THE AMPLIFIED RELEVANCE OF INTERNET OF THINGS BASED AUTOMATED FARMING IN POST COVID-19 TIMES

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Abstract - There is an increasing prevalence of self-grown, small scale vegetation due to rapid escalation in awareness of health-related advantages, and surge in research oriented plant analysis in the times of COVID-19. Oftentimes such motives are accompanied by undermining circumstances. Shortage of time due to rigid schedules provides a possible incapability. Small scale vegetation requires high efficiency of resource utilisation for increased crop yield and reduction in unnecessary mineral wastage. Additionally, the alarming drop in the number of farmers in Agriculture dependent countries like India pushes the food shortage issue deeper. Modern age technology provides a prospective advancement in the way technology is seen in agriculture. IOT in small scale vegetation allows for these circumstances to be accounted for. Design, feasibility and innovation form the basis for the system. Automation of the garden takes it a giant leap further by changing the way users operate within rigid schedules, while Crop Specific Algorithms allow for an increase in efficiency of resource utilisation including greater crop yield and overcoming water wastage issues. The remote monitoring system allows for real time visual interfacing with the crops from a remote location. While long term analysis of temperature and humidity levels gives specific supervision for crop choice.

Key Words: **Internet of Things (IOT), Innovation, Sensor Precision, Crop efficiency, COVID-19, Agriculture development.**

1.INTRODUCTION

As the scare of COVID-19 looms over the world we progress and adapt to these situations with innovative technologies at hand and ideation. With the help of Internet of Things micro controller Node-MCU and sensors we bring forward an innovative approach for the generations to come. The Raspberry Pi allows for adaptation into different forms and a broad array of possibilities ranging from integration into smart home devices, to increasing the scale of the system with the power it brings with it. With user customization and personalization at priority the system gives a user the opportunity to enjoy the realms of farming while ensuring safety from the rising concerns of pesticides and fertilizers.

1.1 Integration of IOT

IoT is the coming of age technology. With IoT this System becomes a real-time experience involving remotely controlling an entire module by just connecting to the internet. As travel becomes a challenge and health become an issue the Internet of Things allows for the intelligent system to always stay with you wherever you go.

1.2 Design Requirements

a. Soil Moisture Sensor

The soil moisture sensor is used to measure the amount of moisture content in the soil sample. It works on the conduction of and electric current through the two legs as represented in the image. These two copper or nickel coated legs measure the strength of the electric current and hence the presence of moisture. The analog output given represents the ratio of water content. It requires 3.3 to 5V for operation.

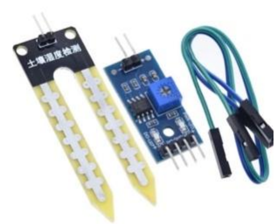

Fig -1: Soil Moisture Sensor

b. Raspberry Pi 3

A Raspberry Pi 3 is a small computer which allows for portable computation and real-time video feed. The Raspberry Pi has a wide range of other uses as it can function as a complete computer.

Fig -2: Raspberry Pi 3

c. DHT-11 humidity and temperature sensor

The DHT-11 module acts as both the humidity and temperature sensors. It measures the atmospheric water levels. It can measure temperatures of the range 0 to 50 degree Celsius with a 2% margin of error, as well as humidity between 20 to 80 percent with a 5% margin of error. It requires 3 to 5V for operation.

Fig -3: DHT-11 module

d. Node-MCU ESP8266

The Node-MCU is the IOT integrated micro controller chip. The Node-MCU acts as the brain of the system by giving out commands to the various devices and taking in real-time information from sensors. The Node-MCU works on a TTL logic.

Fig -4: Node-MCU

e. Camera Module

The camera Module Helps run the real-time monitoring of the plants why sending live footage according to the instructions to the desired system.

Fig -5: Camera Module

f. Submergible water pump

The submergible water pump helps automatically water the plants by irrigating the plants when instructed.

Fig -6: Submersible pump

g. Relay Module

Relays are able to transmit direct as well as alternating currents so that the different parts of circuit may function as required. The relay also acts as a safety measure in the event of a short circuit by transferring the load off the main circuit.

Fig -7: Relay Module

2. EXISTING SYSTEMS

Existing Systems use weather systems to create an interface with the help of manual tools and methodologies such as rain gauges, barometers. Farmers and Household agriculturists often acquire this data from secondary sources and manually adapt their crop treatment.

