A STUDY TO IMPROVE CROP YIELD IN AGRICULTURE USING IOT AND BIG DATA

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ABSTRACT

We are entered in to the era of big data. Big data is the term used for data sets so huge and complicated that it becomes hard to process using traditional data management tools or processing applications. As with many other sectors the amount of agriculture data are increasing on a daily source. Big data is an increasingly important concern in modern agriculture. The use of electronic and smart technologies, now make it possible to collect vast amount of digital information about agriculture factors. The Internet of Things, the idea of getting real-world objects connected with each other, will change the way users organize, obtain and consume information radically in coming years. In the Digital Agriculture domain Internet of Things (IoT) enables various applications (crop growth monitoring and selection, irrigation decision support among other numerous applications).Through sensor networks, agriculture can be connected to the IoT, which allows one to create seamless environment among farmers and crops regardless of their geographical boundaries. IoT would enable analysis of data and informed decision making for virtually every stages of agriculture viz. Crop Selection, Support machinery selection, Land Preparation, Seed selection, Seed Sowing, Irrigation, Crop Growth, Fertilizing and Harvesting. In addition multiple independent aspects regarding Soil study, weather forecast and Insecticide, Warehousing facilities. Transportation, Market demand etc., can be amalgamated in the decision making process. Smart Agriculture is one of the good examples of Ubiquitous Computing . Ubiquitous computing is considered to be the core concept behind all advance concepts of today and near future. Proposed System consists of four stages- Analysis, Data Fusion, Classification and Data analytics.

Keywords : *Big data, IOT, WSN, Digital agriculture*

1. INTRODUCTION

Agriculture is the cultivation of animals, plants, fungi, and other life forms for food, fiber, medicinal andother products used to sustain and enhance human life. The study of Agriculture is known as Agricultural science

The Internet-of-Things provides lots of sensor data. However, the data by themselves do not provide value unless it is converted into some action. Big data and data visualization techniques allow to gain new insights by batch-processing and off-line analysis. Real-time sensor data analysis and decision-making is often done manually but to make it scalable, it is preferably automated. Artificial Intelligence provides the framework and tools to go beyond trivial real-time decision and automation use cases for IoT.

Smart Agriculture concept is the combination of context-aware computing and Wireless Sensors and Actuator Networks (WSAN) application. Smart agriculture proved its viability for the better management of Agricultural requirements.

2. REVIEW

Wireless Sensor Network (WSN) in Precision Agriculture (PA). The farmers can use the system conveniently as it has a simple user interface. Also the system will keep the farmers

well notified about the every minute event that occurs in the field based on farmer can take a better action. As current system provides easy monitoring of the field, User Input or user interaction is necessary at every step. The author suggests that this system can be further improved by powering it with artificial intelligence which will able to take decisions on user's behalf by evaluating possible options and further consequences from acquired knowledge.

Study on Agricultural Production System Using IoT as Inclusive Technology. The IoT based agricultural convergence technology is a technology to create a high value such as improvement of production efficiency, quality increase of agricultural products in the whole process of agricultural production. The production system can be improved as suggested by the authors, to support more types of products and provide more services. By taking advantage of IoT technology, the efficiency of agricultural production can get a significant improvement. With constantly improving, agriculture IoT must be able to lead agriculture production to a new era.

Multidisciplinary model for smart agriculture based on the key technologies: Internet-of-Things (IoT), Sensors, Cloud-Computing, Mobile-Computing, Big-Data analysis. Farmers, Agro-Marketing agencies and Agro-Vendors need to be registered to the AgroCloud module through MobileApp module. In this paper however does not provide any interpretation of the data even though large amount of useful data is generated.

3. CURRENT SYSTEM

The Indian agriculture still follows the traditional methods which does not give efficient results in contrast to the effects observed with the help of new technologies. Presently modern farming practices revolves around the new concepts such as Internet of Things (Iot), Wireless Sensor Networks (WSN) and Precision Agriculture (PA). Even though the application of these technologies have been carried out in past in various other domains, but for agriculture, it is still in its nascent stages. Framework for collection of various real time field data using wireless sensor network and other statistical data from the cloud or other data houses and then applying analytics to the correlated data using Artificial Intelligence Techniques has rarely been done.

4. PROPOSED SYSTEM

According to literature survey done till date, there is less reliability found in smart agriculture system. Moreover most of the systems uses precision agriculture which needs 'User Input or User Interaction' at every step. The existing system can be improved by empowering it with artificial intelligence & Data Analytics which will enable to take decisions on user's behalf by evaluating possible options and further consequences from acquired knowledge.

