

# Structural Design and Fabrication Aspects of a Multipurpose Grain Collector

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**Abstract.** A simple physically operated grain and sand collector constructed of locally available materials and using local fabrication technology was designed, built, and tested for grain collection. The innovation belongs to the specialist field of agrarian machines, and it is about an instrument used to collect grains and sand after they have been publicized, specifically a manual grain and sand collection machine. Grains and sand are then piled using screw transport and collected at the end of the pipe region. The following are the main parts of a simple physically operated grain and sand collector: a wheel, a long pipe, a vertical stand outline, a collector, a scoop, a transformer, a capacitor, a rectifier, screw transport, etc. There are significant differences in the collecting capacity. Additional factors including gathering efficacy and speed are discussed. The collection device has been built, tested, and evaluated as part of the design, which centered on specific assumptions and calculations.

**Keywords** — Grain collector, low cost, effective performance, reduce human efforts.

## 1. Introduction -

Product design is the process of creating a new product which has to be accepted by the guests. In a broad conception, it's basically the effective and effective generation and development of ideas through a process that leads to new product. In a methodical approach, product contrivers will conceptualize and estimate ideas, turning them into palpable inventions and products. The product developer's part is to combine art, wisdom, and technology to produce new products so, that the consumers can use. To check the losses of agrarian grain crops in the field. Collecting them from the ground and in the groove of the land by hand and by holders is a hard work and time consuming to that isn't precisely done. Hence the need for a machine to collect the grains in the field has been identified. This design aims to design and fabrication of collecting and storing of grains by manually. Main ideal behind designing and fabricating the collecting of grains is to reduce the mortal trouble and also reduce time taken for storing. This design substantially helpful to the former the problems faced by small scale growers relating with vacuity of labors and cost of collecting and storing eventually It's also able of reducing time and grains destruction. Survey also provides clear idea about the downsides of traditional type of grain collector machine and how this machine can overcome from these downsides. So, came to know there is no machine is used for collecting grains, thus we develop our model to overcome those problems. By integrating technologies similar as detectors, conveyors, and sorting algorithms, this design ensures accurate and speedy collection of grains, thereby optimizing agrarian operations and enhancing overall effectiveness in the grain collection.

### 1.1 Problem Definition

After the extraction of sand from the river, drying them is always a vital process. Also after harvesting the crops grains drying is a traditional method. The custom of sun- drying or solar drying is a practice performed since numerous decades because of its effectiveness and being provident without the need for any tools, so it would not be doable to consider other indispensable process for drying. At the terminal point of solar drying process, it would be necessary to accumulate from the ground before farther processing. To palliate this laborious task is very tough process. To collect the sand or grains from the ground is very complicated process because of such problems and collecting machines have been designed and developed.

The purpose of a grain collecting or sand collecting machine is to snappily stow all the grains or sand into piles or sacks are processing. Several advisable medium ideas similar as sweeper wheel collection, tossing collection, vacuum collection have been enforced. The literature review is conducted of all the multipurpose collectors with their performing performance, cost effectiveness and other prospects shall be assimilated. This project will collect the sand, soil and grains we can use it for multi-purpose collecting machine. By using our machine, we can save the time as well reduce the labour cost.

## 2. Methodology

The methodology involves the following steps

### 2.1 Design and its working Principle

The grains spread over the floor that can be lifted and collected by using this collector. The grain collection system works in a carefully planned way. First, a scoop gathers grains from where they are stored or grown. Then, the grains travel through pipes to a machine called the screw collector. This machine, shaped like a screw or auger, moves the grains along a path, lifting them up as it turns. This helps the grains move smoothly without getting stuck. The speed of the machine can be adjusted to fit different needs. Once the grains reach the end, they are released precisely, ready to be stored or processed further. The whole system is powered by a strong motor that spins at 1700 RPM having 2:1 gear ratio, giving the machine the power it needs to work well. Overall, this system makes collecting grains more efficient and helps in farming and factories.

Objective:

- To collect the sand or grains faster than manually.
- Minimize manpower and reduce the hard work.
- Light weight which makes it easy to handle.
- To be capable of collecting different types of grains
- To minimize waste by collecting grains and sands
- To design the collector for ease of operation and maintenance, allowing operators to efficiently utilize the equipment with minimal training.

Model:



1.1\_Design of Multi grain and Sand Collector model

### 2.2 Collection of raw material by collector

#### **Agriculture:**

Harvesting: Collecting grains such as wheat, rice, corn, etc., during the harvesting process.

Seed Collection: Gathering seeds from fields after crop harvesting.

Construction:

Sand Collection:

Gathering sand from beaches or riverbanks for construction purposes.

