



COLLEGE OF ELECTRICAL & MECHANICAL ENGINEERING

DEPARTMENT OF ELECTROMECHANICAL ENGINEERING

Internship program at Heineken Breweries share company (A.A)



**Title: Reducing Waste and Increasing Efficiency with a Reusable System for
Mislabelled Rejected Bottles**

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ABSTRACT

Heineken, the world's second-largest brewer, and in the duration, we spent in the company we saw a couple of problems that the company is facing and one of these problems is with mislabeled bottles. These bottles are rejected by the checkmate machine and are currently drained and recycled back into the system, even though the beer is perfectly good. This reduces efficiency and causes the company to lose money and resources.

So, we are proposing a new project to develop a reusable system for mislabeled rejected bottles using an agile project approach. The proposed solution is to improve the original checkmate machine by adding an extra pusher and conveyor that specifically rejects mislabeled bottles. The mislabeled bottles would be pushed to a conveyor where they are stacked, and then an employee would collect them and put them on a conveyor that joins the bottles that came from the pasteurizer. This would allow the mislabeled bottles to be recycled without having to be manually sorted.

The project team is aware of the risks associated with using the agile project approach, such as unrealistic expectations, communication challenges, technical debt, and team burnout. The team is developing a plan to mitigate these risks by setting realistic expectations, communicating regularly with the stakeholders, thoroughly designing the project, and properly managing the team.

Our supervisor believes that this project will be successful in reducing waste and increasing efficiency. The company is committed to using the agile project approach to ensure that the project is completed on time and within budget.

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Acronyms

AASTU: Addis Ababa science and technology university

COD: Chemical oxygen demand

HBSC: Heineken breweries share company

PE: Photoelectric

PLC: programable logic control

Chapter One: Introduction

1.1 Background

Heineken is the world's second-largest brewer. The company has been in operation for over 100 years. It started production in Ethiopia in 2011 after buying Harar and Bedele breweries. The Kilinto brewery is the largest in Ethiopia and has a capacity of 1.5 million hectoliters per year.

In recent years, the company has been mildly facing a problem with mislabeled bottles. These bottles are rejected by the checkmate, which is a machine that is used to inspect bottles for defects. The rejected bottles are then drained and recycled back into the system, even though the beer in the bottle is perfectly good. This reduces efficiency and causes the company to lose money and resources.

The agile project approach is a flexible approach to project management that is based on the idea of iterative development. The project is broken down into smaller, more manageable tasks, and the team works on these tasks in short cycles called sprints. At the end of each sprint, the team delivers a working product increment to the stakeholders.

The agile project approach is being used for this project because it allows the team to be more flexible and to adapt to changes as they occur. The project is also being broken down into smaller, more manageable tasks so that the team can focus on one task at a time and avoid getting overwhelmed.

There are some risks associated with using the agile project approach, such as unrealistic expectations, communication challenges, technical debt, and team burnout. The team is aware of these risks and is developing a plan to mitigate them.

The team is setting realistic expectations for the project and is communicating regularly with the stakeholders. The team is also taking the proper time to thoroughly design the project and is properly managing the team.

The company believes that this project will be successful in reducing waste and increasing efficiency. The company is committed to using the agile project approach to ensure that the project is completed on time and within budget.

1.2 Project Overview

1.2.1. Business problem

- Every year, millions of bottles are rejected by Heineken Breweries due to mislabeling. These bottles are typically discarded, which contributes to waste and pollution.
- The mislabeling of bottles can also lead to inefficiencies in the bottling process

1.2.2. Business Opportunity

1. A reusable system for mislabeled bottles could help to reduce waste and inefficiency in the bottling industry.
2. Such a system could collect rejected bottles and return them to the bottling plant, where they could be relabeled and reused.
3. This would help to reduce the amount of waste that ends up in landfills and incinerators.
4. It would also help to improve the efficiency of the bottling process, saving businesses time and money.

1.3. Our objectives

1.3.1. General objective

To develop and implement a reusable system for mislabeled rejected bottles that will reduce waste, save time and resources, improve efficiency, and ensure quality.

