A Framework for Cloud Based Tracking System to Monitor Crop Growth and Crop Loss Compensation for Farmers

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ABSTRACT

Recent past, it is observed that, many farmers are facing a lot of issues in maintaining and protecting the crop growth to give good yield, and they get crop loss due to natural disasters, low production, crop unsustainability, over fertilization etc. Sometimes, the farmers are not able to get remedy in the form of compensation from the government for the same, due to improper prediction of crop loss compensation. Further, there is a chance to misuse of government funds which is related to farmers' compensation funds. In order to eliminate this kind of problem, this system would help policy makers, farmers, government and agriculture departments.

Keywords - Crop Status, Compensation, Cloud, IoT.

1. Introduction

Even though, the technology is developing 70 % of the Indian people depend on agriculture sector. Now-a-days, many farmers are facing issues at the time of cultivation such as low production, crop unsustainability, over fertilization, natural disasters, etc. This leads to huge crop loss to the farmers. Then the farmer sustainability is very difficult and it is also a primary cause for farmers' suicide. Sometimes, the farmers are not able to get remedy in the form of compensation from the government for the same, due to improper prediction of crop loss compensation. Due to this farmer get loss and there is chance to misuse of government funds.

Internet of Things (IoT) plays a crucial role in smart agriculture. Smart farming is an emerging concept, because IoT sensors capable of providing information about their agriculture fields. Internet of Things is widely used in connecting devices and collecting information. IoT is used with IoT frameworks to handle and interact with data and information. In this system, users can register their sensors, create streams of data and process information. It is

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based on device which is capable of analysing the sensed information and then transmitting it to the user.

Cloud computing is a paradigm of distributed computing to provide the customers on-demand, utility based computing services. Cloud users can provide more reliable, available and updated services to their clients in turn. Cloud itself consists of physical machines in the data centres of cloud providers. Virtualization is provided on top of these physical machines. These virtual machines are provided to the cloud users. Different cloud provider provides cloud services of different abstraction level. E.g. Amazon EC2 enables the users to handle very low level details where Google App-Engine provides a development platform for the developers to develop their applications. So the cloud services are divided into many types like Software as a Service, Platform as a Service or Infrastructure as a Service. These services are available over the Internet in the whole world where the cloud acts as the single point of access for serving all customers. Cloud computing architecture addresses difficulties of large scale data processing.

Literature Review

Agriculture is a primary sector for any country. Agricultural problems are always hindering the growth of the country. So agricultural protection is the primary objective for India Smooth agriculture via the usage of Internet of Things (IoT) technologies would help agriculturalists to minimize produced wilds and improve efficiency.

The economic environment and development of the country are depending on agricultural development. Regrettably, conventional agricultural methods are adopted by many farmers, which results in reduced crops, fruits, and yields, where automation is not enabled.

IOT is a novel application domain that integrates different technologies (software) and devices (hardware) such as wireless telecommunications technology, sensors, Radio-Frequency Identification (RFID) tags, actuators, mobile phones, etc. Kevin Ashton invented the word 'Internet of Things' in 1999. The first interesting characteristic of IOT originated from the name that describes it. It is a set of physical interconnected objects or "Things". Physical entities can be an animal, humans, cars, environments, appliance, etc. Furthermore, the "Internet" refers to the fact that "Things" are connected to the internet. Additionally, each "Thing" has an identifier in order to be identifiable.

Increasing food consumption, need for quality food and environmental impacts of agriculture lead to use information technology in the agriculture sector, which comes under the heading of precision agriculture.

IOT is a technology that is growing rapidly in recent years and brings numerous benefits for agriculture. Because of the heterogeneous and enormous amount of data collected by IoT devices, future IoT agricultural applications depend on cloud computing.

The IOT cloud platform has the benefit of scalability, virtualization, low price, and large scale. The precision agriculture use sensors, RFID, wireless communication, intelligent systems and other ICT technologies in order to implement the monitoring and controlling systems. Different sensor-based IoT devices needed to install at various locations in the agricultural fields.

In recent years, there have been advances in low-cost and low-power sensors. These sensors measure soil moisture, temperature, humidity and other parameters such as water content, outdoor temperature, wind speed, etc. Data collected from the sensors analyze by data analysis methods which help to extract more information from the data, decision making support systems and create more accurate prediction models.

Statement of the Problem

At present, if there is any natural disaster occurs then there is a crop loss. Then the crop loss can be estimated by the agriculture department officials on the basis of direct observation method. There are no scientific methods to predict the actual crop loss for giving crop loss compensation to the farmers. So there is a dire need to find a scientific method to predict the actual crop loss at the time of natural calamities.

Objective of the Present Study

To eliminate the information lagging about crop status by the farmers, it is intended to develop the application to maintain the crop status information for the farmers which would help to get the proper remedy for unexpected loss arises from crop on specific or combination of causes.

Methodology

This is a simulated Application which helps for both farmers and government. At present, farmers are not getting sufficient compensation even though they have crop insurance; due to lack of information about crop status at the time unfair situation occurs. It is also very difficult to predict the crop loss by the agriculture department.

