

# AGROTES

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**Abstract** – The world’s population is flourishing and with that growth, we must out-turn more food. Due to the industrial and photochemical revolution, the agricultural industry has kept up in food production, but only by compromising the soil, the environment, our health and food production system itself. Farmers are the backbone of every society they provide us with food materials. Lack of proper management of resources leads to low yield of harvest and soil contamination, which in turn reduces the profit in the agricultural industry. These requirements also get affected by climatic changes. Farmers don’t have the proper facility to know the resource requirements for the crops, the above reasons result in a reduced number of farmers in our new generation and an increasing suicide rate. The vision of the project is to create open and accessible technology. The goal is to define a decision support system (DSS). The proposed system measures soil nutrients, moisture content, temperature, light, and humidity. Initially, the soil sample from the farm area is submitted to verify which plant is suitable for growing with the help of a nodal officer and it will be referred to the registered farmer. Soil nutrients are tested by 2 ways mainly the NPK testing, which can be done by lab testing and another one by measuring pH using a pH sensor which, determines whether the soil is acidic or alkaline. Using a mobile system it monitors each plants moisture content, temperature, light and humidity. Then the sensed value will be compared with the threshold value, if any deficiency it will inform the registered farmer using the mobile application. The application displays the data as a real- time snapshot of our land and pushes notification and suggestions to maximize the plant health. The system surrounds the field which will help to provide equal care for all crops. The real-time monitoring of pH level guarantees the farmer to provide the correct fertilizer at accurate amount. It helps a new farmer to cultivate the most suitable crops for that area thus it provides him an unpredictable yield. The main advantage of the proposed system is that it can plant poly crops in a machine inefficient manner. It allows for democratization and decentralization of food production, maximum productivity from minimum resources.

**Keywords** – Sensors, Real Time Monitoring, Mobile Application, Cloud Platform.

## I. INTRODUCTION

According to the recent statistics, on an accelerating rate, the land used for crop cultivation in India is decreasing. Hence technology solutions for agriculture task automation are the need of the hour. In particular, simplified irrigation mechanisms reducing water wastage are very essential, which encourages precision agriculture. Technological solutions for irrigation and agriculture task automation are driven by electric power. Lack of proper management of resources leads to low yield of harvest and soil contamination, which in turn reduces the profit in the agricultural industry. These requirements also get affected by climatic changes. Farmers do not have the proper facility to know the resource requirements for the crops, the above reasons result in a reduced number of farmers in our new generation and an increasing suicide rate. Farmers are the backbone of every society they provide us with food materials. Cloud computing is an on-demand availability of computer systems resources. Large clouds today generally have functions distributed over

different locations from central servers. It may be designated an edge server If the connection to the user is relatively close. Cloud may be limited to a single organization or be available to many organizations. To achieve coherence and economics of scale, cloud computing relies on sharing of resources by analyzing these situations; we are introducing a fully automatic precision farming system. The system gives proper information regarding the growth of plants. It suggests the farmer for watering, fertilizers. By using our mobile application, sensors provided in the farm stores the values in the cloud.

## II. RELATED WORKS

In this section various techniques for the precision farming are described in brief.

In paper “Precision Farming: The Future of Indian Agriculture” proposed by V. M. Abdul Hakkim, E. Abhilash Joseph, A. J. Ajay Gokul and K. Mufeedha, sensor technologies are used. To measure humidity, vegetation, temperature, texture, structure, physical

character, humidity, nutrient level, vapour, air etc various technologies are used such as electromagnetic, conductivity, photo electricity and ultra sound. Without laboratory analysis Sensors enables the collection of immense quantities of data. To distinguish crop species, locate stress conditions, identify pests and weeds, and monitor drought, soil and plant conditions remote sensing data are used. Here we use humidity, light, temperature, and moisture sensor for analysing the accurate amount of inputs needed for crops.

In the paper "IoT and agriculture data analysis for smart farm" proposed by Jirapond Muangprathub and Nathaphon Boonnam, IoTs was applied in agriculture to improve crop yields, improve quality, and reduce cost. For these reasons, WSNs application to watering crops was proposed. Here a system is designed and implemented a system to control environmental factors in the crop fields. The system had the three parts hardware, web application, and mobile application. The first part was designed and implemented in control boxform. This control box included hardware and electronic control system to connect to sensors and obtain data on crops. The control box was designed for real-life testing. The implemented design connected to and received IoT information from any field in this study. The second part was the web-based application designed and implemented to manipulate details of crop data and field information. In this step, large-scale data from IoT is stored and utilized in data analysis. This work applied data mining by association rules to discover useful information on effects of environment and climate. The results showed that suitable temperature for high productivity of homegrown vegetables and lemons was between 29 °C and 32 °C. The final part was to control the crop watering with a mobile application on a smartphone. This allowed for both automatic and manual functional control to the user. The user can use the automatic function based on data from soil moisture sensors for watering.

