



To Enhancing the Agricultural Sector by Using IOT Enabled CNN Techniques

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**To Enhancing the Agricultural Sector by using IOT enabled
CNN Techniques**

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Content

Abstract.....	5
Keywords.....	5
1. Introduction.....	6
2. Lifecycle of Agriculture.....	7
2.1 Soil preparation.....	7
2.2 Sowing seeds.....	8
2.3 Irrigation.....	9
2.4 Weed protection.....	9
2.5 Harvesting.....	10
2.6 Crop storage and sales.....	11
3 Challenges Faced by The Farmers While Using Nowadays Farming Methods.....	11
3.1 Major Problems In Agriculture Facing By The Farmers.....	11
4 Artificial Intelligence.....	12
5 Convolutional Neural Network and Internet of Things Enabled Agricultural Sector.....	12
6 Modern Agriculture IOT Techniques to Overcome the Problems.....	13
6.1 Weather Forecasting.....	13
6.2 Crop Monitoring system.....	14
6.3 Monitoring plant/crops health by drones.....	15
6.4 Drone Spraying / Irrigation.....	15
6.5 Precision Farming and predictive Analytics.....	16
7 Hardware Support.....	17
8 Applications of IOT to Improving the Crop Yield.....	18
9 Mobile Applications.....	20
10 Conclusion and Future work.....	22
11 References.....	22

List of Figures and Tables Caption List

Figure 1 Lifecycle of Agriculture.....	7
Figure 2 Soil preparation.....	8
Figure 3 Sowing seeds.....	8
Figure 4 Irrigation.....	9
Figure 5 Weed protection.....	10
Figure 6 Harvesting.....	10
Figure 7 Crop storage and sales.....	11
Figure 8 Weather Forecasting.....	14
Figure 9 Crop Monitoring system.....	14
Figure 10 Monitoring plant/crops health by drones.....	15
Figure 11 Drone Spraying / Irrigation.....	16
Figure 12 Precision Farming and predictive Analytics.....	16
Figure 23 Role of IOT in Agriculture.....	17
Figure 14 Intellia INT GOL-Soil Moisturising Sensor.....	18
Figure 15 Working Principles of IOT.....	19
Table 1 Hardware Specifications.....	18

List of Abbreviations

IOT	Internet Of Things
CNN	Conventional Neural Networks
AI	Artificial Intelligence
USDA	United States Department of Agriculture
RML	Routers Market Light
ICT	Information and Communication Technology

Abstract

By the growth of world population, most of the Countries that focusing in an agricultural sector, by improving the majority of food production is very important role in the global economy. With the help of IOT Concepts, the massive agriculture improvement Technology has been widely using modern Agricultural farming [1, 2]. This research effort that implies the Guidance of tools and Techniques to overcome the Agricultural challenges like sensing the temperature of water and soil management, soil humidity, needed nutrients, disease detection, analysing the plant growth, water consumption, crops cultivation. To tackle the problems in un high yielding. There are several AI techniques have been explored, likewise, by enhancing the techniques of CNN in Agriculture to yields the high performance for the end users. The layers of CNN are easy to reduce the effort of manpower by using Mobile Applications based solutions and proposing the Surveillance system to identify the Automatic crop cultivation with accurate solution [2].

Keywords. IOT, CNN, AI, Modern Agricultural Techniques, Improving the Crop Yield, Mobile Applications.

1. INTRODUCTION

The IOT Technologies that used in an agricultural field is more helpful to reduce a human work. The soil conditions to check the irrigation of humidity in soil monitoring system by IOT is a vital role in smart farming. Not only for the food production crop cultivation also becoming equal developed. Economically indeed crops like rubber, gum, and cotton, are becoming important part for developing countries. By focusing the food crops farm frequently farmers need to monitor the agricultural land, Throughout the crop's lifecycle [2].

IOT is connected by the physical objects, the objects that are connected with the internet, the things in IOT are embedded with software, sensors and other technologies, these devices that connects with ordinary home appliances to industrial uses the large volume of data that collected through remote sensing technology

the image analysis that provides the accuracy taken from the agricultural fields gives accuracy and intelligent analysing methods are used in the agricultural field to identify the crops one of the best methods that used to classify the agricultural domain is IOT-based sensing method

The Convolutional Neural Network and Internet of Things techniques give less man power and smart agricultural techniques to reduce the vast monitoring time and field work. There are farmers spent their 70% of time to monitor, understanding the stages of crops growth and field works. Remote sensing and communicational technology provide virtual field works with the help of human to computer interaction. Along with ground water scarcity across with many countries due to the failure of seasonal rainfall.

Agricultural farm lands that convert into residential areas or other development purpose like factories, and manufacturing companies. Still many Agricultural latest techniques are not aware to the farmers. those are the most cost-effective methods unknown by them. In most of the countries has different changes of weather conditions and various types of soil lands. So, farmers facing most of the problems like diseases and damages of the crops due to sudden rainfall by unexpected climatic conditions. It causes more Loss in yields [3].

To classify the problems in agriculture by using CNN techniques is accuracy the image classification which constitute the special class of food production challenges to understanding the eco system.

The nature of the plant growth depends on eco system, soil, climatic conditions cultivational techniques weather changing conditions such as the changes that suddenly occurs in humidity and temperature causes the crop diseases [2].

2. LIFE CYCLE OF AGRICULTURE

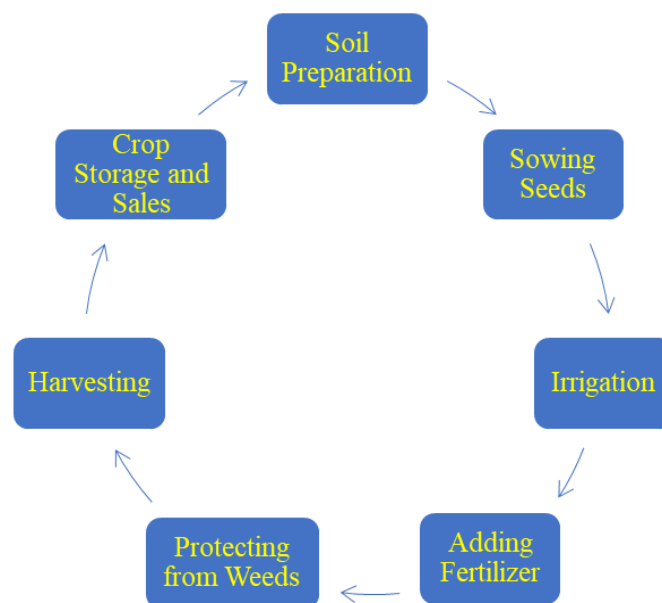


Figure 3 Lifecycle of Agriculture

2.1 Soil preparation

This is the first stage farming. Farmers plough the land to sow seeds. When ploughing the soil, it becomes loosened. and it helps the roots for penetrating. Due to this process, it breaks the clumps of soil, sticks, and roots. Some fertilizers were added to the soil while ploughing the land for the process well growing crops. Depends upon the crops some organic like cow during were added.[5]



Figure 2 Soil preparation

2.2 Sowing seeds

During the time of seed sowing (or) planting wanted to take care of the distance between two seeds. The seeds must be selected under the process of disease free and good quality. All seeds should need an equal amount of nutrients and seed water the depth of the soil is also important. Then seed could not be sow neither top and nor depth.[6]



Figure 3 Sowing seeds

2.3 Irrigation

The irrigation method is very important methods to most the soil in correct stage, underwater irrigation or overwater irrigation system if it cannot do in proper way if causes to damage the seeds and it could not grow up. Depending upon the types of soil and reason. In summer reason the crops require higher amount of irrigation and in winter and raining season is not highly required due to rain fall.[8]



Figure 4 Irrigation

2.4 Weed protection

Weeds are the plants that growing unwantedly in nearby crops and boundary of farms. Growing of weeds decreases the production and delaying the growth of crops. it interferes and took long time for harvesting. The cost of weed controlling in organic farms is more expensive.[7]



