Study of Multipurpose Mini Combine Harvester

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***Abstract*- The main aim of the project is to develop a multipurpose agricultural vehicle, for performing major agricultural operations like harvesting, carrying, threshing, Kula etc. the main target is to fabricate a machine which has a small size. The project is about a machine design which makes harvesting much simpler. The design of the chassis of the vehicle is made in such a way that it is suitable for the operations. The design for automatic harvesting equipment is made. The cutter is designed and modified to the currently available tool in such a way that it withstands the load. The harvester (cutter) is designed and working by scotch yoke mechanism. Presently, a manually handled device is commonly used for cutting the crop over the field which creates pollution and loss of energy. Multipurpose mini combine harvester will reduce the effort required for cutting crops in the field and solar power used will help to contribute in lowering pollution The basic function of Multipurpose mini combine harvester is to harvest the crop iv very short period and use of trolley for carrying purpose also threshers for threshing the crop A Multipurpose mini combine harvester is a device that cut the filed carry it to required destination threshing it and Kula too. Multipurpose farming machine ensures uniformity in cut and proper threshing and saves time and money.**

Index Terms- Harvester, threshing, feeder, farming

I. INTRODUCTION

Agriculture being one of the major occupations in India, Agriculture plays a vital role in the Indian economy. Indian agriculture has registered impressive growth over last few decades. It is very essential to discover and implement new idea in this field, though lot of work has been done in this area. It is unfortunate that, these ideas are not being implemented properly in actual field. This is due to high cost and is complicated for rural people. Multipurpose mini combine harvester is basic and major machine involved in agriculture for maximum yielding. The Conventional method of harvesting and threshing is a laborious process and hence for that reason there is a scarcity of labors and Basically, many farmers in India also use bullocks, horses and buffalo for farming operation. This will not satisfy need of energy requirement of the farming as compared to other countries in the world. This result in delayed agriculture crop production practices to overcome these difficulties, we are thinking that human and animal efforts can be replaced by some advance mechanization which will be suitable for small scale farmer from economical and effort point of view. So, we are developing this machine which will satisfy all this need and to solve labor problem.

Agriculture has been the backbone of the Indian economy and it will continue to remain so for a long time. Agricultural sector is changing the socio-economic environment of the population due to liberalization and globalization. Rice is most important crop in the tropical region. Harvesting is mostly done manually in this region by using hand sickle. The farmers have to keep bend for cutting the plant, due to this the health related problems occurs. The crop cutting is important stage in agriculture field. The availability of human resources for critical operations in rice cultivation is decreasing and affordable technology is required to mechanization to increase the productivity. About 75% people are living in the rural area and are still dependent on agriculture. About 43% of geographical area is used for agricultural activity. Agriculture has been the backbone of the Indian economy. As Indian population is growing continuously, the demand for producing crop per hector is also increasing; this requires efficient and high-capacity machines. So mechanization in agricultural industry plays an important

II. FEATURES

- Reduces human efforts required harvesting threshing and transporting the crops.
- Reduces number of workers required.
- Develop a harvester which is simple and cost effective.
- Minimize the production time. Promote productivity.
- Minimize mis-operation and to make it more safe and easy to operate due to its compact machine design and structure.
- Reduces the investment of the small scale farmers.
- Harvester is a pollution free machine.
- Promote safety and improve working condition of framers.
- Contribute to better quality of living of framers.
- Cost effective into integrated system design.
- Promote development of method which improves and simplifies the work process.
- Recognize human capabilities and limitations.
- Minimum impact upon the working environment.

