Cotton Gin Stand
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WeARE Research Area

The research focuses on the study of the procedure to separate lint and seed from mechanically harvested cotton. The project was focused on designing a cotton gin stand that will be able to be a continuous flow process, without the need of human interaction. Another focus of the project was to develop a system that will automate the seed weighing and disposal process. The last focus of the project was to come up with sensors to be attached to the ginning machine so that measure weight, shaft speed, moisture, and power consumption can be measured and collected.

Motivation or Background

During the development of commercial cotton cultivars, small samples of seed cotton are ginned to allow for the determination of lint and seed yield components and fiber quality parameters. A new ginning system is being developed by USDA ARS to automate the process of ginning seed cotton samples and provide more reliable lint yield and fiber quality data for each sample. Currently, seed cotton, seed, and lint weights are obtained manually by removing the material from the system and placing it on a scale. Automated methods for obtaining these weights are needed to help achieving the objective of automating the ginning process. Additional data in regard to ginning power, cotton moisture content, and system operating parameters (shaft torque, speeds, among others) would further improve the ability for cotton breeders to advance the most productive and high quality cultivars. A data acquisition system is needed in the development of the new ginning system to aid in automation and improvement in data quality.

Objectives

1. Design a system that is able to automatically collect, weigh, and divert cotton seed into a conveying line for disposal.
2. Design a DAQ system for the ginning system that measures and records cotton lint and seed weights, shaft speeds, shaft torque, and other system parameters.

Methodology

The design objective of this project was to use a scale that is able to record the weight of the cotton seed into a computer.

The seed scale will need to have a USB connection. After the sample has been weighted, it will be dumped into an air duct where it will be conveyed to a collection container and finally used to feed livestock. Once a weight scale is chosen the rest will be built around it. The seed scale needs to be stationary. The scale unit will need to be an off the shelf part that is easily integrated into the seed weighting system.

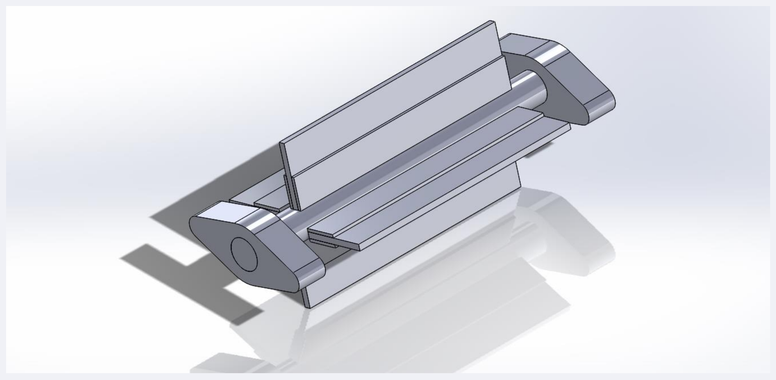

Figure 1. Paddle shaft for gin stand designed in SolidWorks.

Results

Figure 2 displays a possible solution for the weight and transportation of the cotton seed. It displays the container where the seeds are going to be dumped in. At the bottom of the container is where the weight will be located. A conveyer belt was thought of to transport the container to another platform. That platform will have an Pneumatic cylinder to able to rise and lift the platform to carry the load to another conveyer belt where it will be able to send it to an air duct line. These pneumatic cylinders can also be used to push the container from the scale onto the conveyer belt. Finally, the container will return to where the weight scale is. The idea behind this design is to have a automated cycle process that does not require human intervention.

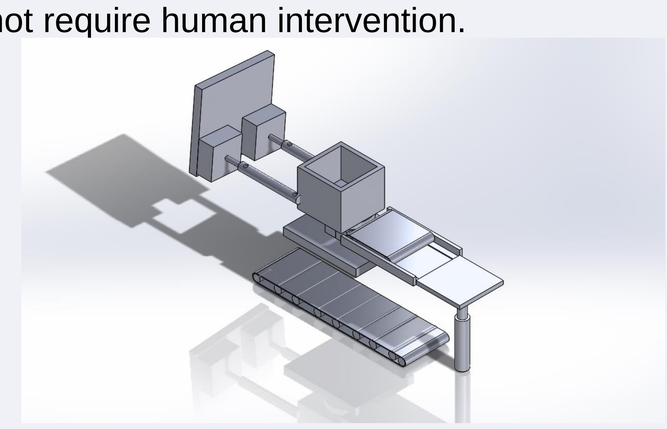

Figure 2. Seed weighing system designed in SolidWorks.

Skills and Experience

- Knowledge of solid works was needed.
- Experience in the design process and function of a cotton gin stand.
- Becoming more proficient in the use of Solidworks®.
- Understanding terminology of cotton gin parts.

What I Learned

If the lint is allowed to accumulate in the low part of the gin ribs the friction of the saw will cause the lint to catch fire or damage the saws. When designing a gin stand the saw and ribs are first to be considered and everything else is built around it. Distance from the point of saw and ginning rib is important because if it is not right, then, the capacity will be reduced and the fibers can be damaged.

Future Plans

The future plans of the project is to design the shell of the gin stand based on the saw and ribs.
The drawings of the ribs will be provided by Lummus and will be modeled in Solidworks ®.
Project takes about 2-3 years from developing to testing..

Acknowledgments

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References

- W.S. Anthony and William D. Mayfield Cotton Ginners Handbook. December, 1994