Figure 5 Weed protection

2.5 Harvesting

It is the process of gathering all the crops in farms. During the harvesting it requires lot of labours for crop gathering activity. This stage includes maturity of the crops have fully grown nutrients. It took 10-15 days to complete this process. There are two types of post-harvest are follows such as threshing and winnowing.[6]



Figure 6 Harvesting

2.6 Crop storage and sales

The storage of crops defines protecting and guarantying the crops in such a way. Storage of crops denotes most security periods other than the agriculture periods. They should provide maximum protection from rainfall, insects, surface moisture, birds etc., during this period the farmers packing and transport the crops to the market and sales it under the market rate.[6]



Figure 7 Crop storage and sales

3. CHALLENGES FACED BY THE FARMERS WHILE USING NOWADAYS FARMING METHODS

In Agriculture lifecycle rainfall such as temperature and humidity play an important role, the soil requires the specific nutrition evenly to all the crops. Nutrient's deficiency which leads to poor quality and low quality of crops want to increase three main nutrients in soil those are called nitrogen (N) phosphorus (P) and potassium (K).

The growing of weeds plays an important role in soil deficiency. If not protect the crops from weeds in Agricultural lifecycle it leads to absorb all the nutrients from the sol and makes minimum production of crops with investing.[5]

3.1 MAJOR PROBLEMS IN AGRICULTURE FACING BY THE FARMERS

- Quality of Seeds is not good
- Irrigation facility is poor
- Lacking of Modern Equipment

- Fragmented holdings of land
- Marketing with local trading Agencies
- Lack of space for storage facilities
- Climate changes due to Deforestation and loss of Biodiversity in soil
- Lack of financial support

4. ARTIFICIAL INTELLIGENCE

AI impact makes huge changes in all domains' factors likewise now day's worldwide economic sector.it plays an important role. As a day by day the world population is now increasing due to the security of water resources and insufficient land demand. So, we all need more sufficient and smarter approach. In this article, I will cover all the challenges faced by the farmers and how the AI is replacing the traditional methods and makes revolution changes. This method is more efficient and helps the farmers to become a good farming.[13]

5. CONVOLUTIONAL NEURAL NETWORK AND INTERNET OF THINGS ENABLED AGRICULTURAL SECTOR

IOT in agricultural modern sector are now available to give live data. The IOT sensor network that connected to the cloud via Cellular/Satellite connection. This technology gathers the live and real time data. It helps to make the correct decisions.

By applying the CNN techniques in smart agriculture makes lot of benefits such as monitors the tank water levels, for irrigation, one of the most important things which makes enrich to the farmers in tracking of seed growth, it's one of the green revolutions in agriculture that makes consumption of resources and how long time taken by the seed to be a fully grown plant.

The weeds are damaging the agricultural product. so, the crop quality yields are diminished sinfully, the weed controlling management are very essential to the high yielding and high-quality crop production, the advanced technology of weed controlling had a huge impact in agricultural sector using robust in weed controlling technology it controls the weeds successfully. Conventional weed control mechanisms with Agri Robots that spray the pesticides and increasing the productivity of the crops [2].

Agricultural robotic methods that are more adaptable that check the current images of crops with their database to detect the infected crops, if any infected crops or any growing weeds are identified in the field. The Agri Robots that spread the pesticide throughout the area.

Benefits by using Artificial Intelligence Techniques:

- With the lesser amount of time;
- Machine to Machine works reduces the man power;
- They can perform high yields [2];
- They get accurate data by IOT that are revolutionizing.
- IOT based techniques also enriching in cattle farming;

6. MODERN AGRICULTURE IOT TECHNIQUES TO OVERCOME THE PROBLEMS

6.1 Weather Forecasting

It's very difficult for the farmers to identify which is the right time to sowing seeds due to the challenges n climatic conditions which the help of IOT in Agriculture, farmers can identify the weather report by using weather forecasting Applications in their Mobile phones. It reports the weather temperature Humidity and rainfall, with the help of this Application farmers can analyse which type of the crops can grow, when the seeds should be sown in the soil and growth of the crops.[11]



