CROP AND SOIL MONITORING BY ARTIFICIAL INTELLIGENCE TECHNIQUE

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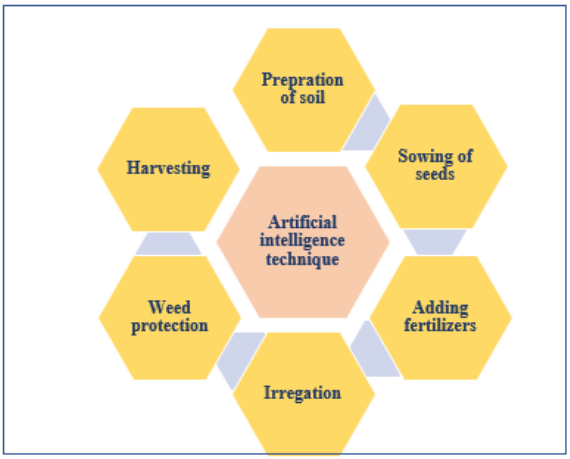
Abstract-
Nnutrients in the soil are critical factors for crop health and both the quantity and quality of yield. Then, once crops are in the soil, monitoring the stages of growth is also essential to optimizing production efficiency. Now, traditionally soil quality and crop health were determined by human observation and judgment. But this method is neither accurate nor timely. Instead, we can now use drones (UAVs) to capture aerial image data, and train computer vision models to use this for intelligent monitoring of crop and soil conditions. Human observation in accurately identifying wheat growth stages, meaning that the farmers no longer had to make daily treks into the fields to examine their crop. Importance of soil, another study set out to see how well computer vision can characterize soil texture and soil organic matter (SOM).Ordinarily, evaluating soil requires farmers to dig up samples and bring them to a lab for time and energy-intensive analysis.

Introduction
Manual observation of wheat head growth stages is just the kind of labour-intensive process that AI can help with in precision agriculture. This computer vision model was then able to outperform human observation in accurately identifying wheat growth stages, meaning that the farmers no longer had to make daily treks into the fields to examine their crop.The algorithm achieved a successful detection and classification rate of 99.31%.Overserving and estimating crop growth and maturity is hard, labour-intensive work for farmers. But AI is proving capable of handling much of that work with both ease and impressive accuracy.Getting back to the importance of soil, another study set out to see how well computer vision can characterize soil texture and soil organic matter (SOM).Ordinarily, evaluating soil requires farmers to dig up samples and bring them to a lab for time- and energy-intensive analysis. the computer vision model managed to make sand content and SOM estimates with accuracy comparable to costly lab processing.
So, not only can computer vision eliminate a large amount of the difficult, manual labour involved in crop and soil monitoring, in many cases it does it more effectively than humans can.Using image recognition technology based on deep learning, we can now automate detection of plant diseases and pests. This works using classification, detection, and image segmentation methods to build models that can “keep an eye” on plant health.

Vision and concept
Over serving and estimating crop growth and maturity is hard, labour-intensive work for farmers. But AI is proving capable of handling much of that work with both case and impressive accuracy.

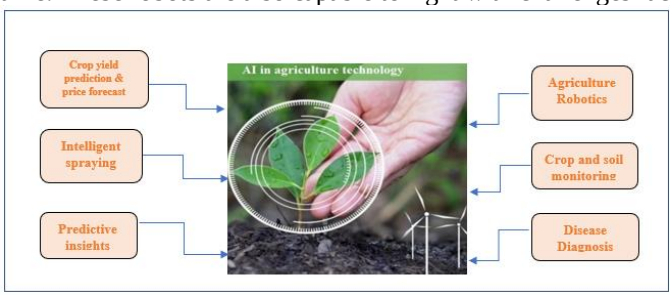
1. Crop and soil monitoring.
2. Insect and plant disease detection.
3. Livestock health monitoring.
4. Intelligent spraying.
5. Automatic weeding.
6. Aerial survey and imaging.
7. Produce grading and sorting.

Perhaps the equipment having the most immediate effect is soil and water sensors. These sensors are durable, unobtrusive and relatively inexpensive. Even family farms are finding it affordable to distribute them throughout their land, and they provide numerous benefits. For instance, these sensors can detect moisture and nitrogen levels, and the farm can use this information to determine when to water and fertilize rather than rely on a predetermined schedule. That results in more efficient use of resources and therefore lowered costs, but it also helps the farm be more environmentally friendly by conserving water, limiting erosion and reducing fertilizer levels in local rivers and lakes. The soil and water sensors mentioned earlier have set a foundation for traceability. The industry has only begun to realize this infrastructure, but it’s taking shape quickly. These sensors provide information that can be associated with farming yields. It may seem like science fiction, but we’re living in a world where a bag of potatoes can have a barcode that you can scan with your Smartphone in order to access information about the soil that yielded them. A future where farms can market themselves and have loyal consumers track their yields for purchase is not far-fetched.
Precision Farming and Predictive Analytics: AI applications in agriculture have developed applications and tools which help farmers inaccurate and controlled farming by providing them proper guidance to farmers about water management, crop rotation, timely harvesting, type of crop to be grown, optimum planting, pest attacks, nutrition management.