The combination of traditional methods with latest technologies as IoT and Wireless Sensor Networks (WSN) can lead to agricultural modernization. The WSN collects the data from different types of sensors and send it to the

main server. This system is useful for collecting data through sensor and store in the database. Based on the collected data, farmers can get a message regarding compensation for their crop loss.

2. Sensors

Sensors are used to monitor different conditions of environment like water level, humidity, temperature, etc. Measuring soil moisture is important in agriculture to help farmers to manage their irrigation systems more efficiently. Not only the farmers are able to generally use less water to grow a crop, they are able to increase yields and the quality of the crop by better management of soil moisture during critical plant growth stages.

Sensor networks allow to collect different types of information which can be conveniently exploited for controlling crop production or monitoring ecosystems by analysing different variables, such as light, temperature, humidity or climatologically and anthropological events, among others.

2.1 Uses of Agriculture Sensors

- ☞ They are used in agricultural weather stations. These equipments are equipped with sensors which provide information such as soil temperature at various depths, air temperature, rainfall, leaf wetness, wind direction, solar radiation, relative humidity, pressure, etc.
- ☞ They are used in many equipments (e.g. dendrometer) developed by agro based industries for agricultural or farming applications such as measuring trunk diameter, leaf wetness and so on.
- ☞ They are used in agriculture drones for the purpose of spraying insecticides and pesticides.
- ☞ Solar based pumps which are mobile operated become very popular due to reduction in cost to electricity.
- ☞ E-fences have become popular in rural India which helps save crops from animals such as elephants.

2.2 Functionalities of Sensors

LIDAR sensors are used to obtain dynamic measurements to estimate fruit-tree leaf areas. 3-D modelling of tomato canopies is obtained through high- resolution portable scanning LIDAR.

Figure 1: LIDAR Sensor

Figure 1: LIDAR Sensor

Soil moisture sensors measure the volumetric water content in soil. Since the direct gravimetric measurement of free soil moisture requires removing, drying, and weighing of a sample.

Figure 2: Soil Moisture Sensor

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Optoelectronic sensors for weed detection in wide row crops have been analysed in terms of accuracy and feasibility. pH soil-based sensors allow measurements of variables in the soil oriented toward crop productivity.

Figure 3 : Optical Sensor

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Air flow sensor is a sensor used to determine soil air permeability. Measurements can made at singular locations or dynamically while in motion. Various types of soil properties, including compaction, structure, soil type, and moisture level, produce unique identifying signatures.

Figure 4: Air Flow Sensor

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1. Proposed Framework

Government Agriculture Department Server

This application featured with former registration process through agriculture officer of concern area. The registration processes includes the former personal details, land details, survey number, and pass book number. Once registration process completed, then the formers provides the information every time regarding type of crop that they are cultivating in their corresponding land along with date of cultivation and expenditure incurred to the cloud surver and the same can be access by the agriculture department server.

Crop Status Monitoring Mobile (CSM) APP

Once cultivation process is initiated, the IOT bundled devices are activated by the farmer for their land which is installed intheir land to monitor and maintain about the status of crop in all aspects and keep transferring that information to cloud servercontinuously.

In due case, the farmer wants to see the crop status for specific period or current status, they can see the status of crop in all aspects, which help the farmer to take suitable decision, if any thing goes wrong, or to eliminate the unwanted loss.

If the crops are properly grown and harvested by the farmer, then the farmer specify the closing date of the harvested crop to the agriculture department for updation.

If the crops are get damaged, due to any reason, in that circumstances, the corresponding data of farmer and crop status of thestipulated period are accessed by the agriculture officer to assess the loss from cloud server through agriculture server based on the corresponding former survey number.

IOT Setup

DataCollection Unit

This unit is installed in every former land to collect the raw data continuously from different sensors that are bundled together for fetching various factors related to crop growth status.

Data Processing Unit

This unit consolidates the raw data for every specific period that are collected from data collection unit.

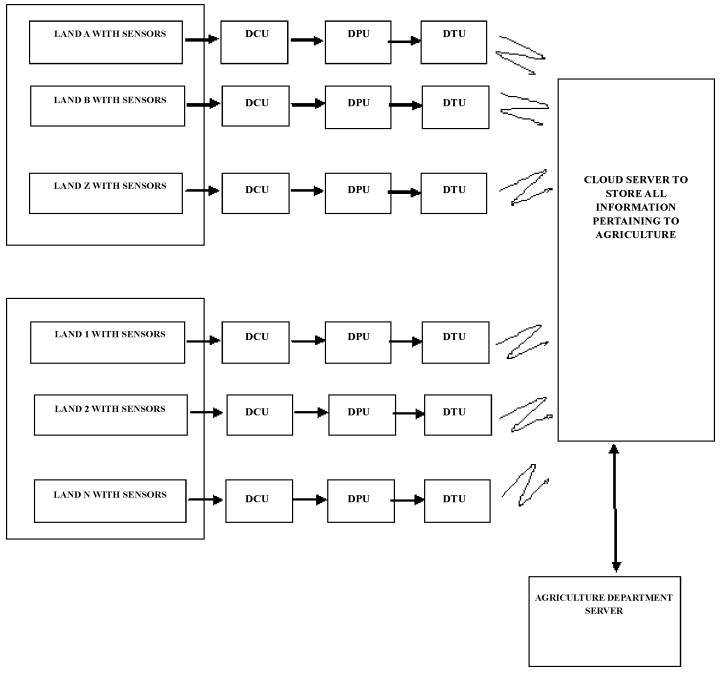
Data Transfer Unit

Consolidated data from DPU is transferred to Cloud server for the corresponding farmer.