Figure 8 Weather Forecasting

6.2 Crop Monitoring system

Monitoring the quality of crops depends upon the nutrition value and soil types. the soil quality is degrading due to climatic changes and deforestation. PEAT denotes the surface organic layer of the soil; German based Tech start-up has developed the Artificial Intelligence based Application it's named as 'plantix'. It is used to identify the nutrients deficiency in soil. and can easily identify the disease and pests' farmers can gather some ideas of treatments about the use of fertilizer which can helps to improve the quality of harvesting. In this app we can use image recognition technology. farmers can learn about the tips of soil restoration techniques and many solutions through this application.[13]



Figure 9 Crop Monitoring system

6.3 Monitoring plant/crops health by drones

In drones' regular cameras are using to monitor the crop health, most of the farmers are already using satellite images to monitor their growth of crops and plant count by using satellite data is not much more effective and it's too costly, but using drones it flies very close to the plants and produce accurate images. it is the easiest method to identify dry plant which is not grown or infected by diseases and quickly replanted in the gap. drones are also being used to monitor fields and health of soil conditions.[12]



Figure 10 Monitoring plant/crops health by drones

6.4 Drone Spraying / Irrigation

In high steep elevation areas drones are used to apply the spray treatments like chemicals which are used to kill the weeds, pests and unwanted plants in boundaries. In nowadays, to maintain the crop health spraying pesticides are much important. It is very low cost when compared to the manual spraying work. the pesticide spraying equipment are fitted with drones' pesticide spraying workers have to navigate fields by carrying their equipment. but in the drone sprayers. It flies all over the fields and manpower time.

By the changes of climatic conditions, drones identify the dry area or which is not irrigated with the help of drone survey it improves efficiency of water by including thermal, hyper spectral or multispectral sensors. it easily identifies which areas need to be improve by farmer. so, the drone irrigation system helps the health of the crops.[14]



Figure 11 Drone Spraying / Irrigation

6.5 Precision Farming and predictive Analytics

By using machine learning Algorithms with the help of images captured by drone cameras predictive analytics, machine learning and data mining methods used to analyse in past.[15]

What has happened?

What is happening currently?

What is going to be happening?



Figure 12 Precision Farming and predictive Analytics

Working principles of Modern Agricultural Techniques:

- Connect the Soil Moisturising sensor boards in the soil,
- Detect the Humidity data in Soil, Water Resources in Tank and any other causes of Diseases,
- Collect the images as an information by using CNN Techniques,
- Image Classification, object detection and Image Segmentation. This Segmented image is used to detect the diseases and send it with the help of Internet or Wi-Fi connection [8, 9],
- Farmers receives the notification through SMS Alert;

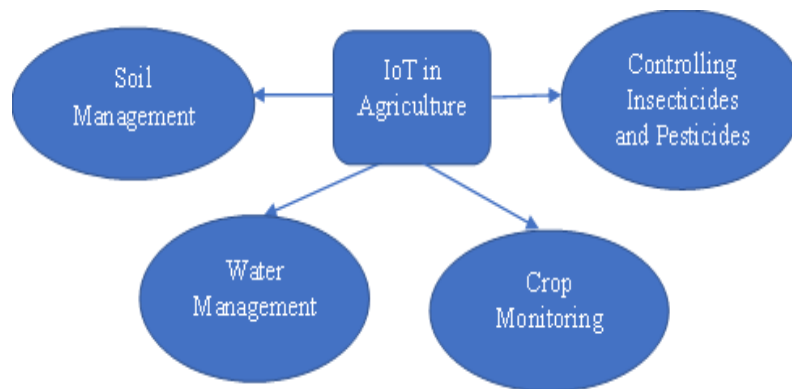


Figure 43 Role of IOT in Agriculture [3, 4]

7 HARDWARE SUPPORT

7.1 *Intellia INT GOL-Soil Moisturising Sensor*

It is one of the high precision sensors with high sensitivity, this product is covered by high compressive strength with the metal shell and gives high sealing performance. the electromagnetic pulse principle is used to measure the apparent di-electric constant of the soil [4, 5].



