DESIGN AND DEVELOPMENT OF AUTOMATIC SEED SOWING MACHINE

Project Work Report

Submitted in Partial Fulfillment of the Requirements for the Award of the Degree of

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In

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This is to certify that the Project work entitled ***"Design and Development of Automatic Seed Sowing Machine"*** has been carried out by

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Under my Guidance in partial fulfillment of the requirements for the Award of the Degree of Bachelor of Technology in Mechanical Engineering of Jawaharlal Nehru Technological University, Kakinada during the Academic year 2021-22.

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ABSTRACT

Manual and animal-drawn seed sowing techniques take a long time and have low productivity. Today's era is marching towards the rapid growth of all sectors including the agricultural sector. To meet the future food demands, the farmers have to implement the new techniques which will not affect the soil texture but will increase the overall crop production. The seed sowing machine is a key component of the agricultural field. The various technologies used in India for seed sowing and fertilizer placement is manual, ox and tractor operator. The manual and ox operator techniques are time-consuming and productivity is low. The tractor is running on fossil fuel which emits carbon dioxide and other pollution every second. This evidence has led to widespread air, water and noise pollution and most importantly has led to a real energy crisis shortly, to make the development of our farmers as well as nation sustainable and cause less harm to our environment. Now the approach of this project is to develop the seed sowing machine which is to minimize the working cost and the time for digging as well as operate on clean energy.

The objective of this project is to increase efficiency and reduce time consumption and also the labour involved. The plantation of seeds can be done by placing seeds at a controlled distance by using a DC motor. Hence the device is to be designed, which helps farmers to overcome the stated problem.

Keywords: Conventional Techniques, Seed Sowing Machine, Agribot, Low-cost Automation, High torque DC Motor.

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ABBREVATIONS

MOTOR DRIVE	
DC	Direct Current
AC	Alternate Current
V	Voltage
A	Amphere
mA	Milli Amphere
C	Centigrade/Celcius
g	Gram
DC SUBMEGIBLE PUMP	
L/H	Litre per Hour
ARDUINO BOARD	
VCC	Voltage at common collector
gnd	Ground Pin
RX	Receiving Pin
TX	Transmitting Pin
BLUETOOTH MODULE	
Dbm	Decibel Milliwatt
I/O	Input/Output
PIO	Programmed Input Output
UART	Universal Asynchronous Reciever Transmitter

Chapter – 1

Introduction

Chapter – 1 INTRODUCTION

In the current generation, most countries do not have sufficient skilled manpower, especially in the agricultural sector and it affects the growth of developing countries. The main requirement of Automation is to reduce manpower in our country; the buzzword in all industrial firms generally involves electrical, and electronic component as well as mechanical parts. Automation saves a lot of tedious manual work and speeds up the production processes. So it is time to automate the sector to overcome this problem. In India, there are 70% of people dependent on agriculture. The seed has been an important agricultural commodity since the first crop plant was domesticated by pre-historic man. In this model, the seed sowing process is automated to reduce the human effort and increase the yield. The plantation of seeds is automatically done by using a DC motor.

Fig.1.1 Broadcasting of Seeds

Cropping is an important and tedious activity for any farmer, and on large scale, this activity is so lengthy also it needs more workers. Thus agriculture machines were developed to simplify human efforts. In the manual method of seed planting, we get results such as low seed placement, less spacing efficiencies and serious backache for the farmer. This also limited the size of the field that can be planted. Hence for achieving the best performance from a seed planter, the above limits should be optimized. Thus we need to make the proper design of the agriculture machine and also a selection of the components is also required for the machine to suit the needs of crops. Agriculture is the backbone of India. And for sustainable growth of India development of agriculture plays a vital role. India has a huge population and day by day it is growing thus demand for food is also increasing. In agriculture, we saw various machines. Also, their traditional methods are there. Since long ago in India traditional method is used. Also, India has huge manpower. This manual planting is popular in villages in India. But for a large scale, this method is very troublesome. The farmer has to spend more time planting. But the time available is less for him. Thus it requires more manpower to complete the task within the stipulated time which is costlier. Also, more wastage happens during manual planting. Hence there is a need of developing such a machine which will help the farmer to reduce his efforts while planting. This process of using machines is called mechanization. Along with mechanization automation also helps to increase the efficiency of the process.

Fig.1.2 Sowing seeds with the help of bulls and plough

The robotic system is electromechanical (conveys a sense that it has agency of its own) and an artificial agent which is steered by a DC motor which has four wheels. The farm is cultivated by the machine, depending on the crop considering particular rows & specific columns. The infrared sensor detects the obstacles in the path and it also senses the turning position of the vehicle at end of the land. The seed block can be detected and solved using water pressure. The machine can be controlled remotely and a solar panel is used to charge the DC battery. Assembly language is used in programming the microcontrollers. The microcontroller is used to control and monitor the process of system motion of the vehicle with the help of a DC motor. As agriculture is extensively supported by technical means like seeding, mowing or harvesting machines, it is widely considered to be a field with a high potential for robotic application as it is a small step from this semi-automatically operated machine to fully autonomous robots in both greenhouse and open-field applications. Robots are available on all development levels from experimental to market-ready in several agricultural applications but most of them are in research, where institutes have made progress to extend the existing agricultural machines to robotic systems. Most of the robots considered in this publication are developed for harvesting. Seeding is not yet as important since there are already good tractor based seeding systems. In horticulture, there are significantly fewer robotic applications than in agriculture.

In the farming process, often used conventional seeding operation takes more time and more labor. The seed feed rate is more but the time required for the total operation is more and the total cost is increased due to labor, and hiring of equipment. The conventional seed sowing machine is less efficient and time-consuming. Today's era is marching towards the rapid growth of all sectors including the agricultural sector. To meet the future food demands, the farmers have to implement the new techniques which will not affect the soil texture but will increase the overall crop production. In the farming process, often used conventional seeding operation takes more time and more labour. The seed feed rate is more but the time required for the total operation is also more and the total cost is increased due to labour, and hiring of equipment. This machine reduces the efforts and total cost of sowing the seeds and fertilizer placement. The sowing machine should be suitable for all farms, all types of corps, robust construction, also it should be reliable, this is a basic requirement of sowing machine. Thus we made a sowing machine which is operated manually but reduces the efforts of farmers thus increasing the efficiency of planting and also reducing the problem encountered in manual planting. For this machine, we can plant different types and different sizes of seeds also we can vary the space between two seeds while planting. This also increased the planting efficiency and accuracy. We made it from raw materials thus it was so cheap and very usable for small scale farmers. For effective handling of the machine by any farmer or by any untrained worker we simplified its design. Also, its adjusting and maintenance method is simplified.

1.1 WHAT IS SOWING?

Sowing is the process of planting seeds into the soil. During this agricultural process, proper precautions should be taken, including the appropriate depth, and proper distance maintained, and the soil should be clean, healthy and free from disease and other pathogens including fungus. All these precautions are essential for seed germination – the process of seeds developing into new plants. Sowing plays an important role in farming. Once, after the soil is loosened and ploughed, the good, disease-free and pure quality seeds are selected and sown into the soil. After selecting seeds of good quality, they are sown on the prepared land.

Fig.1.1.1 Hand Sown Seed Sowing

1.1.1 HISTORY OF SEED SOWING

The idea for dropping seeds through a tube first appeared in Mesopotamia about 1500 B. C. Up until this period, farmers planted the seeds for cereal crops by carrying the seeds in a bag and walking up and down the field throwing or broadcasting the seed. They broadcast the seed by hand onto the ploughed and harrowed ground. The problem with this method was that it did not give a very even distribution. It was not, therefore, efficient use of the seed and much of it was wasted.

Jethro Tull invented a Seed Drill which could be pulled behind a horse. It consisted of a wheeled vehicle containing a box filled with grain. There was a wheel-driven ratchet that sprayed the seed out evenly as the Seed Drill was pulled across the field.

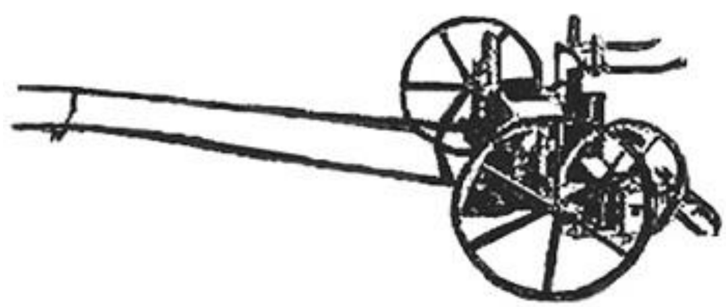

Fig.1.1.1.1 Tull's Seed Drill

Jethro Tull invented the seed drill in 1701 as a way to plant more efficiently. Before his invention, sowing seeds was done by hand, by scattering them on the ground or placing them in the ground individually, such as with bean and pea seeds. Tull considered scattering wasteful because many seeds did not take root.

His finished seed drill included a hopper to store the seed, a cylinder to move it, and a funnel to direct it. A plough at the front created the row, and a harrow at the back covered the seed with soil. It was the first agricultural machine with moving parts. It started as a one-man, one-row device, but later designs sowed seeds in three uniform rows, had wheels and were drawn by horses. Using wider spacing than previous practices allowed horses to draw the equipment and not step on the plants.

Fig.1.1.1.2 Demonstrated usage of Tull’s Seed Drill

Tull advocated the importance of pulverising (crumbling) the soil so that air and moisture could reach the roots of the crop plants. His horse-drawn hoe was able to do this. He also emphasised the importance of manure and of tilling the soil during the growing season.

At the time, Tull's ideas came under attack, mainly because they were new. His Seed Drill was not immediately popular in England, although it was quickly adopted by the New England colonists across the Atlantic.

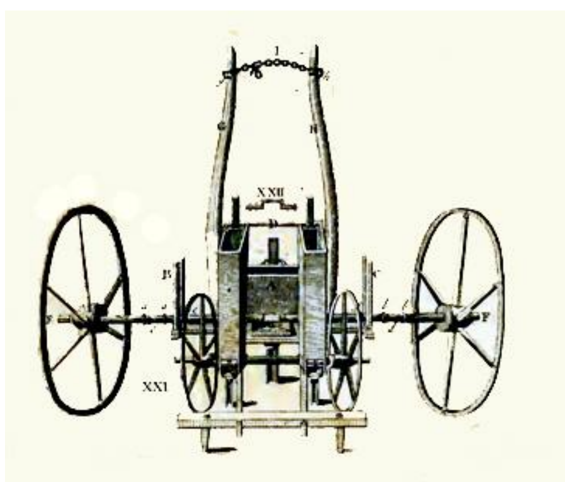

Fig.1.1.1.3 Horse-hoeing husbandry by Jethro Tull 4th edition, from 1762, plate IV

In 1731, Tull wrote a book called "Horse-houghing (hoeing) Husbandry" which he revised in 1733. Although his Seed Drill was improved in 1782 by adding gears to the distribution mechanism, the rotary mechanism of the drill provided the foundation for all future sowing technology.

1.1.2 TYPES OF SOWING

Broadcasting

A field is initially prepared with a plough to a series of linear cuts known as furrows. The field is then seeded by throwing the seeds over the field, a method known as manual broadcasting. The result was a field planted roughly in rows, but having a large number of plants. When the seeds are scattered randomly with the help of a hand on the soil, the method is called broadcasting. In this process, the seeds are scattered on the seedbeds either mechanically or manually. In the broadcasting method of sowing, the seeds are spread uniformly and are then covered with planking. When there are a large number of seeds, the work is done using mechanical broadcasters. The seed rate is very high in this system.

Fig.1.1.2.1 Broadcasting of Seeds

Dibbling

Drill sowing and dibbling (making small holes in the ground for seeds) are better methods of sowing the seeds. Once the seeds are put in the holes, they are then covered with the soil. This saves time and labour and prevents the damage of seeds by birds. Holes are made in the seedbeds and the seeds are placed in them. The seedbeds are then covered. The holes are made at definite depths. A dibbler is used for dibbling. It is a conical instrument that makes proper holes in the seedbed. This method is usually used to sow vegetables.

Another method of sowing the seeds is with the help of a simple device consisting of a bamboo tube with a funnel on it attached to a plough. As the plough moves over the field, the tube attached to it leaves the seeds kept in the funnel at proper spacing and depth. The plough keeps making furrows in the soil in which the seeds are dropped by the seed drill.

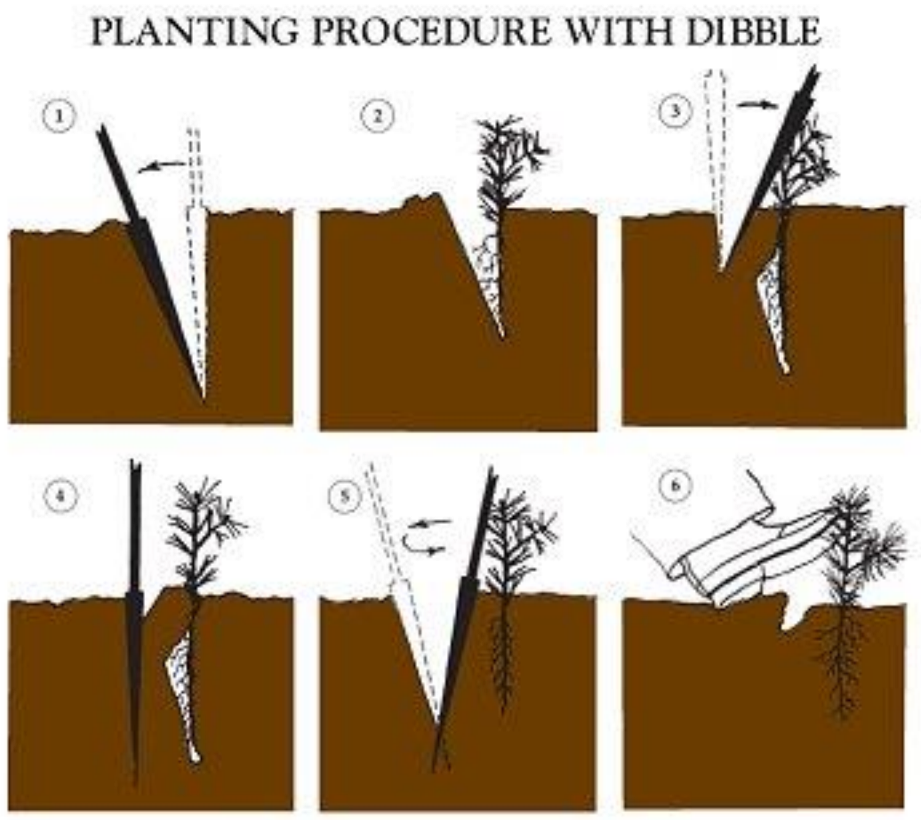

Fig. 1.1.2.2 Dibbling of Seeds

Transplanting

In this process, the seedlings are first planted in nurseries and then planted in the prepared fields. It is usually done to grow vegetables and flowers. A transplanter is used for the purpose. But, this process is time-consuming.

Fig. 1.1.2.3 Transplanting of Plants

Prepration of broad beds

Rainwater in furrows

Crop stand with BBF planting

FIRB planting in wheat

Fig. 1.1.2.4 Types of Planting

Hill Dropping

In this method of sowing, the selected seeds are dropped in regular spaces but not in a continuous manner.

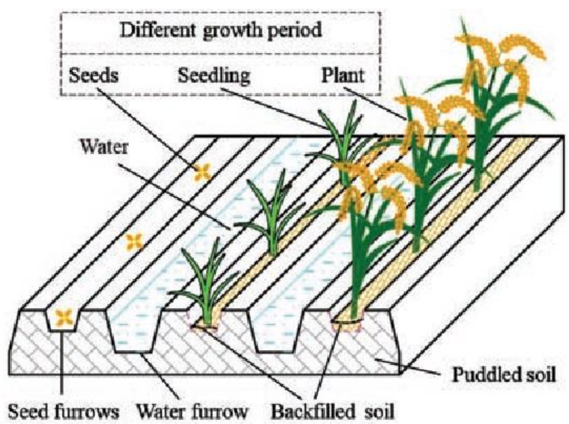

Fig. 1.1.2.5 Hill Dropping method in sowing

Check Row Planting

The seeds are planted along straight parallel furrows. A check row planter is used for the method. The row-to-row and plant-to-plant distance is uniform.

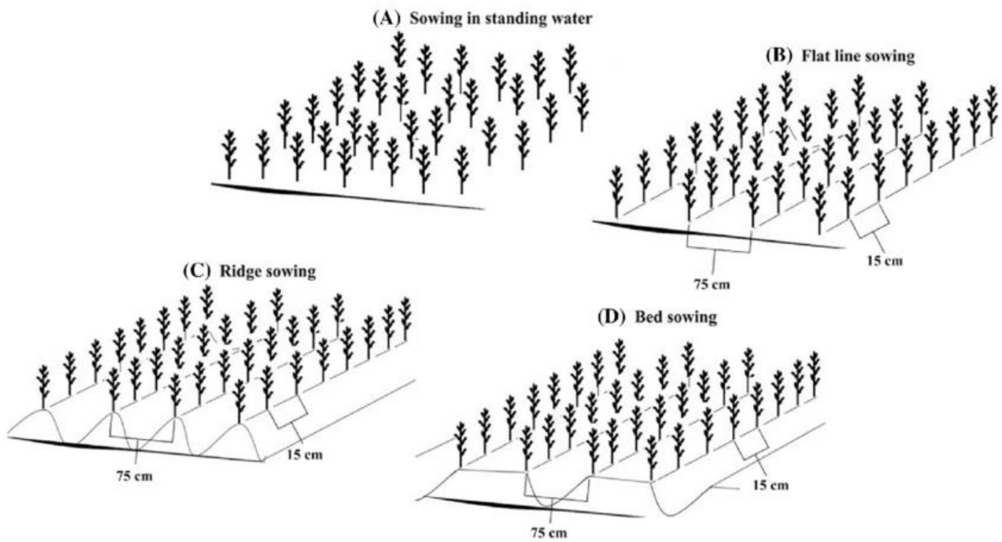

Fig. 1.1.2.6 Types in Check Row Plantation method

Seed Dropping behind the Plough

This method is commonly used in villages to sow a variety of food crops such as maize, peas, wheat, barley, and gram. Seeds are dropped in furrows behind the plough by a device known as malobansa. It comprises a bamboo tube with a funnel-shaped mouth. It needs two men to drop the seeds. One handles the bullocks and the plough and the other drops the seeds. However, this method consumes a lot of time and is labor-intensive.

