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Smart Agriculture Using IOT Technology

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ABSTRACT: Regarding Agricultural process, the real Scenario is that Today's agricultural industry is data-centred, precise, and smarter ever. The rapid Emergence of day-to-day life is that everything is Internet based and easier to evaluate everything about agriculture so called "smart Agriculture" which moved Statistical to industrial approach. India being an agricultural country Indian farming are mostly dependent on soil types, land, rain, climatic conditions etc. This is the better time to change the farming method to smart farming method to increase more crop yield. The compilation of data from sensors, Actuators, and modern electronic gadgets will help the farmer to monitor the agricultural land. On the process of research and development in smart agriculture and Artificial Intelligence can be cutting edge Technology In data compiling and research Optimization.

KEYWORDS: IoT, Agriculture, Crop Management , Weeds

I. INTRODUCTION

To improve the yield with fewer resources, Substantial innovations have been made throughout human history. Use of Smart techniques like Precision farming, efficient Water management, Soil moisture and humidity monitoring are the perfect factors for increasing crop yield. IoT plays a major role in increasing crop productivity. Due to enormous growth in technology farming has become more precise and significant. Today many farmers turned to adopt IoT technology to gain more amount of crop yield and to save time. IoT allows covid -19 many youngsters have chosen their carrier on farming. Smart agriculture takes lesser time compared to traditional method of farming to adopt for the implementation of IoT. The network also easily accessible globally so that smart farming can be achieved with full pledge. Many agriculture tools related to IoT are also available in market to increase crop productivity. The main aim of smart agriculture is to solve the problem easily which are faced when we practice traditional agriculture so, each one should change to smart agriculture and save time.

II. RELATED WORK

Puranik, v @ all described about the smart agriculture works. They have given the basic details of the agricultural works that have been used in the fields through iot. They have alsohelped to make the agricultural field develop with the technical works[1]. Namani, s., &gonen, ball described aboutthe agricultural works of iot devices. They have given introduction to the technical devices and methods for the better use of them in the agricultural fields[4]. Marcu, @ all described that the iot devices used in the agricultural fields. They have also said about the sensors that are used in the agricultural fields[9]. Mat, i., mohdkassim, m. R., harun, a. N., &yusoff, i. M all described about theeffective use of the smart farming techniques. They have explained about the use and financial support required for the smart farming[8]. Chaudhary, s. @ all gave the concept of farming using iotsensors. It gives the review of the smart agricultural fielding. The sensors efficiency and its uses areexplained clearly[5]. Farooq, m. S., @ all described about the implementation of agricultural workswith iot. Those implementations were successfully implemented.[6]. Rahul dagar, @ all describes the proceeding techniques for the agricultural iot. It also explains the applications and techniques ofthe iot sensors[3].

III. IOT IN AGRICULTURE

Agriculture is considered as major pillar of world's economy and satisfies one of the basic needs of human being. Most of the countries still use traditional way of agriculture which use more amount of time and energy. For this purpose, many Started using Smart agriculture which make more sense and increase in crop productivity. Low productivity comes in the case when people are unaware of new technologies that exists about farming and lack of knowledge about farming. Lack of knowledge arise due to improper use of pesticides problem in irrigation, enormous harvest handling and lack of knowledge due to market trend in agriculture. overall losses in agriculture starts from crop selection to selling of products is very high. "Information is the power" in which keep tracking the crops,

Environment and market may help farmers to take better decisions when problems faced. Technologies like IoT, Machine Learning, Deep Learning, Cloud Computing and Edge computing may help farmers to know about the current trend in smart agriculture. Many fields like medicine, health care, robotics, banking, biochemistry, food etc uses IoT but agriculture plays a very vital role in it. So, people are in eager about using the emerging techniques in a smarter way. While preparing agriculture task some steps are to be followed. They are

- ✓ Selection Of Crop
- ✓ Land Preparation
- ✓ Seed Sowing
- ✓ Irrigation and Fertilizing
- ✓ Crop Maintenance
- ✓ Harvesting
- ✓ Post Harvesting Techniques

IV. APPLICATIONS OF IOT

A. Robotics:

The main application of robots in agriculture today is harvesting stage. Emerging application of robots in agriculture are weed control, cloud seeding, planting seeds, harvesting, environmental monitoring and soil analysis. Compared to before generation automation must increase gradually due to sophisticated task and increased production. Robotics made possible because they used satellite GPS Tracking System to living. Weeds can be control in three types. They are Mechanical Weed, Chemical weed computer vision sensors and GPS to navigate and act as the driver in robotic ploughing trucks. Another existing technique about agriculture is machine learning which is interrelated to robotics. Machine vision makes it possible to perform task like weed picking, growth monitoring, harvesting, sorting, and packing.

