International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 06 | June-2019 www.irjet.net p-ISSN: 2395-0072

# Implementation & Testing of Soil Analysis in cultivation land using IoT

**Laxmi Jadhav[1], Prof. Vidya Pai[2]**

*[1]M. Tech II Year, Dept. of Computer Science and Engineering, BMSIT & M, Yelahanka, Bangalore - India*
*[2]Prof. Vidya Pai, Dept. of Computer Science and Engineering, BMSIT & M, Yelahanka, Bangalore - India*

---

**Abstract** – *Recent evolution in agricultural technology various practices have shifted from traditional techniques to automated techniques like field irrigation system. Many such agricultural measurable factor are measured remotely to produce better quality and production of farming. The important measurable factor in farming is fertility of soil i.e. relative values in which various nutrient factors for crop is present in soil. To monitor soil analysis, moisture level of soil, humidity and temperature of soil is most commonly measured. It is also the best technique to get required soil parameters because of it is connected to many aspects of soil analysis and plant growth. In the proposed system, we determine the average percentage of basic soil parameters like temperature, humidity, and moisture level of soil to determine the suitable crops for the matching soil type. The system will analyze soil nutrient parameter with current conditions and make proper crop prediction with best results. System will be developed on Arduino technology. This system also suggests the crops on the facts of determined nutrition's values of soil.*

***Key Words***: **Internet of Things (IOT), Nitrogen(N), Phosphorous(P), Potassium(K)**

## 1.INTRODUCTION

Due to significant increase in technology, farming has become more famous and sizeable. Exceptional tools and strategies are available for development of farming. a good way to feed the growing populace of the Earth, the sector will need to provide 70% extra meals in 2050 than it did in 2017. to meet this, call for, farmers and agricultural groups are turning to the net of things for analytics and greater manufacturing abilities. IoT (Internet of things) can play large position in growing productivity, acquiring huge worldwide marketplace, idea about current tendencies of vegetation. IoT is a community of interconnected devices that can switch statistics effectively without human involvement.

These days many agricultural industries turned to undertake IoT generation for smart farming to enhance performance, productiveness, worldwide marketplace and different features which includes minimal human intervention, time and cost etc. The advancement within the technology ensures that the sensors are becoming smaller, newest and greater monetary. The networks also are without difficulty accessible globally in order that smart farming may be successfully accepted with full pledge that will promote innovation in agriculture, smart agriculture is the answer to the troubles. All this may be finished the usage of smart phones and IoT gadgets. Farmer can get any required records or facts as nicely can reveal his agricultural area.

### 1.1 Key Features of IoT

**AI** - IoT absolutely makes really anything "clever", which means it complements every component of day today life with the power of facts series, synthetic intelligence algorithms, and networks.

**Connectivity** - New allowing technology for networking, and especially IoT networking, suggest networks are longer completely tied to fundamental providers. community can exit on a far smaller and cheaper scale at the exact time as nevertheless being realistic.

**Sensors** - IoT loses its excellence without sensors devices as they play as defining devices which converts IoT from a popular virtual network of devices into an energetic device capable of actual-world integration.

**Small gadgets** - gadgets as expected, have end up smaller, cheaper, and extra powerful through the years. IoT exploits reason-constructed small devices to supply its quality, scalability, and adaptivity.

### 1.2 Application Areas of IoT

The ability of IoT has become very famous in latest years. there are numerous advantages to having a device based on IoT. McKinney international Institute reviews that IoT commercial enterprise will attain 6.2 trillion in revenue via 2025. There are many of programs are to be had in the marketplace in different areas like environment, towns, energy gadget, enterprise, logistics, healthcare, agriculture, homes, etc. It can be listed as Agriculture, Retail, Consumer, Healthcare, Automotive, Environment, Military and Industrial etc.

### 1.2 Aim and Objectives

This paper addresses an IoT software-based approach on the field of Agriculture which helps to farmer to analyse soil parameters during each crop cycle based on soil parameters such as nutrition's, humidity, temperature etc and suggested suitable crops and quantity to cultivate which results in high profit and production.

