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A Review on Increasing Agriculture Yields by Precision Agriculture Methods

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Abstract

Despite the perception people may have regarding the agricultural process, the reality is that today's agriculture industry is data-centered, precise, and smarter than ever. The rapid emergence of the Internet-of-Things (IoT) based technologies redesigned almost every industry including "smart agriculture" which moved the industry from statistical to quantitative approaches. Such revolutionary changes are shaking the existing agriculture methods and creating new opportunities along a range of challenges. This article highlights the potential of wireless sensors and IoT in agriculture, as well as the challenges expected to be faced when integrating this technology with the traditional farming practices. IoT devices and communication techniques associated with wireless sensors encountered in agriculture applications are analysed in detail. What sensors are available for specific agriculture application, like soil preparation, crop status, irrigation, insect and pest detection are listed. How this technology helping the growers throughout the crop stages, from sowing until harvesting, packing and transportation is explained. Furthermore, the use of unmanned aerial vehicles for crop surveillance and other favourable applications such as optimizing crop yield is considered in this article. State-of-the-art IoT-based architectures and platforms used in agriculture are also highlighted wherever suitable. Finally, based on this thorough review, we identify current and future trends of IoT in agriculture and highlight potential research challenges. Internet of things (IoT) is a promising technology which provides efficient and reliable solutions towards the modernization of several domains.

Keywords: ***Data, Internet of Things, integrating, sensors, surveillance***

1. INTRODUCTION

IoT based solutions are being developed to automatically maintain and monitor agricultural farms with minimal human involvement. It presents many aspects of technologies involved in the domain of IoT in agriculture.

It explains the major components of IoT based smart farming. A rigorous discussion on network technologies used in IoT based agriculture has been presented, that involves network architecture and layers, network topologies used, and protocols. Furthermore, the connection of IoT based agriculture systems with relevant technologies including cloud computing, big data storage and analytics has also been presented. In addition, security issues in IoT agriculture have been highlighted. A list of smart phone based and sensor based applications developed for different aspects of farm management has also been presented. Lastly, the regulations and policies made by several countries to standardize IoT based agriculture have been presented along with few available success stories. In the end, some open research issues and challenges in IoT agriculture field have been presented. The IoT is the current domain and a unique for technology to transform many smart agriculture in the world. Smart agriculture is to provide farmers and to help sustainable agriculture techniques such as spaying, sensing, scaring, keeping, vigilance, weeding, moisture, humidity, bird, animal, etc. They are effects and factors that relate the method of technological and smart agriculture requirements, monitoring environmental from various aspects and controlled by an automatic system. The "Smart" a major of IoT technology has attracted the various of network physical objects and connected to the internet of a global infrastructure of the network at very fast and applications link [9]. The word of "Smart" refers to the environment and communicate controlled such as smart home, smart agriculture, smart energy, smart grid, smart water, smart city, smart industry and so forth includes cloud-based data, sensors, and a variety to identify and approach to support the system. Smart agriculture is the use of IoT technologies to control smart farming as need precision agriculture to ensure exact coverage of a field.

2. LITERATURE SURVEY

- Nikesh Gondchawar et al., [1] proposed work on IoT based smart agriculture. The aim of the paper is making agriculture smart using automation and IoT technologies. Smart GPS based remote controlled robot will perform the operations like weeding, spraying, moisture sensing etc. It includes smart irrigation with smart control and intelligent decision making based on accurate real time field data and smart warehouse management. It monitors temperature maintenance, humidity maintenance and theft detection in the warehouse. All the operations will be controlled by smart device and it will be performed by interfacing sensors, ZigBee modules, camera and actuators with microcontroller and raspberry pi. All the sensors and microcontrollers are successfully interfaced with three Nodes using raspberry pi and wireless communication. This paper gives information about field activities, irrigation problems, and storage problems using remote controlled robot for smart irrigation system and smart warehouse management system respectively.
- Rajalakshmi P.et.al., [2] described to monitor the crop-field using soil moisture sensors, temperature and humidity sensor, light sensor and automated the irrigation system. The data from sensors are sent to web server using wireless transmission and JSON format is used for data encoding to maintain server database. The moisture and temperature of the agriculture field falls below the brink, irrigation system will be automated. The notifications are sent to farmers mobile periodically and farmers can be able to monitor the field conditions from anywhere. The parameters used here are soil moisture sensor, temperature and humidity sensor- DHT11, LDR used as light sensor and web server – NRF24L01 used for transmitter and receiver. This system will be more useful in areas where water is in scarcity and it is 92% more efficient than the conventional aii]pproach. Automation of irrigation system data was stored in MySQL database using PHP script. Total average power consumption is 2 Ah per day for a single motor pump and water requirement analysis.
- Tanmay Baranwal et al., [3] this project concentrates security and protection of agricultural products from attacks of rodents or insects in the fields or grain stores. Security systems are used to provide real time notification after sensing the problem. Sensors and electronic devices are integrated using Python scripts. Algorithm is designed based on collecting information to provide accuracy in notifying user and activation of repeller. Testing is done in an area of 10 sq. m. and the device is placed at the corner. The PIR sensor identifies heat it starts URD sensor and webcam. Based on attempted test cases 84.8% success is achieved. It will be helpful to extend the security system to prevent rodents in grain stores.
- Nelson Sales et al., [4] this paper describes Wireless sensor Networks. The network performs three nodes i.e. acquisition, collection and analysis of data such as temperature and soil moisture. The benefits of irrigation process in agriculture are decreasing water consumption and environmental aspects. Cloud Computing is an attractive solution for high storage and processing capabilities of large amount of data by the Wireless Sensor and Actuator Network. This work aims to agriculture, greenhouses, golf courses and landscapes. Architecture is divided in to three main components: a WSAN component, a cloud platform component and a user application component. It contains three different types of nodes such as sink node, a sensor node and an actuator node. SimplitiTI is a simple protocol for WSAN implementation in a cluster tree topology. The soil moisture monitors to assess the plants it need water for its proper development and optimization of natural resources.
- Mohamed Rawidean Mohd Kassim et al., [5] this work describes a Precision Agriculture (PA). A WSN is the best way to solve the agricultural problems like farming resources optimization, decision making support, and land monitoring. Using this approach provides real-time information about the lands and crops that will help the farmers to make right decisions. Precision agriculture systems based on the IOT technology explains the hardware architecture, network architecture and software process control of the precision irrigation system. The software collects data from the sensors in a feedback loop depending on that activates the control devices based on threshold value. Implementation of WSN in PA optimizes the usage of water fertilizer through irrigation and also maximized the yield of the crops.
- LIU Dan et al., [6] this paper describes greenhouse technology in agriculture represents the design and implementation based on ZigBee technology using CC2530 chip. It is mainly used for environment monitoring system. The wireless sensor and control nodes uses CC2530F256 core for data acquisition, data processing, data transmission and reception. Here computer provides all the real time data for the concerned person using wireless communication like temperature control, fans condition. In this system uses intelligent monitoring and control of green house. It is helpful to farms for scientific and balanced planting crops.

