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Development of Multipurpose Biowaste Shredder Machine

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Abstract: ***The scope of this project was to design and develop a Shredder machine with focus on chopping of coconut leaves, areca leaves, this chopped powder to prepare the vermin compost. The project began with collection of information and data on user lifestyle and current process by which they perform their job. Concepts were developed with reference of four different shredder machine and operating processes. Concept was developed considering the safety factor users operating environment and maintenance. Considering the users' needs and buying capacity, a prototype was fabricated. The machine consists of single-phase motor, bearings, structural frame, cutter and shaft. The machine frame is built using mild steel and*** CPM REX M4 HC ***is used for cutter tip preparation. Four cutters are mounted on shafts, which rotates.. The power from the electrical motor is transmitted to cutter shaft through a belt drive. Cut is made inside the chopping house due to the effect of tensile, friction, and impact effect in chopping process. The coconut leaves get chopped and powder is collected.***

The possible outcomes of this project are:

- ***The working efficiency is set to increase with the reduced power to weight ratio.***
- ***Reduced cost with reliable performance output.***
- ***People with different physics can be accommodated on this equipment.***

Keywords: Agro waste; shredding machine; Cutter, Single-Φ motor, shaft.

I. INTRODUCTION

The conventional agro-waste disposal is a traditional and oldest method of waste disposal in which agriculture wastes are dumped as it is to degrade in a particular place for decomposing. As the wastes are dumped as such, it takes more time to degrade and it causes environmental pollution.

The waste shredder machine aims to reduce the agro waste and convert it into useful nourishing fertilizer. Agriculture is one of the most important sectors in the Indian economy. Coconut palm cultivation is one of the major livelihoods of farmers of Kerala and Karnataka.

It has been realized that large quantity of agricultural wastes remains being unutilized because handling, storage and management related difficulties. The reasons are their low bulk density, large area/volume for storage. The farmers on the field burn most of these wastes after the harvesting of crops.

Thus the agricultural waste burning phenomena is being repeated every year.

In current agriculture practice we can observe that there is plenty of sources are being wasted without having developed technologies and ideology. So we here trying our best to introduce a new machine which helps in agricultural aspect to develop and improve in comfort and makes farmers life easier.

"BIO WASTE SHEDDER MACHINE" which works as conversion of particular agriculture products like dry maize stick, dry coconut leafs, banana stem and other related products into small grain sized powder. Considering the coconut leaf growing up to with pinnate leaves 4–6 m (13–20 feet) long, and pinnae 60–90 cm (2–3 feet) long; old leaves break away cleanly, leaving the trunk smooth by its thickness of the leaf it would take around 90 to 120 days to complete degradation in the soil with presence water content in the soil.

When it comes to maize stick after the cultivation of the maize bunch farmers were left the maize stick in the cultivation land itself, due to lack in its benefits. And then it fired by the farmers (and the slash used as the fertilizer for the next crop (not for all the crops it applicable only for sugar cane). So those soils get loss the property of porosity and field capacity.

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II. LITERATURE SURVEY

A. *P.B. Khope and J.P. Modak Research Scholar and Assistant Professor, Department of Mechanical Engineering, Priyadarshini College of Engineering, Nagpur, Maharashtra, India. . Journal IOSR Journal of Agriculture and Veterinary Science*

P.B. Khope and J.P. Modak et al., observed that proposed the Design of experimental set-up for establishing empirical relationship for chaff cutter energized by human powered flywheel motor. This machine used to chop the forage into small pieces for easy consumption by the animals. In the human powered flywheel motor concept, the bicycle mechanism for converting and transmitting human energy through padding to rotational kinetic energy of flywheel is hereby proposed. The energy stored in the flywheel can be used for actual cutting process.

