GENERAL SIR JOHN KOTELAWALA DEFENCE UNIVERSITY INTAKE XXXVII

ARTIFICIAL INTELLIGENCE APPLICATIONS IN PRECISION AGRICULTURE

SYNDICATE - S

DS COMMENT

COVER SHEET

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DECLARATION

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ABSTRACT

Agriculture plays a significant role in the economic sector. Automation in agriculture is the main concern and an emerging subject across the world. The population is increasing tremendously and with this increase, the demand for food and employment is also growing. The traditional methods which were used by the farmers were not sufficient enough to fulfill these requirements. Thus, new automated methods were introduced. These new approaches satisfied the food requirements and also provided employment opportunities to billions of people. Artificial Intelligence in agriculture has brought an agricultural revolution. This technology has protected the crop yield from various factors like climate changes, population growth, employment issues, and food security problems. The main concern of this paper is to audit the various applications of Artificial intelligence in agriculture such as for irrigation, weeding, spraying with the aid of sensors and other means embedded in robots and drones. These technologies save the excess use of water, pesticides, herbicides, maintains the fertility of the soil, also helps in the efficient use of manpower and lift productivity and improve the quality. This is a brief overview of the current implementation of automation in agriculture, the weeding systems through robots and drones.

AIM

The Aim is to study about Artificial Intelligence Applications in precision Agriculture in the world and how to use them to enhance the agricultural products with less human interaction as well as with minimum time.

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CHAPTER ONE

INTRODUCTION

1. Artificial intelligence is based on the principle that human intelligence can be defined in a way that a machine can easily mimic it and execute tasks, from the meekest to those that are even more complex. The goals of artificial intelligence include learning, reasoning, and perception. It can be applied in many fields in many ways. AI is attained by examining how the human brain thinks, and how humans learn, decide, and work while trying to solve a problem. AI techniques heighten the speed of execution of the complex program it is equipped with and which is normally not achievable by humans. Artificial Intelligent is making a huge impact in all domains of the industry. Every industry looking to automate certain jobs through the use of intelligent machinery.

2. In today the global population is growing, and urbanization is continuing. Disposable income is rising, and consumption habits are changing. The expected global population to reach more than nine billion by today which will require an increase in agricultural production by 70% to fulfill the demand. As result of the world population swelling then land water and resources becoming insufficient to continue the demand-supply chain. Farmers are under a lot of pressure to meet the amassed demand, and agriculture is both a major industry and foundation of the economy today because of that. then farmers need a way to increase productivity.

3. Thirty years from now, there will be more people to feed and today amount of fertile soil is limited, as well as the number of people who are attended for agriculture is less than before. Then Agriculture will need to move out from old-style agricultural methods. Then agriculture moves to implement and test many novel ideas. Then will need to find various ways to help farmers minimize their risks, or at least make them more manageable. Implementing artificial intelligence in agriculture on a global scale is one of the best options to make agriculture advantageous.

4. AI can potentially change the way of agriculture, enabling farmers to achieve more results with less effort while bringing many other benefits. when considering the field of agriculture, we have to consider some important facts that reducing crops and needs that want to farm. they can mention as climatic factors such as rainfall, temperature, and humidity changes happen due to increasing deforestation and pollution and it causes difficulty for farmers to take decisions to prepare the soil, sow seeds, and harvest.

5. Crop requires precise nutrition in the soil such as nitrogen, phosphorous, and potassium. these nutrition deficiencies can lead to poor quality of crops. This also a fact that farmer should consider. While considering these challenges, farmers search modern technologies to solve this. Then Agriculture now turns into using Artificial Intelligence technologies to help yield healthier crops, control pests, monitor soil, and growing conditions, organize data for farmers, help with the workload, and improve a wide range of agriculture-related tasks in the entire food supply. Then field of agriculture in today use many Artificial Intelligent applications while making crops.

Fig 2.1-Robot with Watering Plant

CHAPTER TWO

AI APPLICATIONS USE IN MODERN AGRICULTURE

6. While the field of Agriculture change from traditional agriculture to modern agriculture artificial intelligence technology take priority. Artificial Intelligence can provide farmers with real-time insights into their fields, allowing them to identify areas that need irrigation, fertilization, or pesticide treatment, and also innovative farming practices like vertical agriculture may help increase food production while minimizing the use of resources. Then in today, Artificial Intelligent provides many applications to achieve this as mentioned

a. Agricultural Robot.

b. Soil Health Monitoring.

c. Intelligent Spraying crop Monitoring.

d. Artificial Intelligence use in harvesting paddy.

AGRICULTURAL ROBOTS

7. Companies are developing and programming autonomous robots to handle essential agricultural task such as harvesting crops at a higher volume and faster. This type of robot is trained to control weeds and harvest crops faster than compared to humans. These robots are trained to check the quality of crops and detect weeds with picking and packing of crops at the same time. These robots are also capable of fighting challenges faced by agricultural force labor. Then it helps to increase the agricultural products. These robots have the capability to analyze, contemplate, and carry out a multitude of functions, and they can be programmed to grow and evolve to match the requirements of various tasks. Agri robots are used in many fields of agriculture such as weed control and crop harvesting.