Challenge: The main challenge is to develop a method to fuse **multi-sensor data for classifier training**

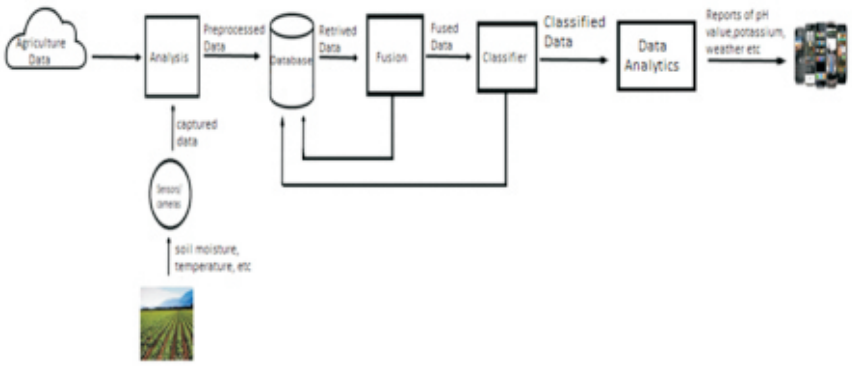

Figure 1: Proposed Architecture for Smart Agriculture using IoT

The Figure 1 shows proposed architecture to improve yield of a crop in Smart Agriculture using IoT. In this architecture the sensors / cameras captures the real data such as soil moisture, temperature etc. from agriculture site and is inputted to the analysis block. This block also collects other statistical agricultural data from cloud or other data houses. The combined data set is then analysed, then stored into the database.

Analysis

In this step the captured data will be analysed (collecting & organizing data). One of the objective of this block is to organize the data while checking for the variations since the different sensor data is captured at different time. This data is analysed using time series analysis method. It is also checked for errors and redundancy by applying outlier removal technique to make it error free and usable. Different types of data that are read using sensor will have different units of measurement viz. temperature will be in Celsius, soil moisture tension will be in units of Pressure (kilo Pascal's) etc. Thus all these different types of data has to be analysed. The pre-processed data is then stored into the database.

Fusion

Data fusion for multiple sensors is very big and complicated task. But it has an advantage because data fusion takes multiple data from multiple sensors. The fused data is more accurate and usable. Based on the usability the output prediction becomes simpler. In this step data is converted into common format and given to the classifier.

Classifier

In this step the fused data is taken as input for the classifier. It classifies data corresponding to the sensor output parameters (eg. soil pH value, chemical content, weather etc.). Classification is proposed be done by using different artificial intelligence techniques such as Neural Network, Support Vector Machine, Regression and Fuzzy Logic. The technique which gives the optimal result will be taken into consideration.

Data Analytics

Since most of the data would have correlation i.e. each factor would have dependency over multiple other factors, analytical study needs to be performed. The usable correlated data is then subjected to Data analytics tools to extract information for decision making process. Various open source software are proposed to be used in this block. At this stage necessary interim reports will be generated which consist of the details such as pH value of soil, chemical content, weather etc. These reports may be displayed on the farmer mobile device.

5. METHODOLOGY

5.1 Analysis

Analysis is checking variation of data because the different sensor data comes at different time. This data has to be analysed using Time Seriesanalysis method also to be checked for errors, redundant data or unwanted junk data. It also applies Outlier Removal technique so that data will be error free.

5.2 Data fusion

Data fusion is one of the most important and challenging task in internet of things. In order to obtain accurate data, lot of sensor nodes in monitoring area are to be deployed.

In this methodology different sensor data like soil moisture, temperature and humidity will be considered and these different data's are combined to get a fused data which will be used for classification shown in figure 2. Different algorithms can be used for data fusion such as

Probabilistic fusion, Fusion and fuzzy reasoning etc.

Probabilistic fusion: Probabilistic methods rely on the probability distribution/density functions to express data uncertainty. At the core of these methods lies the Bayes estimator, which enables fusion of pieces of data, hence the name ‘‘Bayesian fusion’’.

Fusion and fuzzy reasoning: Fuzzy set theory is another theoretical reasoning scheme for dealing with imperfect data. It introduces the novel notion of partial set membership, which enables imprecise (rather than crisp) reasoning

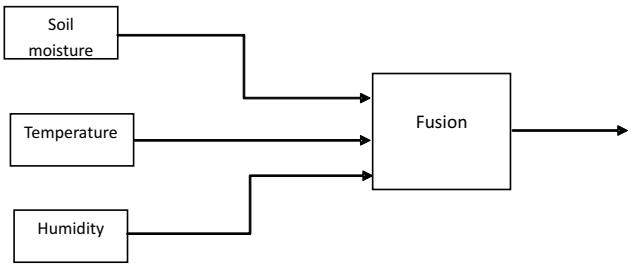

Figure 2: Methodology for Data Fusion in Smart Agriculture using IoT

5.3 Classification

In this methodology pre-processed data from the analysis step is taken and this data is applied to different artificial intelligence techniques such as Neural Network, Support Vector Machine, Regression and Fuzzy Logic. The technique which gives the optimal result will be taken into consideration.

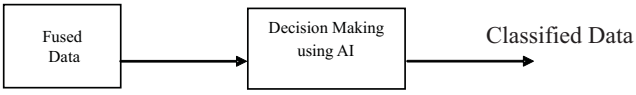

Figure 3: Methodology for Classification in Smart Agriculture using IOT

5.4 Data Analytics

In this methodology the usable correlated data is then subjected to Data analytics tools to extract information for decision making process. Various open source software are proposed to be used.

CONCLUSION

As an important constituent part of the IoT, sensor networks enables us to interact with the real world objects. It is a comprehensive system designed to fulfil the gap between farmers and the technology in agriculture. Finally the implemented framework will be helpful to the farmer's to understand the requirements to grow the crops in critical seasons in a better manner and avoid financial loss caused to the farmers. It will be helpful to the farmers of different geographical regions.

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