



IOT Based Smart Agriculture System.

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ABSTRACT

A low-cost soil observation system called Smart-Agro Farm examines the weather and different soil parameters to create high-tech smart farm equipment for farmers. The proposed project aims to design a cost-effective smart irrigation system because the current method is not very cost-effective. The soil monitoring module, where we can use the smart irrigation system, and the machine learning module make up the two key modules of this system. The first module consists of the characterization of several soil sensors and circuit linkages. A sensor that measures soil moisture is used. DHT 11 can measure the temperature and humidity. The second module (Machine Learning), which deals with obtaining information from each of the aforementioned sensor data values. Farmers are given the correct information and direction on the cultivation of preferred crops through the use of a web-based application that has been developed. We can therefore say that our solution is the ideal fusion of IoT, Machine Learning, and Web Application. It is also advantageous for low-income household farmers to step up their usage of climate-smart farming techniques.

Keywords: Digital Humidity Temperature, Internet of Things.

1, INTRODUCTION

1.1 Significance

India is characterized by small farms. Over 75percent of total land capitals within the country are less than 5 acres. Most crops are rain nourished, with just about 45percent of the land irrigated. As per some estimations, about 55percent of total population of India depends on farming. In the US, because of heavy mechanization of agriculture, it is about 5percent. India is one of the biggest producers of agricultural products and still has very less farm productivity. Productivity needs to be increased so that farmers can get more pay from the same piece of land with less labour. Precision agriculture provides a way to do it. Precision farming, as the name implies, refers to the applying of precise and proper total of comment like pee, fertilizers, soil etc. at the proper time to the crop for increasing its productivity and increasing its yields. Not all precision agriculture systems offer best results. But in agriculture it is important that the recommendations made are accurate and precise because in case of errors it may lead to heavy material and capital loss. Many researches are being carried out, in order to attain an accurate and efficient model for crop prediction. Ensembling is one such technique that is included in such research works. Among these various machine learning techniques that are being used in this field; this system proposes a system that uses the voting method to build an efficient and accurate model.

1.2 OBJECTIVES OF PROJECT

- To detect the soil Classification Using Machine Learning Methods Based on NTP values.
- To Predict crop based on soil.
- To train dataset using Support Vector Machine, Random Forest Techniques.
- To get real time update (Temperature, Humidity, Soil Moisture Level, Water level, etc) of field on your remote device.

2. LITERATURE SURVEY

Ashwani kumar Kushwaha, Depicts crop yield forecast techniques and a propose reasonable harvest with the goal that it will work on the benefit for the rancher and nature of the agribusiness area. In this paper for crop yield expectation they acquire huge volume information, it's been called as large information (soil and climate information) utilizing Hadoop stage and agro calculation. Subsequently based store information will foresee the appropriateness crop for specific condition what's more improvement crop quality.

Girish L, portray the harvest yield and downpour fall expectation utilizing an AI strategy. In this paper they gone through an alternate AI approach for the expectation of precipitation and harvest yield and furthermore notice the effectiveness of an alternate AI calculation like liner relapse, SVM, KNN strategy and choice tree. In that calculation they presume that SVM have the most elevated productivity for precipitation expectation.

Rahul katarya, Portrays the distinctive AI strategies utilized for speeding up crop yield. In this paper they gone through various man-made brainpower methods such as AI calculation, enormous information investigation for accuracy agribusiness. They clarify about crop recommender framework utilizing KNN, Ensemble-based Models, Neural organizations, and so forth.

The planned framework will suggest the most reasonable yield for specific land. Considering climate boundary and soil content like Rainfall, Temperature, Humidity and pH. They are gathered from V C Farm Mandya, Government site furthermore climate office. The framework takes the necessary info from the ranchers or sensors like Temperature, Humidity what is more pH. This all sources of info information applies to AI prescient calculations like Support Vector Machine (SVM) also Decision tree to recognize the example among information and then, at that point, process it according to include conditions.

Planned the framework utilizing an AI for improvement of the rancher. Machine learning(ML) is a distinct advantage for farming area. AI is the piece of counterfeit insight, has arisen along with big data advances also superior execution processing to set out new open doors for information concentrated science in the multi-disciplinary agri-technology area.

