IE 43100 Fall 2022

NOISE MANAGING HEADPHONES: HARPA

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HARPA:

- Innovative selective noise canceling headphones
- Revolutionary modules to detect ambient noise



Introduction

Currently headphones for cancelling *all* noise are widely available to everyone, but for many industrial work environments, having headphones that block out all noise can lead to dangerous conditions. A recently started company, Harpa, is designing a selective noise cancelling headphone. These headphones will be used in mostly industrial settings and will detect specific various loud and dangerous noises. Using the module and iOS app invented by the founders of Harpa, the headphones will be able to block unwanted sounds out without sacrificing worker safety. Harpa is currently working with the Purdue Research Foundation and Purdue Polytechnic Institute to create and test prototypes in an industrial workplace. These headphones could change the way we perceive worker safety and help improve key aspects like worker satisfaction and productivity on a larger scale.

About the Client

Our client, Dipak Narula, is the project manager for this company here at Purdue. He was assisted by four Purdue polytechnic students and Mr. Narula helped them license their selective noise cancelling technology through the Purdue Research Foundation.

Harpa is working with both the Industrial Engineering team and a team of Purdue Polytechnic students. The Industrial Engineering students are working on a complete production process while the polytechnic team works on creating a working prototype.

Project Objectives

A Complete Process for Manufacturing the Desired Product

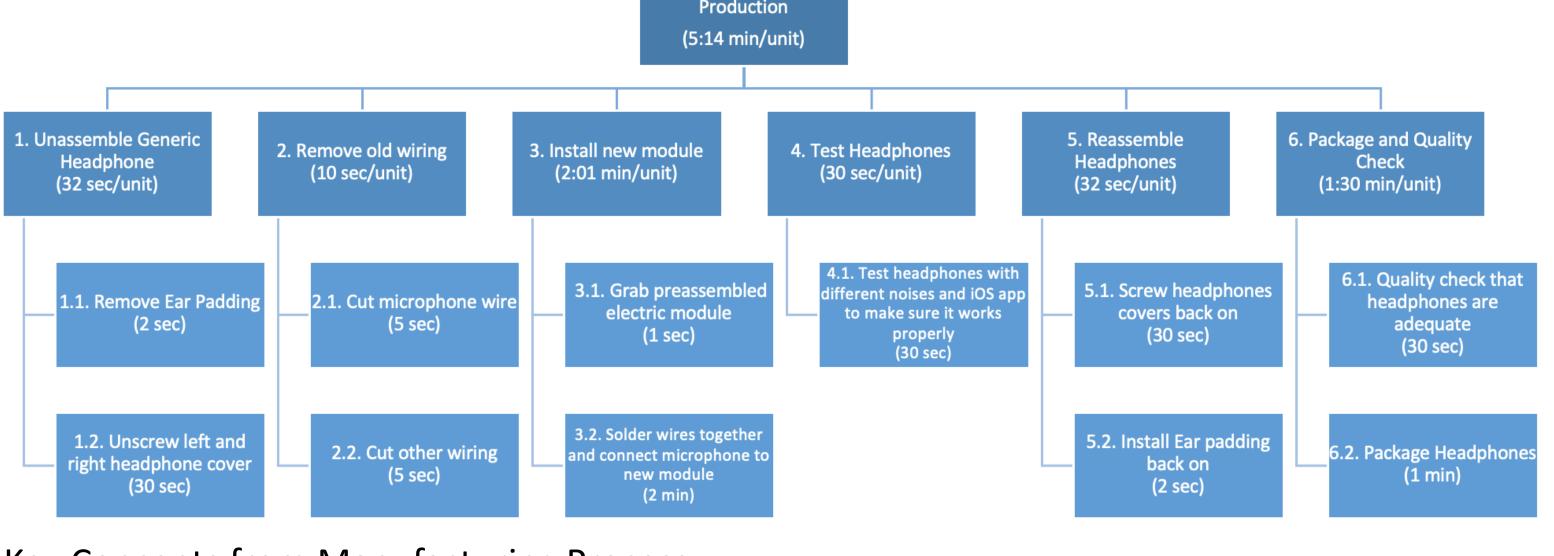
- Creating a manufacturing process with accurate time and labor analysis
- Calculating a budget to determine how much it would cost to manufacture the desired product.
- Making an accurate facility layout with maximum efficiency

Product Process Method

Overview:

Throughout this semester our group studied the problem the company was aimed to solve. We collaborated with the polytechnic team to understand the module they have developed to design an efficient product process. This product process is to effectively layout our manufacturing process needed to produce one unit to the customer. Our product process strategy was split into three sections. The categories consisted of strategizing a hierarchical task analysis, constructing a facility design, and calculating our budget. These calculations will accurately estimate expected revenue and profits to potential investors.