Figure 14 Intellia INT GOL-Soil Moisturising Sensor

Table 1 Hardware Specifications

Model Number	INT G01
Structure	4 - pin type
Monitoring Principle	FDR
Measuring Range	0~100%
Output Signal	4-20 mA Communication protocol
Power supply	DC12-24V
Working current	27mA typical, 50mA maximum
Response time	<1 Sec

8. APPLICATIONS OF IOT TO IMPROVING THE CROP YIELD

3.3.1 Climate Conditions

IOT features enables to know about the real-time weather conditions. to collect the weather data about the environment, the sensors are placed in the Agricultural fields. it detects the weather conditions accurately and alert the notifications through SMS [6, 7].

3.3.2 Precision Farming

The precision farming is also called as live stock monitoring, the main goal of precision farming is used to analyse the vehicle tracking, field observation and inventory monitoring [5].

3.3.3 Smart Green House

By using the smart Greenhouse like solar energy IOT brings cost less greenhouses. this sensor is manly used to detect the temperature and light energy [8, 9].

3.3.4 Data Analytics

With the help of IOT sensor devices, we can capture the crop conditions and its real time status. it's used to increase the quality and fertility of the crops and land.

3.3.5 Agricultural drones

The drone cameras are used to monitor the crops health. the Ground and Arial drones are used to accessing the measurements of crops. the drones are also used to spray the water to the crops [6].

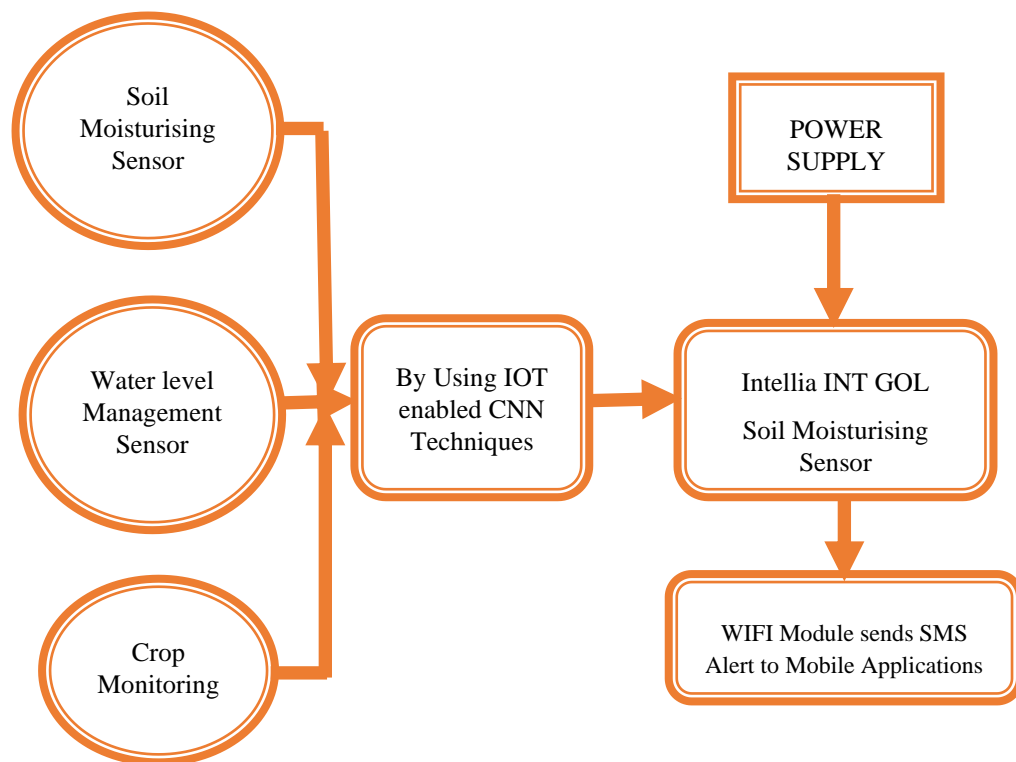


Figure 15 Working Principles of IOT

9. MOBILE APPLICATIONS

There are several IOT Applications in Agricultural sector, now farmers can track the climatic changes, monitor their crops, analyse their data by using mobile phone. The mobile Applications that play the role of medium between mobile and IOT devices, Mobile phones are loaded with the sensors that connects with Wi-Fi. with the help of IOT mobile Apps it delivers the geolocation and sends the SMS Alert to the Farmers.

