

AGRICULTURAL ROBOTS: NEW HOPES FOR AGRIBUSINESS

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Abstract

The skills and various engineering areas that are related with the construction, design, structural depositions and manufacture refers to robotics. The robotics engineering that deals with the engineering mechanics, science of electronics, software and mechatronics that have mounting mechanics that wheels on the axles, connecting motors and balancing. The growing field of robotics is with design, research and practical purpose of new robotics. In various robotics application one important field is agriculture. The interchangeable tools are electrical farm and electric factory assist the drive manufacturing productivity, sustainable intensification of agriculture and under pin future food security technology. For the food producers and farmers, the robotic technology gradually introduced with its exciting production systems. The present study focusing on introduction of robotics, automation, national field of markets and budgeting cost in the field of agriculture robotics. For future scope such researches are required to understand problems and guide scientists to create robotic and automation solutions.

Key words: Agricultural, Design, Drone, Farm, Robotics

Introduction

The robots are the branch of engineering that deals with the science of electronics, mechanics, software and mechatronics. The robot can sense and move with the help of various engineering technologies[1]. The basic requirement of design of robot is multiple sensors, allowable control that moves in different known and unknown environments. Robotics and Autonomous Systems are set to improve global industries[2]. The robot technologies will have greatest effect on different sectors of the economy with relatively low productivity. Figure 1 shown the introduction of robotics wherein input refers to sensor, processor is computer and output refers to actuator



Figure 1: Introduction of Robots

There are various parts used in the designing of robots, specifically agricultural robotics are shown below:

- Sensors
- Actuators
- Arm
- Controller
- End effectors

The agricultural robotics are robust, smart, compliant, flexible, robust, interconnected robotic and autonomous systems working seamlessly with their human coworkers in food factories and farms[3]. The Figure 2 shown the different types of agricultural robotics.

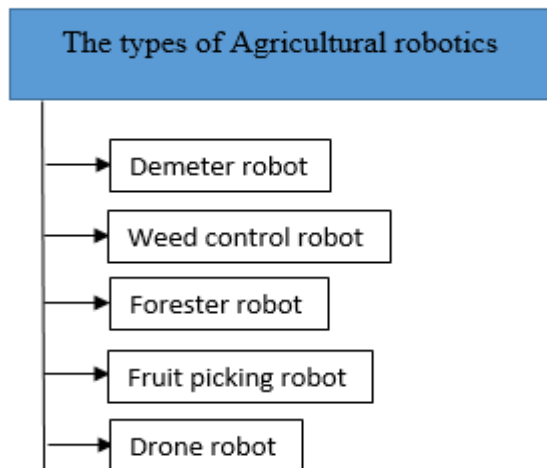


Figure 2: Different types of Agricultural robots

The types of agricultural robotics are shown in below:

1. Demeter robot:

The Demeter is basically a machine that is controlled by computer. The machine is speed rowing that consist of video cameras and some sensors for the navigation. The diagram of robot is shown in Figure 3.



Figure 3: Demeter Robot

2. Weed controller robot:

A weed controller robot is basically a machine that have control system and consist of identification of weeds, detection, four wheelers, and wide range to agricultural field. The diagram for weed control robot is shown in Figure 4.



Figure 4: Weed control Robot

3. Forester robot:

The application forester robot are such agriculture robot used for harvesting pulp and hard work in the forest [4]. Therefore it is special jaws and axes for chopping the branch. The forester robot diagram is shown in Figure 5.



Figure 5: Forester Robot

4. Fruit picking robots:

The robots can distinguish between fruit and leaves by using video image capturing[5]. Figure 6 shown the fruit picking robot.



Figure 6: Fruit picking Robot

5. Drones robot:

To check quick and easy way on the progress of crops and it need to replant or direct pesticides applications. It is used for weed, pest and disease control. The Figure 7 shown the diagram of drone robot.