1.3.2. Specific objectives

- Reduce the number of mislabeled bottles that are discarded.
- Improve the efficiency of the bottling process.
- Improve the quality of the bottles that are shipped to customers.
- Develop a reusable system for mislabeled rejected bottles.
- Create a system that is affordable and easy to maintain.

1.4. Solution

1.4.1. Problem

The current system for checking for mislabeled bottles is not effective. It rejects mislabeled bottles along with other issues, such as underfill and uncrowned bottles. This leads to wasted time and resources, as workers have to manually sort through the rejected bottles to find the mislabeled ones. There are hundreds of bottles with incorrect labels each day. According to our research on phase two, one block rejects at least 62 000 bottles on a monthly basis, which, when we include in the cost, equals around three million Birr. The number of bottles rejected by each block throughout the course of six-month period is depicted in the chart below.

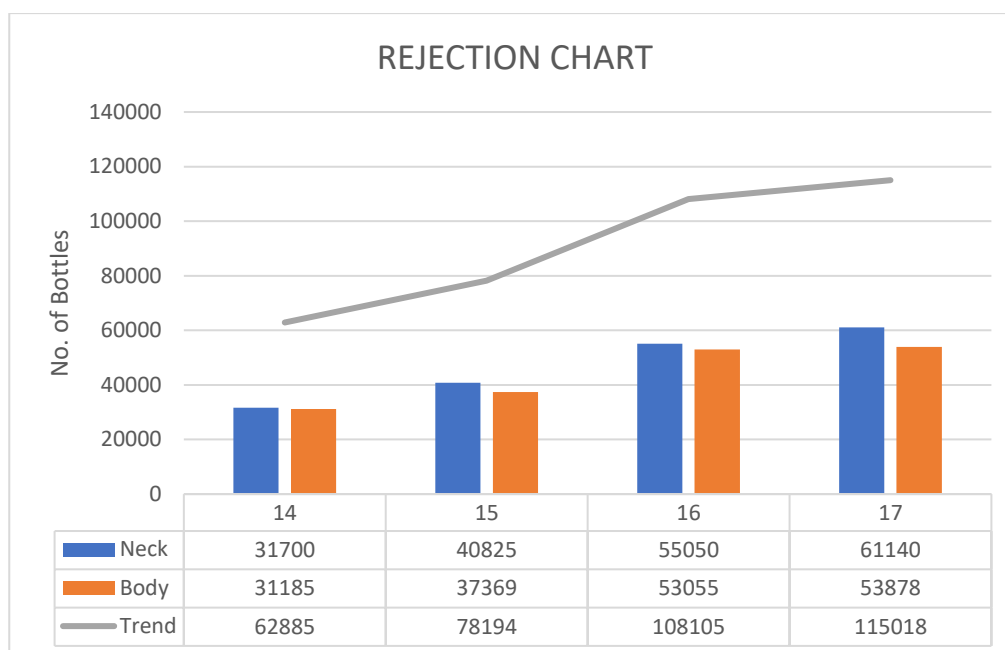


Figure 1: Mislabeled bottle rejection chart

1.4.2. Solution

The proposed solution is to improve the original machine by adding an extra pusher and conveyor that specifically rejects mislabeled bottles. The mislabeled bottles would be pushed to a conveyor where they are stacked. Then, an employee would collect the mislabeled bottles and put them on a conveyor that joins the bottles that came from the pasteurizer. This would allow the mislabeled bottles to be recycled without having to be manually sorted.

The proposed solution would have the following benefits:

- ✓ It would reduce waste by preventing mislabeled bottles from being discarded.
- ✓ It would save time and resources by eliminating the need for manual sorting.
- ✓ It would improve efficiency by reducing the number of bottles that have to be rejected.
- ✓ It would improve the quality of the bottles by ensuring that only properly labelled bottles are shipped to customers.

The scope of the proposed solution includes the design and construction of a new pusher and conveyor system, the modification of the existing checkmate machine to accommodate the new system. The proposed solution is expected to take 6 months to complete.

1.5. Proposal

1.5.1. Vision and goals

Vision: A brewing company where all rejected bottles related to labelling are reused, reducing waste and increasing efficiency.

Goal: To develop and implement a reusable system for mislabeled rejected bottles that will reduce waste and increase efficiency by 20% within 5 years.