In paper "Agri-IoT: A Semantic Framework for Internet of Things-enabled Smart Farming Applications" proposed by Andreas Kamilaris, Feng Gao, Francesc X. Prenafeta-Boldu and Muhammad Intizar Ali described that Internet of Things (IoT) is now possible to process a large number of sensor data streams using different large-scale IoT platforms. and also described Agri-IoT, an IoT-based framework applying real-time stream processing, analysis and reasoning in the domain of agriculture, based on semantic web technologies, facilitating more informed and accurate decision making by farmers and event detection. Agri-IoT achieves this by offering interoperability between sensors, processes, data streams, farms as entities and web-based services, exploiting open data, making use of semantic technologies and linked web data.

**1. Final Stage:** The proposed system is mainly used for real time monitoring of farm field. Sensors inserted

into soil collect the information about temperature, moisture, light and humidity which will be displayed in mobile application. According to the sensor readings, if the inputs are more or less, alert messages will be sending to mobile application of farmers. With help of alert messages farmers can provide inputs in precise amount. The proposed system makes use of Arduino Uno a microcontroller board based on the ATmega328p. NodeMCU, Thingspeak is an open-source IoT application and API to store and retrieve data from hardware devices and sensors which uses HTTP protocol over the Internet or LAN for its communication. (1) Arduino Uno, (2) NodeMCU, (3) Cloud Platform, (4) Firebase Server, (5) MIT App Inventor.

In this project we are using an Arduino Uno a microcontroller board based on the ATmega328p. We can easily connect it to a computer with a USB cable or power it with an AC to DC adapter or battery to get started. The Arduino integrated development environment (IDE) has a text editor for writing code, a text console, a message area a toolbar with buttons for usual functions. It connects to the Arduino and Genuino hardware to transfer programs and communicate with them. Programs authored using Arduino software is called sketches. These sketches are written in the text editor and are secured with the file extension (.ino). The Arduino IDE stores a software library from the wiring project, which keeps many common input and output procedures.

- 2. NodeMCU:** Thingspeak is an open-source IoT application and API to store and retrieve data from hardware devices and sensors which uses HTTP protocol over the Internet or LAN for its communication. MATLAB analytics is included to analyze and visualize the data received from your hardware or sensor devices. We can create channels for every sensor data. These channel can be set as a private channel or you can share data publically through public channels.
- 3. Cloud Platform:** Here we are using IoT which makes use of several sensors for monitoring the required data. The task of sensors is to collect the data across the field and it is sent to the cloud. The cloud is loaded with some basic measurements which will then be compared with the sensed data and send it to the firebase server. IoT and cloud computing technologies are used for better production of plants. The farmers are getting live data like temperature, humidity, PH, light, etc... Agricultural security is increased by using this technology.
- 4. Firebase Server:** Firebase server is used for developing the mobile application. It helps to develop high-quality applications which are a Google's mobile platform and enlarge the business. A firebase

server key and firebase ID are required to send push notifications and to Android mobile app devices. Builders can secure their data by using the realtime database by using the user's server-side-enforced security rules. Google's Firebase Cloud Messaging (FCM) server is used to send push notification to both Android as well as iOS. The server side of the Firebase Cloud Messaging consists of two components: (1) The FCM backend provided by Google. (2) App server or any other trusted server environment where your server logic runs.

5. **MIT App Inventor:** The mobile app is created using MIT App Inventor (App Inventor for Android). MIT App inventor is provided by Google which is a web application integrated development environment and now maintained by the Massachusetts Institute of Technology (MIT). It allows newcomers to create application software for two operating systems: Android and iOS. The sensor reading from the field is given to the mobile app using MIT app inventor. When the deficiency in any of the sensor readings, it provides notification to the users. It makes use of a graphical user interface (GUI) very similar to the programming languages. Via an experimental firebase the App inventor also supports the use of cloud data. Embedded C is the language we are using in proposed system. Embedded C is one of the most popular and most commonly used programming languages is the development of embedded system. It is used for the Embedded system due to the following reasons like, its efficiency, less development time and portability. The Embedded system consists of hardware and software. A hardware module is the processor, which is the heart of the Embedded system and can be anything like a microprocessor, microcontroller, DSP, CPLD and FPGA, these all are programmable ie, we can write program to define how the device actually works. Embedded software or program allows hardware to monitor external events and controls external devices accordingly. The program for embedded software may have to directly manipulate internal architecture of embedded hardware such as timers, serial communication interface, interrupt handling and output ports. Embedded C programming language, which is widely used in the development of the embedded system, is an extension of C program language. Embedded C programming language uses the same syntax and semantics like the main function, declaration of data-types, defining variables, loops, functions, and statements (etc) of C program language. Extension in Embedded C from standard programming language includes input hardware addressing, fixed-point arithmetic operations, accessing address spaces.

Technique	Remarks	Advantage
Sensor Technology	It helps to determine the humidity, temperature, nutrient levels etc of soil.	Farmers can determine crop condition by using sensor technology.
Automatic Watering	It provides watering to the crops automatically.	Farmers can water crops at where they are.
Farmers Mobile App	It helps the farmers to monitor the crops from anywhere.	Farmers can identify the condition of their crops by using their smartphone.

Fig. 1: Consolidation.

