جامعة الأمير محمد بن فهد
PRINCE MOHAMMAD BIN FAHD UNIVERSITY

College of Engineering
Department of Mechanical Engineering
Fall 2020/2021

Senior Design Project Report

Design of Cost Effective Adjustable Rice Planting Machine

In partial fulfillment of the requirements for the Degree of Bachelor of Science in Mechanical Engineering

Team-14
Team Members

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Project Advisors:

Advisor Name: **Dr. Nassim Khaled**

Abstract

Rice is a famous crop in most of the world and in Saudi Arabia. There are minority of farmers in AlHasa city who still plants rice but with low scale production. Rice farming process goes in many stages start from land preparation, seeding, planting, planting and harvesting. Al Hasa farmers are still using the traditional method, which is costly, time consuming and need labor intensive work. The aim of this project is to ease the manual planting process in AlHasa farms and in some regions of the world by introducing the cost effective rice planting machine.

The intent of this project focused on developing improved techniques for planting and harvesting rice that would help Al Hasa farmers and third world countries to improve their production of rice and to keep up with the rising demand of rice. The idea of the project and the developed machine will improve the speed of rice planting with the help of laser for proper placement of the rice and proposed solution includes 3D printed parts. This project is focused on design analysis and fabrication of a manually operated rice planting for small-scale farms in the region. By achieving the objective and goal in simplifying the mechanism and reduce cost as well inspire the farmers in AlHasa about this idea in their farms.

Acknowledgments

This is the team acknowledgments expressing the thanks and appreciations to the project advisor Dr. Nassim Khaled. We cannot express enough thanks to our team for his continued support and encouragement. Our completion of this project could not have been accomplished without the support of our classmates:

Qasem K AlZaid

Abdulwhab AlNuwaider

Abdulrahman Alhuwaiji

Khalid AlKhaldi

Meshal Fenais

List of Acronyms (Symbols) used in the report:

Symbol	Definition
ω	Angular velocity
v	man walking speed
R	radius of wheels
N	Speed of rotation
Z1	No. of teeth on driver
Z2	No. of teeth on driven
D	Diameter

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1. Introduction

Rice is a very famous food. It is the most consumed food in the world. Developing improved techniques for planting and harvesting rice would help rice farming in third world countries and within the region to improve their production of rice to keep and maintain the demand of the market. Rice planting machine has a reciprocating motion and mechanism driven by the power from the axle. This motion will plant rice seedlings onto the field continuously with a certain speed and calculated motion. Looking into the current situation in AlHasa farms, the rice planting process is generally manual which involves number of labors. It is not so efficient compared to the rice-transplanting machine. The machine requires less time and labors than manual transplanting. With this machine, the rice transplanting will become more efficient and more productive for a small scale of farms. It also can be used with major scale with farms that have wide and promising area to meet the local and global demand of rice.

1.1 Project Definition

This project is intended to design and manufacture simple and cost effective rice-transplanting machine. This is to improve the manual rice transplanting by the help of laser for proper placement of the rice seedlings and proposed solution includes 3D printed parts. The design shall be made to be light in weight for the machine manual pulling and to maintain transplanting in an automotive row manner. This project is intended to be environmental friendly by using renewable material.

1.2 Project Objectives

The objective of the project is have innovative solution that can help poor and moderate rice farms owner to have this simple machine which can be further developed to meet the major rice farms makers.

1. Design the machine in a simple manner.
2. Consider a cost effective design while applying the 3D printing.
3. Integrate the machine with laser technology to have row rice transplanting.

2. Literature Review

During the 1990s, Brazil, Indonesia, Saudi Arabia, and Iraq were the major destinations in the rice market. In the last few years, however, Saudi Arabia production to rice becomes very moderate and only available on farming area like AlHasa. Hasawi rice is seeded and planted in eastern province farms but go into hard manual transplanting process. Rice farming and cultivation undergo many stages starting from land preparation, seeding, planting, transplanting and harvesting. Successful rice farming no longer depends on heavy rainfall season but the most critical stage is when moving the rice seeding from the seeding area to the planting area. [1]

Many technologies are available in the market to perform the rice planting process in easy and accurate manner. The cost of the machine are vary depending upon the functions and features available in the machine. Some machines can place the rice in one row while some can perform double or triple rows. Other rice-transplanting machines are manually operated while some are motor or engine driven. The concept of rice planting stage is the same no matter what the

medium or the mechanism are. All rice planting machine consider to be expensive for a light and moderate scale of rice farming.

We as a team of the senior project, found that there are some challenges. The first challenge is that there was no initial design or previous work to start with considering proper selection of the material in order to reduce the cost of the machine. This issue make the team to start from the beginning to have initial design of the machine. The objective to have a cost effective machine starting with 3D printing components. However, due to the cost the option of 3D printing will not meet the objective of the design. The second challenge to find alternative material, which will allow us to reduce the cost of the machine during the manufacturing phase.

3. System Design

The farmers in Alhasa exert effort to fit the seeding onto the field manually by hand (**Figure-1** below and the video [1]. Looking into the problem and the time to do rice fitting, the team thought of the rice planter as a solution, which is a machine to plant and fit rice seedlings onto the field. There are two types of rice planting; engine riding type and walking non-engine type. This system and the machine design is walking type machine. The principle of operation on this design is that the seedlings are kept in the tray and while in motion, the system allows the seeding to flow down under gravity for placing the seeding on straight line while in operation. The machine is useful to transfer energy to do work. By this machine, the energy and effort that the farmers do will become less and more effective and efficient as well cost effective. It contains mechanisms, which are design to provide forces and transmit power. The system of the machine will be analyzed based on static and dynamic sciences. Also, it will be analyzed on the concept of kinematics (deals with motion and time) and kinetics (deals with motion, time and forces). Maintaining the placement of the seeding on a straight line shall be

determined by a laser to guide the operator or the farmer on keeping the fitting on one straight line. The laser option consider to be a development for the machine if the initial design succeed.

Figure 1 Farmers performing manually rice planting

3.1 Design Constraints and Design Methodology

3.1.2 Sustainability

In a muddy field, corrosion is consider constraint for the main component of the machine. The applied coating, selection of the material and the main components have to be specific in order to reduce the effect of corrosion

3.1.2 Social

The material selection is another constraint, which effects the weight and the cost of overall design. If the cost of the design reach high, we will not meet the main objective of the design to have a cost effective rice-planting machine. As a result, farmer with low scale rice production will not be able to buy the machine.

3.1.3 Safety

The weight if the machine can result to musculoskeletal injury. Pulling force by operator can cause injury resulting from trip, fall or slip hazard while operating the machine. The constraint can be reduce with the effective material and part selection to avoid shutdown the design because of safety constraint.

3.1.4 Economy

By manufacturing this machine, low scale farms can elevate their rice production by reducing the labor cost comparing to time and effort can be obtained during the operation of rice planting machine. This is essential part of rice industry if labor cost drop profit increase and production increase also.