Crop Harvesting Using Robots

8. When using Robots for harvesting varies crops provides various benefits to farmer. The lack of labor interacts reduce the cost and enhance the efficiency. As example in California farming between 10,000 and 11,000 acres of strawberries are typically harvested in a season. It is not an easy task to harvest and farm this much. For this developed a robot to help strawberry farmers pick and pack their crops. Then it helps to farmers for avoid millions of dollars of revenue loss due to Lack of laborers. There are many crop harvesting robots. As an example, pepper picking robot sweeper, ArgoBot is another testing machine that pick strawberries and green cotton robot is a robot which use for harvesting cotton.

9. Sweeper is an autonomous robot used in greenhouses for picking up ripe peppers. Using LED lights and a camera that can recognize color and distance with the help of computer vision, sweeper decides if the pepper is ripe. It has a mobile platform with a robotic arm holding an end effector for fruit harvesting. The robotic arm with the end effecter scans the crop for mature peppers. In here camera is independent of surrounding light conditions. It gives color images and distance maps and this information is used for pepper detection localization and maturity classification.

10. The arm moves upwards by observing the bottom part of pepper maturity can easily detect maturity. A robot is programmed to find obstacles like leaves and stems. After detection performs path planning for the robot arm. It is a complex trajectory since the space in which the robot arm may move is very limited.it employs visual servo control to reach the peduncle of the peppers on target and for this, it takes images on several sides. Then uses a razor to cut off peduncle just above pepper.

11. It takes 24 seconds to pick a single pepper. But it can only work 20 hours per day. The robot is 61% accurate in picking ripe fruit. It helps with labor shortage and reduce food spoilage. This will contribute to salt today's major grower issues such as labor cost and availability, food safety and quality.

Fig 2.2- Crop Health Monitoring Robot

Weed Control Robots

12. Weeds are unwanted plants that interfere with the use of land and water resources and therefore have an adverse effect on agriculture. Weeds compete in croplands with the beneficial and desired vegetation and pose a major problem. The losses caused by weeds are greater than the losses caused by any other agricultural pest category. Weeds account for 45% of the total annual loss in agricultural production, insect 30%, disease 20%, and other pests 5%. Then farmers move to new technology. There many examples to weed control machines such as blue spray technology.

13. Using computer vision and artificial intelligence, these smart machines can detect, identify, and make management decisions about plants in the field. The machines see every plant and determine the appropriate treatment for each. The machine can distinguish subtle differences between plants and weeds of many species and sizes. The robot's nozzles target unwanted weeds in real-time as the machine passes. It applies herbicide only to weeds, avoiding application on crops or areas without weeds. The machine then assesses the applied herbicide, makes adjustments, and learns as it goes.

14. The best machine to do this is blue spray technology. See and spray select users advanced camera and nozzle control technology to differentiate color on follow ground detecting weeds and spot spray length of spot spray zone. These lands must can be small median or large and can be vary based on ground speed and spray pressure. In here weeds detect automatically as 3D image and then turn nozzle on and off for desired spray lane to hit just the weed. But since see and spray only hits weed not entire field, it uses 77% less herbicide than broadcast spray. Best of all you can track and access your application data for display and since sprayer is connected machine can monitor performance and can make decisions any time. This is a good method to control weed and increase the agricultural products of farmers.

SOIL HEALTH MONITORING

15. The type of soil and nutrition of soil plays an important factor in the type of crop which is grown and the quality of the crop. Due to surge of deforestation and world population soil quality is degrading and it is hard to determine the quality of the soil. Due to that agriculturist developed an AI-based application called Plantix can identify the nutrient deficiencies in soil including plant pests and diseases by which farmers can also get an idea to use fertilizer which helps to improve harvest quality. Even though soil moisture is quite small in amount in a specific region, it significantly affects all kinds of hydrological, biological, and biogeochemical processes; and weather patterns, runoffs, and erosion and thermal exchange models of land surface and atmosphere.

16. 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, and AI-enabled technologies forecast weather conditions, analyze 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.

17. Specialized drones can be used to this. The airborne multispectral and infrared images of an agricultural field are obtained with a UAV system. In order to make the multispectral and infrared sensors to obtain the images of the same location at the both sensors are equipped on the UAV simultaneously. It has a system for the data collection that consists of the commercial products to show that the proposed soil moisture retrieval model can operate with the remote sensing and which can be easily constructed. The maximum takeoff of these is 2500 m from sea level and its maximum speed is 21.9 m/s. The weight of this UAV is 2845 g and its maximum takeoff weight is 3500 g.

18. The maximum flight time is about 1080 s. The IR sensor, and image sensor which is used captures the images of five different wavelengths which are near-IR, red edge, red, green, and blue at the same time. This handheld soil moisture sensor system measures the moisture content level at a single point by driving the two 51 mm stainless steel rods of SM200 into the point as deep as possible and connecting power to the sensor. The soil moisture level is displayed on the screen. The ground truth soil moisture data for are acquired in %Vol unit. Using these pictures taken by drone and soil moisture sensor which use to know contain of soil farmer can detect the soil contains.