While using the machine learning algorithms in connection with images captured by satellites and drones, AI-enabled technologies predict weather conditions, analyse crop sustainability and evaluate farms for the presence of diseases or pests and poor plant nutrition on farms with data like temperature, precipitation, wind speed, and solar radiation.
Farmers without connectivity can get AI benefits right now, with tools as simple as an SMS-enabled phone. Meanwhile, farmers with Wi-Fi access can use AI applications to get a continually AI-customized plan for their lands. With such IoT- and AI-driven solutions, farmers can meet the world's needs for increased food sustainably growing production and revenues without depleting precious natural resources.
In the future, AI will help farmers evolve into agricultural technologists, using data to optimize yields down to individual rows of plants

Agricultural Robotics: AI companies are developing robots that can easily perform multiple tasks in farming fields. This type of robot is trained to control weeds and harvest crops at a faster pace with higher volumes compared to humans.
These types of robots are trained to check the quality of crops and detect weed with picking and packing of crops at the same time. These robots are also capable to fight with challenges faced by agricultural force labour.



AI-enabled system to detect pests: Pests are one of the worst enemies of the farmers which damages crops.
AI systems use satellite images and compare them with historical data using AI algorithms and detect that if any insect has landed and which type of insect has landed like the locust, grasshopper, etc. And send alerts to farmers to their smart phones so that farmers can take required precautions and use required pest control thus AI helps farmers to fight against pests.

Discussion
Artificial Intelligence in agriculture not only helping farmers to automate their farming but also shifts to precise cultivation for higher crop yield and better quality while using fewer resources.
Companies involved in improving machine learning or Artificial Intelligence-based products or services like training data for agriculture, drone, and automated machine making will get technological advancement in the future will provide more useful applications to this sector helping the world deal with food production issues for the growing population.
AI-powered solutions will not only enable farmers to do more with less, it will also improve quality and ensure faster go-to-market for crops. Today's technology advancement in Artificial Intelligence, Big Data, IoT are becoming the major drivers for providing the Digital IT solution almost in all the fields and business sectors. Hence, it is proposed to make use of Digital solution aided with Artificial intelligence to uplift the habitat of the trampled farmer community while providing yet a new opportunity for business and entrepreneurs by enabling smart farm as a service.

- Images of different crops under white/UV-A light are captured to determine how ripe the green fruits are. Farmers can create different levels of readiness based on the crop/fruit category and add them into separate stacks before sending them to the market.

Conclusion and future work
The Internet of things (IoT), which is the ability for technology in everyday objects to send and receive data, will revolutionize how we do everything from transportation to communication. Agriculture also stands to benefit greatly from integrating this technology into simple electronics IoT will enable farmers to increase food production by 70 percent by the year 2050. In addition

to better pest management and weather forecasting, IoT could save up to 50 billion gallons of water annually, as sensors can better help farmers optimize water usage. Being able to better optimize crop management will have a transformative effect on agriculture in the following years.

It is estimated that diseases correspond to a big chunk in crop yield losses. The most widely used practice in pest and disease control is to uniformly spray pesticides over the cropping area. This practice, although effective, has a significant financial and environmental cost.

Traditionally, disease detection can be manually done by observing the colour of the leaves and the presence of spots. However, it has been leveraged by computer vision systems that are able to segment these affected leaf regions and classify them as being associated with a disease or not.

In a similar use case, concerning wheat, one of the most economically significant crops worldwide, developed a new system to differentiate between diseased and healthy crops. The system detected nitrogen stressed, yellow rust infected and healthy winter wheat canopies based on hierarchical self-organizing classifier and hyper spectral reflectance imaging data.

Soil and field analysis: By producing precise 3-D maps for early soil analysis, drones can play a role in planning seed planting and gathering data for managing irrigation and nitrogen levels.

Planting: Start-ups have created drone-planting systems that decrease planting costs by 85 percent. These systems shoot pods with seeds and nutrients into the soil, providing all the nutrients necessary for growing crops.

Crop monitoring: Inefficient crop monitoring is a huge obstacle. With drones, time-series animations can show the development of a crop and reveal production inefficiencies, enabling better management.

AI technologies help farmers to analyse land/soil/health of crop etc and save time and allow farmers to grow right crop in each season that has best yield. Vertical cropping can reduce water usage, make efficient land usage, can be cultivated in urban areas in buildings. It can reduce the problems with labour unavailability. Allows prediction of next year crop seasons/weather/climate/rainfall etc. AI based predictions enable suggesting appropriate pesticides/crops/place at right time before large scale incidence of disease.

To implement a system with this use case is first necessary to differentiate the crops from the weeds, and, as we already know, computer vision is a powerful tool for doing so. Afterwards, micro spraying, or lasers can be used to remove the undesired guests.

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