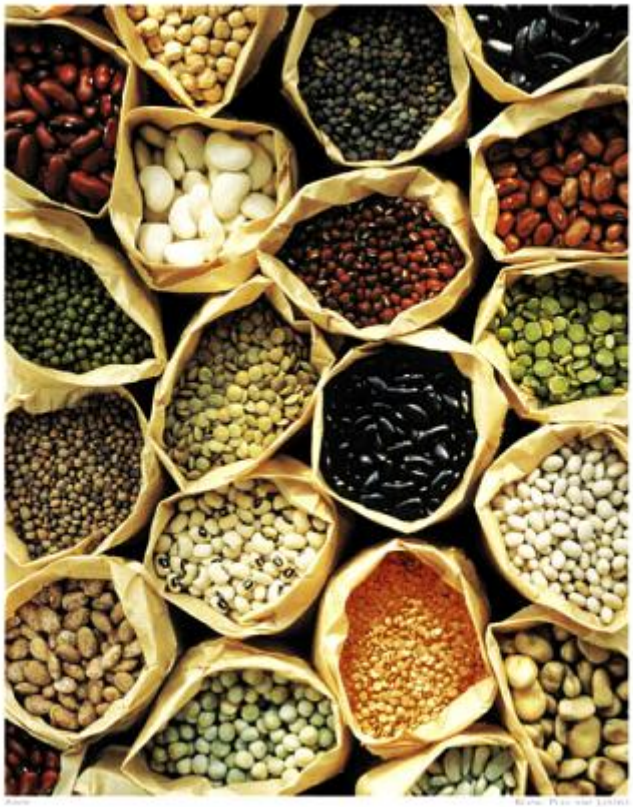
Automated

Lentil

Bagger Machine



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Summary:
The purpose of this project is to automate the packaging of lentils for Saanichton Farm. The current method of packaging lentils is to scoop them from a bulk bag into small, sealable paper bags manually. This is both time consuming and labour intensive. The proposed machine would have facilities to: move lentils vertically from the bag to the hopper and through automation dispense the lentils into a bag with the proper weight, and repeat the process. Additionally, if time permits, the machine will attempt to seal the bag after filling it.

Introduction:
The purpose of the lentil bagger is to assist a local farm to bag lentils through automation. The objective of this project is to free up both time and energy which could be invested in other aspects of the farm, and potentially increase the accuracy with which lentils are dispensed into their respective bags. Currently, the lentil packaging operation is being done by hand with a scoop and this approach is very time intensive, and makes for dull work. The machine will unload bulk bags of lentils, ration them into specific weights, and package them into smaller bags for sale. The project minimum requirements include the machine fitting through the door into the room, and hold at least one bulk bag of lentils in the hopper. The materials to be used will be mostly plastics and mild steels, as this will provide affordability and reliability while maintaining replaceability in the case of a malfunction.

Discussion:

Technical:
The technical hurdles to overcome will dictate the course of action in the machine. The lentils must be transported from floor to hopper, released in a controlled fashion into a weighing mechanism, and dispensed into smaller individual bags. This must be done rapidly and efficiently.

For moving the lentils vertically, a vacuum (mounted either on the top of the hopper or on the floor) connected to a hose which can reach into the bulk lentil bag on the floor. The vacuum action pulls lentils at a reasonable rate to the top of the system where they are deposited into the hopper. The limiting factors for the grain transfer mechanism will be complexity, power capability of the vacuum, usability, and noise.

The hopper, consisting of several baffles to limit weight distribution, will store a minimum of 75 lbs of lentils. At the bottom of the hopper, a manual flat plate slide covering the bottom exit hole opens onto a near-horizontal vibrating tray. The tray is close enough to the hopper to limit the flow volume of lentils per minute. The vibrating mechanism located on the underside of the tray agitates the lentils and causes them to travel down

the length of the tray in a slow, controlled fashion. The logic here is that the power to the vibration mechanism can be easily turned off, stopping the flow of lentils. The tray will offload lentils (while vibrating) into a holding bucket connected to a pressure sensor. When the pressure sensor reaches its threshold value (2.5 pounds), the vibration mechanism will be unpowered, and the bucket will empty its contents into the chute that the individual bags are placed onto. This simple switching mechanism will be controlled by a 5 volt Arduino Uno microcontroller. Once the bucket has been given time to empty, it will close and the tray will begin vibrating again until the weight goal of 2.5 pounds has been achieved.

Management:

To complete this project, access to the machine shop, computer labs, rapid prototyping lab and robotics lab are required. Each group member will be responsible for numerous duties such as designing, machining, and programming. A formal design report is to be completed by July 26th 2013. The machine is planned to be completed and built by August 16th which will give three weeks to test and troubleshoot. The final report and project must be completed by September 13th.

Financial:

The project is technically for a private company, but due to the nature of the program, the project is being taken on and financed by the program supervisor, Jeffrey Stephen. Upon successful completion of the machine, the private company, Saanichton Farms will take ownership. However, the idea behind financial responsibility lying with the school is that the company will be exposed to no financial risk based on student inexperience. The budget for this project is currently set at $500.

Software:

The project will incorporate an Arduino Uno™ as the main microprocessing unit. The technical hurdles to overcome for the software aspect of the project will be:

- Receiving analog information and displaying it on a LCD screen.
- Controlling motors on the vibrating tray as well as the actuated filler valve.
- Receiving analog information to control a servomechanism
- Controlling servomechanism with a switch
- Datalogging the weight of each bag to determine the day's tally

Mock timeline:

- 26 July **Finalized project design**
- 16 August **Project built**
- 30 August **Testing completed**
- 6 September **Testing report complete**
- 13 September **Final report**

- 20 September **Showcase**

Conclusion:

With the completion of this project we will have a fully functional lentil bagging machine that will assist Saanichton Farms in packaging of their lentil harvest. The machine will be inexpensive, time efficient, reliable, and completable in the allotted time.

Proposed cost:

Shop vac	$100
Hopper	$30
Steel frame	$200
Electronics	$75
Misc	$50
Total	$655

Appendices:

Gantt Chart

Drawings: