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Smart Agriculture: Solution for the growing world!

[1]Prof. Rakhee Kundu, [2]Prof. Anshul Vyas, [3]Aditi Alok Sinha, [4]Hitaxi Dhiren Vyas, [5]Esha Ketan Taswala, [6]Pratima Jiyaram Yadav

[1,2]Assistant Professor, Mumbai, Maharastra-400056, India
[3,4,5,6] Students, Master of Computer Applications, Mumbai, Maharastra-400056, India

ABSTRACT

Today's urban commercial farms have oppressed advanced technology and biotechnology for quite some time. IOT introduces more access to deeper automation and analysis. Our Purpose is to develop a device which will help in agriculture using this technology. It helps to reduce human intervention in system function.

We can optimize standard processes through analysis of large, rich data collections with the help of Fog Computing, which extends the concept of cloud computing to the network edge, making it ideal for IOT that requires real-time applications. Our objective is to develop a Smart Farming culture with the help of our Solar Powered Device, so that better production is obtained with considerably lesser effort and more use of knowledge and technology. The device detects the soil fertility, environmental effects and so on. It will also help in proper Soil Irrigation. Moreover suggestions will be made according to the soil of that particular place and location.

Keywords: IOT, Fog Computing, Smart Farming, Solar Powered, Soil Irrigation.

1. INTRODUCTION

India, being a constantly developing country , pays enough attention toward the The major income of the country i.e. agricultural sector .Agricultural sector is the backbone of the country. The growing population puts forth even more pressure and challenges on the agricultural sector. To keep up with the growing demands, latest technology advancements such as IoT can be used for better and sustainable yield productions with minimal effort. Here we put forward an idea making a device helping fellow agriculturists with the assistance of technology.

Technical advancements such as smart farming, Cloud services, Fog computing, IOT, wireless sensor networks etc. will be useful at great extent. Various kinds of sensors will be used to detect minor changes in the soil, climate, crop condition etc. The device will be powered by solar energy to reduce the hassle of keeping a check on the battery and charging of the device. The traditional farming methods complimented by the above-mentioned technologies can lead to agricultural modernization.

2. SMART FARMING DEVICE AND ITS DETAILS

2.1 Device prototype

We are going to use high quality eco-friendly plastic casing for this device. The size of this device will be 7*5*3(inch). The device will have the following features and specifications.

i. A ON-OFF switch occupying of space in the top right corner.
ii. A climate sensor next to the ON-OFF switch (Top left) occupying an area of to detect temperature, barometric pressure, relative humidity, UV light, dew point etc.
iii. A SMS module to give timely notifications and updates about soil health, climate, next irrigation cycle etc.
iv. A screen to view all the details of the soil. The screen will be placed in middle and size will be 4*3(inch).
v. A navigation button taking from bottom of the screen display, to help the user fill and view the data.
vi. A soil sensor to get the data about the Humidity, Temperature, Water level, Fertility, PH Level etc. will be placed below this device so that it can be easily put into the soil to get readings of the above-mentioned parameters.
vii. When farmer checks from soil the data will be send to fog for processing and analysis and from fog the processed data will be store into the cloud, so that whenever we want to see that data we can view it.
viii. A solar panel at the back of this device of size is 5*3(inch), to generate green energy and keep the device up and working without any external power supply during the daylight.
ix. A raspberry pi for implementing this sensor. The size of this raspberry pi is 4.5*3*1.30(inch).

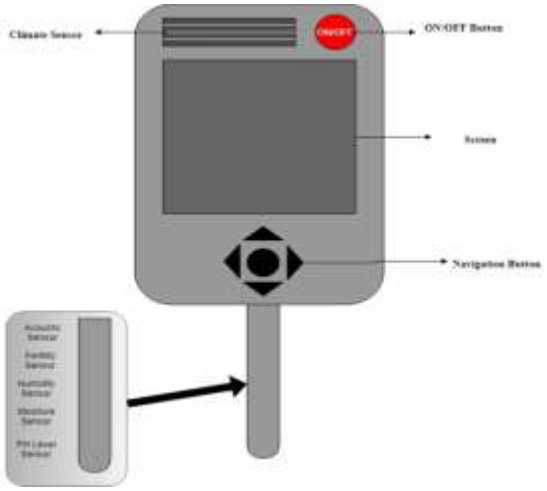

fig. 1: front side of device

In this device we will add sim card to get the everyday message and use internet for uploading the data on fog. During times of no connectivity/ connectivity issues, the data can be stored offline as well on the local device storage which will sync once the connectivity is back. Device will have a buffer storage space which will help to sync the data after the device is reconnected to the internet.

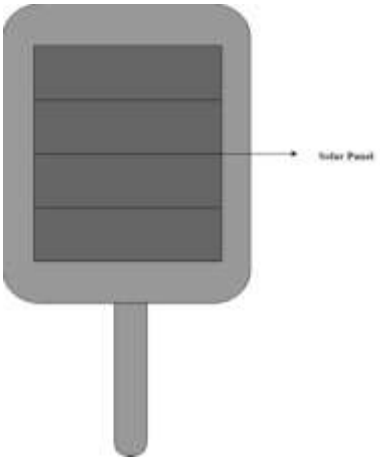

fig. 2 : back side of device

The device will also come laced with an inbuilt alarm system which goes off if the crop is in bad condition and sends a notification to the user enabling him to act at the right time.

2.2 Solar Powered Device

Electricity is the lifeblood of many businesses, including agriculture. Using green energy, we can make our device work more efficiently during the power cutoffs. Solar panels will generate energy for the device and the energy will also be stored in a battery for the shady climatic weather .

2.3. GPS system (Global positioning system)

GPS can be used to get accurate position of device. The user needs to start the recording of the trajectory before proceeding with the collection of readings and should end it once he's done. The GPS module creates an area out of the traversed trajectory and gives the condition for that area. Every device has a unique number which is stored in the database. All the further readings peruse on the device will be stored along with its location. Thus, if multiple readings are taken in the same farm, the analysis can be combined and the result can be displayed accordingly.

2.4 IoT (Internet of things) and its application

IoT is a revolutionary technology that represents the future of computing and communications. Since most of the people over all world depend on agriculture, smart IT technologies should be leveraged to migrate the traditional agriculture methods into the smart agriculture for increasing crop productivity by managing and controlling the everyday farming activities such as

i. Crop water management (Using web-map and sensor observation services)
ii. Precision agriculture (By timely forecasts and notification about dynamic agricultural processes like plantation, harvesting etc. and weather forecasts, soil quality)
iii. Integrated Pest Management or Control (By monitoring and scanning the environmental parameters & plant growth,)

2.5 Raspberry pi

i. The Raspberry Pi is a low-cost single-board computer.
ii. Which will be a centre heart of our system connecting various sensors and will transfer data to the Fog .There are various types of Raspberry pi available which can be used for different purpose.
iii. It will make data transfer hassle free and efficient.
iv. It's ability to interact with the outside world and has been used in a wide array of digital maker projects like parent detectors to weather stations.
v. Connecting a GPS device to Raspberry pi is just like connecting it to any other computer.

2.6 FOG Computing

Fog computing provides computation, storage, and network services between end devices and cloud computing data centers. Whenever we need low latency and low cost, fog computing is used. It can act in real time on the incoming data and works within the limit of available bandwidth. Fog computing provides better quality of service in terms of latency, power consumption and data traffic over internet. The main feature of fog computing is its support application which has low-latency, location awareness and mobility.

Moreover with the assistance of the analysis generated through the FOG computing suggestions will be made for fertilizers & pesticides & which crops to be grown in the farm. Analyzed data can be used for finding out over all GDP of the country

Feature of fog computing in smart agriculture:

- Using Localization feature, fog computing can predict ideal harvesting time.
- Expand their global reach in the most remote rural areas without internet connectivity
- Generate crop health analysis report locally
- Livestock monitoring, health analysis, and location tracking.

Since we are using multiple sensors like temperature, humidity, PH level, water level, soil nutrient to gather agri-related information, the data is raw and unstructured which leads to high latency. To overcome this problem, fog computing can be used to process the raw data obtained from end devices locally and can periodically push the data to central mainframe and ensures the most optimal use of network bandwidth.

2.7 Sensors and their application in the device

i. Soil moisture sensor: We propose to use a Time Domain Reflectometry method in which electrical signals are send from TDR device. Sensors measure the signal's rate of return, which estimates how much water is in the soil. Dry soil will return the signal faster than wet soil.
ii. Humidity sensor: For Humidity and temperature we can use a DH11 sensor. It which generates calibrated digital output, DH11 sensor is highly reliable and is long-time stable.
iii. PH sensor: The pH of soil is an important factor in determining which plants will grow because it controls which nutrients are available for the plants to use. Electrochemical sensors can be used for detecting the PH of soil.
iv. Light Sensor: LDR (Light Dependent Resister) can be used to measure the intensity of light.
v. Spoiled crop detection sensor:

Acoustic Sensors measure the change in noise level due to the interaction of a tool with soil particles. Fertility sensor: This sensor will help us in detecting the fertility of soil.
Climate sensor: the climate sensor can be used for detection of current climatic conditions.

2.8 SMS, Internet based service

The device shall come preconfigured with Internet access. Placing a computer and giving Wi-Fi access to remote locations and villages in India will be difficult because of the low penetration. As mobile phone networks are highly reached to the rural area public as well, we'll be using this medium for the internet access. Also, mobile internet gives ease of portability to the device.

SMS (Text based service) – As we discussed about the reach of mobile networks and internet access, not all places will have the reach of network so getting the reports e.g. (live weather updates) will be difficult for such conditions. We are providing text based service once a day. Where we will send message on each device for the day's weather forecast for morning, noon and evening.

Fig. 3 Block Diagram

3. SERVICES

3.1 Timely Services

Along with the device, farmers who are given device will be registered with the device. Each and every device will have a specific identification number through which a report could be sent if the device encounters a problem. Also, free service will be provided to the farmers. Technician will be visiting the customer and minor problems will be solved. In case of major breakdown, the device needs to be sent to the nearest service center for further repairs.

3.2 Employment Opportunities

Unemployment in India is an issue existing in majority of the rural areas. So along with providing the devices to the farmers we also aim to train an individual from that village of area for providing device problem related services. This will not only improve Quality of Service, but also generate employment. This training will just require basic literacy. Thus, creating a better scope for others too.

4. CONCLUSION

By putting into view this paper, we are proposing an idea which will bring advancement in the agricultural sector and make it more convenient for farmers. Our device will be facilitating farmers with basic requirements of checking the soil and getting all the analysis. The IOT based system and benefit of the FOG computing associated with raspberry pi makes data transfer hassle free and efficient. Also providing it globally, positioning of your system and detection of the surrounding environment will be helping agriculture analysis with it benefit gives unique expertise administration to agriculturist with respect to the development of yields, evaluating manures illness details, strategy for cure to be utilized, scientist chipping away at agriculture will give their revelations, recommendations in regard to advanced method for development. [5]

5. FUTURE SCOPE

Internet of Things is wide castoff in relating devices and gathering statistics. This system serves as a reliable and efficient system and corrective actions can be taken if timely updates are provided. Besides, the system can be used in greenhouses and temperature dependent plants as well. The device can be further enhanced by using a drone or a rover which will scan the entered trajectory collecting superior quality data using advanced sensors, thermal imaging etc. and analyzing the data collected for facilitating farmers with relevant piece of information like wind speed, air pressure etc. using artificial intelligence. Research effort is still required to look over the problems in efficient implementation such as cost feasibility, handling large data volumes, data mining, analytics, design of a service-oriented architecture to tackle performance and cost related issues of service based objects, Quality of Service etc.

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