Figure 7: Drones Robot

A Large application of technologies will enable the engineering agricultural robotics into the field. Among the various technologies need to be developed specifically for agriculture, while other technologies already developed for other areas, for example, machine vision, autonomous vehicles and artificial intelligence. The current status, opportunities and benefits of various enabling technologies from hardware to software, human robot systems and multi-robot systems.

Research Question

The Role of agricultural robots in agribusiness?

The importance of Agricultural robots?

Literature Review

James lowenberg deboer et al has given view in paper economics of robots and automation in field crop production published in 2019 that the various factors are useful for the new technology. The new factors such as robotic technology, automation etc. are beneficial for the smart robot technology. Study related to budgeting mostly focuses on revenue and cost of the product that changed technology like robotics and automation by considering everything. The study on new technology selects the economic implications of the smart technology. The parameters of the smart technology are achieved that are based on prototype data, basically the designed parameters. The problem data needed for the robotics on farm [6].

Syed mutahir mohiuddin et al explained in his paper agricultural robotics and its scope in India published in 2015 that works for somebody for the body balancing through wheels mounting on axes. For the body balancing, motor and sensors are also connected. For the active operation of motor and sensor, electronics is required. Some software also used with the smart robot for operation the sensor, so that robot can work perfectly. Innovation in robotics is new to technology and for the growth of growing such technology, the study robotic involves design, review and researches on different new robot's technology. The study of robot technology in agricultural field also plays important task with various benefits[7].

H.L. Kushwaha et al explained in his paper status and scope of robotics in agriculture published in 2016 that the growing technology in the field of agriculture improves new innovation robot technology. The agricultural developed technology has benefits that improves the precision, repeatability, reliability, efficiency and

minimizing the soil drudgery. The review of such technology states the potential of robot having sensory, multitasking, suitability to odd operation conditions etc. The Innovation in robotics is new to technology and for the growth of growing such technology, the study of such technology involves design, review and researches on different new robot's technology. study on agricultural robotic system had been done using model structure design mingled with different precision farming machineries. The different factors are used for the successful working of smart robot is laser, GPS, control system etc [8].

Methodology

1. Design:

The agricultural robots: new hopes for agribusiness strategy implementation concerns various design and structure of strategies to implement. The various agricultural robots have been discussed and introduction of robotics, automation, national field of markets and budgeting cost in the field of agriculture robotics has been discussed and analyses the different advanced agricultural robots as shown in Figure 8.

2. Sample:

For the study, different advanced agricultural robots have been selected from the various robots. Different agricultural robotics have different characteristics, some of the quantities are selected for the comparison of different characteristics of agricultural robots. There are some business platforms selected for the agribusiness.

3. Data Collection and Analysis:

The data for the agricultural robots: new hopes for agriculture has been collected from the different sources of the technical research and review papers. The robotic is new technology and for the growth of such technology, the study involves design, review and researches on different new robot's technology. The study on agricultural robotic system has model, structure, design, mingled with different precision farming machineries The field weeded book that service on the internet and the closest robots.

4. The Conventional and Atomized technologies are:

- The robots work non-stop that a human cannot.
- In muddy place large sized wheels are required.
- The large machinery can compact the soil that a lightweight of the robots cannot.
- The smart agricultural robot depends on human power and different techniques.
- The smart agricultural robot can work easily on hazardous environments.
- The weeds, insect infestation, present diseases and other stress are detected by the robots.

5. Seed mapping:

- The seed mapping is the position of each seed as it goes under ground.
- The infrared sensor used below seed chute for counting and checking the seed and a data logger that records a position orientation of seeder.

6. Ploughing (Seed bed preparation):

- The preparation is for top mixed soil that burying the residue of surface crop.

7. Seed placement:

- The placement of seed is important in order to get more water, light and air.
- It provides triangular and hexagonal patterns that may be applied by using robots.

8. Reseeding:

- It seeds automatically at same position and its concept is to identify where to not placed seeds.

