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An Effective Early Identification of Diseases causes Parameter and Decision Making System based on Agriculture IoT

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Abstract— Accurate identification of diseases in the vineyard is key to preventing serious outbreaks and losses in profits and quality. The severity of diseases varies from year to year, depending primarily on weather condition, history of the disease, soil and water parameters and susceptibility of vines. That means a diseases can be devastating one year and insignificant the next year. The measure to be taken to prevent losses may therefore any from season to season. The purpose of propose system to identify the causes, various factors and conditions which are make favorable environment for attacking of diseases. Various favorable condition for disease development during the life cycle of grapes such as minimum and maximum temperature, percentage (%) of humidity in air, cloudy weather, Rainy with light showering weather, Rainy with heavy showering weather, soil quality and contents and water quality. Propose system ensures to find out the current values of that all parameters and deal with real time data and timely communication for upcoming diseases in vine and take appropriate preventive action over that. Various types of smart sensor used in this system for identifying real time data. That data analyses and visualized by system program and provide to next level. Proposed system ensures to find favorable condition and parameters of eleven different diseases such as Powdery mildew, Bacterial Leaf Spot, Anthracnose, Downy Mildew, Greenaria bitter rot, Alternaria blight , Black Mould rot, Rhizopus rot, Rust, Bacterial cancer etc.

Keywords—Agriculture IoT, WSN(Wireless Sensor Network), DHT22,SHT10, LLC200D3SH-LLPK1, SEN -209, SHS-A5, Raspberry Pi, ThingSpeak Cloud, Data Visualization, Python script,Write API Key's,Read API key's.

I. INTRODUCTION (AGRICULTURE IOT)

Agriculture Internet of Things (IoT) helps in increasing crop productivity by way of managing and controlling the attack of disease like –Downy mildew, Powdery mildew, Anthracnose,Greenaria biter rot, Bacterial Leaf spot,Alternaria blight, Black rot, Blue mold rot,Rhizopest rot, Green mold rot,Botyistic bunch rot, gray rot, Rust, Bacterial Leaf Spot, Foot rot, Bacterial Cancer and more. Agriculture IoT smartly analyses the favorable environment that causes the disease of crop and considering the growth of Internet of Things Since the year 2000, we will find the following shift in use of sensors over the period –

Year 2000 – Globally there were 525 Million farms

- on record out of which not a single farm was connected to Internet of Things Year 2025 – With same base of 525 Million farms
- there were 600 Million in use at these farms. This is a major shift of technological advancement in Agriculture Internet of Things: 2050 Year 2035 – With 525 Millions of farm globally there
- was a growth of more than three fold in sensors implanted at these farms as compared to the year 2020. There were 2 Billion sensors used in 525 Million farms globally in the year 2050.

Observation, Inspection Identification Record Tracking is the Agriculture Internet of Things fundamental working stages

A. Wireless Sensor Networks

Wireless sensor network is widely used in application .It consists of autonomous working devices is called as sensors. In this network all devices connected to each other through sesors. Sesors collect data of various parameters such as tempreture, wind pressor, humidity, soil water level or other environmental parameters and send that data to server or controlling system for analyzing. Recently WNS is important part of agriculture IoT applications. According to Jason Lester Hill, Wireless Sensor Network (WSN) is Sensing + CPU + Radio = Thousands of potential applications.

B. Raspberry Pi 3.0 Model B.

Raspberry Pi is a microcontroller that is capable of doing task as a computer machine. Pi is run with python programming language. General purpose Input and output Pins (GPIO) are provided with Pi for extending feature of pi. Following fig shoes the configuration of GPIO of Model B.

General Specification of Raspberry Pi 3.0 Model B.

- Processor-32-bit 900 MHz quad-core ARM CortexA7 Processor speed -700 MHz to 1.2 GHz.
- Memory ranges-256 MB to 1 GB RAM(on board)
- USB ports-4
- video output-HDMI
- audio output-3.5 mm phono jack
- operating system and program memory- SDHC or
- MicroSDHC Ethernet port-8P8C
- Wi-Fi- 802.11n 2.4 GHz

C. Thing Speak Cloud Servece

We can publish data from your hardware board, such as sensor data, to the Internet of Things using the ThingSpeak. Thingspeak is one of the IoT applications and API to store and retrieve data from raspberry Pi using HTTP protocol over Internet.Thingspeak is one of the open source program. It provide IoT platform that use to collect data from sensors in the cloud and support to developing application based on IoT.Thingspeak provide app and programs that used to analyze and visualize data in graphs and MATLAB.Using channel we get graph and sensor data in thingspeak platform, so we need to create account on thingspeak platform. After we need to form new channel on platform. After creating channel we need to get API Key of that channel .And we used that key in our python program. Here we showed steps for thingspeak account.

