

# Review on IOT Based Multidisciplinary Models for Smart Farming

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**Abstract** - Now it is the day of telling everything is possible which is made possible by 'Internet Of Things' which connects everything on the earth together via internet. It will collect or capture the many massive data and is considered as useful and valuable information. Data mining is important thing for making it as smart system, to provide convenient services and environments. Efficient water management techniques are required for increasing yield of any crop that requires estimating crop water requirements in a reliable manner and realistic manner. Evapotranspiration is an essential component of the hydrological circle and its accurate estimation is necessary for many hydrological studies. A wireless sensor Networks (WSN) provides a simple cost effective solution to monitor and control, the sensor motes have several external sensors namely leaf wetness, soil moisture, soil pH, atmospheric pressure sensors attached to it. Based on the value of soil moisture sensor the mote triggers the water sprinkler during the period of water scarcity. Cyber Physical systems (CPS) will play an important role in the field of precision agriculture and it is expected to improve productivity in order to feed the world and prevent starvation, Precision agriculture is already adopted in other countries, but we still need to involve IOT and cloud computing technologies for better production of crops.

**Index Terms**- Internet of Things, Wireless Sensor Networks, Evapotranspiration, Cyber Physical systems, Precision Agriculture

## I. INTRODUCTION

In the present day people are getting educated and having knowledge about technologies. They are using social websites and using more internets, in which regular updates takes place, which leads to huge amount of data collection.

In [1] its completely a clear one by one stepped procedures for establishing an effective and rewarding big data solution of any company or organization, which wants to embark on the big data adventure. This leads to drive better decision making solution by using an analytical methodology which consists of descriptive, predictive, inquisitive and prescriptive analytics takes action to build increased best result. In [2] water is the main thing which is most necessary for agriculture. Some amount of water may be lost in leaky channels, which is going to affect the yield of crops and loss. There are many kinds of crops, whose intake (water consumption) is different. For that sake, we need to supply the water to the crops in required quantity and at correct time so that we can prevent the loss of water supply and loss of growth of crops. For this, it is important to get the information about the soil moisture at different levels and characteristics of the crop. To estimate the soil water content available to the crop a simple model is used which is relatively based on meteorological forcing. The Actual requirement of water to any crop [3] can be found (calculated) by multiplying reference crop Evapotranspiration with crop co-efficient. The most seeming

means of reducing the scarcity of water in different regions is done by increasing the production of water from existing water resources and with less amount of water produce more food. The [4] Agriculture industry got huge improvement and there also an invention of automated system in which plants growth can be monitored and devices are controlled by using WSN. The main job of WSN is to sense the data from remote of required location and transmit the sensed data through wireless networks which can be observed by the receiver. The WSN [5] is the best thing which can be used in agriculture sector particularly for handling distributed data collection in any type of environments it can be fixed, and importantly for guiding farmers in real time data gathering/collection. The WSN system can be communicated with other devices with low power consumption for transferring the collected data to farmer's mobile via GSM technology. The CPS [6] plays good role for getting a better yield of potato. The CPS design based precision agriculture architecture has three layers: Physical, Network and Decision layers. The Wireless Underground Sensor-Aided Centre Pivot (WUSA-CP) system which is a proof-of-concept for a CPS application. Using wireless underground sensors real time soil conditions can be monitored which is the autonomous irrigation management capabilities provided by WUSA-CP system. It is important to use new methods for production of more output with less available natural resources. Now, it's the day we can connect various objects in the world to the internet using technology called IOT and Cloud Computing [7]. The technology uses RFID wireless and sensors. To monitor and control various domains, applications are developed based on IOT enabled devices. The integral part of IOT is M2M[Machine-to-Machine] which will sense the geographical requirements by looking out the land in which IOT wanted to be implemented.

## II. METHODOLOGY

In [1] authors explored the design of the workflow of the Big data project. The proposed methodology is having three major phases: Elaboration, Project Implementation and Post implementation.

Elaboration of Global Strategy: Usually, before stating any new project, a person should get the point of newidea and some changes to be considered. It includes infrastructure to be done as per the requirement of project and there should be new path to process the data. In the companies the professionals should think why big data project. Before taking this step, they should go through some analysis like type of challenge or problem, whether it

can be solved by using new techniques or can be solved with known present software or techniques, real time, predictive, volume problems or other problem. But finally it should focus on the important activities which should bring big economic leverage to the company business.