Fig. 1.1.2.7 Traditional Seed Dropping method

Drilling

The seeds are dropped into furrow lines in a continuous flow and are then covered with soil. This is done either mechanically or manually. The proper amount of seeds is sown at proper depths and proper spaces. Drilling can be done in the following ways:

- Sowing behind the plough
- Bullock-drawn seed drills
- Tractor-drawn seeds drills

Fig. 1.1.2.8 Drilling Technique by using tractor with seed drill

The above sowing methods have some disadvantages which are as follows

1. No control over the depth of seed placement.
2. No uniformity in the distribution of seed placement.
3. Loss of seeds.
4. No proper germination of seeds
5. More labour requirement
6. The time required for sowing is more.

7. During sheriff sowing, Placement of seeds at uneven depth may result in poor emergence because subsequent rains bring additional soil cover over the seed and affect plant emergence.

An effective sowing method can yield good results for different variety of crops. An effective sowing method should maintain the proper row spacing, plant density, seed rate, plant population etc. When these parameters are controlled there is an increase in the yield of different crops. Some of the parameters which affect the yield of wheat, soybean and chickpea are sowing date, plant population, plant density, row spacing, plant spacing seed rate etc.

1.1.3 TRADITIONAL SOWING METHODS

Traditional methods include broadcasting manually, opening furrows by a country plough and dropping seeds by hand, known as ‘Kera’, and dropping seeds in the furrow through a bamboo/metal funnel attached to a country plough. For sowing in small areas dibbling (making holes or slits with a stick or tool and dropping seeds by hand) is practiced.The conventional method for seeding is manual but the manual seed filling method suffers from various problems. Conventional techniques depend on human power and old techniques, it requires more time and more effort. Humans need rest, they may not be able to work in hazardous environments also large-sized wheels required in muddy soil which may be compact the soil. In agriculture, we require skilled manpower. The need for manpower can be accomplished by automating the process of soil loosening and sowing seeds by a robot. So conventional systems suffer from various problems. Multi-row traditional seeding devices with manual metering of seeds are quite popular with experienced farmers.

Hand Sowing

Hand sowing or (planting) is the process of casting handfuls of seed over the prepared ground or broadcasting. Usually, a drag or harrow is employed to incorporate the seed into the soil. Though labour-intensive for any but small areas, this method is still used in some situations. Practice is required to sow evenly and at the desired rate. A hand seeder can be used for sowing, though it is less of a help than it is for the smaller seeds of grasses and legumes. Hand sowing may be combined with pre-sowing in seed trays. This allows the plants to come to strength indoors during cold periods (eg spring in temperate countries).

Fig.1.1.3.1 Traditional Hand Sowing

Seed Drill

In agriculture, most seed is now sown using a seed drill, which offers greater precision; the seed is sown evenly and at the desired rate. The drill also places the seed at a measured distance below the soil, so that less seed is required. The standard design uses a fluted feed metering system, which is volumetric; individual seeds are not counted. Rows are typically about 10–30 cm apart, depending on the crop species and growing conditions. Several row opener types are used depending on soil type and local tradition. Grain drills are most often drawn by tractors, but can also be pulled by horses. Pickup trucks are sometimes used since a little draft is required.

A seed rate of about 100 kg of seed per hectare (2 bushels per acre) is typical, though rates vary considerably depending on crop species, soil conditions, and farmer's preference. Excessive rates can cause the crop to lodge, while too thin a rate will result in poor utilisation of the land, competition with weeds and a reduction in the yield.

Open-field planting refers to the form of sowing used historically in the agricultural context whereby fields are prepared generically and left open, as the name suggests, before being sown directly with seed. The seed is frequently left uncovered at the surface of the soil before germinating and therefore exposed to the prevailing climate and conditions like storms etc. This is in contrast to the seedbed method used more commonly in domestic gardening or more specific (modern) agricultural scenarios where the seed is applied beneath the soil surface and monitored and manually tended frequently to ensure more successful growth rates and better yields.

Pre-treatment of seed and soil before sowing

Before sowing, certain seeds first require treatment before the sowing process. This treatment may be seed scarification, stratification, seed soaking or seed cleaning with cold (or medium hot) water.

Seed soaking is generally done by placing seeds in medium hot water for at least 24 to 48 hours. Seed cleaning is done especially with fruit, as the flesh of the fruit around the seed can quickly become prone to attack from insects or plagues. Seed washing is generally done by submerging cleansed seeds for 20 minutes in 50 degrees Celsius water. This (rather hot than moderately hot) water kills any organisms that may have survived on the skin of a seed. Especially with easily infected tropical fruit such as lychees and rambutans, seed washing with high-temperature water is vital.

In addition to the mentioned seed pretreatments, seed germination is also assisted when a disease-free soil is used. Especially when trying to germinate difficult seeds (e.g. certain tropical fruit), prior treatment of the soil (along with the usage of the most suitable soil; e.g. potting soil, prepared soil or other substrates) is vital. The two most used soil treatments are pasteurisation and sterilisation. Depending on the necessity, pasteurisation is to be preferred as this does not kill all organisms. Sterilisation can be done when trying to grow truly difficult crops. To pasteurise the soil, the soil is heated for 15 minutes in an oven of 120 °C.

Traditional sowing methods have the following limitations

1. A In manual seeding, it is not possible to achieve uniformity in the distribution of seeds. A farmer may sow at desired seed rate but inter-row and intra – row distribution of seeds is likely to be uneven resulting in bunching and gaps in the field.
2. Poor control over depth of seed placement.
3. It is necessary to sow at high seed rates and bring the plant population to the desired level by thinning.
4. Labour requirement is high because two persons are required for dropping seed and fertilizer.
5. The effect of inaccuracies in seed placement on plant stand is greater in case of crops sown under dry farming conditions. During Kharif sowing, placement of seeds at uneven depth may result in poor emergence because subsequent rains bring additional soil cover over the seed and affect the plant.
6. The Weight of the Machine is more.
7. Available for Tractors drive.
8. No Arrangement for depth control.
9. No Arrangement for seedbed preparation.
10. Improper compaction of soil over furrows.
11. Adjustment of row spacing is improper.
12. The cost of the machine is more

1.2 WORKING PRINCIPLE

It works on a simple mechanism, a battery-operated D.C. motor is used to transmit the rotary motion to the Wheel. When the farmer puts seeds into the hopper. As the seed hopper rotates, seed drops in the seed pipe, which is connected to the furrow opener for the seeding. A seed drill is used to drill a hole at a particular distance so that the seed drops at a certain distance. A seed drill is a device used in agriculture that sows seeds for crops by positioning them in the soil and burying them to a specific depth. This ensures that seeds will be distributed evenly. The seed drill sows the seeds at the proper seeding rate and depth, ensuring that the seeds are covered by soil. Also, a water pump is used to spray water after the seed drops.

1.3 USE OF SEED SOWING MACHINE

The Automated seed sowing technology is a method designed to reduce human efforts as it requires less amount of manmade labour and can be handled efficiently without a skilled operator. Seeding manually requires lots of time, therefore this technology develops which eradicated much amount of time with proper efficiency, less time consumption, and accuracy in sowing seeds at a specific distance.

Seed sowing machine reduces the time and effort in the cultivation of the crops. There may be single or multiple crops according to the type of soil and kind of location. Hence to sow the seeds in the agriculture field for multiple crops, a capable and efficient seed sowing machine is mandatory.
A seed drill is a device used in agriculture that sows seeds for crops by positioning them in the soil and burying them to a specific depth. This ensures that seeds will be distributed evenly. The seed drill sows the seeds at the proper seeding rate and depth, ensuring that the seeds are covered by soil.

Fig.1.3.1 Tractor using Seed Drill for Drilling method of sowing

1.4 FUNCTIONS OF SEED SOWING MACHINE AND PLANTERS

Improved seed-cum-fertilizer drills are provided with seed and fertilizer boxes, metering Mechanism, furrow openers, covering devices, frame, ground drive system and controls for Variation of seed and fertilizer rates. Other researchers evaluate that depending upon climatic and Soil conditions, seeds are shown on well-prepared and levelled fields, on ridges, in furrows or on beds. To achieve the best performance from a seed drill or planter, the important factors Are to be optimized by proper design and selection of the components required on the Machine to suit the needs of the crops. The seed drill or planter can play an important role in manipulating the physical environment. The metering system selected for the seed should not Damage the seed while in operation the functions of a well-designed seed drill or planter are as follows: Meter seeds of different sizes and shapes, Place the seed in the acceptable pattern of distribution in the field, Place the seed accurately and uniformly at the desired depth in the soil and cover the seed and compact the soil around it to enhance germination and emergence.

Fig.1.4.1 Tractor using pesticide sprayer and seed drill

1.5 IMPACT OF SEED SOWING MACHINE

The invention of the seed drill dramatically improved germination. The seed drill employed a series of runners spaced at the same distance as the ploughed furrows. These runners, or drills, opened the furrow to a uniform depth before the seed was dropped. Behind the drills were a series of presses, metal discs which cut down the sides of the trench into which the seeds had been planted, covering them over.

This innovation permitted farmers to have precise control over the depth at which seeds were planted. This greater measure of control meant that fewer seeds germinated early or late and that seeds were able to take optimum advantage of available soil moisture in a prepared seedbed. The result was that farmers were able to use less seed and at the same time experience larger yields than under the broadcast methods.

The seed drill allows farmers to sow seeds in well-spaced rows at specific depths at a specific speed rate; each tube creates a hole of a specific depth, drops in one or more seeds, and covers it over. This invention gives farmers much greater control over the depth that the seed is planted and the ability to cover the seeds without back-tracking. The result is an increased rate of germination, and a much-improved crop yield (up to eight times).

The use of a seed drill also facilitates weed control. Broadcast seeding results in a random array of growing crops, making it difficult to control weeds using any method other than hand weeding. A field planted using a seed drill is much more uniform, typically in rows, allowing weeding with a hoe during the growing season. Weeding by hand is laborious and inefficient. Poor weeding reduces crop yield, so this benefit is extremely significant.

1.6 WHAT IS AN EMBEDDED SYSTEM?

A combination of computer hardware and software, and perhaps additional mechanical or other parts, designed to perform a dedicated function. Most of the controlling systems, today, are embedded systems. The complexity of the systems may differ from to the other.

1.5.1 BRIEF HISTORY

The first recognizably modern embedded system was the Apollo Guidance Computer, developed by Charles Stark Draper at the MIT instrumentation Laboratory. The first mass-produced embedded system was the autonetics D-17 guidance Computer for the Minuteman (missile), released in 1961. It was built from transistor logic and had a hard disk for main memory. Since these early applications in the 1960s, embedded systems have come down in price. There has also been an enormous rise in processing power and functionality. In 1978 National Engineering Manufacturers Association released the standard for a programmable microcontroller. The definition was an almost any Computer –based controller. They included single board Computers, numerical controllers and sequential controllers in order to perform event-based instructions. By the mid-1980s, many of the previously external system components had been integrated into the same chip as the processor, resulting in integrated circuits called microcontrollers, and wide spread use of embedded systems became feasible. Presently, a lot of varieties of embedded systems are available at very low costs.

1.5.2 CHARACTERSTICS

Embedded systems are designed to do some specific task. Some also have real time performance constraints that must be met, for reason such as safety and 2

usability; others may have low or no performance requirements, allowing the system hardware to be simplified to reduce cost. The software written for embedded systems is often called firmware, and is stored in read-only memory or flash memory chips rather than a disk drive. It often runs with limited computer hardware resources: small or no keyboard, screen, and little memory.

1.5.3 EMBEDDED SOFTWARE ARCHITECTURES

There are several different types of software architecture in common use. a. Simple Control Loop:

In this design, the software has a loop. The loop calls the subroutines, each of which manages a part of the hardware or software.

b. Interrupt Controlled System:

Some embedded systems are predominantly interrupt controlled. This means that tasks performed by the system are triggered by different kinds of events. An interrupt could be generated for example by a timer in a pre-defined frequency, or by a serial port controller receiving a byte.

FEATURES: The main features of an embedded system are its reliability and the scope for debugging.

DEBUGGING: Debugging may be performed at different levels, depending on the facilities available, ranging from assembly or source-level Debugging with an in-circuit emulator or in circuit Debugger, to outputs from serial debug ports to an emulated environment running on a PC. As the complexity of embedded systems grows, higher level tools and Operating systems or migrating into machinery where it makes sense.

1.5.4 RELIABILITY

Embedded systems often reside in machines that are expected to run continuously for years without errors and in some cases recover by themselves if any error occurs. Therefore the software is usually developed and tested more carefully than that for PC, and unreliable mechanical moving parts such as Disk drives, switches or buttons are avoided. Specific reliability issues may include: The system cannot safely be shut down for repair, or it is too inaccessible to repair. Solutions may involve subsystems with redundant spares that can be switched over to, or software ―limp modes‖ that provide partial function. Examples include space systems, undersea cables, navigational beacons, bore-hole systems and automobiles. The system must be kept running for safety reasons. ―Limp modes‖ are less tolerable. Often backups are selected by an operator. Examples include Aircraft, Navigation, Reactor control systems, safety-critical Chemical factory controls, Train signals and engines on single-engine Aircraft.

The system will lose large amounts of money when shutdown: Telephone switches, Factory controls, Bridge and elevator controls, funds transfer and market making, automated sales and service.

Physically, embedded systems ranged from portable devices such as MP3 players, to large stationary installations like traffic lights, Factory controllers. In terms of complexity embedded systems can range from very simple with a single microcontroller chip to very complex with multiple units, peripherals and networks mounted inside a large chassis or enclosure.

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Chapter – 2
Literature Review

Chapter-2 LITERATURE REVIEW

2.1 REVIEW OF PAPERS

Kyada A et al. [1]

This research paper presents design and development of manually operated seed planter machine. In this they present objective of seed planter machine design, factors affecting seed emergence, some mechanisms. The basic objective of sowing operation is to put the seed and fertilizer in rows at desired depth and seed to seed spacing, cover the seeds with soil and provide proper compaction over the seed. The recommended seed to seed spacing and depth of seed placement vary from crop to crop and for different agro-climate conditions to achieve optimum yields. From this we know that mechanical factors effects on seed germination like uniformity of depth of placement of seed, uniformity of distribution of seed along rows. In this power transmission mechanism, seed meter mechanisms, plunger mechanism etc. mechanisms" are used. The working as machine is pushed; power wheel is rotating which transmit power to plunger through chain and sprocket mechanism. Now cam is mounted on sprocket shaft which push plunger towards downward direction. Once plunger is penetrate in soil and during backward stroke flapper is opened so seed get separated from plunger and inserted in dig. From this we get idea that if we use the belt having small holes with defined thickness then it is beneficial for our project. As our automatic seed feeder is only for small seeds then using of conveyor belt with motor is useful.

Ramesh D et al. [2]

This research paper present “Agriculture Seed Sowing Equipment: A Review”. The present review provides brief information about the various types of innovations done in seed sowing equipment. The basic objective of sowing operation is to put the seed and fertilizer in rows at desired depth and seed to seed spacing, cover the seeds with soil and provide proper compaction over the seed. In this multipurpose seeding machine equipment consists of cylindrical shape container in which the seeds can fill. The container is attached on the four wheeled carrier assembly. It consists of metering plate bevel gear mechanism and two holes at the bottom depending on seed size. The working as plate will rotate in container when the bottom holes of container and meter plate hole coincide seeds will flow through pipe to soil. Here the metering plate gets rotating motion by bevel gear assembly and the bevel gears get the motion by rear wheels with the help chain and sprocket assembly.

Kannan A et al. [3]

This research paper presents design modification in multipurpose sowing machine. In this they present that for sowing purpose we import the machinery which are bulk in size having more cost. To prevent this they design multipurpose sowing machine which consists of hopper, seed metering mechanism, ground wheel, power transmission system, seed distributor, and tiller. In this they design model on PRO-E software. Actually the working is very simple as the tiller rotates it directly transmit motion to ground wheel which directly connected through main shaft. A main shaft has a disc with scoops inside the hopper. When the ground wheel rotates the main shaft also rotates with the help of power transmission system. The scoops collect the seed from hopper and leave it inside the seed distributor. The tiller is having very good contact with ground.

Marode A et al. [4]

This research paper represents "Design & Implementation of Multi Seed Sowing Machine" .In this paper gives types sowing machine. The following are the three different types of seed sowing are broadcasting: A field is initially prepared with a plough to a series of linear cuts known as furrows. The field is then seeded by throwing the seeds over the field, a method known as manual broadcasting. The result was a field planted roughly in rows, but having a large number of plants. When the seeds are scattered randomly with the help of hand on the soil, the method is called broadcasting. Dribbling: Drill sowing and dribbling (making small holes in the ground for seeds) are better method of sowing the seeds. Once the seeds are put in the holes, they are then covered with the soil. This saves time and labour and prevents the damage of seeds by birds. Another method of sowing the seeds is with the help of a simple device consisting of bamboo tube with a funnel on it attached to a plough. As the plough moves over the field the tube attached to it leaves the seeds kept in the funnel at proper spacing and depth. The plough keeps making furrows in the soil in which the seeds are dropped by the seed drill.

Rohokale A et al. [5]

Agriculture is demographically the broadest economic sector and plays a significant role in the overall economy of India. For the growth of Indian economy, mechanization is necessary. The main purpose of mechanization in the agriculture is to improve the overall productivity and production. Planning is conventionally done manually which involves humans and draught animals, this result in higher cost of cultivation and delay in planting. The purpose of this paper is to compare conventional sowing methods and modern methods. The required row to row spacing ,seed rate ,seed to seed spacing can be achieved by proposed machine. The machine reduces the human efforts.

Shriprasad B et al. [6]

This research paper presents information about modern globalization; many technologies are to update a new development based on automation which works very rigidly, high effectively and within short time period. The progressive invention in agricultural system is becoming an important task especial because of rising demand on quality of agriculture products and declining labours availability in rural farming areas. The designed system is seeding and fertilizing agriculture robot using micro controller. The aim of designed system is to seeding fertilizing and soil ph, temperature, moisture, humidity checking. The robot is controlled by remote. The designed system involves navigation of robot is controlled via remote. The robot and remote system are connected through internet system. DC motors are used for navigation of the robot. The speed of DC motor is controlled using controller. The solenoid is used to control seeding fertilizing. This paper gives idea about the automation and use of motor for movement of belt conveyor.

2.2 THE KNOWLEDGE GAP IN EARLIER INVESTIGATION

The extensive literature survey presented above reveals the following knowledge gap in the research reported so far:

- The recommended seed to seed spacing and depth of seed placement vary from crop to crop and for different agro-climate conditions to achieve optimum yields.

- Dribbling is a better method of sowing where seeds are put in the holes, which are then covered with the soil, saving time and labour.
- The required row to row spacing, seed rate, seed to seed spacing can be achieved by mechanization in the agriculture. The machine reduces the human efforts.
- The robot is controlled by remote using micro controller to check seeding, fertilizing and soil's ph, temperature, moisture, humidity.

