Internet of Things (IoT) & Agriculture

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ABSTRACT:-

Agriculture is the backbone of the Indian economy as two-third of its population is engaged in agricultural activities. Agricultural methods have significantly changed over the years. Technological revolution integrates the development of smart devices and IoT services. It is need of hour to extend agriculture industry as to feed the ever growing population. Internet of Things opens the door wide for smart farming solution to increase the agricultural production. IoT technologies helps the farmers by providing historical and real time data for predicting soil quality, sensing temperature of soil, nutrients and humidity, controlling and analyzing water consumption for growth of plants, weather conditions, climatic changes, environmental impact, and crop's health. Smart farming provides the enhanced facility for process automation, evaluation and waste reduction. As a result, IoT is a driving force behind the increase of quality and quantity of the food products decreasing the production cost. It is necessary to provide farmers with a clear perspective of IoT applications in agriculture. Internet of Things in Agriculture has come up as a second wave of green revolution. Our study in this chapter deals with various issues and scope of IoT technology in the agricultural domain.

Keywords : Agriculture, Internet of Things, Smart Farming, IoT technology.

INTRODUCTION:-

Agriculture forms the major part of our Indian economy. IoT is the network of interconnected devices to transfer the sensed data without human involvement. The use of IoT in agriculture is important as it plays a pivotal role in the development of our countries economy. IoT technology is already having a profound effect in various fields like Education, Business, Medical, Weather forecasting system, Communication and Agriculture. However, in agriculture, the IoT .has brought the greatest impact. IoT technologies allow developing systems that support different agricultural processes. Some of these systems are remote monitoring systems, decision support tools, automated irrigation systems and frost protection systems. IoT based Smart Farming improves the entire Agriculture system by monitoring the field in real-time. With the help of sensors and interconnectivity, the Internet of Things in Agriculture has not only saved the time of the farmers but has also reduced the extravagant use of resources such as Water and Electricity..

IOT APPLICATIONS IN AGRICULTURE :-

In agricultural industry, technological advancements lead the comfortable pathway for the farmers. Internet of Things is the driving force behind agricultural production at a lower cost in smarter way. In Smart Farming farms are managed using Information and Communication Technologies like IoT and, Big data, to raise the quantity and quality of crop and reduce the human labour required. The benefits that the farmers are getting by adapting IoT are twofold. It has helped farmers to decrease their costs and increase yields at the same time by improving farmer's decision making with accurate data. Smart farming technologies can remotely detect soil quality, weather conditions, crop growth, and crop damage using

wireless monitoring sensors with cloud based platform. The Internet of things are various sensors, autonomous vehicles, control systems and robotics. Smart farming practices provides the solutions to overcome the challenges such as rising climate changes, weather conditions, soil conditions, waste reduction and green housing.

A. Monitoring climate conditions, soil and plants

Climate plays a very critical role for farming .Dramatic changes in the climate and natural disasters seriously affect the plant growth and agricultural production. IoT solutions enable you to know the real-time weather conditions. Variety of environmental conditions can also be collected by sensors placing inside and outside of the agriculture fields. Sensing soil and nutrients, measurement of moisture, rainfall, temperature and electrical conductivity are collected through sensors and stored in integrated databases. Various sensors such as Temperature sensor (LM35 SENSOR), Humidity sensor (DHT11), Soil PH sensor(INTELLIA INT G01, INTELLIA INT-PH 1), Pyroelectric infrared sensor(PIR), Pressure sensor, Dielectric sensors, Mechanical sensor, Amperometric sensor, Arduino microcontroller etc are used.

Figure :-Agricultural internet of things model.

Based on soil profile, fertilizer level to be determined and applied. Farmers and agriculturalists needs to install mobile applications and register with cloud through Mobile App. Cloud storage consists of all the details of weather conditions, soil conditions irrigation levels, plant growth and damage. It also stores details about farmer, marketing agent details, and agro vendors and service providers and government schemes for agriculture sector including bank loans for farmers and concessions given on seed and/or fertilizers. Periodical data is collected from soil and environment sampling through sensors, will be updated and is used for controlling the smart farms.