To achieve this vision and goal, we will need to develop a system that is:

- ✓ **Cost-effective:** The system must be affordable to implement and use.
- ✓ **Scalable:** The system must be able to be scaled up to accommodate a large number of bottles.
- ✓ **Durable:** The system must be able to withstand the wear and tear of everyday use.
- ✓ **Easy to use:** The system must be easy for employees to use and maintain.

we believe that this vision and goal are achievable. By working together, we can make a difference in reducing waste and increasing efficiency.

1.6. Scope

- The project will be limited to the brewing plant in Kilinto, Addis Abeba, Ethiopia.
- The project will involve the design and construction of a new pusher and conveyor system, and the modification of the existing checkmate machine.

- The project will not include the development of new software or hardware for the checkmate machine.
- The project will focus on improving the current system for checking for mislabeled bottles.
- The project is expected to take 6 months to complete.

1.7. Limitations

While dealing with this practical project. We might face a number of limitations. These include:

Lack of experience: as a still university student we might not have enough experience than full-time employees, which can make it difficult to complete complex projects on time and within budget.

Lack of knowledge: we might not have the same level of knowledge required to practically apply our projects, which can lead to mistakes and delays.

Time constraints: we have limited time to complete our project.

Technical challenges: Developing a system that can accurately and reliably identify and reject mislabeled bottles is a challenging task. The system must be able to operate in a variety of environmental conditions, and it must be able to handle a wide range of bottle sizes and shapes.

Cost: The cost of developing and implementing the system must be affordable for Heineken Brewery.

Integration: The system must be able to be integrated with the existing bottling line at Heineken Brewery, Kilinto Branch. This may require some modifications to the bottling line.

Chapter Two: Literature Review

2.1. Literature Review

There is a growing body of research on the topic of reducing waste and inefficiency in the bottling process. One study found that, on average, 1% of all bottles produced are rejected due to mislabeling. This may seem like a small number, but it adds up to millions of bottles each year. The study also found that the cost of mislabeled bottles is significant. In addition to the cost of the lost beer, there are also the costs of labor and materials associated with sorting and discarding the mislabeled bottles.

Several different strategies have been proposed for reducing the number of mislabeled bottles produced. One strategy is to improve the quality of the labelling process. This can be done by using more reliable labelling equipment and by implementing stricter quality control procedures. Another strategy is to develop a system for reusing mislabeled bottles. This could involve relabeling the bottles or using them for other purposes, such as storing water or other beverages.

The project proposal that we have developed describes a new system for reusing mislabeled rejected bottles. The system would involve adding an extra pusher and conveyor to the existing checkmate machine. The mislabeled bottles would be pushed to a conveyor where they would be stacked. Then, an employee would collect the mislabeled bottles and put them on a conveyor that would join the bottles that came from the pasteurizer.

The proposed system has several potential benefits. First, it would reduce the amount of waste produced by the bottling process. Second, it would save time and resources by eliminating the need for manual sorting of mislabeled bottle. In addition to these benefits, the proposed system would also help to reduce our environmental impact. By reducing the amount of waste produced, we would also be reducing the amount of COD (chemical oxygen demand) that is discharged into the environment. COD is a measure of the amount of organic matter in water that can be broken down by bacteria. High COD levels can deplete water oxygen levels and harm aquatic life.

Overall, the proposed system has the potential to be a valuable asset to the company and the bottling industry as a whole. The system has the potential to reduce waste, save time and resources, improve efficiency, ensure quality, and reduce environmental impacts.

Chapter Three: Materials and Methods

3.1. Materials

The following materials are some of the main materials required to build the reusable system for mislabeled rejected bottles:

Pusher: A pusher is a mechanical device that is used to move objects from one location to another. In this system, the pusher will be used to remove mislabeled bottles from the conveyor belt.



Figure 2: Pneumatic pusher

Conveyor: A conveyor is a device that transports objects from one point to another. In this system, the conveyor will be used to transport the bottles through the system.