III. LITERATURE REVIEW

Aravinde et al, designed and fabricated simple and cost-effective "Paddy Harvester". A detailed design of paddy harvester which included a cutting system, transmission from the engine to the cutting system and mainframe had been carried out. The assembled paddy harvester was tested for its working and found to be working satisfactorily. But the developed paddy harvester was large in size and there is a scope for making it more compact and light in weight its make the harvesting process faster and safer also reduce the time of harvesting as 2 hp petrol engines is used cost increase. [1]

Pamujula Hythika Madhav et al, Designed and fabricated "Manually operated rotary lawn mower". The manually operated lawn mower works without fuel. The gear train mechanism and bevel gear system used to rotate the cutting blade. By this lawn mower variety of grass lawns can be cut. Maximum cutting efficiency found was 62 % Energy expenditure on operating model requires fewer calories. It can be operated easily and is economically cheaper. [2]

Dr. U.V. Kongre et al, Dr. U.V. Kongre along with his team fabricated a "Multi-Crop Cutter". This machine does not employees any use of power equipment's such as DC motors and it is fully human operated. The use of this machine makes the harvesting process faster hence reduce most of the cutting time and labour required to operate the machine is also less. This machine is helpful for small as well as big firms. This human-powered machine will help to improve an economic condition. This is a new type of machine which is different to the other cutting machine which is used for harvesting purpose. [3]

Humbade A et al, This Project presents work on the design of a new agricultural multipurpose vehicle to be used for various applications. Mechanized agriculture has become one of the important modern agricultural methods. In India 60% population involved in agricultural work, Conventional mechanized systems may increase productivity but are less adaptive and flexible. As a consequence, there have been initiatives in developing advanced mechanized systems. They have evolved a multipurpose vehicle for a farm, which can easily use for digging, seeding, spreading fertilizer. The help of this vehicle farmer are able to improve the crop efficiency & the overall result of the quality of crop into the Indian market. From this, we may conclude that the overall result of the agriculture field is increased. [4]

V.M. Martin Vimal et al, In this research paper author developing equipment which will satisfy all this need and to solve labour problem. After comparing various models, the agro machine has considerable potential to increase productivity and decrease the labour efforts, cost and time. It is effective replacement for usual labour in medium and small scale farm lands. The cost for various components is less expensive and are easily available compared to other existing models by using this machine there is flexibility in area covered and time taken. The model is designed to be eco-friendly and less maintenance, operating cost and thus it is proved to be more efficient when compared to petrol based pesticide sprayer. [5]

Abdulkarinm K.O. et al, This research has clearly demonstrated that it is quite possible to design for manufacture of a multipurpose mini combine harvester aimed at solving farmer's problem of harvesting and transportation in developing nations. The combine harvester is designed not only to harvest, thresh and store grains but also to drive other farm implements and used for irrigation purpose when an engine is connected to a pump. The calculated results obtained showed that the chassis was able to withstand the design load the harvester may be subjected to as long as high strength material is used for the chassis construction. The result also revealed a deflection of 1.76 mm when the chassis is subjected to the maximum load, which it was safe to use considering a factor of safety of 3.1 incorporated in the design. [6]

Sarkar bikash et al, The research paper revealed that the capacity of crop cutter was 2.23 times higher than manual harvesting for wheat and 2.44 times higher for rice depending on operator's skill, variety and harvesting condition. The labour required for the harvesting of wheat was 23.20 man-hour/ha and manual was 115.74 man-hour/ha. Whereas for rice harvesting labour requirement was 32.74 and 149.25 man-hour/ha for crop cutter and manual operation, respectively. Thus, as compared to manual harvesting labour saving through crop cutter was 5.0 and 4.6 folds in wheat and rice harvesting, respectively. The cost of operation for wheat harvesting in the one-hectare area was Rs. 2340.40/- in case of crop cutter and Rs. 3750/- for manual labour operation. While in rice, it was Rs. 2464.28/- and 5596.87/- for crop cutter and manual operation, respectively. [7]

IV. PROBLEM DEFINITION

Most of the available techniques are efficient for performing a particular task like cutting by sickle. There are integrated machines but they are either expensive or too big to be operated in small scale farms. The aim of the project is to build a small size portable machine which integrates all the above mentioned tasks like threshing, cutting, carrying, Kula etc.

In spite of the large scale mechanization of agriculture in some parts of the country, most of the agricultural operations in larger parts are carried on by human hand using simple and conventional tools and implements like wooden plough, sickle, etc. Little or no use of machines is made in harvesting threshing and transporting the crops. This is specially the case with small and marginal farmers. It results in huge wastage of human labour and in low yields per capita labour force. There is urgent need to mechanize the agricultural operations so that wastage of labour force is avoided and farming is made convenient and efficient.