- ThingSpeak account setup Enter basic details of the channel
- Save the channel.
- Save Channel ID
- Get API Keys
- To update channel / data logging: API Write Key will
- be used to access in this mode. For retrieve data: API Read Key is used in this mode.
    - Write API Key – A 16 digit code that allows an application to write data to a channel
    - Read API Key – A 16 digit code that allows an application to read the data stored in a channel
- Accessing Channel
    - To Update channel / data uploading / data logging:
    - URL: http://api.thingspeak.com/update?api_key=YOUR-API&field1=VAR-1&field2=VAR-2

D. Python Script and API's

Python includes a built-in HTTP client. Python provide solution for many problems that occurs in day today programming. Python provide modules for better solution designing for problems. Python provide platform independent API and they are powerful. Normal python provide many API's for UNIX platform such as matplotlib, panads, numpy etc. Using Matplotlib we can generate histograms, plots, error charts, power spectra, bar charts, scatterplots, etc., with just a few lines of code. Matplotlib is a Python 2D plotting library which produces publication quality figures in a variety of hardcopy formats and interactive environments across platforms.

II. LITEATURE SURVEY

Before going into the details of our Agriculture IoT based Effective early Identification of Diseases causes parameter and decision making System, we will review some of the existing system in Agriculture IoT and Machine Learning.

Finally, complete content and organizational editing before formatting. Please take note of the following items when proofreading spelling and grammar:

A. Early Detection of Grapes Diseases using Machine Learning and IoT

Suyash S. Patil and Sandeep A. Thorat develop system a monitoring system which will identify the chances of grape diseases in its early stages by using Hidden Markov Model provides alerts via SMS to the farmer and the expert. The system includes temperature, relative humidity, moisture, leaf wetness sensor and Zig-Bee for wireless data transmission. This system used two methods for the data analysis. The first one is statistical method and second is Hidden Markov Model. System only developed for 5 to 6 disease and its causes parameters or favorable conditions. (Bacterial Leaf Spot, Powdery Mildew, Downy Mildew, Anthracnose, Bacterial Cancer, Rust).

B. Software Solutions for Improving Quality of the Vineyard

In [12] Nattapong Tongrod et al. are focused on the development of high quality grapes. For that preparation is needed like preparation of soil, cultivation, and irrigation management and harvesting. In current days precision agriculture is fast growing area of smart agriculture. This paper discusses various tools for developing software solutions for improving quality of the vineyard. The image array module monitors the vineyard using a webcam; also the web module is used to generate web pages automatically.

Xufeng Ding et al. in [13] shows early cautioning framework taking into account Internet, which gathers soil dampness, nitrogen focus, pH esteem, temperature, air stickiness and CO2 fixation, and sends it to a focal server situated outside the field. The central server analyzes these parameters and sends necessary warning message to related persons.

C. Identification of Grape Diseases using Image Processing.

In [14], A. Meukaewjinda developed a system in Thailand for identification of grape diseases using image processing. This framework is sorted out into principle three stages I) grape leaf shading division, II) grape leaf ailment division, and III) examination and characterization of maladies. Here back propagation neural network is used for recognizing the colour of grape leaves. This system categorizes the image taken as input into three classes: scab disease, rust disease and no disease. The support vector machine is used for this classification. Sai Kirti Pilli [15] has built up an aGROBOT (model) which recognizes and screens plant ailments, supplements insufficiency, controlled watering system and controlled utilization of composts and pesticides. Proposed system identifies diseases using image processing and the robot will spray pesticides accordingly.

D. vite.net

In [10], Vittorio Rossi, Francesca Salinari, Stefano Poni, Tito Caffi, Tiziano Bettati delivered a decision support supportive network (DSS) called vite.net. This was predominantly created for administration of vineyards and it is planned for vineyard chiefs. The exhibited DSS has two fundamental parts, I) An incorporated framework for observing ongoing segments like soil, air, bothers, sicknesses, and so forth. II) An electronic apparatus that can dissect this information and give up and coming data to overseeing vineyard supervisors as cautions and choices. The paper exhibits the all-encompassing methodology towards the concentrating on critical issues in vineyards. Creator conveyed a framework by means of s web entry so it empowers both consistent redesigning by the supplier and adaptable access by the client. This paper gives a full computerization and joining of information gathering. A. Matese, et al. [11] displayed NAV (Advanced Vineyard Network) which is for the most part dealing with expert slave units of remote correspondence. This framework was actualized in Italy to collect and checking ongoing Micrometeorological parameters. This framework is sorted out in three parts, for example, equipment usefulness and information securing, vitality utilization and correspondence.

III. IMPLEMENTATION AMD METHODOLOGY

In the proposed system we will connect raspberry Pi board with Wi-Fi module and all the sensors are also connected to Pi board. Different types of sensor send value with particular time interval (approximate 2 sec/per), Pi read that all data using python script (program) and upload all data on thingspeak cloud. Following figure shows proposed system architecture.

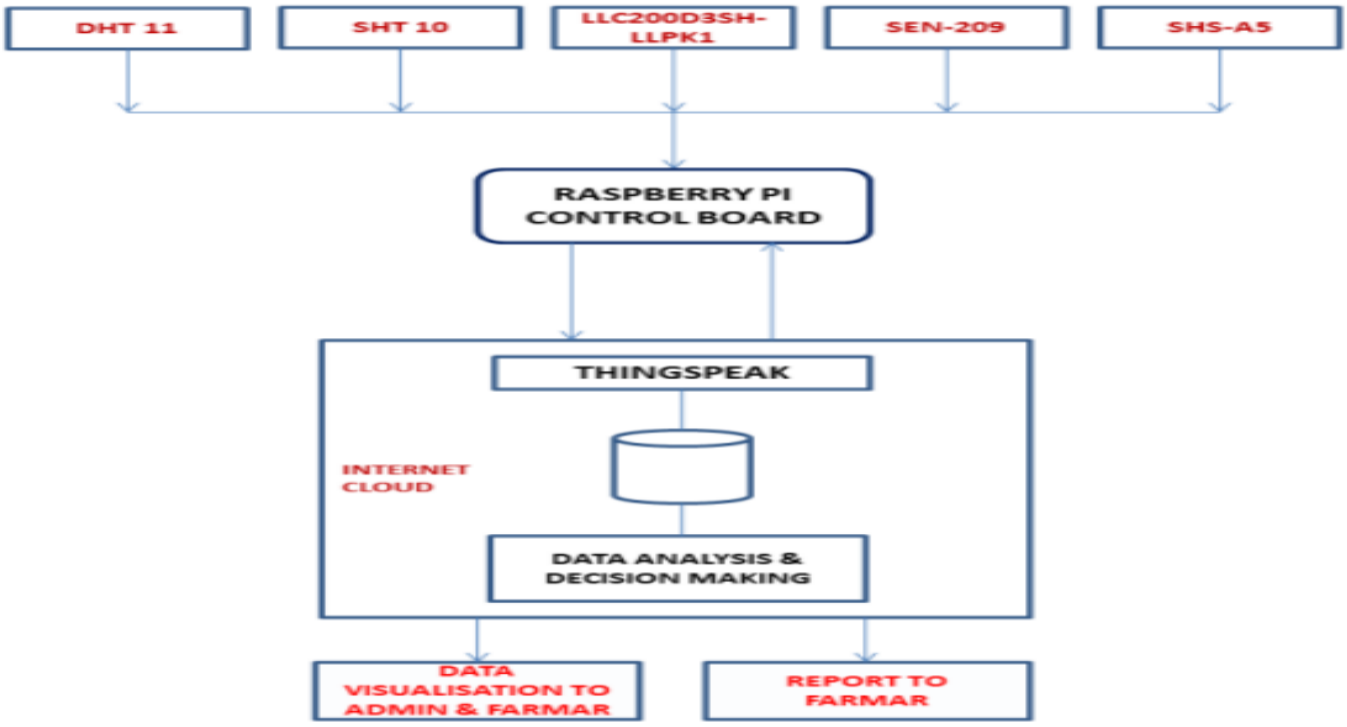

Fig. 1. Block Diagram of Proposed System.

Thingspeak cloud server collect data from raspberry pi channel and analysis that data using API's.Python program generate appropriate decision as per the record by sensor data and plot graph for visualization.Thinkspek cloud also send email and SMS to farmer and administrator, that message include information indication about upcoming diseases. Upcoming disease decision is based on favorable condition for particular disease. Python program take decision with reference of favorable condition parameters values.

A. Sensor and specification

Sr.No.	Sensor Name and Model number	Specification
01	DHT22 Air Temperature Sensor	• 3 to 5V power and I/O • 2.5mA max current • -40 to 80°C • temperature ±0.5°C accuracy • 0.5 Hz sampling rate
02	DHT22 Air Humidity Sensor	• 0-100% humidity • 2-5% accuracy • 0.5 Hz sampling rate
03	SHT10 Soil Moisture & Temperature Sensor	• 4.5% accuracy • Temp.0.5 degree C(- • 40°C ~ 120°C,) Hum.0~100% RH • 14mm diameter, • 50mm long
04	LLC200D3SHLLPK1-Water Level In Soil sensor	• Reverse polarity • ESD and transient • over-voltage protected Built-in delays • available on request for applications • Fast response time
05	SEN -209-PH value sensor	• Analog O/p - 0.2volts - • 0.9 volts Probe length:21cm
06	SHS-A5- Dew sensor	• Humidity Range • 0.1 to 100 % Dew Point Range • 32 to 140 F (0 to 60 C)