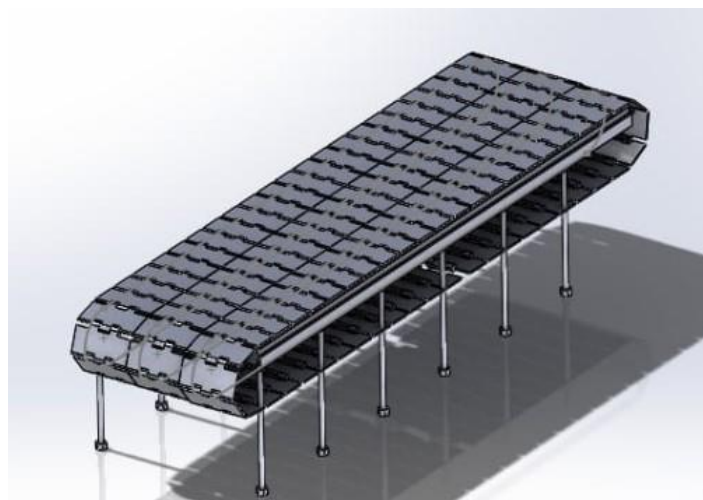


Figure 3: conveyor

PE sensor: A PE sensor is a type of sensor that uses a photoelectric effect to detect the presence of objects. In this system, the PE sensors will be used to detect the mislabeled bottles.



Figure 4: PE sensor

Coaxial cables: Coaxial cables are used to transmit signals between the PE sensors and the control system.



Figure 5: coaxial cables

Structural supports: Structural supports will be needed to support the conveyor belt and the PE sensors.

Motor: to move the conveyors in a specific direction.



Figure 6: Motor

Electrical wiring: Electrical wiring will be needed to connect the PE sensors to the control system.

Software: Software will be needed to control the system and to identify the mislabeled bottles.

3.2. Methods followed

To reduce waste and increase efficiency with a reusable system for mislabeled rejected bottles, we propose the following steps:

First, we will conduct a survey of manufacturers and distributors to assess the current level of waste and inefficiency associated with mislabeled rejected bottles. This will help us to understand the scope of the problem and to identify the areas where our system can have the greatest impact.

Next, we will develop a prototype of the reusable system and test it in a controlled environment. This will allow us to identify and address any potential problems with the system before we implement it on a wider scale. We will also collect feedback from the testing phase to improve the design and functionality of the system.

Once the prototype is finalized, we will implement the system in a pilot program. This will give us the opportunity to test the system in a real-world setting and to collect data on its effectiveness. We will track the amount of waste and inefficiency that is reduced by the system, as well as the cost savings that it generates.

Based on the data we collect from the pilot program; we will make any necessary adjustments to the system to improve its performance. Once we are satisfied with the performance of the system, we will scale it up and implement it in more manufacturing and distribution facilities.

We believe that by following these steps, we can achieve our vision and goal of reducing waste and increasing efficiency with a reusable system for mislabeled rejected bottles.

Engineering specifications:

- The system must be able to identify and reject mislabeled bottles with in a high accuracy.
- The system must be able to handle a throughput of at least 10,000 bottles per hour.

- The system must be able to integrate with the existing bottling line at Heineken Brewery, Kilinto Branch.
- The system must be able to be operated and maintained by Heineken Brewery staff.
- The system must be able to withstand the harsh operating environment of a brewery.

Engineering targets:

- The system must be able to be deployed within six months.
- The system must have a budget of no more than 1,500,000 birr.
- The system must have a lifespan of at least five years.
- The system must be able to reduce waste by at least 10%.

3.3. Development

Development Plan

Risks:

- Technical challenges in modifying the Checkmat machine
- Difficulty in finding the right PE sensors and pushers
- Integration challenges with the existing bottling line
- Unforeseen costs

Deliverables:

- Modified Checkmat machine
- PE sensors and pushers
- Software to control the system
- Documentation

Implementation:

1. Design the system:

Develop a detailed design of the system, including the following:

- The placement of the PE sensors and pushers
- The software to control the system
- The integration with the existing bottling line

- Create a prototype of the system to test the design and identify any potential problems. This will help to ensure that the system is safe and reliable before it is deployed in production.

2. Modify the Checkmat machine:

Make the necessary modifications to the Checkmat machine to accommodate the PE sensors and pushers. We are going to do that by adding another column to the rule assignment part.

