DESIGN AND FABRICATION OF AGROBOT

A project report submitted in partial fulfilment of the requirement for the award of the degree of

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in

MECHANICAL ENGINEERING

by

M. Pavan Kumar (317126520095)

G. Sri Sai (317126520079)

K. Krishna Karthik (317126520089)

K. Anuraag (317126520090)

K. Appala Naidu (317126520084)

Under the esteemed guidance of

Dr. M. Vinod Babu

Asst. Professor

DEPARTMENT OF MECHANICAL ENGINEERING

ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY & SCIENCES (A)

(Affiliated to Andhra University, Accredited By NBA and NAAC with 'A' Grade)

SANGIVALASA, VISAKHAPATNAM (District) – 531162

ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY & SCIENCES (A)

(Affiliated to Andhra University, Approved by AICTE, Accredited by NBA & NAAC with A grade)
SANGIVALASA, VISAKHAPATNAM (District) – 531162

PRAGNANAM BRAHMA
ANITS

CERTIFICATE

This is to certify that the Project Report entitled **"DESIGN AND FABRICATION OF AGROBOT"** being submitted by MADAKA PAVAN KUMAR (317126520095), GANDU SRISAI (317126520079), KONDURI KRISHNA KARTHIK (317126520089), KORCHIPATI ANURAAG (317126520090), KALLEPALLI P C V APPALA NAIDU (317126520084) in partial fulfillments for the award of degree of **BACHELOR OF TECHNOLOGY** in **MECHANICAL ENGINEERING**. It is the work of bona-fide, carried out under the guidance and supervision of **MR.M.VINODH BABU**, Assistant Professor, Department Of Mechanical Engineering, ANITS during the academic year of 2017-2021.

PROJECT GUIDE

(MR.M.VINODH BABU)
Assistant Professor
Mechanical Engineering Department
ANITS, Visakhapatnam.

Approved By

HEAD OF THE DEPARTMENT

(Dr. B. Naga Raju)
Head of the Department
Mechanical Engineering Department
ANITS, Visakhapatnam.

PROFESSOR & HEAD
Department of Mechanical Engineering
ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY & SCIENCE
Sangivalasa-531 162 VISAKHAPATNAM Dist A P

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Mr. M. Pavan Kumar (317126520095)

Mr. G. Sri Sai (317126520079)

Mr. K. Krishna Karthik (317126520089)

Mr. K. Anuraag (317126520090)

Mr. K. Appala Naidu (317126520084)

ABSTRACT

The agricultural robot is used to reduce human efforts made by farmers during farming. There are many aspects to the future of this Agrobot. Agriculture is considered one of the most important economic activities in India. The bot uses various techniques that help us track the various activities involved in the farming process such as soil moisture level, soil type, different nutrient levels in the soil, suggestion of the crop to be cultivated. The multi functionality of the robot will also help the farmer use the same robot to extract weeds, maintain records on soil data, and make it available at any time as it will be stored in a cloud server. Farmers using bots will be easier to monitor the field.

In recent years, robotics in agriculture sector with its implementation based on precision agriculture concept is the newly emerging technology. The main reason behind automation of farming processes are saving the time and energy required for performing repetitive farming tasks and increasing the productivity of yield by treating every crop individually using precision farming concept. Designing of such robots is modeled based on particular approach and certain considerations of agriculture environment in which it is going to work.

These considerations and different approaches are discussed in this project. Also, prototype of an Agriculture Robot is presented which is specifically designed for seed sowing task only. It is a four wheeled vehicle which is controlled by switching. Its working is based on the precision agriculture which enables efficient seed sowing at optimal depth and at optimal distances between crops and their rows, specific for each crop type.

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CHAPTER 1

INTRODUCTION

In the current generation most of the countries do not have sufficient skilled man power specifically in agricultural sector and it affects the growth of developing countries. So it's a time to automate the sector to overcome this problem. In India there are 70% people dependent on agriculture. So we need to study agriculture. Innovative idea of our project is to automate the process of ploughing and sowing seeding such as sunflower, corn, groundnut and vegetables like beans, lady's finger, pumpkin and seed of wheat etc.

The farmers are involved in agriculture practices, but proper automation in agriculture makes farmer work ease. There are various equipments that are moisture sensor, ph sensor and soil temperature sensor are implemented with automatic seed sowing machine. This machine helps a farmer in automatic seed sowing which reduces labor work.

Agricultural Robots or Agrobot is a robot deployed for doing agricultural purposes. Pollution is also a big problem. Which is eliminated by using solar panel. The energy needed for robotic machine is less as compared with other machines like tractors or any agriculture tools; also this energy is getting from the solar energy which is found abundantly in nature.

Nowadays robotics technology plays a paramount role in all Sections like medical field, industries and various organizations. In other countries robots are used to perform different operations in the agricultural field. The main application area of robots in agriculture is at the harvesting stage and Seed Sowing Stage. Driverless robots are designed to replace human labor. The Agrobot developed in this project performs ploughing, seed sowing and covering seeds simultaneously and powered by solar panel with a control by wiring. Every movement is controlled by DPDT switches connection.

1.1 Main Features of Indian Agriculture

- **Source of livelihood:**

  Agriculture is the main occupation. It provides employment to nearly 61% persons of total population. It contributes 25% to national income.

- **Dependence on monsoon:**

  Agriculture in India mainly depends on monsoon. If monsoon is good, the production will be more and if monsoon is less than average then the crops fail. As irrigation facilities are quite inadequate, the agriculture depends on monsoon.

- **Labour intensive cultivation:**

  Due to increase in population the pressure on land holding increased. Land holdings get fragmented and subdivided and become uneconomical. Machinery and equipment cannot be used on such farms.

- **Under employment:**

  Due to inadequate irrigation facilities and uncertain rainfall, the production of agriculture is less; farmers find work a few months in the year. Their capacity of work cannot be properly utilized. In agriculture there is under employment as well as disguised unemployment.

- **Small size of holdings :**

  Due to large scale sub-division and fragmentation of holdings, land holding size is quite small. Average size of land holding was 2 to 3 hectares in India while in Australia it was 1993 hectares and in USA it was 158 hectares.

- **Traditional methods of production :**

  In India methods of production of crops along with equipment are traditional. It is due to poverty and illiteracy of people. Traditional technology is the main cause of low production.

- **Low Agricultural production:**

  In India methods of production of crops along with equipment are traditional. It is due to poverty and illiteracy of people. Traditional technology is the main cause of low production.

- **Dominance of food crops:**

  75% of the cultivated area is under food crops like Wheat, Rice and Bajra, while 25% of cultivated area is under commercial crops. This pattern is cause of backward agriculture.

1.2 Major Challenges Faced By Indian Agriculture

- **Stagnation in Production of Major Crops:**

  Production of some of the major staple food crops like rice and wheat has been stagnating for quite some time. This is a situation which is worrying our agricultural scientists, planners and policy makers. If this trend continues, there would be a huge gap between the demand of ever growing population and the production.

- **High cost of Farm Inputs:**

  Over the years rates of farm inputs have increased. Farm inputs include fertilizer, insecticide, pesticides, HYV seeds, farm labour cost etc. Such an increase puts low and medium land holding farmers at a disadvantage.

- **Soil Exhaustion:**

  Soil exhaustion means loss of nutrients in the soil from farming the same crop over and over again. This usually happens in the rain forest.

- **Depletion of Fresh Ground Water:**

  Most of the irrigation in dry areas of Punjab, Haryana and Western Uttar Pradesh was carried out by excessive use of ground water. Today fresh ground water situation in these states is alarming. In the coming few years if this type of farming practice continues, these states are going to face water famine.

- **Adverse impact of Global Climatic Change:**

  Among various challenges, global climatic change is the recent one. It is predicted that due to climate change, temperature would increase from 2°C to 3°C, there would be increase in sea level, more intense cyclones, unpredictable rainfall etc These changes would adversely affect the production of crops.

- **Impact of Globalization:**

  You can see the effect of globalization on the farm sector in India. All developing countries have been affected by it. The most evident effect is the squeeze on farmer‘s income and the threat to the viability of cultivation in India. This is due to the rising

input costs and falling output prices. This reflects the combination of reduced subsidy and protection to farmers.

