

Baker/Koob Proposal Template

Engineering Interdisciplinary Senior Project – Air Wear

Abstract

Air Wear is a team of three Cal Poly engineering student, undertaking an interdisciplinary senior project. The mission of Air Wear is to improve/redesign an existing prototype of a portable oxygen assisting breathing device. The purpose of this device is to provide supplemental oxygen to patients with respiratory problems for use while at rest or under exertion. The existing prototype was a senior project and is taken over by the Air Wear team to improve upon the design because this device is functional but not practical or safe enough for a customer to use it. Potential improvements include implementing a more sustainable oxygen delivery method with a universally accessible design, making the device portable for at least an hour and making the design more compact and user friendly. The timeline provided by the senior project class will be used as checkpoints to complete the project. The knowledge and experiences of the students with different majors will be used to achieve the goals of the project.

Objectives

In the past year and a half, hospitals have experienced an overwhelming increase in patients needing respiratory assistance due to the COVID-19 pandemic. While COVID is not the only disease that causes symptoms that require oxygen assistance, it is currently the most prevalent one. The team identified a need for an affordable, sustainable, and portable oxygen assisting device that can be used as an outpatient product. The target patients that would benefit most from using this device are healthy enough to not be on a ventilator or under constant hospital surveillance, yet still require oxygen assistance to carry out daily activities and maintain a healthy quality of life.

The diverse perspectives of each member and their respective engineering background will be a big part of the project. The electrical engineering expertise will be heavily used in the hardware and software part of the design. The biomedical engineering expertise will be heavily used in making sure the device is safe to use and user friendly. The general engineering expertise will be heavily used in modeling the design and technical writing.

The objectives of this senior project are listed below:

1. Redesign the oxygen generation system into something more sustainable
2. Weighs less than 10lbs
3. Oxygen flow rate of at least 6 LPM
4. High oxygen concentration (21% to 100%)
5. Modify the hardware to be compact

Methodology

Before creating the design, the team will test the original prototype and acquire another portable oxygenator to deconstruct/reverse-engineer. The team will gather information about how they both work and what frameworks are already in place. At this point, the modeling and/or designing of the individual components of the oxygen support device will be completed. This could potentially be done in a variety of ways, including computer assisted design (CAD), physical models constructed from available materials, and/or modifying existing systems taken from the reverse-engineering process. The team will then create a design concept with the most

feasible oxygen generation method. This design concept will go through several reviews before it is finalized, and the team will seek the advice of experts in mechanical and biomedical engineering when creating this concept. Once the design concept has been approved, the team will take its conceptual models and create a detailed design including measurements, necessary materials, specific part numbers, and 3-d printing files. This detailed design will also be formatted into a report for client and advisor approval. Once the detailed design is approved, the team will begin to acquire the necessary materials and put together its first original prototype. The team will also create tests and test materials before the prototype is built - so that they have a clear understanding of how their prototype fits the requirements once the testing is complete. After collecting test data, they will request sponsor feedback. When the initial product is fully functioning and meets the sponsor's requirements, they will incorporate these results and feedback into a second, improved original prototype.

Timeline

Checkpoint	Approximate Completion Date
Background Research	Completed
Initial Design Concepts	November 16, 2021
Final Design Concept	November 25, 2021
Design Concept Report	December 5, 2021
Detailed Design	January 19, 2022
Final Design Report	January 28, 2022
Order Materials	February 9, 2022
Manufacturing	February 18, 2022
Plan Testing	March 6, 2022
Complete First Original Prototype	April 12, 2022
Perform Tests/Design Improvements	May 26, 2022
Final Project Report	June 3, 2022

Final Products and Dissemination

The final project form will include a fully functioning prototype of an oxygen assisting breathing device integrated into backpack. Features of the final product will include portability, lightweight, comfort, low maintenance, and the ability to be connected and controlled via Apple products (iPhone and Apple Watch) via software application. Team Air Wear will present their final product and report to the Engineering Interdisciplinary Senior Project advisory board and the project sponsor, Rich Murray.

Budget Justification

The team's proposed budget included materials needed for the physical construction of the device. A 256GB SD card will be required for the storage of the software. The on-the-market oxygen concentrator will be utilized for an in-depth investigation of the intra-functional components of the device. Analysis of the deconstructed product will contribute towards the development of team Air Wear's final product. The camera backpack serves as the carrier of the oxygen assisting breathing device and will also consist of personal storage space for the patient using the product. The benefits of obtaining a backpack designed

for the storage of cameras/photography equipment over a typical school backpack, is the compartmental layout that is optimal for our current design, its waterproof nature to keep electrical components safe, and it maintains a discrete look as to not bring attention to the user. 3D components will be printed for the housing of the device's electrical systems and to ensure a clean, organized, and secure fit. Electrical components needed for the final product include items such as a printed circuit boards, raspberry pi, sensors, humidifiers, etc. A miscellaneous section is included in our budget for materials needed in future ideations of the product that will either resolve dysfunctional errors or improve the current design.

Budget Proposal Sheet

Student Applicant(s): Ada Tadeo Ani Svadjian Deepthi Ravuru	
Faculty Advisor: Jim Widmann	
Project Title: Engineering Interdisciplinary Senior Project - Air Wear	Requested Endowment Funding
Operating Expenses <i>subtotal</i>	\$ 1,294.98
MicroSDXC EVO Select Memory Card 256GB	\$ 49.99
VARON 5L/min Pulse Flow Portable Oxygen Concentrator NT-01	\$549.00
Endurax Waterproof Camera Backpack	\$85.99
3D Printing Materials	\$60.00
Electrical Components	\$450.00
Miscellaneous	\$100.00
TOTAL	\$ 1,294.98