## 2. RELATED WORK

This section provides the possible methods suggested by the researchers in the past in the field of Agriculture.

[1] Vinayak N. Malavade, Pooja K. Akulwar "Role of IoT in Agriculture [1]." International Organization of Scientific Research (IOSR). - They specialize in role of IoT in agriculture that ends in clever framing.to enhance performance, productiveness, global marketplace and to reduce human intervention, time and fee there may be a want to divert towards new technology named internet of factors. Farming will play critical function in next few years in nation. hence there's need of smart farming. net of things will help to decorate smart farming. IoT works in special domains of farming to improve time efficiency, water control, crop monitoring, soil management, control of insecticides and pesticides [1].

[2] Dr M Suchithra, Asuwini T, Charumathi M C, Ritu N Lal "Sensor Data Validation" International Journal of Pure and Applied Mathematics (IJPAM) - The inspiration is to perform the agriculture in clever and more green way. In addition, this technique advocates for using the internet of factors.net of factors has enabled the agriculture crop monitoring smooth and green to enhance the productivity of the crop and hence profits for the farmer. Sensors of different types are used to acquire the records of crop situations and environmental changes and this fact is transmitted via community to the farmer/gadgets that initiates corrective actions. Farmers are linked and aware about the situations of the agricultural area at whenever and anywhere within the world.

[3] Dr V Anandkumar, Kalaiarasan T R, Dr.S. Balakrishnan "IoT Based Soil Analysis and Irrigation System." International Journal of Pure and Applied Mathematics(IJPAM) - Agriculture, the backbone of our country nowadays is facing many challenges. Our system is designed to provide a solution which is one step forward towards the agricultural growth. Using IoT, an attempt is made to automate the irrigation. Farmers face some difficulties in switching on/off the motor. Any delay in watering may reduce the production. In this context, we propose "IoT Based Soil Analysis and Irrigation System" to help the farmer in reducing human effort and increase the yield. The farmer can control the power of motor even at distance.

[4] Amandeep, Arshia Battacharejee, Paboni Das "Smart farming usingIOT, Electronics and Mobile Communication Conference (IEMCON)", IEEE Annual Information Technology, 2017: Even today, different developing countries are also using traditional methods and backward techniques in agriculture sector. Little or very less technological advancement is found here that has increased the production efficiency significantly. To increase the productivity, a novel design approach is presented in this paper. Smart farming with the help of Internet of Things (IOT) has been designed. A remote-controlled vehicle operates on both automatic and manual modes, for various agriculture operations like spraying, cutting, weeding etc. The controller keeps monitoring the temperature, humidity, soil condition and accordingly supplies water to the field.

## 3. SYSTEM ARCHITECTURE

In this section, there is a description of the overall proposed system, which is going to cover architecture overview of the proposed solution.

### 3.1 Problem Definition

Crop fertility changes with each harvest and changing weather circumstance and additionally affects the nutrient content material of soil. also, fertility of soil varies at distinctive part of discipline and it requires to be monitored for healthy crop production. To decide crop fertility PH of soil is determined the usage of PH electrodes, PH electrodes experience the soil alkalinity and electric conductivity. On foundation of this sensed parameter we determine the approximate percent of simple NPK (Nitrogen, Phosphorous, Potassium) nutrient contents present in soil. more than one observations could be taken from numerous elements of land. The average of all the commentary taken from more than one a part of land will deliver the soils nation of fertility. On basis of calculated fertility, machine will decide the ideal plants for the examined land and additionally farmer will get a concept of what fertilizer is required.

