IoT Applications in Agriculture

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Abstract

Agricultural practices have changed over the ages. With increasing population and challenges like climate change, there is lot of pressure on countries to increase yield of crops, make them less prone to damage from climate changes and pests. The green revolution led to an increase in yield of crops, but there is lot of scope for improvement. Technologies like Internet of Things, Big Data and Predictive Analytics are being used for smart farming. This paper discusses various smart farming technologies and their benefits.

Keywords:Agriculture,IoT, smart farming, precision farming

I. INTRODUCTION

Agriculture faces a number of challenges like climate change, and decrease in availability of agricultural land. To fulfill the demand for food, a number of innovations have been done to reduce damage to crops, increase productivity, making crops drought resistant,and increasing the variety of crops. Some examples of these are GM food, new fertilizers, pesticides etc.

Internet of Things refers to interconnected computing devices, sensors, and mechanical devices which can transfer data over a network without human intervention. IoT is finding uses in various industries as it makes real time information available that improves efficiency, communication, privacy and security in a cost effective and simple manner. This paper discusses the potential of Internet of Things in agriculture.

Till the end of 2018, the connected agriculture market stood at USD 1.8 billion globally and the change hasn't stopped yet. It is expected to grow to USD 4.3 billion by 2023 at a Compound Annual Growth Rate (CAGR) of 19.3% [1].
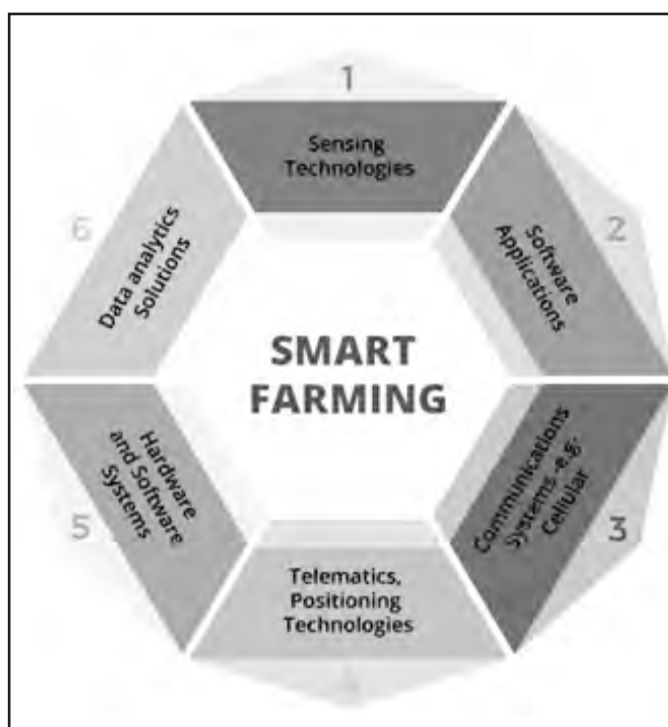

Fig. 1. Smart Farming
Source:https://www.iotforall.com/smart-farming-
future-of-agriculture/[6]

II. USE CASES OF SMART FARMING

a) Know the climate

Real time weather conditions like humidity, rainfall, and temperature can be known accurately by using sensors in agricultural fields. Farmers can take decisions about the types of crops to be sown, time of sowing crops, and harvesting on the basis of this information.

b) Smart Greenhouse

The conditions inside a greenhouse can be controlled by using IoT automatically. This reduces manual labour requirements and cost.

c) Data analytics

Data collected from sensors are analyzed for patterns, identifying patterns, problems, and changes. Predictive analysis can be used to take decisions related to sowing and harvesting of crops [5].

d) Drones

Ground and aerial drones are used for assessing the health of crops, crop monitoring, planting, crop spraying, and field analysis. Drones with thermal or multispectral sensors identify the areas that require changes in irrigation. Once the crops start growing, sensors indicate their health and calculate their vegetation index. The result is that the use of pesticides has reduced and much lower amount of chemicals reach groundwater[1].

e) Pest Management

Manual methods of checking for pests are time consuming and prone to errors. IoT sensors can be used to understand extent of pest infestation and to take preventive and remedial measures. Specific weather patterns make crops prone to attack by pests. Such conditions can be predicted using IoT sensors that provide real time information and predictive analytics. This enables farmers to apply smart farming techniques at required places and at the right time [2].

f) Improve water usage

Too much use of water or inadequate use of water can damage crops and reduce yield. IoT can be used to assess soil moisture content and irrigation requirements. The sensors are connected to sprinkler systems which irrigate crops as required.

g) Monitor Animals

IoT technology has spurred positive changes in the way farmers keep tabs on grazing animals, such as sheep and cows. It is now common for many creatures to wear fabric-covered collars that have tracking capabilities.

h) Vehicles

Use of smart vehicles increases efficiency. These vehicles are equipped with sensors, computer vision, and machine learning to enable self-driving and precision farming capabilities [3]. The following should be taken into account for using IoT for farming [4] :
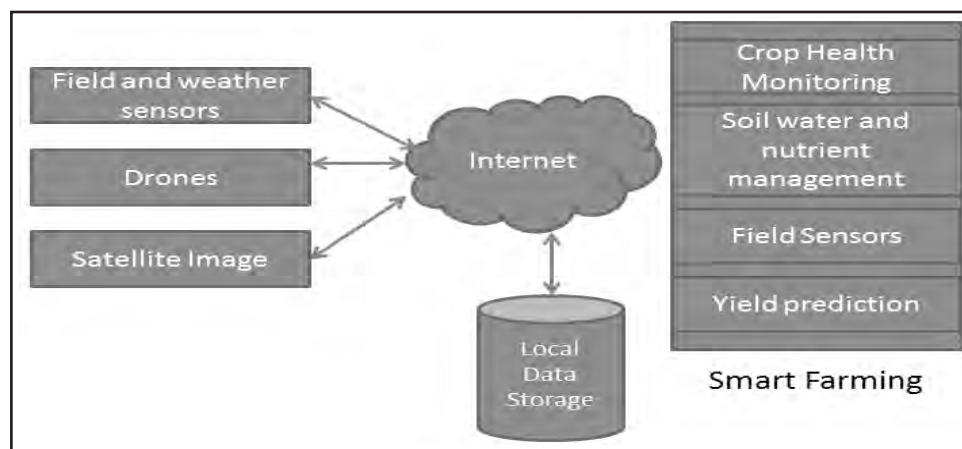(i) Parameters to be monitored

Fig. 2. Smart Farming Architecture

(ii) Distance: Near field communication or RFID, and Bluetooth Low-Energy for short distances. Low-power wide-area network technology is used for long distances.
(iii) Ways to power equipments
(iv) Data collection frequency

III. ARCHITECTURE

Fig. 2 shows smart farming architecture.

IV. CONCLUSION

"Less than 2% of agricultural land worldwide is equipped for soil-moisture measurement, which presents a very large market for wireless soil-monitoring and a big opportunity to improve water conservation," said Christine Fraser-Boer, Chief Operating Officer at Sensoterra [7].

Networked agriculture has immense potential for saving resources, reducing costs, and improving efficiency in agriculture. These can be used not just in large farms, but also in small farms.

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About the Author

Deepak Jain is an experienced engineer and product leader with a demonstrated history of working in the computer software industry solving technically challenging problems at scale. Eager to build products, solving real-time problems, Deepak founded Subtlelabs as a product engineering company that is today serving customers across the globe. He had earlier worked with global companies and architechted solutions in Healthcare, Security, Fintech, Logistics and CRM domains.