The system is designed initially by Computer-aided design (CAD) where the use of computer to aid in the creation, modification, analysis, or optimization of a design. On this project, **SOLIDWORKS** delivers 3D CAD software that helped the team to create the design [2]. The design went into many constraints especially during the implementation stage. On the software, the mechanism was easy to observe and gave the team an overview of what is the final product. However, the fabrication of the entire machine was a challenge. To meet the project objective the machine has to be 3D printed and insert the laser component in the machine to have a straight-line placement of rice seeding. On this project we followed the general designing methodology and process as shown in **figure -2** below:

Figure 2 General designing methodology and process

However, we will not be talking about “production” since this is another scope of work on the project. Production can be driven by third-party, supplier or other investors who want to take this project into production in farm making industry.

3.2 Engineering Design standards

The engineering design standard is followed and available in Appendix-B. The basic operation of the machine is according to **Grashof's Law** for bar mechanism, which is the sum of shortest and longest link lengths should not be greater than the sum of the remaining links if there is continuous relative motion between the two links [3]. The major concept are crank follower, quick return mechanism and the analysis of both kinematics and kinetics concepts. The machine main components are:

- **Crank and sprocket (Standard Gears, Appendix-B)**: These to transfer the energy of rotation to the other component of the machine.
- **Wheel**: It is contact on ground and mounted on driver shaft. Its motion gives to the Four Bar Chain through the chain drive. Blade is to reach proper grip in mud.
- **Chain (Standard Sprocket, Appendix-B)**: The function of chain is to transmit torque from driver to driven gears.
- **Tray support:** This to support the tray from bending.
- **Shaft:** To hold the rotating gears and wheels.
- **Picking arm**: They are the main element, which are responsible for fitting the seeding. They have specific shape, which picks the seeding, and fit them in the mud. Its mechanism moves at certain angle.
- **Tray:** This is used to store the rice seeding from where the picking arms do its function.
- **Links:** Fixed link, input Link (crank), Output link (Follower /rocker)
- **Bottom Sheet:** This is protect the upper component from external damages.
- **Frame:** The frame provides the weight and support for the entire machine.
- **Bearings and bearing housing:** They support the shaft and the rotating part inside the machine act as cover from external damage by the housing.

3.3 Theory and Theoretical Calculations

The machine operation implements the basic crank follower and quick return mechanism. As the process is manual, the operator/worker need to provide the initial motion or pulling force [4]. When the rice plant moves forward, the ground wheels will rotate. The wheel is provided with the blades so that the machine can move easily in the mud. Then, two sprockets are provided on the same shaft with the ground wheels and at the same time sprocket will rotate. The picking arm pick from the tray and keeps it in horizontal position on the skid. The picking arms plant the seedling from tray to ground. The motion for the arm is given by wheel rotation using chain and sprocket arrangement. The picking mechanism is used to plant seedlings into the ground. The design calculation for a pre-existing design shall be on **Tabel-1** [5] as shown below:

Description	**Equation**
Diameter of Ground Wheel:	Circumference = π x D = Diameter of the wheel
Angular Velocity Of wheel:	= V_{ave} /r, where $N_1 = (\omega_1 \times 60)/2\pi$
Calculation of Driven Sprocket Speed:	$\frac{N2}{N1}$ where N_1 and N_2 are speed of driver and driven sprocket.
Sprocket Velocity Ratio:	SR= $\frac{N2}{N1} = \frac{N2}{N1}$ Constant where Z_1 and Z_2 are No. of teeth on driver and driven sprocket
Diameter of small sprocket	D1 = P/sin180/z1=12.7/sin180/18 D1 = 73mm
Diameter of large sprocket	D2 = p/sin 180/Z2 = 12.7/sin180/40 D2 = 162mm

Table 1 Pre-existing design calculation

Also, we set the following components calculation and parameter to reach the standard design of the machaine as shown in **Table-2** below:

Components	**Parameters**

Man walking speed	30m/min
Diameter of the ground wheel	250mm
Perimeter of ground wheel	$2\pi r = 2\pi$ (125)
Perimeter of ground wheel	785mm
Number of plants planted per ground wheel rotation **No of plants planted per rotation = Perimeter /Distance between plants** **Distance between the plants**	180mm=785/180 = 4.3 = 4
No of plants to be planed per ground wheel rotation	4
Number of teeth of sprocket at wheel	40
Number of teeth of sprocket at planting mechanism	18
Angular velocity ω=V/R	ω= 30/60/0.125 , ω=4rad/sec
Speed of rotation	N1= ω×60/2×π, = 4×60/2π, N1 = 38 rpm
Speed ratio	Z2/Z1= I = 2.2, 2.2 = 38/N2, N2 = 17rpm
Diameter of sprocket	Diameter of small sprocket D1 = P/sin180/z1 =12.7/sin180/18 **D1 = 73mm** Diameter of large sprocket D2 = p/sin 180/Z2 = 12.7/sin180/40 **D2 = 162mm**

Table 2 Components calculation and parameter

3.4 Product Subsystems and selection of Components

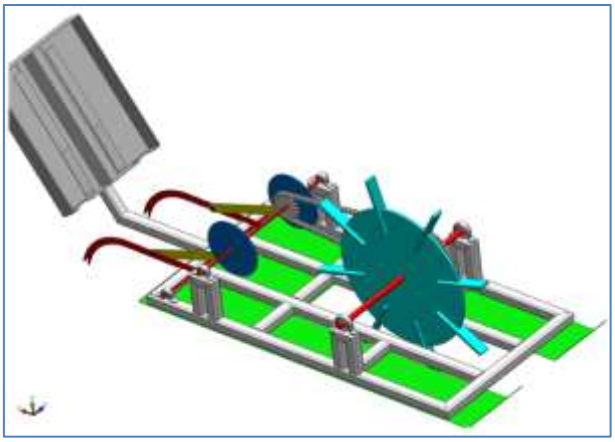

Figure 3 CAD (SOILIDWORK) Design

The selection of components resulted after the design stage in CAD (SOILIDWORK) as shown in **Figure-3**. The main components will be carbon steel while some other material are determined to be 3D printing material and will be based on the need of the machine and the

environment. The part selection and dimension are available in **Appendix-A** (**Drawing Sheet-1)**. The part Engineering Standard in **Appendix-B**.

3.5 Manufacturing and assembly (Implementation)

The feasibility of the project to be fully 3D was a challenge. The available local 3D printing shops do not have the capability to print all components and assemble them to reach the final product. Most of the 3D printing shop declined to take the project and manufacture it. Some accepted to design a prototype but it will be without a motion. Some accepted to print only some components but at least seven parts in order to start the printing machine but again it was not in a cost effective. All the 3D printing shops gave the team high cost estimation to fulfill the project objective (between SAR 10,000-15,000). Eventually, the team decided to go with initially metal machining work with welding and fabrication shop to design the main components and to follow the below phases of designing **(Figure 4)** the machine to reach the final design on a cost effective manner:

