THE DEVELOPMENT OF ERROR FREE DEVICES FOR AUTOMATED ASSEMBLY LINE SORTING AND PACKAGING.

THE BALANCE BETWEEN HUMAN INTERACTION AND AUTOMATION TECHNOLOGY ON ASSEMBLY LINES IN AMAZON WAREHOUSE DURING THE COVID19 PANDEMIC.

A Thesis Prospectus
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By
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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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How can automation be utilized effectively while also maintaining necessary human interaction within the workforce?

Automation is a defining feature of the modern world, enabling the speed and efficiency at which the planet runs. While automation has been very beneficial for many industries, it also presents many challenges to human interaction within labor. This leads me to the central focus for both my STS and Technical Research which examines the use of automation technologies in engineering and manufacturing, particularly how this has affected automated and human worker balance during the COVID 19 Pandemic.

For my technical research, I will focus on creating a device that can automate the sorting, organizing, and transporting of materials. I will also be using assembly lines as the key reference for such a device. Their ability to sort high quantities of material at incredible rates makes them ideal models for our device, thanks to the efficiency and effectiveness of the automation they utilize in manufacturing and sorting.

For My STS research problem, I will be exploring the effect of automation during the COVID 19 pandemic on Amazon warehouse employees in California. Automation is designed for speed and efficiency, but the human counterpart necessary for maintaining these systems can only keep pace for so long. During the COVID 19 Pandemic as people moved indoors for unparallelled periods of time, Amazon became the largest online distributor of goods. To meet demand, automation was widely utilized at Amazon warehouses throughout the United States. As a result, warehouse employees were often expected to perform at the rate of automation, leading to higher levels of reported injury.

By addressing the technical and human aspects of automation, this research will help to shed light on the larger implications of automation in industry settings, offering guidance for the future development of manufacturing processes.

The development of error free devices for automated assembly line sorting and packaging.

The Assembly line, first introduced in the early 20th Century, was designed to streamline mass production of goods in a systematic and efficient manner. By the 21st century assembly lines had evolved significantly to integrate a variety of engineering technologies, most notably automation (Janssen, et al 2019). This evolution has given rise to the technical research problem that I will address.

For my technical research problem, I will be researching a device that will need to sort ball bearings of various sizes and materials through automation. The device will then be used in an engineering design competition to determine the most efficient design for sorting ball bearings. The sorting process is intended to reflect the manufacturing process of an assembly line. The ball bearings will have diameters of 0.5in and 0.25in. While the materials will include brass, steel, and nylon. To solve this problem a device will be built and will utilize many

different methods to sort. Methods will be evaluated on a case-by-case basis. As of now, to sort the sizes of the ball bearings, holes will be cut on a track that will allow the larger ball bearings to cross freely while dropping smaller ball bearings through the hole onto a separate track. The two tracks will then more or less operate the same. To separate the steel from the other varieties of ball bearings a magnet will be placed on one side of a fork in a track. This attracts the steel ball bearings while the brass and nylon move to the other side of the track. To separate the brass and nylon a conductivity activated door will be utilized where, if a brass ball bearing rolls over two copper track pieces connected to the door, the door will open briefly to open one side of the track while blocking the other side. After the brass ball bearing moves through the door it will immediately close allowing for the nylon to run smoothly on a separate track. All these separation methods are still being experimented with and are subject to change but, if done correctly, the device should be able to sort the ball bearings completely independently of human interaction, while also being able to compete properly in an ASME design competition.

It is also important to note that there are some constraints within this project. Most notably the device must fit within a box that is less than 20in x 20in x 20in. Also, the Ball bearings must be at least partially visible by the competition judges at all periods during the competition. Consequently, the team is planning to construct our box using a clear material as a frame. Another significant constraint is that the device must contain a clearly visible power switch. Upon pressing the switch, the ball bearings placed into the hopper (funnel at the start of the track) of the device should automatically begin to sort. While these are not the only constraints for the device, they do represent the most significant challenges for our team. Some knowledge our group hopes to gain from this experience is to better understand how automation can be more effectively applied in industry settings as well as how to account for timing in engineering processes.

Overall, this process should be an excellent exercise in pattern recognition that future engineers can use as a template for design efficiency. It is also worth noting that this project is important because the technology used in the device can determine how much automation is appropriate for manufacturing systems without compromising human involvement. While automation is ubiquitous in the modern world, there hasn't been as much research conducted into the level of human involvement and balancing that involvement with mechanical systems.

The balance between human interaction and automation technology on Assembly lines in Amazon warehouses during the COVID 19 Pandemic.

For my STS Research Problem, I aim to investigate how and why Amazon allowed automation to outpace its warehouse staff in California during the COVID 19 pandemic, leading to significant strain on warehouse workers. This question will also explore the broader interaction between humans and automation technology. According to a report from the Center for Investigative Reporting (BBC 2020), warehouses that utilized automation co-working with human stuff experienced significantly higher rates of injury among employees when compared to those without. This trend was consistently observed nationwide, but it was especially alarming

for employees in California where rates of injury were found to be “more than four times the national average” (Human Impact, 2021, p. 7) These spikes in injury were particularly acute around dates of major company wide sales such as Black Friday or Cyber Monday (Peters 2020). The primary issue that arises is the physical exhaustion that Amazon warehouse employees experience while working under these demanding conditions. This challenge is further exacerbated by the presence of numerous automated systems, which often operate at a faster pace than the workers, intensifying the strain on the workforce.