INTELLIGENT SPRAYING AND CROP MONITORING

19. Drones are a major method used in intelligent spraying and to crop monitoring. These drones have been utilized as substance sprayers by farmers for numerous years and they are considered effective and of great importance in situations of cloudy climate. Additionally, they are accepted to have a solid favorable position contrasted with satellite airborne sensors to detect pictures of plantation to spray with a microcomputer-based sprayer control framework and to detect crop monitoring.

Intelligent Spraying Using Drones

20. These intelligent AI sprayers can drastically reduce the number of chemicals used in the fields and thus improve the quality of agricultural produce, and bring in cost efficiency.AI sensors can detect the weed-affected areas and can precisely spray herbicides in the right region reducing the usage of herbicides. For this AI technology-based drones can be used. Then farmer can give a specified location and then can be spread automatically. These are mostly used in Tea cultivation. As examples for these spraying drones Agras T16 and Agras T30 can be mention.

21. These drones are designed from the ground up it features six rotors and RTK dual redundancy system and avionic resin sea system and it was payload up to 16 liters spray of up to 4.8 per minute. Main structure consists of DBF imaging Radar, core module IP67 rating, FPV camera and AI engine. Each sprinklers work flawlessly with the downward airflow resulting in an impressive spraying effect it and have 6.5 meters width spraying effect and can cover 10 hectares per hour. These spraying drones can be categorized as Hydraulic energy sprayer, Centrifugal energy sprayer, Gaseous energy sprayer, kinetic energy sprayer according functions it performed and methods used to implement.

22. In Hydraulic Energy Sprayer, the material to be sprayed is pressurized up to 40–1000 psi in any of the two possible ways. Either straightforwardly by utilizing a positive uprooting siphon or by utilizing a vacuum apparatus which will make the gaseous tension over the shower material noticeable all around the tight holder and In Gaseous Energy Sprayer a blower produces a high-speed air stream. This airstream is coordinated through the pipe toward the finish of which spray liquid will be available which will be permitted to be streamed by the activity of gravity through a diffuser plate. In Kinetic Energy Sprayer the spray liquid streams by gravity to a vibrating or swaying spout which delivers a coarse fan-like spray design.

23. This is explicitly utilized for the spraying of herbicides. The Centrifugal Energy Sprayer consists of a fast-turning device, a concave or a convex plate, a wire mesh cage or a bucket, a puncture strainer or chamber, or a brush. At the focal point of this gadget, the shower liquid is nourished under low weight which is additionally atomized by diffusive power as it leaves the outskirts of the atomizer.

24. The multi-aircraft control mode functions with the FPV camera as well as an HD video transmission system with a range of up 3 kilometers ensuring flight safety and boosting spraying efficiency thanks to the all-new modular design of the 16 both the spray tank and batteries are easily swappable which significantly improves operational efficiency. Its core module has a rating of ip67 making it easy for maintenance the foldable aircraft arms are convenient for storage and transportation. When flying in complex farmland environments the onboard DBF imaging radar empowers the aircraft to fly over varying terrain intelligently. When encountering an obstacle, It detects the obstacle's orientation and the distance to it automatically planning a flight path to circumvent the obstacle.

25. Pilots can view the live video feed and adjusted route on their display monitor after circumventing the obstacle it will automatically resume spraying. also generate 3d flight paths for more efficient planning with the help of the RTK centimeter-level positioning system and it is capable of flying precisely along flight paths while accurately adjusting its spray rate according to tree distribution reducing the pesticide dosage. It delivers more effective, reliable and intelligent solutions pushing the boundaries of crop protection it lifts agricultural efficiency to new highs opening more possibilities for the future of agriculture.

Fig 2.3-Intelligent Spraying and pet detection

Crop Monitoring Using Drones

26. The advanced sensors and imaging capabilities have provided the farmers with many new ways to increase yield and reduce crop damage. New sensors mounted on drones, with high-tech cameras being the eyes of the client on the ground and optimal procedures for a survey, data acquisition, and analysis are continuously developed and tested. Satellites have been used for a decade to inspect large croplands and forestry but a new level of precision and flexibility has been obtained with the use of drones. To carry out drones' flights, one does not need to depend on the position of the satellite or having the correct weather conditions and as drone pictures are taken 400–500 ft. from the ground level, they result in better quality and provide precision. Using this farmer can be evaluated using Digital Photography from Model Aircraft for Remote Sensing of Crop Biomass and Nitrogen Status.

27. The drones are equipped with GPS systems and cameras that allow them to fly over every part of the field that needs to be inspected and take images. In here use SkySqurrel Technologies drone-based Ariel imaging solutions. These drones use multispectral imaging cameras which are used in the military to detect land mines. So once the crops have been planted and started to grow, farmers implement this technology and give a certain flight path based on the area they want to survey. After collecting images from fields, drones transmit data via an internet connection or automatically store data and deliver it to farmers in the case of poor connectivity with crop analysis software. Once data has been uploaded, the crop scout software can analyze drone imagery according to a wide range of parameters including crop variety, yield, type of pesticide or herbicide, etc. The farm crop monitoring software conducts a thorough assessment based on trial data and matches drone photos with additional satellite images.