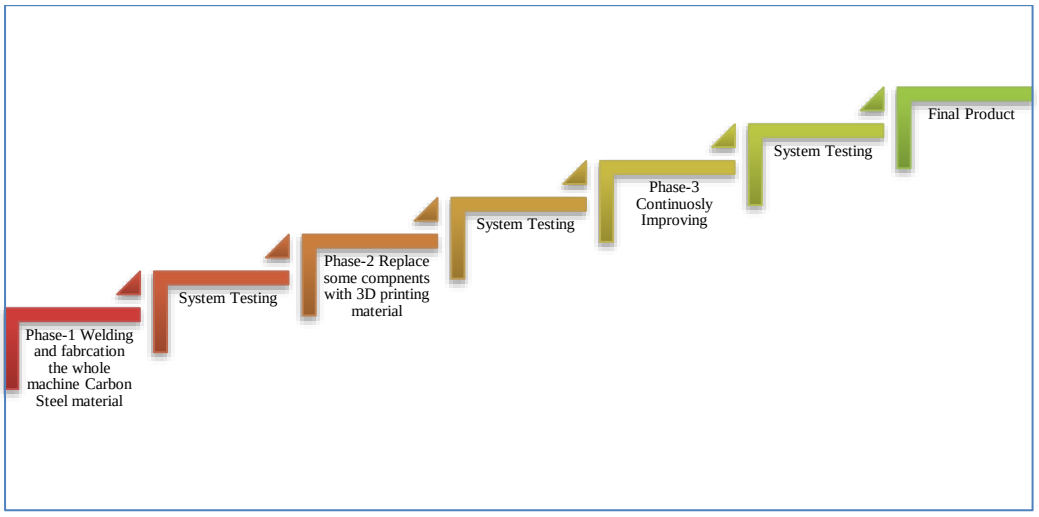

Figure 4 Machining work and design phases

The team managed to meet only phase-1 of the plan by performing the welding and fabrication for the whole machine with Carbon Steel material **(Figure-5).**

Figure 5 Welding and Fabrication shop (Metal work for the components)

4. System Testing and Analysis

4.1 Experimental Setup, Sensors and data acquisition system

The team had a plan to simulate the testing for the machine after the fabrication **(Figure-6)**. This is to ensure having the right measurement and dimension for each component. The testing procedure are available as shown in photos below **(Figure 8 a-e)**.

Figure 6 Rice transplanting machine after fabrication

Figure 7a, Place the machine in a leveled and muddy spot.

Figure- 7b, Test the wheel rotation and other components motions.

Figure 7-c, Place the plants in the tray and ensure there are aligned to touch the arms

Figure 7-d, start running the machine with a certain speed

Figure 7-e, Testing result

4.2 Results, Analysis and Discussion

The testing concluded with number of findings and deficiencies on the design. The below **table-3** compile the findings observed during the test.

	Finding/Deficiency	**Recommendation**
1.	Picking arms parameter needs adjustment.	Adjust the picking arms to prevent the deep motion at the ground.
2.	Tray middle beam found with wrong direction.	Relocate the middle beam to be place at the back of the tray for support.
3.	Tray size is small	Enlarge the dimension of the tray to accommodate large size rice seeding.
4.	No anchor point for manual pulling.	Install anchor point to attach sling and shackle for pulling.
5.	Main component with no guard or mean of protection from the mud or sand that cause corrosion.	Install protection guard on the wheel, sprockets, bearing and chain to protect the component from external damage or corrosion while in contact with mud and water. Provide coating or non-corrosive material for the machine.
6.	Machine is slightly heavy.	Find alternative material and replace heavy component with light material considering 3D printing.
7.	Position of the laser needs troubleshooting (Figure 8- laser element).	Test again while placing the laser in a good position.

Table 3 Findings, deficiencies and recommendations

Figure 8 Laser element

5. Project Management

5.1 Project Plan and Contribution of Team Members

During the project the, the team agreed on the below tasks to meet certain objectives and milestones to complete the project and reach to the desire result. The below **table-4** included all tasks assigned to each team member.

#	Task	From	To	Duration (days)	Assigned members	Contr. %
1.	Chapter 1: Introduction	August 31,2020	September 3, 2020	3 days	All	100%
2.	Chapter 2: Literature Review	September 4, 2020	September 8, 2020	4 days	All	100%
3.	Chapter 3: System Design: • Design Constraints and • Design Methodology • Engineering Design standards • Theory and Theoretical Calculations Product Subsystems and selection of Components • Manufacturing and assembly	September 9,2020	October 8, 2020	32 days	Al-Nuwaider Al-Kalidi Alhuwaiji AlZaid Al Fenais	100%
4.	Chapter 4: System Testing & Analysis: • Experimental Setup, Sensors and data • Results, Analysis and Discussion	October 8, 2020	October 11, 2020	4 days	All	100%
5.	Chapter 5: Project Management: • Project Plan • Contribution of Team members • Project Execution Monitoring • Challenges & Decision making • Project Bill of Material & Budget	October 12, 2020	November 1, 2020	17 days	Al-Nuwaider	80%
6.	Chapter 6: Project Analysis: • Life Long Learning • Impact of Engineering Solution • Contemporary Issues Addressed	November 2, 2020	November 15, 2020	13 days	Al-Kalidi Alhuwaiji AlZaid Al Fenais	50%
7.	Chapter 7: Conclusion & Recommendation • Conclusion Future Recommendation	November 14, 2020	December 1, 2020	15 days	All	0%

Table 4 Task assigned to each team member

5.3 Project Execution Monitoring

Table-5 below set the team regular activities with the periodic update and progress. It includes major events that the team needs to accomplish during the project time line.

Time/Date	Activities/Events
One time a week Assessment class	Weekly Meeting with group members
Biweekly	Meeting with the advisor and co-advisor
October 31, 2020	Finishing first prototype
November 12, 2020	Midterm presentation
November 14, 2020	Finish the final design
November 21, 2020	First test of the system
December 8, 2020	Final Submission of the report
December 16, 2020	Final presentation

Table 5 Project major activities

5.4 Challenges and Decision Making

During the project execution, the team faced number of challenges that required the team quick response to meet the project deadline. Challenges included the following:

1. Finding 3D printing shop with reasonable price
2. Finding proper welding and fabrication shop.
3. Design problems

5.4.1 Finding 3D printing shop with reasonable price

It was no easy to find 3D printing shop that can print the design in a cost effective manner. Most of the shop declined to give us an offer explaining that the machine body and the rotating part needs hard material to sustain the desire objective of the machine.

5.4.2 Finding proper welding and fabrication shop

The team failed to find the proper 3D printing shop. The alternative plan was to fabricate the design in a local shop. Eventually, the team found a welding and fabrication shop that can do the design with reasonable cost. The welding and fabrication shop took 3 weeks to complete the design and submit the final prototype of the machine.

5.4.3 Design Problem

After completing the welding and fabrication of the machine and during the testing, number of observations were noted that need the team attention and correction to have a good design. The picking arms parameter needs adjustment. Also, the tray middle beam found with wrong direction which must be back of the tray. No anchor point for manual pulling. Main component with no guard or mean of protection from the mud or sand.

5.5 Project Bill of Materials and Budget

Table-6 below summarized the expenses that the team went into during the design phase. Most of the expenses went to the welding and fabrication shop. Some went into buying the needed laser to be integrated part of the machine design. The laser will be the final part when adjust the machine parameter.