4. Proposed Framework Simulation

This proposed framework is simulated by using virtual sensor to monitor the crop status. The problem is to get proper subsidy from government to the farmers. First farmer has to register their personal and farming land details, then, farmer has to give crop details that are currently cultivated in their farming land. The admin has to maintain all these details and has to assign the required sensors for monitoring crop growth continuously. If the crops are get damaged, due to any reason, in that circumstances, the corresponding data of farmer and crop status of the stipulated period is stored in the government agriculture server based on their survey number for assessing the crop loss. The collected data through sensor will be analysed and also predict the accurate crop loss. The farmer who losses their crop due to disaster can get alert message about the eligibility for compensation for crop loss.

4.1 Simulated Framework Architecture



5. Conclusion

It is believed that agriculture sector is the backbone of India, but still, many farmers are getting huge loss due to natural disasters, lack of cultivation process and could not get remedy to overcome their difficulties. Sometimes, the farmers are not able to get revival in the form of compensation from the government for the same due to proper prediction of crop loss compensation. Then the farmers' sustainability is very difficult and it is also a primary cause for suicide of farmers. Furthermore there is chance to misuse of government funds which is related to farmers compensation funds. In order to eliminate this kind of problem, this framework can be simulated which would help policy makers, farmers, government and agriculture departments.

References

- Ko, G. Mascaro, and E. R. Vivoni, Irrigation Impacts on Scaling Properties of Soil Moisture and the Calibration of a Multifractal Downscaling Model, IEEE Trans. Geoscience Remote Sensing, Vol. 54, No. 6, 3128–3142, 2016.
- D. Singh, G. Tripathi, A. J. Jara, A survey of Internet-of-Things: Future Vision, Architecture, Challenges, and Services in Internet of Things (WF- IoT), 2014.
- Dong Haitao, Qu Yugui, Zhao Baohua, Zigbee wireless sensor network platform for the design and implementation?, Electronic Technology Application, pp.124-126, Dec. 2007.
- Evangelos A, Kosmatos, Tselikas Nikolaos D, and Boucouvalas Anthony C. "Integrating RFIDs and smart objects into a UnifiedInternet of Things architecture." Advances in Internet of Things, 2011.
- F.M. Aymerich, G. Fenu, and S. Surcis. An approach to a cloud comput ing network. Applications of Digital Information and Web Technologies, 2008. ICADIWT, 2008, pp. 113 –118, August 2008.
- Garg, Saurabh Kumar, and Rajkumar Buyya. Green cloud computing and environmental sustainability. Harnessing Green IT: Principles and Practices, pp. 315-340, 2020.
- https://www.mouser.in/applications/smart-agriculture-sensors/
- https://www.rfwireless-world.com/Terminology/Advantages-and-uses-of-Agriculture-Sensors.html

- Kavitha B C, Shilpa D P, Thanushree K S, Agricultural Crop Monitoring Sensors using IoT-A Study, International Journal of Engineering Research & Technology (IJERT), ISSN: 2278-0181, 2018.
- M.V.Narayana, K Raveendra Kumar, J Rajeshwar, Rishi Sayal, H S Saini, A Comprehensive Review of Internet of Things Impact on Smart Agricultural Fields andRelated Domains,International Journal of Advanced Science and Technology, Vol. 28, No. 16, pp. 276-294 276, 2019.
- Mahmoud Abbasi, Mohammad Hossein Yaghmaee, Fereshteh Rahnama, Internet of Things in agriculture: A survey, Third International Conference on Internet of Things and Applications, University of Isfahan, Isfahan, Iran, IEEE, pp.1-13, 2019.
- Navyasree T, Sheik Mohamed J, Dr. Ramakrishna S, A Framework for Crop Status Monitoring and Subscription System to Obtain Crop Loss Compensation for the Farmers, Journal of Emerging Technologies and Innovative Research (JETIR) ISSN-2349-5162, 2019.
- Prathibha S R, Anupama Hongal, Jyothi M P, IOT Based Monitoring System in Smart Agriculture, International Conference on Recent Advances in Electronics and Communication Technology, 2017.
- Rakesh Kumar Saini & Chandra Prakash, Internet of Things (IoT) application for agriculture and how farmer can grow by using Internet of Things for agriculture, Global Journal of Computer Science and
- Technology: E Network, Web & Security, Vol. 20, Issue 2, Version 1.0, 2020.
- Srbinovska, M., Gavrovski, C., Dimcev, V., Krkoleva, A., & Borozan, V. Environmental parameters monitoring in precision agriculture using wireless sensor networks. Journal of Cleaner Production, Vol. 88, pp.297-307, 2015.

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