Next thing authors considered is on data. Which kind of data to be considered is important thing. The considered data should have some value yielding capacity. Authors gave example of IBM on Data Exploration which was helpful in Decision Making. The valuable thing authors explained is protection of data. Continuously updating data management and its security is the toughest task to be followed regularly. For this issue Cloud Security Alliance (CSA) provides a solution for every challenge of security and privacy.

While planning about implementation of new security management solution authors considered some main features: there should have control on the access of the data and should provide encryption techniques for sensitive data protection. Local networks should be monitored, data coming from security devices and network end-points, suspicious traffic and reacting to it, timely detecting intrusions are all should be analyzed for management of Network Security should show Security Intelligence by auctioning and comprehensive insight that reduces risk and operational effort for any size organization using data.

Implementation of Project: In this phase authors considered about some steps they are Data Collection, Data Preprocessing, Smart Data Analysis, Representation and Visualization. Data Collection is the one of the major set up of this method. Collection of data should be from different sources like Internet of Things, Open data, social networks, crowd sourcing. In the Internet of things sensors plays an important role for collection of big data. They are used everywhere like in mobile phones and daily usable devices, in buildings and travelling area etc. We can fetch any sort of data through this.

The next source is the Open data which is from public instructions, organization companies which are likely to provide this respective data to public. The open data catalog is one, which is for contribution of government. Data can be accessed through proposed APIs or through grants also which is the Social Networks.

Next step is about Data Preprocessing. Preprocessing is nothing but taking purifications steps to get raw data from different resources. In this process, there are some operations to have look on various fault in the collected material. In this there are some procedures which are applied on data, they are cleaning of data in which improper values are removed. Filtered different data are integrated. Transformations of data format of all data are converted. Reduction of data is done when there will be repeated properties or characteristics are present.

Next important thing to be done is analysis of data in smarter way. From the huge amount of data which is preprocessed getting the main theme out of that collected data is the basic need. For this though there are many algorithms for analysis of complex things from either structured or unstructured data.

In [1] authors gave description about advanced analytics types. There are four types: Descriptive, Inquisitive, Predictive, Prescriptive Analysis. In the previous step the result will occur. The Representation and Visualization of the result should be taken care. While at the

working place many issues use to generate like technical volume related, memory problem etc. The other thing is getting the meaning or point of view from the unstructured data or semi-structured data is also the part of it. In this Visualization will help out for analysis of unstructured data.

Next thing is the efficient timely actionable extraction of Big data is like a motto in big data projects. The collected, processed, represented data can be of different paths/fields. For required project its respective field related information or data fetching is beneficiary.

Now the thing is to evaluate the project. To evaluate there is a need of huge data inputs, and their quality finally checking expected results. Have to evaluate, does the project allow stream processing, parallelize processing i.e. supporting of distributed computing, will it integrate easily with visualization tools.

Storage is the basic property which is must in the data base project. The storage property should support scalability. It should run familiarly when new thing is added to it. Almost popular companies like Google and Amazon use to take care of these.

Agriculture is the heart of the Indian occupation. Crop management is the basic care to be taken. Development of technology has made the work easy. Using Big data and remote sensing technology we can predict the status of crop and we can take action respect to it.

In [2] authors proposed methodology for crops management. In the first phase of methodology, farmers have to get the particular area as marked for sensing that only area, and getting updates of it. It means land cover is defined as a physical coverage like differentiating crops, forest and building. Other than this farmer has to mention about the type of land like grass land, bare land, wet land, dry land so that necessity of water can be judged. Manually the land cover classification can be done. In case if the land is large, there are multiple classification methods to apply. The authors [1] told about classification process and types of land cover, they are: Automated, Manual, Hybrid.

The next phase is the Data collection. In this meteorological data has been collected, to estimate the need of water. From the agro weather stations also we can get the climatological and physical parameters [2]. The images which are from satellite are considered for calculating some data which is beneficial to meteorological services throughout the world. Remotely sensed information will be having more value in crops management, Normalized Difference Vegetation Index (NDVI), Leaf Area Index (LAI) are the example for this.

In the Data Preprocessing phase, collected data is given under some operations in which unwanted images or some inconsistencies are removed and only required valuable, useful information is stored in the database.

