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STUDY ON ARCHIMEDES PACKING SYSTEM WITH ARDUINO CONTROLLER

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Abstract - *A* Traditional method of collecting grains and other similar kind of foodstuff in supermarkets is such that consumers make use of steel mugs to collect grains and put it in plastic bags and then form other queue to stick the price tag.In an attempt to minimize the queue, also the wastage of foodstuffs during collection and increase the profit margin of supermarket by providing quick services development of 'Archimedes Packing System' is best solution. Different ways used by supermarkets to encounter this problems are stocking predefined quantity of packs but this way doesn't satisfy the consumer need.

Key Words: Archimedes Screw; Sealing mechanism; Arduino UNO; load cell, Hopper

1. INTRODUCTION

Considering today's situation, there is an utmost need of making everything automatic and without the need of human interaction. From smaller supermarkets to a bigger shopping mall, hundreds of customers visit the place for buying various products such as Clothing's, Food-grains, Cosmetics etc. Looking into the foodgrain section, lot of grains gets wasted while filling them into polythene bags as this involves human activity. To avoid wastage of grains and eliminating long queues Archimedes Packing system can be a better option in near future. Archimedes Packing System will be a device which will transfer the grains from the container towards plastic bag. This plastic bag would be connected to a mechanism which would allow the food grains to be collected automatically. Below the plastic bag there would be weighing mechanism which would be programmed for desire weight as per requirement of consumer. Once the bag would be filled sealing of bag would be done for which sealing mechanism is provided.

1.1 STRUCTURE

Archimedes Packing system consists of a container made of plastic or steel, Archimedes screw, load cell, Arduino UNO, connecting wires, battery supply, sealing machine, polythene/plastic rolls, holder, hopper. For the designing of Archimedes screw dimensions of [2] are considered. Following dimensions are selected to provide proper grain output at other end. For controlling the polythene discharge, selection of weight of food-grains and amount of time required for sealing is controlled by Arduino UNO. The load cell is able to weight the food-grains and once the reading matched with Arduino command, the packet is discharged with proper sealing. The actual procedure from pouring to sealing is as follows:

- Grains from the container are transferred with the help of Archimedes Screw. When screw is rotated clockwise the grains from container are filled inside the screw buckets and at the end of screw the last bucket discharge the grains.
- From there grains travel through the hopper and at the end of the hopper grains are collected in the plastic bag. This plastic bags would be a continuous roll initially when grains enter the bag due to weight of grains bag travel in downward direction where it comes in contact with the load cell.
- Load cell calculates the weight of the grains and send signal to the sealing mechanism which is connected via Arduino UNO.
- Once the bag is filled with require amount of grain. Sealing mechanism seals the bag and discharge it and further bag rolls for other grains.

2. OBJECTIVE AND SCOPE

2.1 OBJECTIVE

As we know in supermarkets near granaries sections due to human interaction lot of wastage of grains takes place to reduce this waste and increase profitability of markets is the main aim of this project.

Also important objectives of this project are

1. To make a machine compact and precise.
2. To make the machine economical.
3. Machine should be consumer friendly.
4. To avoid queue for plastic bag sealing.
5. To make the process fast and easy.

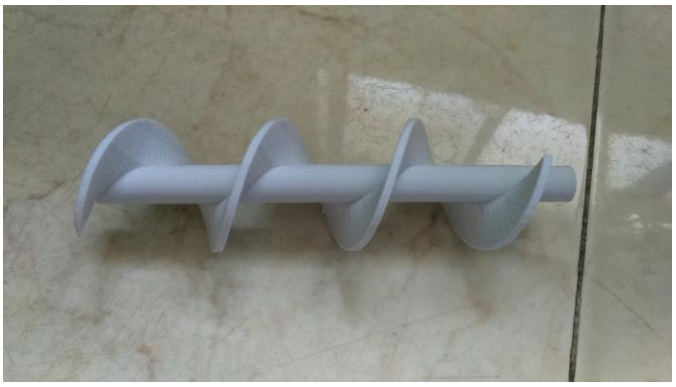
3. METHODOLOGY

- Designing of model in CAD software and provide basic idea of concept.
- Provide list of materials and components required to manufacture the product.

- Making Archimedes Screw to carry the food-grains and discharge it at required position.
- Making of Hopper which consist vertical sealer.
- Making of sealing mechanism which seals the bag once bag is filled with required quantity of food-grains.
- Programming all the components to work relative to each other effectively and efficiently.

4. COMPONENTS USED

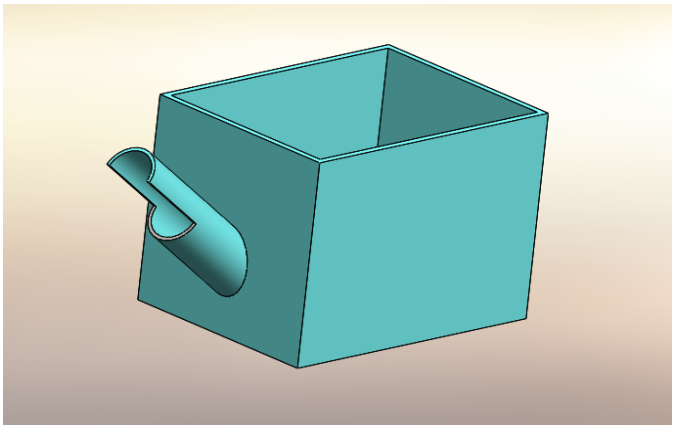
4.1. ARCHIMEDES SCREW



In this project, Archimedes Screw is designed in such a way that it can carry solid materials (grains) from the container and travels them at the end where they are discharged. Profile of screw is designed using formulations from [2]. Material used to manufacture the screw is suitable for food-grains and doesn't react with it.