2.3 OBJECTIVES OF PRESENT WORK

The knowledge gap in the existing literature summarized above has helped to set the objectives of this research work which are outlined as follows:

- To make the development of our farmers as well as nation sustainable and cause less harm to our environment.
- To meet the future food demands, the farmers have to implement the new techniques which will not affect the soil texture but will increase the overall crop production.
- To design a device which increases the efficiency and reduce time consumption and also the labour involved by planting the seeds at a controlled distance using a DC motor.

***

Chapter – 3

Methodology, Design Modelling and Fabrication

Chapter–3 METHODOLOGY

3.1 METHODOLOGY (EXPERIMENTATION)

This chapter presents the Components and methods used for the fabrication of Seed Sowing Machine. The Methodology is followed by the components and parts used for fabrication and how they are used, followed by the design and drafting of the 3D model in CATIA. Also some Coding work and the code given to do the set of operations are discussed. The proposed model uses the Electrically powered DC motors placed in the wheels of the robot. The fall of seeds from the seed drum and seed sowing process takes place without any wastage of seeds. It also has a Bluetooth module to control the bot with the help of mobile to make it automatic.

Addition of Bluetooth module reduces the human intervention. Control action is provided by ARDUINO UNO which is interfered to the whole working through the USB channel. DC motors are driven by L298N driver circuit. As the technique of seed sowing with robot is good and efficient and gradually reduce the man power. Seeding depth will be accurate, this tends to no later or earlier growth of plant and yield will be of the same growth. Seeds will be sowed accurately in rows and this tends accurate plantation and causes very well growth of food and economy. The complete system becomes eco-friendly, since there is no usage of fossil fuels.

The Automatic Seed sowing Machine basically works on the principle of “VERTICAL DISCONTINOUS WORKING PRINCIPLE” which refers to the vertical movement which can be followed by an individual body in an agricultural field and implements its discontinuous action in relation to the horizontal line of work.

3.2 COMPONENTS/PARTS USED

1. ***Arduino UNO:***

The Arduino UNO is a widely used open-source micro controller board based on the AT mega 328 microcontroller and developed by Arduino. The board is equipped with sets of digital and Analog input and outputs pins that may be interfaced to various expansion boards(shields) and other circuits. The board features 14 Digital pins and 6 Analog pins. It is programmable with the Arduino IDE (Integrated Development Environment) via a type B USB cable. It can be powered by a USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts. It is also similar to the Arduino Nano and Leonardo. Layout and production files for some versions of the hardware are also available. "Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform. The ATmega328 on the Arduino Uno comes pre-programmed with a boot loader that allows to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol. The Uno also differs from all preceding boards in that it does not use the FTDI USB-to serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to serial converter.

Fig.3.2.1 Arduino Control Kit

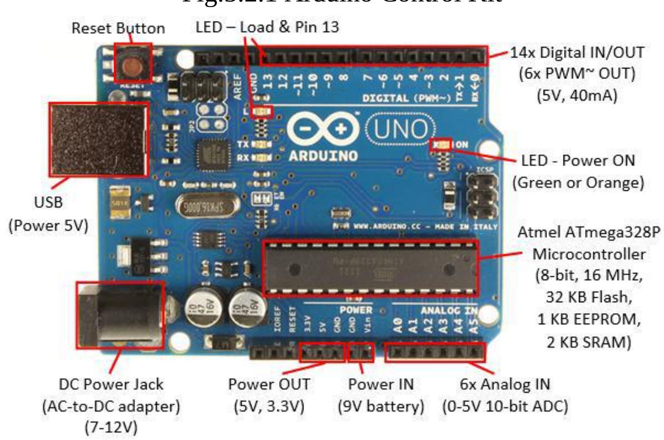

Fig.3.2.2 Arduino UNO Specifications

The Arduino programming language is an implementation of Wiring, a similar physical computing platform, which is based on the Processing multimedia programming environment.

2. ***DC Motor:***

A DC motor is a device that converts direct current (electrical energy) into mechanical energy four DC motors are used for driving the wheels connected to the robot. L298N is a dc motor driver used for driving dc motors. 30RPM Centre Shaft Economy Series DC Motor is high-quality low-cost DC geared motor. It has steel gears and pinions to ensure longer life and better wear and tear properties. The gears are fixed on hardened steel spindles polished to a mirror finish. The output shaft rotates in a plastic bushing. The whole assembly is covered with a plastic ring. Gearbox is sealed and lubricated with lithium grease and require no maintenance. The motor is screwed to the gear box from inside. Although motor gives 30 RPM at 12V, but motor runs smoothly from 6 V to 12V and gives wide range of RPM, and torque around 2kg/cm.

Fig.3.2.3 10 RPM DC Motor

Fig. 3.2.4 30,10,60 RPM DC Motor

3. ***L298N Motor Driver:***

L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. 12931) is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motor with a single L293D IC. Dual H Bridge Motor Driver integrated circuit (IC).

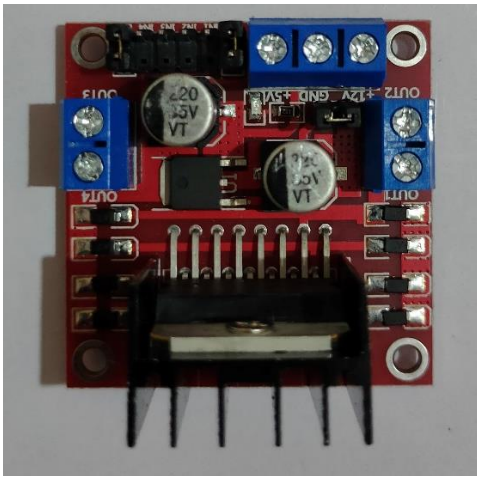

Fig. 3.2.5 L298N Motor Drive

It is a dual H bridge motor driver integrated circuit (IC). Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher current signal. This higher current signal is used to drive the motors.

FEATURES

- Driver: L298N
- Driver power supply: +5V~+46V
- Driver Io: 2A
- Logic power output Vss: +5~+7V (internal supply +5V)
- Logic current: 0~36mA
- Controlling level: Low -0.3V~1.5V, high: 2.3V~Vss
- Enable signal level: Low -0.3V~1.5V, high: 2.3V~Vss
- Max power: 25W (Temperature 75 cesus)
- Working temperature: -25C~+130C
- Dimension: 60mm*54mm
- Driver weight: ~48g
- Other extensions: current probe, controlling direction indicator, pull-up resistoer switch, logic part power supply.

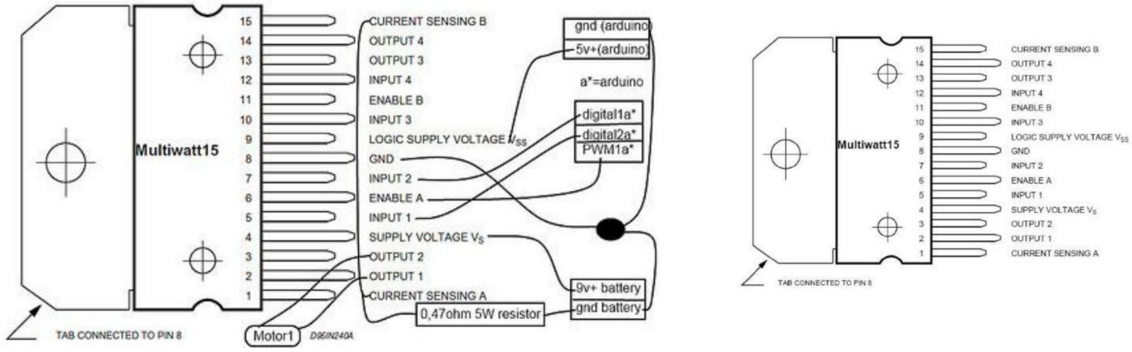

Fig. 3.2.6 Images/Pinout of L298 H-Bridge Motor Driver IC

4. ***Bluetooth module:***

The Android app is designed to send serial data to the Arduino Bluetooth module when a button is pressed on the app, the Arduino Bluetooth module at the other end receives the data and sends it to the Arduino through the TX pin of the Bluetooth module (connected to RX pin of Arduino).

Fig. 3.2.7 Bluetooth Module HC-05

We used HC-05 Bluetooth Module in our Module. HC-05 Bluetooth Module is an easy to use. Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. Its communication is via serial communication which makes an easy way to interface with controller or PC. This module works on 3.3 V. We can connect 5V supply voltage as well since the module has on board 5 to 3.3 V regulator. As HC-05 Bluetooth module has 3.3 V level for RX/TX and microcontroller can detect 3.3 V level, so, no need to shift transmit level of HC-05 module.

a) Hardware Features

- Typical -80dBm sensitivity
- Up to +4dBm RF transmit power
- Low Power 1.8V Operation ,1.8 to 3.6V I/O
- PIO control
- UART interface with programmable baud rate
- With integrated antenna

b) Software Features

- Default Baud rate: 38400, Data bits:8, Stop bit:1,Parity:No parity, Data control: has supported baud rate: 9600, 19200, 38400, 57600, 115200, 230400,460800
- Given a rising pulse in PIO0, device will be disconnected
- Status instruction port PIO1: low-disconnected, high-connected;
- PIO10 and PIO11 can be connected to red and blue led separately. When master and slave are paired, red and blue led blinks 1time/2s in interval, while disconnected only blue led blinks 2times/s.
- Auto-connect to the last device on power as default.
- Permit pairing device to connect as default.
- Auto-pairing PINCODE: “0000” as default
- Auto-reconnect in 30 min when disconnected as a result of beyond the range of connection.

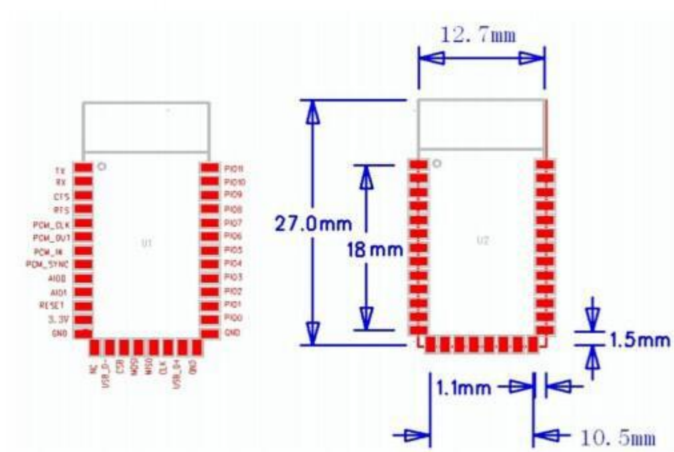

Fig. 3.2.8 Hardware schematics of HC-05

5. ***12v DC submersible Pump:***

A submersible pump pushes water to the surface by converting rotary energy into Kinetic Energy into Pressure Energy. This is done by the water being pulled into the pump first in the take, where the rotation of the impeller pushes the water through the diffuser. From there it goes to the surface. The water pump when used when running will pull about 5 Amps at 12 volts or about 60watts. The good news, is that the water pump usually only runs for a few minutes at most. Thus, it is a relatively small load.

Fig. 3.2.9 12v DC Submersible Pump

- Voltage: 12 V
- Maximum lift: 40-110cm / 15.75"-43.4"
- Flow rate: 80-120L/H
- Outside diameter: 7.5mm / 0.3"
- Inside diameter: 5mm / 0.2"
- Diameter: Approx. 24mm / 0.95"
- Length: Approx. 45mm / 1.8"
- Height: Approx. 30mm / 1.2"
- Material: Engineering plastic
- Driving mode: DC design, magnetic driving

6. ***Battery :***

An electric battery is a device consisting of one or more electrochemical cells that convert stored chemical energy into electrical energy. Each cell contains a positive terminal, or cathode, and a negative terminal, or anode. Electrolytes allow ions to move between the electrodes and terminals, which allows current to flow out of the battery to perform work. Battery: 7 Amp Hour 12 Volts Sealed Lead Acid Battery.

Fig. 3.2.10 Electric Battery

3.3 SOFTWARE CODING

The Arduino Uno can be programmed with the Arduino software. The ATmega328 on the Arduino Uno comes pre burned with a boot loader that allows you to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol (reference, C header files).We can also bypass the boot loader and program the microcontroller through the ICSP (In-Circuit Serial Programming) header; see these instructions for details.

3.3.1 CONNECTIONS

1. The +Vcc pin of the Bluetooth module is connected to the 3.3 volts pin of the Arduino.
2. The GND pin of the Bluetooth module is connected to the Ground pin of the Arduino.
3. The RX pin is connected to the TX pin on the Arduino.
4. The TX pin is connected to the RX pin on the Arduino.

5. The Vcc pin on the motor driver module is connected to 5volts pin on the Arduino.
6. The GND pin on the motor driver is connected to GND pin on Arduino.
7. The 12Volts pin on motor driver board is connected to Vin pin on Arduino.
8. The input pin A1 on motor driver is connected to digital pin 4 on Arduino.
9. The input pin A2 on motor driver is connected to digital pin 3 on Arduino.
10. The input pin B1 on motor driver is connected to digital pin 6 on Arduino.
11. The input pin B2 on motor driver is connected to digital pin 5 on Arduino.
12. The output ports A1 and A2 are connected to motors on the right side of the Robot Base.
13. The output ports B1 and B2 are connected to motors on the left side of the Robot Base.
14. The input pin C1 on motor driver is connected to digital pin 7 on Arduino.
15. The input pin C2 on motor driver is connected to digital pin 8 on Arduino.
16. The input pin D1 on motor driver is connected to digital pin 9 on Arduino.
17. The input pin D2 on motor driver is connected to digital pin 10 on Arduino.
18. The output ports C1 and C2 are connected to motors on the right side of the Robot Gripper.
19. The output ports D1 and D2 are connected to motors on the left side of the Robot Shoulder.

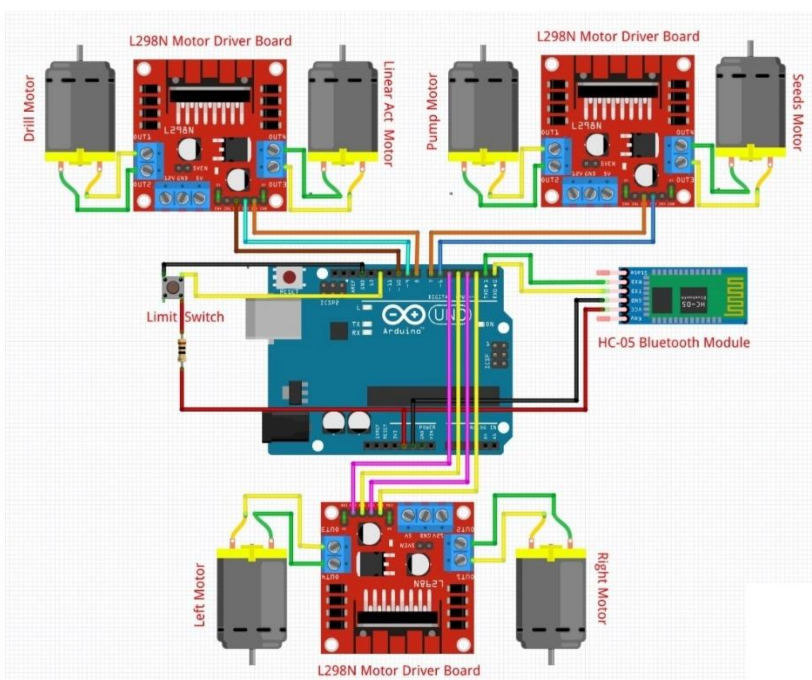

Fig.3.3.1 Connections of Circuit Board

3.3.2 PROCEDURE

1. Connect the power supply jack from the battery to the DC input on the Arduino.
2. Switch on the Bluetooth on the mobile and pair it with the corresponding HC-05 module.
3. Now click on the Bluetooth controller application on the mobile
4. After the app opens, click on proceed button and select the corresponding Bluetooth.
5. Then switch to the gesture mode on the app and enter the values as 1 for forward gesture, 2 for back gesture, 3 for left and 4 for right gesture.
6. Then press save button and then the start button
7. Now slowly tilt the mobile in the required direction and the movement can be observed correspondingly.

