Feasibility Study:

Home Oxygen Tube Management

BME 5715: Project B

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Date: 03/19/26

Completed under direction of Colleen Bringman to better understand the home oxygen therapy market, specifically home oxygen tube management. We have found that oxygen tube management problems involving tripping hazards, back tracking, tube kinking, and more create unsafe and frustrating homes for users and caretakers. Through this document and the research conducted to produce it, it has been deemed feasible to enter this market space. I have developed a potential solution for the Research and Development department to further develop.

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Problem Statement

Oxygen tube management problems involving tripping hazards, back tracking, tube kinking, and more create unsafe and frustrating homes for users and caretakers.

Background

Introduction

Long-term oxygen therapy (LTOT) is a widely prescribed clinical intervention for patients with chronic hypoxemia, defined as insufficient oxygen levels in the blood. In the United States, approximately 1.5 million patients were prescribed LTOT annually as of the mid-2000s, reflecting a substantial and persistent patient population requiring supplemental oxygen support (Doherty et al., 2006). Clinically, LTOT is typically indicated when a patient's arterial oxygen saturation (SpO_2) falls at or below 88% at rest, during exertion, or during sleep, corresponding to impaired pulmonary gas exchange and reduced oxygen delivery to tissues (Centers for Medicare & Medicaid Services [CMS], 2023).

Patients eligible for home oxygen systems generally exhibit chronic hypoxemia. Clinical qualification criteria include a resting partial pressure of oxygen (PPO_2) ≤ 55 mmHg or SpO_2 ≤ 88%, or slightly higher oxygen levels in the presence of comorbid conditions such as pulmonary hypertension or heart failure (CMS, 2023). Oxygen therapy may also be prescribed based on desaturation observed during functional testing, such as a six-minute walk test, or prolonged periods of low oxygen saturation during rest or sleep (Doherty et al., 2006).

Patient Population via Clinical Diagnoses

Clinical diagnosis that typically leads to a LTOT prescription by a physician includes Chronic Obstructive Pulmonary Disease (COPD), Pulmonary Fibrosis, Pneumonia, Severe Asthma, Cystic Fibrosis, and Sleep Apnea. This diagnosis can require between minutes to 15+ hours of oxygen or oxygen-enriched air (nitrox) daily.

COPD is the most common indication for LTOT and is characterized by persistent airflow limitation due to airway inflammation, mucus hypersecretion, and alveolar destruction. In the United States, COPD affects approximately 16 million adults (3.8% of the population), with prevalence increasing to over 10% in individuals aged 75 and older (Centers for Disease Control and Prevention [CDC], 2023). Globally, COPD accounted for approximately 3.5 million deaths in 2021 (World Health Organization [WHO], 2023). Patients with severe COPD often require oxygen therapy for 15 or more hours per day to maintain adequate PPO_2 levels.

Pulmonary fibrosis encompasses a group of interstitial lung diseases characterized by progressive scarring of lung tissue, resulting in reduced lung compliance and impaired oxygen diffusion. Prevalence in North America is estimated at approximately 27 cases per 100,000 individuals, with incidence rates ranging from 9 to 26 cases per 100,000 annually (Raghu et al., 2016). Due to the progressive nature of the disease, approximately 28.5% of patients eventually require LTOT, often on a lifelong basis (Raghu et al., 2016). Oxygen dependence typically increases over time as lung function deteriorates.

Asthma, sleep apnea, and pneumonia are all respiratory conditions that can involve impaired oxygenation, but they are generally not appropriate indications for long-term oxygen therapy (LTOT) due to their transient or treatable nature. Asthma is a chronic inflammatory disease leading to symptoms such as wheezing and shortness of breath; while supplemental oxygen may be used during acute exacerbations, oxygen needs are typically short-term and resolve with proper pharmacologic management (Global Initiative for Asthma [GINA], 2023). Similarly, sleep apnea is caused by intermittent upper airway collapse, resulting in episodic hypoxemia; however, most effective treatments use positive airway pressure devices (e.g., CPAP or BiPAP) to address the underlying mechanical obstruction rather than supplemental oxygen (Patil et al., 2019). Pneumonia can require temporary oxygen supplementation, but because it is typically resolved with antimicrobial treatment over days to weeks, it does not warrant long-term oxygen use (Metlay et al., 2019). In all three conditions, oxygen therapy serves as a short-term supportive measure rather than a continuous or lifelong intervention, limiting their relevance as target populations for LTOT system design.

Cystic fibrosis is a genetic disorder caused by mutations in the CFTR gene, leading to thick mucus accumulation in the lungs and progressive respiratory decline. In the United States, approximately 35,000–40,000 individuals are affected, with around 1,000 new cases diagnosed annually (CDC, 2023). Oxygen therapy requirements vary significantly depending on disease severity, with LTOT typically reserved for advanced stages of lung disease.

