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Based on Mobile GIS, the design of an Agriculture Information Collector

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Abstract: The agricultural information can be collected with greater accuracy by implementation of digital agriculture. At present, it is complex to collect agricultural information and data acquisition which involves very restricted methodology. This system enables a portable and highly reliable agricultural information collection system with high degree of integration. It can capture the GPS coordinates of the farmland directly by android smart phones. This will make the interpretation of spatial data easy and sensors are used for measuring the agricultural attribute. This sensor value is used as agriculture attribute such as pest monitoring data, crop growth, etc. In earlier times, collecting information and follow-up process is complicated because it requires variety of devices, which include GPS satellite positioning equipment, notebook computers, field information sensors and so on; Also it needs complex process after finishing collecting data, such as matching and data format conversion one by one. The system supports android and IOS system mobile phones is be used to develop a real-time agricultural information collection system, which is based on cross-platform mobile GIS..

Keywords— GIS, GPS, *agricultural information, cross-platform mobile*.

1. INTRODUCTION

Agriculture is continuing to play a important role in Indian economy. By clearly understanding of the fertility, soil type and other parameters related to agricultural yield, farmers can be able to achieve better agricultural yield. With the development of geo informatics, the mobile GIS (Geographic Information System) is becoming the intersection of

evolution of mobility, it is representing the ambition and user demand to exploit the geographic knowledge in the places of decision support anytime.

The mobile GIS are the most reliable information system which can be used by a single user everywhere at any time. The mobile GIS will host the applications related to geography which is essential for the access of the databases having geographical data locally or remotely.

Embedded GIS and wireless communications are all part of a Mobile GIS solution that utilises a variety of technologies. The fundamental technology for this agricultural information system is smart phones, and the spatial geometry information of specific sites is obtained via the in-built GPS of Android smart phones.

Global Positioning System is designed by U.S. Department of Defence. It is a satellite-based radio location and navigation system. Continuous real-time field computers, three-dimensional velocity and time information, positioning for the globe surface and near Earth space, application navigation and all-weather field computers may be provided by 21 (plus three backup) satellites. Precision agriculture is a term used to describe the use of GPS in mobile phones to improve agricultural practises.

With precision farming, farmers can get the most out of their land. Precision farming refers to the use of technology to access crop plot productivity on farmland and the difference between the crop yields on each plot of farmland that can be measured.

and analysing the reasons for differences in plot yield that are influenced by differences in temporal and spatial information (such as topography or plant nutrition or insect pest disease or soil structure or water content or other actual differences), and taking economically effective control measures and technically feasible differential treatment or on-demand positioning measures "This technology is an agricultural information collector system, and implementation is based on the geographical disparities in farmland."

2. METHODOOLOGY

2.1. Framework of the system

Instead of using separate GPS for the acquiring farmland attributes in other existing systems, in this project we make use of the mobile GIS by interfacing

microcontroller board with the android mobile phone using Wi-Fi module or any other network topology.

This GIS can help a farmer to adapt some of the important variables, estimate yields from a desired field and monitoring the health of individual crops, and maximize the production of crop. There are many existing resource for data free of cost GIS and also for a charges. Government agencies, Universities, and private companies are all repositories of the spatial data.
Using a GIS, the analysis of a farmland can be able to make down to sub- paddock regions. Information such as aspect, soil, rainfall and slope can be analysed to develop a clear picture of the characteristics of each parcel of the farmland. Imagery can also be used to determine the health and the vigour of crops and to assist in determining the growth rates.
he spatial location information (GPS coordinates) and attribute information are recorded in the mobile GIS system, and are conversed format automatically at the mobile client to form a complete collection data, and then upload pre-processed information to complete the data acquisition and processing.
This information collector system will collect the measurements data from the farmland through different types of sensors such as soil moisture sensor, pH sensor, salinity sensor, etc. (here only the soil moisture sensor is used for explaining the processing of system).
The attribute information and spatial location information are recorded by using the mobile GIS system, and it will converse the format automatically at the mobile client to make the system user friendly, then the system will upload the pre-processed information in the conversed format by the mobile client to the data server and GIS server through the Wi-Fi module by accomplishing the data acquisition. The system is using the Mobile GIS which is directly got accessed through the Mobile app which is already got installed in the host's device.

2.2 Data acquisition process

Currently, producers are using GIS to better manage the farmland by creating information-dense maps and report that will give them a different perspective of their operations. Other than that of sunlight and nutrients, the plants need right amount of water. Too much or little amount of water has impact on crop growth. Thus soil moisture content is very important for plant's growth.

Let us consider soil moisture sensor as the attribute and it is processed as follows. This system will be using the database which has been collected real time by testing the soil moisture for

various soil types. Here 4 different soil types are compared and collected red soil, black soil, silt soil and clay sand.

After collecting database the comparison of soil moisture sensor value with the minimum threshold value of that particular soil will be happened. if the soil moisture level is lesser than the minimum threshold level, then the motor will be turn ON and thus it will automatically irrigate the plants. This comparing process will be takes place for a fixed time instance. When it reaches the maximum threshold value, the motor will be turned OFF.