3.4 PROGRAM FOR THE PROJECT

```
#define pin1 2

#define pin2 3

#define pin3 4

#define pin4 5


#define pw1 9     // Drill Up

#define pw2 8     // Drill Down

#define pw3 10    // Drill Run

#define pw4 6     // Seeds Run

#define pw5 7     // Water Run


int DrilCh = 12;  // DrillCheck
```

```
char i;


int Flag1 = 0;

int Flag2 = 0;


void setup()

{

  pinMode(pin1, OUTPUT);

  pinMode(pin2, OUTPUT);

  pinMode(pin3, OUTPUT);

  pinMode(pin4, OUTPUT);


    digitalWrite(pin1, LOW);

    digitalWrite(pin2, LOW);

    digitalWrite(pin3, LOW);

    digitalWrite(pin4, LOW);


  pinMode(pw1, OUTPUT);

  pinMode(pw2, OUTPUT);
```

```
  pinMode(pw3, OUTPUT);
  pinMode(pw4, OUTPUT);
  pinMode(pw5, OUTPUT);

    digitalWrite(pw1, HIGH);
    digitalWrite(pw2, LOW);
    digitalWrite(pw3, LOW);
    digitalWrite(pw4, LOW);
    digitalWrite(pw5, LOW);

  pinMode(DrilCh,   INPUT);

  Serial.begin(9600);
}

void loop()
{

  if(digitalRead(DrilCh)==HIGH && Flag2 == 0)
  {
    Flag2 = 1;
```

```
  digitalWrite(pw1, LOW);
 }


 if (Serial.available())
 {
  i = Serial.read();


  switch (i)
  {
    case 'F':
      digitalWrite(pin1, HIGH);
      digitalWrite(pin4, HIGH);
      break;


    case 'R':
      digitalWrite(pin1, HIGH);
      digitalWrite(pin3, HIGH);
      break;


    case 'L':
      digitalWrite(pin2, HIGH);
```

```
  digitalWrite(pin4, HIGH);
  break;

case 'B':
  digitalWrite(pin2, HIGH);
  digitalWrite(pin3, HIGH);
  break;

case 'S':
  digitalWrite(pin1, LOW);
  digitalWrite(pin2, LOW);
  digitalWrite(pin3, LOW);
  digitalWrite(pin4, LOW);
  digitalWrite(pw1, LOW);
  digitalWrite(pw2, LOW);
  digitalWrite(pw3, LOW);
  digitalWrite(pw4, LOW);
  digitalWrite(pw5, LOW);
  break;

case 'A':
```

```
  Flag1 = 1;
  break;

case 'a':
  Flag1 = 0;
  digitalWrite(pin1, LOW);
  digitalWrite(pin2, LOW);
  digitalWrite(pin3, LOW);
  digitalWrite(pin4, LOW);
  digitalWrite(pw1, LOW);
  digitalWrite(pw2, LOW);
  digitalWrite(pw3, LOW);
  digitalWrite(pw4, LOW);
  digitalWrite(pw5, LOW);
  break;

case 'U':
  digitalWrite(pw1, HIGH);
  digitalWrite(pw3, HIGH);
  break;
```

```
    case 'D':
      digitalWrite(pw2, HIGH);
      digitalWrite(pw3, HIGH);
      break;

    case 'C':
      digitalWrite(pw4, HIGH);
      break;

    case 'P':
      digitalWrite(pw5, HIGH);
      break;

  }
 }

// AUTO RUN Function Start Running

   if(Flag1 == 1)
    {
    digitalWrite(pin1, HIGH);
```

```
digitalWrite(pin2, LOW);
digitalWrite(pin3, LOW);
digitalWrite(pin4, HIGH);
digitalWrite(pw1, LOW);
digitalWrite(pw2, LOW);
digitalWrite(pw3, LOW);
digitalWrite(pw4, LOW);
digitalWrite(pw5, LOW);
delay(2000);

digitalWrite(pin1, LOW);
digitalWrite(pin2, LOW);
digitalWrite(pin3, LOW);
digitalWrite(pin4, LOW);
digitalWrite(pw1, LOW);
digitalWrite(pw2, LOW);
digitalWrite(pw3, LOW);
digitalWrite(pw4, LOW);
digitalWrite(pw5, LOW);
delay(1000);
```

```
digitalWrite(pin1, LOW);
digitalWrite(pin2, LOW);
digitalWrite(pin3, LOW);
digitalWrite(pin4, LOW);
digitalWrite(pw1, LOW);
digitalWrite(pw2, HIGH);
digitalWrite(pw3, HIGH);
digitalWrite(pw4, LOW);
digitalWrite(pw5, LOW);
delay(2000);


digitalWrite(pin1, LOW);
digitalWrite(pin2, LOW);
digitalWrite(pin3, LOW);
digitalWrite(pin4, LOW);
digitalWrite(pw1, LOW);
digitalWrite(pw2, LOW);
digitalWrite(pw3, LOW);
digitalWrite(pw4, LOW);
digitalWrite(pw5, LOW);
delay(1000);
```

```
digitalWrite(pin1, LOW);
digitalWrite(pin2, LOW);
digitalWrite(pin3, LOW);
digitalWrite(pin4, LOW);
digitalWrite(pw1, HIGH);
digitalWrite(pw2, LOW);
digitalWrite(pw3, HIGH);
digitalWrite(pw4, LOW);
digitalWrite(pw5, LOW);
delay(2000);

digitalWrite(pin1, LOW);
digitalWrite(pin2, LOW);
digitalWrite(pin3, LOW);
digitalWrite(pin4, LOW);
digitalWrite(pw1, LOW);
digitalWrite(pw2, LOW);
digitalWrite(pw3, LOW);
digitalWrite(pw4, LOW);
digitalWrite(pw5, LOW);
```

```
delay(1000);


digitalWrite(pin1, LOW);
digitalWrite(pin2, LOW);
digitalWrite(pin3, LOW);
digitalWrite(pin4, LOW);
digitalWrite(pw1, LOW);
digitalWrite(pw2, LOW);
digitalWrite(pw3, LOW);
digitalWrite(pw4, HIGH);
digitalWrite(pw5, LOW);
delay(1000);


digitalWrite(pin1, LOW);
digitalWrite(pin2, LOW);
digitalWrite(pin3, LOW);
digitalWrite(pin4, LOW);
digitalWrite(pw1, LOW);
digitalWrite(pw2, LOW);
digitalWrite(pw3, LOW);
digitalWrite(pw4, LOW);
```

```
digitalWrite(pw5, LOW);
delay(2000);

digitalWrite(pin1, HIGH);
digitalWrite(pin2, LOW);
digitalWrite(pin3, LOW);
digitalWrite(pin4, HIGH);
digitalWrite(pw1, LOW);
digitalWrite(pw2, LOW);
digitalWrite(pw3, LOW);
digitalWrite(pw4, LOW);
digitalWrite(pw5, LOW);
delay(2000);

digitalWrite(pin1, LOW);
digitalWrite(pin2, LOW);
digitalWrite(pin3, LOW);
digitalWrite(pin4, LOW);
digitalWrite(pw1, LOW);
digitalWrite(pw2, LOW);
digitalWrite(pw3, LOW);
```

```
digitalWrite(pw4, LOW);
digitalWrite(pw5, LOW);
delay(1000);

digitalWrite(pin1, LOW);
digitalWrite(pin2, LOW);
digitalWrite(pin3, LOW);
digitalWrite(pin4, LOW);
digitalWrite(pw1, LOW);
digitalWrite(pw2, LOW);
digitalWrite(pw3, LOW);
digitalWrite(pw4, LOW);
digitalWrite(pw5, HIGH);
delay(1000);

digitalWrite(pin1, LOW);
digitalWrite(pin2, LOW);
digitalWrite(pin3, LOW);
digitalWrite(pin4, LOW);
digitalWrite(pw1, LOW);
digitalWrite(pw2, LOW);
```

```
    digitalWrite(pw3, LOW);

    digitalWrite(pw4, LOW);

    digitalWrite(pw5, LOW);

    delay(2000);

    /* */

    }

    else

    {


    }

}
```

3.5 MODELLING DESIGN PROCESS

This chapter deals with the design process of various parts and their assembly using some 3D cad software and it also includes the simulation of the mechanism using the appropriate 3D cad software.

3.5.1 DESIGN OF VARIOUS PARTS

- Design of Base
- Design of Battery
- Design of Circuit Board
- Design of Hopper Wheel
- Design of Hopper
- Design of Outer Frame
- Design of Water Tank
- Design of Wheel
- Design of Drill Bit
- Design of Drill Screw
- Design of Linear Actuator
- Design of Circuit Board Nut
- Design of Wheels Motor

3.5.1.1 Design of Base

1. Length of Base = 400mm.
2. Width of Base = 200mm.
3. Thickness of Base = 15mm.

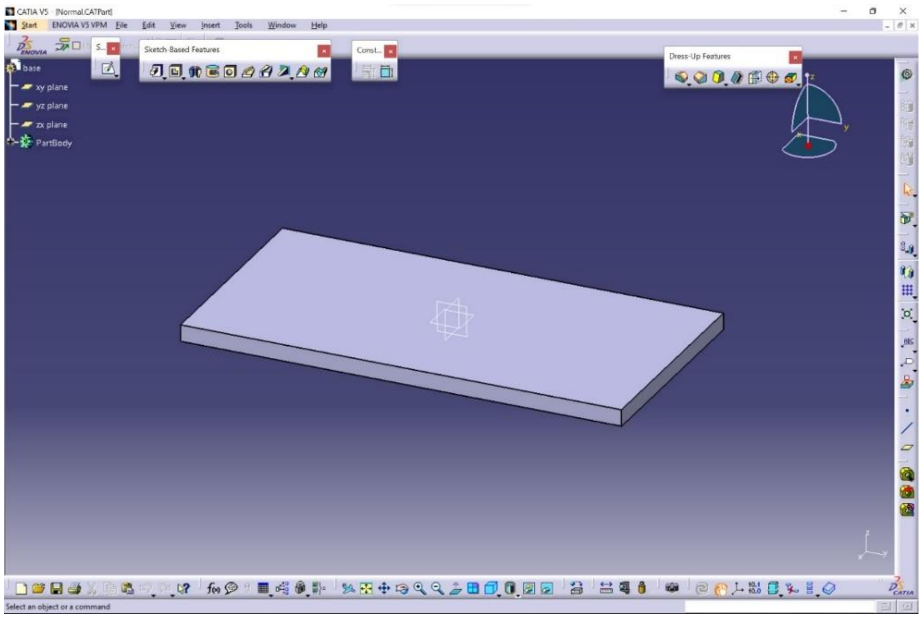

Fig.3.5.1.1.1 3D Model of Base in CATIA

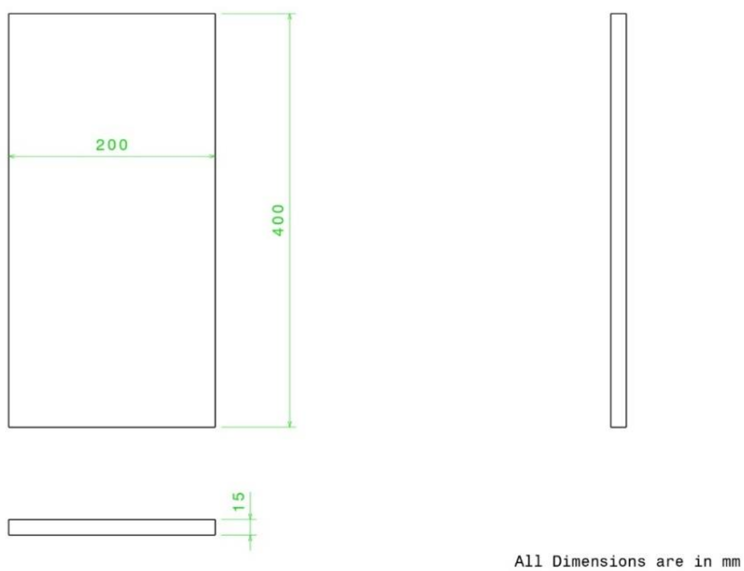

Fig. 3.5.1.1.2 Isometric Drafted Views of Base

3.5.1.2 Design of Battery

1. Length of Battery = 145mm.
2. Breadth of Battery = 65mm.
3. Height of Battery = 95mm.

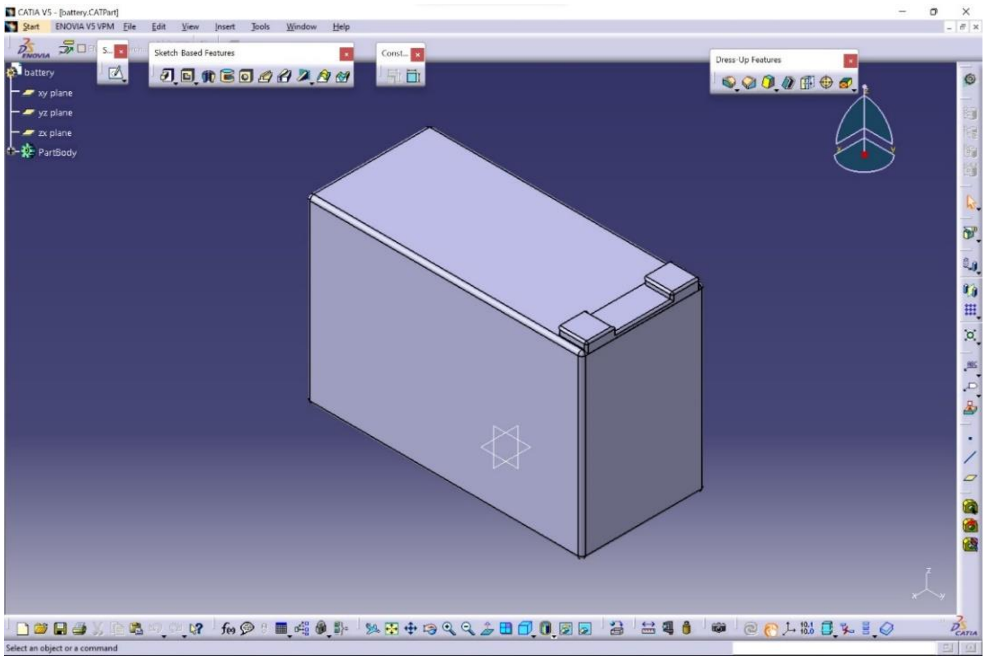

Fig. 3.5.1.2.1 3D Model of Battery in CATIA

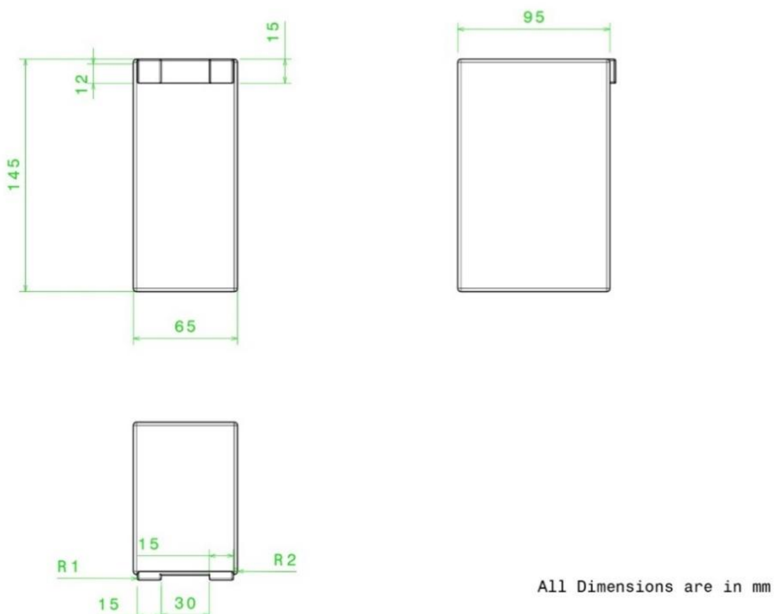

Fig. 3.5.1.2.2 Isometric Drafted Views of Battery

3.5.1.3 Design of Circuit Board

1. Length of Circuit Board = 205mm.
2. Breadth of Circuit Board = 155mm.
3. Thickness of Circuit Board = 5mm.
4. Hole diameter in Circuit Board =10mm.

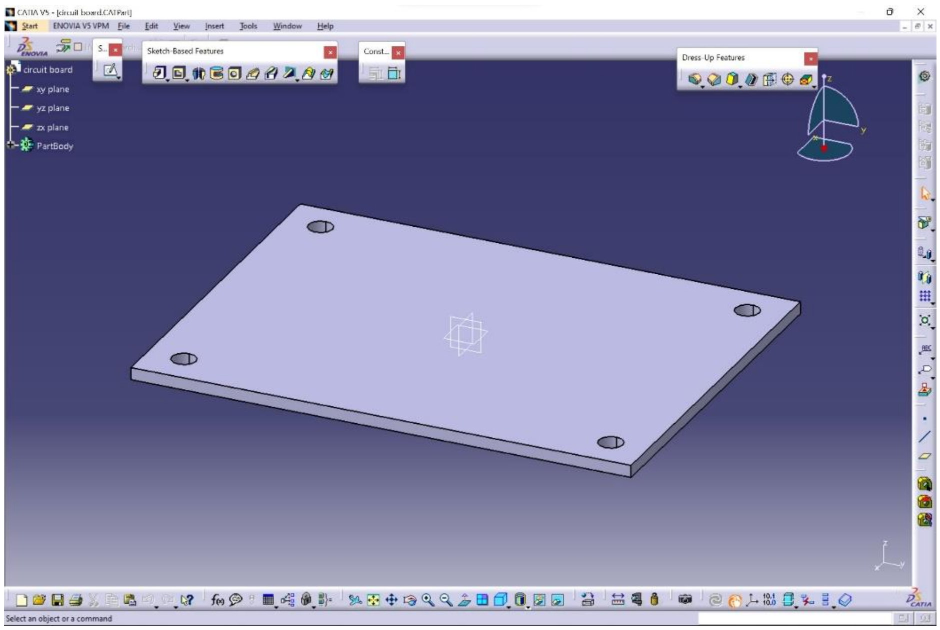

Fig.3.5.1.3.1 3D Model of Circuit Board in CATIA

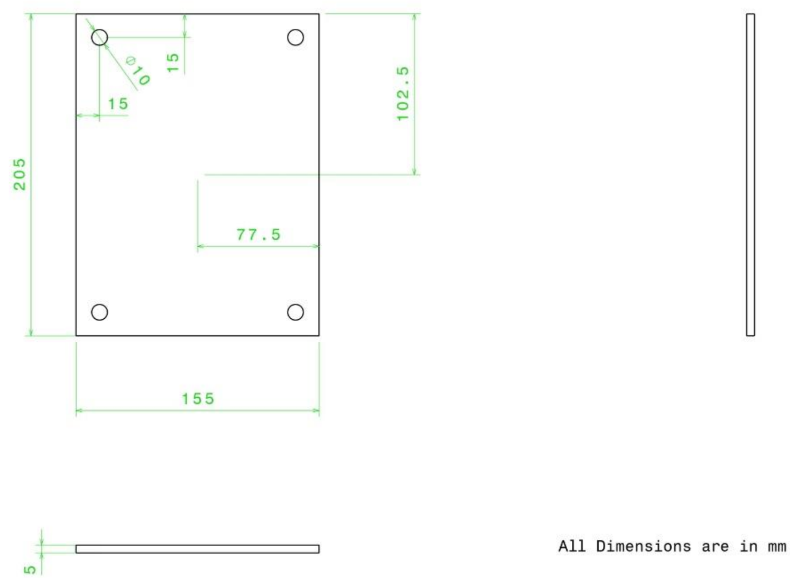

Fig.3.5.1.3.2 Isometric Drafted Views of Circuit Board

3.5.1.4 Design of Hopper Wheel

1. Inner Diameter of Hopper Wheel = 5mm.
2. Outer Diameter of Hopper Wheel = 55mm.
3. Width of Hopper Wheel = 20mm.
4. Length of Slot = 15mm.
5. Breadth of Slot = 15mm.