Material	Cost (SAR)
Stainless Steel Ball bearing SS 6800 open C3 / SS 61800 open C3 oiled (4 piece)	SR 300
Chain High Quality Bicycle Chain Standard- C9	SR 100
Material carbon steel ASTM A36	SR 1100
Machining, Cold-work, Hot work	SR 1000
Welding and fabrication	SR 3000
Total	SR 5500

Table 6 project expenses

6. Project Analysis

6.1 Life-long Learning

The project provided learning experience that included number of skills development. Skill development like leadership skills, communication skills, teamwork, problem solving skills and time management. All the mentioned skills are important skills in future career wise for

effective and productive outcome at work. It was a great learning opportunity that provided the team a supportive learning experience to develop number of skills and more.

6.2 Impact of Engineering Solutions

The team believes that the project will inspire the local region since rice planting is still traditional in Alhasa area. We provided a solution that can help the farmer and improve the farming activities and the way rice is planted in the field. The project has impacts in terms of society, economy, and safety. The project will fulfil the society and farmer need because it is easy process and plant the rice in muddy farms, which will reduce the time and effort with the farmers. We also can support the economy and stop importing such machines to our market and start manufacturing the machine locally with our simple design.

6.3 Contemporary Issues Addressed

We found during our litterateur review that rice are so common in the poor countries where they need support and help to have better rice transplanting process. Due to the cost of buying big machine, some farmers cannot afford buying the complicated and expensive machine. We tried as a team to help farmers locally and globally with a simple design that can easily made with the available material and resources.

Chapter 7: Conclusions and Future Recommendations

7.1 Conclusions

Senior design project provided a learning opportunity for the team that resulted into great personal growth by developing various skills. Skills like communication, leadership,

teamwork, time management and planning effectiveness. The team used the engineering skills, which we learned during our study in PMU College of Engineering (COE). We applied many engineering concepts including mechanical engineering design, solid mechanics, material engineering, manufacturing in CAD and manufacturing methods in designs. Moreover, the problem solving skills are improved by looking into the problems the team faced and come up with solutions to overcome some challenges. The 3D printing was one of the major challenge that consumed our time in searching for printing shop with reasonable cost. The available local and commercial 3D printing shops cannot design the machine within our budget. Going with full-scale 3D printing was not cost effective which will not meet the design objective. However, replacing some component with 3D printing material can be a good solution to optimize the material cost like having nonmetallic components in order to improve the life of the machine.

7.2 Future Recommendations

The team finds areas of improvement on the machine. The initial design proved that the engineering concept would help the process in rice planting. The design can be locally manufactured but with low scale production. The mentioned **Table-7** below list some of the recommendations that can help and continuously improve the design. The picking arms needs frequent adjustment or maintenance by replacement the arms due to the repetitive motion and friction with the ground. However, the cost of maintenance is reasonable and can be found within the local market.

	Finding/Deficiency	**Recommendation**
1.	Picking arms parameter needs adjustment.	Adjust the picking arms to prevent the deep motion at the ground.
2.	Tray middle beam found with wrong direction.	Relocate the middle beam to be place at the back of the tray for support.
3.	Tray size is small	Enlarge the dimension of the tray to accommodate large size rice seeding.
4.	No anchor point for manual pulling.	Install anchor point to attach sling and shackle for pulling.

5.	Main component with no guard or mean of protection from the mud or sand that cause corrosion.	Install protection guard on the wheel, sprockets, bearing and chain to protect the component from external damage or corrosion while in contact with mud and water. Provide coating or non-corrosive material for the machine.
6.	Machine is slightly heavy.	Find alternative material and replace heavy component with light material considering 3D printing.
7.	Position of the laser needs troubleshooting (Figure 8- laser element).	Test again while placing the laser in a good position.

Table 7 Findings, deficiencies and future recommendations

There is an idea to manufacture the machine from recyclable material. Another idea to make the machine automotive and the team recommends having a motor that operates the machine with solar energy. This idea can even disregard the human factor in pulling the machine, which will result on labor cost reduction and avoid human interference with the machine. These ideas can fulfill the environment requirement to reduce pollution and have the advantage from the recyclable material and renewable energy.

8. References

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Appendix A: Progress Reports

	SDP – MONTHLY REPORT
	Department of Electrical Engineering **Prince Mohammad bin Fahd University**

SEMESTER:	**Fall**	**ACADEMIC YEAR:**	**2020/2021**
PROJECT TITLE	**Design of Cost Effective Adjustable Rice Planting Machine**		
SUPERVISORS	**Dr. Nassim Khaled**		

Month 3: November - Team 14

ID Number	Member Name
Qasem K AlZaid (QKZ)	201501158
Abdulwhab AlNuwaider (AAN)	201500995
Abdulrahman Alhuwaiji (AKH)	201500742
Khalid AlKhaldi (KMK)	201600510
Meshal Fenais (MSF)	201602213

List the tasks conducted this month and the team member assigned to conduct these tasks

#	Task description	Team member assigned	Progress 0%-100%	Delivery proof
1.	Finalize the fabrication of the machine with the shop.	AAN	100%	See below Figuer -1
2.	Present the design and share it with the advisor.	All	100%	Communicated and shared photo and video
3.	Perform the testing for the design along with the advisor and see the result.	All	50	Shared recorded video
4.	Look for other 3D printing vendor to see the feasibility of printing some of the other design components.	KMK	100%	Not feasible
5.	Prepare for midterm presentation “Milestone 4” on **November 12, 2020**.	All	100%	Presented thru BB on November 12 with the committee

List the tasks planned for the month of <u>December</u> and the team member/s assigned to conduct these tasks

#	Task description	Team member/s assigned
1.	Test the design and share it with the advisor on December 10, 2020.	QKZ AKH KMK MSF AAN
2.	Collect any design issues and do the needed correction.	QKZ AKH KMK MSF AAN
3.	Work on the final reports and the needed assignment. Complete Softcopy of brochure before **December 16, 2020.**	AAN
4.	Prepare for final presentation "Milestone 7" on **December 18, 2020**. Complete the peer review before Sunday December 20, 2020. Complete the Mechanical Engineering Exit survey before Sunday **December 6, 2020.**	QKZ AKH KMK MSF AAN

Figuer -1 "Prototype completed"

- **To be Filled by Project Supervisor and team leader:**
- **Please have your supervisor fill according to the criteria shown below**

<u>Outcome MEEN4:</u> an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts				
Criteria	**None (1)**	**Low (2)**	**Moderate (3)**	**High (4)**
MEEN4A. Demonstrate an understanding of engineering	Fails to demonstrate an understanding of engineering professional and	Shows limited and less than adequate understanding of engineering	Demonstrates satisfactory understanding of engineering	Understands appropriately and accurately the engineering professional and ethical standards and their impact on engineering

professional and ethical standards and their impact on engineering solutions in global, economic, environmental and societal context	ethical standards and their impact on engineering solutions in global, economic, environmental, and societal contexts	professional and ethical standards and their impact on engineering solutions in global, economic, environmental, and societal contexts	professional and ethical standards and their impact on engineering solutions in global, economic, environmental, and societal contexts	solutions in global, economic, environmental, and societal contexts