- The conventional harvester are consuming large amount of non-renewable energy sources.
- By using engine and motor based harvester large human efforts are required for proper mowing.
- The electric harvester is having heavy expenses and labor charge.
- Previously majority of work is done by manually, the time is passed away many equipment's are developed to ease human activities.
- Manually cutting is time consuming.
- As to consider an economical factor. It is very expensive due to high labor's charges as lack of labors in field.

V.OBJECTIVES

- The primary objective is to develop a harvester which is simple and cost effective and to make harvester a pollution free machine.
- To reduce human efforts required harvesting threshing and transporting the crops.
- Reducing the investment of the farmers. To reduce number of workers required.
- To design the multipurpose agriculture vehicle for small farmers. The reduction of cost of the harvesting machine present today.

VI. DESIGN METHODOLOGY

The machine is a walk behind type of harvester which can be used for harvesting crops especially fodder crops such wheat, bajra etc. There are two cutter blades; one is moving and another is stationary. The slider crank mechanism was used to convert rotary motion to linear sliding motion. Scissoring action is obtained due to reciprocating movement of cutter blade over stationery blade was used to cut the crops. The frame of the harvester with the dimensions

760 X 560 X620 (l X b X h) mm was fabricated. The mild steel angle section was used to build the frame. Mild steel angle was used because they are light weighted and can be easily welded.

The frame was fitted with 2 pair of wheels. Front pair is smaller in size whereas other one is bigger in size. Two pair of wheels was used for easy movement of harvester in the field. Two handles were provided at the end of the frame for pushing the harvester forward. Motor of 1440 rpm was used

Cutter assembly consists of two cutter blade plates. One of the cutter plates is stationary and other is sliding in nature. The cutters used are of triangular shape. In sliding cutter plate, cutter blade was riveted on 3mm plate and in stationary cutter plate; cutter blade was riveted on 5mm plate. The stationary cutter plate was directly welded and fixed on frame. Sliding cutter blade was provided with 2 slots of 80mm on its ends; it allowed sliding motion to be in straight line. The bottom of the sliding cutter plate was connected to the slider crank mechanism. The height of cutting blade is 10 mm and has a base of 560 mm. The blades were made up of Mild steel.

Rice Stem Specifications

- Height of Rice Crop = 1 to 1.8m
- Width = 20 to 25 mm
- Bunch Dia. of rice stem (D) = 1000mm
- Length of Blade (L) = 560mm
- Square hollow angle =(20 X20 X3)mm
- L angle =(20 X20 X3)mm
- Plates =(25 X4)mm
- Bearing (Pedestal Bearing)
- Internal Diameter, ID = 20mm

Shaft (Mild Steel) Bright Material

- Shaft Diameter =20mm
- Motor = 12V
- Battery =12V, 7.2 Amp
- Nut Bolt = M6
- Wheel Disc = 5 inch

Thickness t = 4mm
Internal Diameter, ID =20 mm
Outer Diameter, OD = 120mm
Total Wheel = 4 Nos.

- Blade

Length = 24” inches
=560mm
Width= 4” inches
=100mm
Cutter Width =50 mm
Length
=700mm

- Roller Bearing for pressure purposes

Internal Dia. ID =8mm
Outer Dia. OD =30mm

VII. DESIGN CALCULATION

- SELECTION OF DC MOTOR:-

Selection of DC motor over the wattage rating
Calculation:
P = w/t
Where, P =Power,
w = Work,
t = time
∴ w = F×distance
Where, F = force
Now, Power = force×distance/time
∴ Power = force×velocity
Let’s say the vehicle moves forward at a rate of 1 meter per 6 second.