2.3 Interfacing hardware with software

The mobile GIS will enable the users to view the spatial data in the proper format. This result in the spatial data interpretation easier and become simple to understand. Everyone does not have the knowledge of how to accessing the GIS and they are not ready to spend the sufficient time to use mobile GIS efficiently. Web GIS has becomes cheaper and easier way for dissemination of processing tools and geospatial data. Network analysis is one of the major requirements for people who are moving with the mobile devices, they need to manage their trips and movement and comprehend their nearby location. This mind-set is facing many challenges in internet navigation from the algorithms and solutions for navigation problems and up to accurate position to the geo data.

The connectivity between the host's device and the microcontroller can be provided by various ways such as, Wi-Fi, Ethernet, USB, GSM, Bluetooth, BLE, etc. In the case of connecting it with the Wi-Fi module the SSID (Service Set Identifier) along with the password should be made accessed by the microcontroller. For other wireless networking, we can simply mention the IP address of the host device.

2.4 Physical Structure of the system

The physical structure of this proposed agricultural information collector system is given below in which the mobile GIS can be accessed wirelessly through GIS server. Inaccurate data collection in agriculture might be result in unwise decisions. This system will overcome the disadvantage of traditional survey method for data acquisition and performing the precise measurement of farming.
As a result, we could efficiently manage the farming land and crops, decrease cost of labour, time, and also unnecessary usage of resources. Here the desktop is used for uploading the program in the board. After

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uploading the program, external power supply can also be used instead of connecting it to the desktop.

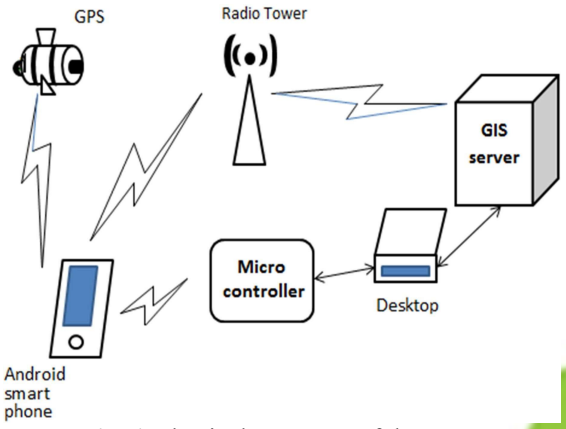

Fig. 1: Physical Structure of the System

After the resource management system for agriculture is completed and updating data in the information systems to maintain the time management in the necessary conditions. For solving the problem of update cycle of agricultural resources system, tedious GIS data update, this device using the agricultural

information collection system which is portable.

This software for portable agricultural information collection can be installed in either smart phone or tablet PC, then update the Web services for getting the system data and WMS map services in the shared services through mobile network, can be collected as location GPS coordinates, agricultural points of interest (POI) name, scene photos which is directly delivered through the shared services interface of the system database, "one-stop collection the system of agricultural data, and quickly update in the field survey site.

3. Results And Discussions

3.1 Soil Moisture Levels for Different Soil Types

The soil moisture level which is required for the appropriate plant growth

will got varied from one soil type to another. To find the optimal and minimal soil moisture of different soil types, the samples of various types of soils are collected and tested for its moisture content by using the soil moisture sensor.

Here, there will be comparison between four different samples of soil for testing. They are red soil, slit soil, clay soil and black soil. The comparison table for the optimal and minimal moisture level suitable for soil growth of different soil samples is given below. Among these soil types, clay soil requires more amount of water as it is composed of very tiny mineral particles which reduces air space and thereby lack of water content may results in harden the soil surface.

By comparing with other soil types, red soil requires lesser water content with greater fertility. The comparison table with the suitable crop for different soil types are given below.

Table 1: comparison table for soil moisture threshold and suitable crops for different soil types

S. No	Soil Type	Soil Moisture Threshold Level		Suitable Crops
		Minimum Moisture Content	Maximum Moisture Content	
1.	Red soil	65	150	Rice, wheat, sugarcane, oilseeds, pulses, millets, etc.
2.	Silt soil	85	160	Vegetables like pumpkin, cucumber, cabbage, carrot, etc.
3.	Clay soil	100	170	Broccoli, Cabbage, Cauliflower, Bean, Pea, Potato, etc.
4.	Black soil	75	150	Cotton, rice, sugarcane, sunflower, linseed, groundnut, etc.

3.2 Comparison chart for the maximum and minimum threshold values for different soil types

As we know that wet land crops such rice, sugarcane, etc. will need more water as for its better growth. In India, these kinds of crops are more frequently cropped as they are having the greater demand.

This kind of crops are most widely grown in red soil and black soil as it can provide nutrients to crop with comparatively lesser water than other soil types. As we know India is a tropical region and also these two soil types can withstand higher temperature which will increase the feasibility.