Outcome MEEN5:

an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives

Criteria	None (1)	Low (2)	Moderate (3)	High (4)
MEEN5A: Ability to develop team work plans and allocate resources and tasks	Fails to develop team work plans and allocate resources and tasks	Shows limited and less than adequate ability to develop team work plans and allocate resources and tasks	Demonstrates satisfactory ability to develop team work plans and allocate resources and tasks	Properly and efficiently makes team work plans and allocate resources and tasks
MEEN5B: Ability to participate and function effectively in team work projects to meet objectives	Fails to participate and function effectively in team work projects to meet objectives	Shows limited and less than adequate ability to participate and function effectively in team work projects to meet objectives	Demonstrates satisfactory ability to participate and function effectively in team work projects to meet objectives	Function effectively in team work projects to meet objectives
MEEN5C: Ability to communicate effectively with team members	Fails to communicate effectively with team members	Shows limited and less than adequate ability to communicate effectively with team members	Demonstrates satisfactory ability to communicate effectively with team members	Communicates properly and effectively with team members

Indicate the extent to which you agree with the above statement, using a scale of 1-4 (1=None; 2=Low; 3=Moderate; 4=High)

#	Name	Criteria (MEEN4A)	Criteria (MEEN5A)	Criteria (MEEN5B)	Criteria (MEEN5C)
1	Qasem K AlZaid (QKZ)	4	4	4	4
2	Abdulwhab AlNuwaider (AAN)	4	4	4	4
3	Abdulrahman Alhuwaiji (AKH)	4	4	4	4
4	Khalid AlKhaldi (KMK)	4	4	4	4
5	Meshal Fenais (MSF)	4	4	4	4

SDP – MONTHLY REPORT

Department of Electrical Engineering
Prince Mohammad bin Fahd University

SEMESTER:	**Fall**	**ACADEMIC YEAR:**	**2020/2021**
PROJECT TITLE	**Design of Cost Effective Adjustable Rice Planting Machine**		
SUPERVISORS	**Dr. Nassim Khaled**		

Month 1: October - Team 14

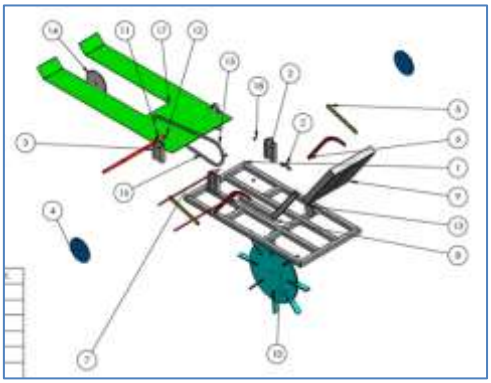
ID Number	Member Name
Qasem K AlZaid (QKZ)	201501158
Abdulwhab AlNuwaider (AAN)	201500995
Abdulrahman Alhuwaiji (AKH)	201500742
Khalid AlKhaldi (KMK)	201600510
Meshal Fenais (MSF)	201602213

List the tasks conducted this month and the team member assigned to conduct these tasks

#	Task description	Team member assigned	Progress 0%-100%	Delivery proof
6.	Formulated the team (Team-14) and assigned the team leader (Qasem K AlZaid)	QKZ	100%	SDP-01 submitted
7.	Selected the project and work with the advisor (Dr. Nassim Khaled)	QKZ	100%	SDP-02 submitted
8.	Submitted SDP-01 and SDP-02 to the instructor	AAN	100%	Sent through whatsapp
9.	Submitted Gannet Chart for that shows timeline for the team activities.	AAN	100%	Submitted in BB
10.	Designed in CAD the Adjustable Rice Planting Machine.	AKH KMK MSF	100%	*See figure-1 below*
11.	Agreed with the advisor on the CAD design.	QKZ AKH KMK MSF AAN	100%	Agree during the meeting via zoom
12.	Found welding and fabrication shop to do the needed machining and metalwork. All 3D printing shops declined to do the dosing.	KMK AAN	90%	*See figure-2 below*
13.	Called for a bi-weekly meeting with the advisor	QKZ	100%	Meeting via zoom
14.	Submitted milestones 1, 2, and 3.	AAN	100%	See BB

List the tasks planned for the month of November and the team member/s assigned to conduct these tasks

#	Task description	Team member/s assigned
5.	Finalize the fabrication of the machine with the shop.	AAN
6.	Present the design and share it with the advisor.	QKZ AKH KMK MSF AAN
7.	Perform the testing for the design along with the advisor and see the result.	QKZ AKH KMK MSF AAN
8.	Look for other 3D printing vendor to see the feasibility of printing some of the other design components.	KMK
9.	Prepare for midterm presentation “Milestone 4” on **November 12, 2020**.	QKZ AKH KMK MSF AAN



Figuer -1 “ CAD design for the machine

Figure-2 Welding and fabrication stage.

- **To be Filled by Project Supervisor and team leader:**
- **Please have your supervisor fill according to the criteria shown below**

Outcome MEEN4: an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts				
Criteria	**None (1)**	**Low (2)**	**Moderate (3)**	**High (4)**
MEEN4A. Demonstrate an understanding of engineering professional and ethical standards and their impact on engineering solutions in global, economic, environmental and societal context	Fails to demonstrate an understanding of engineering professional and ethical standards and their impact on engineering solutions in global, economic, environmental, and societal contexts	Shows limited and less than adequate understanding of engineering professional and ethical standards and their impact on engineering solutions in global, economic, environmental, and societal contexts	Demonstrates satisfactory understanding of engineering professional and ethical standards and their impact on engineering solutions in global, economic, environmental, and societal contexts	Understands appropriately and accurately the engineering professional and ethical standards and their impact on engineering solutions in global, economic, environmental, and societal contexts

Outcome MEEN5: an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives				
Criteria	**None (1)**	**Low (2)**	**Moderate (3)**	**High (4)**
MEEN5A: Ability to develop team work plans and allocate resources and tasks	Fails to develop team work plans and allocate resources and tasks	Shows limited and less than adequate ability to develop team work plans and allocate resources and tasks	Demonstrates satisfactory ability to develop team work plans and allocate resources and tasks	Properly and efficiently makes team work plans and allocate resources and tasks
MEEN5B: Ability to participate and function effectively in team work projects to meet objectives	Fails to participate and function effectively in team work projects to meet objectives	Shows limited and less than adequate ability to participate and function effectively in team work projects to meet objectives	Demonstrates satisfactory ability to participate and function effectively in team work projects to meet objectives	Function effectively in team work projects to meet objectives
MEEN5C: Ability to communicate effectively with team members	Fails to communicate effectively with team members	Shows limited and less than adequate ability to communicate effectively with team members	Demonstrates satisfactory ability to communicate effectively with team members	Communicates properly and effectively with team members

Indicate the extent to which you agree with the above statement, using a scale of 1-4 (1=None; 2=Low; 3=Moderate; 4=High)

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SDP – MONTHLY REPORT

Department of Electrical Engineering
Prince Mohammad bin Fahd University

SEMESTER:	**Fall**	**ACADEMIC YEAR:**	**2020/2021**
PROJECT TITLE	**Design of Cost Effective Adjustable Rice Planting Machine**		
SUPERVISORS	**Dr. Nassim Khaled**		