3.METHODOLOGY

3.1 EXISTING SYSTEM

In the field of real time monitoring the temperature and humidity of soil and other factor like monitoring of conditions like weather, wind direction, wind speed, water level, flood. monitoring, automated irrigation facility and providing alarming system that's warning alarm to farmer's phone when certain condition occurs supported Wireless Farming System can correctly guide agricultural production and improve crop yield. It has been assumed that yield rate in an agricultural isn't improving. Soil moisture is that the water stored within the soil and is suffering from precipitation, temperature, soil characteristics, and more. It have a many node but each node includes temperature, humidity, soil moisture and water level sensors as well as microcontroller and relay switching unit. The Plenty of research work has been done to improve the performance of agriculture field the system uses technology to control watering and roofing of the green house. It uses statistical data acquired from sensors (like temperature, humidity, moisture and intensity of light intensity sensors) compared with the weather outlook for making decision.

3.2 PROPOSED SYSTEM

Internet of Things (IoT) is nothing but it is an advanced technology for the live monitoring and controlling device anywhere in the world. We are going to develop a system that can help in an automated irrigation system by analysing the moisture level of the ground. The crop prediction process done with consolidating the preceding data and the present data of the various sensors connected with IoT. Machine learning may be a methodology of analysing information to automatize the given model. Within the past preceding data, crop prediction was calculated by analysing farmer's previous expertise on climatic condition. Finally, Android application is developed which provides proper awareness and guidance regarding the cultivation of preferable crops to farmers. Hence, our system is perfect combination of IoT, machine learning and Android Application. Finally, mobile android application is developed that provides correct awareness and steering guidance the cultivation of preferred crops to farmers. Hence, our system is ideal combination of IoT, machine learning and android application. additionally, it welcomes low-income home farmers to accentuate into good climate farming practice.

4. HARDWARE AND SOFTWARE REQUIREMENTS

4.1 Software Requirements (Platform Choice)

- Tools – Python and Arduino IDE

Arduino:- It is an open-source software. It is shown in the figure 6.2. It is mainly used for writing and compiling the code. The code is compiled into the module. The code is done in an official Arduino software. The code compilation is very easy. It is available for many operating systems. They are MAC, Windows, and Linux. It runs in java platform. It comes with the inbuilt functions. Debugging, editing and compiling is done in the Arduino Ide. Different types of modules are available. They are Arduino Mega, Leonardo, Micro and many more. They contain a microcontroller on the board, it is programmed in the c programming. The code is created on IDE platform. A Hex file will be created. It can be transferred and uploaded in the Arduino compiler. The IDE has two basic parts. They are Editor and Compiler. The compiler is used for compiling and uploading the code. It supports both C and C++ languages. The IDE environment is mainly divided into three sections. They are

- Menu Bar
- Text Editor
- Output Pane

Menu Bar is defined as the bar appearing on the top is called as Menu Bar. The check mark is in the circular button. After writing the code, it is used to check. Once the code is written, it is used to verify it. The arrow key is used to upload. In order to create a new code, the dotted paper is used. There are two types of arrow present in the Arduino. One is upward arrow and the other one is downward arrow. The upward arrow is used to open an existing project. The downward arrow is used to save the code which is currently going on. On the top right, there will be available of serial monitor. It is used to debug the code. The Arduino module is connected to the computer using Cable, in order to activate it. The baud rate should be selected before performing the coding operations. The Arduino baud rate is 9600. Arduino C language is similar to the C language. It can be used for any embedded system microcontroller.