This is the reason why we are saying red soil is the fertile one. The nutrition content of red soil is suitable for wet land crops and this threshold level is the added advantage for this soil. Also black soil is having better threshold for the plant growth. The comparison chart for the maximum and minimum threshold values for different soil types (red soil, silt soil, clay soil, and black soil) is given in below fig. 2.

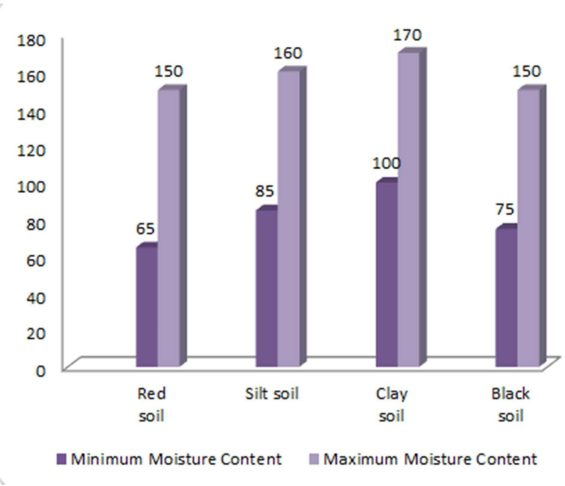

Fig. 2: Comparison chart for moisture level of various soil types

Unlike the wet land crops, the vegetables like broccoli, cabbage, cauliflower, potato, bean, etc. are requiring very lesser water content in the soil for proper growth.

3.3 Interfacing Mobile GIS with Agriculture information collector system

After collecting the database, the agricultural attribute of the farmland has to be compared with it. Thus, the agricultural attribute of the farmland has to be displayed in the Android smart phone. For that the connectivity between the Android smart phone and the Agricultural information collector system has to be provided.

This may be Ethernet, Bluetooth, USB, GSM, etc. Through this, the system can acquire the accessibility of the Android Smart phones. This will be useful for displaying the sensed attributes of the farmland in the Mobile app.

If the soil moisture level goes below the minimum threshold level, the notification will be appeared on the mobile screen. Also the motor will be automatically switched ON. We can use the value display for displaying the sensor value in the mobile app. Instead of this, we can also use the gauge or slider in which the maximum and minimum threshold value can be mentioned in the widget settings.

Surface recovery requires parallel quantities in both the spatial and the spatial-frequency domains which is called as 2-D Gabor filter function. Filters with low

CONCLUSION:

This agricultural information collector system is basically a portable mobile GIS with smart phone, which is a easy to expandable software architecture to satisfy the requirements of multiple agricultural information applications area in which it can provide agricultural information site called "one stop" collection and processing rapidly.

Some of the important services provide by this agricultural information collector system are given below:

Collection and uploading of information in "one stop" service:

We can use the browse of system and also edit the spatial coordinate data and attribute data on the smart phone, and also to achieve the format of conversing data and involves uploading the data. It can able to access and also analysing the real-time GPS data which is provided by the built-in GPS device present in the smart phone and thus the image data collected by camera of mobile phone itself, and then realizing the synchronization of mobile GIS module for data collection and smart phones built-in equipment, and also it will meet other synchronization which is associated with requirements among image data, GPS data, and GIS map data.

Software architecture system design which is scalable:

The mobile client can adopt various widget modes and also can achieve a simple explanation of the functions via load widgets that are dynamic, which will extend lifecycle for software. The Mobile server is adopting the SOA architecture; the mobile client also invokes the web service through any wireless network and followed by completing the upload and download of the agricultural attributes.

Field test assessment of system availability:

Already a test had been carried out on Station which is under the jurisdiction of the Shanghai Academy of Agricultural Sciences called Zhuanghang Comprehensive experiment. In this test the plant disease monitoring, collected agricultural attributes of the farmland soil, and the plant management, performance of test system and reliability which is purely based on the real-time image followed by video processing and experiment of wireless transmission.

The current status of this agricultural information collector is displaying only the soil moisture values and its GPS coordinates. Further more information can be added to this by placing various other sensor such as salinity sensor, pH sensor and sensor for collecting other important agricultural attributes for making the system more reliable.

The future of this project will be of creating a complete system which is displaying complete information regarding farmland which includes pest monitoring, crop growth, yield, organic matter content, etc.

This proposed system is using the portable mobile GIS for collecting information and it is easier for extending as we can include various sensors for getting an extra attribute and we thus say it as a system providing "one stop service". The App used in this project is more reliable for displaying other agricultural information. The soil type can also be displayed in the Blynk app, but for that image processing can be used.

The advantage in this system is that it uses the mobile GIS which is not requiring the separate GIS system as in other existing systems. The proposed system will be greatly useful for farmers for getting the knowledge about their farmland and thereby the comfort of doing it will be increased as it is a simple system and everyone is having a Smart phone of their own at present and it does not require a huge knowledge about the system and thus everyone can learn to access it.

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