SMART IRRIGATION SYSTEM AND BEST CROP SUGGESTION

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***Abstract*- Freshwater scarcity is becoming a huge problem all over the world, hence a solution for optimal water resource exploitation is urgently needed. The monsoon is the primary source of water for agriculture, yet it is insufficient. A smart irrigation system based on Internet of Things (IoT) and Machine Learning (ML) is being made to solve the problem of water resource management and which crops to grow in the agricultural sector. A smart irrigation system is designed in this research to estimate the field's watering requirements based on a variety of environmental variables such as soil moisture, temperature, and humidity, which helps crop growth. The website is updated in real time with irrigation status using a laptop. This method involves putting sensors in the field to monitor soil moisture, temperature, and humidity, then sending the data to a microcontroller, which calculates the amount of water needed.The collected data is regularly uploaded to the server and can be accessed using Google Firebase.This technology also allows you to post about your experience in the website's Blog section and helps us predict weather through the website. Our website Smart-Farmer also assists farmers in purchasing and selling products such as fruits, vegetables, and grains via the internet. This method saves water, labor, and plant nutrients by reducing the use of traditional irrigation methods. This system provides a low-cost, fully working prototype model with superior technological features.**

***Index Terms*- Irrigation, Environmental parameters, Water conservation, Smart System, NodeMCU, Machine Learning, IoT**

I. INTRODUCTION

Agriculture is significant not only in terms of economics, but also in terms of our social, political, and cultural lives. "58 percent of rural people in India are employed in the agricultural sector, which contributes roughly 17-19 percent to the country's GDP," according to a study report from February 2018. Due to poor and haphazard usage of water resources, the agricultural field is currently experiencing a slew of issues. Agriculture is both the victim and the perpetrator of water scarcity. Irrigation presently consumes approximately 84 percent of the country's total available water. The most major contributor to the ecosystem and water scarcity is field water management. Some farmers may have enough rain, but it often falls when it isn't needed and disappears during droughts. The agricultural industry likewise has the difficulty of meeting the growing demand of India's population while also ensuring food security when land resources are limited. In order to help the farmers overcome the uncertainty of rainfall and to improve their yield, in addition to Smart Irrigation System based on IoT we are proposing an efficient Crop Prediction feature using Machine Learning which provides a better decision-making model for crop sowing according to the weather, location and soil conditions of the field. Our website **Smart-Farmer** includes all these features which would help farmers for agricultural doings.

II. LITERATURE SURVEY

A. A study on Smart Irrigation using Machine Learning: Proposed by Janani M and Jebakumar R [2] , who wanted to improve the irrigation system by using machine learning in agriculture. It aids in the efficient use of water and the reduction of water waste. This entirely knowledge-based system combines automated data analysis, data recording, and decision making with machine learning implementation. It improves the quantity and quality of crop yield.

B. Automation of Irrigation System using IoT:
Pavan Kumar Naik, Arun Kumbi, Kirthishree Katti, and Nagaraj Telkar [3] proposed a mechanism to reduce the amount of water that flows into agricultural regions unnecessarily. Temperature, moisture, and humidity measurements are constantly monitored and sent to the

given IP address via temperature, moisture, and humidity sensors. The data from that assigned IP address is constantly collected by an Android application.

C. Automation by IoT and machine learning in irrigation: In this study, Yashika Mahajan, Mrunalini Pachpande, Ruchita Sonje, Swati Yelapure, and Manisha Navale [4] aim to improve water system works by combining machine learning and the internet of things to improve water efficiency, get a financial advantage, and reduce monetary weight. Ranchers, for the most part, require enough means and impetuses to understand crops and water. They began by creating an informational index including data on reasonable qualities for this investigation. They then use a decision tree technique to forecast future water requirements. Furthermore, they create an electronic choice emotionally supportive network for chiefs, agriculturists, and scientists with the purpose of gaining access to various data, including a projection of future water requirements.

D. Intelligent IoT Based Automated Irrigation System: Ekta Dagur, Sourabh Mishra, Rijo Jackson Tom, Veeramanikandan, Yuthika Shekhar M [8] created an Intelligent IoT-based Automated Irrigation system in which sensor data on soil moisture and temperature is recorded and analysed using a KNN (K- Nearest Neighbor) classification machine learning algorithm to forecast when the soil should be watered with water. This is a completely automated system in which devices communicate with one another and irrigate using intelligence. This was made with inexpensive embedded devices like the Arduino Uno and the Raspberry Pi 3.