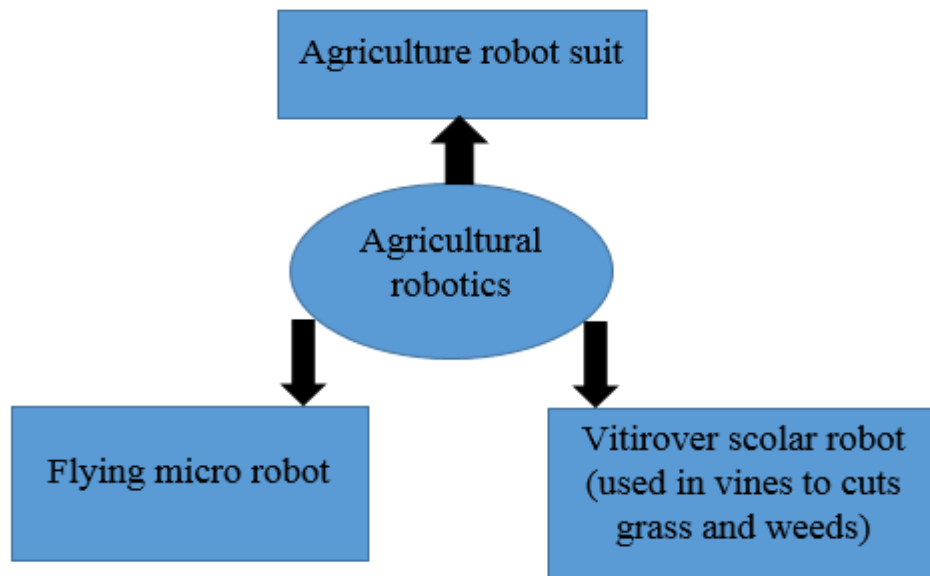


Figure 8: Advancement of agricultural robotics

9. The different advanced agricultural robots are as follows:

9.1. Flying micro robots:

- Designing midget robot to scout battlefield that is trapped in rubble and record image in agricultural fields.
- To control insects and weeds[9].
- The robot consists of propeller by which its features include the ability to zero in and land precisely on a potato chip.

9.2. Agriculture robot suit:

- The pulling radishes of agricultural work is specifying by design of robot suit.
- The agricultural robot designers to work with the suit to reduce the weight.
- The recent design 55 pounds' weight and 16 sensors to function.

9.3. Vitirover solar robot:

- Smart agricultural robot that is autonomous.
- Its size is large and in battery store energy is not beneficial as lower power to return for battery charging.
- It is for cutting grass, wherein vine is two to three centimeter and speed allowable five hundred meter per hour.
- The robots will increase in different agriculture fields[10].
- Solar energy is used to use electrical motors in small robots.

The different types of advancement of agricultural robots as shown in Figure 8. There are some basic different between the conventional and robotics as shown in Table1.

Table 1: Comparison between conventional and robotic techniques

| Quantity | Conventional techniques | Robotics techniques |
|---------------------|------------------------------------|------------------------------------|
| Power | Human power and old techniques | Machinery power |
| Time | More | Less |
| Cost of cultivation | Initially low but in long run high | Initially high but in long run low |

| | | |
|------------------|-----------------------|------|
| Work capacity | Low (Human need rest) | High |
| Product quantity | Low | High |
| Yield | Low | High |

10. Importance of Robotic agriculture:

- Improves safety
- Reduces chemical usage
- Sustain domestic agriculture
- Facilitates twenty-four hour operations
- Reduce labor needs

11. The agriculture robot suits are as follows:

- The motors are fitted in agriculture robot and the motors are fitted over knees, elbows in order to provide wearer power boost.
- Smart agricultural robot work like pulling radishes.

12. The advantages of Agricultural robots are:

- Agricultural robots are small in size
- The cameras and sensors are connected with the agricultural robots that makes the simple robot agricultural smart that detect weeds and other forms of stress.
- It collects soil sample and collects crop.
- It is capable of mowing, spraying pesticides and performing mechanical weeding that makes smart agricultural robot.