2.1 Limitations of the Existing Systems

a. Existing Systems often compose of large scale equipment with little in correlation to the backyard or small-scale vegetation.
b. The remote weather monitoring is averages over a region and exact values required for agricultural purposes cannot be acquired.
c. There are often no feasible methods of achieving crop recommendations based of physical crop yield data.
d. Large Costs of single use and high maintenance devices.

3. LITERATURE SURVEY

An increasing research involvement and the influence of technology has led to many models for automation in the agriculture industry.

Swapnil Kudalkar (2020) presents the scope of IOT and applications in day to day life with agriculture. He demonstrates the effective nature of sensor based information synthesis. The integration of the smart gardening system with day to day appliances for a complete home IOT experience has been introduced.

Amruthamathi. A (2020) Presents the various challenges faced by farmers, and how varying needs of different soil types in different locations present challenges to conventional methods. Along with the importance of computer based WPI's and algorithmic approaches to crop growth.

Reeta Joshi (2019) Presents innovative studies and methods of sensing the land capability for high returns on a long-term basis with greater accuracy rates. Which allows for improved crop yield in small scale resource intensive farming.

Bathula Preetham Kumar Reddy (2020) Presents the analysis of COVID-19 pandemic across the country and emphasizes on the various long-term effects which analytic results of artificial intelligence provide.

Tejas Jnanesh Ghalsasi (2018) Provides useful insight into real-time monitoring systems and their prevalence in the modern times along with possible extension to gesture based systems.

4. PROPOSED SYSTEM

An irrigation system which is designed to monitor and maintain the moisture level for plants. In this gateway sensor is used to handle sensor information and helps to transmit data to user, Wireless through moisture sensors and an ESP8266 chip programmed with microcontroller based gateway which is used to monitor agriculture area. The proposed system runs on Batteries and is based on C++ programming. The ESP8266 WIFI module is connected to an online web server with Internet of Things enabled so that it will receive data from all sensor nodes, store data on cloud and it will get displayed on smart phone and web portal on PC in tabular and graphical format.

Fig -8: Miniature representative working model

System Features Include

a. Remotely Controlled Water Pump.
b. Automatic irrigation if soil moisture level is low.
c. Soil moisture and water pump display.
d. Log Soil moisture and humidity values.
e. Real time crop life video feed.
f. Algorithmic crop preference guide.

Table -1: Analysis of the Crop Yields of common crops

Crop Analysis			
Crop	**kg/m^2/harvest (cubic packing)**	**Days/harvest**	**Calories/ kg**
Cabbage	3.53	90.0	250
Garlic	0.48	90.0	1490
Onions	4.32	110	400
Tomato	1.23	85.0	180

Once the irrigation task has been set according to the type of crop present the threshold value of moisture content is updated. This is transferred as a task to the Node-MCU which gives out the command code to the digital motors to run the pump in the required manner for irrigation. As this process occurs the sensor task happens simultaneously. A delay time is set to allow for accuracy in moisture measurement and not wasting water resources or drowning the plant.

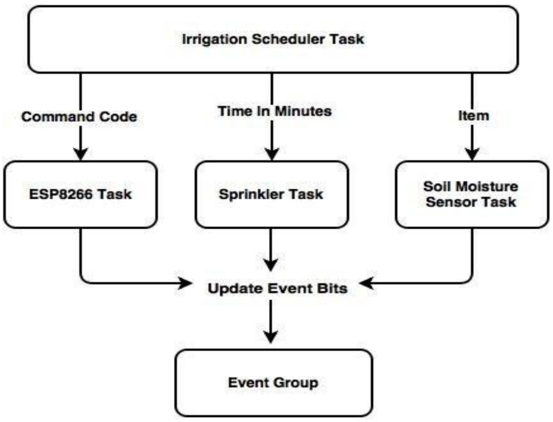

Chart -1: Irrigation Schematic

5. WORKING

The working of the entire system is a collaborative set of modules with separate functions all integrated into a large system. The system has many components in the prototyping stages.

5.1 The Circuit

The analog pin of the soil moisture sensor in connected to the 0th pin of the node-MCU (16th GPIO pin), While the input pin of the DHT-11 module is connected to the D3 (GPIO 0). Although the humidity sensor comes with two types of inputs we prefer the analog pin for accuracy. We use another GPIO pin of the Node-MCU to interface the relay module. This pin will be giving outputs unlike the first two so it is chosen accordingly. For electric safety measures, we ground the ESP8266 module by connecting its grounding pin to the ground pin of a transistor. This transistor is in turn connected with the power supply required for the chosen relay module and submergible pump.