So, for Eg:- container is filled with rice, screw would be provided with rotational motion with which profiles of screw will transfer the grains at the discharge position and grains will be discharged.

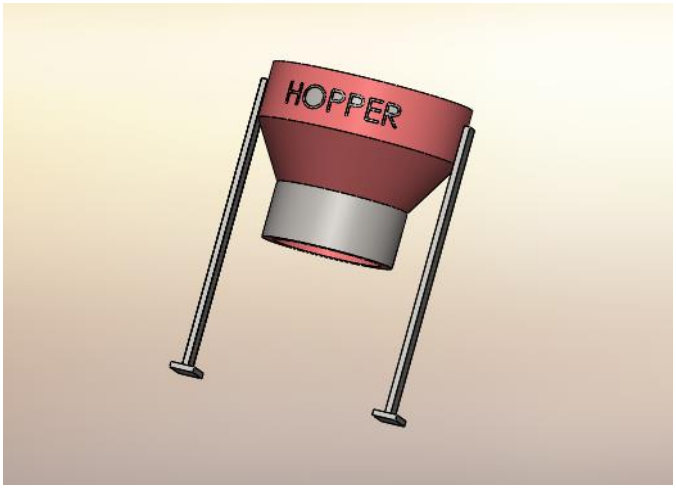
4.2. CONTAINER



Container is made up of mild steel and quoted with food grade coating so that MS won't react with foodstuff.

Container is manufactured using cutting, bending and welding process.

4.3 HOPPER AND VERTICAL SEALER



Grains discharged at the end of the Archimedes screw fall inside the hopper. Inside the hopper vertical sealer is present which seals the one side of plastic bag and make the bag available to carry the grains. Hopper is provided with stand for its support.

Hopper is designed as per project requirement.

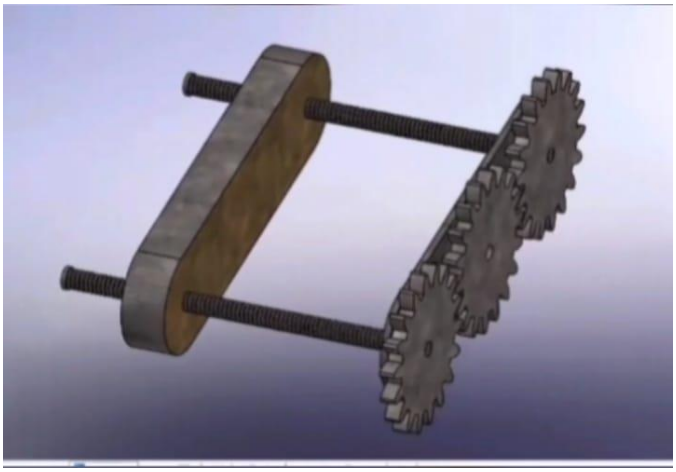
4.4 LOAD CELL UNIT

A transducer which converts the force such as tension, compression, torque into equivalent electrical signal is called as load cell.

In our project load cell is use to detect the weight of grains through the equivalent electrical signal caused by the weight.

This signal is sent to the Arduino after that further operation of sealing is carried out.

4.5 SEALING MECHANISM



Sealing mechanism is designed in such a way that centre gear will be the driver and the gears in contact with the centre gear will be driven. Driven gear are attached with the rod. The rod consist of two plates one is stationary and one is moveable. Moveable plate consist of heating element when the centre gear rotates the gears relative to the centre gear also rotates and movable plate is clamped towards stationary plate and sealing takes place.

Arduino controls the sealing mechanism by receiving the signal from the load cell.

Table 1: Dimensions used for designing of components:

Components	Quantity	Material	Dimesions
Container	1	MS	300x400x300mm
Screw	1	PLA	Diameter-50mm Length-320mm
Hopper	1	MS	Diameter-180mm Length-100mm
Gears	2	MS	Module-2.75 No. of teeth-11
Rod	2	MS	Length-140mm
Load cell unit	1	-	-

Note: MS= Mild Steel
PLA= Polylactide (Thermoplastic Polyester)

5. CONCLUSIONS

5.1 CONCLUSION

The study of Archimedes packing system along with Arduino controller will eliminate human efforts for filling and discharge of grains in Malls, Avenue super-marts and general grocery stores. The following study is done using software like Solidworks and based on the dimensions the resultant is achieved. Arduino coding is used to control the rotation of screw, start and stop mode of screw, sealing mechanism for proper working of the model. In this paper, detailed study of Screw dimensions, Arduino controller and Dimensions of entire model is presented. Based on this study, this model can be considered as the first step towards automating the functioning of Super-marts.

5.2 FUTURE SCOPE

For future research, the hardware model will be presented that will depict the actual calculations and total cost required for 1 Unit of system. Reliability and accuracy of the model will be attained using multiple load conditions, changing the speed of the screw to get faster results.

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