Figure 2.1

B. *Ajinkya S. Hande et al, Department Mechanical Engineering Department A.G.P.C.E., Nagpur, India Journal International Journal of Innovative Research in Science, Engineering and Technology Volume-3*

In their research work carried out project on "Methodology for Design & Fabrication of Portable Organic Waste Chopping Machine "Organic waste is fed uniformly through feeding drum and tray. Then the Shaft rotated at 1440 rpm through electric motor by means of pulleys makes the chopping drum to cut the waste by the effect of impact shear obtained from the shearing blades. The cut is also made inside the chopping house due to the effect of tensile, friction, and impact effect in chopping process. Then the cut pieces pass through the concave holes of the sieve & come out of the machine. The sieves of different sized holes can be used

C. *Sreenivas H T1, Sundeep Y2, Ajay Krishna T M3, Naveen Kumar K H4, DR.N Krishnamurthy5 Asst. Professor, Department of Mechanical Engineering, VVIT, Bangalore, Karnataka, India. Research article International Journal of Innovative Research in Science, Engineering and Technology volume-3*

Shredder machine focusing on chopping of dry leaves, areca leaves, this chopped powder to prepare the vermin compost. The work began with collection of information and data on user lifestyle and current process by which they perform their job. A concept was developed with reference of four different shredder machine and operating processes. Concept was developed considering the safety factor users operating environment and maintenance. The power from the electrical motor is transmitted to cutter shaft through a belt drive. Cut is made inside the chopping house due to the effect of tensile, friction, and impact effect in chopping process. The dry leaves get chopped and powder is collected at the bottom.

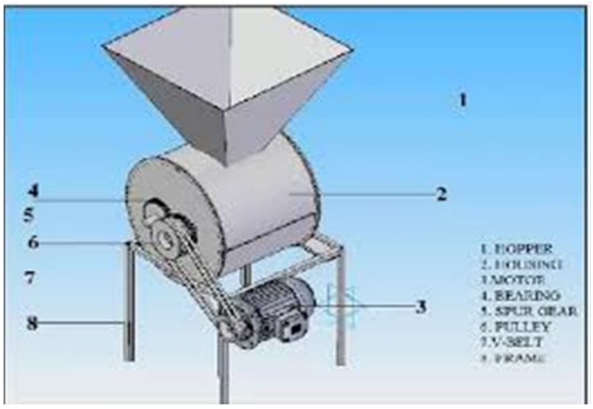

Figure2.2

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D. *Abhishek K N1, NithinBhandary K Assistant Professor, Department of Mechanical Engineering, K V G C E, Sullia,Karnataka . Research article International Journal of Scientific & Engineering Research Volume 9,*

The project began with collection of information and data on user life style and current process by which they perform their job. Concepts were developed with reference of four different shredder machine and operating processes. Concept was developed considering the safety factor users operating environment and maintenance. Considering the user's needs and buying capacity. A prototype was fabricated the machine consists of single phase motor; bearings structural frame cutter, and shaft.The power from electrical motor is transmitted to cutter stat through a belt drive. The coconut leaves get chopped and powder is collected at the bottom. As the waste is dumped as such, it takes more time to degrade and it causes environmental pollution. The waste shredder machine aims to reduce the agro waste and convert it into useful nourishing fertilizers.

E. *S Nithyananth et al, Department of Mechanical Engineering Jai Shree Ram Group of Institutions Tirupur-63866. Research article IJERA Journal | International Journal of Engineering Research*

They are developed a Design of waste shredder machine. The waste shredder machine is an attachment as like a ploughing attachment. Shredder can be operated with Tractor- power take off shaft. The power from the Tractor is transmitted to the assembly. The assembly consists of one fixed blade and five circular blades. The organic matter shredded will be in small pieces to enable the farmer to make use to prepare for vermin compost.

III. SCOPE OF SHREDDER MACHINE

A. Literature study is carried out based on various existing shredder machine, and field survey it is observed that labour is widely used for chopping agro waste, and cost of the existing machine also expensive some of the machines are operate by manually it enhances the human fatigue to overcome these difficulties to design the machine using electric power. While designing the machine safety factor also considered such as covering the belt and pulleys, and gears

B. We observed that the machine in market are usually the Top loading (or)Top feeding which causes the safety problems and more noise and vibration.