13. The main E-commerce Platforms in Agriculture in India are as follows:

- e-national agriculture market
- Destamart and destatalk
- E-chaupal
- Agricultural commodities exchanges
- Big-haat an agri-commerce start
- Indian farmer's fertilizer cooperative limited
- RML free mobile application

India is facing problem by not be met demand with the supply due to rising demand for food grains. The alternatives use of biofuels and food crop results in the situation to become more and more alarming.

Results & Discussions

The study of agricultural robots: new hopes for agribusiness has been done successfully. The robotics engineering that deals with the engineering mechanics, science of electronics, software and mechatronics that have mounting mechanics that wheels on the axles, connecting motors and balancing. The growing field of robotics is with design, research and practical purpose of new robotics. In various robotics application one important field is agriculture. The study on robotics engineering with respect to agriculture is relatively abundant, economic studies of technology. The study focuses on crop robotic benefits, economic impact and cost effective crop robotics.

Conclusion

The robotics engineering assist human to determine the quantity in order to achieve desired output. The robotics engineering that deals with the engineering mechanics, science of electronics, software and mechatronics that have mounting mechanics that wheels on the axles, connecting motors and balancing. The paper mostly focuses on current trends. The growing field of robotics is with design, research and practical purpose of new robotics. In various robotics application one important field is agriculture. The interchangeable tools are electrical farm and electric factory assist the drive manufacturing productivity, sustainable intensification of agriculture and

under pin future food security technology. For the food producers and farmers, the robotic technology gradually introduced with its exciting production systems. The present study focusing on introduction of robotics, automation, national field of markets and budgeting cost in the field of agriculture robotics. For future scope such researches are required to understand problems and guide scientists to create robotic and automation solutions

References

1. N. H. Rao, "A framework for implementing information and communication technologies in agricultural development in India," *Technol. Forecast. Soc. Change*, 2007, doi: 10.1016/j.techfore.2006.02.002.
2. P. Mondal, "Critical Review of Precision Agriculture Technologies and Its Scope of Adoption in India," *Am. J. Exp. Agric.*, 2011, doi: 10.9734/ajea/2011/155.
3. A. Vandeplas, B. Minten, and J. Swinnen, "Multinationals vs. Cooperatives: The Income and Efficiency Effects of Supply Chain Governance in India," *J. Agric. Econ.*, 2013, doi: 10.1111/1477-9552.12004.
4. R. Gupta and P. K. Sharma, "Scope of E-Commerce in Agri-Business in India : An Overview," *Int. J. Adv. Sci. Res. Manag.*, 2018.
5. J. K.C., "Agricultural Marketing and Sustainable Development," *IOSR J. Econ. Financ.*, 2014, doi: 10.9790/5933-0420108.
6. J. Lowenberg-DeBoer, I. Y. Huang, V. Grigoriadis, and S. Blackmore, "Economics of robots and automation in field crop production," *Precis. Agric.*, 2020, doi: 10.1007/s11119-019-09667-5.
7. Syed Mutahir Mohiuddin, "Agricultural Robotics and Its Scope in India," *Int. J. Eng. Res.*, 2015, doi: 10.17577/ijertv4is070784.
8. H. L. Kushwaha, T. Khura, J. P. Sinha, and D. K. Kushwaha, "Status and Scope of Robotics in Agriculture," *Int. Conf. Emerg. Technol. Agric. Food Eng.*, 2016.
9. J. De Baerdemaeker, "Precision agriculture technology and robotics for good agricultural practices," 2013, doi: 10.3182/20130327-3-jp-3017.00003.
10. F. A. Auat Cheein and R. Carelli, "Agricultural robotics: Unmanned robotic service units in agricultural tasks," *IEEE Ind. Electron. Mag.*, 2013, doi: 10.1109/MIE.2013.2252957..