- **Providing Food Security:**

  Before the introduction of green revolution in India, we were not self sufficient in terms of our food grain production. With the introduction of green revolution, production of food grains increased substantially and India became self sufficient. However, during the last one decade the total production has become stagnant. On the other hand we have added another 16 to 18 million populations over this period. Although India has become self sufficient in good it is yet to ensure food security which is dependent upon accessibility, affordability as well nutritional value of the food available. One of the biggest challenges facing India is Providing Food Security to its population.

- **Farmers Suicide:**

  Every suicide has a multiple of causes but when you have nearly 200,000 of them, it makes sense to seek broad common factors within that group. The suicides appear concentrated in regions of high commercialization of agriculture and very high peasant debt. Cash crop farmers seemed far more vulnerable to suicide than those growing food crops. Yet the basic underlying causes of the crisis remained untouched. Commercialization of the countryside along with massive decline in investment in agriculture was the beginning of the decline. Withdrawal of bank credit at a time of soaring input prices and the crash in farm incomes compounded the problems. Shifting of millions from food crop to cash crop cultivation had its own risks. Privatization of many resources has also compounded the problems. The devastation lies in the big 5 States of Maharashtra, Andhra Pradesh, Karnataka, Madhya Pradesh and Chhattisgarh. These states accounted for two-thirds of all farm suicides during 2003-08.Some of the major factors responsible are indebtedness, crop failure and deterioration in economic status. Decline in social position, exorbitant charges by local money lenders for the vulnerable farmers, chronic illness in the family, addiction etc. have made life of farmers difficult.

Crop	Production rank	Productivity rank
Paddy	2nd	30th
Wheat	2nd	22nd
Maize	7th	35th
Total cereals	3rd	36th
Groundnut	2nd	40th
Rapeseeds	3rd	28th
Pulses	1st	44th
Potato	4th	26th
Fruits	2nd (10 per cent share)	-
Vegetables	2nd (9 per cent share)	-

Table 1. 1: Global ranking of India in farm production and productivity

Average size of farm holdings gradually reduced from 2.58 ha to 1.57 ha. Small and marginal farmers have limited resources especially in rain-fed regions where only animal power is used resulting in low productivity. Though agricultural production is high, per hectare productivity is much lower than world average. There is an urgent need to increase productivity. The above table 1.1 shows the global ranking of India from farm production and productivity.

1.3 Problem Statement:

Agriculture is a very important sector in Indian economy. Most of the livelihood in India depends on agriculture. As the knowledge based farm labours are less, the requirement for them is high and their wages are increasing. Traditionally farming is done by human being with the help of bullock carts, tractors and tillers etc.

The main problem in agricultural field includes lack of labor availability, lack of knowledge regarding soil testing, increase in labor wages, wastage of seeds and more wastage in water. The idea of applying robotics technology in the field of agriculture is very new. In agriculture, the opportunity for robot-enhanced productivity is more and the robots are appearing on farms in various guises and in increasing numbers.

1.4 Problem Solution:

In recent years there are many agricultural robots which can perform only single or dual tasks. We are improving the robot by designing a agricultural robot for spraying water, seeding, mulching and cutting operation. More than 42% of the total population in the world has chosen agriculture as their primary occupation. In recent years, the development of autonomous vehicles in agriculture rational and adaptable vehicles.

In the field of agricultural autonomous vehicles, a concept is being developed to investigate if multiple small autonomous machines are more efficient than traditional large tractors and human force. These vehicles should be capable of working round the clock all year round, in most weather conditions and have the intelligence embedded within them to behave sensibly in a semi-natural environment over long periods of time, unattended, while carrying out the useful task. There are a number of field operations that can be executed by autonomous vehicles, giving more benefits than conventional machines.

1.5 Existing System:

Many agriculture operations are automated nowadays and many automatic machineries and robots available commercially. Some of the major operations in farming which are under research and automation are seeding, weeding and spraying processes. When it comes to designing a robot for automating these operations one has to decompose its idea into two considerations which are agriculture environment in which robot/system is going to work and precision requirement in the task over traditional methods. Based

on this for seeding process, considerations which are taken into account in terms of environment are robot must be able to move in straightway properly on bumpy roads of farm field, soil moisture content may affect the soil digging function, sensors to be selected for the system must be chosen by considering farming environmental effects on their working.

Apart from these three other requirements are in terms of accuracy required in the task and these are: digging depth, particular optimal distances between rows and plants for certain type of crop, rows to be sown at a time and accurate navigation in the field. Whereas the other processes like weeding, spraying and harvesting, for which functioning depends on seeding stage by knowing the exact location of crop and then making those operations on it accordingly. So the major stage of all subsequent operations is maintaining a precision in seed sowing process.

When considering the physical aspects of the vehicle or robotic system, farmer's present condition in particular area plays a major role in designing these aspects. Considering facts of farming industry of India, system to be developed must have advantage over traditional methods and tractors in terms of cost, speed, accuracy in operation for which it is designed, fuel consumption and physical energy required by human for it. By targeting these issues and consideration properly the end product will be real help for farmers.

Interface by using Arduino board and various types of sensors. Various aspects shows Agricultural robot serves better result than manual system. It is expected that recent trends in robots shall make it to be used in enhanced role in future. In agriculture, Agricultural robot can be experienced for several advancements. Implementation of Agricultural robot has significant saving in terms of time, efficiency and saving the wastage of resources and reduced utilization of manpower should pay the cost once the system is activated. The scope of the system, especially in metro cities, is located in places where people are unaware of farming. Agriculture is more valuable compared to

others fields for occupation. The utility of technology with agriculture consider for automation. The Farming System is a suitable system which aids to sure that it has wide scope for improvement, which in turn eases the agricultural system for the farmers and ultimately helps in effective crop productivity.

1.6 Limitations:

1. It costs a lot of money to make or buy robots.
2. They need maintenance to keep them running.
3. The farmers can lose their jobs.
4. The robots can change the culture / the emotional appeal of agriculture.
5. Energy cost and maintenance.
6. The high cost of research and development.
7. Lack of access to poor farmer.

CHAPTER-2

LITERATURE REVIEW

[1] Amritanshu Srivastava *et. al* (2014) worked together and published and research paper which deals with the robot which performs operation like soil, moisture testing, seeding, spraying pesticides, removes compost from the field and it also performs obstacles avoidance operation and metal detection in the path. The robot is controlled using cell phone using DTMF technique. Because of using DTMF technique it overcomes the range or distance problem of using Bluetooth or RF module which having limited working range.

[2] Gulam Amer *et. al* (2015) motivates to develop a agrobot integrated system which uses Wi-Fi to communicate between two robots, which perform activities like seeding, weeding, spraying of fertilizers and insecticides. It is controlled using Arduino Atmega2560 controller and powerful Raspberry pi minicomputer to control and monitor working of robot. It has hexapod body which can move in any direction as per required. It has ultrasonic proximity sensor to avoid the obstacles in the path, and underbody sensor system to detect that seed is planted or not. It can dig a hole in soil plant seed in it n cover the hole again with soil and necessary pre emergence fertilizers applies on it, and move on along with communicating with other robot near to it using Wi-Fi.

[3] M. Priyadarshini *et. al* (2015) dealt with command based self-guided digging and seed sowing rover, a sensor guided rover for digging, precise seed positioning and sowing has been proposed to reduce the human effort and also to increase the yield is presented. The rover's navigation is performed by remote guiding devices fortified with the positioning system. It uses Arduino Atmega2560 controller and ultrasonic radar sensor for obstacle avoidance. It is controlled using wireless module that can be control by PC/ TAB/ Mobile. It gives acknowledgement massage of seed tank empty or full to the farmer.

[4] Akhila Gollakota *et. al* (2011) they made the agrobot which perform only two operations digging hole in field that is ploughing in the field and then planting a seed

at a regular interval and cover the plough area with soil. To drop the seed stepper motor is used and to dig a hole spike wheel is used. The PSOC controller from cypress is used to control all the operation.