Fig 1. Robotics in Agriculture

B. Weeds:

*For Maintaining more amount of Crop production Weed control is more important. However, weeds are not w*anted plants which grow in roadside and other hill station which will cause damage to electric vehicles on harvesting task Post - harvesting roadside and cause health hazard to many people. When more weed area is converted to any park or walking area, they will create nuisance and it will be more burden to people and biolofical weed.

➢ *Mechanical Control :*

Mechanical weed control is a physical activity that inhibits unwanted plant growth. Mechanical control also makes the plant grow more dangerous through physical methods that injure, kill the plant and make the growth of plant unfavourable. In this mechanical control various techniques are used like weed pulling, mowing, mulching, and tillage. Weed pulling uproot and remove the weed from the soil. Mowing methods cut or shreds the above ground of the weed and can prevent and reduce seed populations as well as restrict the growth of weeds. Mulch is a layer of material that spread on ground and relatively low expensive and make sense while growing crops. Tillage will control the plant when it is in damage and make it overturned without any damage.

Fig 3.1: Mechanical control of weeds

➢   *Chemical control:*

Chemical weed control is essential for operations on crop which control the crops using some pesticides. Major criteria are that these chemicals are applied for both pre and postemergence of crop. The chemicals which are informed to be safe to used for crops are Alachor, Alachor+, CIPC, Benzene dicarboxylic acid, Dimethyl ether etc. There are no such considerations happens before 20th Century that chemicals can be used manually to remove weeds from the crop. Weeds can be removed biologically to, but this chemical method can remove the crop weeds without harming or destroying the crops, so many farmers use this technique to remove weeds.

➢   *Biological control:*

Fig 3.2:Chemical weed used in plants

Biological method is used to supress the plant population and to control the number of weeds in the crop. Biological methods can be used against all kind of pests, including vertebrates, plant pathogens and insects. Natural enemies play an important role in attacking the crops. by using IoT we can control and monitor the pests attack in crops.
Most natural enemies are highly susceptible to crop filed. Integrated pest management(IPM) combines biological and chemical control to reducing pesticide use which lead to minimum requirement of economic production and applying the required pesticides in a manner that is least disruptive to biological control agents. Several use of pesticides to crop that indicate the quantity of pesticide use has become stable or increasing since 1980's.

C. Machine navigation:
Over the past few years terrestrial and global measurement system for filed of crops plays a vital role in providing more yield of crops. Heavy machines are used for navigation of crops in the fields to manage and the environment. The guidance provided for controlling heavy machinery in navigation sector with appropriate performance and security to perform Stable task. The first GPS based guidance system for yield mapping used 15 years ago is Auernhammer in 1995 which improves efficiency and optimization for the machine control and guidance. Many techniques have been used in machine navigation like 1D and 3D guidance system for the analysis of crop navigation.
The modern farm machinery has upgraded the agricultural industry for the best. Some of the essential and most used machinery are Combine or Combine Harvester, Rotavator or Rotary Tiller, Plough or Plow, Tractor Trailer, Power Harrow, Leveler, water bowser, ripper machine, and disc harrow. Carefully chosen machinery are used to navigate the

crops because there should be no disturbance among crops while navigating.

D.   Harvest Handling:
Harvest handling is the method of collecting the crops from the seeds and carried out to attain maturity levelof crops. Harvest handling also includes post harvesting techniques like winnowing, threshing etc.

Methods Of Harvesting:
1.   Hand Harvesting:

Hand harvesting is the method of harvesting without using any machinery tool. This technique is one of the easiest and the safest technique by which the farmers can visually image the fruits or vegetables rapidly whether the crop is suitable for harvesting or not.

2.   Harvesting with hand tools:
Harvesting with hand tools include some of the hand made tools used to harvest the crops. some of the harvesting tools are sickle, mover, reaper, thresher, sugarcane crusher etc.

Fig 4: some of the tools used while harvesting

3.   Harvesting by machinery:
Machine harvesting is a process of mass removal of commodity using machinery. Harvesting process can cutand clean the crops at the same time in large quantity, so this method will be easier than other two .