28. Finally, the crop inventory solution saves the assessment in an appropriate format, overlays it on the field map as an additional layer, and uploads results to another Ag crop scouting app with a huge database to compare results and predict growth. If you have an irrigation or fertigation system you will know just how tedious it can be to check all points are working and free from obstruction. Drones give you quick access to sprinklers and nozzles and allow you to check them effectively without the need to physically trudge around the fields. They also work well when crops grow and bury the once easily accessible points. Some drones even have thermal imaging cameras so simply running through water at temperature will allow you to check that the outlets are all working as intended. Drone images can be used to identify the biggest enemy of farmers, insects and then farmer can take action for that.

ARTIFICIAL INTELLIGENT USE IN PADDY

29. When we consider harvesting paddy lot of AI-based technologies are used in irrigation agriculture in Australia. In the beginning, while making ground they use laser levels with the padlocks pulling to create and fertilizer to ground. Here AI-based technology is used. Then a plane is used to saw rice seeds. It uses satellite guide technology to spread seeds uniformly through the field. AI-based system moisture container is used to check the moisture of paddy and lastly a combined harvester machine is used which develops with AI technology to harvest the paddy. Now we shall discuss them separately as follows.

Preparing the Field

30. Preparing field is the basic step of preparing rice and it is a most important step. When preparing field, it takes long time to level and prepare it correctly but when AI embedded machines are used to prepare this it takes less time. Therefore, farmers use AI based system laser levelling and padlock machine to prepare fields. In previously it was done by two-wheel hand tractors and leveling boats across flooded field to level land. It is not an ideal way to level and preparing land and then farmers go with this machine.

31. In here laser transmitter placed at side of the field sends laser beam to a laser receiver which is attached to a leveling bucket drown by tractor the control panel or box mounted on tractor interprets signal from the receiver and opens and closes the hydraulic valve which raises or lovers the bucket. The bucket then drags and drops soil across the field to make it even. The laser receivers signal the adjustment of the leveling bucket accordingly to ensure height distance between the soil and laser signal stays the same for making soil leveled as possible.

32. This can be done in dry field then it serves most valuable thing in paddy, water and there is another advantage of this is farmer can level the field during dry season and then while raining farmers can be sowing the rice seeds. While we use properly leveled field then we can reduce the cost of water pumping and cost of weed control. This machine can use to prepare 1 hectare (2.5 acre) land withing one day.

33. After preparing land next step is sowing the rise seed. Many farmers who are using plane to sow their rice seeds in to fields. In here use satellite guidance technology to spread seeds evenly across the field. This is also an application of Artificial Intelligence.

Harvesting Paddy

34. Before harvesting the paddy farmers must know moisture contain of the grains. For this AI embedded moisture meter is used. Then it displays the moisture content of that seed and ready to harvest or not. Most probably it displays ready or not using moisture content above and below 22%. If moisture content below 22% then machine display it is not ready to harvest. While it ready to harvest then use combine reaper to harvest the paddy.

35. These combined harvesters are made up of about 21 parts including the header, reel, cutter bar, sieves, rotating blades, grain tank, unloading pipe, augers, conveyors, belts, layers, wheels, and various sensors such as grain flow sensor (determines grain volume), grain moisture content sensor (remunerates for grain moisture), GPS antenna (satellite signal), Yield screen show with a GPS receiver (geo-reference and records information), header position sensor(distinguishes estimations logged during turns), travel speed sensor (determines the separation the join goes during a specific logging interim).

36. These crops are only partly edible. The inedible parts along with their stalks need to be eliminated. Earlier, the farmers' main tool was their hands, but now separating the edible from the inedible grains and clean the grains by this machine while harvesting. The header at the front of the machine gathers the cereal crops which are then pushed towards the cutter bar via the pick-up reel. The crops are then cut down by the cutter bar and are then gathered by the revolving reel. Going through the conveyor to the threshing area, the cut crops are shaken and broken until the grains are separated from the stalks. The grains and the stalks have distinct futures and are meant to go their separate ways whereby the grains are collected in a collecting tank and while the tank is filled it is automatically transferred to another truck.

37. It happens due to the sensors used in this machine. The stalks along with the other unwanted stuff are passed towards the back of the machine which waits to be later thrown away onto a wide area or the ground they were harvested from. Here we have to use the agro pilot system to do the harvest. In this machine high-resolution color camera is protected from dust and vibration and a computer system with a powerful microprocessor, advanced AI algorithms CAN interface, and android base touch screen display. Using these machines detect other machines, all obstacles and it stops in front of any obstacle. And also Build trajectory and adjust harvesting speed automatically. Then it acts as Intelligent Robot.

38. A machine such as a combine harvester reduces the number of people employed in harvesting, thereby reducing manpower, time, and effort taken which consequently increases the overall productivity and also Wide patches of crops can be harvested with ease and in a more efficient manner which in turn profits the farmers owing to its ability in getting better grain yields. Using this machine farmers can be harvesting the paddy two-acre within an hour. Then farmers can secure the time.

