

A SURVEY ON INTERNET OF THINGS APPLICATIONS IN AGRICULTURE IN VARIOUS COUNTRIES

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Abstract: The Internet of Things (IoT) is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction [1]. The Technology enables human life easier. In this context Internet of Things enables human life easier and comfort. The various countries of world utilises the technology in field of agriculture. As Agriculture is the backbone of any country survival and development. This paper deals with a survey on Internet of Things applications in agriculture in various countries.

Keywords: IoT, smart agriculture, IoT applications, smart farming.

INTRODUCTION

The Internet technology used in agricultural irrigation is based on crop water requirement rules using internet technology and wireless sensor network technology to control water-saving irrigation of farmland and maximize the scientific use of water. Gartner's statement is that Internet of Things is the blooming communicating technology along with sensors and digital smarts. [2]

Everywhere in the world is in thirst of change in the field of agriculture towards improvement and solve the problems faced. The production in developing countries must be double in future in meeting the essential of human life. The UN Food and Agriculture Organization (FAO) perceive towards Climate Smart Agriculture (CSA) approach in farming [3]

- ❖ Increase agriculture production and incomes,
- ❖ Adapting to Climate change
- ❖ Reducing and/or removing greenhouse gas emissions

Figure:1 Goals of Farming[3]

To achieve the above goals farmers are driving their thoughts towards Internet of Things. The United States currently leads the world in IoT smart agriculture. The country is capable because of usage of sensors and smart tractors by farmers. [3]

The World of business sectors and industries had been revolutionized by the Internet of Things. It also created impact on farming and agriculture.

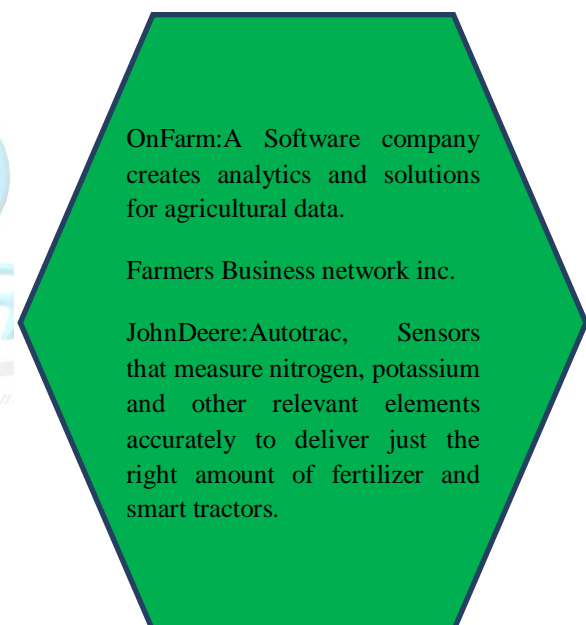


Figure: 2 Platforms for smart agriculture[3]

The innovative method of farming and in agriculture lead to success with

- least wastage of water,
- knowledge of what kind of seeds to plant
- when, deciding harvest time, and so on.

There are many drawbacks faced in the field of agriculture

- Productivity has become considerably slow
- Water scarcity
- Availability and price of fossil fuels
- Arable land becoming scarce
- Drastic changes in climate
- Lack of labor due to effects of urbanization

These lead a path to IoT to enter the field of agriculture to save farmers and improve their livelihood.

The Technologies including GPS, Big data and Sensors would help in improving crop yields. It also help to avoid failures due to adverse steps in yield of crops. Farmers started to use Computer-based imaging, GPS technology,

robotics, precise climate forecasting techniques, knowledge of environment controlling factors and various kinds of highly accurate science-based solutions as IoT enters the world of agriculture. Software applications like Hardware and software systems, Data analytics solutions, Positioning technologies, Modern communication technologies are used in smart farming.

Internet of Things is capable of receiving highly accurate, real time information about dynamic agricultural processes like planting of seeds, harvesting and so on. It also able to reveal real time information like labour cost, quality of soil, weather conditions and more.

Pest Management and Control

IoT involves in monitoring pests remotely and insist what kind of pesticide and how much should be used. This would help in preventing high chemical resist in crop which would spoil human life. Pest control sensors foresee pest behaviour and control the damage created by pests in vast.

Crop Water Management

The basic essential for crop production is water management in proper way. With the sensors, farmers will be able to open and close gates through their applications in their smartphones. They also able to analysis the amount of rain received in the year and choose minimum level of irrigation required for the crops.

