

# **Eco Seal**

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## Problem:

Each year, 119 billion pounds of food is wasted in the United States. [1] Food wastage is one of the most prevalent problems in the globe, and this is due to the short shelf life of produce. The wastage of food due to spoiling is a common problem in factories and storage facilities, where large amounts of food are produced, processed, and stored. 61% of all food wastage in America comes from the spoiling of food in commercial storage. [1] The short shelf life occurs due to: exposure to air, moisture, contaminants, and fluctuations in temperature and humidity levels. [2] Although manufacturers attempt to tackle this problem through regulated environment settings, similar to greenhouses, this can be costly and not viable for warehouses with different types of food with multiple climate settings. Lengthy transportation times may also lead to increased spoilage as regulated environments are kept to a minimum. [3] Spoiled food leads to losses of food, food safety risks and food wastage.

There is a need for a solution that can prevent food wastage due to spoiling in large scale facilities.

## Research:

The food industry often uses vacuum sealers to package and preserve food by removing the air from packaging to create airtight seals. These sealers can limit food oxidation, spoilage, bacteria growth, and mold all caused by oxygen. Vacuum sealing can prevent the migration of oxygen into the packaging, which can cause the discoloration and degradation of pigments and vitamins in fruits and vegetables. Furthermore, vacuum sealing food retains its taste, nutrients, texture, flavor, and quality of meat and seafood, and reduces freezer burn and ice crystals (which damages food structure) as well as prevents oxidation of lipids, which causes rancidity. [4]

Previous research on vacuum sealers has focused on various aspects, including:

1) Effectiveness of vacuum sealing: Studies conducted by researchers have demonstrated the impact that vacuum sealing has on perishable items with regards to longer shelf life and better food quality. By vacuum sealing perishable foods, researchers were able to observe a longer shelf life due the reduction of oxidation within the foods, which in turn led to lesser amounts of microorganism growth. [5]

2) Research and studies has proven that for vacuum sealing with multi-layer vacuum bags out perform plastic bags, vacuum pouches and vacuum rolls. These multilayer bags have proven to result in longer food preservation as opposed to the other current vacuum bags. [6]

3) Food Safety: Vacuum sealing has proven to result in better food safety, which is a critical concern within the food industry. The use of vacuum bags has shown a decrease in the number of chemical substance contamination and pathogen growth. Vacuum sealing can reduce the growth of pathogenic microorganisms by creating an airtight environment that limits the growth of bacteria, yeast, and mold. [2] This can help to reduce the risk of foodborne illness and contamination. However, vacuum sealing is not a substitute for proper food handling and storage practices; it is still necessary to handle and store vacuum-sealed food at appropriate temperatures and conditions to prevent the growth of pathogenic microorganisms anyway. [7]

5) In regards to the danger of consuming plastics and other chemicals, researchers have assessed the spread of plasticizers and other chemicals from plastic packaging materials into the food. Researchers have found that vacuum sealing can reduce the diffusion of these chemicals into the food. However, it is important to use packaging materials that are food-safe and approved by regulatory agencies. [8]

Overall, the research has shown that vacuum sealing can improve the safety of food, but it is important to follow proper food handling and storage practices, and use packaging materials that are safe and approved for food contact to ensure the safety of vacuum-sealed food.

Consumer preferences:

Researchers have looked into customer preferences for food that has been vacuum-sealed in a number of studies since consumer preferences play a significant influence in the food sector. These investigations have emphasized on characteristics including taste, appearance, and convenience.

Researchers have found that consumers prefer fresh, tasty, and visually appealing food. [9] By vacuum sealing food, the quality of the food is ensured as they will have a longer shelf life and keep their condition.

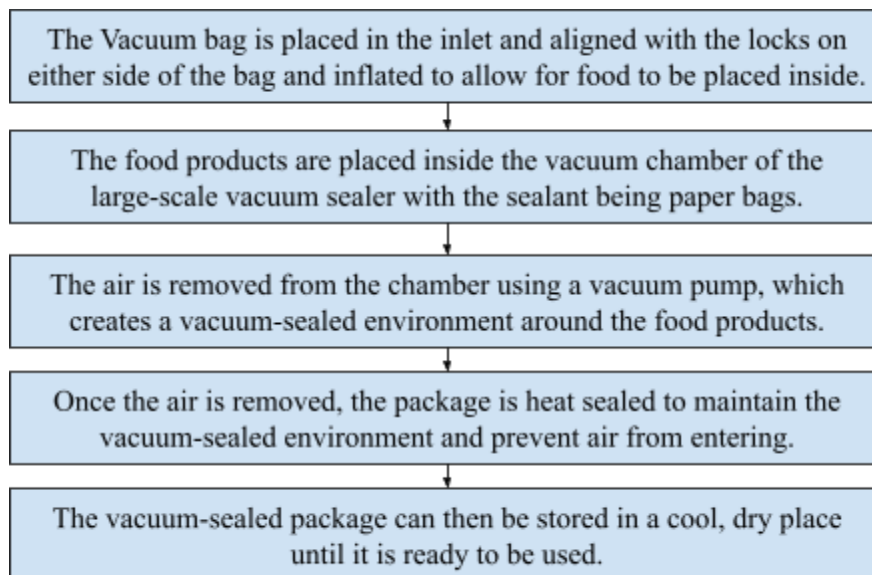
Vacuum sealing allows consumers to store their food for longer, reducing waste and saving both money and time.[10] Additionally, vacuum-sealed food is easier to be transported and taken on-the-go, appealing to customers for its convenience. [11]