Month 1: September - Team 14

ID Number	Member Name
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Abdulwhab AlNuwaider (AAN)	201500995
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21.	Found welding and fabrication shop to do the needed machining and metalwork. All 3D printing shops declined to do the dosing.	KMK AAN	90%	*See figure-2 below*
22.	Called for a bi-weekly meeting with the advisor	QKZ	100%	Meeting via zoom
23.	Submitted milestones 1, 2, and 3.	AAN	100%	See BB

List the tasks planned for the month of November and the team member/s assigned to conduct these tasks

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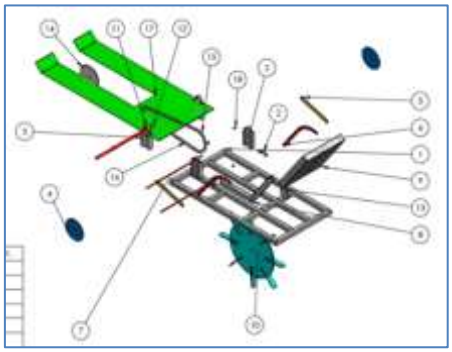
14.	Prepare for midterm presentation "Milestone 4" on **November 12, 2020**.	QKZ AKH KMK MSF AAN



Figuer -1 " CAD design for the machine

- **To be Filled by Project Supervisor and team leader:**
- **Please have your supervisor fill according to the criteria shown below**

Outcome MEEN4:
an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts

Criteria	None (1)	Low (2)	Moderate (3)	High (4)
MEEN4A. Demonstrate an understanding of engineering professional and ethical standards and their impact on	Fails to demonstrate an understanding of engineering professional and ethical standards and their impact on engineering solutions	Shows limited and less than adequate understanding of engineering professional and ethical standards and their impact on	Demonstrates satisfactory understanding of engineering professional and ethical standards and their impact	Understands appropriately and accurately the engineering professional and ethical standards and their impact on engineering solutions in global, economic, environmental, and societal contexts

engineering solutions in global, economic, environmental and societal context	in global, economic, environmental, and societal contexts	engineering solutions in global, economic, environmental, and societal contexts	on engineering solutions in global, economic, environmental, and societal contexts	

Outcome MEEN5:

an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives

Criteria	None (1)	Low (2)	Moderate (3)	High (4)
MEEN5A: Ability to develop team work plans and allocate resources and tasks	Fails to develop team work plans and allocate resources and tasks	Shows limited and less than adequate ability to develop team work plans and allocate resources and tasks	Demonstrates satisfactory ability to develop team work plans and allocate resources and tasks	Properly and efficiently makes team work plans and allocate resources and tasks
MEEN5B: Ability to participate and function effectively in team work projects to meet objectives	Fails to participate and function effectively in team work projects to meet objectives	Shows limited and less than adequate ability to participate and function effectively in team work projects to meet objectives	Demonstrates satisfactory ability to participate and function effectively in team work projects to meet objectives	Function effectively in team work projects to meet objectives
MEEN5C: Ability to communicate effectively with team members	Fails to communicate effectively with team members	Shows limited and less than adequate ability to communicate effectively with team members	Demonstrates satisfactory ability to communicate effectively with team members	Communicates properly and effectively with team members

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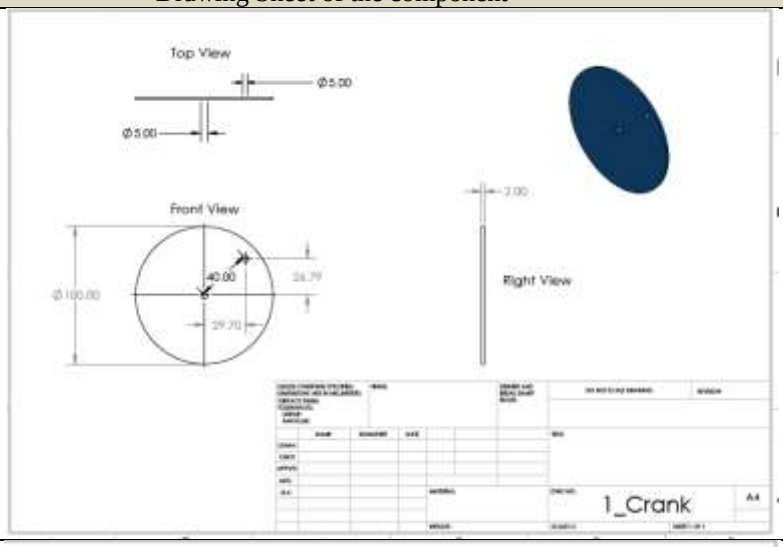
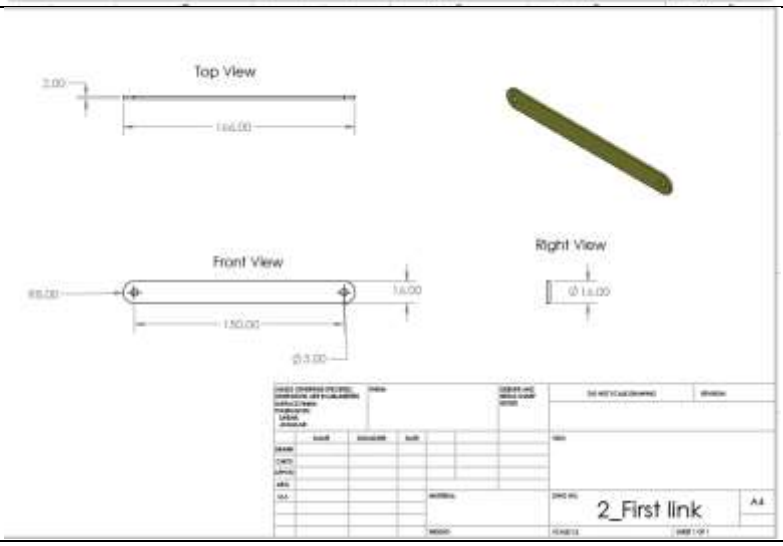
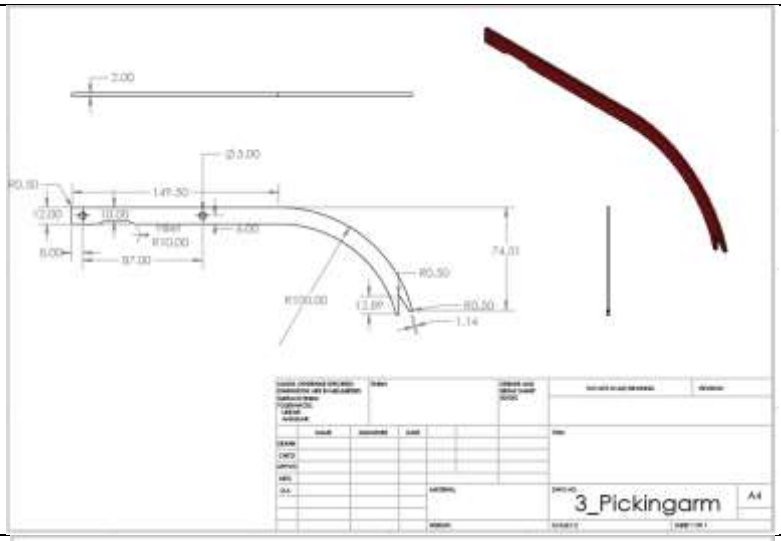
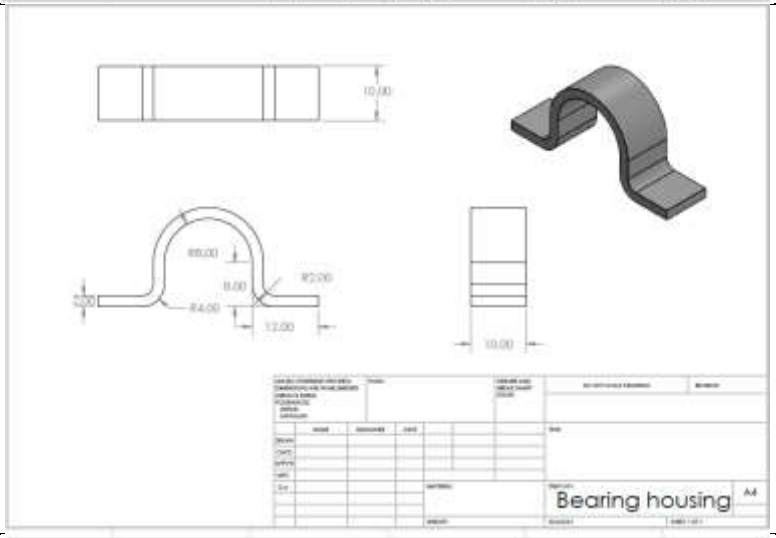
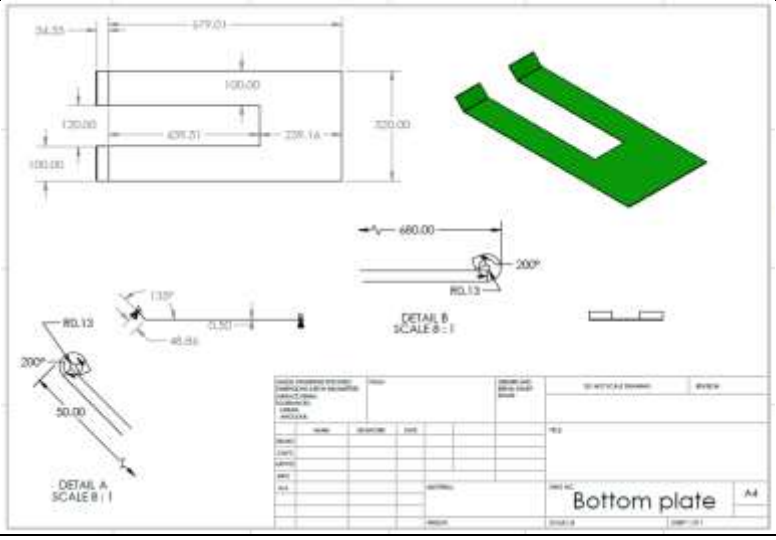
4	Khalid AlKhaldi (KMK)	4	4	4	4
5	Meshal Fenais (MSF)	4	4	4	4