Clinical Function

From a clinical perspective, oxygen therapy helps reduce symptoms, not cure the underlying problem. It simply reduces hypoxemia and its effects. As a result, many patients require lifelong therapy, contributing to sustained demand for home oxygen delivery systems. Rising elderly populations, the ability to live longer with modern medicine, the chronic state of these conditions, and more all give way to a large and growing market population.

Coverage policies, such as those from Medicare, classify oxygen therapy as medically necessary for both acute and chronic conditions when hypoxemia criteria are met, further reinforcing its widespread use (CMS, 2023). These systems fall under U.S. Food and Drug Administration (FDA) medical device regulations (21 CFR §868.5440), which govern oxygen delivery equipment safety and performance.

Current home oxygen systems must balance oxygen delivery performance characteristics including flow rate, pulse of continuous flow, portability, power supply, and increasingly patient and caregiver safety considerations. It is important to note that oxygen concentrators do not deliver 100% oxygen to the user; most deliver 70-85% oxygen mixture called nitrox.

Prior Art

Introduction

Existing solutions for oxygen tube management can incorporate a variety of components of a user's total oxygen system. While oxygen delivery systems themselves are well established, the management of oxygen tubing in home environments remains a significant use and safety challenge. To get a better understanding of the design space, prior art is divided into two categories: technical prior art and system-level prior art. Technical prior art focuses on existing methods and devices used to manage oxygen tubing in home settings, while system-level prior art addresses the broader oxygen delivery systems upon which any home oxygen tube management system solution depends.

Technical Prior Art

Existing home oxygen tube management approaches can be broadly categorized into four groups: portable oxygen supplementation, user-planned management, reeled management systems, and alternative hose geometries.

Portable oxygen supplementation:

Portable oxygen supplementation systems include portable oxygen concentrators (POCs), compressed O_2, and liquid oxygen cylinders. These systems are described in more detail below but are designed to improve patient mobility by allowing users to move freely without being tethered to a stationary oxygen source. However, despite their benefits, these systems introduce several limitations. Their weight, ranging from 4-15lbs, can be overbearing for some users, particularly those with limited mobility or comorbid conditions (Jacobs et al., 2018) (Courtney, 2025). Additionally, portable systems are constrained by finite oxygen supply or battery life, requiring frequent recharging or replacement. This creates ongoing logistical challenges for patients, particularly in home environments where continuous oxygen access is needed.

User-planned management:

User-planned management is one of the most common approaches in home oxygen therapy. In this method, a stationary oxygen concentrator supplies oxygen through long lengths (often 50 feet) of tubing, which the user manually arranges throughout their living space. Patients must plan their daily movements, such as navigating between rooms or completing routine tasks around the physical layout of the tubing.

While this approach requires no additional equipment, it introduces substantial safety risks. Long tubing placed across floors, doorways, and staircases creates significant tripping hazards for both the patient and others in the household (Doherty et al., 2006).

Additionally, tubing is prone to kinking or tangling, which can restrict oxygen flow and require constant user attention. For patients already relying on assistive devices such as canes or walkers, managing excess tubing further increases physical and cognitive burden, contributing to frustration and elevated fall risk.

Reeled oxygen tubing systems:

Reeled oxygen tubing systems attempt to mitigate excess tubing hazards by mechanically managing slack. Devices such as the O_2 Remote Retractable Oxygen Tube Reel (U.S. Patent No. 11,008,195) use a motorized mechanism housed in a container to retract and deploy tubing as needed. These systems are typically controlled via a remote device, allowing users to adjust tubing length dynamically (Oxygen Tube Reel, 2026).

Figure 1: Reeled oxygen tube management device (Oxygen Tube Reel ,2026)

While reel-based systems can reduce tripping hazards by minimizing excess tubing on the floor, they introduce new usability challenges. Manual control via remote adds cognitive and operational demands, requiring users to actively manage tubing length during movement. Even in systems with automatic retraction, tension in the tubing can create discomfort or unintended pulling on the nasal cannula interface. Additionally, these systems often generate noise and still require integration with a stationary oxygen source and backup supply, limiting their overall effectiveness in reducing user burden.

Alternative tubing designs:

Alternative tubing designs, such as coiled or “stretchable” tubing (e.g., marketed as Tidy Tubing) pictured below, aim to reduce slack by allowing tubing to contract and expand as needed (Health Connection). These systems can extend from short lengths (approximately 15 inches) to several feet under tension, and multiple segments may be connected to increase reach.