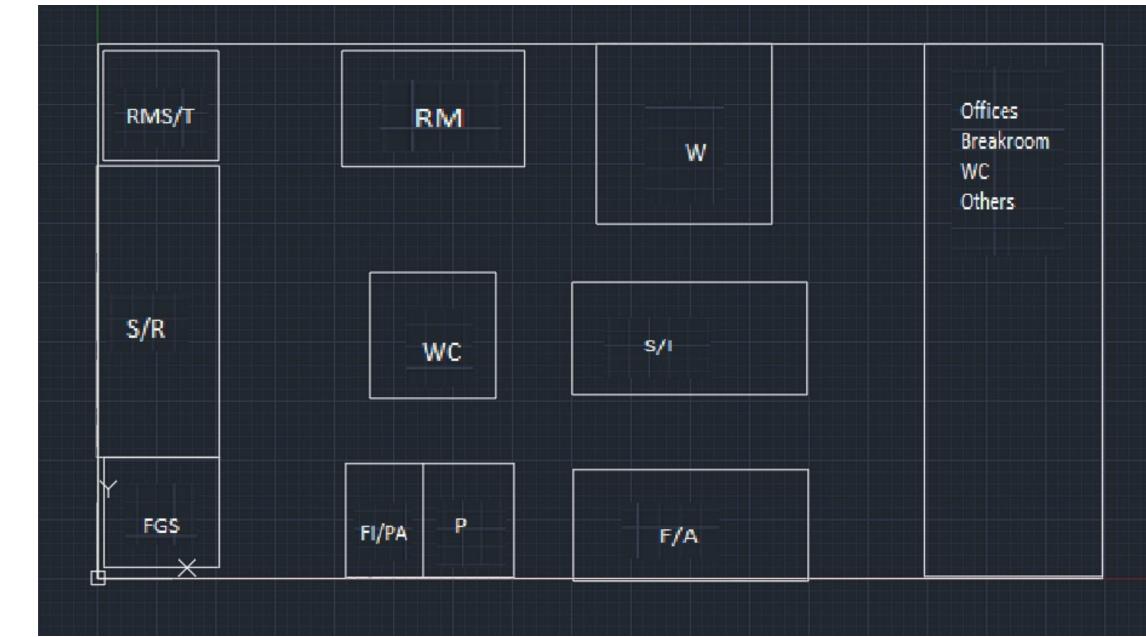
Hierarchical Task Analysis / Manufacturing Process



Key Concepts from Manufacturing Process

- Broke down each step down into sub-steps
- Used time studies and estimations to find final times for each step.
- 5:14 min/unit -> 22,026.72 units/year (8-hour work weeks)
- 7 workers needed. 1 worker for each step, but we expect a bottleneck at step 3, so 2 workers will be stationed there.