Interviews had been conducted with various teachers in the school, and partners at shamrock farms. The teachers in the school recognized a need for the solution in their day to day lives to help reduce food wastage from spoilage of their fruits and meats. The Produce Branch Manager of Shamrock farms identified this problem as faced in their day to day lives at the farms, and mentioned that there is a large amount of food that goes to waste due to spoilage. Therefore, we have been able to reconfirm a need for a solution that can prevent food wastage, while being environmentally- friendly.

Solution: EcoSeal:

A large-scale vacuum seal can be defined as a solution to factory food spoilage, as it creates a vacuum-sealed environment that removes air from the packaging, preventing the growth of bacteria, mold, and other contaminants that can spoil the food. Vacuum seals have been implemented on a much smaller scale. However, no vacuum seal larger than 1 foot by 1 foot has been implemented. By using a large-scale vacuum seal in a food processing facility, manufacturers and processors can store and preserve large quantities of food for longer periods of time, reducing the likelihood of spoilage and waste. This can be especially beneficial for perishable items such as meat, fish, and produce that have a limited shelf life especially under imperfect conditions .

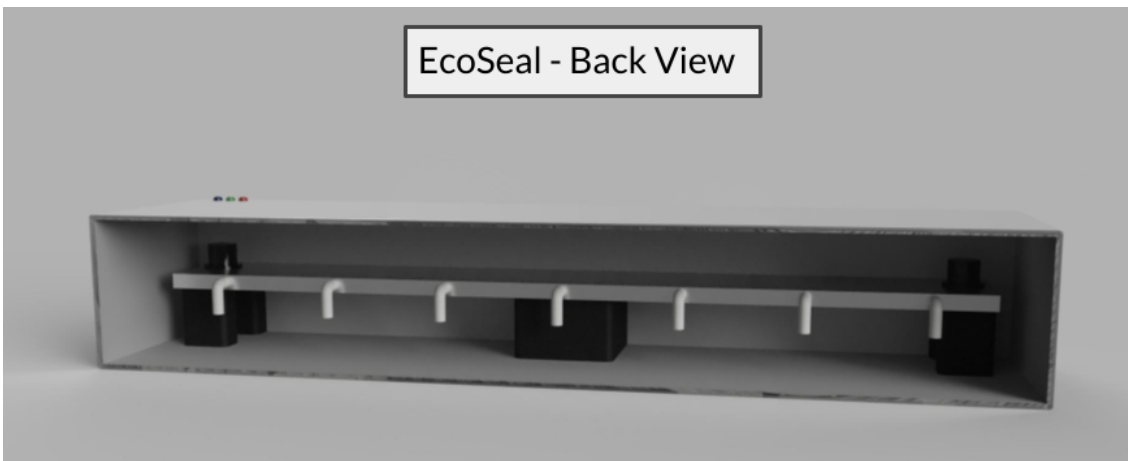
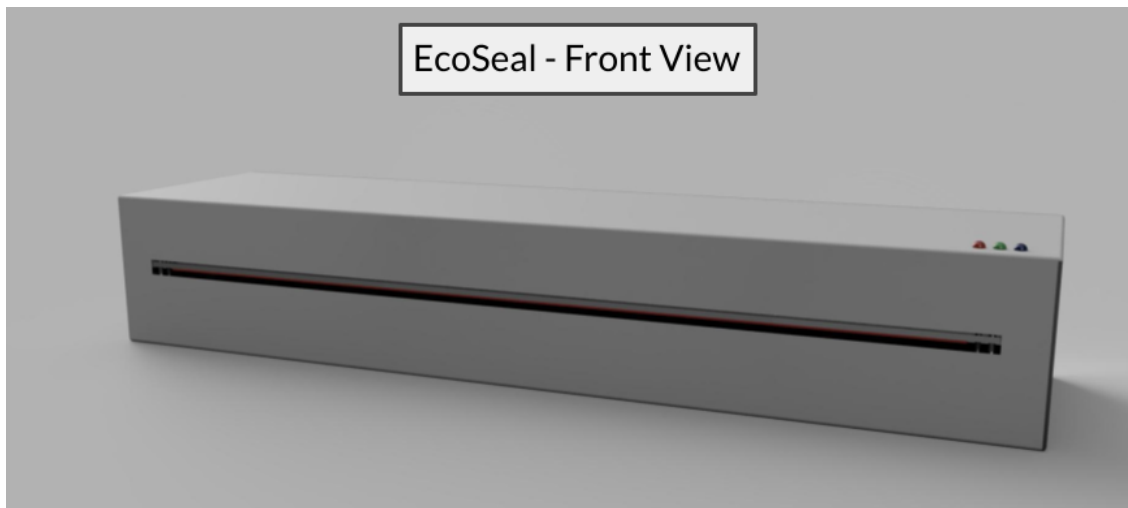
Flow Chart:

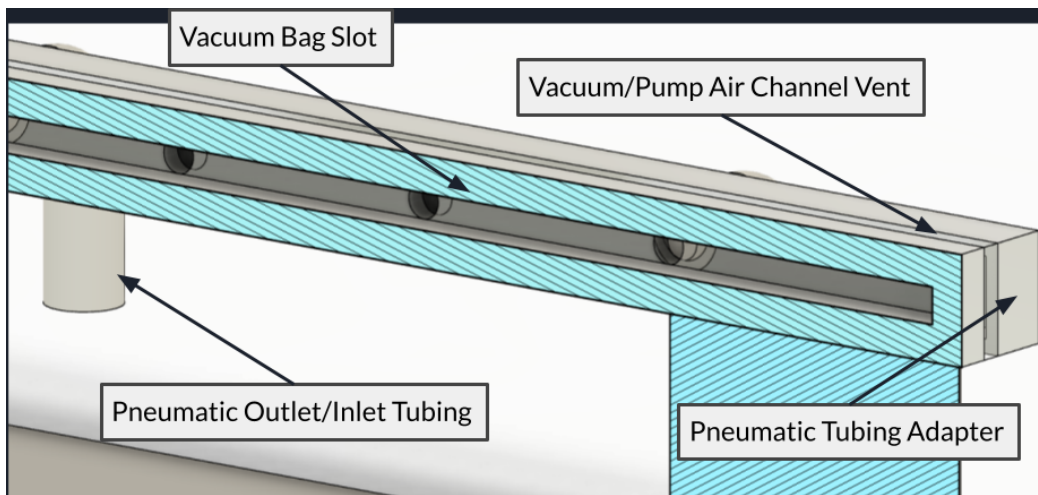
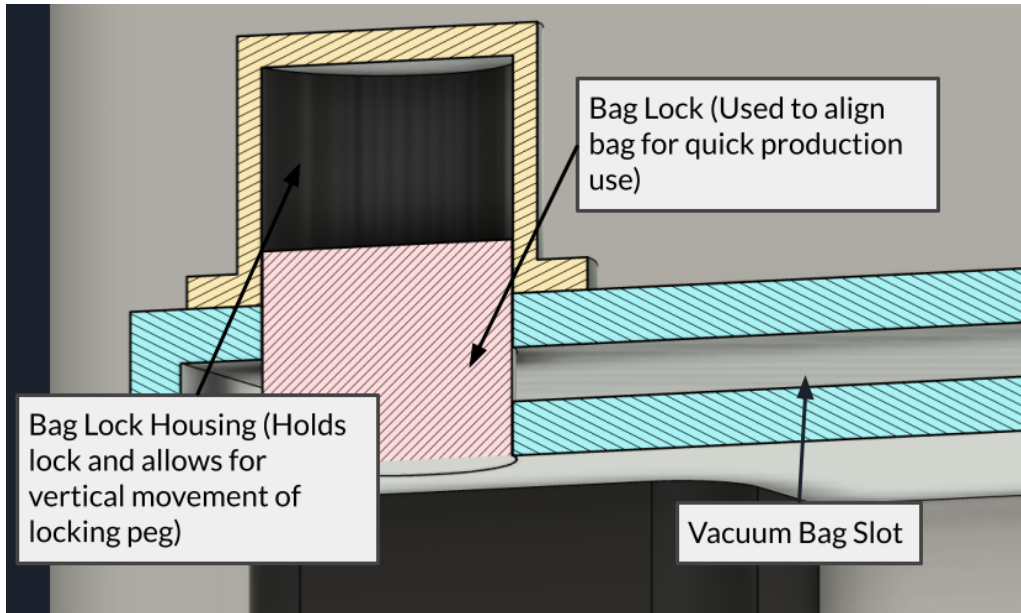
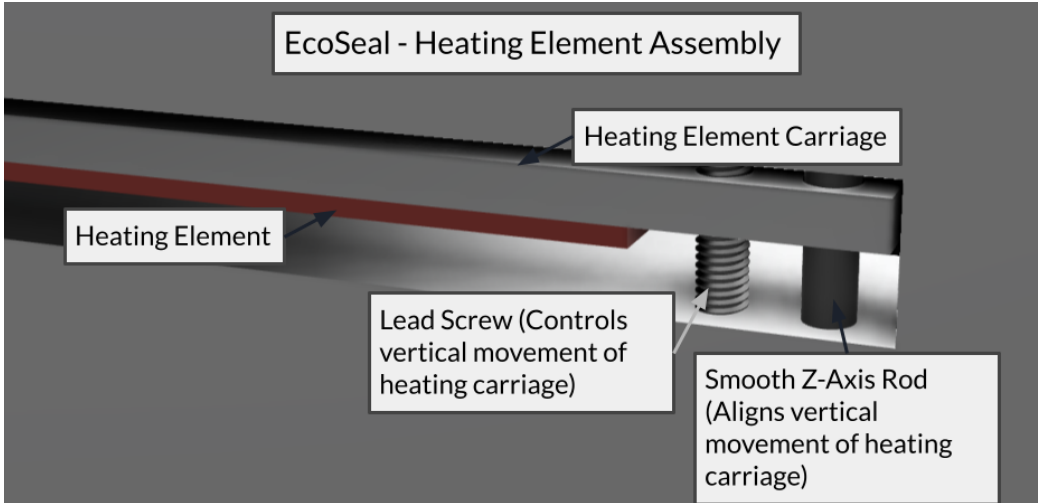