### 3.2 Architecture

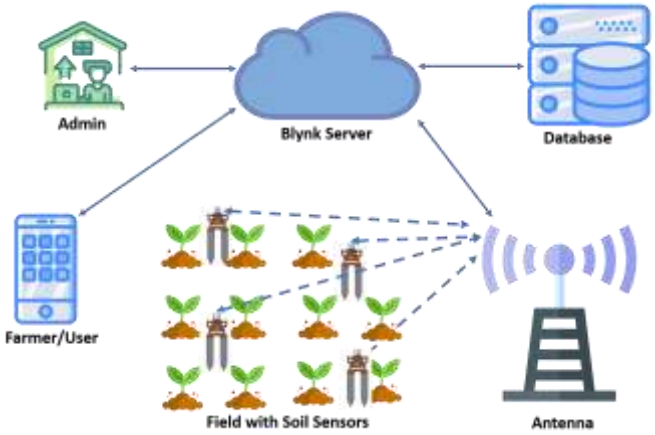


Fig 3.1 system architecture

The proposed system is a distributed home security system, consists of server, sensors. Server controls and monitors the various sensors, and can be easily configured to handle more hardware interface module (sensors). The Intel Galileo development board, with built in Wi-Fi card port to which the card is inserted, acts as web server.

Security System can be accessed from the web browser of any local PC in the same LAN using server IP, or remotely from any PC or mobile handheld device connected to the internet with appropriate web browser through server real IP (internet). Wi-Fi technology is selected to be the network infrastructure that connects server and the sensors. Wi-Fi is chosen to improve system security (by using secure Wi-Fi connection), and to increase system mobility and scalability.

Crops should be seeded and grown at their ideal conditions such as moisture, temperature. Sensors placed underneath ground level can monitor moisture, temperature for a favourable reading using IoT.

## 4. IMPLEMENTATION

### 4.1 Design

Below is the high-level system design irrigation field monitor system. The system consists centralized circuit Arduino-ESP32 as a main component of system which is connected to external sensors like soil, temperature (DS18B20) and humidity (DHT-11) sensor. External power supply of 5μA current is supplied to external source. Based on the configuration Arduino-ESP32 module collects soil parameter such as temperature, humidity and nutrition's values from connected sensors and relays the data to Blynk server. On server, using machine learning algorithms system suggests feasible conditions and crops to farmer. Farmer receives notifications and alerts regularly so that he can take measurable action and get use of the system.

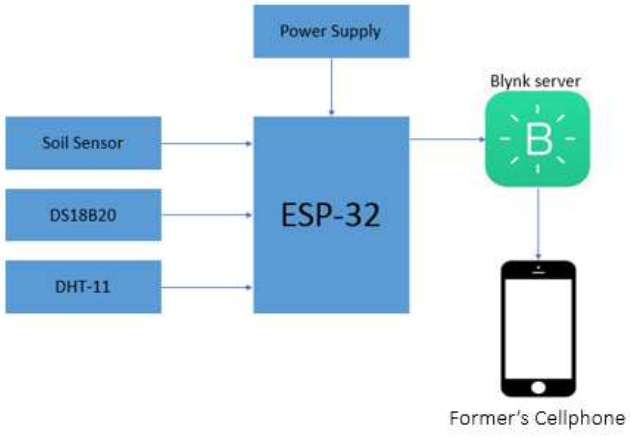


Fig 4.1 High level system design

### 4.2 Programing

We are using the java code for the front-end development using android application. The embedded C is used for the main programming function in the sketch_apr. The main program determines the median percentage of basic soil nutrients Nitrogen(N), Phosphorous(P), Potassium(K) and determine the suitable crops for the soil type and Wi-Fi module is utilized to send/receive the updates. The syntax of sketch_apr application program is shown in figure 6.1