[5] B. Shiva prasad *et. al* (2014) analyzed the effect of robot performing soil moisture test, Ph measurements, seeding and fertilizing using Arduino328 is live streamed to see the operation of robot, the camera is mounted on robot, by live streaming it is possible to control the direction of it instead of making it path follower or line follower. The robot is controlled by remote which is connected through internet using Raspberry pi. Up to this point only seeding and fertilizing techniques are discussed now we see about harvesting techniques. Motivation for the research is to decrease harvesting cost and increase the value of their product to the consumer. Conventional harvesting method is highly labor intensive and inefficient in terms of both economy and time. Machine harvesting systems are a partial solution to overcome these issues by removing fruits from the trees efficiently thus to reduce the harvesting cost to about 35-45% of total production cost.

[6] Sandeep Konam *et. al* (2012) focuses on algorithms and made a agrobot which is unmanned aerial vehicle (UAV's), high speed image processing algorithms and machine vision techniques are used. The techniques that have used in this paper reinforce the possibility of transforming agricultural scenario to modernity within given resources. It is basically a quadcopter empowered with vision for detecting mangoes on tree and cutting ancillaries. It could hover around the trees, detect the ripe mangoes, cut and collect them.

[7] Hetal Patel *et. al* (2013) they implemented a approach that has been applied for targeting fruits for robotic fruit harvesting. Efficient locating the fruit on tree is one of the major requirements for any harvesting system is presented in this paper.

[8] F.J. Czymmek *et. al* (2018) they proposed an optical measurement system for organic farming, the following research steps are listed in chronological order. At the beginning of their research, they investigated different plant stem emerging point search algorithms to successfully remove the weed. They presented the first research results oftwo RGB vegetation index determination methods. These two methods don't need

expensive and sensitive bi-spectral cameras. Here, a new and improved algorithm for segmentation of the vegetation from the background was mathematically derived and verified by the Dice-Score. The segmentation algorithm requires only one RGB camera and achieves accuracies of over 96%.

[9] Devika CM *et. al* (2017) in this paper a sensible irrigation system has been accustomed to give irrigation supported soil wetness. Soil wetness testing aims to understand whether or not the soil is in dry condition or it's in wet condition. For this purpose, the ATMega328 microcontroller is used. It deals with an associate automatic plant irrigation system that mechanically senses the moisture content of the soil and judges whether or not irrigation is needed or not and the way a lot of water required {is required} for soil. This method uses the AtMega328 microcontroller. It's programmed to sense the moisture content If the soil over an amount of your time. When the moisture content is a smaller amount than the limit that is predefined, it will start to supply the required quantity of water until it reaches the limit. Thus, once the soil is dry the pump can mechanically water the fields and once the soil is wet the pump can mechanically switch off, thereby eradicate the requirement of the workforce and conserve the time. Only within the dry condition, the pump can be operating, since the necessity of water is added for that soil for the proper growth of the crops and in wet soil, the pump won't work since the soil doesn't want any water thanks to the presence of water in it. Hence this project can conserve water throughout irrigation.

[10] Amrita Sneha *et. al* (2015) in this paper, Autonomous Ploughing and Seeding strives to develop automation capable of performing arts operations like automatic tilling, seed dispensing, fruit choosing and chemical spraying. It also offers manual handling when necessary and controls the moisture tabs with the aid of moisture sensors. The main part here is that the AVR At mega microcontroller that supervises the whole method. at first, the automation tills the whole field and takings to tilling, at the same time dispensing seeds aspect by aspect. The device used for navigation is an unhear able device that unendingly sends the knowledge to the microcontroller. On the sector the automatic operates on machine-controlled mode, however outside the sector is strictly operated in manual mode. For manual management, the mechanism uses the

Bluetooth pairing app as a management device and helps within the navigation of the automation outside the sector. So, we tend to use a robotic transportable to overcome those limitations.

[11] Pratibha S R *et. al* (2017) discuss the development activities for optimal growth and health, plants need to correct specific conditions. Watching the crop field condition is bad, so the sensor area device used. The infrasound temperature thermometer detector is used; it is optical control and side engine combined. In conjunction with the cameras, the humidity sensor-HDC1010 controls the relative humidity of the air between the farmland. The camera is attached to the CC3200 camera booster box via the MT9D111 camera detector, a PCB victimization tool.

[12] Saurabh *et. al* (2016) Arduino using autonomous agrobot in paper spells out the complete set up of the agrobot which includes hardware and software. Ultrasonic Sensor and Digital Compass sensor is used with the help of the Wi-Fi interface operated on Android Applications.

[13] Ashish Lalwani *et. al* (2016) their goal is to create "robot farms" where all the works will be done by the machines. Agrobot performs two operations digging hole that is ploughing in the field and then planting a seed at a regular interval and covers the ploughed area with soil. To seed, the stepper motor is used and to dig a hole spike wheel is used. When the robot starts performing at the same time it can detect obstacles in the path using IR sensors PSCO controller is used to controlling all the operations. To increase productivity and ease their work with its multitasking working features. By developing this it overcomes the difficulties in their fields in every season no matter what is the weather. With the different sub, modules can be used for redemption and agricultural purpose.

[14] M. Chetan Dwarkani *et. al* (2015) in this paper they focused on the farming with sensing system and movable smart irrigator. The smart farm sensing system senses the moisture content with the aid of the Soil Moisture Sensor. It can control the system by having wireless communication with the GSM module through mobile phones. The recorded readings are transferred to the database server from which all the crop-growth details are analyzed and transferred to the irrigator system.

CHAPTER 3

AGRICULTURE

3.1 Introduction

Agriculture is the art and underlying science in production and improvement of field crops with the efficient use of soil fertility, water, labor and other factors related to crop production. It is the most important enterprise in the world. About 70% of Indian populations are either farmers or involved in some agricultural related activities.

3.2 Steps Involved in Agriculture

3.2.1 Seed Selection

Seeds are the fundamental requirement in most of the agricultural process. Before beginning with the cultivation, selecting the best quality seeds is a challenging task for the farmers. Because only the good quality of seeds give an expected result or yield. Therefore, farmers have to choose suitable seeds from the variety of options available in the market. Below figure 3.1 shows the selection of seeds.

Figure3. 1 :Selection of seeds

3.2.2 Land Preparation

Land preparation or Tillage practice is a very important practice to enhance good yield from crops grown. It is one of the measures used to control crop diseases and pest invasion. The objective of land preparation is to develop potential tree growth, survival, and uniformity of a crop about to be established. Figure 3.2 shows ploughing of land.

Figure3. 2 :Ploughing

3.2.3 Fertilizer Application

Organic fertilizer is applied during ploughing; chemical fertilizer is applied before sowing and during vegetative stage. Below figure 3.3 shows fertilizing of the land.

Figure3. 3 :Fertilizer application

3.2.4 Seed Preparation

Seed preparation is an important step that can optimize seed germination and survival rate. These treatments are presumed to improve water infiltration rates and reduce the bulk density of the rooting media following soil reconstruction. The soil and the planting technique must assure that good soil-seed contact is achieved. Below figure 3.4 shows the cleaning of seeds before sowing.

Figure3. 4 :Seed preparation

3.2.5 Sowing

Sowing is placement of seed in the seed bed at an appropriate depth where the soil environment is ideal for optimum germination and crop stand establishment. Optimum time of sowing for each crop has been well established, through many dates of sowing experiments for each of the agro-climatic zones in the country. Optimum time of sowing also varies with rainfall**.** Below figure 3.5 shows the sowing of the land.

Figure3. 5 :Sowing

3.2.6 Irrigation

To irrigate is to water crops by bringing in water from pipes, canals, sprinklers, or other man-made means, rather than relying on rainfall alone. Below figure 3.6 shows the watering of the land after sowing.

Figure3. 6 :Irrigation

3.2.7 Germination

The sprouting of a seed, spore, or other reproductive body, usually after a period of dormancy. The absorption of water, the passage of time, chilling, warming, oxygen availability, and light exposure may all operate in initiating the process. Below figure 3.7 shows the germination process.