Mobile and Cloud based Applications

In both developed and developing countries the mobile applications are used to develop the agriculture sectors.

The mobile technology and portable, wireless devices are the innovative services.

By comparing with developed countries, mechanisms are more advanced and the labour forces of agriculture is slightly small

But in develop countries, large portion of workforce is needed in agriculture and the mobile applications should be implemented for farmers. the mobile technology is most commonly used services for all traders and producers in the host of mobile technology application it includes market information like weather report, trading facilities, peer-to-peer learn technologies and financial services such as Insurance, payments and loans.

How to help Farmers by using Mobile Apps

By Training modern Agriculture related information's to the farmers with the help of easy method. Technology based usage like online education increasing number of mobile phones, cloud computing, The farmers such connect with other farmers and make better management decisions.

Uses of Mobile App Technology all over the World

USDA

Nowadays services of mobile apps are designing and using in different countries. For Android users. USDA – United States Department of Agriculture helps the farmers about Organic Farms. The Agricultural Research Service (ARS) recently released 2 types of Mobile Applications known as 'Land info' and 'Land Cover'

RML

Routers Market Light (RML) is the SMS based Subscription service that provides the information about crop cultivation, weather and

commodity prices. one of the benefits by using ICT in Agricultural Aspects. It gives real time price information which helps the farmers to decide whether to sell the crops or being hold. After the price level increases. It becomes sold.

Agrotech

Jayalakshmi Agrotech from India developed the smartphone Mobile Application. It is one of the most commonly using agricultural apps in India. this mobile app based on the regional languages, it designed to break the literacy barrier. In all over Asia several thousands of farmers are benefitted and empowered with this app. Its specially designed to deliver the information to the farmers in simple manner.[12]

Plantix

This app works with the help of Deep Neural Networks, Big Data and Artificial Intelligence (AI)

At first by accessing the application in smart phones farmers can capture the images of plants, soil lands and growing crops and wanted to upload those images into ‘plantix’ app.

After scanning the uploaded images in the app with many images which are already stored and it gives solutions to the farmers.

Needed recommendation messages and videos are available to prevent he crops.

It sends Alert messages and short videos to the concern farmers about diseases.[9]

Uses of ‘Plantix’ App

- It can easily identify crop disease, pest damage, deficiency of nutrients and along with corresponding treatment measures.
- It relates the access of farmers and scientists with plants experts to discuss about plant health.
- The app is used for all major crops and avails all the information in many languages.
- Farmers can join in online community to access about their local weather reports.

Farmerlink

Farmerlink is one of the mobile Application to enable the Coconut value in Philippines. It was created by Grameen Foundation and it combines with Satellite data with farm data. It helps the field agents to help the Coconut farmers to increase the level of productivity. The Farmerlink will send warnings to their mobile phones in case of any pests or diseases.

Mobile Technology Solution

The Vodacom is partnered with Giz in South Africa and launch a Mobile Technology Solution. It is used to support the south African farmers to become a smallholder and make commercial agriculture.[14]

10. CONCLUSION AND FUTURE WORK

The smart farming which based on CNN in an IOT enabled techniques is more efficient when it's compared to the conventional farming, it computes the accurate results and reduces the time and work force with high yields. The smart farming, is all improved related to the fields like organic farming and cattle farming [5, 6]. This research studies that shows the traceability data and monitor it helps improve the business performance and increasing the efficient levels.

- Future work of this IOT works that improve the Plant and Crop yields.
- Training that adopted to the farmer to enrich the smart Farming technology.

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