$\therefore V = \frac{\pi DN}{60}$

Where, V = velocity in m/sec
D = Diameter of wheel in m = 0.232 m
N = Speed of motor shaft in rpm

$\therefore \frac{1}{6} = \frac{\pi \times 0.232 \times N}{60}$

N = 15.6 ≈ 20 rpm.
From above equation we find the speed of motor shaft,
Now, P = F× V
Force needed to move 200 kg weight against the gravity
∴ F = 200×9.81
= 1962 N
F = 1962 N
So power needed,
P = 1962×0.1667
P = 327 W
But this is the power needed without frictional and other losses.
Fairly assuming that motor and driving assembly is 80% efficient.
Therefor actual power of motor is given as,

P = $\frac{327}{0.8}$

P = 408 W

∴ Selecting the Standard DC motor having the power

P = 400 W

- BATTERY CALCULATIONS:-

CHARGING TIME

Basic formula for calculate the charging time of battery is

$T=\frac{Ah}{A}$

Where, T = Time in hours or charging time in hours

Ah = Amp hours rating of battery

A = Current in battery

Now as per the data our battery is of 7 Amp/hours

First of all we will calculate the current in 7A/H battery

As we know that charging current should be 12% of AH rating of battery

So, Charging current for 7AH battery

=7AH ×($\frac{12}{100}$)

= 0.84Amp

Considering some losses we will the charging current is about 0.9 Amp

Now charging time for 7AH battery

T = $\frac{AH}{A}$

= $\frac{7}{0.84}$

=8.33hours (Theoretically)

But we selecting the charging current is about 0.9 to 1.2Amp

Hence charging time will be,

T= $\frac{AH}{A}$

= $\frac{7}{1.2}$

= 5.83 hours

Note: - As we increase the charging current charging time will decreases but for safety we take only 12% of AH capacity current

DISCHARGING TIME

Battery AH× $\frac{Battery\ Voltage}{Applied\ load}$

As out battery AH is 7AH

Battery voltage = 12 V

Applied load (Full load) = 400 watt

= 7× $\frac{12}{400}$

= 0.21 hours (only for full load)

It is very less,

But our motor cannot run on full load condition, as the load on motor is 200 Kg means near about it consume 150 watt (with 40% loss at the maximum)

= 7× $\frac{12}{120}$

=0.7 Hours

Considering loss it will run about 0.65 Hours ≈ 45 min Backup time

NOTE: - We have used two Batteries which connected Parallel to each other.

Design of bearing:-

Here ball bearings are selected for radial load of transportation along with the self-weight of plate including friction being 10 kg. During 90% of time &

Step 1. Life of bearing

Velocity of shaft = 0.1667 m/s

N = 20 rpm

Assume life required 5 year with 3 hour per day with 25 day of month

L_H = 5× 12×25×3

L_H = 4500 hours

L_{90} = L_H× 60×N

L_{90} = 4500×60×20

L_{90} = 5.4× 10^6 revolution

L_{90} = 5.4 million revolution

Step 2. Equivalent load

Radial Force (Fr)

Fr = 2F

= 2×1962

Fr = 3924 N

Axial force is very small as compare to radial force hence neglected.

Pe = [Cr×X×Fr+Y×Fa] × S.F

PSG 4.2

X = 1

Y = 0

S.F = 1.5 (for rotary motion)

Cr = 1.2 (for inner race rotation)

Pe = [1.2×1×3924+0] ×1.2

Pe = 706.32 kgf

Step 3. Dynamic capacity (C)

$C = [\frac{L'90}{L10}]^{1/k}\times Pe$

PSG 4.2

K = 10/3 (for roller bearing)

L_{10} = 1 mr

∴ C = 1171.44 kgf

Step 4. Selection of bearing

Selecting DGBB, ISI NO- 20BC03

Bearing No – SKF 6304

C = 1250 kgf

Co = 705 kgf

Now using reference table, for static load of 1250 kgf bearing SKF 6304is suitable.

Design of bolt:-

Tension

Bolt is to be fastened tightly also it will take load due to rotation. Stress for C-25 steel ft =420 kg/cm^2 .Std nominal diameter of bolt is 8 mm. From table in design data book, diameter corresponding to M8 bolt is 8.160mm

Let us check the strength:-

Also initial tension in the bolt when belt is fully tightened.

P =30 kg = 300 N is the value of force applied by hand

Also, P = Π /4 dc^{2}x ft

$$ft = \frac{300 \times 4}{3.14 \times (12 \times 0.84)^2} = 3.76\ N / mm^2$$

The calculated ft is less than the maximum ft hence our design is safe.