Figure3. 7 :Germination

3.2.8 Thinning

Only one plant is retained in each pit by plucking the excess seeding. One healthy seeding is left and other seeding is plucked to support the complete resources of water, fertilizer and spacing for single plant. Given figure 3.8 shows the thinning process that is plucking of excess seeds.

Figure3. 8 :Thinning

3.2.9 Filling

If there is no germination in some pits; when some seeds fail to germinate, then seedling is plucked from where it is excess and planted at the empty space.

3.2.10 Weeding

Weeding is the process of killing weeds and eradicating them from an area. Weeding is important because weeds are typically invasive, aggressive plants that destroy the environment they live in. If they're allowed to grow unchecked, they can completely take over an area and make it so it's extremely difficult to ever recover. Below figure 3.9 shows the hand weeding and chemical weeding i.e., killing of unwanted plants using chemicals.

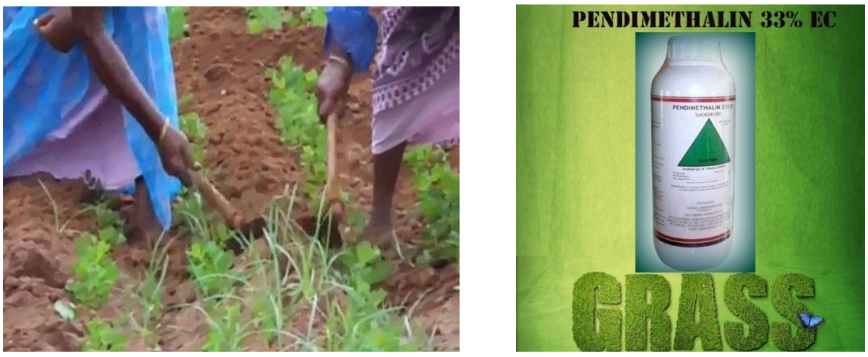

Figure3. 9:Hand and chemical weeding

3.2.11 Vegetative Stage

Vegetative stage refers to the phase of plant growth that occurs after germination/seedling stage and before flowering, during which the plant develops the majority of its foliage, a strong root system, and truly flourishes. Below figure 3.10 shows the early vegetative stage of crops.

Figure3. 10: Vegetative stage

3.2.12 Flowering Stage:

The flowering stage is when plants invest all their energy towards the reproductive phase. The majority of plants reproduce by producing seeds in nuts, fruit, or flowers. Below figure 3.11 shows the flowering stage of plants.

Figure3. 11:Flowering stage

3.2.13 Pesticides Spraying

A pesticide is any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest. Pests can be defined as any organism that causes plant diseases. Agricultural pesticides are then those chemicals that are used by farmers to prevent the effectivity of the pests on the growth and productivity of agricultural crops. Below figure 3.12 shows the pesticides spraying on the fields.

Figure3. 12: Pesticide spraying

3.2.14 Fruit/pod Formation Stage:

Pods play a key role in encapsulating the developing seeds and protecting them from pests and pathogens. In addition to this protective function, it has been shown that the photosynthetically active pod wall contributes assimilates and nutrients to fuel seed growth. Below figure 3.13 shows the pod formation .

Figure3. 13: Pod formation stage

3.2.15 Harvesting Stage

Harvesting is the process of collecting the mature crop from the field. It is important to apply good harvesting methods to be able to maximize crop yield, and minimize crop damage and quality deterioration. Below figure 3.14 shows the harvesting.

Figure3. 14: Harvesting

3.2.16 Threshing

Threshing is the process of separating the grain from the straw. It can be either done by hand, by using a treadle thresher or mechanized. Below figure 3.15 shows the separation of grains from straw by threshing.

Figure3. 15: Threshing

CHAPTER 4
OBJECTIVE

Main objective of automating the seeding operation is to make it more efficient and accurate in its working over traditional seed sowing methods. There are three major distances in seed sowing operation and these are digging or sowing depth for seeds, distances between two crops and two rows.

Agrobot consists of which are needed to be fabricated as parts of the main assembly. Following are the parts of prototype agrobot to be fabricated.

- Chassis – fabrication of chassis consists of plywood .
- T-shaped stand – fabrication of T-shaped stand consists for which solar panel is to be fixed.
- Ploughing tool – fabrication of ploughing tool consists of galvanized iron.
- Apart from the parts said above certain materials and components are required during main assembly of agrobot such as threaded bolts for fastening etc.
- Connect the wires from solar panel to battery and battery to DPDT switches and on to DC motors.
- Finally, agrobot is ready. We can use this agrobot where the farmers are ready for seeding the field.

CHAPTER 5
FABRICATION OF AGROBOT

5.1 Fabrication Process:

In this chapter we will be discussing the fabrication of the agrobot. In this fabrication process, have used certain materials and also different processes such as sawing, cutting, drilling and fastening are used. Most of the fabrication is done. Following figure 5.1 shows the end product of Agrobot.

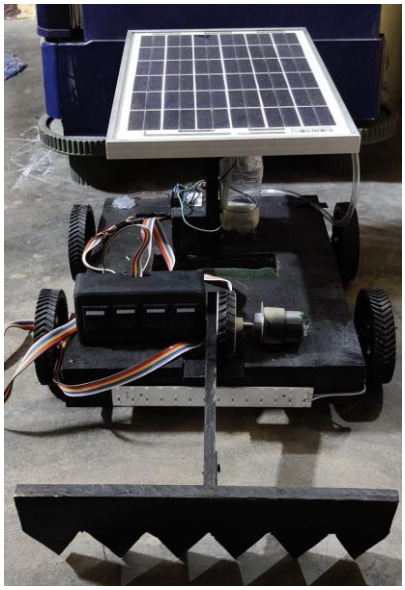

Figure 5. 1: Agrobot

The wood is cut into the desired dimensions to create the chassis. To mount the motors and T-shaped stand to the chassis, U-clamps, L-clamps are used and to fix these clamps fasteners are used. And for this purpose, holes are drilled at the measured locations on the chassis.

Slots are made in the chassis for the fixing of the seed distribution mechanism and also for the plough arm. For the seed distribution mechanism, a slot is made at the center of the chassis. For plough arm a slot is allocated on the chassis, along the shorter edge and the sides of the slot are made at equidistance from the central axis when drawn alongthe length of the chassis. A square cut is made at the centre of the plywood side. This cut is used to attach the plough arm to the chassis. The below table 5.1 shows the components used for making of agrobot.

Components	**Materials**	**Length (mm)**	**Width (mm)**	**Thickness (mm)**	**Diameter (mm)**	**Quantity**
Chassis	Wood	400	300	12		1
Front end Sheet	Plywood	300	45	12		1
T-Shaped Joint						
Top Part	Wood	280	120	10		1
Bottom Part	Wood	210	80	10		1
Plough						
Intermediate link	Wood	250	50	10		1
V-Shaped Points	Wood	50	50	10		1
Beam	Wood	300	50	10		1
Wheels	Plastic	-	-	22.5	70	5
Flexible pipe	Silicon rubber	500			5	1

Table 5. 1: Components used for agrobot

Electrical Components	Type	Voltage(V)	Speed(rpm)	Quantity
Motor	DC	12	60	5
	DC	9	45	1
Solar Panel	MP-3WP	9	-	1
Submersible Pump	Mini	3-6	-	1
Light Source(L.E.D)	Strip	12	-	1
Rechargeable Battery	Lead Acid	12	-	1

Table 5. 2: Electrical components used for agrobot

The above table 5.2 shows the electrical components used for agrobot and also Centre shaft clamp, L-Clamps, Fasteners as per the requirements.

5.2 Components Used For Agrobot:

- Dc motors
- Battery
- Submersible pump
- Solar panel
- DPDT switches

5.2.1 DC Motor

Figure 5. 2: 12v DC motor

A direct current (DC) motor is a type of electric machine that converts electrical energy into mechanical energy. DC motors take electrical power through direct current, and convert this energy into mechanical rotation.DC motors use magnetic fields that occur from the electrical currents generated, which powers the movement of a rotor fixed within the output shaft. The output torque and speed depends upon both the electrical input and the design of the motor.

