water sensor and provide water to crops
* Reduce the man power and conserve the water
* Real time sensing and control
* To observe other parameters for better yield
* To understand the water resources of our country and development of irrigation in India
* To know the necessity of irrigation Benefits and ill effects
* To assess the impacts of the irrigation projects on Environment
* To understand system of irrigation and Command area development aspects
* To Increase access to farming equipment: The multi-purpose agricultural vehicle can be designed to be more affordable and accessible for small-scale farmers, increasing their access to modern farming technology.
* To Improve safety: The multi-purpose agricultural vehicle can be designed with safety features, such as rollover protection and automatic shut-off, to reduce the risk of accidents and injuries during farming operations.

**Research Methodology:**

IOT- IOT is the networking of physical objects that contain element electronics embedded with in their architecture in order to communicate and sense interactions amongst each other or with respect to the external environment

# Internet of things devices are all around use constantly transmitting data and talking with other IOT devices

# If we had computers that knew everything there was to know about things –using data they gathered without any help from us –we would be able to crack and count every thing and greatly reduce waste, loss and cost

**Results and Analysis:**

The main aim of this project is to implement the modern technology in required fields like agriculture. Using IoT technology in agriculture, this system makes agriculture monitoring easy. The benefits as mentioned like water saving and labour saving are required the maximum in current agricultural state of affairs. Consequently, using the sensor network in fields of agriculture makes clever irrigation. The information from IoT is sent to the client using cloud. Consequently, any changes inside the crop may be identified effortlessly and early analysis is achieved as such. The developed hardware kit of the proposed model is shown in figure 9.2



#### Figure 9.2: IOT Based Smart Agriculture Monitoring System

The measured and monitored parameters like temperature, humidity and moisture in soil are shown in figures Figure 10, Figure 11 and Figure 12 respectively



#### Figure 9.3: Temperature Measurement



**Figure 9.4: Humidity Measurement**



**Figure 9.5: Soil Moisture Measurement**

## COMPLETE CODE FOR PROJECT

#include <SPI.> #include <Ethernet.h> #include "DHT.h"

#define DHTPIN 2 #define DHTTYPE DHT11

String tempVarId = "575475df7625423fd9da9c36"; String humVarId = "575475f1762542406cb10c43"; String lightVarId = "575475fc762542410358a0c3"; String soilVarId = "5754760576254241593d4d47"; String token = "xxxxx";

byte mac [] = {0xDE, 0xAD, 0xBE, 0xEF, 0xFE, 0xED}; char server [] ="things.ubidots.com"; EthernetClient client;

IPAddress ip (192, 168, 1, 40); // Arduino IP Add IPAddress myDns (8,8,8,8);

IPAddress myGateway (192,168,1,1);

int moisture Pin = 0; int light Pin = 3;

DHT dht (DHTPIN, DHTTYPE);

void setup () { Serial.begin(9600);

Serial.**print**("Starting...");

// Net connection...

}

void loop () {

float soil Hum = analog Read (moisture Pin);

soil Hum = (1023 - soil Hum) \* 100 /1023;

Serial.println("Soil Humidity: " + String (soil Hum));

// Read light

float volts = analog Read (light Pin) \* 5.0 / 1024.0;

float amps = volts /10000.0;

float microamps = amps \* 1000000;

float lux = microamps \* 2.0;

Serial.println("Lux: " + String(lux));

float h = dht. read Humidity ();

float temp = dht. read Temperature ();

"Temp: " + String(temp,2));

Serial.println(

"Hum: " + String(h,2));

Serial.println(

send Value (temp, h, lux, soil Hum);

delay (60000);

}

void send Value (float tempValue, float hum Value, float lux, float soil)

{

Serial.println("Sending data...");

// if you get a connection, report back via serial:

int body Size = 0;

delay (2000);

// Post single value to single var

String varString = "[{\"variable\": \"" + tempVarId + "\",

\"value\":"

+ String(tempValue) + "}";

// Add other variables

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

**if** (client. Connect(server,80)) {

client. println ("POST /api/v1.6/collections/values HTTP/1.1");

Serial.println("POST /api/v1.6/collections/values HTTP/1.1");

client. println ("Content-Type: application/json");

Serial.println("Content-Type: application/json");

client. println ("Content-Length: "+String (body Size));

Serial.println("Content-Length: "+String (body Size));

client. println ("X-Auth-Token: "+token);

Serial.println("X-Auth-Token: "+token);

client. println ("Host: things.ubidots.com\n");

Serial.println("Host: things.ubidots.com\n");

client. **Print**(varString);

}

**else** {

// if you didn't get a connection to the server:

Serial.println("connection failed");

}

Boolean sta = client. Connected ();

Serial.println("Connection ["+String(sta)+"]");

**if** (! client. Connected ()) {

Serial.println();

Serial.println("disconnecting.");

client. Stop ();

}

Serial.println("Reading.");

**while** (client. Available ()) {

char c = client. Read ();

Serial.**print**(c);

}

client. Flush ();

client. Stop ();

}

**Conclusion:**

As defined earlier the system is made considering the Arduino Uno as the heart of the system and then the sensors were connected accordingly as per the functional requirement. Its main objective is to monitor a plant by providing the suitable environment with the help of sensors such as moisture sensor to check the moisture of the soil and temperature sensor to check the temperature around the plant and then the light sensor to check the availability of the light which plays the major role in the process of photosynthesis. If the moisture content is less than the required then automatic watering will be done with the help of the relay. The values are then read by the internal code present in the Arduino and then the alerts will be sent to the app present in the mobile or the website. These alerts help the person to provide the required materials to create suitable environment for the growth of the plant. This system not only gives the alerts of the plant but also study the properties of the soil and then states whether the existing soil is suitable or not for the plant that has been planted in the jar. This kind of alerts can be given with the help of a predefined data. This predefined data consists of the data such as which kind of plant is best suited for what kind of plant. The main goal of this project is to maintain suitable environment for plant growth

IoT will help to enhance smart farming. Using IoT the system can predict the soil moisture level and humidity so that the irrigation system can be monitored and controlled. IoT works in different domains of farming to improve time efficiency, water management, crop monitoring, soil management and control of insecticides and pesticides. This system also minimizes human efforts, simplifies techniques of farming and helps to gain smart farming. Besides the advantages provided by this system, smart farming can also help to grow the market for farmer with single touch and minimum effort. The efficient automation on monitoring and control of the plants require new and revolutionary solutions. Wireless sensor networks can respond to requirement by offering an accurate and easily configurable monitoring system. In this work we are using the moisture sensor and light sensor with which, we could efficiently monitor the basic resources of the plant. This is prototype of the monitoring and control system for plants. Unlike other automated systems which relies on automated data, our model is more “Intelligent” to utilize the resources according to the changes in weather conditions. Our model has the capability to integrate with any mobile platform, Since the broker service is running on a cloud-based service it is scalable.

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