DESIGN OF WELDED JOINTS:

Checking the strength of the welded joints for safety

The transverse fillet weld welds all the angle and the edge, the maximum load which the weld can carry for transverse fillet weld is

P = 0.707 x S x L x fs

Where, S = size of weld, L = contact length = 30mm (5 mm for starting &

Stopping of weld

The load of shear along with the friction is 45 kg = 441N

Hence, 441 = 0.707 x 5 x 30 x fs

Hence let us find the safe value of 'fs'

Therefore ft = $\frac{441}{0.707\ X\ 5\ X\ 30}$

fs = 4.15 N/mm^2

Since the calculated value of the shear load is very smaller than

The permissible value as fs=56 N/mm^2. Hence welded joint is safe.

VIII. DEVELOPMENT OF CONCEPTUAL MODEL

- With the help of Solidworks software we developed crop cutting machine.
- It consists of four wheels, motor, cutter blade, bearings and handle.
- We are using DC motor which works on principle converting electrical energy into mechanical works. The motor transmit power to the plate which is directly coupled to the mechanism.
- As the application of cutter reciprocates in guide ways and shearing action take place in cutting. One blade is fixed and other is movable

Figure 1 :- Front View

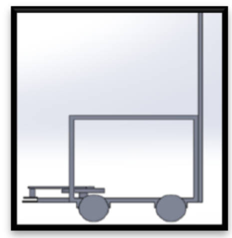

Figure 2 :- Side View

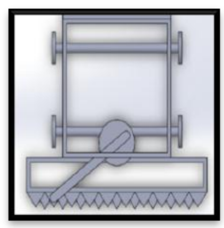

Figure 3:- Top View

Figure 4 :- 3D View

Selection of material for Chassis

➢ The frame of the harvester is made up of mild steel

➢ Mild steel has been chosen because of :

❖ less cost

❖ higher strength

❖ relatively easier availability

➢ Frame is made up of hollow bars of steel with square cross section welded together

➢ Dimensions of cross section of bars is 20×20 mm with a thickness of 2 mm

➢ Mild steel of grade AISI 1018 has the following properties

❖ Ultimate tensile strength : 354 MPa

❖ Yield strength : 236 MPa

❖ Modulus of elasticity : 200GPa

❖ Density : 7870 Kg/m^3

The choice of material for the vehicle is the first and most important factor for automotive design. There is variety of materials that can be used in automotive body and chassis. The most important criteria that a material should meet are lightweight, economic effectiveness, safety, recyclability, and life cycle consideration. Some of these criteria are the result of legislation and regulation. The material for the frame and chassis is steel.

The main factors for selecting material specially for body is wide variety of characteristics such as thermal, chemical and mechanical resistant which are ease for manufacturing and durability. In the frame only the main supporting structures such as motor of the vehicle, the harvester and threshing tool are mounted. It supports the tool static and dynamic load of the vehicle. The design is made which is suitable supporting all the operations. The frame is made for a compact size vehicle