C. Great portion of farmland can easily cut or brushed with agriculture in one day.

D. This project reduced number of personnel that needed in a particular farm operation.

E. To reduce manpower.

IV. PROPOSED METHODOLOGY

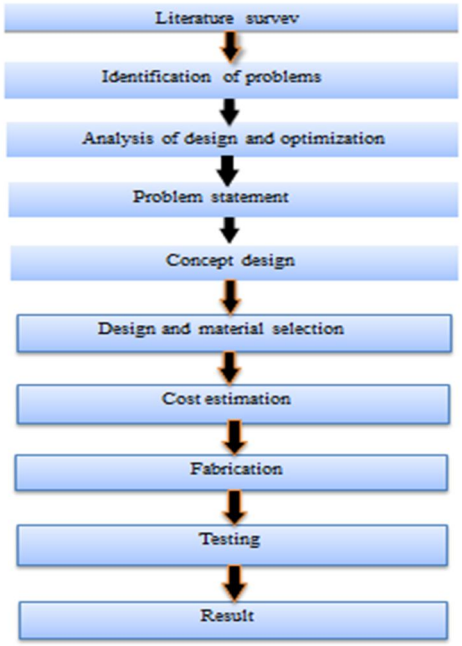

Figure 4.1

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By analyzing the literature review Bio waste shredder machine Development fabricated as follow
Consisting of base stand, DC motor, shaft, blades, pulley with belt drive system and exterior thin steel body. Motor is mounted on base stand with the help of arc welding. By analyzing the literature review Bio waste shredder machine Development and fabricated as follow it consisting of base stand, DC motor, shaft, blades, pulley with belt drive system and exterior thin steel body. Motor is mounted on base stand with the help of arc welding.

A. Planning Phase

The planning phase begins with corporate strategy and includes assessment of technology development and market objectives. The output of planning phase is project mission statement, which specifies the target market for the product, business goals, key assumptions and constraints. Which also includes the concept development phase, where the needs of target market is identified, alternative product concepts are generated and evaluated, and one or more concepts are selected for further development and testing .A concept is a description of the form, function and features of a product and is usually by a set of specifications, an analysis of competitive products and an economic justification of the project.

Figure 1: The Plan-Do-Check-Act Cycle

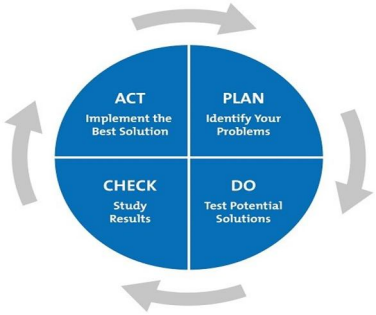

Figure 4.2

B. DO (design) Phase

This phase includes the definition of the product architecture and the decomposition of the product into subsystems and components. The final assembly scheme for the production system is usually defined during this phase as well. The output of this phase usually includes a geometric layout of the product, a functional specification of each of the products subsystems, and a preliminary process flow diagram for the final assembly process.

C. Detail Design

This phase includes the complete specification of the geometry, materials and tolerances of all of the unique parts in the product and the identification of all of the standard parts to be purchased from suppliers. A process plan is established and tooling designed is designed for each part to be fabricated within the production system. The output of this phase is thestage the equipment is tested in the fields by working for 10 hrs and to determine the performance and other factors.

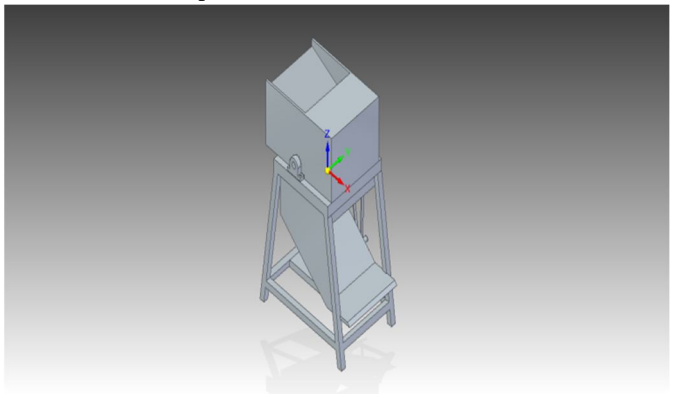

Figure 4.3

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D. Check (Testing and refinement) Phase

This phase involves the construction and evaluation of multiple preproduction versions of the product. At this stage the equipment is tested in the fields by working for 10 hrs and to determine the performance and other factors. The feedback from the formers is collected later, by testing it in different crop cultivation. The work performances, reliability, load bearing capacity after working through the different crop forming.

E. Act Phase

In this phase, the feedback on the developed product is analyzed using the results from testing and any small modification of the product is done if necessary. The purpose of the act phase is to train the work force and to work out any remaining problems in the production processes. Products produced during this phase are sometimes supplied to preferred customers and are carefully evaluated to identify any remaining flaws

F. Hardware Details

1) *Cutting Blade:* A blade is the portion of a tool, weapon, or machine with an edge that is designed to puncture, chop, slice or scrape surfaces or materials. Blades are typically made from materials that are harder than those they are to be used on Blades work by concentrating force on the cutting edge.