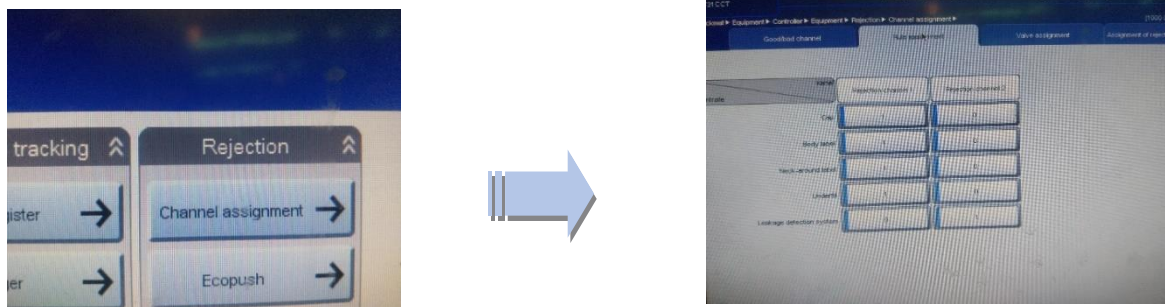


Figure 7: Value Assignment

3. Install the PE sensors and pushers:

Install the PE sensors and pushers by the design. To the open slots in the PLC, I/O module.

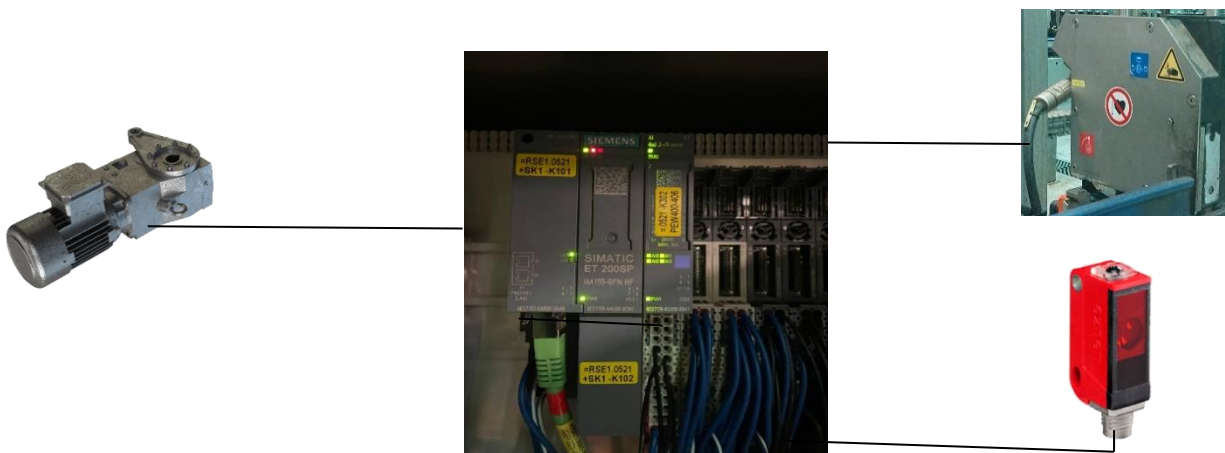


Figure 8: General connection diagram

4. Integrate the system with the existing bottling line:

Finally, Integrate the system with the existing bottling line so that the mislabeled bottles are automatically removed from the line and relabeled.

Testing:

a. Unit testing:

We are going to Test the individual components of the system, such as the PE sensors and pushers, to ensure that they are working properly.

b. Integration testing:

We then Test the system as a whole to ensure that all of the components are working together properly.

c. System testing:

After that, we are going to test the system in a production-like environment to ensure that it can handle the expected load.

d. Performance testing:

Then after it passes the user acceptance testing, we are going to Conduct performance testing to ensure that the system can handle the expected load.

e. Security testing:

Finally, we will conduct security testing to identify and mitigate any security vulnerabilities.

Chapter Four: Mechanical Design

4.1. General design of the machine

The overall process of the recycling mislabeled bottles is shown in the figure below.