Importance Of Harvesting:
- ✓ Harvesting crops by using advanced technology reduces the wastage of grains and increases in quality andquantity.
- ✓ The direction of cutting fruits, grains and vegetables is very important during harvesting to save the qualityof the fruits and, we should see that the tools used should not damage the plant.
- ✓ Harvesting at the right stage enriches the quality of grains or seed protection

E.   Remote Sensing:
Before going into the concept of remote sensing used in IoT, we should know about what remote sensing and is itsuse. The meaning of remote sensing is it is a technique of monitoring and identifying the characteristics of the area by the measurement of its reflection and the radiation emitted at the distance. The best example of remote sensing is GPS, which helps in imposing the route of the location of any point on the Earth. Mainly, the data collected using this is stored and anyone can access the data from anywhere at any time. In Agriculture, remote sensing plays a role wherein the absence of the farmer the productivity and the growth of crops can be watched with the help of this. As a result, the growth of the crop, the color of the leaves of the plant, and the pastures in the leaves can also be keenly watched and helps in the determination of the plant's condition. The main use of these images is it helps in finding the deficient nutrients in the plant, diseases, damages made by the environmental resources, etc., Information from this makes the farmers rectify only the affected plant in the field.
The problems in the field can be remotely identified before they are visually identified. The electromagnetic spectrum is used for the light wave detection of the plant and finding the stress level of the plants. Some comparisons are made on the spectral signals of the plant and those spectral signals are based on the colors of the leaves, their shapes, or the

growth/attachment of the leaves with the plants. It also determines the amount of energy that has been reflected, soaked up, and transferred. These spectral signals of the plants are quite different from the other spectral signals.

F. Computer Imaging:

One of the Emerging technologies is computer vision which is enormously spread among the countries. Among all the industries in India, the Agriculture industry is a wonderful sector that plays a major role in computer vision operation. Now, let's get to know about computer imaging. It uses the camera and the computer in the alternative to our naked eye to find out and track the target using the image processing method. This plays a major role in the development of agricultural products.

The agricultural sector has identified various contributions of Computer Vision models in areas such as seedling, picking, surveying the weather conditions, and deduction of plant health and observing. The most contributions of done by computer imaging in this sector is

- ➢ Crop Observation using Drone
- ➢ Analysis of the crop yield
- ➢ Crop sorting and gathering using smart techniques
- ➢ Automated pesticide spraying
- ➢ Livestock
- ➢ Farming using smart techniques

G. Quality Control:

Quality control means it is a process in which a commercial center ensures that the quality of the product is maintained and enhanced. In the agricultural sector, this plays a major role in the value of the chain and its external place. A major part of the quality control is to ensure the yield produced in the field meets the safety and the standards play a role in processing in the agricultural sector. In this control, the testing takes place and determines the requirements that are necessary for the final product.

The accepted level in the quality of food and its safety is important to provide the required protection for the users and to make clear the trading techniques. The main objective of this quality control can be identified and observed as the assurance of the quality product along with the entire food. The food's quality should be of the best class as it is the edible part used by the consumers, in turn, it is consumed by every person in the world. Hence, the quality of the product should not be compromised with anything in the world.

H. Sorting and grading:

Sorting and Grading are often used terms in the agricultural sector which has a unique operation in its ways. Sorting is the process of separating the individual properties of raw materials including weight, the closeness of the products, size, shape, photometric properties, and so on. Whereas grading is the process of classifying the quality incorporating the value of commerciality, and the standards of the officials. The selection process is more important than the processing point as the manufacturing depends on the product result. Let's take an example of a fruit which should be ripe, and edible to eat with the saturated level of maturity and mainly it should be free from soil and should be clean without dirt, etc., The yield should be free from the insecticides, pesticides, imperfection, and mal nutrient. The fruit or vegetables with over-ripeness says that it is affected by some micro-organism and shows that the product is of poor-quality yield. After this first level of sorting, the fruits and veggies are graded. The collected product should be of a uniform quality which is of the same color, size, etc., Sorting and Grading are either done manually or with the help of the machine.

I. Irrigation monitoring:

Irrigation in the sense shows the water level of the soil. Irrigation monitoring means how much water is needed for the plant in the current situation. Irrigation has some methods in it to water the plants and those are called irrigation techniques. They are:

- ➢ Sprinkler Irrigation
- ➢ Drip Irrigation
- ➢ Surface Irrigation
- ➢ Subsurface Irrigation

Now, let's get to know about the water sensors that are used and the information they give to the farmers are:

- ➢ Optimized result

➢ Water conservation
➢ Decrease the impacts on the environments ➢ Save Money

Nowadays, these techniques can be monitored using IoT, ML, AI, etc., which helps to show the need for water whether it is little or too much. If overwater is there, the plant gets soaked, and it reduces the yield. We are now trying to implement the notification to the farmers about the level of water needed in the field using IoT technology. Irrigation leads to

➢ Increase the water level and cost of energy ➢ Fertilizers are drained below the main area ➢ Soil gets eroded
➢ Movement of soil particles and chemicals to the ditches
➢ Results in the high labor costs.