Figure 4.4

2) *Drive Shaft:* A drive shaft, driveshaft, driving shaft, propeller shaft (prop shaft), or Cardin shaft is a mechanical component for transmitting torque and rotation, usually used to connect other components of a drive train that cannot be connected directly because of distance or the need to allow for relative movement between them.
3) *Bearings:* A bearing is a machine element that constrains relative motion to only the desired motion, and reduces friction between moving parts.
4) *Setscrew Ball Bearings:* It is induced in the assembly. For the double-row spherical roller bearing under an applied radial load.
5) *Pulley:* A pulley is a wheel on an axle or shaft that is designed to support movement and change of direction of a taut cable or belt, or transfer of power between the shaft and cable or belt
6) *Belt and Pulley System:* A belt is a looped strip of flexible material used to mechanically link two or more rotating shafts.
7) *Electric Motor:* An electric motor is an electrical machine that converts electrical energy into mechanical energy. Most electric motors operate through the interaction between the motor's magnetic field and electric current in a wire winding to generate force in the form of rotation of a shaft

V. WORKING PRINCIPLE OF BIO WASTE SHREDDER MACHINE

The scope of this work is to design and develop a Shredder machine focusing on chopping of agricultural wastes such as coconut leaves, areca leaves etc., and this chopped waste can then be used to prepare the vermin-compost. Concepts were developed with reference of 4 completely different device machines and in operation processes. This idea is incorporated by considering the security issue users in operation atmosphere and maintenance. Focusing the need of user’s requirement and purchasing for capability, a prototype was fabricated. The main parts in this equipment which are three-phase motor, bearings, structural frame, cutter and a shaft. The shredder equipment frame is built by using a material mild steel and stainless steel for cutter tip preparation. There are two cutters are mounted on the shaft.

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The shredder equipment frame is built by using a material mild steel and stainless steel for cutter tip preparation There are two cutters are mounted on the shaft. The power derived from the electrical motor which is transmitted to cutter shaft through a belt drive assembly. Cutting action is formed within the chopping house because of the result of tensile, friction, and impact result in chopping method.

A. Scope For Future Advancement

1) There are four tiers to waste management to reduce its environmental impact pollution prevention and source reduction; reuse or redistribution of unwanted, surplus materials; treatment, reclamation, and recycling of materials within the waste
2) To make the product popular in every place of India and gradually cover all nearby country.
3) To make the firm a medium scale industry and then a large scale.
4) The machine can be further automated ,that may leads o rotation of the blade specific time period

VI. ESTIMATED COSTS

Table5.1

SI. NO	COMPONENTS	MATERIAL	QUANTITY	COST
1	AC Motor	MS	1	5500
2	Cutting blade	HSS	4	2000
3	Pulley Belt	Rubber	1	600
4	Shaft	MS	1	400
5	Set screw ball Bearing	-	2	300
6	Nut and bolt	MS	20	500
7	Body/frame Materials	MS	-	2000
8	Fabrication	-	-	3500
9	Paint	-	1LR	200
10	Transportation	-	-	1000
11	Miscellaneous	-	-	500
12	Total			16700

VII. APPLICATION OF SHREDDER MACHINE

The waste shredder machine can be applied not only in mass level but also small level agricultural field.
The coconut husk and coconut fronds can be easily converted to small pieces and can be used as a good fertilizer for coconut cultivation. It can be used in forest industry to convert the heap amount of tree branches and leaves including peals to useful fertilizer or vermin-compost

VIII. ADVANTAGES OF SHREDDER MACHINE

A. Bio waste shredder machine are compact in size hence easy to carry any where we required
B. Waste shredder machine reduces the amount of agro waste from the farm and make the farm beat and clean.
C. It converts the solid wastes which are too hard to decompose and digest to very small pieces and it will decompose easily.
D. Output of the waste is good for vermin-compost and it's a good bio fertilizer for cultivation.
E. The bio waste output scan be used as a nutrient food for cattle and other domestic animals
F. The waste coconut fiber removed can be used in coir industries which are used in product such as floor mates, door mates' brushes and mattresses

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IX. CONCLUSION

The following important point drawn from our project Work as follows.