In the hardware section of the application, we want to create an account in the firebase. It's Google's platform that helps to develop high-quality apps. Then we will get a host and authentication. Here we are connecting common wifi to upload the details in the cloud. For firebase, in Thinkspeak and MIT App we want to connect common wifi. After getting a connection we will get some variables and check whether the values are coming serially.

After that, we will upload the values to Thinkspeak and Firebase then, by using the medium cloud we will send the values. From firebase, we want to take the values and set the fields in firebase. Firstly, we will set the fields in the MIT app so that we want to give the firebase URL correctly. After integrating both hardware and software section we can get real-time monitoring from our farm field. Then the values from the firebase will be displayed in our mobile application. We will crosscheck the values with the threshold value, and an alert message in our mobile application automatically pumps the motor if the moisture content is less. And all the plant need will be done with the help of farmer's mobile application.

### III.WORKING

The project Agrotex aims at developing a fully automatic precision farming system which is a unique methodology for providing accurate inputs. This project provides real-time monitoring of the field with the help of sensor readings from the field. The project also helps farmers to decide when to plant and harvest crops. As a result, precision farming can improve time management, reduce water and chemical use and produce healthier crops and

higher yields-all of which benefits farmer's bottom line and conserves resource while reducing chemical runoff. Through this system the farmer, the nodal officer is connected, using a mobile application that gives the soil lab test results which help farmers for future decisions. Using the mobile application, the farmers can automatically turn on watering and so that farmers can control the whole field in his absence too. Our system is mainly divided into 3 modules, (1) Registration Module (2) Lab Module (3) Mobile application Module

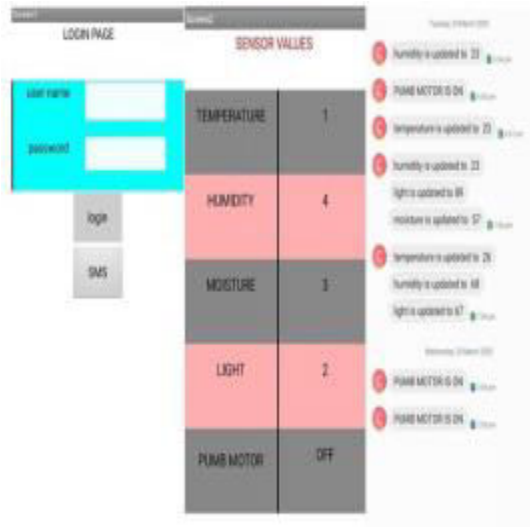


Fig.2: Mobile Application.

### 1. Registration Module

In the Registration Module, it cross-checks whether the user is an existing member, else the user has to be registered with the mail id and phone number.

### 2. Lab Module

In Lab Module, the soil PH and NPK values are tested manually at the lab and the results will be displayed in the mobile application of farmers, which help farmers to decide which crop to be cultivated according to the lab results.

### 3. Mobile Application Module

Mobile Application which is connected to the database, displays the message from the nodal officer regarding the test results also displays the sensor readings from the field such as temperature, humidity, light, moisture and accordingly the watering and other inputs are given. The number of inputs will be compared with the threshold values and alert messages will be provided to farmers.

## IV. TABLES

### 1. Hardware Requirements

Components	Specification
Android Phone	
Arduino Uno	ATmega328P – 8 bit AVR family microcontroller
NodeMcu	ESP-8266 32-bit
Motor Pump	Standard 130 Type DC motor
Motor Drivers	L293D Motor Driver

Fig. 3: Hardware Requirements.

## V. CONCLUSION

Now a day's the farmers didn't get expected productivity from their fields. Because of this condition, the new generation is turning towards white-collar jobs always. The proposed system can overcome these problems. The design proposes a fully automatic precision farming system for providing accurate inputs and proves that the use of water can be diminished so that the water will not be wasted as compared to the present records. The sensors are placed in the crop fields and the values are depicted. We are introducing IoT based smart farming system. A system is built for monitoring the crop field with the help of sensors and automating the irrigation system. IoT based farming is highly efficient when compared with the conventional approach. The farmers can monitor the field conditions from anywhere. Also known as precision agriculture, precision farming can be thought of as anything that makes farming practice more controlled and accurate. The result of this system is intended to help farmers make better decisions and increase crop yield through the use of technology.

### 2. Software Requirements

- Arduino
- Firebase
- MIT App Inventor

## VI. FUTURE ENHANCEMENT

In the future years, smart farming is predicted to create a big impact on the agricultural economy by linking the gap between small and large scale businesses. The trend is increasing in all the developing countries too. To improve the profit and yield all should be ready for working behind it. Agriculture automation can be integrated with future agriculture systems like hydroponics, aeroponics and aquaponics. It is required to reduce the human intervention and the crops can be sown cultivated and harvested without human intervention. We can also build with vertical farms operating autonomously, growing

crops and supplying oxygen to everyone. The proposed system is expected in the future to be a base system for studying the development of environmental algorithms for optimal growth of plants using cultivated environment data. We can also attempt to understand the effect of extreme weather conditions on food production. Future work on the project can be a more simplified wireless sensor network proposing minimizing the cost of the project. Finally, an experimental implementation will allow data analysis to conclude the efficiency of the project.

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