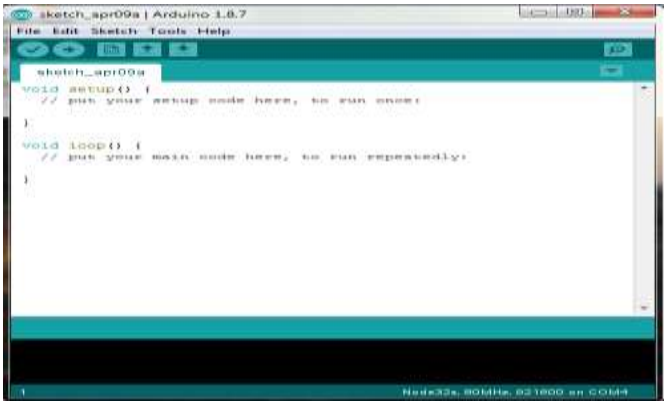

Figure 4.2 The syntax of the sketch_apr programming

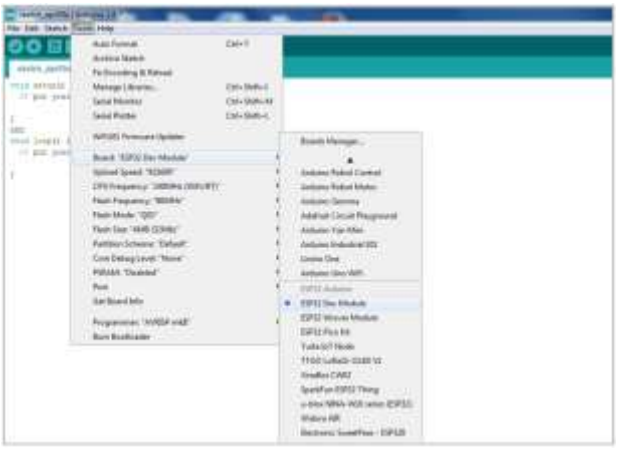

Figure 4.3 Selecting ESP32 on sketch_arp

### 4.3 Blynk System

When we install the blynk application in our phone it asks for the create account. We must create the new account in app with the username, password and email id. Once the account is created successfully it send authentications number to given email account. Then in blynk app we must select the Adriano board which we are going to use in our project and then in our program we must give the same blynk authentication number. Once program is done we must upload the program to the board using sketch_arp tool. Then both Arduino and blynk app will be connected successfully.

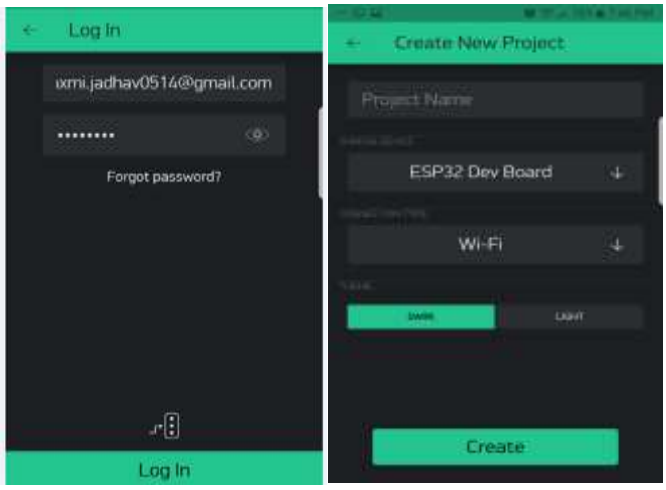


Figure 4.3 Login and Create project page

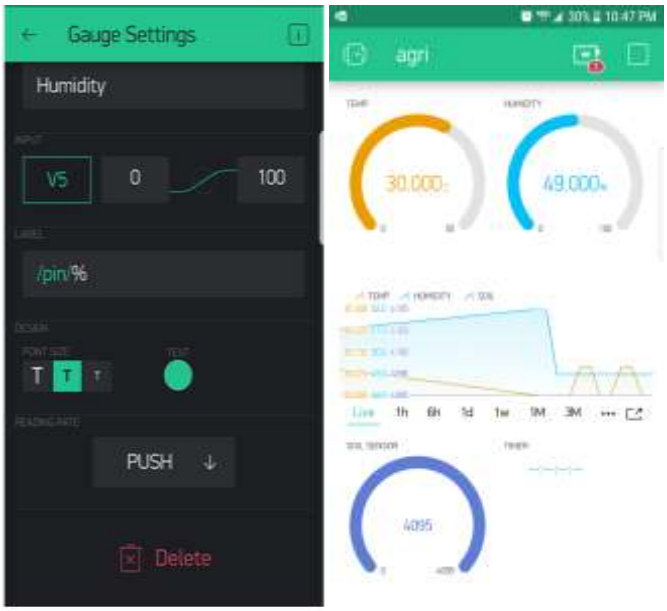


Figure 4.4 Settings and Results

### 4.4 Test Results

Below tables shows the test case results of Software with the results based on the test conducted.