A DC motor is composed of the following main parts:

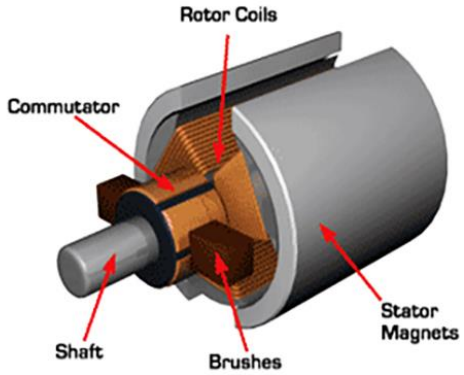

Figure 5. 3: components of DC motor

- **Armature or Rotor:**

The armature of a DC motor is a cylinder of magnetic laminations that are insulated from one another. The armature is perpendicular to the axis of the cylinder. The armature is a rotating part that rotates on its axis and is separated from the field coil by an air gap.

- **Field Coil or Stator:**

A DC motor field coil is a non-moving part on which winding is wound to produce a magnetic field. This electro-magnet has a cylindrical cavity between its poles. Commutator and Brushes

- **Commutator:**

The commutator of a DC motor is a cylindrical structure that is made of copper segments stacked together but insulated from each other using mica. The primary function of a commutator is to supply electrical current to the armature winding.

- **Brushes:**

The brushes of a DC motor are made with graphite and carbon structure. These brushes conduct electric current from the external circuit to the rotating commutator. Hence, we come to understand that the commutator and the brush unit are concerned with transmitting the power from the static electrical circuit to the mechanically rotating region or the rotor. The conductors located on the other pole are subjected to a force of the same intensity but in the opposite direction. These two opposing forces create a torque that causes the motor armature to rotate.

Working Of Dc Motor:

The term 'DC motor' is used to refer to any rotary electrical machine that converts direct current electrical energy into mechanical energy. DC motors can vary in size and power from small motors in toys and appliances to large mechanisms that power vehicles, pull elevators and hoists, and drive steel rolling mills.

DC motors include two key components: a stator and an armature. The stator is the stationary part of a motor, while the armature rotates. In a DC motor, the stator provides a rotating magnetic field that drives the armature to rotate.

A simple DC motor uses a stationary set of magnets in the stator, and a coil of wire with a current running through it to generate an electromagnetic field aligned with the centre of the coil. One or more windings of insulated wire are wrapped around the core of the motor to concentrate the magnetic field.

The windings of insulated wire are connected to a commutator (a rotary electrical switch), that applies an electrical current to the windings. The commutator allows each armature coil to be energized in turn, creating a steady rotating force (known as torque).

When the coils are turned on and off in sequence, a rotating magnetic field is created that interacts with the differing fields of the stationary magnets in the stator to create torque, which causes it to rotate. These key operating principles of DC motors allow them to convert the electrical energy from direct current into mechanical energy through the rotating movement, which can then be used for the propulsion of objects.

5.2.2 Battery :

Figure 5. 4: 12v 1.4AH lead acid battery

A battery can be defined as; it is a combination of one or more electrochemical cells that are capable of converting stored chemical energy into electrical energy. Simply said that the battery is a storing device to store the energy.

In this project we are using a 12Volts battery for the running of coin based sensor mobile charging project. The capacity of this battery is 12V 1.4 AH

Common Types Of Batteries:

Batteries have been around for a really long time and have become an extremely important and convenient device to power things up. Essentially, batteries store chemical energy that converts into electric energy and makes other devices work. Basically, batteries are tiny chemical reactors that produce energetic electrons as an ultimate reaction and flow through the connected device. In this world we have so many types of batteries, those are classified as follows. While batteries can be divided depending on their sizes, composition, form, and functions, they are, generally, classified into the following categories:

- Primary Batteries
- Secondary Batteries

5.2.2.1 Primary Batteries:

The simplest meaning for understanding primary batteries is that these batteries are for one-time use only and must be discarded then. These batteries are also known as non-rechargeable batteries, considering that they can't be recharged and used again. It was this kind of battery that Alessandro Volta invented first in 1800. Non-rechargeable batteries come with a wide range of advantages which make these devices the number one choice for most users. First of all, primary batteries cost super low as compared to other smart batteries. These batteries are easy, simple, and convenient to the extent that any novice can use them without any trouble.

Types Of Primary Batteries:

- **Alkaline Batteries:**

  This is one of the most basic types of primary battery that gets its energy from the chemical reaction between zinc metal and manganese dioxide. As compared to other

batteries like a zinc-carbon battery of the zinc chloride, alkaline batteries possess a greater energy density and longer lifespan. Below figure 5.5 shows the Alkaline batteries

Figure 5. 5 :Alkaline batteries

Alkaline batteries consist of a steady voltage which provides better energy density and leakage resistance, unlike carbon zinc batteries. These batteries get this characteristic mainly due to the presence of manganese dioxide anode as it is better and denser and avoid other components to take up a lot of unnecessary space.

- **Lithium Batteries:**

Figure 5. 6: Lithium batteries

Also known as lithium rechargeable batteries, these primary batteries consist of metallic lithium as an anode. They are widely popular today, as you can use them to power devices such as MP3 players, car locks, thermometers, laser pointers, and hearing aids. Above figure 5.6 shows the Lithium batteries.

What sets them apart from other types of batteries is they provide high charge density and high cost per unit. Lithium cells are known for producing voltages from 1.5 V to 3.7 V, depending on their model and chemical compounds used. However, lithium batteries should not be confused with lithium-ion batteries as they are rechargeable, storage battery used in devices like laptops, cell phones, PDAs, and iPods.

- **Mercury Batteries:**

These batteries are also known as mercuric oxide battery or mercury cell, the mercury battery is a non-rechargeable electrochemical battery that can be used up to 10 years. This miniature-sized battery uses a chemical reaction between zinc electrodes and mercuric oxide in an alkaline electrolyte.

Figure 5. 7: Mercury batteries

Owing to their long lifespan and steady voltage output, these batteries are the most common type of battery in the 20th century. They are popularly used in portable electronic devices such as watches, calculators, toys, cameras, digital thermometer etc. Unlike the other two batteries that are discussed above, mercury cells come in a button-like shape and size which make these batteries super convenient and easy to carry around.

- **Zinc Air Batteries:**

Zinc air batteries are also called zinc-air fuel cells, zinc air batteries are metal air devices that function with the combination of oxygen and oxidizing zinc. These batteries possess high energy density and aren't costly to produce. You can get these batteries, in various sizes, at quite an affordable price range.

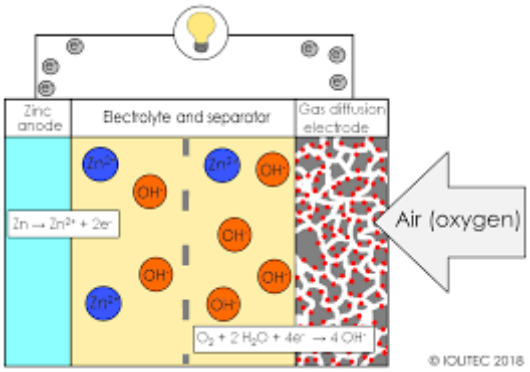

Figure 5. 8: Zinc Air Batteries

Zinc air fuel cells comprise an anode that is made up of granulated powder and electrolyte. The electrolyte acts as a gelling agent that helps maintain the contact between the zinc particles and electrolyte. Secondly, these batteries also contain a cathode that helps oxygen to come in contact with the other chemical compound so that the reaction can take place.

The common applications of zinc air fuel cells include watches, torch lights, remote control, film cameras, hearing aids etc. Depending on the size of the device, you can choose the zinc air battery accordingly.

5.2.2.2 Secondary Batteries:

Secondary batteries are also referred to as rechargeable batteries; secondary batteries come with electrochemical cells whose chemical reactions can easily be reversed by applying some amount of voltage in an opposite direction. Unlike primary batteries,

secondary cells can be recharged and made to be used again. Typically, these cells are used in high-drain appliances or in situations that may be too costly or impractical. Some of the uses of secondary batteries include mobile phones, MP3 players, computer, telephone exchanges, wristwatches, hearing aids etc.