Food Production and Safety

IoT enables the capability of farmers by giving yield status from monitoring food production and handling operations like monitoring and adjusting temperature in the food storage centers. For best protection and production of food, Temperature is important one concerned. Alerts are made to farmer if there is in need of human intervention [4].

II. VARIOUS IOT APPLICATIONS:

The following table gives the various applications for farming.

Table: 1 Apps for Smart Agriculture [4]

Applications	Functions
Compost	Helps in controlling the humidity and temperature levels of hay, straw, alfalfa, etc.
Green Houses	Helps in increasing the production and quality of fruits and vegetables by controlling micro-climate conditions.
Meteorological Station Network	A useful tool that would forecast rain, snow, drought conditions, wind changes and ice formation.
Claas Equipment	Farmers can automate this equipment and get information on how to minimize grain loss, improve crop flow, perform fertilization planning, adjust nutrient balance and more.

ThingWorx provides IoT solutions for smart agriculture. It provides the following services:

- Data Management through sensors, cloud services such as weather or maps, connected equipment and existing systems.

- High speed and Graphical user Interface enables easy usage
- Influence Big data and analytics to benefit decision-making.
- Help farmers to capture data and take appropriate actions as revealed.

Enabling an IoT Ecosystem

Brian Walsh, Chief Executive Officer of VitalHerd, created a cloud platform ecosystem led by PTC ThingWorx that allows all companies to work together in managing health and nutrition in precision agriculture for livestock [5].

SEATTLE:

The Internet of Things (IoT) in agriculture mainly for large-scale farmers, there is need of highly interconnected sensors which reveals the values like number of seeds planted, the amount of fertilizer used, soil moisture levels and the temperature of stored products. These leads farmers to make decision regarding planting, fertilizing and harvesting crops. The Internet of Things for agriculture include the use of self-driven tractors to control the spacing between crops to allow for more crops to be planted per acre. Farmers can also use drones with multi-spectral and optical sensors to remotely monitor the health of their crops or identify sick livestock within their herds.

EZ Farmer Application:

The EZ farmer application developed by scientists at IBM Africa research lab uses IoT and big data technologies to deliver up to date information to smallholder farmers about current and future water and soil moisture levels. The application is targeted at “telephone farmers.” These are small-scale farmers living in urban areas who travel to their farms only over weekends and monitor operations during the week by telephoning frequently.

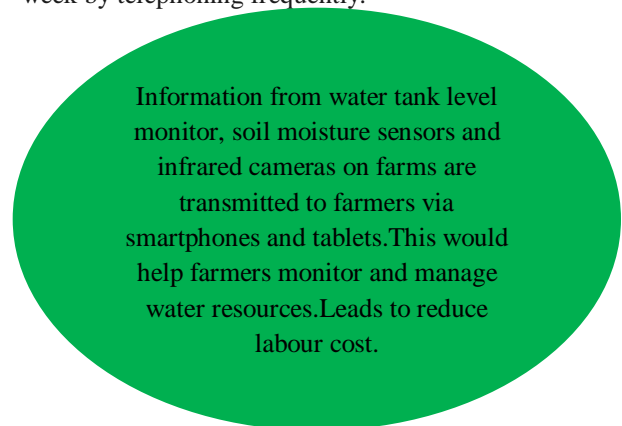


Figure: 3 EZ Farmer Application [6]

Illuminum greenhouses solution:

Illuminum solutions provide answers to open and close the greenhouse irrigation system through SMS. It provides viable solar-powered greenhouses with sensor technology to monitor soil moisture, humidity and temperature within the greenhouse for smallholder farmers. [6]

CommonsenseNet:

In Karnataka, the rural area has COMMONSenseNet which measures temperature, humidity, light, and barometric pressure in an area of two acres area.

Syngenta :

Syngenta monitor temperature and moisture in the air and soil, solar radiation, wind speed, air pressure and other factors. The information acquired is transmitted to insurance firms to estimate losses after weather events. This would facilitate an easy and quick claims process.

Nano Ganesh:

A feature-phone (2G) operated unit that attaches to the pump for drip irrigation system in India. [7]

Asahi Shuzo Ltd:

Asahi Shuzo Ltd adopted a system for smart agriculture in Japan which performs functions with a single sensor and mobile phone [8].

III. CONCLUSION

This paper would give potential benefits of IoT for farmers in agriculture and the influence of technology to help in improving lives and livelihood in developing countries. This paper would be the best survey paper to analyze the IoT in agriculture in various countries,

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