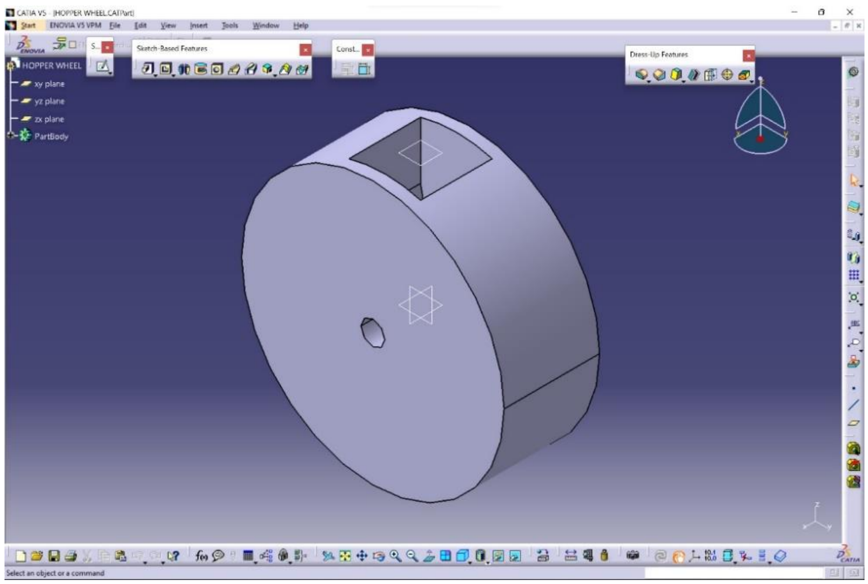

Fig.3.5.1.4.1 3D Model of Hopper Wheel in CATIA

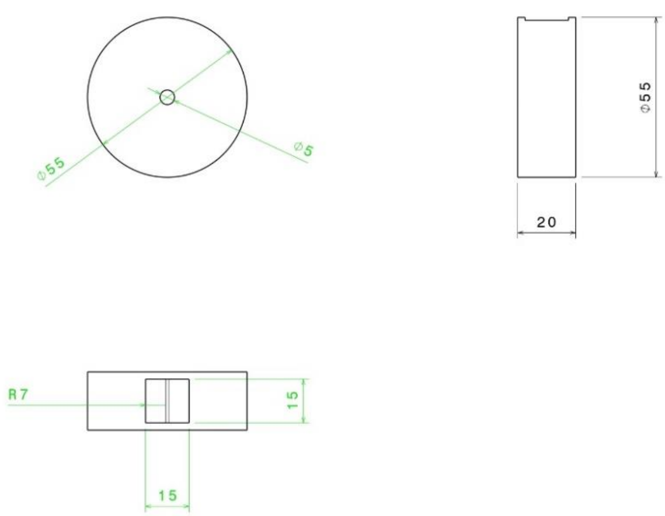

Fig. 3.5.1.4.2 Isometric Drafted Views of Hopper Wheel

3.5.1.5 Design of Hopper

1. Diameter of Hopper = 80mm.
2. Diameter of Hopper Throat = 15mm.
3. Height of Hopper = 90mm.
4. Gate Height of Hopper = 30mm.
5. Slope of Hopper Wall = 61.56°

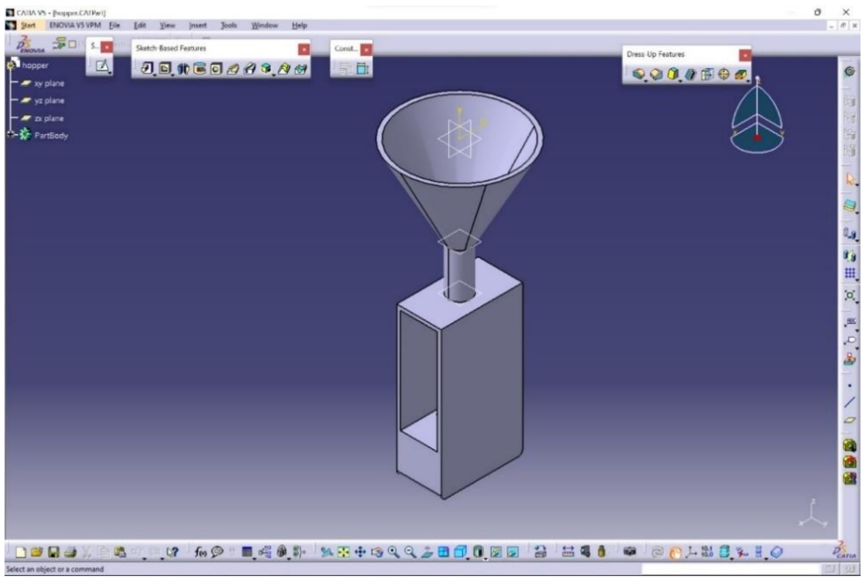

Fig.3.2.1.5.1 3D Model of Hopper in CATIA

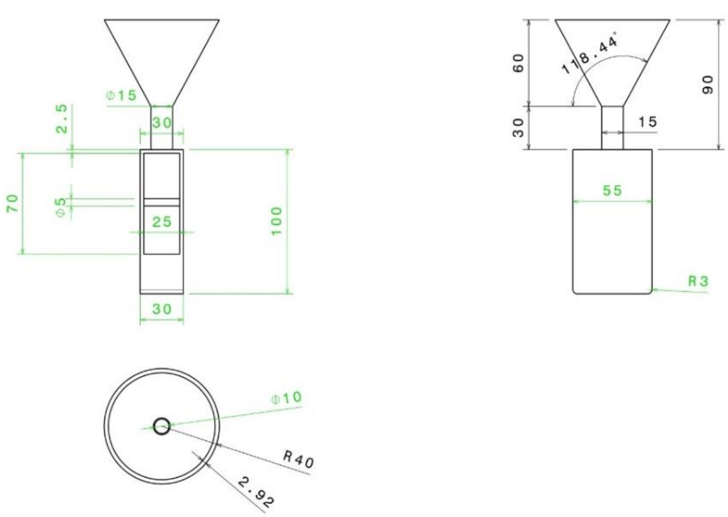

Fig. 3.2.1.5.2 Isometric Drafted Views of Hopper

3.5.1.6 Design of Outer Frame

1. Length of Outer Frame = 400mm.
2. Breadth of Outer Frame = 250mm.
3. Height of Outer Frame = 150mm.
4. Thickness of Outer Frame = 10mm.

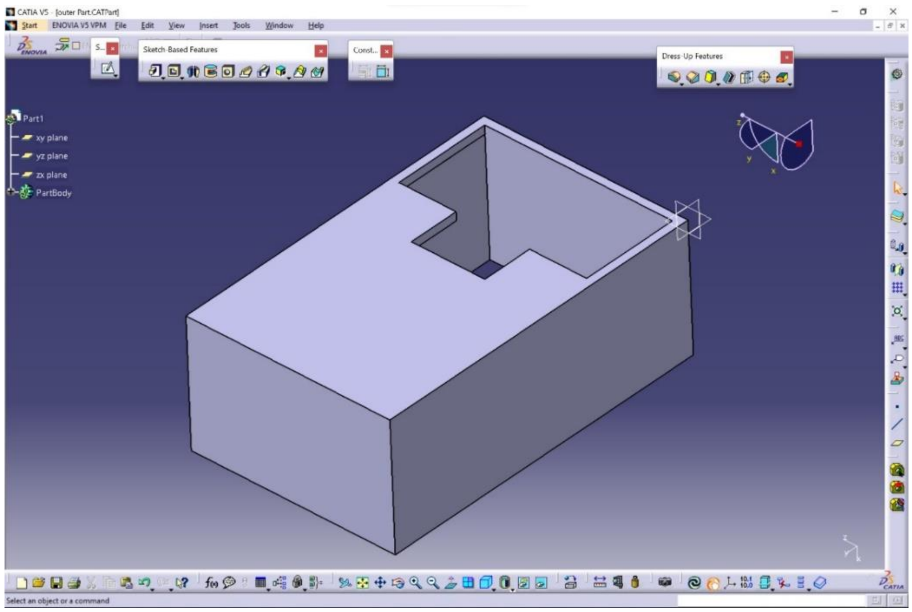

Fig. 3.2.1.6.1 3D Model of Outer Frame in CATIA

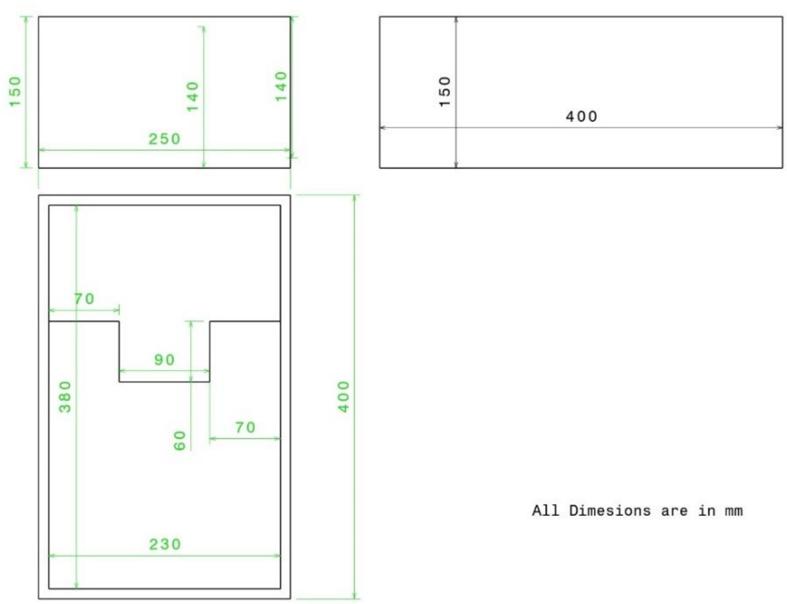

Fig. 3.2.1.6.2 Isometric Drafted Views of Outer Frame

3.5.1.7 Design of Water Tank

1. Length of Water Tank = 150mm.
2. Breadth of Water Tank = 110mm.
3. Thickness of Water Tank = 4.67mm.
4. Inner Fillet Radius of Water Tank = 2mm.

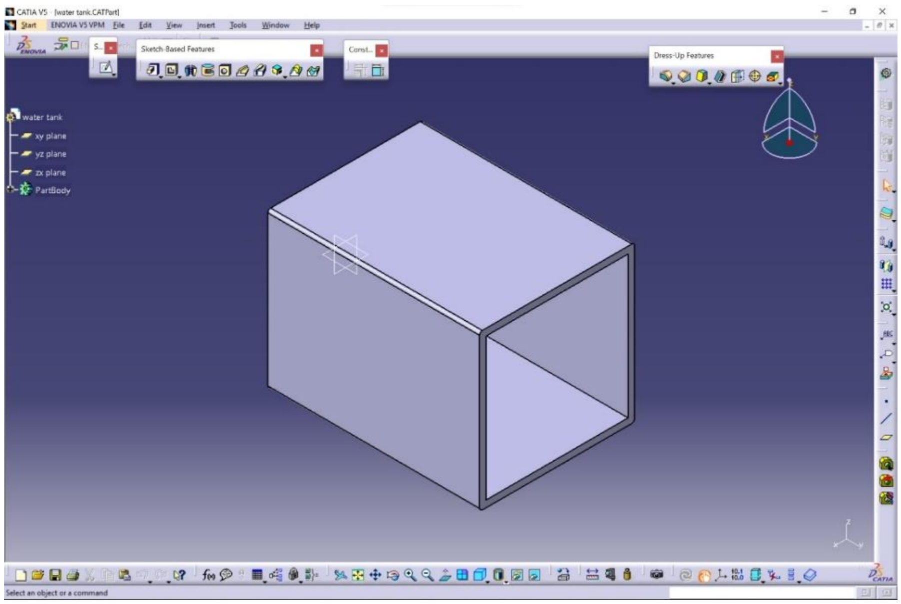

Fig. 3.2.1.7.1 3D Model of Water Tank in CATIA

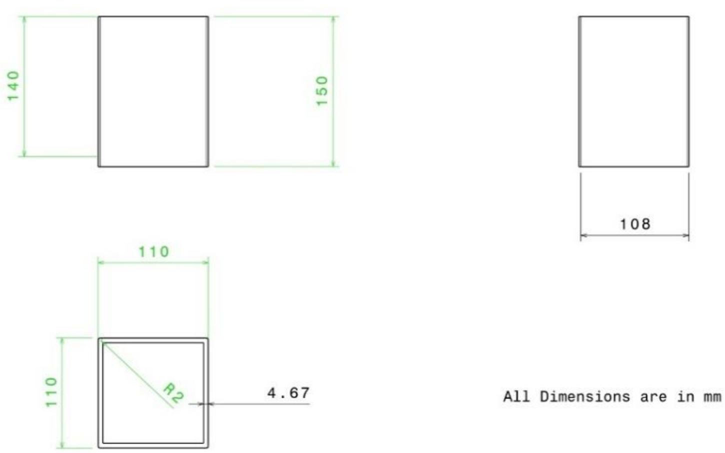

Fig. 3.2.1.7.2 Isometric Drafted Views of Water Tank

3.5.1.8 Design of Wheel

1. Tip Diameter of wheel = 220mm.
2. Root Diameter of Wheel = 200mm.
3. Reference Diameter of the wheel = 210mm.
4. Addendum of Wheel = 5mm.
5. Deddendum of Wheel = 5mm.
6. Width of Wheel = 45mm.
7. Diameter of Axle = 20mm.

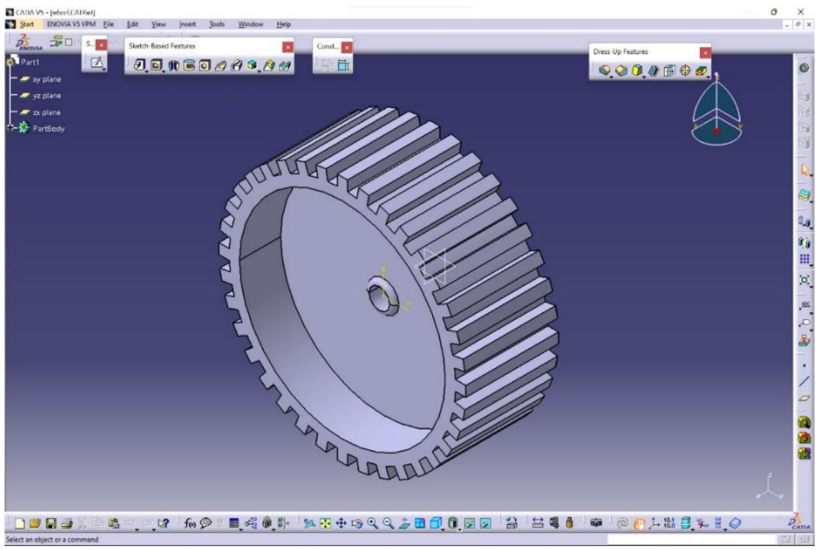

Fig. 3.2.1.8.1 3D Model of Wheel in CATIA

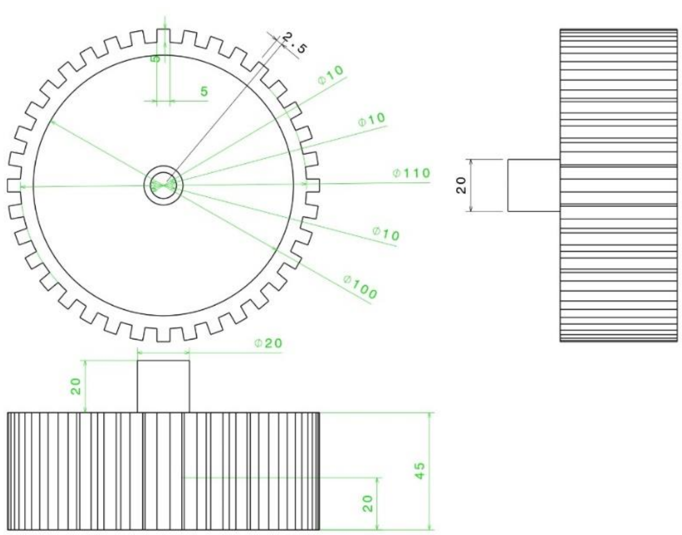

Fig. 3.2.1.8.2 Isometric Drafted Views of Wheel

3.5.1.9 Design of Drill Bit

1. Length of Drill Bit Shank = 20mm.
2. Length of Drill Bit Neck = 70mm.
3. Length of Drill Bit Flute =
4. Diameter of Drill Bit = 20mm.

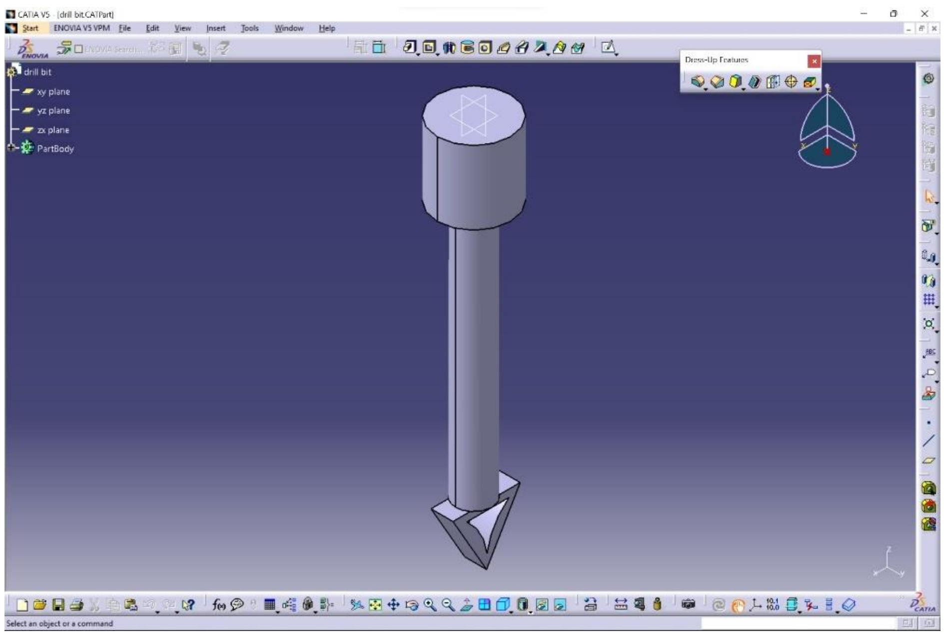

Fig. 3.2.1.9.1 3D Model of Drill Bit in CATIA

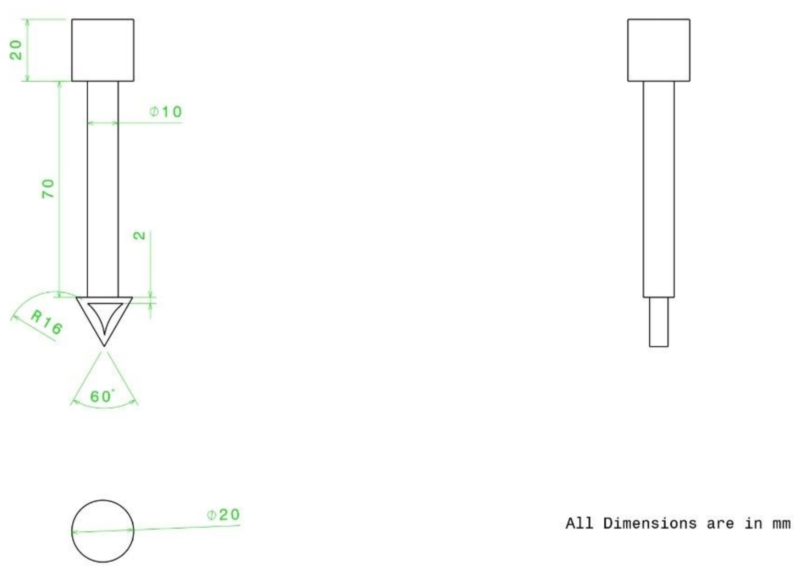

Fig. 3.2.1.9.2 Isometric Views of Drill bit

3.5.1.10 Design of Drill Screw

1. Length of Drill Screw = 215mm.
2. Over all length of Drill Screw = 255mm.
3. Outer Shaft Diameter of Drill Screw = 30mm.
4. Inner Shaft Diameter of Drill Screw = 20mm.
5. Length of Outer Shaft = 20mm.
6. Length of Inner Shaft = 20mm.