Fig 2.4.1- Paddy Sowing AI machine

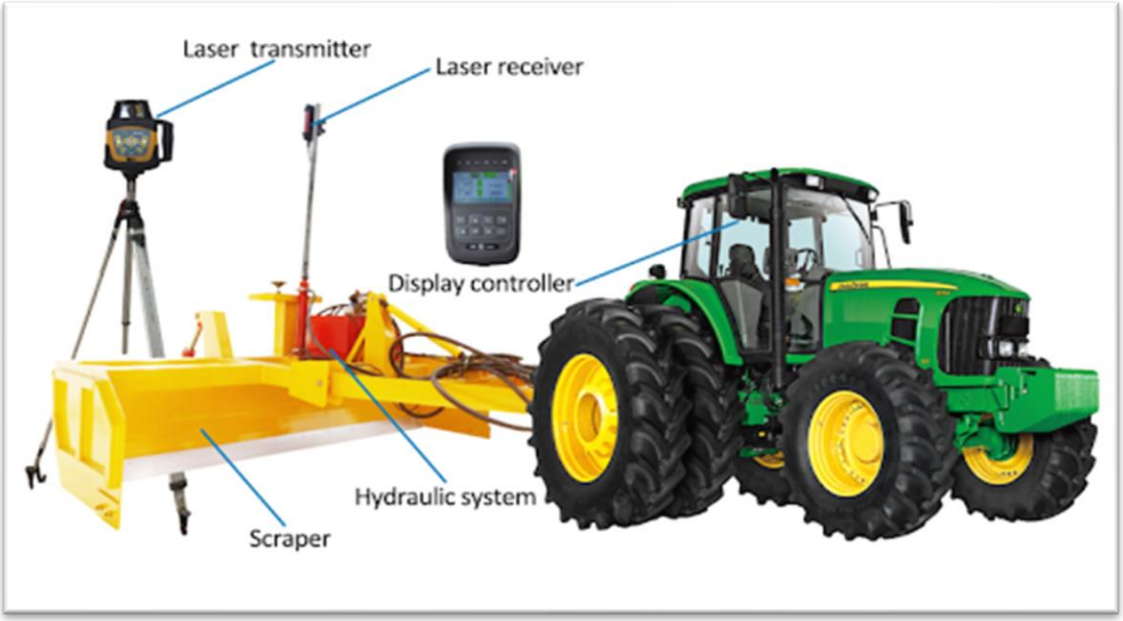

Fig 2.4.2-Laser Leveling System

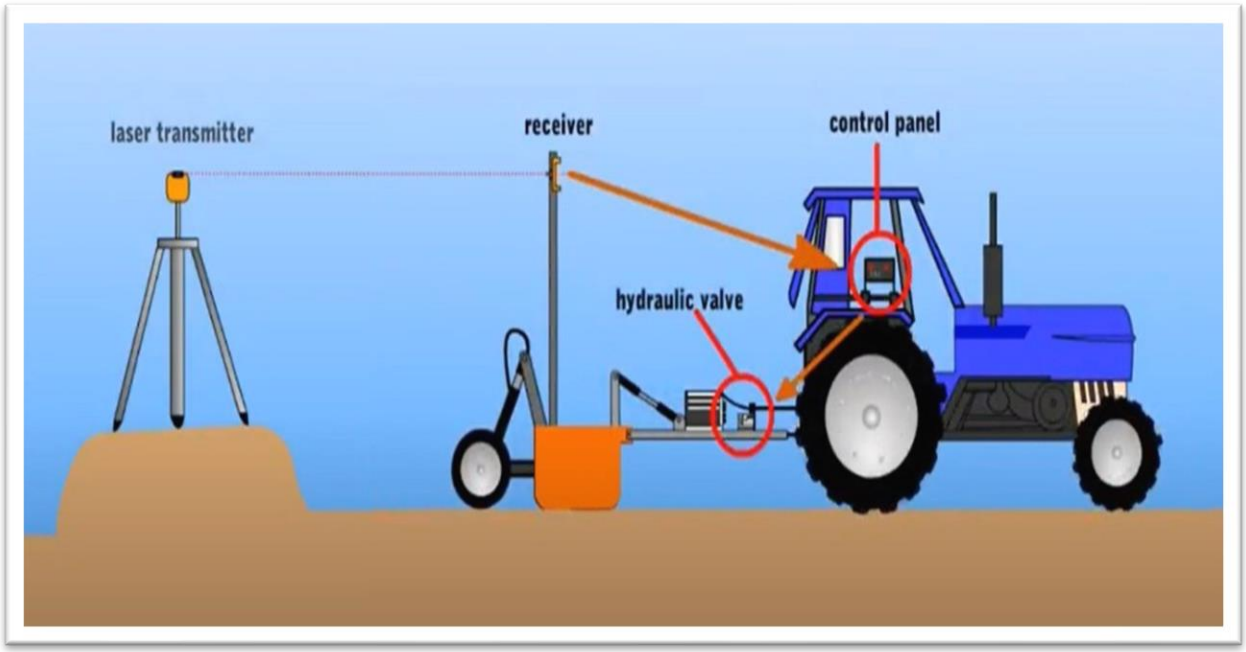

Fig 2.4.3-Laser Leveling System Side View

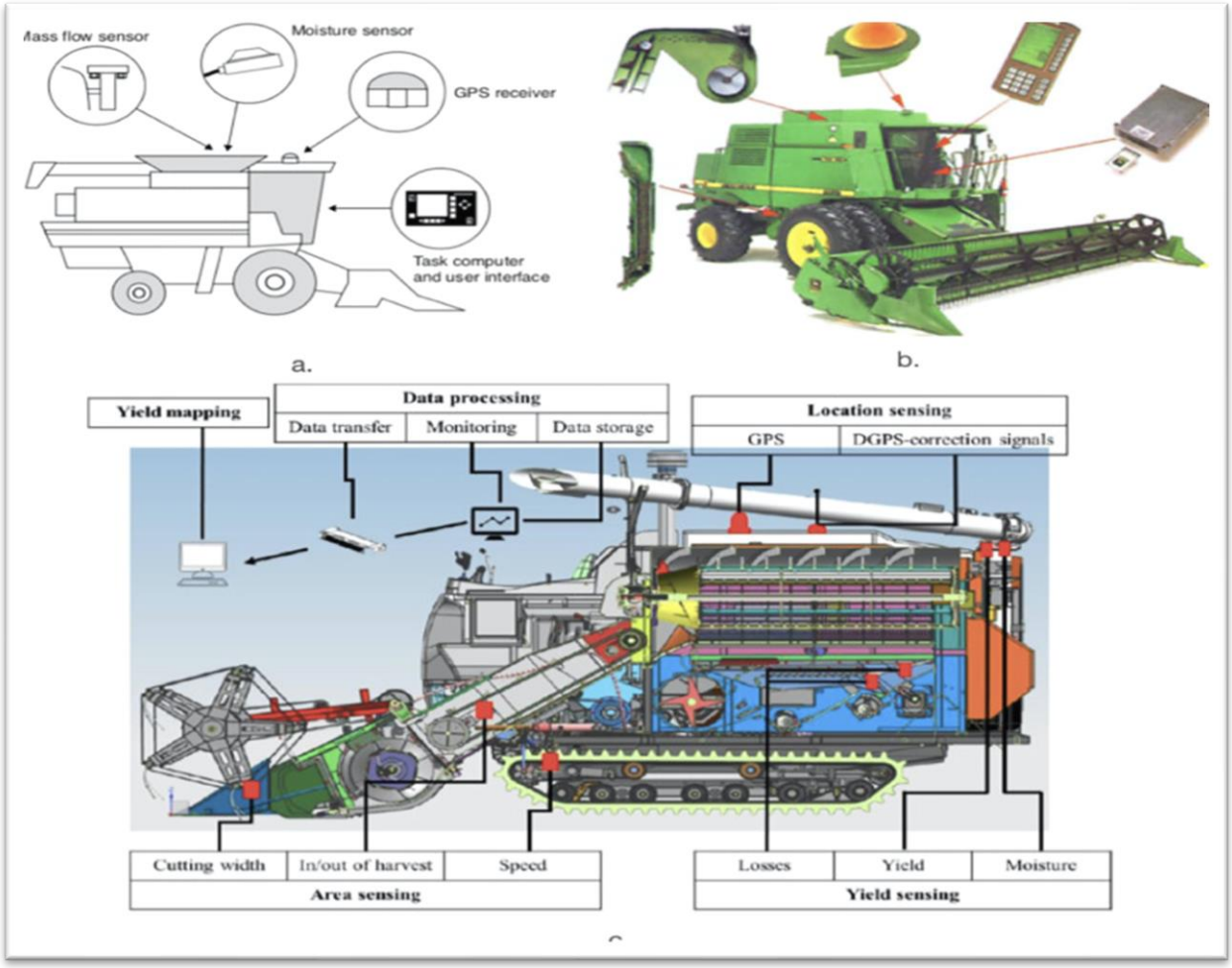

Fig-2.4.4-Combined Harvester

CHAPTER THREE

ADVANTAGES OF USING AI-APLICATIONS IN AGRICULTURE

ANALYZING MARKET DEMAND

39. AI can simplify crop selection and help farmers identify what products will be most profitable. Then farmers can identify what product must want to farm. If it is not then while they farm in large amount, they can't sell them in market. Then they not get any profit.

MANAGING RISK & BREEDING SEEDS

40. Farmers can use forecasting and predictive analytics to reduce errors in business processes and minimize the risk of crop failures. Predictive analytics can be a real game-changer. Farmers can collect and process significantly more data and do it faster with AI than they would otherwise. Analyzing market demand, forecasting prices, and determining the optimal time for sowing and harvesting are key challenges farmers can solve with AI. By collecting data on plant growth, AI can help produce crops that are less prone to disease and better adapted to weather conditions.