### 2.3 . System Description

A multipurpose grains and sand collector system is designed to efficiently collect grains and sand from various surfaces for agricultural or construction purposes. The system typically consists of several components:

**Collection Mechanism:** This could be a Screw conveyor, suction mechanism, or a combination of both, designed to gather grains and sand from the ground or other surfaces.

#### **Dc Series motor:**

It is used to develop high torque at low speeds, low torque at high speed, to rotate a Screw conveyor for collecting grains and sand from the ground surface.

**Step down Transformer:**

This type of transformer is used in electric circuits to change the high voltage to the low voltage of electricity flowing in the circuit, Because of low voltage requirement. Capacitor:

A capacitor is a circuit component that temporarily stores electrical energy. The role of a capacitor in our project is to prevent a dangerous failure of the circuit.

**Rectifier:**

The role of rectifier in our project is to convert alternating current (AC) into direct current (DC) by allowing a current to flow through the device in one direction only.

Storage Unit: The collected grains and sand are stored in a designated container.

**Power Source:**

The system may be powered by electricity.

Overall, the multipurpose grains and sand collector system aims to streamline the collection process, ameliorate effectiveness, and reduce homemade labor for tasks similar as agrarian harvesting or construction point.

## 2.3.1. List of material used

Détails summary of materials used

Sr. no	Components	Material	Specification
1	DC Motor	Copper segment	Speed :1700rpm Power : 40 watt
2	Screw conveyer	iron	Length : 60 cm
3	Capacitor	Aluminum	Voltage 25 volt
4	Transformer	copper, steel Aluminum	0 to 12 V
5	Rectifier	Silicon diodes	AC to DC
6	Wheel	Polymer	Length: 6.4cm Thickness: 2cm
7	Speed controller	Stainless steel	To control speed of machine.
8	Hook	Aluminum	To lift the sack
9	Bush bearing	Chrome steel	Maximum load capacity
10	PVC Pipe	Plastic	62 cm

## 2.4 Collector Utility Test

### Performance Test

The testing is done by comparing the determinations of traditional or customary strategies with the collection of grains on the premise of work required, work fetched and the time required for the collection of grains from the floor.

Trial tests were conducted to see the time required for collecting of grains and to check that the grain collector equipment is working appropriately or not. The comes about appear that they are working legitimately as expected.



2.4.1 Performance test

## 3. Comparative Analysis

Manually grain collection process is laborious whereas machines can easily collect the grains with minimal effort. Manual labour tends to be less efficient, while machines offer higher efficiency and productivity.

Labour involves recurring charges whereas machines require a one-time investment.

Labourers need allowances, breaks, and regular rest periods, but machines can operate continuously without interruption.

Machines not only collect grains but also separate sand and impurities easily during the collection process.

## 4. Result and Discussion

The grain collector proved to be a valuable solution for efficiently collecting grains from the floor. A conceptual design was successfully developed and fabricated using locally available components, demonstrating both practicality and cost-effectiveness. The machine shows significant potential to enhance grain collection productivity when compared to traditional, manual methods.

Its performance indicates that it can substantially reduce labor dependency, minimize grain loss, and streamline the overall collection process. The key advantage lies in its ability to perform continuous work while also separating sand and other impurities during collection—something conventional manual methods lack.

Furthermore, by utilizing locally sourced materials and manufacturing it in a nearby workshop, the cost of production can be kept low, making it accessible to farmers and small-scale users. The focus now should be on promoting this innovation and ensuring it reaches end-users at an affordable price to maximize its impact in agricultural practices.

## 5. Future Scope

The mini grain collector developed in this project has shown promising results, but there is considerable scope for further enhancement. One of the primary improvements could be in optimizing its size and weight to make the machine more compact and easier to handle or transport, especially for small-scale farmers.

Incorporating remote control functionality can also be explored to allow for convenient, user-friendly operation, reducing the need for manual intervention.

Additionally, there is potential to further increase the efficiency of the machine by refining its components and improving the grain separation mechanism. Integrating an automated sack packaging system after the collection process could also streamline the workflow, saving time and reducing manual labour.

Overall, continuous innovation and refinement will help in making the grain collector more practical, efficient, and widely accessible.

## 6. Conclusion

In conclusion, the developed multipurpose grain and sand collector offers an effective and practical solution for streamlining the processes of grain collection and cleaning. Its ability to handle various types of grains and sand, along with its simple and user-friendly design, ensures improved efficiency and reduced manual effort for both farmers and construction workers.

This innovation highlights a significant step forward in agricultural and construction technology by promoting sustainability, enhancing productivity, and minimizing labour dependency. With further improvements and wider adoption, the grain and sand collector has the potential to make a meaningful impact in both sectors.

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