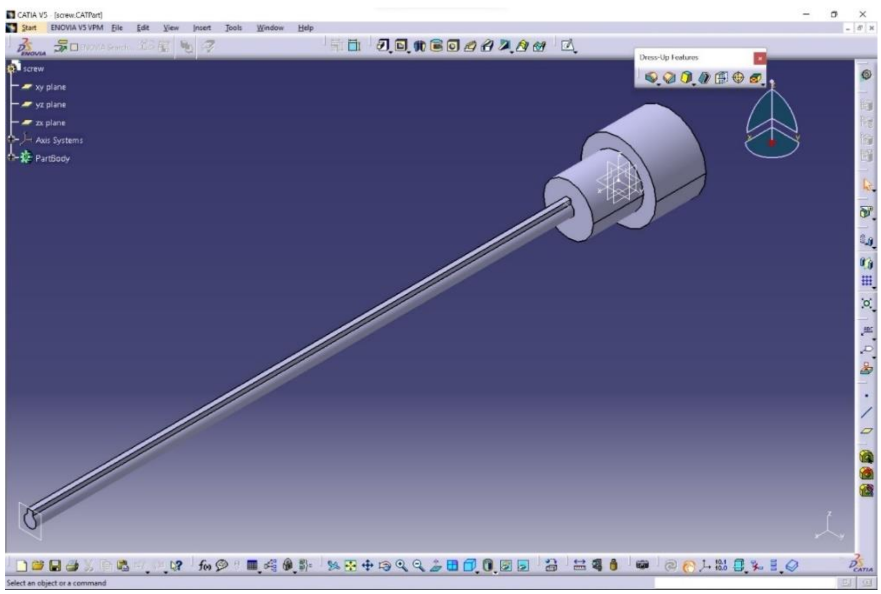

Fig. 3.2.1.10.1 3D Model of Drill screw in CATIA

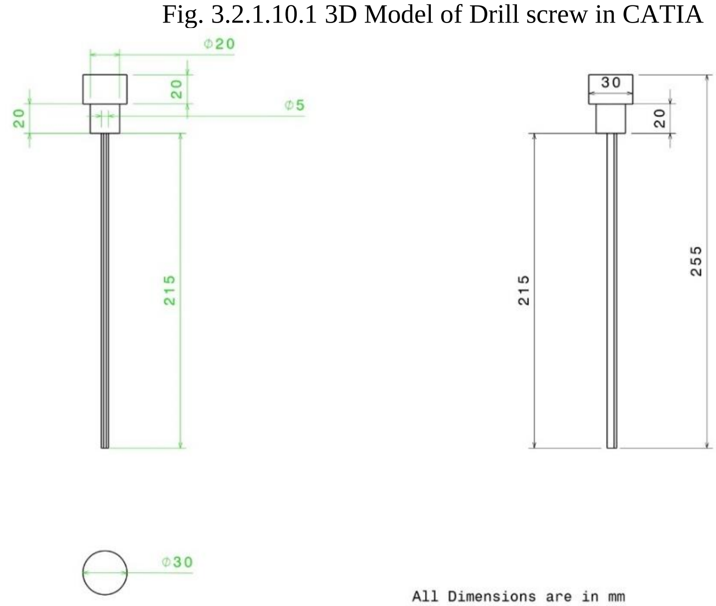

Fig. 3.2.1.10.2 Isometric Views of Drill Screw

3.5.1.11 Design of Linear Actuator

1. Length of Linear Actuator =100mm.
2. Over all Length of Attachment Box = 120mm.
3. Over all Width of Linear Actuator = 50mm.
4. Thickness of Linear Actuator = 5mm.
5. Diameter of Drill Screw Shaft= 6mm.
6. Width of Key = 2mm.

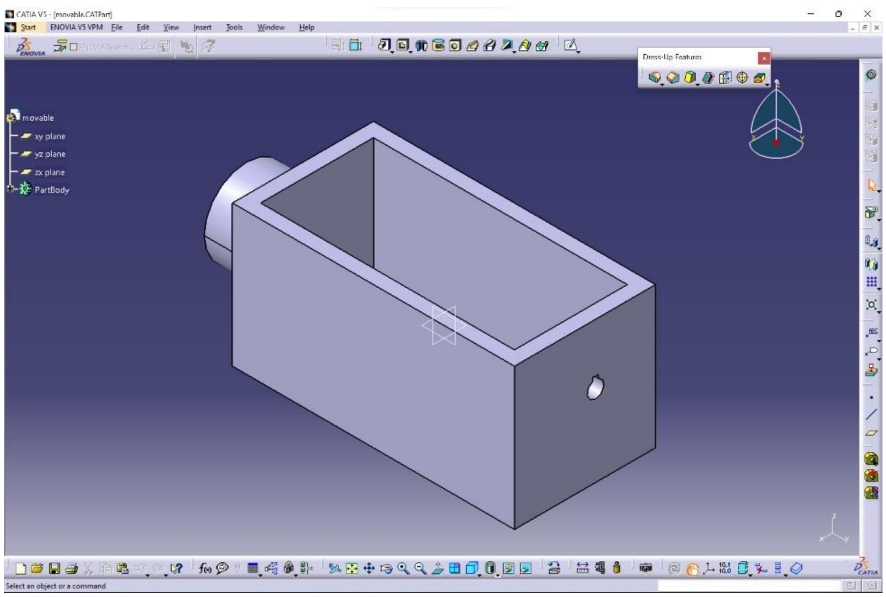

Fig. 3.2.1.11.1 3D Model of Linear Actuator in CATIA

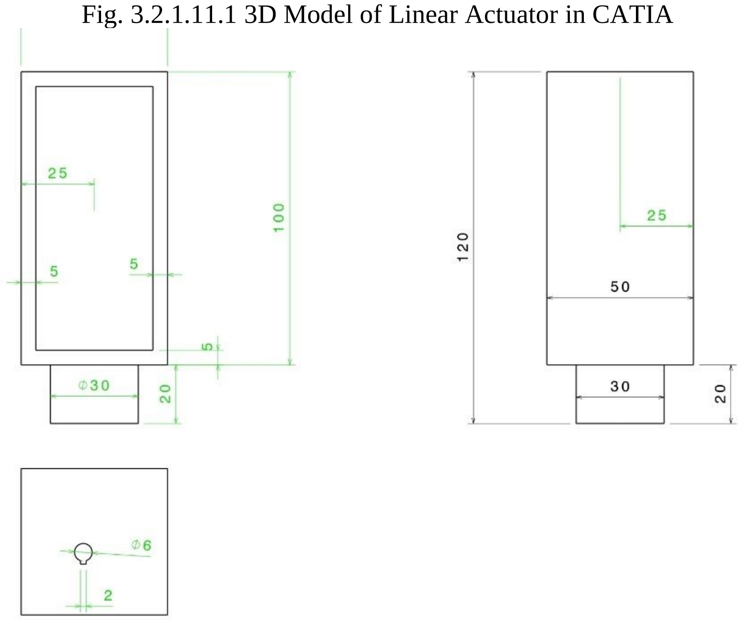

Fig. 3.2.11.2 Isometric Views of Linear Actautor

3.5.1.12 Design of Screws for Circuit Board

1. Body Diameter of Screw = 10mm.
2. Width Across Flats of Screw = 20mm.
3. Length of Screw Shaft = 20mm.
4. Height of Head = 6.85mm.

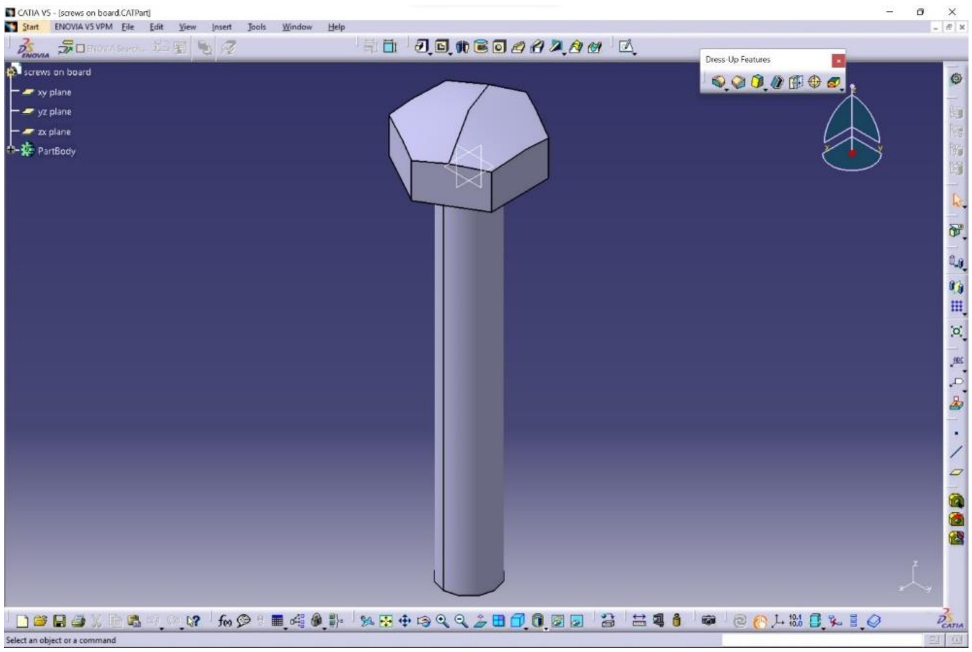

Fig. 3.2.1.12.1 3D Model of Nut in CATIA

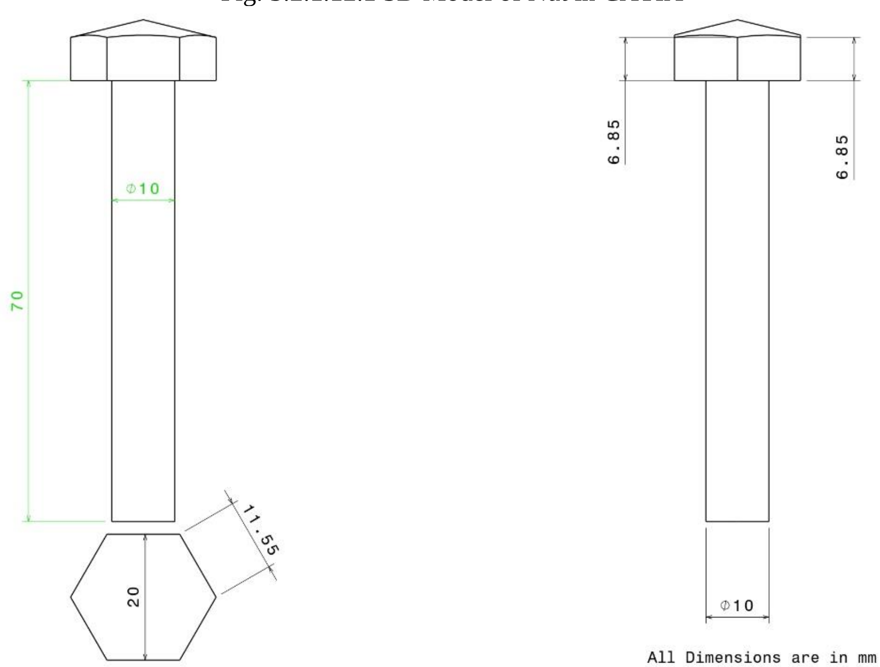

Fig. 3.2.1.12.2 Isometric Views of Nut

3.5.1.13 Design of Wheel Motor

1. Length of Motor Base = 60mm.
2. Breadth of Motor Base = 30mm.
3. Diameter of Wheel Motor = 30mm.
4. Diameter of Shaft = 9.5mm.
5. Fillet Radius = 5mm.

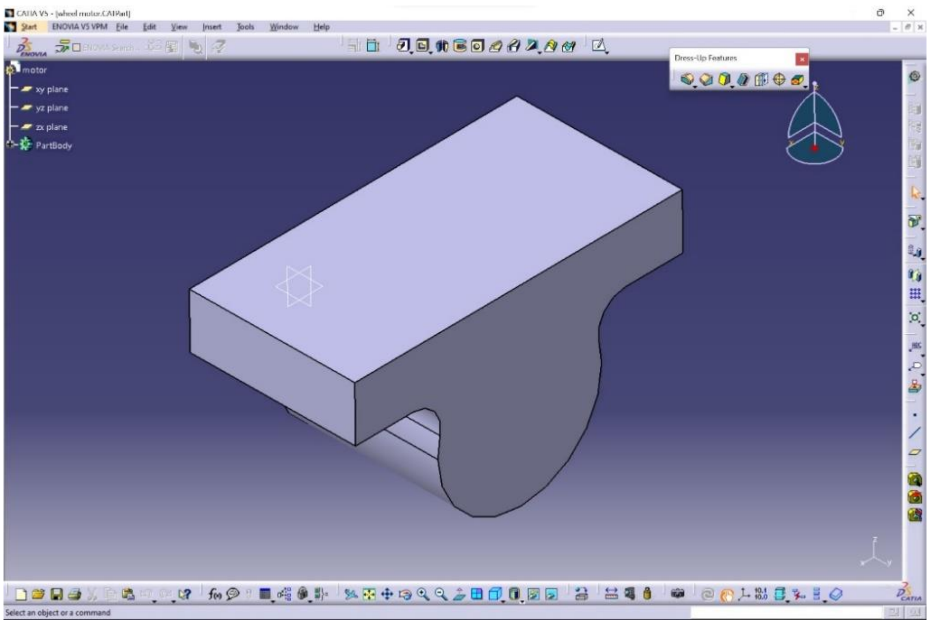

Fig. 3.2.1.13.1 3D Model of Wheel motor in CATIA

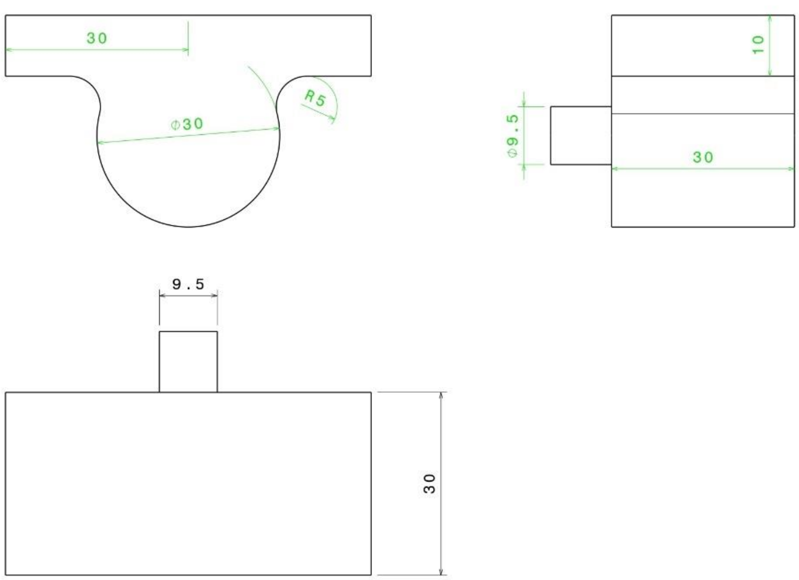

Fig. 3.2.1.13.2 Isometric Views of Wheel Motor

3.5.2 ASSEMBLY OF DESIGNED PARTS

1. Wheel Base = 300mm.
2. Track width = 210mm.
3. Clearance Heigth = 79.74mm.
4. Distance Between Water Tank and Drill Bit Assembly = 23.95mm.
5. Distance Between Battery and Drill Bit Assembly = 19.88mm.
6. Distance between Linear Actuator and Hopper = 25.95
7. Distance between Wheel Motor and Wheel = 22mm.
8. Distance between Base and Wheel = 5mm.