Internet of Things plays a vital role for monitoring the plants for identifying diseases and insects which are affecting the growth. If the level of pest control exceeds prescribed range, through sensors alarm and alerts can be generated to warn the farmers to take actions. Optimal time for planting crops, controlling the pests and plant diseases and harvesting can also be intimated through and cloud database to the farmers and agriculturists.

Technological advancements has almost revolutionized the agricultural operations and the introduction of agricultural drones is the trending disruption. The Ground and Aerial drones are used for assessment of crop health, crop monitoring, planting, crop spraying, irrigation and field analysis. With proper strategy and planning based on real-time data, drone technology has given a high rise and makeover to the agriculture industry. 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. Eventually smart drones have reduced the environmental impact. The real-time data collection via drone has the potential to increase crop yields. The results have been such that there has been a massive reduction and much lower chemical reaching the groundwater.

B. Smart Greenhouses

Modern affordable and healthy green houses are to be built by using IoT sensors which are solar powered. The sensors are used for providing information about temperature, pressure, humidity and light levels. These environmental parameters are monitored by sensors and controlled either by control systems or by manual intervention. Smart sprinklers are also used for water irrigation. All these are connected using IoT cloud server accesses the data and provide cost effective solutions to the farmers.

To make our greenhouses smart, IoT has enabled weather stations to automatically adjust the climate conditions according to a particular set of instructions. Adoption of IoT in Greenhouses has eliminated the human intervention, thus making entire process cost-effective and increasing accuracy at the same time. For example, using solar-powered IoT sensors builds modern and inexpensive greenhouses. These sensors collect and transmit the real-time data which helps in monitoring the greenhouse state very precisely in real-time. With the help of the sensors, the water consumption and greenhouse state can be monitored via emails or SMS alerts. Automatic and smart irrigation is carried out with the help of IoT. These sensors keeps various factors like pressure, humidity, temperature, soil, light level etc. under check and gives a crystal clear real-time observation.

C. Water Irrigation and Waste Reduction

Controlling water usage for optimal plant growth is enabled by an Internet of Things to monitor tank leveling and schedule irrigation timings. It is also necessary to monitor the unwanted leakages. All these are accessible through the web and mobile applications hosted on enterprise cloud. IoT technologies help the agriculturists and farmers to reduce generated wastes and enhance productivity. It is a practice that makes the farming procedure more controlled and accurate for the growing of crops. After harvesting, for agriculture storage, silos and grain elevators are to be monitored for sensing temperature, pressure, humidity and light levels of the grains.

D. Livestock monitoring

Farmers and agriculturalists collect information about the location, health conditions of their cattle and feeding schedule. IoT based sensors are also used for finding the sick animal in the herd before it contaminates the rest of the animals, It will drastically reduce livestock losses and reduce costs by monitoring them continually and recover the others in the large group.

CHALLENGES

The main challenge in technology diffusion in agriculture is that land holdings are so small, hurting long-term productivity growth. All our technologies, like high yielding seeds, are for irrigated lands, although 48% of our sown area is dry lands. Nearly 90% of farmers are small and marginal. The average size of a farm is now just 1.15 hectares. Only 5% farmers operate on land bigger than 4 hectares. Farmers, who have been able to pool in their lands to increase their farm size to at least 100-200 acres

have been the early beneficiaries. By contrast, only 5% of farmers operate on land parcels larger than 4 hectares. Often, those exploiting smart technologies aren't farmers but large agri-businesses. Some of these tools are used by farm-loan companies for risk management, The industry must overcome increasing water shortages, limited availability of lands, and fertility of lands difficult to manage cost. Moreover, existing strategies are not enough to overcome the challenges. Security challenges in the environment of small embedded devices must be easy to implement and cost effective.

CONCLUSION

Internet of Things has the impending to create a world where everything is connected by means of internet. IoT technologies are already an essential part of solving different problems and indispensable part of doing business in the agricultural context.

IoT enabled agriculture has helped implement modern technological solutions. This has helped bridge the gap between production and quality and quantity yield. Data Ingested by obtaining and importing information from the multiple sensors for real time use or storage in a database ensures swift action and less damage to the crops. With seamless end to end intelligent operations and improved business process execution, produce gets processed faster and reaches supermarkets in fastest time possible. So, in conclusion IOT will not only open up multiple job opportunities but also help in solving major economical as well as environmental challenges.

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