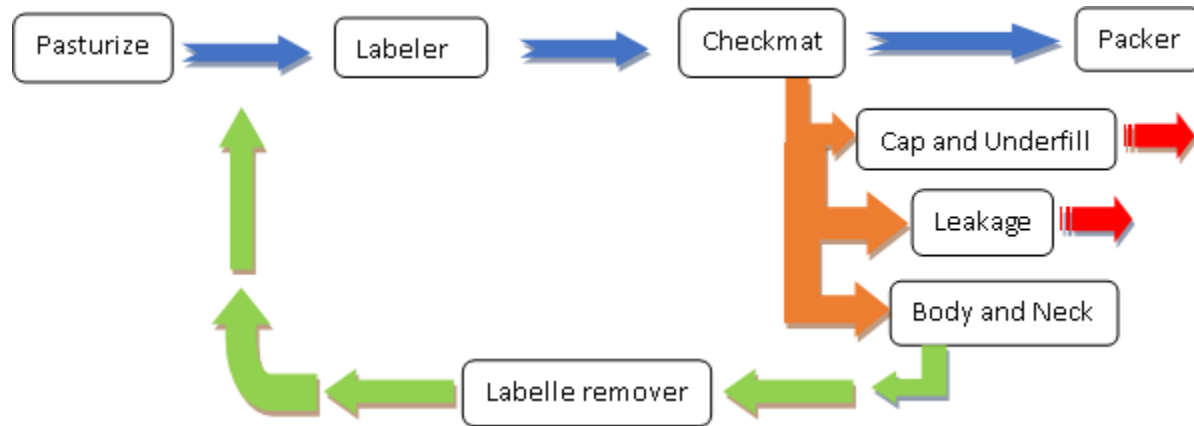


Figure 9: The overall bottle movement

General Design

The figure below shows the general design of a system to reject mislabeled bottles.

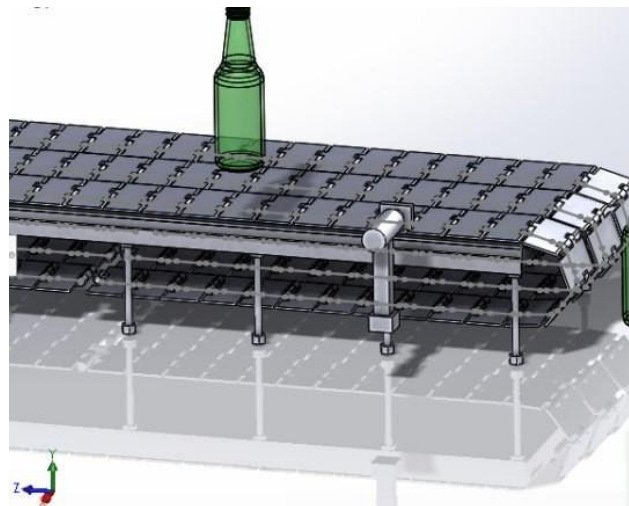


Figure 10: General design

Conveyor base

Figure 11 tries to show the base where the conveyor belt is going to slide on.



Figure 11: Conveyor base

Motor

Figure 12 shows the designed model of the motor that we are going to use to rotate the conveyor belts.

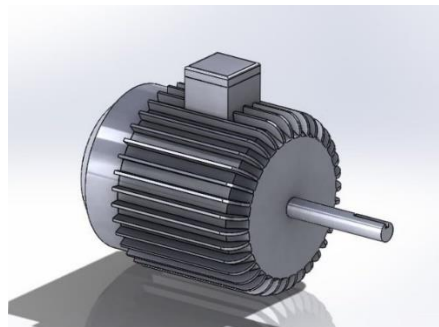


Figure 12: Motor

Conveyor belts

Figure 13 shows the part of a conveyor belt. When assembled will form the conveyor belt shown in figure 14.