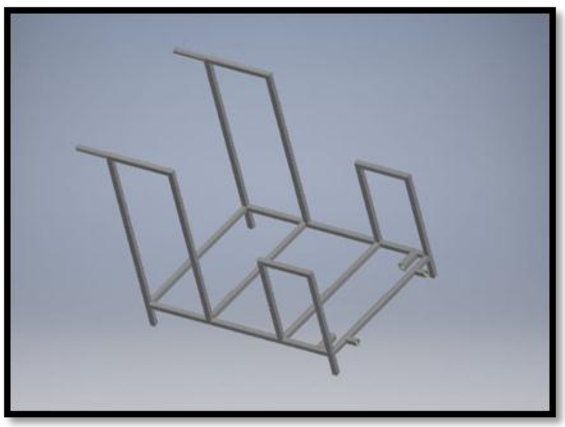

Figure 16 :- inventor model of frame

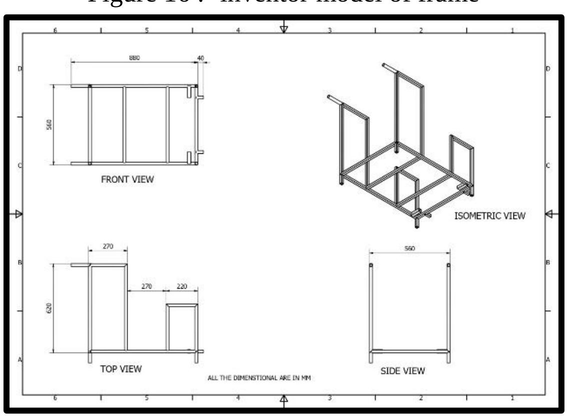

Figure 5 :- frame design sheet

Selection of material for Thresher

- ➢ The Thresher of the harvester is made up of mild steel
- ➢ Mild steel has been chosen because of :
- ❖ less cost
- ❖ higher strength
- ❖ relatively easier availability
- ➢ Thresher is made up of solid bars of steel with square cross section welded together
- ➢ Dimensions of cross section of bars is 560 X 202 mm with a thickness of 10 mm
- ➢ Mild steel of grade AISI 1018 has the following properties
- ❖ Ultimate tensile strength : 354 MPa
- ❖ Yield strength : 236 MPa
- ❖ Modulus of elasticity : 200GPa
- ❖ Density : 7870 Kg/m^3

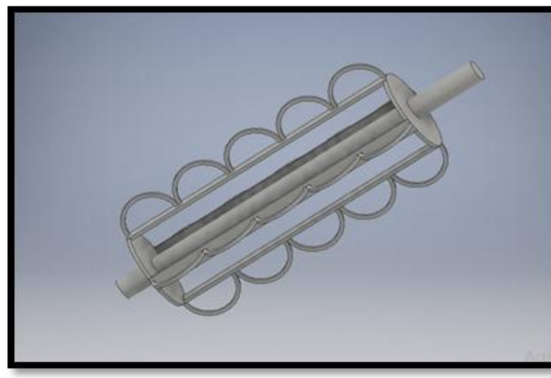

Figure 18 :- inventor model of Thresher

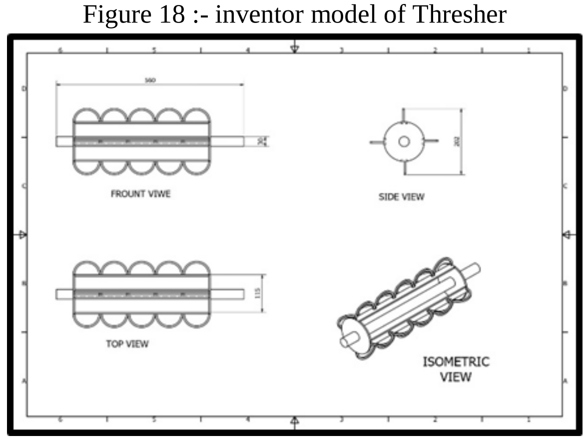

Figure 6 :- design of thresher sheet

Selection of material for Feeder

- ➢ The Feeder of the trolley is made up of mild steel
- ➢ Mild steel has been chosen because of :
- ❖ less cost
- ❖ higher strength
- ❖ relatively easier availability
- ➢ Thresher is made up of solid bars of steel with square cross section welded together

- Dimensions of cross section of bars is 400 x 500 mm with a thickness of 10 mm
- Mild steel of grade AISI 1018 has the following properties
  - Ultimate tensile strength : 354 MPa
  - Yield strength : 236 MPa
  - Modulus of elasticity : 200GPa
  - Density : 7870 Kg/m^3