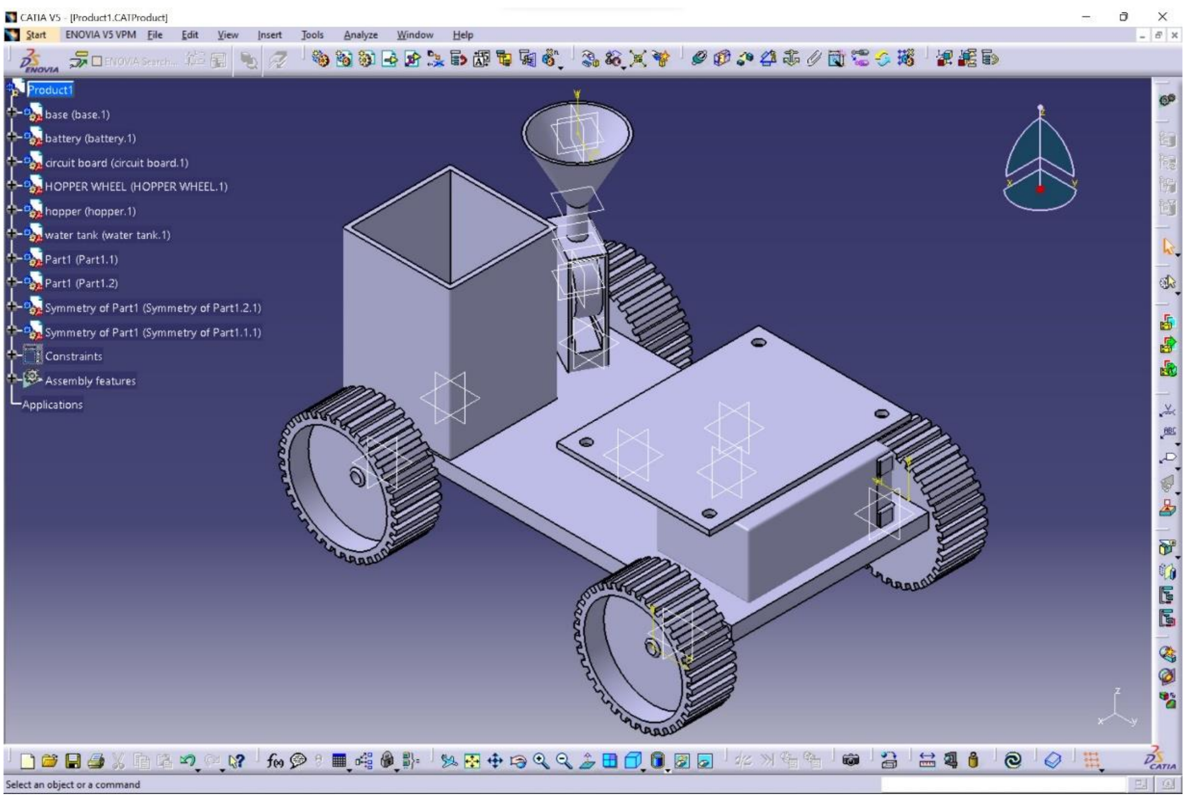

Fig 3.5.2.1 Asselmbly of Seed Sowing without Drill Bit Assembly

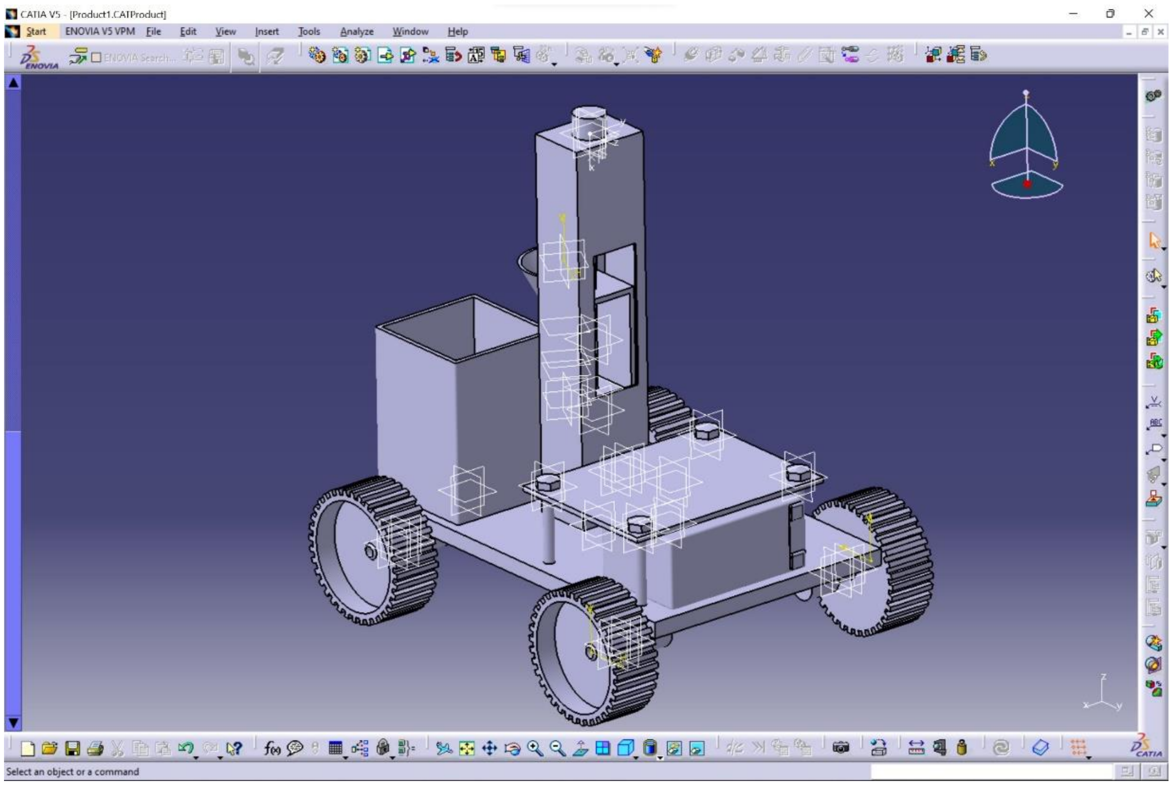

Fig.3.5.2.2 3D Model Assembly of Seed Sowing Machine in CATIA

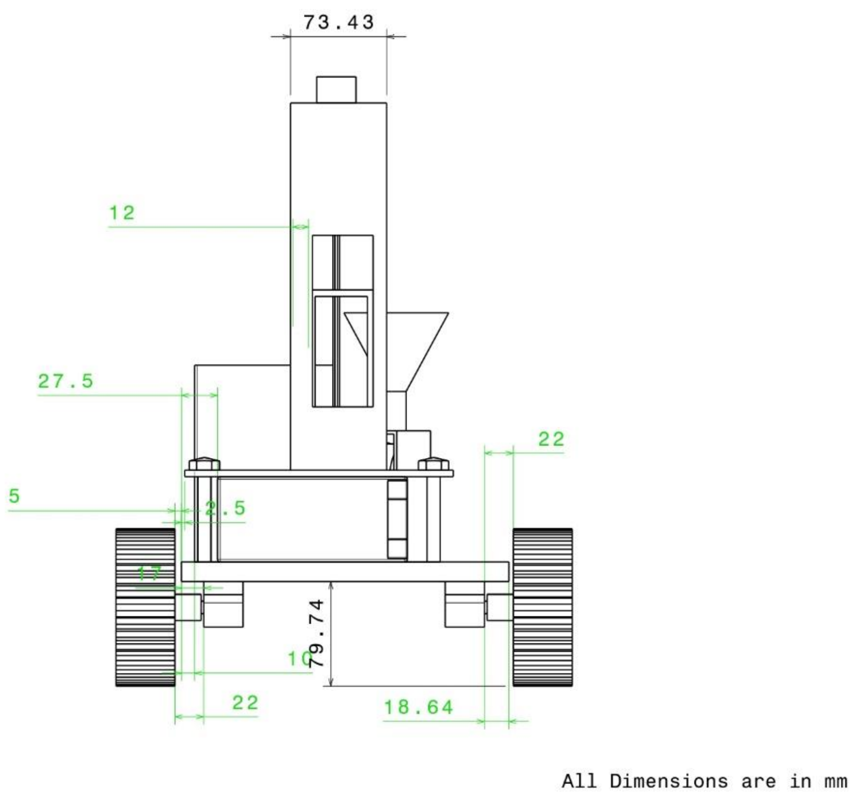

Fig.3.5.2.3 Front View of Assembly Model

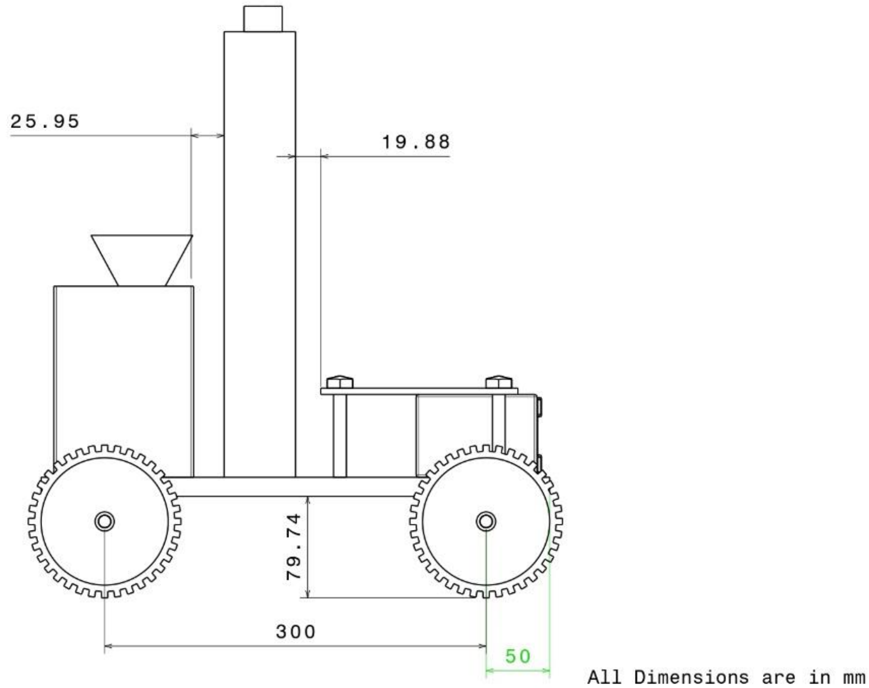

Fig.3.5.2.4 Side View of Assembly Model

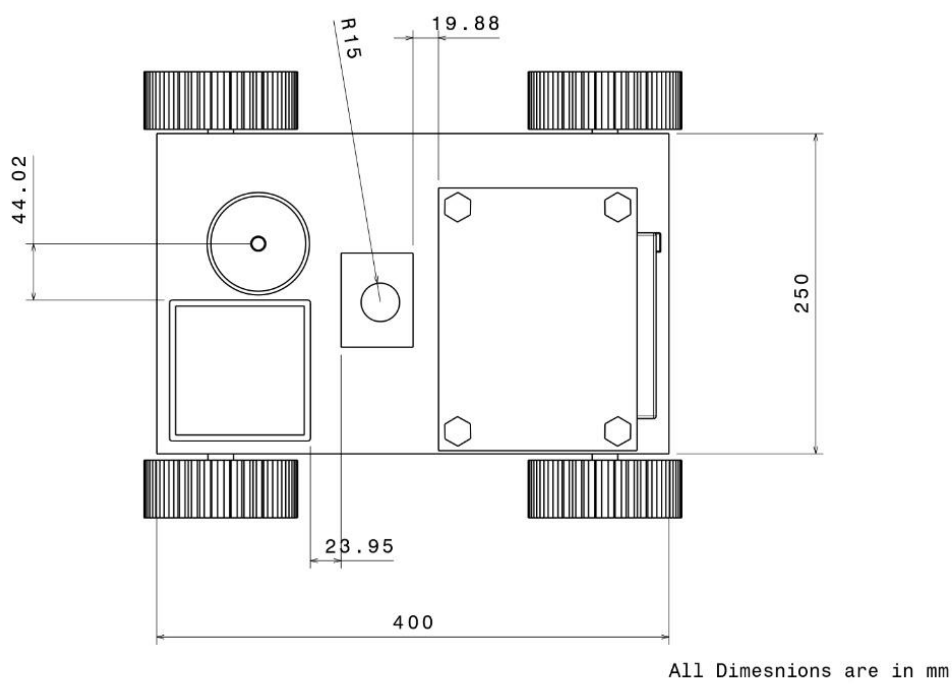

Fig.3.5.2.5 Top View of Assembly Model

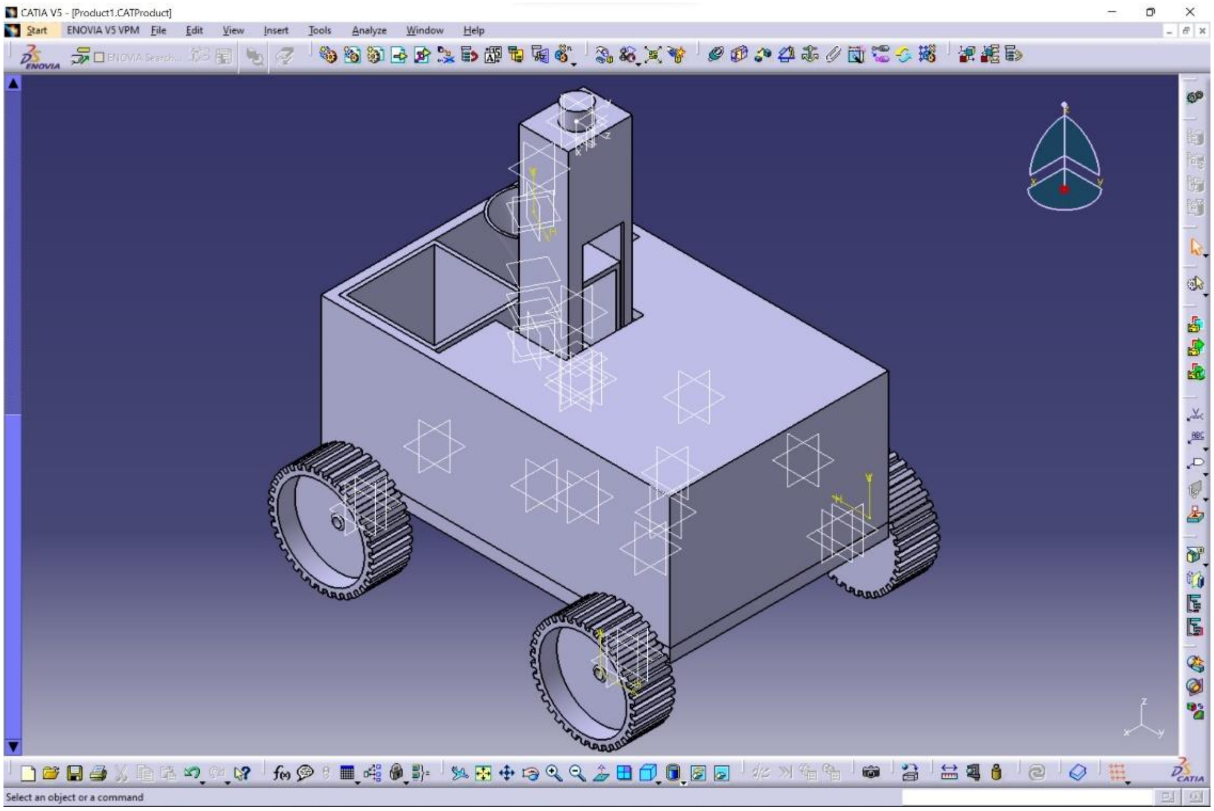

Fig.3.5.2.6 Assembly of Seed Sowing Machine with Outerpart

3.6 FABRICATION

This chapter includes the Fabrication of various parts i.e fabrication of plywood, fabrication of Drill Bit, fabrication of 3D printed parts, preparation of outer frame and preparation of water tank .The fabrication process includes the materials and different machining processes used during fabrication work.

3.6.1 MATERIALS USED FOR FABRICATION AND ASSEMBLY

1. Plywood (Base) = 15*12 inches
2. Arduino, Bluetooth and L298N For circuit connections
3. Connecting Wires for Circuit Connections
4. Wheels = 40*100 mm.
5. Motors = 30 RPM (qty 4)
6. Motors = 10 RPM (qty 3)

7. DC Water Pump = 12 V
8. Battery = 12 V, 7 A
9. Drill Bit = 6.5 mm, 130 mm
10. Nut and bolt = 6 mm Diameter, 100 mm Height

3.6.2 FABRICATION OF PARTS

3.6.2.1 Fabrication of wooden base:

1. The base is selected as wooden sheet in which it is marked in required dimensions with pencil and ruler.
2. The required part is cut down by using Hack saw blade.
3. After cutting the wood into required shape, mark the spots for drilling.
4. After marking the wooden sheet drill the spots with help of drilling machine with a drill bit diameter of 6mm.
5. The wheels of the bot are attached with the DC motors with the help of nut and bolt.
6. Now attach the wheels and motors to the base at the bottom.

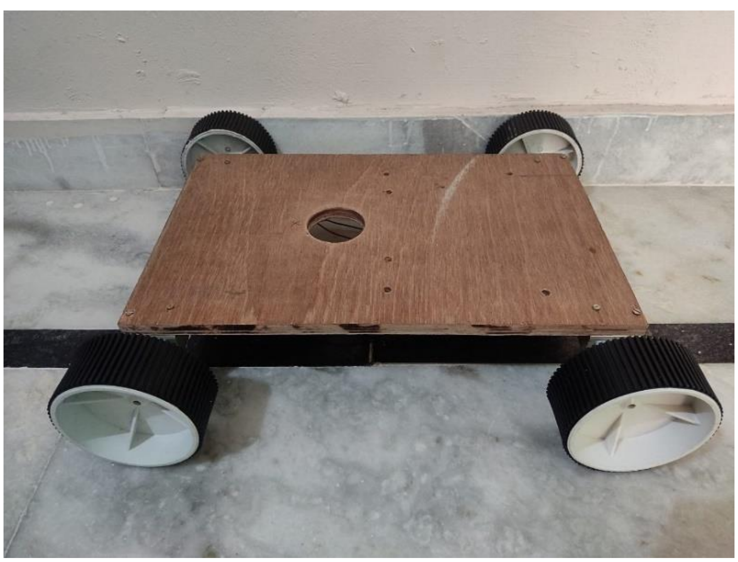

Fig.3.6.2.1.1 Fabrication of Plywood

3.6.2.2 Drill bit assembly:

1. The drill bit assembly is generally consisting of components such as drill bit, DC motor, 3D printed Holder & connecting wires.
2. It is connected to the DC motor to run the drill bit and all the connections are made as per the circuit diagrams.
3. The foam sheet is used to cover the whole set-up of drill bit Assembly.

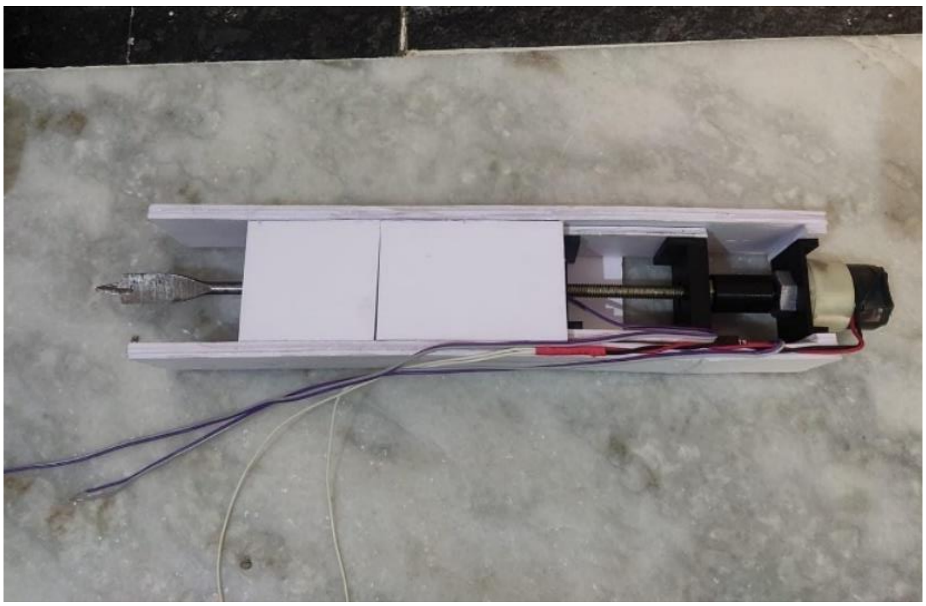

Fig. 3.6.2.2.1 Fabrication of Drill Bit Assembly

3.6.2.3 Foam Sheet:

1. Now by using foam sheet, cut it into desired dimensions to prepare an outer from of the body which helps in protecting the internal circuits and components.
2. Now again using foam sheet prepare a water tank with required dimensions and place a water pump.
3. Now each component has been fabricated using different operations.
4. Now using all the components assemble them together to get the proposed model.