III. PROPOSED WORK

Agriculture is important not simply for economic reasons, but also for our social, political, and aesthetic life. According to a study report from February 2018, "58 percent of pastoral people in India are employed in the agriculture sector, which contributes around 17-19 percent to the country's GDP." Due to poor and erratic operation of water coffers, the agrarian field is presently passing a slew of issues. Agriculture is both the victim and the perpetrator of water failure. Irrigation presently consumes roughly 84 percent of the country's total available water. The most major contributor to the ecosystem and water failure is field water operation. Some growers may have enough rain, but it frequently falls when it is not demanded and disappears during famines in numerous regions. The agrarian assiduity likewise has the difficulty of meeting India's expanding population demand while contemporaneously icing food security in a terrain where land coffers are scarce. In addition to the IoT- grounded Smart Irrigation System, we propose an effective Crop Vaticination point that uses Machine Learning to give a superior decision- making model for crop sowing depending on the rainfall, position, and soil characteristics of the ranch. Our website **Smart-Farmer** includes all these features which would help farmers for agricultural doings.

3.1 System Architecture

The system architecture is given in Figure 1. Each block is described in this Section.

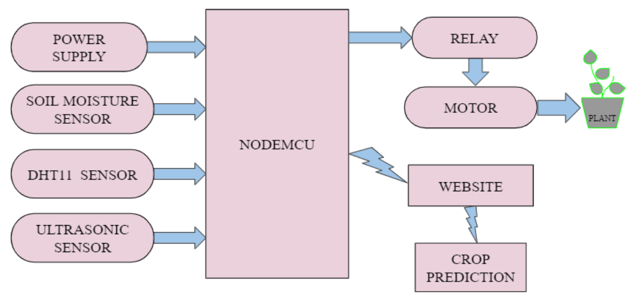

Fig. 1 Proposed system architecture

A. Sensor Blocks: The first step is to use the soil moisture sensor to detect soil moisture content and the DHT11 sensor to monitor temperature and humidity in order to irrigate the fields, and the motor will switch on when the amount of water falls below the threshold value. The ultrasonic sensor detects the level of water in the tank and delivers the information to the microcontroller. The microcontroller uses this information to determine whether the tank is full or not.

B. Power Supply Block: 5V power supply is used.

C. NodeMCU Block: The application runs on the NodeMCU board and determines whether the sensor data is larger than or less than the specified threshold value before turning on the water pump. The pump will start and stop automatically if the data falls below the specified threshold value. The NodeMCU (Node MicroController Unit) is an open-source software and hardware development environment built around the ESP8266, a low-cost System-on-Chip. All of the main components of a computer are included in the ESP8266, including a CPU, RAM, networking (WiFi), and even a modern operating system and SDK. As a result, it's a great fit for a variety of Internet of Things (IoT) projects.

D. Google Firebase: On the web server moisture, temperature, and distance for the water level in the tank are all predetermined. The motor will be controlled by a machine learning system, and fertilizers will be recommended accordingly. The Decision Tree uses a Machine Learning Algorithm to advise fertilizers based on the inputs measured for the current crop.

E. Wi-Fi Module: Data is uploaded into the Google Firebase using Node MCU module and after analyzing data, it is sent to the Website.

F. Relay and Motor: The relay module is an electrically regulated switch that allows or prevents current passage by turning on or off. They're designed to run on low voltages like 3.3V (like the ESP32, ESP8266, and others) or 5V (like the ESP32, ESP8266, and others) (like your Arduino).

G. Smart Farmer Website: The data is retrieved from google firebase at a specific time of day by the Website. Sensor data variations might be displayed in the app. Users have access to the data at any time. The user will be notified if the sensor data falls below the threshold value.

3.2 Requirement Analysis

The implementation detail is given in this section.

3.2.1 Hardware

Farmers are beginning to use a variety of monitoring and control systems to boost production by automating agricultural parameters including temperature, humidity, soil moisture, carbon dioxide, light detection, soil pH, and so on. Systems that can assist farmers in boosting production monitor and adjust these characteristics.