The water sensor has both strengths and weaknesses, and irrigation improves the crop efficiency, conservation of water and helps to get more profit

IV. BENEFITS OF ADOPTING NEW TECHNIOLOGY

A.   Climatic Conditions:
In Agriculture, the conditions of climate play a key role. The Internet of Things devices helps agriculture to trace its climate conditions. Moreover, the crops are cultivated in accordance with climatic conditions. In this, to check the proper climatic conditions the sensors are placed both inside and outside of the land. If an emergency arises, the sensor sends the alert signal. These sensors gather information and help to detect the real-time conditions of the weather such as temperature, dew, rain, etc., It also helps to choose the proper crop at the correct time and produce the extreme growth which helps in hand to the farmer to lead their life. The sensors monitor the growth of crops, climatic conditions, and weather surrounding the land. The presence of the farmers during the urgent situation makes the crop production increase and produces more yield.

B.   PRECISION FARMING:
Precision Farming is used to cope with the uniqueness of the field in the crop growth and modulate it properly with a small amount of cost and resources. It helps to support livestock, lab works, vehicles, etc., Precision had the meaning of accurateness hence this type helps in the accurate crop production. In the livestock area, precision farming collects data on the livestock, and maintains the information about it such as its well-being, location, health conditions, etc., In tracing the vehicle, it maintains the total amount of load that has been exported from the land and its location, maintenance, etc., This type is also called as Precision Agriculture. The given figure below represents the technique of precision farming.

Fig. 5. Precision Farming Techniques

C.   SMART GREENHOUSE USING IOT:
Greenhouse is a structural building with various covering materials, like plastic roof or plastic walls or a glass. Mostly greenhouse will be in controlled environment to grow plants. It is heats up using the invisible solar that is made using transparent glass. The heat that comes from the sun is absorbed by the plants, soil and other things inside the building. In indoor farming sensors, monitoring and control system which helps in optimization and in automation of growing process. Now days smart houses are equipped with cutting-edge sensor and communication technology which automatically records and transfer the data to their surroundings for every 24hrs or weekly once. The data which is recorded will be sent to Iot platform where it is converted into actionable intelligence by analytical algorithm to check the irregularities. Smart houses are mainly brought into existence to make the work easier for farmers; V it will mainly reduce the labour costs and it increases resources and chemical efficiency and it majorly used to increases in output by

accessing a lot if huge crops.

D. Drones:

Drones are unscrewed aerial vehicle used for surveillance also known as UVs it is majorly used in industries like mining sector, construction and it also used in army and now a days it also came existence in agriculture. Though in most of areas in India doesn't use drones for agriculture many companies try to make easily available for Indian farmers to make easy and make increases production in agriculture.

On 16th November 2020, the Indian government granted the International Crops Research Institute (ICRISAT),to use of drones for agricultural research activities. With this move, the government hopes to encourage budding researchers and entrepreneurs to look at budget-friendly drone solutions for more than 6.6 lakh Indian villages.

On 26th November 2022, government released a certification scheme for agriculture drones, which is now used for carrying chemicals, liquids and it is also used to spray liquids in spraying drones.

On 23rd January 2022, in this date they had promoted drones for agriculture purposes and reduce labour work in agriculture. Recently Indian government has offered 100% subsidiary or 10lakh up to March 2023 for farm testing and training institutes, ICAR Institutes, Krishi Vigyan Kendra's & State Agriculture Universities.

Avoid Chemical Overuse Check Crop Health Geo Fencing

Livestock Management Prepare for weather glitches Crop Spraying Crop Monitorin g Drones use advantges Monitor Growth Plantation Soil and field analysis

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Fig. 6. Advantages of using Drones i

V. CONCLUSION

Thus, in this paper we have done a review of the agricultural methods that are produced using the new emerging Technology mainly Internet of Things. Nowadays, there are not enough farmers for farming. We all know that Our countries economic status completely depends on the farming. We can use the technical methods to increase the productivity of the crops without the interference of the manpower. And we have discussed those techniques in this paper. While we are using the technology, the crop growth is increased to the twice of their normal yield. This makes the consumers and the producers happy which in turn makes them to increase the productivity to the farmers.

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