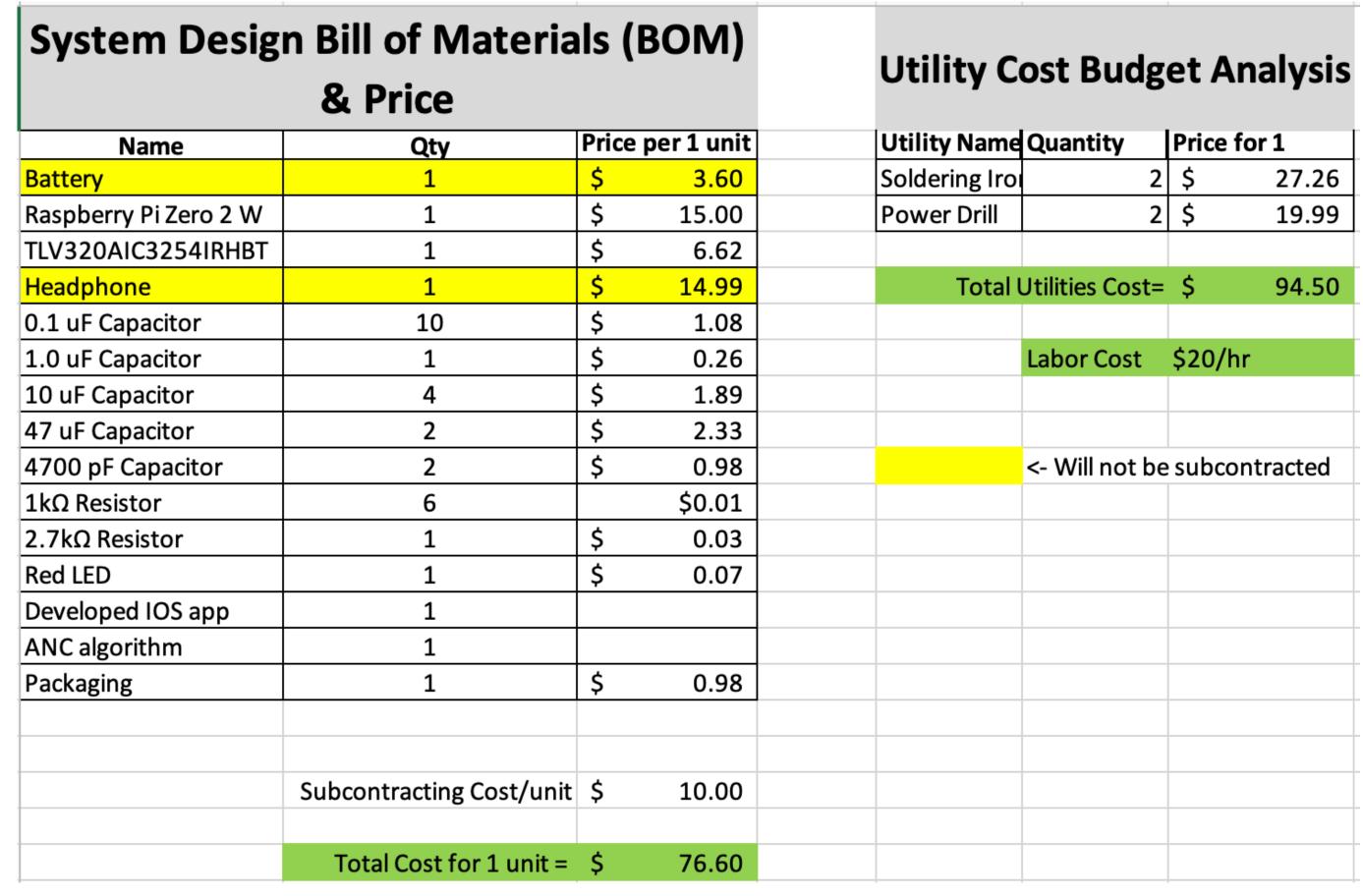
Facility Layout



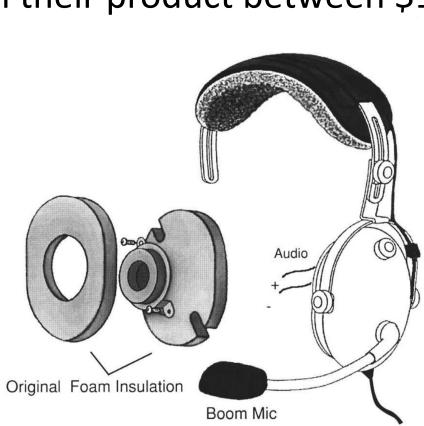
- S/R: Shipping/Receiving
- RMS/T: Raw Material Storage/Tracking
- RM: Removal of parts
- W: Wiring
- S/I: Soldering/Insulation
- F/A: Final Assembly
- P: Painting
- FI/PA: Final Inspection/Packaging
- FGS: Finished Goods Storage
- WC and offices

The proposed facility design was made with the intention to give Harpa space for growth in the future, as well as maximize the flow of goods.

Cost Budget



From our research and calculations, the total cost of material to create one unit is \$76.60. The cost of utilities is \$94.50 (one time purchase). We used the average American cost of labor for manufacture workers, which is \$20/hour. Harpa plans to sell their product between \$150-175.



New crossover cable These 3 leads will attach to new crossover cable audio(+) 9v(+) common ground divides into two leads, one to each side splice audio(-) and 9v(-) together to form common ground Continuity Tester audio (-) Place tie wrap every 10 inches

Quick Facts!

The proposed manufacturing process produces a unit every 5:14 minutes!

The proposed facility layout is designed to help maximize production and efficiency!

Our calculated cost of material to build Harpa's product is only \$76.60!

Conclusion

We believe that through the research and analysis we have done in IE 43100 this semester we have found an adept and complete production process for HARPA to follow through their early years of foundation. We believe this can help them progress and build into a very successful company that produces products helping people all around the world.

References

Active noise reduction module™ installation instructions. (n.d.). Retrieved November 30, 2022, from https://www.aircraftspruce.com/catalog/pdf/11-12165.pdf