1) Temperature Sensors: It can detect temperatures between 0 and 110 degrees Celsius. It's part of the LM35 series. It is RTD, which is based on the concept of resistance measurement. The higher the temperature, the higher the resistance.
2) Moisture Sensors: It measures moisture levels in the range of 0 to 60%. The sensor used is the SM300. It determines the soil's dielectric constant. The moisture content is proportional to the dielectric constant. The soil resistance will be returned by this sensor. The lower the moisture level, the higher the resistance, and vice versa.
3) Ultrasonic Sensor: The sensor measures the water level in the tank and provides the information to the microcontroller. The microcontroller uses this information to determine whether the tank is full or not.
4) Relay: This will be a manually operated switch that will automatically turn on or off depending on the amount of water required.
5) Servo motor: It will control the angular position of the pipe to ensure that water is distributed evenly. It will rotate in a clockwise direction from 0 to 180 degrees.
6) The power supply is a 5V power supply.

The actuators will determine the movement of servo motors and the precise amount of water to be provided according to the crops based on these numbers, temperature, and moisture. NodeMCU works in the system to check for sensor values and then drives the relay to turn on the motor as needed.

3.3 Dataset

The temperature and moisture values measured will be high if we take a sample of dry soil for testing, and the pump will immediately turn on. The temperature and moisture readings sensed will be low if we gather a sample of damp soil, and the motor will remain turned off. The system will compute and choose motor activation based on the parameters displayed on the webpage.

IV. RESULT/ OUTPUTS

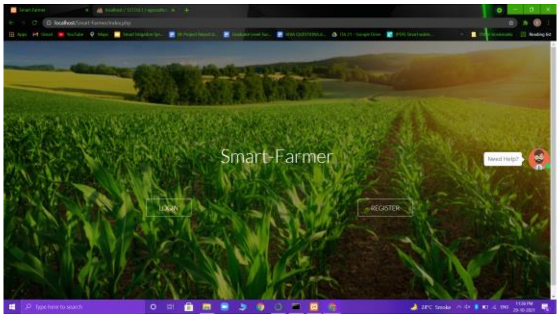

Fig. 2 This is the login and register page for our website.

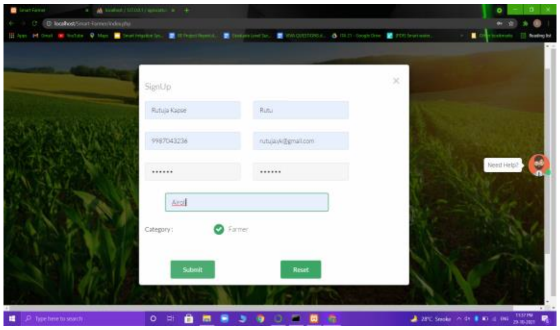

Fig. 3 If you click on the register button it will guide you to the registration page.

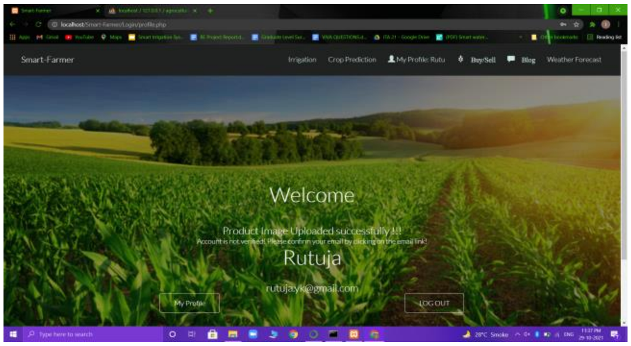

Fig. 4 After Registration is done you will see the homepage of our website.

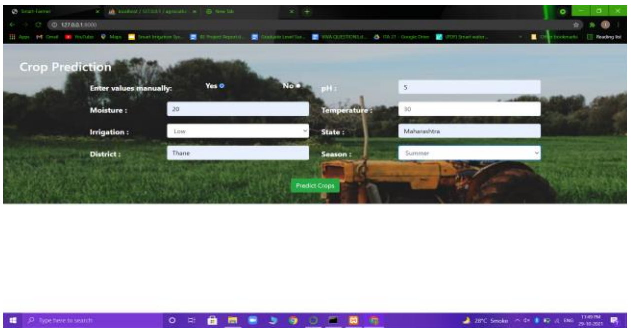

Fig. 5 By clicking on the Crop prediction button on the top right you will see this page, you need to enter the details required.

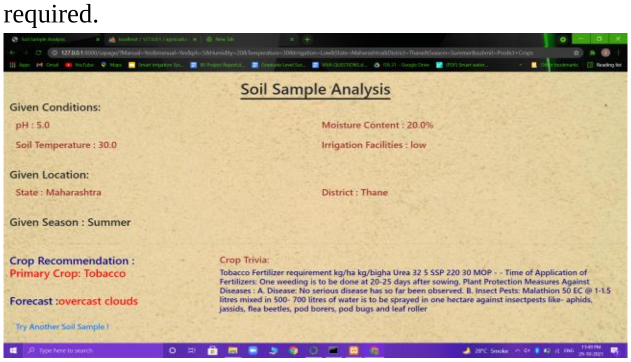

Fig. 6 After entering the details you will be provided with the information about what crop is best suitable for your area/ region.