Types Of Secondary Batteries:

- **Lead Acid Batteries:**

  Also known as “gel cells”, the lead acid gel battery is a VRLA battery (which stands for valve-regulated lead-acid battery) with a gel-like electrolyte. This gel-like mass is produced through a mixture of sulfuric acid with fumed silica. The gel cell is often confused with AGM styled cells as in both of them the electrolyte is suspended. However, unlike AGM cells, the gel cell has silica that makes the electrolyte stiff. The advantage of gel-based batteries over other kinds of batteries is that they last longer, especially in hot weather. Below figure 5.9 shows the lead acid battery.

Figure 5. 9: Lead Acid Battery

Bear in mind that these are the most sensitive batteries as they can result in an adverse reaction if they are overly charged. Also, if the wrong battery charger is used for powering up lead acid cells, then the device may poorly perform or fail entirely. The absorption voltage range from 14.0 to 14.2 volts.

Gel cells are not as common as other batteries like AGM, but they are popularly used in wheelchairs, trolling motors, and RV cycles.

- **Lithium-Ion Battery:**

  Lithium-ion batteries are extremely popular these days as they are used for charging or recharging popular gadgets like PDAs, cell phones, iPods, and laptops. Besides the fact that they help charge devices we can't live without, these batteries are considered to be the most light-weight and energetic batteries available on the market. These batteries are composed of super airy lithium and carbon which is why they are lightweight in nature. Lithium also has highly-reactive energy which means that li-ion batteries can store an excessive amount of energy in its atomic bonds.

Figure 5. 10: Lithium- Ion Battery

Moreover, lithium-ion batteries lack the memory effect. This means that you won't have to discharge them first to recharge them as it is with some other batteries. Above all, these cells are able to pack 5% of its charge every month as compared to a 20% loss witnessed in NIMH batteries. Above figure 5.10 shows the lithium – Ion battery.

- **Nickel Cadmium (NiCad) Battery:**

  This is the type of rechargeable battery that uses metallic cadmium and nickel oxide hydroxide as their source of electrodes. To make these cells work, they need to be kept within +60 degrees centigrade all the way down to minus 20 degrees centigrade. Below figure 5.11 shows the nickel cadmium battery.

Figure 5. 11: Nickel Cadmium (NICD) Battery

Choosing the right separator like polypropylene or nylon and the electrolyte such as LiOH, NaOH, and KOH is also of utmost importance for these batteries to work efficiently. These constituents keep the voltage conditions of NiCad battery intact, especially in cases like high current discharge.

If misused or mishandled, these batteries can result in a dangerously high pressure that can damage the device altogether. To avoid such an occurrence, these cells comprise a reversible safety valve. The best advantage of nickel cadmium cells is that they remain durable for a really long time.

5.2.3 Submersible Pump:

A submersible pump, also called an electric submersible pump, is a pump that can be fully submerged in water. The motor is hermetically sealed and close-coupled to the body of the pump. A submersible pump pushes water to the surface by converting rotary energy into kinetic energy into pressure energy. Below figure 5.12 shows the submersible pump.

Figure 5. 12:Submersible Pump

Listed below are some common submersible pumps:

- Bladder Pumps.
- Grinder Pumps.
- Well Pumps.
- Borehole Pumps.
- Fountain Pumps.
- Utility Pumps.

Submersible pumps are often used to pump excess water from work sites or flooded basements in construction sites. They can also be used to pump slurries. Submersible pumps can be used in inland or offshore oil wells to pump oil from the ground to treatment and holding facilities above ground.

Many submersible pumps operate under the principle of Electric Submersible Pumping (ESP). This is achieved by lowering flowing pressure, which decreases the pressure at the bottom of the shaft in which the submersible pump sits. The motor of an ESP system is also designed to function under high temperatures (up to 300 degrees Fahrenheit) and high pressures, so it is used in situations where very deep wells are common, such as oil wells.

They can be relatively expensive to run because they require special electricity cables, although new developments have seen the introduction of coiled tubing umbilical's to supply energy to the deep motors. Additionally, electric usage is much higher than other submersible pump motors and the pump functions on tight tolerances that don't allow for solids and sand.

5.2.4 Solar Panel:

Solar panels are those devices which are used to absorb the sun's rays and convert them into electricity or heat. A solar panel is actually a collection of solar (or photovoltaic) cells, which can be used to generate electricity through photovoltaic effect.

These cells are arranged in a grid-like pattern on the surface of solar panels. Thus, it may also be described as a set of photovoltaic modules, mounted on a structure supporting it. A photovoltaic (PV) module is a packaged and connected assembly of 6×10 solar cells. When it comes to wear-and-tear, these panels are very hardy. Solar panels wear out extremely slow. In a year, their effectiveness decreases only about one to two per cent (at times, even lesser).

Most solar panels are made up using crystalline silicon solar cells. Installation of solar panels in homes helps in combating the harmful emissions of greenhouse gases and thus helps reduce global warming. Solar panels do not lead to any form of pollution and are clean. They also decrease our reliance on fossil fuels (which are limited) and traditional power sources. These days, solar panels are used in wide-ranging electronic equipment like calculators, which work as long as sunlight is available. However, the only major drawback of solar panels is that they are quite costly. Also, solar panels are installed outdoors as they need sunlight to get charged. Below figure 5.13 shows the solar panel used in our Agrobot.

Figure 5. 13: Solar panel

5.2.5 Switches:

Switch is an electrical component which can make or break electrical circuit automatically or manually. Switch is mainly works with ON (open) and OFF (closed) mechanism. Numerous circuits hold switches that control how the circuit works or actuate different characteristics of the circuit. The classification of switches depends on the connection they make. Two vital components that confirm what sorts of connections a switch makes are pole and throw.

- **Pole:**

  The amount of circuits controlled by the switch is indicated by poles. Single pole (SP) switch controls only one electrical circuit. Double pole (DP) switch controls two independent circuits.

- **Throw:**

  The number of throws indicates how many different output connections every switch pole can connect its input. A single throw (ST) switch is a simple on/off switch. When the switch is ON, the two terminals of switch are connected and current flows between them. When the switch is OFF the terminals are not connected, so current does not flow. These are classified on based the connections they make. If you were under the impression that switches simply turn circuits on and off, guess again.

Types of Switches

Basic types of switches are

- SPST
- SPDT
- DPST
- DPDT

5.2.5.1 SPST Switch

The Single Pole Single through (SPST) is a basic on/off switch that just connects or breaks the connection between two terminals. The power supply to a circuit is switched by the SPST switch. A simple SPST switch is shown in figure 5.14.

Figure 5. 14: SPST switch

These types of switches are also called toggle switches. This switch has two contacts one is input and other output. From the typical light switch diagram, it controls one wire (pole) and it makes one connection (throw). This is an on/off switch, when the switch is closed or on then current flows through the terminals and the bulb in circuit will glow. When the switch is open or off then there is no current flow in the circuit.

5.2.5.2 SPDT Switch:

The single pole double throw (SPDT) switch is a three-terminal switch, one for input and other two for the outputs. It connects a common terminal to one or the other of two terminals. For using the SPDT as SPST switch then just use the COM terminal instead of other terminals. For instance, we can use COM and A or COM and B. Below figure 5.15 shows the schematic diagram of SPDT Switch.

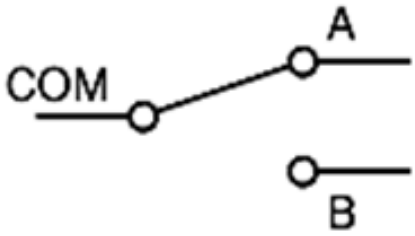

Figure 5. 15: SPDT switch

From the circuit, it clearly demonstrates what happens when the SPDT switch is moved back and forth. These switches are used in a three-way circuit to turn a light ON/OFF from two locations, such as from the top and bottom of a stairway. When the switch A is closed then current flows through the terminal and only light A will ON, and light B will OFF. When the switch B is closed then current flows through the terminal and only light B will ON and light A will OFF. Here we are controlling the two circuits or paths via one way or source.