3. PROPOSED WORK

We proposed model for smart agriculture to develop real time monitoring system for soil properties like temperature, moisture, pH and to implement decision support advisory models for Pest & Disease forewarning, Crop Disease identification using image analysis and its value. It will also be possible to control and monitor various operations of the field remotely from anywhere, anytime by mobile as well as web application.
Proposed system has three modules –

- Farm side,
- Server side and
- Client side.

Farm side consists of some methods as follows.

- Identification of parameter based data.
- Transferring data from crop fields for decision making.
- Decision support and early warming based on data analysis, domain knowledge and history generated.
- 6. Crop monitoring via dataset prediction methods.

It wise agricultural model in integration with ICT. ICT have always mattered in Agriculture domain. Village farmers may have planted the "same" crop for centuries, but over period, weather patterns and soil conditions and epidemics of pests and diseases changed. By using the proposed approach, received updated information allows the farmers to cope with and even benefit from these changes. It is really challenging task that needs to provide such knowledge because of highly localized nature of agriculture information specifically distinct conditions. The complete real-time and historical environment information is expected to help to achieve efficient management and utilization of resources.

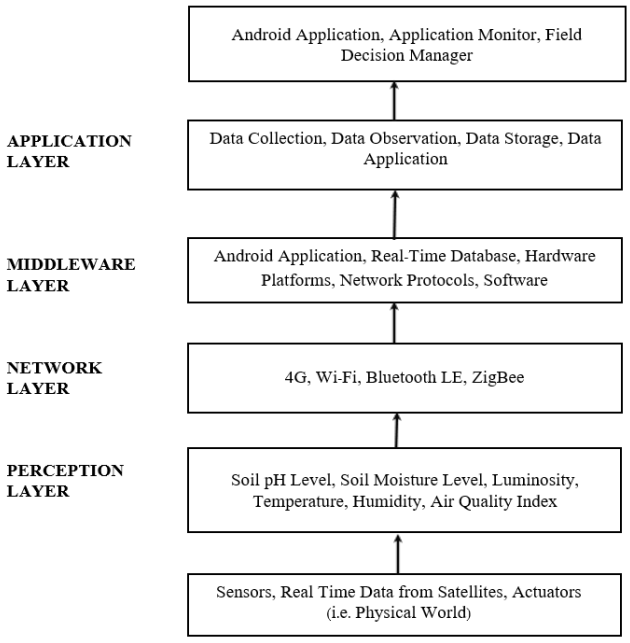

Fig.1 Structural flow of the system

4. EXPECTED OUTCOMES

- First and most important aspect is to provide more security by making use of less devices handling by user.
- It does not required manual triggering as with the previous devices.
- Hassle free use of system is possible.
- All parameters need to match which helps to reduce the redundant error occurred in the process.
- It makes the possibility of data entry easy for number of process accessibility.
- It is possible to increase the yield in farming by providing efficient use of technology.

5. CONCLUSION

All over the globe researchers are exploring technological solutions to enhance the agriculture productivity in a way that complements existing services by deploying IoT technology. In this article, we have presented a comprehensive

survey on the state-of-the-art for Machine Learning Precision Technoques in agriculture. To this end, we discuss agricultural network architecture, platform, and topology which help to access to improve backbone and facilitates farmers to enhance the crop productivity. In addition, this article provides an extensive overview on current and continuing advances in IoT agricultural applications, devices/sensors, communication protocols and many innovative technologies. This research considers various IoT agricultural challenges and security requirements for the better understanding of IoT smart farming security. Furthermore, many important dimensions of IoT based agricultural including technologies, industries trends and countries policies have been also been presented to facilitate various stake holders. Government has started patronizing IoT in agriculture and it is anticipated that soon IoT in agriculture will revamp the conventional farming method. It is also clear that many big organizations have started investing and developing new techniques for farm management system using IoT. Finally, it is expected that this comprehensive survey results into a very useful piece of information for researchers, professionals, agriculturists and policy makers who are participating and working in IoT field and agricultural technologies.

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