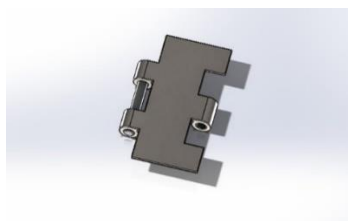


Figure 13: Conveyor belt part

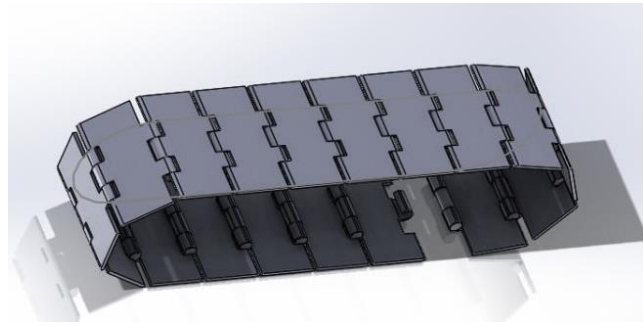


Figure 14: Conveyor belt parts assembled

Pusher

Figure 15 shows a pneumatic pusher which pushes the bottles when received instruction from the PLC to separate the mislabeled bottles.

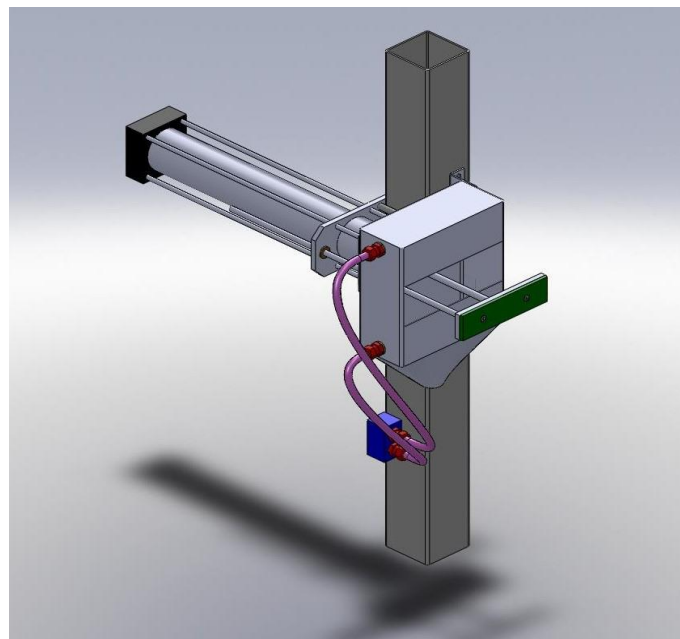


Figure 15: Pneumatic usher

Chapter Five: Conclusion and Recommendation

5.1. Conclusion

The proposed system for reusing mislabeled rejected bottles has the potential to provide several benefits to the company. First, it would reduce waste by preventing mislabeled bottles from being discarded. Second, it would save time and resources by eliminating the need for manual sorting of mislabeled bottles. Third, it would improve the efficiency of the bottling process by reducing the number of bottles that have to be rejected. Fourth, it would ensure that only properly labelled bottles are shipped to customers.

In addition to these benefits, the proposed system would also help to reduce the company's environmental impact. By reducing the amount of waste produced, the company would also be reducing the amount of COD (chemical oxygen demand) that is discharged into the environment. COD is a measure of the amount of organic matter in water that can be broken down by bacteria. High COD levels can deplete water oxygen levels and harm aquatic life.

Overall, the proposed system has the potential to be a valuable asset to the company and the bottling industry as a whole. The system has the potential to reduce waste, save time and resources, improve efficiency, ensure quality, and reduce environmental impacts.

5.2. Recommendations

Suggestions for future work

The system could be integrated with other systems in the bottling plant, such as the production planning system and the inventory management system. This would allow for more efficient and effective operation of the system.

The system could be adapted to reuse other types of mislabeled or rejected products. This would help to reduce waste and improve efficiency in other areas of the bottling plant.

The system could be marketed to other bottling companies as a way to reduce waste and improve efficiency. This would allow the company to generate additional revenue and make a positive impact on the bottling industry as a whole.

Areas for improvement

- The system could be made more robust and reliable. This could be done by using higher-quality components and by implementing more rigorous testing procedures.
- The system could be made easier to use and maintain. This could be done by simplifying the user interface and by providing better documentation.
- The system could be made more affordable. This could be done by using less expensive components and by optimizing the design of the system.

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