By removing the air from the packaging, a large-scale vacuum sealer can help to preserve the quality and freshness of food products, which can significantly extend their shelf life. This can help to reduce food waste, as food products that would have otherwise spoiled can now be

stored for longer periods of time. Vacuum sealing can be particularly effective for perishable items such as meat, fish, and produce that have a limited shelf life. Additionally, vacuum-sealed packaging can help to protect food products from exposure to oxygen and other environmental factors that can degrade their quality and safety over time.

CAD Design:





## Community Partners:

**Food Processing Companies:** Food processing companies are a key stakeholder as they are the primary users of large-scale vacuum sealers. Ever since the 1950s and the improvement of plastics, food manufacturers often use vacuum sealers or another similar method as a way to remove oxygen that causes food spoilage. They rely on sealants to preserve food products and extend shelf life, reducing food waste and increasing profits. Likewise, in this new age of consumerism, customers and consumers of perishable food products also benefit from this vacuum sealer as they will continue to receive high-quality products that do not spoil quickly. Before the past few decades, most people used more reusable packaging, like paper or cloth bags, for food storage. However, the implementation of vacuum sealing allowed for consumers to start purchasing foods in bulk and last longer, increasing convenience. Lastly, regulatory agencies, like the US Food and Drug Administration, are another important stakeholder as they play a role in ensuring the safety and quality of food products. Agencies like these prevent food-borne illnesses and other issues that arise from mispackaged foods. Large-scale vacuum sealers must meet regulatory standards and guidelines to ensure that food products are safe for consumption and free from contamination or spoilage.

We would also consider implementation with Shamrock Farms, Whole Foods and Sprouts, three major stores with an abundance of daily wastage. They would be perfect for trials and solution testing.

## Timeline:

- 2/24/23: Stage 1: Project Kickoff
  - Initial Design Idea Approved



- 2/25/23-3/10/23: Stage 2: Project Design
  - Using CAD, Obtain materials and develop a final design
- 3/10/23-3/21/23: Stage 3: Project Development
  - Design and Build Prototype (due to the 2.5 weeks of spring break, this time will be utilized to develop the prototype)
- 3/21/23-3/28/23: Stage 4: Project Presentation
  - Pitch Preparation
- 3/28/23: Stage 5: Final Event
  - Pitch Idea and Demonstrate Prototype
- 3/28/23-5/1/23: Stage 5: Final Development
  - Product Development, Patent Applications, Implementation into Stores and Farms

#### Team Members:

- Prisha Shroff: Inventor who loves to create solutions to real world problems. Computer science Skills: Java, Python and C++.
- Liam Stange: Amature engineer and designer who focuses on creating solutions from everyday problems to universal technological limitations. Cad Design: Fusion 360, machining and fabrication experience on robotics team.
- Alex Huang: Interest in Mechanical Engineering and Building. Skills: Builder on Robotics team, built bumpers and part of the robot. Metal and woodworking skills.
- Noah Hing: Aspiring Researcher with a passion for Physics and Exploration. Skills: Researcher, Communication, Writing, Project Management, Creativity

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