Figure 2: Tidy Tubing (Health Connection)

Although these designs reduce loose tubing compared to traditional straight tubing, they do not fully eliminate the need for extended lengths in home environments. Furthermore, the elastic properties of coiled tubing can introduce tension forces that pull on the nasal cannula, creating uncomfortable user experience and potentially impacting user compliance. While these systems represent a partial improvement, they do not comprehensively address safety, usability, or comfort concerns.

System-Level Prior Art

In addition to tubing management, it is essential to consider the oxygen delivery systems that serve as the foundation for home oxygen therapy. These systems include stationary oxygen concentrators, portable oxygen concentrators, compressed gas cylinders, and liquid oxygen systems.

Stationary oxygen concentrators:

Stationary oxygen concentrators are the most common solution for home oxygen therapy. These electrically powered devices extract oxygen from ambient air and deliver it continuously, typically at flow rates up to approximately 5 L/min (McCoy, 2013). They provide an effectively unlimited oxygen supply when connected to a power source and are well suited for continuous home use, particularly during sleep.

Figure 3: At home oxygen concentrator (DirectHomeMedical, 2026)

However, their size and weight (typically 20–25lbs) limits portability, necessitating long tubing to allow movement throughout the home. This reliance on extended tubing directly contributes to the management challenges described in the technical prior art.

Portable oxygen concentrators (POCs):

Portable oxygen concentrators are designed for mobility and operate using battery power. These devices are significantly lighter than stationary systems but typically provide lower oxygen flow rates (approximately 1–1.5 L/min) and often rely on pulse-dose delivery rather than continuous flow (Jacobs et al., 2018). Battery life is limited (commonly 10–12 hours), requiring regular recharging.

Figure 4: Portable Oxygen Concentrator (Inogen, Inc., 2026)

While POCs are highly effective for short-term activities outside the home, their limited output capacity makes them unsuitable for patients requiring high-flow or continuous oxygen therapy.

Compressed gas cylinders:

Compressed oxygen cylinders store oxygen at high pressures and can deliver continuous or on-demand flow. These systems are commonly used as backup oxygen sources in home settings. While they are relatively simple and reliable, they provide a finite oxygen supply and require regular replacement or refilling. Users will rent tanks or purchase them and work through the hassle of filling and hydrostatic testing of cylinders. Their weight and limited duration make them impractical as a primary long-term solution.

Figure 5: Compressed Oxygen Cylinder (Oxygen Delivers, n.d.)

Liquid oxygen systems:

Liquid oxygen (LOX) systems store oxygen in a cryogenic liquid form, allowing for higher oxygen density and longer duration compared to compressed gas. Portable LOX units can provide continuous flow rates exceeding 3 L/min while maintaining relatively low weight (approximately 8 pounds when filled) (McCoy, 2013). Users require both a portable system and larger at home reserve that weighs 120lbs or more when full. However, these systems are expensive and require specialized infrastructure for refilling, limiting their accessibility.

Figure 6: Liquid oxygen systems, large at home reserves in the back of photo and small portable systems in front ("What Is a Liquid Oxygen System? | CAIRE, Inc.," 2025).

Total System Breakdown

All supplemental oxygen systems share several core components: an oxygen source (compressed gas, liquid oxygen, or ambient air), a regulation mechanism to control flow rate and delivery mode (continuous or pulse), a power source (mechanical, battery, or electrical), and a patient interface, typically a nasal cannula or mask (Doherty et al., 2006). While significant advancements have been made in oxygen generation and delivery, the interface between the system and the patient—particularly tubing management—remains an area with substantial opportunity for improvement.

Concept Document

Product/Project Name: Total Home Oxygen System

Initiation Date: 03/09/26

Intended Use/User Need

According to a 2006 assessment 1.5 million patients in the US were prescribed long term oxygen therapy (LTOT) each year (S1.2). Diagnoses like chronic obstructive pulmonary disease (COPD), pulmonary fibrosis, cystic fibrosis, and more can cause a decrease in oxygen saturation, this leads medical professionals to prescribe LTOT. The purpose of this device is to deliver oxygen or oxygen enriched air from a pre-existing source (i.e. O_2 concentrator, O_2 gas, or liquid O_2) and deliver it to the user in various rooms of their home.

Product Requirements

This device delivers oxygen or nitrox to the user through clear, medical-grade, oxygen-safe tubing to various areas within the home. The device requires a preexisting oxygen concentrator or other oxygen source, including but not limited to ambient air concentrators, liquid oxygen systems, and/or compressed oxygen gas as a backup or primary source.