MONITORING SOIL HEALTH

41. AI systems can conduct chemical soil analyses and provide accurate estimates of missing nutrients. AI can also gather soil health insights, provide fertilizer recommendations, monitor the weather, and track the readiness of produce. All of that enables farmers to make better decisions at every stage of the crop cultivation process. Then farmer can add fertilizers, water extra and then plant grow well.

PROTECTING CROPS & FEEDING CROPS

42. AI can monitor the state of plants to spot and even predict diseases, identify and remove weeds, and recommend effective treatment of pests. AI is useful for identifying ideal irrigation patterns and nutrient application times and predicting the optimal mix of agronomic products. These identifications are important to protecting and feeding crops. It increases the products.

TIME WASTAGE IS MINIMUM

43. With the help of AI technology, it is possible to automate harvesting and even predict the best time for it. While harvesting and crop planting both done with AI based machines it can be done in quickly and easy. As example combine harvester take only two hours to harvest three-acre paddy. When we use labors to this it takes more than 3 days. This example proves that when we using these kinds of machines help farmer to do their work easy and with minimum time interval.

CHAPTER FOUR

AI-APPLICATIONS IN SRI LANKA

44. In our country main role played by agricultural sector. But still methods use in Sri Lanka is traditional. Compared with the rest of the world, Sri Lanka is far behind in using data science in agriculture. Speaking about the future, Agriculture depends a lot on many hardware solutions. Enabling software solutions such as AI requires that we already set up the necessary hardware solutions. Countries such as India are far ahead of us. They already use AI in fertilizer application, decrease recognition, and identifying deficiencies. Now a days our country also needs for change traditional agriculture to new technologies. But there are many problems and challenges when achieve this level. But every problem has a solution, like that these problems also have solutions.

PROBLEMS AND CHALLENGES

Expensive machines and maintenance

45. The food systems of Sri Lanka require transformation. Emerging technological innovations have the potential to overcome the structural weaknesses of current agricultural systems and deliver a more productive, competitive, and sustainable outcome, using a more precise and resource-efficient approach. as In Sri Lankan farmers are low-income people. They do their cultivation method of debt settlement. If they cultivate a one season then they have to take debt to farm next season. The expectations are high that smart farming will not only optimize the production output and focus on preservation of scarce resources, but it will also address issues of climate change, labor scarcity, and post-harvest losses that affect the whole value chain, from planting to harvesting and distribution, while eliminating hunger.as the scenario goes like this farmers are reluctant to invest in new technology so because type of conditions farmers does not move to new technology and tend to stick with they are old ways and means.

46. Hence Sri Lanka is a solitary island importing required parts and other machinery equipment requires a huge cost which the majority of the poor farmers can't handle as they struggle for their own day to day meals and even to barely maintain the required needs of the machines. Under these kinds of circumstances updating the technology according to the new world has become a dream to our farmers. Sri Lankans acquire the tech ages after the rest of the world start using it. Though it is sad we should face the bitter truth that the uplifting of the agricultural sector of Sri Lanka is on the low run because of the poor economic status of the country.

Minimum Government Support

47. More research and development need to be carried out to improve the use of modern technologies in the agriculture sector. Both government and private sector involvement in technology R&D should be strengthened through collaboration with local universities and research organizations as well as foreign institutions.

48. Lower resource endowments of smallholder farmers, such as lack of capital and other resources, and poor access to markets and institutions, including extension services, may affect and put them at a disadvantage in reaping the benefits associated with technological innovations in agriculture. Thus, the government must implement a different approach for such farmers in facilitating this transformation. Government support is critical to reduce the costs of technology by using different management and incentive schemes, such as shared platforms, financing schemes, and subsidized services. Farmer participation in technology usage can also be strengthened through contract farming systems.

49. Every day Sri Lankans are coming up with new ideas but the lack of the government support drags then to the dirt. Though the people have new ideas of innovation they can't make it a reality because of the lack of support in the system of Sri Lanka. If we are to expect greater outcomes or to move forward with the new technology the system must be changed and the government must be involved more and support more.

The Lengthy Technology Adoption Process.

50. Farmers need to understand that AI is only an advanced part of simpler technologies for processing, gathering, and monitoring field data. Farmers tend to perceive AI as something that applies only to the digital world. They might not see how it can help them work the physical land. This is not because they're conservative or wary of the unknown. Their resistance is caused by a lack of understanding of the practical application of AI tools. New technologies often seem confusing and unreasonably expensive because Aggrotech providers fail to clearly explain why their solutions are useful and how exactly they should be implemented. This is what happens with artificial intelligence in agriculture. Although AI can be useful, there's still a lot of work to be done by technology providers to help farmers implement it the right way. Even the world is at this stage Sri Lanka still struggles with introducing AI to the local farmers

Lack of Experience with Emerging Technologies

51. This fact is obvious as Sri Lanka is always behind the new technology run. Some regions could profit from artificial intelligence agriculture, but it may be hard to sell such technology in areas where agricultural technology is not common. Farmers will most likely need help adopting it. It wants experience. The agricultural sector in developing countries is different from the agricultural sector in Western Europe and the US. Some regions could benefit from artificial intelligence agriculture, but it may be hard to sell such technology in areas where agricultural technology is not common. Farmers will most likely need help adopting it. Even the geographical location of Sri Lanka avoids us from acquiring the new technology.