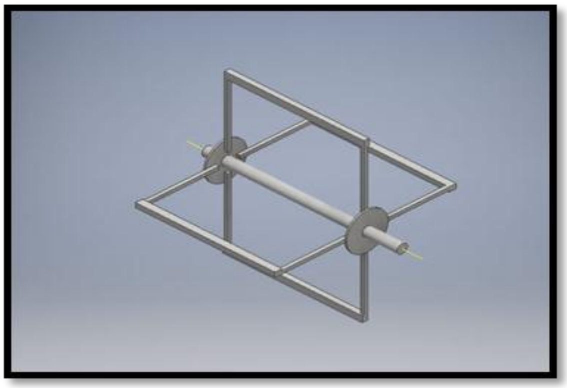

Figure 20 :- inventor feeder

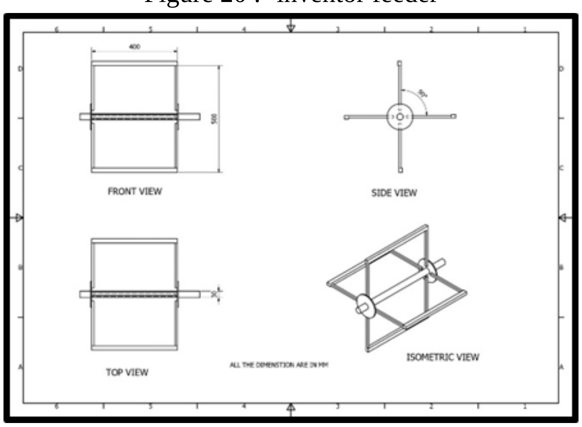

Figure 7 :-design of feeder sheet

Mechanism and Design

The scotch yoke mechanism is used in the harvester design. It is also known as slotted link mechanism. It converts rotational motion into linear motion. The reciprocation part is directly coupled with the sliding yoke. The components in the harvester are frame plate, scotch, yoke, supporting rods and blades. One blade is fixed stationary and the other one is fixed to the moving rod.

The Scotch yoke mechanism is a reciprocating motion mechanism, converting the linear motion of a slider into rotational motion, or vice versa. The piston or other reciprocating part is directly coupled to a sliding yoke with a slot that engages a pin on the rotating part. In many internal combustion engines, linear motion is converted into rotational motion by means of a crankshaft, a piston and a rod that connects them.

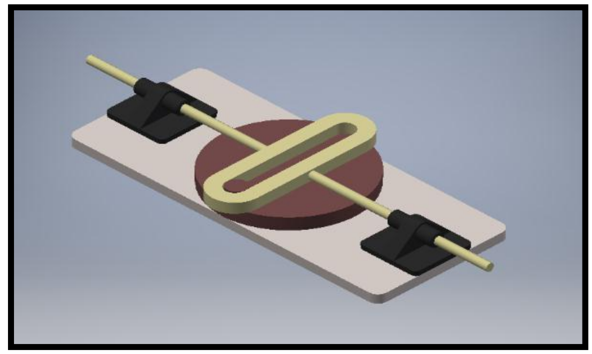

Figure 22:- Scotch Yoke Mechanism isometric view

The Scotch Yoke is considered to be a more efficient means of producing the rotational motion as it spends more time at the high point of its rotation than a piston and it has fewer parts. The location of the piston versus time is a sine wave of constant amplitude, and constant frequency given a constant rotational speed. The reciprocating motion as discussed in construction part above. The power is supplied to the Dc motor, shaft and crank attached to the shaft start rotating. As the crank rotates the pin slides inside the yoke and also moves the yoke forward.

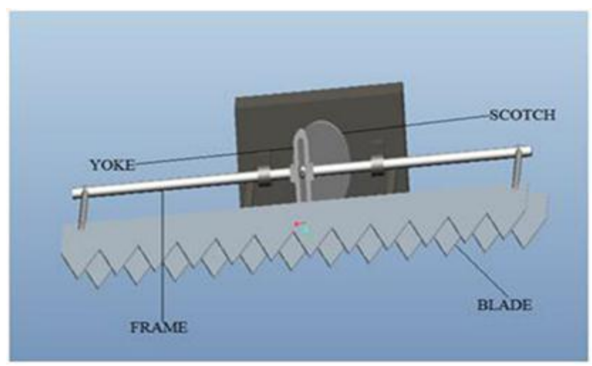

Figure 8: Scotch Yoke Mechanism and blade assembly [6]

The 3D design for the harvester is given below and it consist of the following parts

1) Scotch
2) Yoke
3) Frame plate
4) Blade

When the crank rotates through in clockwise direction the yoke will get a displacement in the forward direction. The maximum displacement will be equal to the length of the crank. When the crank completes the next of rotation the yoke comes back to its initial position. For the next of rotation, yoke moves in the backward direction. When the crank completes a full rotation the yoke moves back to the initial position. For a complete rotation of crank the yoke moves through a length equal to double the length of the crank. The displacement of the yoke can be controlled by varying the length of the crank.[7]