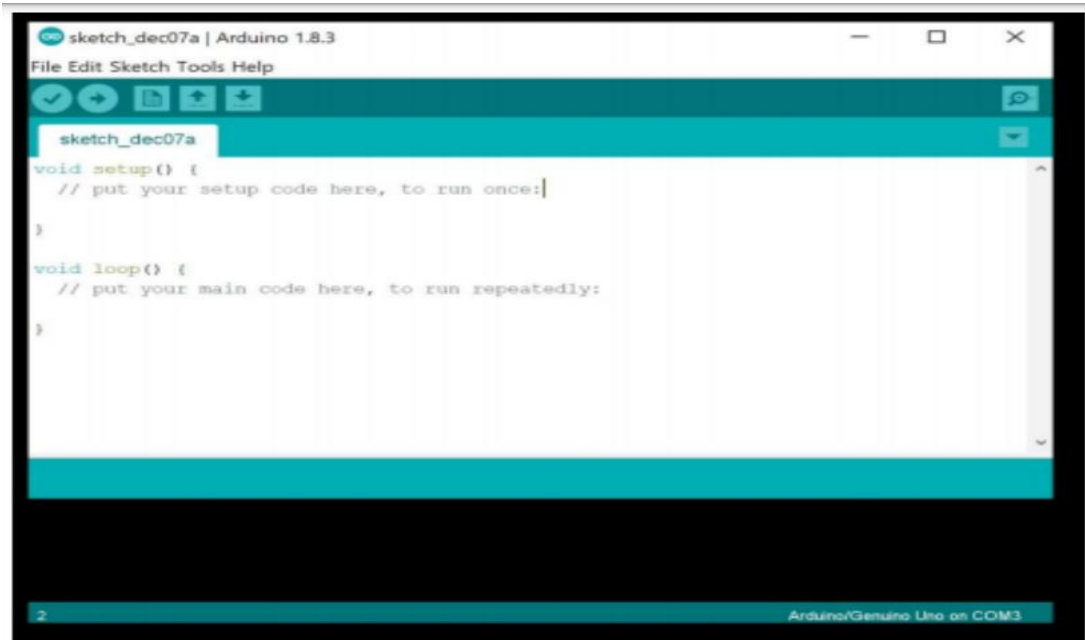


Fig:- Arduino IDE

Python: - Python is a deciphered, undeniable level, universally useful programming language. Made by Guido van Rossum and first delivered in 1991, Python has a plan theory that underscores code comprehensibility, quite utilizing significant whitespace. It gives develops that empower clear programming on both little and enormous scales. Van Rossum drove the language local area until July 2018. Python is progressively composed and trash gathered. It upholds different programming ideal models, including procedural, object-arranged, and utilitarian programming. Python includes an exhaustive standard library, and is alluded to as "batteries included". Python translators are accessible for some working frameworks. C Python, the reference execution of Python, is open-source programming and has a local area-based advancement model. Python and C Python are overseen by the non-benefit Python Software Foundation.

Python is a universally useful item situated programming language with significant level programming abilities. It has become renowned due to its obvious and effectively reasonable language structure, convey ability and simple to learn. Python is a programming language that incorporates highlights of C and Java. It gives the way of composing a rich code like C, and for object-situated programming, it offers classes and items like Java.

- Python was created in the last part of the eighties, i.e., late 1980's by Guido van Rossum at the National Research Institute for Mathematics and Computer Science in the Netherlands as a replacement of ABC language equipped for special case taking care of and interfacing.
- Python is gotten from programming dialects like ABC, Modula 3, casual chitchat, Algol-68. Van Rossum picked the name Python for the new dialect from a TV show, Monty Python's Flying Circus.
- Python page is a document with a .py augmentation that contains could be the mix of HTML Tags and Python scripts.
- In December 1989 the maker fostered the first python mediator as a leisure activity and afterward on 16 October 2000, Python 2.0 was delivered with many new elements. On third December 2008, Python 3.0 was delivered with really testing and incorporates new highlights.
- Python is an open source prearranging language., which implies that anybody can download it uninhibitedly from www.python.org and use it to foster projects. Its source code can be gotten to and changed as needed in the project. Python is one of the authority dialects at Google.

Features of Python

- Easy to Learn and Use. Python is not difficult to learn and utilize.
- Expressive Language. Python language is more expressive implies that it is more reasonable and intelligible.

- Interpreted Language.
- Cross-stage Language.
- Free and Open Source.
- Object-Oriented Language.
- Extensible.
- Large Standard Library.

4.2 HARDWARE REQUIREMENTS

1. ESP8266 NodeMCU

The ESP8266 NodeMCU CP2102 board has ESP8266 which is a highly integrated chip designed for the needs of a new connected world. It offers a complete and self-contained Wi-Fi networking solution, allowing it to either host the application or to offload all Wi-Fi networking functions from another application processor. ESP8266 has powerful on-board processing and storage capabilities that allow it to be integrated with the sensors and other application-specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. Its high degree of on-chip integration allows for minimal external circuitry, and the entire solution, including the front-end module, is designed to occupy minimal PCB area. The ESP8266 NodeMCU development board – a true plug-and-play solution for inexpensive projects using WiFi. The module arrives pre-flashed with NodeMCU firmware so they're ready to go – just install your USB driver (below). ESP-12 Lua Nodemcu WIFI Dev Board Internet Of Things board contains a full ESP8266 WiFi module with all the GPIO broken out, a full USB-serial interface, and a power supply all on the one breadboard-friendly package.

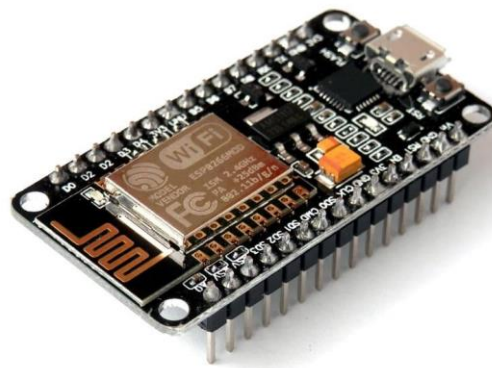


Fig:- Node MCU

Features: -

- 11 b/g/n Wi-Fi Direct (P2P), soft-AP
- Integrated TCP/IP protocol stack
- Use CH340G to replace the CP2102.
- Open-source, Interactive, Programmable, Low cost, Simple, Smart, WI-FI enable
- Arduino-like hardware IO
- Integrated low power 32-bit CPU
- Advanced API for hardware IO, which can dramatically reduce the redundant work for configuring and manipulating hardware.
- Code like Arduino, but interactively in Lua script.

2. Soil Sensor

This is Soil Moisture Meter, Soil Humidity Sensor, Water Sensor, Soil Hygrometer for [Arduino](#). With this module, you can tell when your plants need watering by how moist the soil is in your pot, garden, or yard. The two probes on the sensor act as variable resistors. Use it in a home automated watering system, hook it up to IoT, or just use it to find out when your plant needs a little love. Installing this sensor and its PCB will have you on your way to growing a green thumb. **The soil moisture sensor consists of two probes which are used to measure the volumetric content of water. The two probes allow the current to pass through the soil and then it gets the resistance value to measure the moisture value.** When there is more water, the soil will conduct more electricity which means that there will be less resistance. Therefore, the moisture level will be higher. Dry soil conducts electricity poorly, so when there will be less water, then the soil will conduct less electricity which means that there will be more resistance. Therefore, the moisture level will be lower.

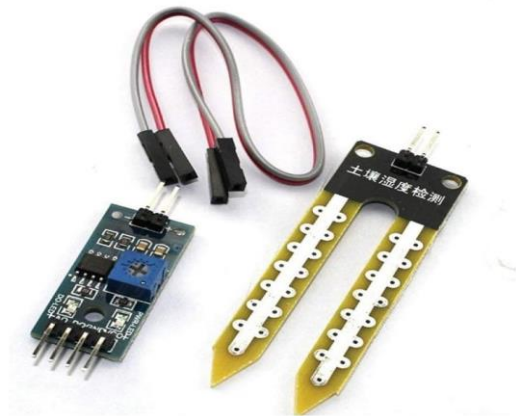


Fig:- Soil Sensor

Features: -

1. Dual output mode, analog output more accurate
2. A fixed bolt hole for easy installation
3. With power indicator (red) and digital switching output indicator (green)
4. Having LM393 comparator chip, stable.

3. Temperature and Humidity Sensor

The DHT11 Humidity & Temperature Sensor Module is a basic, low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air and outputs a digital signal on the data pin (no analog input pins needed). Its very simple to use, and libraries and sample codes are available for Arduino and Raspberry Pi. This DHT11 Humidity & Temperature Sensor Module makes is easy to connect to an Arduino or microcontroller as it includes the pull-up resistor required to use the sensor. Only three connections are required to be made to use the sensor – Vcc, Gnd, and Output. We have also included the cables required to connect the DHT11 to a microcontroller.