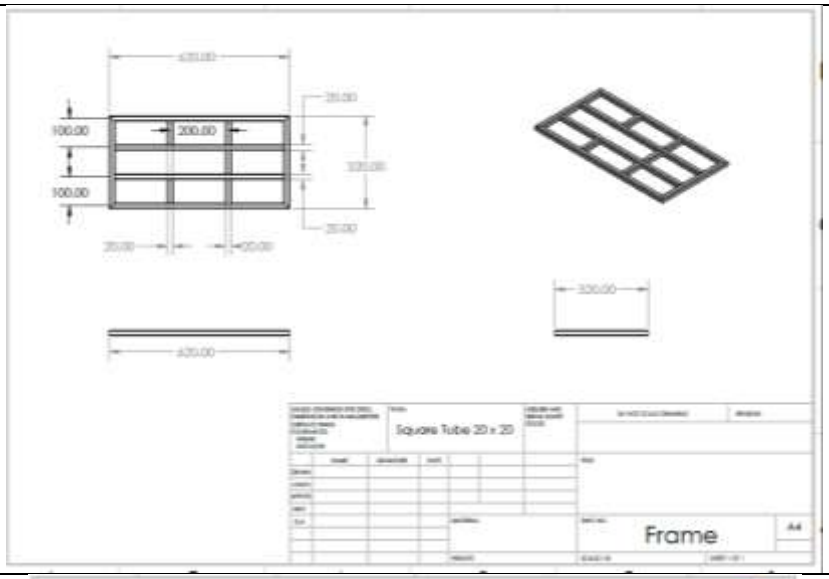
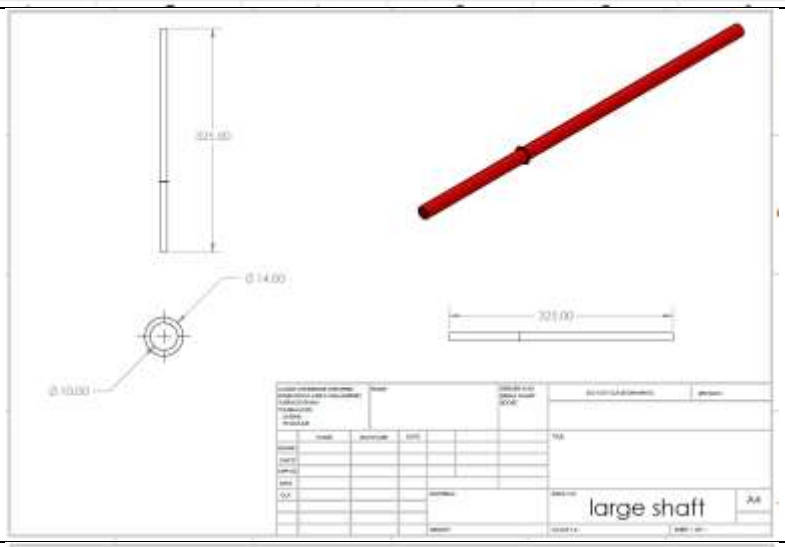
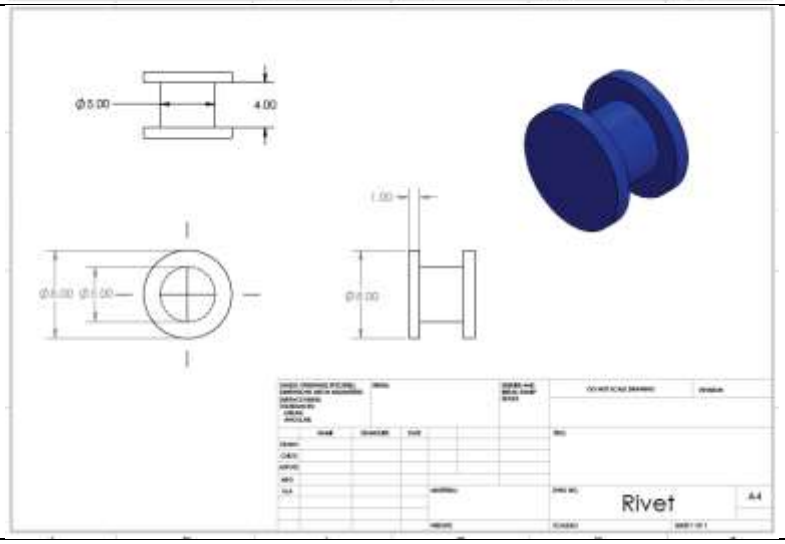
Appendix B: Engineering standards (Local and International)