Material used for various components

Sr. No.	Name of Component	Material Used
1	Frame	Mild Steel
2	Ground Wheel	Standard
3	Rotating Disc	Mild Steel
4	Shaft ➢ Thresher ➢ Feeder	 High Carbon Steel High Carbon Steel
5	Handles	Mild Steel
6	Chain	High Carbon Steel
7	Bearing (SKF 6304)	Cast Iron And Al
8	Sprockets	Gun Metal & Mild Steel
9	Gear	High Carbon Steel
10	Plates	Mild Steel
11	Grip	Wood
12	Base	Plywood
13	Cutter Blade	Hard Steel
14	Nut Bolts	Aluminium
15	Motor	Standard

Hence the total manufacturing cost = material cost + machining cost +labour cost
= 9470 + 1940 +1150
= 12560

Hence the total manufacturing cost is 12,560 rupees
This cost can be reduced by 25% if this machine is manufactured on Mass quantity as below:-
Cost = 12650-3140 =9420
Multipurpose mini combine harvester can cost for only 9,420 rupees in market

IX. TESTING AND RESULTS

After fabrication of machine we did experimental analysis, we conduct the two major tests they are

a. Rice crop cutting
b. Grass cutting

FIELD PERFORMANCE

DESCRIPTION	UNIT
Time of start	11:00 am
Time of finish	11:15 am
Actual field operation	15 min
Time lost owing to A) Turing B) cleaning and clogging	 1 min 4 min
Actual area covered	100 sq.m
Effective working width	300 mm
Effective filed capacity	0.055 ha/hr
Field efficiency	66.13 %
Speed of machine	0.5 m/s
Height of cut	75 mm
Labour required	2
Length	10 m
Width	10 m
Area	10 m
Type of soil	Black cotton soil

A comparison of harvesting cost by traditional method and our harvester.

a) Harvesting done by manual process:

Amount paid to the labour for one day = Rs. 300 per day
Total number of labour required in general to harvester the 1 acre farm of rice in a day= 12
Total amount paid to the labour = 12 X 300
= Rs. 3600 per acre in one day
Therefore, total expenditure in one day is = Rs. 3600 + 1000 (Lunch)

b) Harvester done by machine:

Quantity of electricity for 0.25 to 0.5 acre = required 2 hours
= 746X2/1000
= 1.5 unit electricity required
Hence 1.5 unit = 1.5 X 7 = 1.5 X 7 = 11Rs.
Quantity of electricity require for 1 to 1.2 acre = required 4-5 hours
= 746 X 5 / 1000
= 3.37 unit electricity required
1 unit = 7 Rs.
Hence, 1.5 unit = 3.37 X 7
Cost of Electricity per unit = 7 Rs.
Total cost of Electricity for acre farm for a day = 27Rs.
Amount paid to the labour = 300Rs.
Total expenditure = Total cost of electricity + amount paid to the labour + Maintenance
Total expenditure = 27 + 300 + 50
= 377 Rs.
Amount saved by using the harvester = 4600 – 377
= 4223 Rs.

X. CONCLUSION

This multipurpose mini combine harvester machine has considerable potential to greatly increase productivity of crops. So, we are designing and fabricating a multipurpose mini combine harvester machine which will do multiple operation simultaneously i.e. harvesting, threshing, Kula, carrying or transporting goods. The machine is successfully tested into farming field and reduces time and cost as compare to the traditional method. Less manpower needed to operate this machine i.e. 1 person to operate. Therefore, the cost of production crops is less. Design and fabricate machine at affordable price for small farmer. The main task now is to promote this technology and have available to farmers at an affordable price. The multipurpose farming machine can be readily made from local components in workshops. This machine is more beneficial to small scale farmer who cannot afford farming equipment at higher cost. And one person can be easily handle this machine. Promote development of method which improves and simplifies the work process. This machine is a pollution free machine and Promote safety and improve working condition of framers.

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Following different references we have taken to make our project a Successes one

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