5.2.5.3 DPST Switch:

DPST is abbreviation for double pole, single throw. Double pole means that the unit contains two identical switches, side by side, and operated by one single toggle or lever. This means that two separate circuits are at a time controlled through one push. Below figure 5.16 shows the schematic diagram of DPST Switch.

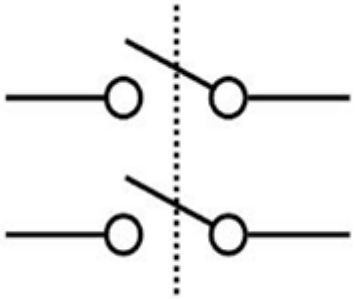

Figure 5. 16: DPST switch

A DPST switch turns two circuits on or off. A DPST switch has four terminals: two inputs and two outputs. The most common use for a DPST switch is to control a 240-volt appliance, where both supply lines must be switched, while the neutral wire may be permanently connected. Here when this switch is toggled current starts flowing through two circuits and interrupted when it is turned OFF.

5.2.5.4 DPDT Switch:

DPDT is a double pole double throw switch; this is equivalent to two SPDT switches. It routes two separate circuits, connecting each of two inputs to one of two outputs. The position of the switch determines the number of ways in which each of the two contacts can be routed. Below figure 5.17 shows the schematic diagram of DPDT Switch.

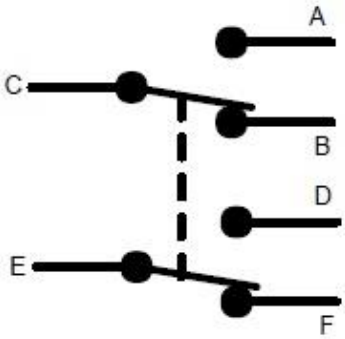

Figure 5. 17: DPDT switch

Whether it is in ON-ON or ON-OFF-ON mode they function like two separate SPDT switches operated by the same actuator. Only two loads can be ON at a time. A DPDT can be used on any application that requires an open and closed wiring system, an example of which is railroad modelling, which makes use of small scaled trains and railways, bridges and cars. The closed allows for the system to be ON at all times while open allows for another piece to be turned ON or activated through the relay. The connections A, B and C form one pole of the switch and connections D, E and F form the other. Connections B and E are common in each of the poles. If the positive power supply (Vs) enters at connection B and the switch is set to the top most position, connection A becomes positive and the motor will rotate in one direction. If the switch is set to the lower most position, the power supply is reversed and connection D becomes positive then the motor will rotate in the opposite direction. In the centre position, the power supply is not connected to the motor and it does not rotate. These types of switches are mainly used in various motor controllers where speed of that motor is to be reversed.

5.3 Preparation Of Chassis:

1. The chassis is made with wood of dimensions of 400*300*12 millimetres length, width and thickness respectively.
2. This agriculture robot having four wheels for the movement purpose. we have used U clamps to hold the motors to the chassis to which the wheels are attached.
3. The wheels are made of plastic and has the diameter of 70 mm, thickness of 22.5 mm.
4. The placing of each motor to the chassis has specific location. The dimensions of motor placing from each corner is 50*10 millimetres length and width respectively.
5. The motors are used to rotate the wheels are of 12v, 60 rpm type.
6. Wires of required length are soldered to the motors. On the left side both motors are attached to the battery in parallel connection.
7. Similarly, the motors are connected in parallel connection on the right side.

8. A 300*50 millimetres size wood is added at the front of the chassis and is fixed to the chassis using screws. L-clamps are also used to provide extra support.
9. A wooden strip of dimensions 300*45 mm is fixed to front end of chassis to this an L.E.D strip is attached. These lights help the user to navigate the agrobot even in the dark

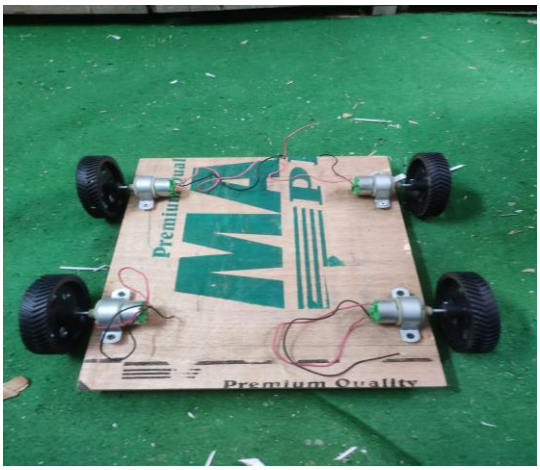

Figure 5. 18: Chassis with wheels

The above figure 5.18 shows the chassis with wheels and motors.

5.4 Seeding Arrangement:

1. A cut is made in the chassis for the seeding operation. This cut is of dimensions 150*50 millimetres as length and width respectively. The below figure 5.19 shows the cutting of chassis for the pet bottle arrangement.

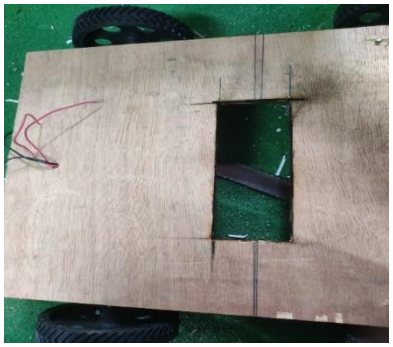

Figure 5. 19: Cutting of chassis for seed arrangement

2. A P.E.T bottle is used for the seeding purpose. Some holes are made in the P.E.T bottle for the seeds to fall out, at certain distance from each other.
3. 9V, 45r.p.m motor is used for the seeding purpose. whenever the motor rotates the bottle also gets rotated. With every one complete rotation made by the bottle, the seeds will fall out through the holes.
4. 5 holes are made in the P.E.T bottle along its length. These holes are made 20 mm away from each other with equidistance. This causes the seeds to fall out at their designated points.
5. On the other side a hole is made at the base center of the bottle. A shaft is inserted in this hole. This shaft supports the bottle and also allows it to freely rotate. Below figure 5.20 shows the complete seeding arrangement in the agrobot.

Figure 5. 20: Seed container

5.5 Ploughing Arrangement:

1. We are using one more motor for the ploughing operation, having specifications as follows

   Capacity : 12 V

   Speed : 60 RPM

   Torque : 2 KG-M
2. One more cut is made on the chassis for ploughing purpose with dimensions of 165*50 mm of length and width. On the right-side position of the cut, the motor is fixed to hold the plough.
3. The above specified motor is fixed to the chassis by using a centre shaft clamp.
4. Two bars of wood are used to fabricate the plough arm. One bar is used to fashion the intermediate link of dimensions 200*25mm and the other one is used to make the beam with five V-shaped share points of the plough.
5. After joining these bars, a motor of the type 12V, 60 r.p.m is connected to a wheel of dimensions, 22.5 mm width and 70 mm diameter. This wheel is attached to one end of the intermediate bar for ploughing motion. The below figure 5.21 shows the ploughing tool to perform ploughing operation in Agrobot.

Figure 5. 21: Ploughing tool

6. The dimensions of ploughing bar are 300*100*10 millimetres length, width and thickness respectively.
   Width of the teeth : 75mm
   Length of the teeth : 50mm

5.6 Watering Arrangement:

1. Another P.E.T bottle is used for watering operation. Which is place on chassis behind the seeding operation.
2. The white colour object in the bottle is the submergible pump as shown in figure of rated voltage 6-12V.
3. A clear plastic pipe is attached to the pump and run along the back end of the chassis. This pipe is attached to the chassis at two points, using glue.
4. Five equidistant holes are made on the plastic pipe. Each hole is 20 mm apart.
5. These holes are aligned with the holes in the seed distributing bottle. The below figure 5.22 shows the watering arrangement in Agrobot.