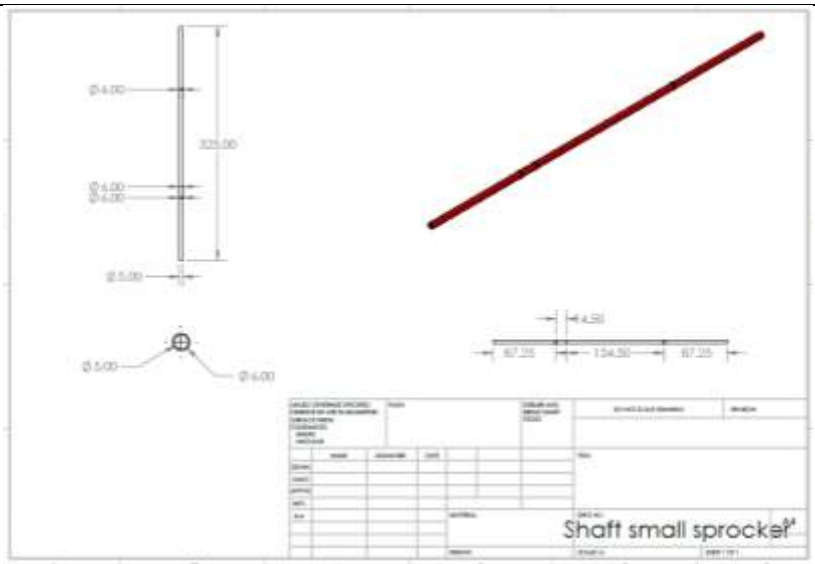
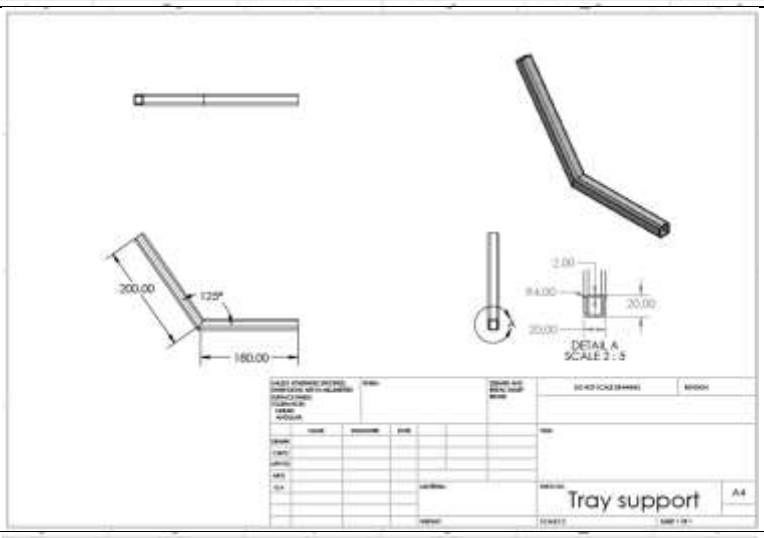
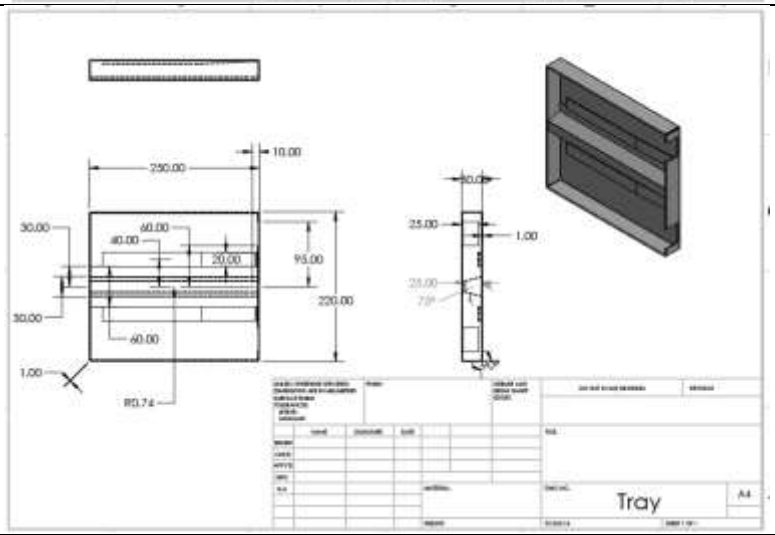
Component	Engineering Standard	Details
Cylindrical Ball Bearings	Stainless Steel Deep Groove Ball Bearing	SS 6800 open C3 / SS 61800 open C3 oiled 10x19x5 mm
Shaft	Stainless Steel-304	The composition includes chromium and nickel (both of which enhance the corrosion resistance of the steel)
Crank, frame , plate, tray and arms	Carbon Steel	ASTM A36
Chain High Quality Bicycle Chain	Carbon Steel	Standard- C9

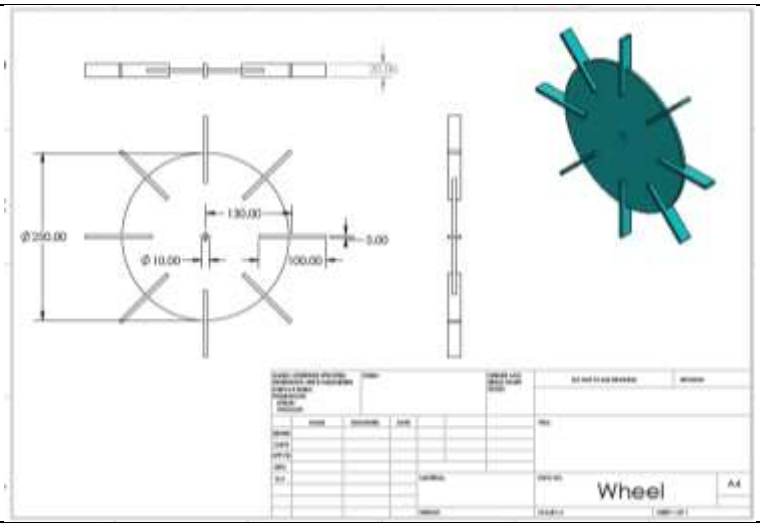
Appendix C: CAD drawings and Bill of Materials

Drawing Sheet of the component	
Crank	
Link	

Picking arm		
Bearing housing		
Bottom Plate		

Frame	
Large shaft	
Rivet	

Small shaft	
Tray Support	
Tray	

Wheel		

Appendix D: Operation Manual

To operate the machine, follow the below steps:

- Rice field has to be leveled
- Place the machine in a leveled spot
- Attached a sling to provide a pulling force
- Fit the rice seeding in the tray
- Pull the machine with a constant speed
- Adjust the speed of the machine if required