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Application of Robots in Different Agricultural Operations

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The agricultural operation is most drudgery than other than non-agricultural operations like industrial operations because the mostly agricultural operation is weather (rainfall, sunlight, humidity, and temperature) dependent. Weather effect the field operation completion within the available time, and due to this effect final yield of crops is also affected. If increase the working hour (utilization of day and night) during the time available between two consecutive crops then agricultural field operations are complete within the time available. In India, the topography of agricultural land is very from north to south and west to east from flat to hilly reason. Due to undulation agricultural operations are very difficult to complete in that areas. Adverse weather of temperate climatic zone in J&K, Himachal Pradesh these area orchard monitoring are very difficult for the human being. Above all these challenges are resolved by applying small agri-robots (Unmanned aerial vehicles (drones) and unmanned agricultural ground vehicles (robots) to complete the different operations without difficulties and compromise of production and productivity. Know days robots are used for primary and secondary tasks like seeding, planting, weeding, spraying, monitoring, mobility, interaction, human-robot, manipulator, navigation, steering, etc.

Seeding

Unmanned agricultural ground vehicles are used for sowing (line sowing) and broadcasting small cereals and crop seeds. These robots precisely place the seeds at the desired depth in a particular row for better germination of seeds without struggling to come out from the soil. The seeds are stored in a hopper, the outlet of the hopper one flips is fixe and opens and close this flips with servo motor rotation through 180 and releases the seeds in a particular row through a seed pipe-furrow opener after that seeds are covered with seed covering device whose model is given below

Weeding

The manual weeding operation is replaced by an autonomous unmanned agricultural ground vehicle weeder for weeding day and night for improving the productivity of a farm. In weeding first detections of weeds by sensors based on size, shape, and color, if the quality of detections is good then automatically weeding is also good. After sensing the weed by signal sends to Arduino, Arduino manipulates these signal logically and

Fig.1 Modeling of sowing ag-robot

sends it to the mechanical actuator which operated the weeding tools. Weeding in inter-row is easy in comparison to the intra –row, because inter-row weeds are very near to plants, these weeds are very difficult to destroy by flaming, hot water jet, microwave, electricity, and infrared without damaging plants.

Fig. 2. Mechanical weeding through Agri –robots in vegetable crops
(Source: - Ben ari and Mondada, 2018)

Spraying

Plant protection is an important operation during crop production. Insecticides save approximately about 37 percent of crops from insects, insecticides and pesticides increase the production of crops by proving protection from the attack of insects and pests. Conventionally the sparing is done by a knapsack sprayer which has low efficiency of application and the operator feels drudgery, more labor is also required during spraying time. All above mention points related to conventional spraying practices are compensated by adopting automated variable rate application sprayer ag-robot, and Unmanned areal vehicles (Drone). the drones are currently available for sparing in crops and orchards for controlling insects and pests in flat land and hilly area effectively, where big agricultural sprayer machinery is not operating easily. The main part of the drone are the sensor, GPS, and laser, the board helps in adjusting the height of the drone and cover the entire area effectively.

Fig.3. spraying of insecticides through drones in paddy field
(Source:https://www.indiamart.com/proddetail/agriculture-drone-sprayer-20772440197.html)

Harvesting

The advancement of technology like computers and electronics and electrical components, and software, push human beings from unskilled to skilled and used updated automated machinery to increase productivity, quality products. The harvesting of vegetable and fruits are generally by manually but these operations are full of drudgery and difficulty. To resolve these issues researchers are to be shifted towards the automated vegetables and fruits harvester. But robots available for harvesting are expensive and small and medium farmers are not afford them. The researcher designed an integrated robot to solve this problem and compared it with manually operated based on economic affordability and found agri- robot is the most cost-effective, efficient, and affordable solution (Raja et al, 2022). The ag robot first detects the image of crops through deep machine learning and plants are acquired through robotic manipulators. The robot uses the Cartesian coordinate system to move and pick up vegetables and fruits.

Fig. 4. Harvesting of tomato by ag-robot
(Sources: - https://www.istockphoto.com/photo/image-processing-technology-was-apply-with-the-robot-to-used-to-harvesting-tomatoes-gm1130498724-299005093)

Conclusion

1. The timely agricultural field operation is completed with the help of a small agricultural robot by utilizing the day and night time, without the intervenes of weather.
2. The small agri-robot is most suitable in hilly reason and temperate zone of India for agricultural operations like sowing, weeding, spraying, monitoring, harvesting, etc. easily.
3. The UAV is more suitable for fertilizer spreading, spraying, and a dusting of insecticides and pesticides, whereas tractive vehicles do not go there due to adverse field soil conditions and the undulation of farmland.
4. The agri-robot precisely places agriculture inputs like seeds, pesticides, insecticides, water, fertilizer, to reduce the input cost of farmers and increases the productivity of the field, and saves the soil from deterioration.

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