Figure 5. 22: Water container

5.7 Solar Arrangement:

1. The solar panel is attached to the chassis by the support of a T-shaped stand of dimensions 200*200mm. This stand is held to the chassis with the help of L-clamps and screws.
2. The solar panel is placed at a specific location on the chassis so as to avoid the overturning of the agrobot to balance the weight distribution.
3. The electricity generated by the solar panels is stored in rechargeable Lead -based battery.
4. Wires are used to connect the solar panel from the back panel to the battery terminals in between them a diode is connected to avoid reverse current.
5. Technical data

   Number of cells: 36

   Module type: MP-3WP

   Peak power (Pmax): 3

Maximum power current (Imp) (A): 0.34

Maximum power voltage (Vmp) (V): 9

Short circuit current (Isc) (A): 0.41

Open circuit voltage (Vsc) (V): 11.25

Maximum system voltage (VDC): 1000

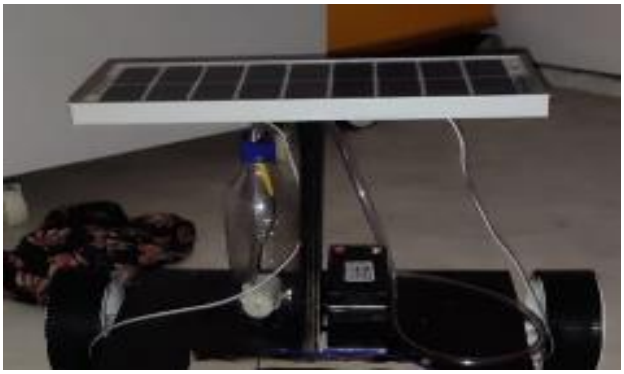

Figure 5. 23: Solar arrangement

The above figure 5.23 shows the solar panel fitted on T- shaped stand

5.8 DPDT Switches Connection

1. In this project we have used four DPDT switches to control the motions of the agrobot.
2. The two motors that are placed left side of the chassis are connected to one DPDT switch similarly motors on the other side are connected to second DPDT switch.
3. The third DPDT switch is used for raising and lowering of the ploughing arm.
4. Last DPDT switch is used to run the submersible pump for watering and also to rotate the bottle which is attached to the motor, for seeding.

CHAPTER 6
WORKING OF AGROBOT

6.1 Working Principle

Four DC motors are used for driving the four wheels of vehicle. These four motors gives the directions like forward, backward, left and right For these directions of movements we used two DPDT switches. If we have press two switches at a time front side, then the robot will move forward. If we have to press two switches at a time back side, then the robot will move backward direction. If we have to press one switch is front side and another switch is back it will make a turn. If you do not press any switch the robot should be in stable condition. V-shaped arms for Agrobot are used, closing of which will dig the soil and opening of it will release the soil to cover the pit. DC motors of arms and wheels are directly connected to DPDT switches to enable them rotating in both clockwise and anticlockwise direction. A single DC motor is required for the movement of V-shaped arms as ploughing. The movement of the ploughing motor is also operated by another DPDT switch. Seed tank and water tank are connected for storage of seeds and water respectively. A DC motor is connected for rotating wheel mechanism to drop the seeds. Submersible entirely waterproof DC water pump is used for pouring the water.one more DPDT switch is required for performing both seeding and watering operations. Input of crop type is given manually by selecting one of the four input switches. We are using an X principle while connecting the DPDT switch. This principle gives the both directions to the motors when we are using throwing two directions.

6.2 Operations Performed By The Agrobot

In this chapter we have discuss about working and operations that are to be performed by this robot are as follows.

6.2.1 Ploughing

The ploughing tool can be operated in three modes namely on, off and mid. The microcontroller will receive the command to work on any of these three modes and it directs the plugging tool to plough the field accordingly.

Ploughing is one of the first steps in farming. During this process we till the land and make it ready for the seed sowing. By tilling we mean that a plough will be used which will have teeth like structure at the end and will be able to turn the top layer of soil down and vice-versa. One end of the frame, cultivator is fitted which is also driven by dc motor and design is made to dig the soil which moves in clock and anticlockwise directions whereas 2 relays are used for each of the directions to be performed which is nothing but relay switching through a motor. The amount of depth it is digging can be obtained from the calculations.

6.2.2 Seed Sowing

The seeds are stored in a small container and it is closed with a small flip. This flip is controlled by the motor to open and close the container. The motor is capable of rotating to 360 degrees.

Traditional methods include broadcasting manually, opening furrows by a country plough and dropping seeds by hand, and dropping seeds in the furrow through a bamboo/meta funnel attached to a country plough (Pora). For sowing in small areas dibbling i.e., making holes or slits by a stick or tool and dropping seeds by hand is practiced.

Multi row traditional seeding devices with manual metering of seeds are quite popular with experienced farmers. Seed sowing comes next where the seeds need to be put in ground at regular intervals and these needs to be controlled automatically. Limiting the

flow of seeds from the seeds chamber is typically doing this. In this project, it is presenting that the farm cultivation process in autonomous agriculture system which is controlled by microcontroller assembly. The technique of seed preparation in ploughed land is based on row per column depending on the types of cultivation. The main part of the robot technique is sensor part. The sensor performs to identifying obstacles as well as the completion of farm for end of the land and then turn the position of robot either in left or right or forward direction.

6.2.3 Watering

During summer there is shortage of water due to the scarcity if rain and frequent power cuts, so a smart method to pump water is described as follows. A water container is used for water storage. A water pump is used for pumping water to the water sprayer. The water flows to the sprayer through pipe. The power for pump is regulated by using a relay switch.

In the bottle we can store the water and also uses a pump to deliver the water whenever the plant needs water. The pipe is connected to the pump and that pipe having some holes that are to be placed in a particular distance. The distance of the holes of a pump is equal to the distance of the seeding bottle holes.

A holed pipe is provided at the bottom of the project where the water is sprayed on the field. A pipe is fitted to the submersible pump of 500gms,500 RPM is used which is dropped into the container as a result of centrifugal force the water is pumped outside through the pipe into the pipe which is fitted at the bottom.

CHAPTER 7
CONCLUSION AND SCOPE FOR FUTURE WORK

Main objective of automating the seeding operation is to make it more efficient and accurate in its working over traditional seed sowing methods. There are three major distances in seed sowing operation and these are digging or sowing depth for seeds, distances between two crops and two rows.

This can be interpreted as row and column distance. Experiments are done on the wet soil and distances covered by the robot are compared with predefined optimal distances. Accuracy obtained is satisfactory and can be improved by utilizing more mechatronics design methodology, modern controllers and advanced information systems.

7.1 Conclusion

An autonomous robot is developed to perform the complex farming task of seeding. Agrobot in this project is designed to perform sowing only for four crops: cotton, maize, soybean, wheat. Row and column distances required for these four crop types are modeled in the system. With slight variations of few centimeters in the distances defined robot successfully covers distances between crops and their rows.

Navigation technique using IR sensors in Agrobot is easier and less bulky over other existing agriculture robotic systems. Ease of handling and precision working makes this agriculture robot real aid for farmers. Less complexity in the mechanical design and simpler navigation technique makes the system of lower cost and less bulky compared to conventional tractors. Also, the coverage area by the robot is restricted because of its dependence on DC battery. Other crop types can be included by modeling their required optimal distances.

In future, the system can be modified for other farming tasks too such as weeding and spraying processes with some mechanical designing modifications and by using advanced controllers and sensors. More advanced and fast system can be developed with more focus on implementation of right mechanical parts and their designing.

7.2 Scope For Future Work

In this project we tried to present related work of agricultural robot as labour problem can be reduced as compared to the manual and tractor based sowing time, energy required for this robot machine is less. At the same time by using solar energy environment pollution can also be reduced.

Future agriculture will use sophisticated technologies such as robots, temperature and moisture sensors, aerial images, and GPS technology. These advanced devices and precision agriculture and robotic systems will allow farms to be more profitable, efficient, safe, and environmentally friendly. From high-tech greenhouses to cloud seeding, here's how agricultural robots are helping farmers fill labor shortages and our supermarket shelves. Robots pick apples, gather strawberries, harvest lettuce and strip away weeds. Drones gather aerial images that help farmers quickly assess crop health.

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