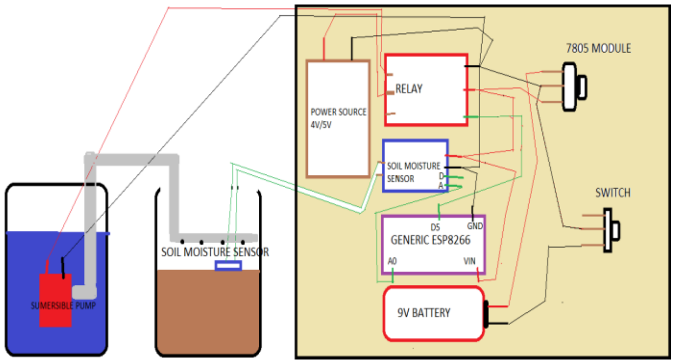

Fig -9: Circuit diagram

5.2 The Code

The model is Coded in the Arduino IDE. The required libraries ae added for their corresponding sensors. After the libraries are imported the various sensors must be defined and initialized, hence the corresponding pins are utilized as shown in figure.

```
const int sensorPin= A0;
float Moisture;
```

Fig -10: Defining the sensor pins

The code takes in user inputs for SSID credentials to connect to the nearby WIFI network. The serial Communication baud rate is set to 9600 and is initialised in a loop. As shown in figure

```
void setup() {
    Serial.begin(9600);
    Cayenne.begin(username, password, clientID, ssid, wifiPassword);
   pinMode(sensorPin, INPUT);
  pinMode(2,OUTPUT);
  digitalWrite(2,HIGH);
  pinMode(RELAY_PIN, OUTPUT);
  digitalWrite(RELAY_PIN,LOW);
}
```

Fig -11: Initializing the loop

In the loop function the system waits for client request for manual control while running the automated system simultaneously.

5.3 Generating the User Interface

After the code is run, the system provides the user with a custom URL. This URL leads the user to the user interface with the various controls and real-time values. Constant fluctuations can be avoided as the sensors test the area after fixed intervals automatically.

Fig -12: Serial monitor

The user interface is created with the help of the local IP address' WIFI connection and ESP-8266 module.

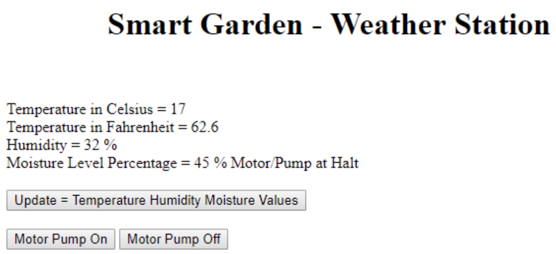

Fig -13: User Interface

6. CONCLUSIONS

This model expands with usage as greater samples of data and yield allows for easier sophistication of algorithms. With Artificial Systems coming into daily life IoT allows for easy integration of these systems into an end users day to day smart home device.

In an environmental perspective, the resource management allows for reduction in harm done to the environment. As minerals in soil, water and energy are used to their capacity, the toll on the environments takes a major dip.

The system provides next gen solution to a present-day problem and has scope for improvement and additions to the model.

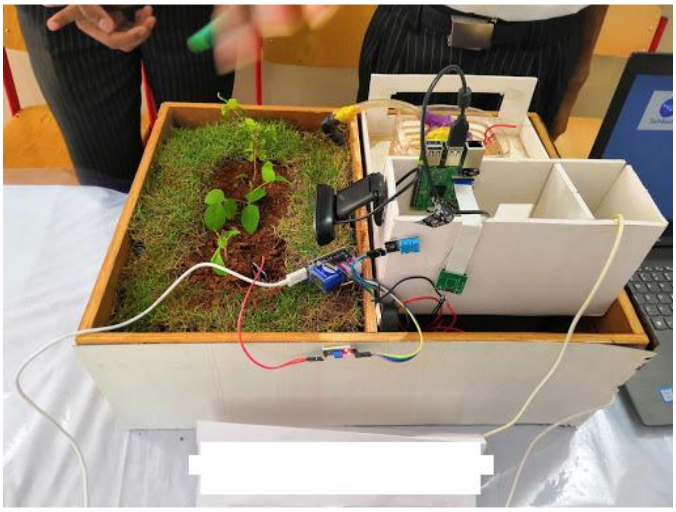

Fig -9: Project Model

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