| S No | Test cases | Expected Results | Obtained Results |
|---|---|---|---|
| 1 | Enter valid user name and password on user login page of blynk application | Login successful and directs to next page | Pass |
| 2 | Enter invalid user name and password on user login page of blynk application | Login failed | Pass |
| 3 | Create new project by selecting required parameter such as connectivity and devices | Project should be created successfully | Pass |
| 4 | Configure gauge settings for measurable parameter such humidity and temperature. | Configuration should be successful. | Pass |
| 5 | Verify dashboard for the initial values and configuration. | Dashboard should show default values and graph. | Pass |
| 6. | Monitor soil parameters every 24 hours | Dashboard should show temperature and humidity values with graph. | Pass |
| 7. | Verify temperature alert received based on conditions changes. | Application should receive temperature alert notifications from blynk server. | Pass. |
| 8. | Verify humidity alert received based on conditions changes. | Application should receive humidity alert notifications from blynk server. | Pass |

Table 4.1 Test cases executed and results

## 5. CONCLUSIONS

According to Soil analysis using IOT system the content of nutrients in the soil obtained by chemical analysis and the requirements of the culture for a certain yield, it is simple to predict the amount of needed fertilizer to achieve good quality yields. To figure out the quantity of nutrients required for the best condition in the soil plants which can adjust or take up to 80% of nitrogen, 40% of phosphorus, 60% of potassium and 40% of magnesium. Good quality soil analysis and monitoring is fundamental of planning of fertilizing, and hence the quality of the entire production period, which results in a high production quality and

yield and better farm management. With this system, we can determine the level of availability of nutrients or the need for its introduction. It also helps to determine the increase in crop yields against profitability of soil fertilization (poor soils do not always provide yield increase due to fertilization because of possible limiting factors). In addition to this system provides the basis for calculating the required fertilizing of each crop, which evaluates the status (supply) of each nutrient element and simultaneously determine the compensation irrigation plan. This system is flexible to support additional sensors with slight modification which can help to measure additional soil parameter in future.

**REFERENCES**

[1] https://ieeexplore.ieee.org/document/8305835

[2]https://www.researchgate.net/publication/313720615_Arduinobased_system_for_soil_moisture_measurement

[3]https://www.semanticscholar.org/paper/Arduino-based-smart-irrigation-using-water-flow-and-Singh-Saikia/b35cba9513348875c7dd28b72b70b95964737765

[4]http://www.academia.edu/Documents/in/Soil_Moisture_Sensors

[5]https://ijoer.com/Paper-May-2017/IJOER-MAY-2017-6.pdf

[6] Krist´ofSzabados and Attila Kov´acs "Titanium: Visualization of TTCN-3 system Architecture" IEEE-2016.

[7]https://www.scirp.org/journal/PaperInformation.aspx?PaperID=89748.

[8]https://www.dellemc.com/content/dam/uwaem/production-design-assets/emea/campaigns/envisionthefuture/Final_report_DELL_EMC_Automated_irrigation%20System.pdf

[9] https://www.ijier.net/ijier/article/view/1123

[10]https://en.wikipedia.org/wiki/Soil_moisture_sensor

[11] https://www.instructables.com/id/How-to-Create-a-Blynk-Local-Server/

[12] https://www.hackster.io/rei-vilo/private-iot-with-blynk-on-local-server-619926

[13]https://embeddedcomputing.weebly.com/private-iot-with-blynk-on-local-server.html

[14]https://learning.thimble.io/forum/t/getting-module-2-working-with-a-local-blynk-server-install/314

[15]https://p.codekk.com/detail/Android/blynkkk/blynk-server