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Artificial Intelligence Based Fruit Orchard Management

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Sustainable fruit production is the need of the hour to meet the growing global population requirements. Integration of latest technological solutions for the improvement of farming might be the only possible way to meet out this requirement. Sustainability, enhancing the resource efficiency and automation are the components of precision farming. GPS (Global Positioning System) and GIS (Geographic Information Systems) for precise mapping and monitoring of orchards are the important components. Remote sensing and drones are critical for capturing real-time data on canopy health, pest infestations and stress levels. Similarly, IoT (Internet of Things) devices, such as soil moisture sensors and weather stations, collect continuous data, enabling real-time decision-making. As the manual methods of management of orchards are time consuming and inaccurate, artificial intelligence based models can be exploited. Presently artificial intelligence systems are the advanced technology for developing predictive models for many intercultural practices and monitoring of yield (Panda *et al*., 2010).

Fruit yield can be estimated by counting the flowers by using the correlation between the blossoms detected in an image with the actual number of fruits on the tree. It was found that during the flowering period, photosynthetic activity increases, which positively correlates with the fruiting process. This system of early yield prediction is successfully implanted in Pink Lady Apple cultivars. In case of checking the crop maturity in the fruit orchard, precise monitoring equipment that is capable of rapid detection of produce quality is desirable, together with a low marketing cost. The crop health monitoring is a critical factor to ensure productivity of crops. Early detection of crop infestation with pest, nutrient deficiencies and stress due to climate change are needed to lower the problems of low productivity. This can be achieved by means of high resolution weather data, remote sensing data and AI technologies. Various sensors for soil moisture, soil temperature, ambient humidity and ambient temperature sensor can be used to make a decision on optimum irrigation using mobile app in order to increase the water use efficiency. The plantix application is used to determine the potential defects and nutrient deficiencies in soil. The analysis is conducted by software algorithms which correlate particular foliage patterns with certain soil defects, plant pest and disease. This application also detects crop diseases and offers advice regarding control measures for the detected disease by the app. In banana, *Fusarium* wilt (the most common and serious diseases of banana) can be mass diagnosed early by using E-Nose integrated autonomous rover system which is fabricated with MOS sensors (Sanjay and Kalpana, 2017).

Crop protection is important in crop production especially in large acreage where it is difficult to understand the cause of the maladies and also early detection is very important as severe infection is unmanageable. A cost-effective automated system comprising AI and machine vision were used to recognize, differentiate and geo-locate citrus psyllid (*Diaphornia citri*) in orchard of citrus (Partela *et al*., 2019). Deep learning models in image processing are recent developments to spot diseases of different crops through visible symptoms captured in précised manner. Several banana pest and disease are identified with

the help of detection model developed using artificial intelligence with deep learning methods (Selvraj *et al*., 2019).

A knowledge-based system for apple diseases helps the farmers to identify the symptoms and cause of various diseases and treats the disease whenever possible (Shawwa and Naser, 2019). A knowledge-based expert system for detection of various diseases and recommendation of disease management method for pineapple diseases was introduced (Shawwa and Naser, 2018). The most common postharvest disease of Golden Delicious apple was able to identify with aid of an electronic nose (E-Nose) technology during processing and packing of apples (Jia *et al*., 2019).

AI is used in harvesting fruits to enhance precision, efficiency, and sustainability by employing technologies like computer vision and robotic systems to identify ripe fruits, automate picking with specialized robotic arms, ensure delicate handling as well as to harvest the produce at right time. Mechanical vibration harvester is used to harvest walnut. This harvester comprises two mechanism namely clamping and exciting mechanism. Here mechanical force used to create vibration at definite frequency and amplitude which makes fruits fall off from branches and are collected on loading device (Yang, 2020).

Conclusion

Artificial Intelligence (AI) a technology developed based on the concept that a technology which works like a human brain. This technology helps in finding the solution for the orchard management problems. Pest and disease attacks in fruit orchards can be detected through image processing and analysing data obtained from AI systems. But Artificial Intelligence systems are more complex, expensive and needs technical guidance. So research should be planned and conducted to overcome these challenges for widespread adoption to utilize its full potential by working upon AI-driven sensors which helps to improve fruit production and productivity.

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