The developed model is simple, efficient, requires less time and cost effective when compared to the existing available model. Importance is given towards user friendly in operation and mainly towards safety. The rotating elements like belt and pulley and gears are covered, so it is fully safety to operator the assembly was checked for its sturdiness and was found to be reliable. The overall performance of shredder machine was satisfactory by considering the quantity of powder produced with respect to time.

X. ACKNOWLEDGEMENTS

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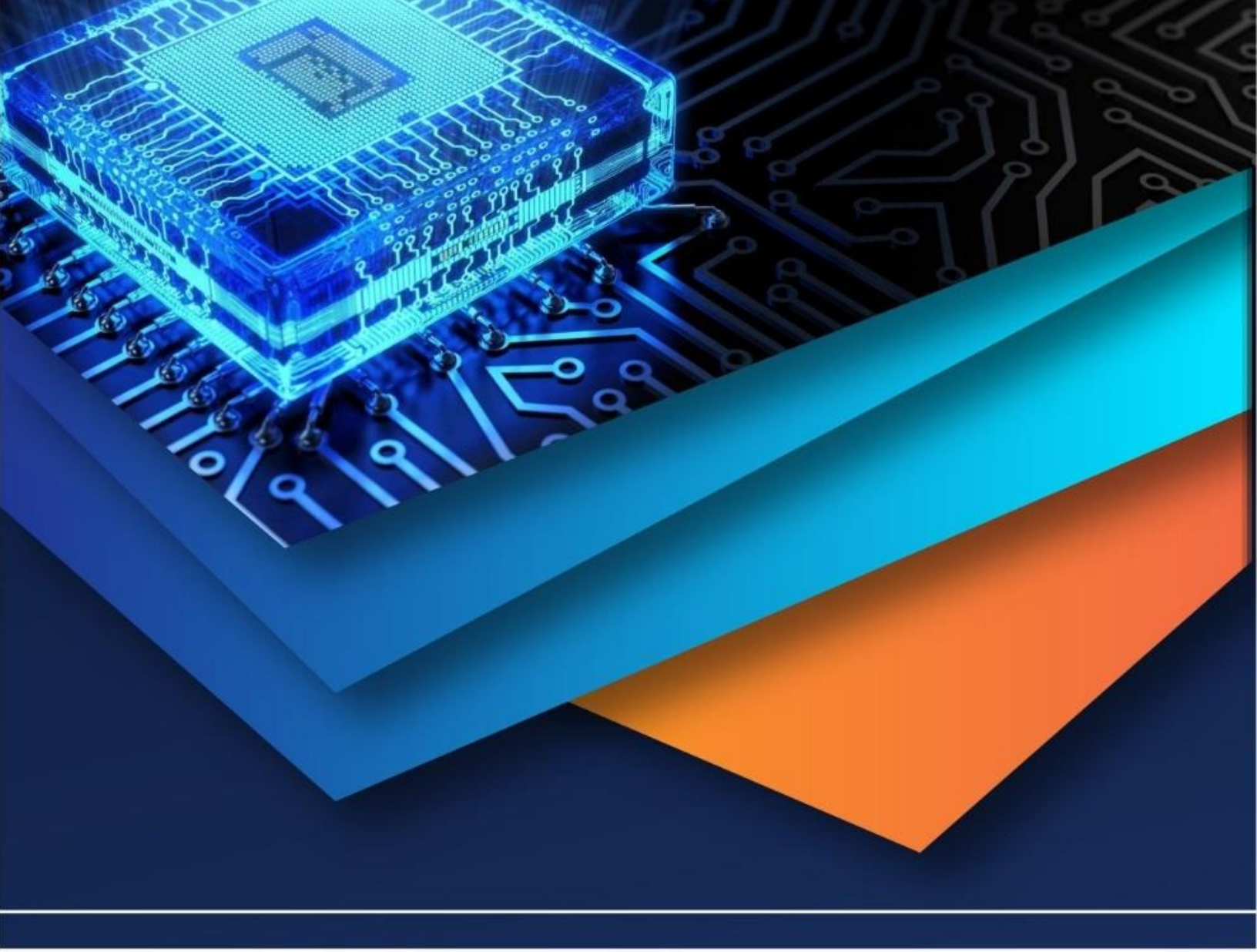

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