While most people may think that automation will is simply displacing human labor, the truth is a little more complicated. Most manufacturing warehouses in the United States can be best be characterized as a co-working of humans and machines. A human component is still necessary to run many of the secondary functions of manufacturing involve critical thinking, unexpected situations, and complex tasks. Automation is generally utilized when performing simpler tasks in quick succession. This standard has been increasing since e-commerce has grown in popularity.

Amazon has relied on e-commerce for nearly 25 years to drive its business (Altrad, A., et al. 2021), and the pandemic merely intensified business trends that had already been developing over time. At first most automated systems present in warehouses were small (Bogue, 2022), but to facilitate e-commerce in the early 2010s Amazon expanded its use of automation. By the pandemic, there was a heightened need for faster and more reliable automation to keep up with the surge in demand. This is only likely to increase as the products consumers want have begun to grow larger. For example, many people have a more diverse taste in the products they want (Pilati, et al. 2022). The desire for more specific product tastes in recent years has also led to a surge in the development of automation. This surge in automation has led to an increase in workplace related injuries which has caused concerns for many people working within Amazon manufacturing warehouses. If Amazon fails to effectively address these concerns, it could negatively impact on other aspects of company efficiency. For instance, Amazon often prides itself on its 24-hour Prime delivery service. However, if employee well-being is not prioritized then the speed and reliability at which this service operates could be jeopardized.

The relationship between Amazon warehouse employees and the company itself can be viewed through the realm of Technological Politics. This is the idea that technology (in this case automation) has political qualities beyond its immediate technical function. In other words, technology is measured not only by its practicality but also the power or authority that such technology brings about. (Winner, 1980, p.1) Utilizing this theory, I plan to explore the relationship between the Amazon warehouse employees, the company of Amazon, and the automation technology itself. Regardless of how automation should be used, it is a tool of labor control by Amazon to keep their employees working within a standard that they have developed. While the automation technology used in these warehouses is not political on its own, its use as a tool of dominance has expanded well beyond its original function. It is also important to realize that Amazon was ground central for much of the automation conducted during the Pandemic and this situation gave the company enormous leverage over their own employees.

Methodology

To address the STS research, I will collect evidence that reflects both the technical and the personal costs related to the use of automation in Amazon warehouses. A combination of qualitative and quantitative data will provide a multifaceted source of information. This will allow me to develop a pattern to determine why, and how Amazon allowed for this "relationship" between its staff and automation to develop. I will focus on examining rates of staff reported injuries from warehouses in California, comparing the period before and during the COVID 19 Pandemic. First-hand accounts will be important for gaining insights into the impact of automation because they offer a personal and more emotional testimony to the workplace standards of Amazon. There are also a variety of employee testimonies available including written interviews found on websites like Quora or Reddit. More reliable sources like Indeed, Glassdoor, and Blind offer anonymous employee reviews that can provide valuable information. Additionally, there are also numerous social media websites like Twitter and Facebook. These websites may include further employee testimonies under specific hashtags.

In addition to employee experiences, I will explore public statements made by companies who develop automation technology, with a strong focus on Amazon Robotics. As Amazon uses robots built by this subsidiary extensively in its warehouses, these robots are tested annually in competitive settings to optimize efficiency (Corbato, 2018). Insights from these statements will help address why and how automation in Amazon warehouses in California has been able to outpace human workers. Also, by exploring warehouse industry trade groups statistics I will be able to analyze data related to industry trends, technological developments, and workforce conditions. I will review relevant data through groups like the National Association of Warehouse and Storage (NAW) or the U.S. Bureau of Labor Statistics (BLS). By combining all these resources, I will identify a general pattern to support my argument.

Conclusion

This research aims to explore how and why Amazon automation outpaced its warehouse staff in California during the COVID 19 pandemic, resulting in significant strain on its employees. I plan to undercover the reasons for Amazon's rapid adoption of automation, the negative effects this has had on employee wellbeing, and how these factors were exacerbated during the pandemic.

On the technical side of my report, my research will focus on designing a device capable of sorting ball bearings of various sizes and materials through automation. This project will offer valuable insights into the technical challenges and the innovations required to implement automation. By examining a device like this, I hope to gain a better understanding of how automation can be optimized for the greatest efficiency and reliability.

These two research projects will contribute to understanding the intersection between automation technology and labor. My STS project will explore the ethical and social considerations of automation in the workplace, while my technical project will explore how

automation can be best applied practically. By addressing the technical and human components of automation, this research will help to shed light on the larger implications of automation in industry settings and provide insights that will guide future development in manufacturing.

Word Count: 2076

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