3.6.2.4 Arrangement of Circuit Board

1. Prepare an Ilam sheet of required dimensions and then drill holes at specified area by using drilling operation.
2. After that place all the Circuits on the circuit board at desired place.
3. Using Nut and Bolt fix all the circuits to the circuit board.
4. Now the Circuit board with all the circuits is prepared.

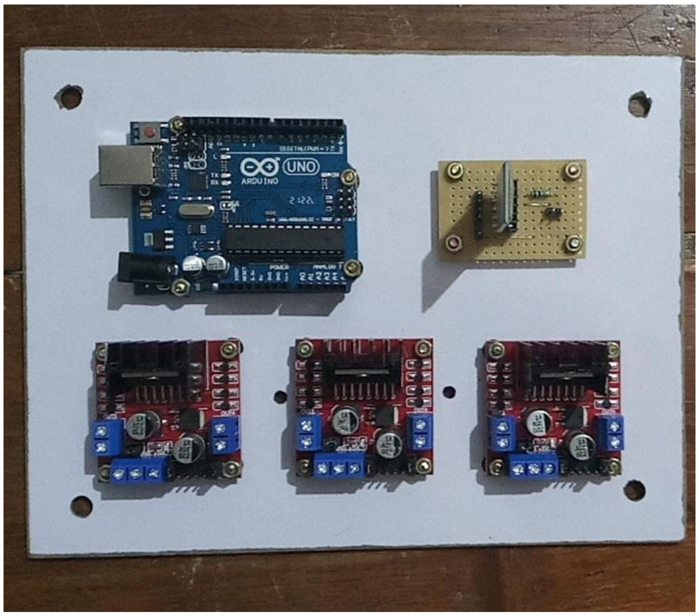

Fig. 3.6.2.4.1 Assembly of Circuit Board

3.6.2.5 Preparation of Water Tank

1. Using Foam Sheet cut the desired rectangle shape or square shapes using blade.
2. After the desired shapes has been cut now attach them together using a glue gun.
3. Form a closed rectangle as shown in the design water tank.
4. The required water tank has been prepared.

Fig. 3.6.2.5.1 Preparation of Water Tank

3.6.2.6 Preparation of Outer Frame

1. Again by using the Foam sheet cut the sheet into given dimension.
2. By using a blade cut all the sides of the frame.
3. Now by using a glue gun, stick all the sides of the frame.
4. The outer frame has been prepared which is used to shield the internal circuits and battery.

Fig. 3.6.2.6.1 Preparation of Outer Frame

3.6.3 FABRICATION OF COMPONENTS USING 3D PRINTER

1. The funnel is made-up of plastic using 3D printer in which the FDM process is involved.

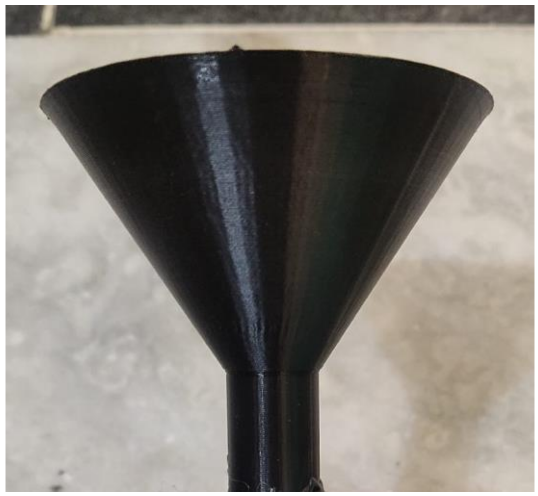

Fig.3.6.3.1 3D Printed Hopper Funnel

2. The fulcrum which is used to sow the seed into the drilled hole is attached to DC motor to maintain the seed-to-seed distance.

Fig.3.6.3.2 3D Printed Hopper Funnel and Fulcrum

3. The set-up of funnel and fulcrum is about to attach with the glue gun.
4. The whole set-up of fulcrum and funnel is as shown below in which the seed from hopper is dropped into funnel and then the seed is dropped into the fulcrum.

Fig.3.6.3.3 3D Printed Hopper Funnel

5. There after the seed is successfully dropped into the drilled hole.
6. A clamp is made using FDM process which is used to support the drill bit structure of the proposed model.

3.6.4 ASSEMBLY OF FABRICATED COMPONENTS

1. Now take the wooden base. Which is already fixed with wheels. Ender. Place the circuits. On the wooden board. At a certain distance using nut and bolt So that the battery can be placed there.
2. Now take the battery, place it in the area which is left in between the circuit and the base.

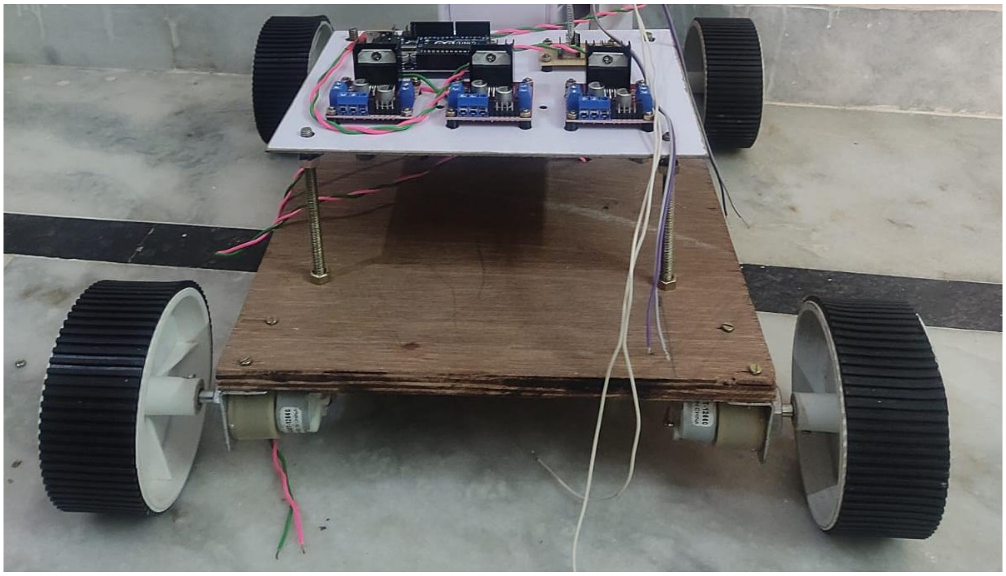

Fig.3.6.4.1 Assembly of Base and Circuit Board

3. Now take the drill bit which is already assembled, place it on the hole which is drilled on the wooden plywood base.

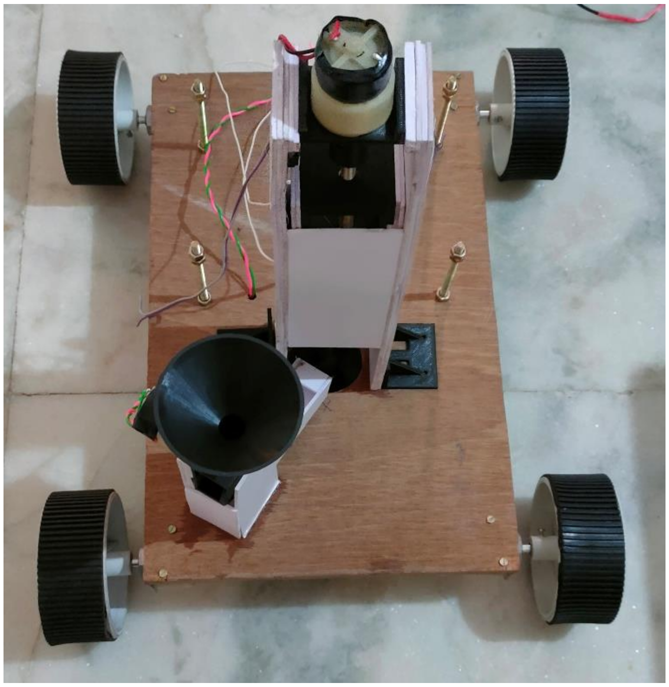

Fig. 3.6.4.2 Assembly of Drill Bit on the Base

4. Now place the water tank at the end of the base and now place the 12 volts DC water pump in the water tank to supply water out of the tank.

5. Now arrange the seed Hopper and fulcrum arrangement At this side of the base and to the side of the water tank so that the seats pass through the drilled hole on the base.

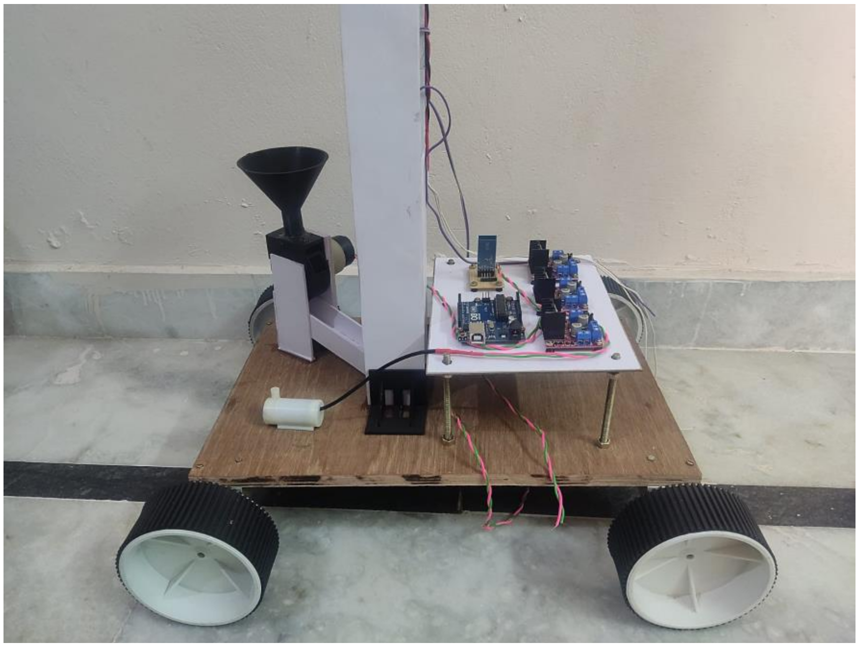

Fig. 3.6.4.3 Assembly of Hopper arrangement of the Base

6. Using the connecting circuits, connect all the circuits with the motors and circuit board by using soldering.

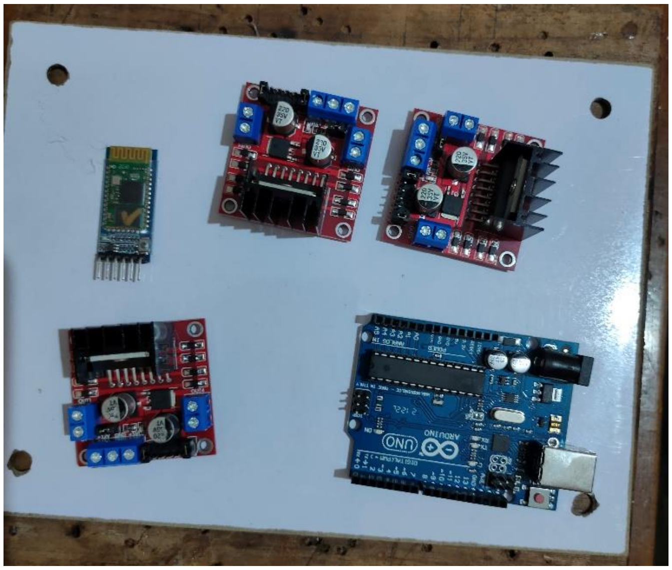

Fig. 3.6.4.4 Arrangement of Circuits on Circuit Board

7. Now program the Arduino. With the above mentioned code, So that the model works with specified operations.

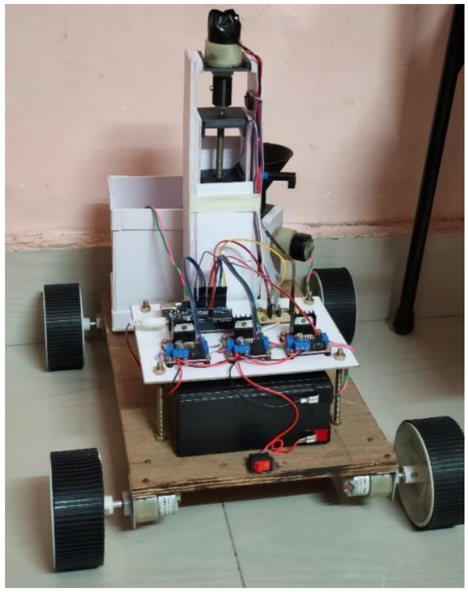

Fig. 3.6.4.5 Proposed Model after Assembly of all components

8. Now the proposed model is ready to use.

Fig. 3.6.4.6 Proposed Model after Complete Assembly

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Chapter – 4
Results and Discussions

Chapter-4 RESULT & DISCUSSIONS

4.1 FORMULAES USED

1. Output power = $A \times V \times \sqrt{3}$
   i. A= Current in Ampere
   ii. V= Voltage

2. Efficiency (η) = $\frac{Po}{Pi}$
   a. $= \frac{\tau \times \omega}{I \times V}$

   2. $\tau = Torque$; $\omega = rotational\ velocity$;
   3. $I\ = current; V = voltage$

3. Horse power $= \frac{9.5488 \times power(kw)}{N}$
   1. N= Speed in r.p.m
4. Energy Consumed = $\frac{P \times t}{100}$
   1. P = Power in watts
   2. T = Time
   3. $1\ H.P\ =\ 746\ watts$
      a. $10\ r.p.m\ - 7\ Ah\ motor -\ 12\ V$
      b. $12V -\ 0.5\ H.P$
5. $\therefore 0.5\ H.P = 373\ W\ or\ 42Amp$

6. Charging rate = $\frac{Ah}{A}$
   1. Ah = Ampere/hour
   2. A = Current

7. Discharge Rate = $\frac{Battery capacity}{no.of\ hrs\ takes\ to\ charge\ the\ battery}$

4.2 CALCULATIONS

1. 10 r.p.m motor – 5kg/cm (500kg/m)

- Efficiency = $\frac{Po}{Pi}$

$$= \frac{\tau \times \frac{2\pi N}{60}}{I \times V}$$

$$= \frac{500 \times 2 \times \pi \times 10}{42 \times 12 \times 60}$$

$$= 97.62\%$$

$For\ 12\ V$ – $[H.P\ -\ 0.5]$

- Total Power Consumption = $0.746 \times (H.P)\% \times (1)hrs$

$$= 0.746 \times (\frac{0.5}{100}) \times 60 \times 60$$

$$= 13.4\ W$$

2. $30\ r.p.m\ motor$ – $2kg/cm\ (200kg/m)$

- Efficiency = $\frac{Po}{Pi}$

$$= \frac{\tau \times \frac{2\pi N}{60}}{I \times V}$$

$$= \frac{200 \times 2 \times \pi \times 30}{9.5 \times 18 \times 60}$$

$$= 95.46\ \%$$

- Total Power Consumption = $0.746 \times (\frac{0.75}{100}) \times 60 \times 60$

$$= 20.142W$$

3. L298N motor drive

- Energy Consumed = $\frac{p \times t}{1000}$

Where $P = V \times 2$

$= 9.0 \times 2$

$= 18\ Watts$

$= \frac{18 \times 60 \times 60}{1000}$

$= 64.8 Watts$

4. DC water pump

- Energy consumed = $\frac{p \times t}{1000}$

P = 60Watts

$= \frac{60 \times 60 \times 60}{1000}$

$= 216\ Watts$

- Efficiency = $\frac{\left(\tau \times \frac{2 \times \pi \times N}{60}\right)}{A \times V}$

$= \frac{200 \times 2 \times \pi \times 60}{5 \times 12 \times 60}$

$= 98.72\%$

5. $Battery - 12\ V - 7A$

- Output power of the battery of $12V, 7A - 560W$
- Efficiency $- 89\%$
- Discharge rate = $\frac{Battery\ capacity}{No.of\ hrs\ it\ take\ to\ charge}$

$= \frac{7000}{2.3 \times 60}$

$= 42\ mins$

- Charging rate = $(\frac{Ah}{A})$

$$= (\frac{7}{2})$$

$$= 3\ hrs(Approx)$$

6. Overall, Power Consumption = $(\frac{p\times t}{1000})$

$$= \frac{560\times 60}{1000}$$

$$= 84 Watts$$

7. Arduino UNO

- Energy consumed = $\frac{p\times t}{1000}$

$$= \frac{(4\times 60\times 60)}{1000}$$

$$= 14.4 Watts$$

8. TotalPowerconsumed = $3(motor\ power)10\ r.p.m + 4(motor\ power)30\ r.p.m + Pump\ Power + Motor\ drive + Arduino\ UNO$

$$= 3(13.4) + 4(20.142) + 60 + 64.8 + 5$$

$$= 250.56W$$

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Chapter – 5
Conclusion and Future Scope

Chapter-5 CONCLUSIONS & FUTURE SCOPE OF WORK

6.1 Conclusions

This seed sowing machine has a great potential for increasing the productivity of planting. Till now tractor was the main traction unit for nourishment in farming. With the adaptation of this seed sowing machine its purpose will be fulfilled. Hence there is a need to promote this technology and made available to even small-scale farmers with affordable prices. This machine can also be made by raw materials, which saves the cost of whole project and is easily manufactured in workshops. Hence by using this machine we can achieve flexibility of distance and control depth variation for different seeds. Hence it is usable to all seeds.

By using this project of seed sowing equipment, we can reduce lot of labour costs and is very helpful for small scale farmers. After comparing the different method of seed sowing and limitations of the existing machine, it is concluded that this automated seed sowing machine can

1. Maintain row spacing and controls seed rate.
2. Control the seed depth and proper utilization of seeds can be done with less loss.
3. Perform the various simultaneous operations and hence saves labour requirement so as labour cost, labour time and also save lots of energy.

We have designed our robot for small scale farmers where in future it can be designed for large scale. The system can be upgraded by introducing ploughing of fields and closing of seeds automatically. It can be made still more user friendly with improvements like efficiency and accuracy.

6.2 Scope for Future work

The robot dispenses seeds automatically at a fixed distance. The robot can be further improved by using image processing and robotic arm for the weed removal.

1. Introduction of Cutter in place of plougher can be used as grass cutter equipment.
2. Addition of multi-sized toothed wheel can be attached for sowing of large farm.

3. Addition of rainfall sensors can be used to detect and calculate the amount of irrigation required to the crops.
4. This vehicle can be added with other sensors such as soil pH sensors and temperature and humidity sensors which are other factors in farming.

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Chapter – 6
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Chapter-6 REFERENCES

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