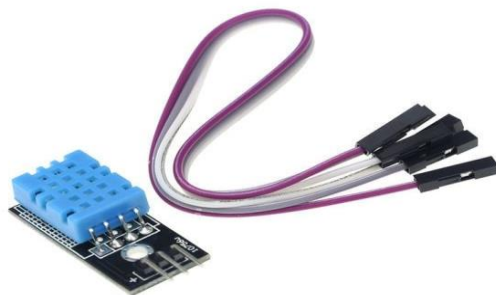


Fig:- DHT11 Sensor

Features: -

1. Low-cost Module.
2. 5V power and I/O.

3. 2.5mA max current use during conversion (while requesting data).
4. Good for 20-80% humidity readings with 5% accuracy.
5. Good for 0-50°C temperature readings $\pm 2^\circ\text{C}$ accuracy.
6. No more than 1 Hz sampling rate (once every second).
7. It comes with cables to make connections to a microcontroller.

4. GSM

GSM SIM800C Modem with Antenna Module's baud rate is configurable from 9600-115200 through AT command. The GSM GPRS Modem is having internal TCP/IP stack to enable you to connect with the internet via GPRS. It is suitable for SMS, Voice as well as DATA transfer applications in the M2M interface. The onboard Regulated Power supply allows you to connect a wide range of unregulated power supply. Using this modem, you can make audio calls, SMS, Read SMS, attend the incoming calls and internet, etc through simple AT commands. The Modem is built with Quad-Band GSM/GPRS engine-SIM800C from SIMCOM, works on frequencies 850/ 900/ 1800/ 1900 MHz. The Modem is populated with DB9 Female connector so as to directly connect with computer or other RS232 Compatible devices. MAX3232 from MAXIM Semiconductor is used for the RS232 Level conversion. The modem will work with 5-12V DC, which can be fed either through onboard 2 Pin RMC connector or DC Jack. The modem is powered by a High Current Low Dropout Linear Voltage regulator to withstand high surge current requirement (may rise up to 2A).



Fig:- GSM Module

Features: -

1. Quad-band 850/900/1800/1900MHz.
2. GPRS multi-slot class 12/10.
3. GPRS mobile station class B.
4. Compliant to GSM phase 2/2+
5. Class 4 (2 W @ 850/900MHz)
6. Class 1 (1 W @ 1800/1900MHz)
7. Control via AT commands.
8. (3GPP TS 27.007, 27.005 and SIMCom enhanced AT Commands).
9. Low power consumption.

5. TEST RESULT

The listed tests were conducted in the software at the various developments stages. Unit testing was conducted. The errors were debugged and regression testing was performed. The integration testing will be performed once the system is integrated with other related systems like Inventory, Budget etc. Once the design stage was over the Black Box and White Box Testing was performed on the entire application. The results were analyzed and the appropriate alterations were made. The test results proved to be positive and henceforth the application is feasible and test approved.

SR. NO	TEST CASE	TEST CASE STEPS	EXPECTED RESULT	ACTUAL RESULT	STATUS
1.	DHT11 Sensor	Initialize Sensor	Should Detect Temp and Humidity	Temp and Humidity	PASS

2.	Soil Sensor	Initialize Sensor	Should Detect Soil Level	Soil Moisture Reading	PASS
3.	DC Pump	Initialize Sensor	On Motor Depending on parameters	Motor On	PASS
4	Login	Pass input username and password	Should grant authentication	Granted	PASS

Table. No :- Test Cases

6. CONCLUSION AND REFERENCES

6.1 CONCLUSION

This system is mainly designed for developing a low-cost soil monitoring system which analyses the different soil properties and thereby developing a hi-tech smart farm set up for farmers. This project proposes an IoT based smart irrigation with soil monitoring architecture along with a hybrid machine learning based approach to predict the suitable crop. The proposed algorithm uses sensors data of recent, past data for prediction of suitable crop using machine learning.

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