AI Should Be Combined with Other Technologies

52. AI can't exist without other technologies already in place such as big data, sensors, and software. Likewise, the farmers should have knowledge of them and they should be well aware of the use of them. Agriculture has constantly improved with the introduction of various technologies, from motorized equipment to biotechnology. Following business trends, the agricultural industry is looking to maximize efficiency by turning to AI technologies. AI technology has been implemented to help yield healthier crops, reduce workloads, organize data and improve a wide range of tasks in this industry.

53. From the Al point of view, Agriculture offers a vast application area for all kinds of Al core technologies: Mobile, autonomous agents operating in uncontrolled environments, stand-alone or in collaborative settings, allow to investigate, test and exploit technologies from robotics, computer vision, sensing, and environment interaction. Integrating multiple partners and their heterogeneous information sources leads to application of semantic technologies. The complexity of the agricultural production asks for progress in modeling capabilities, handling of uncertainty, and in the algorithmic and usability aspects of location- and context-specific decision support. Though the aid of technology means a lot it comes with some major challenges too.

54. The growing interest in reliable predictions as a basis for planning and control of agricultural activities requires the interdisciplinary cooperation with domain experts for an example from agricultural research. Modern agricultural machines shall use self-confidence components and shall be able to collaborate and exhibit aspects of self-organization and swarm intelligence.

55. If we consider a simple circuit, it is compact with thousands of sensors and one malfunction may lead into the destruction of a whole harvest and the signal issues regarding the GPS system may lead into some frustrations too. Not only that the complex programming used in all the digital machinery may go south suddenly, the chances of this happening might be very low but never zero. And updating the newest updates of the programming might also to troublesome time for the farmers.

Market is Not Stable

56. In our country there is no demand for supply. Then farmers are face many problems while they not having stable market. It is also another problem that farmers not go with technology. If farmer using technologies, then produce large number of products. It may be ten times before. But in Sri Lankan market is not enough for sell them. If there is a market but price of the product also varies. Then farmer cannot adjust the cultivation for stable value.

Fig-4.1-Soil Moisture Monitoring AI Machine

OVERCOME METHODS

57. One company can purchase the required equipment's and they can lend them to farmers. This will be a win -win for both investors and the farmers as the company can gain profit while the farmers get the machinery at a reasonable price and they want to have purchase it for a huge price.

58. The government can pass loan schemes to the farmers.so they would have capital to invest in the necessary machinery. The loan should be specialized in to machinery and the total value must be divided in to small payments, so it is easy to farmers to cooperated with the payments.

59. Also, the government can lover the tax regarding technological machinery for agriculture. This will encourage the farmers to import new technology as it will cost much as it did before but will surely make their work easy.

60. A system must be provided to train technicians and mechanics for every segment in agriculture.so they will be able to deal with malfunctioning machinery and the farmers will tend to use more technologies as they know if something goes wrong, her are people to fix it. Also, knowledge must be given farmers on how to use AI and machinery for uplifting their harvest and should teach them about benefit of using AI and the newest technology for their own good.

61. The government, the agriculture sector company and resource personal like university students, technical expert can take part in spreading knowledge among farmers.it is obvious that young farmers will understand the new technology easily but it would be hard for old ones.so we can use second hand experience to make them aware of the new technology.

62. Also, government can encourage new inventors to make new investment, it will lead farmers to acquire equipment with low product costs and high availability. Also, investors can be encouraged by organizing completions with cash prizes which will lead the sector to an innovative new phase.

63. There should be a stable market is another solution. For this, farmers who chosen new technology must want to combining with various factories such as nature secret involving government farmers got new market for their products. Then they attend to use new technologies. Like this type of company involved we can attend to foreign market also. If farmers got that kind of stable market, they attend to use these.

CHAPTER FIVE

CONCLUSION

64. The future will provide more useful applications to this sector helping the world deal with food production issues for the growing population. The Artificial Intelligence will improve the yield. The agronomists who interpret the maps generated by the data can provide recommendations to improve crop harvest. Using the data captured by AI-equipped drones and examined by collaborative software, farm owners are able to monitor crop growth and crop health and evaluate the condition of the soil. In turn, this information enables them to make decisions about managing weeds, diseases, and pests, as well as the amount of fertilizer and pesticides to apply to crops.

65. Then can be concluded that Artificial Intelligence Applications which are used in the field of Agriculture are providing many aids and advantages for farmers to achieve their targets in many ways with less time and humans. And also, if Sri Lanka government involved to establish the new technologies in agricultural sector, then Sri Lanka can achieve many goals and economy rate is rising up.

66. Companies involved in improving Artificial Intelligent based products or services like training data for agriculture, drone and automated machine making will get technological advancement in the future will provide more valuable applications to this sector helping the world deal with food production issues for the upcoming population. If the Sri Lankan government involve in establishing the new technologies in agricultural sector, then Sri Lanka can achieve many goals and economy rate would rise up.

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