Table 1. Sensor and its Specification

B. Data Transmission and Collection

Air Temperature, relative humidity, Soil moisture, Soli temperature, PH, water level sensors are put in the vineyard. These sensors sense values of parameters and generate data. Data will be transfer to think speak cloud by using Wi-Fi module placed on Raspberry Pi board. Raspberry Pi use IEEE 802.11i-2004 protocol for data transfer toward Thing speaks Cloud. All sensors are connected to Raspberry Pi board and by connecting a small analog to digital converter (ADC) chip to the Pi system can open up the way to transfer analog signals to your Raspberry Pi. MCP3008 chip will use as ADC. This chip will add 8 channels of 10-bit analog input to Pi. Following table shows the favorable conditions for growth of diseases on grapes at location "Niphad, Nashik, Sinner of district Nashik (M.S.)"

Disease Name	Powdery Mildew	Bacterial Leaf Spot	Anthracnose	Downy Mildew	Greenaria bitter rot	Alternaria blight	Black Mould rot	Rhizopus rot	Rust	Bacterial cancer
Picture										
Air Temp(Min)	20 C	25 C	02 C	11 C	20 C	12 C	08 C	-	-	25 C
Air Temp Max	28 C	30 C	30 C	26 C	25 C	25 C	30 C	<30 C	<20 C	30 C
Humidity in Air	39%-98%	80%-90%	98%	<80%	80%-90%	<70%	-	-	-	-
Soil Moisture	L	H	HIGH	H	NORMAL	L	H	H	H	H
Water Level In Soil	NORMAL	H	<5''	<0.4''	NORMAL	L (Worm water) (12 C-20 C)	H	H	H	H
Soil Temp(Min)	60 C	25 C	16 C	-	-	17 C	-	-	9 C	-
Soil Temp Max	80 C	35 C	32 C	> 8 C	21 C	25 C	24 C	27 C	30 C	-
Ideal PH value	5.5 - 7.0	5.5 - 7.0	5.5 - 7.0	5.5 - 7.0	5.5 - 7.0	5.5 - 7.0	5.5 - 7.0	5.5 - 7.0	5.5 - 7.0	5.5 - 7.0

Table 2: Favorable Condition Parameters Value for Grouth of Disease on Graps

C. Data Analysis and Visualisation

Data visualization is a general term in that resultant data display in the form of graphical terms. It helps peoples to understand of data with randomly process and shown. Patterns, trends that might go undetected in text-based data can be exposed and recognized easier with data visualization software. In this system data will be visualize in graph, so is easy to monitor and control. Output will be seen on Thingspeak and serial monitor. Open your channel at Thingspeak and output will be shown as mentioned below.

Visualization includes:

- View temperature variation over the last 12 hours
- using a histogram Plot wind velocity over the last hour using a compass
- plot Understand relative temperature variation
- Plot data from multiple fields
- View temperature and pressure levels
- Visualize relationship between temperature and
- humidity

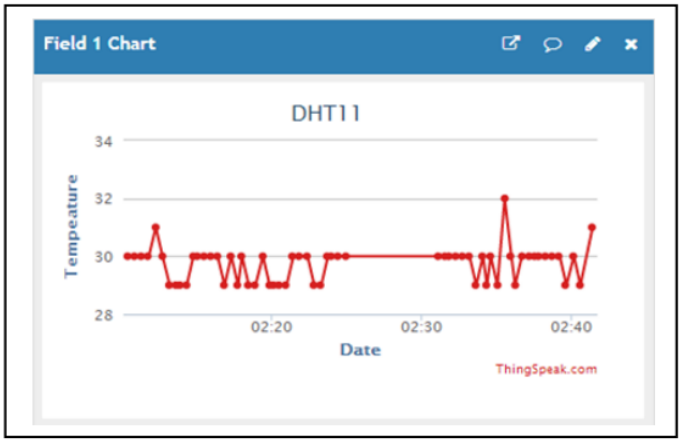

Fig. 2 Plot Graph for Temperature Sensor Data as Below

IV. CONCLUSION

After implementation of this proposed system will be effectively early identify the diseases cause's parameters and favorable conditions of greps using Internet of Things (IoT). It will help farmers to improve the quality of farming and increase the production of grapes. This will be helpful to farmers to increase their profits, and protect the vineyards from affecting the diseases. In this system will be use total 11 deferent sensors so it will helps to farmer for accurate identification of diseases and providing more awareness about upcoming diseases. This proposes system will focus on total 10 major diseases on greps in three talukas of Maharashtra state.

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