Though there are more technical procedures but sometimes like cloud failure, technical problem on satellite etc may cause lack of data in remote sensing. There may be occurrence of malfunction or breakdown in the weather station. In such cases, user can get the guidance from database. This can be done by using some operations [2]: Data Cleaning, data Integration, Data transformation.

In the previous step the data is completely meaningful and can get the result from that data in this Bigdata Analysis phase. Now the data is pure, we can analyze the data to get to some valid decision. This

operation includes three steps: Satellite image processing, Data extraction, Coefficient computation.

After all these phase the previous record (data) which is processed should be stored safely so that collection of huge amount of meaningful data should be there so that it will be useful for decision making in the future. It is easy to fetch and retrieve the data from and to the storage. The limitation of traditional database has been overcome by these storage. It is flexible, scaling and can get updated to the newer versions. They support to the real based dynamic schemas.

Getting information and decisions from the collected data may get lack for some space. This space can be filled by applying the new technology called “Wireless Sensor Networks” and “Zigbee” [4]. By using these technique authors proposed a methodology to get the regular information about the field. Temperature and humidity are the parameters on which authors concentrated on. They designed to get the up-to-date information about temperature and humidity. Both the sensors are having respective features, capacity and functionality [4]. Sensors should be placed in the farm field, the present temperature and humidity can be sensed by the sensors. And those sensed data is sent to the users mobile. The sensed data is first sent to the Arduino, there data is collected, analyzed and checked for some threshold values based upon the conditions of threshold value the message has been generated and sent to the user’s mobile through Zigbee.

Information can be fetched by sitting in home is done. But if it is necessary to take any actions in the field may occur. At that time user can do any operations by sitting in his place by just clicking on his mobile. This can be done by using actuators [5].

The agriculture functioning and managing has become like autonomous running system [5]. Nowadays all types of sensors are available, just by situating them in the farm land we can get all type of information. In [5] authors used some of the sensors like soil moisture sensor, the water sprinkler mote triggers, soil pH, etc. From these exact value can be retrieved, analyzed and actuators will be activated for some interval of time and stopped automatically.

The present changing world can be sensed by using CPS technology. CPS is a smart system that includes hardware, software and physical components in which continuous integrated and interaction can be done to sense the all changing performance of the world [6]. CPS is the result of design process of transdisciplinary engineering – mechatronics, software, personal computers and motor control. Such an integrated system is the solution for multidisciplinary monitoring of potato crop, which leads to improvement of precision agriculture management. This solution will have the four layer architecture which is presented in [6].

Though there are all techniques are introduced but still cost of data service is not reduced. For this purpose cloud computing storage server is proposed [7]. The data which is fetched by several sensors are sent to cloud server by various gateways. The gateways are helpful for collection of data from all the fields sensors which are placed at different locations of agriculture fields. The WSN gathers data by tracking Radio-Frequency-Identification and other sensing devices. The server acts as the perception layer which senses and gives location information. The cloud

computing technology is used for the virtual storage purpose.

### III. DISCUSSION

Making the system like human is a explored one. This can be done using data mining technologies. Now IOT has made it possible to build the smart thinking system. The system should be convenient, provide high performance and intelligent.

IOT will connect whole world. Any data from any source can be retrieved and used. Some methods have been introduced for making the system intelligent which are described in below table 1.

TABLE 1 TECHNIQUES EVOLVED

Techniques	Description
Big Data	Used for collection of data and helps for decision making in the way like water management.
Evapotranspiration	Water demand of any crop can be determined by using reference crop Evapotranspiration and crop coefficient.
Wireless Sensor Network	It provides a cost effective solution to monitor and control the atmospheric pressure, temperature, humidity and soil pH.
Cyber Physical System	System which integrates computational and physical components and interacts between them to sense the occurrence of change.
Cloud Computing	IOT with cloud computing is helpful to sense the geographical requirements by tracking land and charge pay per usage can be implemented which reduces cost.

### IV. CONCLUSION AND FUTURE WORK

In this paper, we review studies on step-by-step procedures to build big data projects. The crop management can be done by providing required amount of water, fertilizers and all updates about crop growth can be received from anywhere to any place. Machine-to-Machine can be connected and all meteorological information is accessed and solution can be applied and implemented.

Future work is to provide security system to the field as well as to the yields. The unregistered person or any animal should be recognized and intimation should be sent to the farmer’s mobile.

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