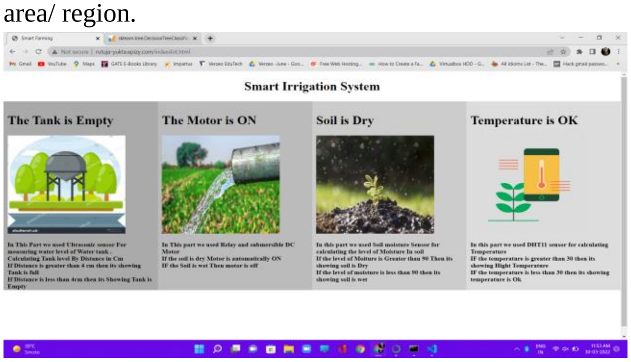

Fig.7 The irrigation option on the homepage will let you know about the real time data about the field with the help of sensors.

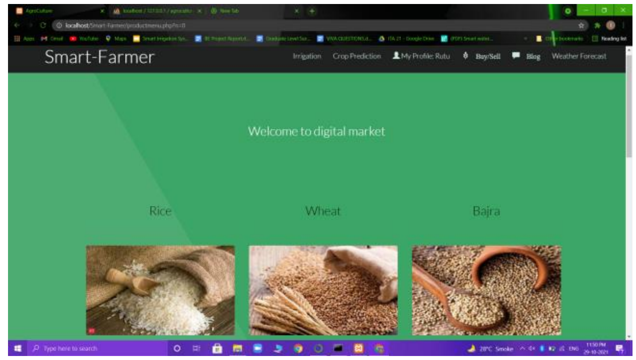

Fig. 8 The Buy/ Sell button will redirect you to this page where you can buy products and sell yours too.

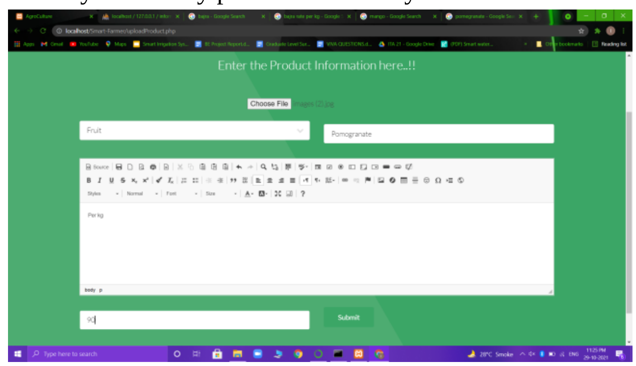

Fig. 9 The Blog button will redirect you to this page where you can share your experience with every user.

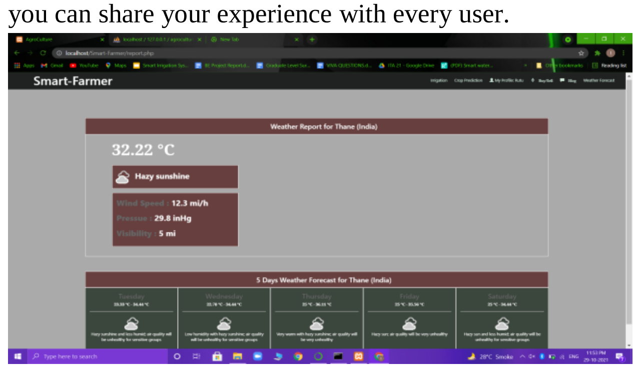

Fig. 10 The Weather forecast button will let you know about the weather in your area.

Fig.11 Hardware setup for our project.

V. CONCLUSION

The suggested method will provide farmers with data from the sensors while also reducing water consumption. The farmer will be able to access real-time field data, as well as a weather prediction component on the website. This technology will assist farmers in achieving the ideal moisture level in the soil for a certain crop while also reducing their reliance on the rainy season. Its goal is to provide farmers with decision-making tools, automation technology, and a platform for buying and selling produced crops that seamlessly integrates products, expertise, and services for improved production, quality, and Dirt.

VI. ACKNOWLEDGMENT

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