Oxygen or nitrox is distributed to rooms including the bedroom, bathroom, living room, kitchen, and other areas as needed. From the primary concentrator and backup O_2 supply, tubing will run along the walls of the house and branch into individual rooms. Using a 6-10ft oxygen tube (depending on user preference) connected to a nasal cannula or mask, with a quick-disconnect adapter on the opposite end, the user connects to the room's port when occupying that space. When the user wishes to move to another room, they simply disconnect, move to the new location, and reconnect to the corresponding port.

This device requires the use of standard oxygen tubing, which must be delivered sterile to the user. Per FDA regulations, 21 CFR §820 specifies packaging design controls, and 21 CFR §801 outlines required labeling, including lot numbers for potential recalls (FDA). Packaging will consist of clear plastic with easy-to-read labeling. Sterilization of tubing will be performed using ethylene oxide (EtO) sterilization (AdvaMed®, 2023).

The device will need to be compatible with preexisting home oxygen concentrators, including stationary oxygen concentrators, portable oxygen concentrators, compressed gas cylinders, and liquid oxygen systems, all of which serve as primary oxygen sources for patients.

Claims

The purpose of this device is to deliver oxygenated air or pure oxygen from a pre-existing oxygen source in order to increase blood oxygen saturation (**,*).

This device is not intended to be used as life-sustaining or life-supporting equipment (*,**).

Clinical/Technical Requirements

The product is intended for individuals prescribed long-term oxygen therapy (LTOT). LTOT is typically prescribed when a patient's resting oxygen saturation falls below 88% or when the partial pressure of oxygen (PaO_2) is less than 55 mmHg. Patients with certain comorbidities may qualify for LTOT at slightly higher oxygen saturation levels. The device is intended to manage low oxygen saturation by delivering elevated oxygen concentrations as prescribed by a physician.

Existing oxygen tube management devices include stationary reel systems with electronic intake and outtake mechanisms that the user must operate via remote control to retract or extend tubing. Other solutions involve manually placing tubing along specific paths within the home or collecting excess tubing in a walker basket as the user moves. Expanding beyond tubing management, portable oxygen concentrators represent another alternative; however, these devices require charging, are often plugged in when at home, and can be burdensome due to their weight during movement.

This device enables the user to maintain a shorter length of tubing for mobility within a room. When transitioning between rooms, the user simply disconnects, moves, and reconnects at the new location. This eliminates long hoses that create tripping hazards, reduces reliance on heavy portable concentrators or wheeled oxygen tanks, and removes the need for remote-controlled systems. The system consists of a central unit connected to a primary oxygen concentrator and backup compressed O_2 supply, distributing oxygen throughout the home.

It is anticipated that a clinical evaluation will be sufficient for this device, as it does not generate or concentrate oxygen but instead serves solely as a delivery system.

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Date: 03/12/26

Product Performance Specification

Project Lead: Kian Hageman

Product Name: Total Home Oxygen System

Description of System

This home oxygen tube management system requires a pre-existing concentrator and a backup oxygen tank to supply oxygen. Oxygen tubing will be installed throughout the home in a manner that is both easily accessible for maintenance and unobtrusive. The system originates from a central room or space that houses the concentrator and backup compressed oxygen supply. A primary line runs from this location, with branching tubes extending into high-frequency rooms, including but not limited to the bedroom, bathroom, kitchen, living room, dining room, office, and any other rooms the user frequently occupies. Within each room, a “port” will be installed near the primary activity or seating area, allowing the user to connect a 6-foot oxygen tube to their mask or nasal cannula. When moving between rooms, the user simply unplugs from the current room and reconnects in the next room.

Performance Characteristics

Indications for use:

The purpose of this device is to deliver oxygenated air or pure oxygen from a pre-existing oxygen concentrator in order to increase blood oxygen saturation.

This device is not intended to be used as life sustaining or life supporting.

Clinical procedure of use:

Installation of the system will require a professional. A detailed installation manual, along with a training course, will need to be developed and conducted in order to properly install this device. With that in mind, below is a list of potential considerations with associated outcomes and examples.

Install Considerations Table

Table 1: Install considerations table, see figure 8 below for related images.

No	Consideration	Example
1	Height of ports and gas lines	For wheelchair users, lower ports and O_2 lines such that the user can easily plug in and unplug from the system.
2	Existing furniture placements	Work around existing furniture placements and place ports next to the side of the bed, couch, countertop, etc.
3	Route optimization	Ensure hose and ports are in high frequency rooms (e.g. not guest bedrooms).
4	Inspection	Route and place hoses to allow for easy leak, mold, or break detections.
5	Switches and Outlets	Avoid placing ports next to outlets, switches, fireplaces, etc. that might unnecessarily increase risk.
6	Doorways	Routing over and not under doors to avoid tripping hazards.
7	Kitchens	Avoid placement within the kitchen triangle (within the triangle created by the fridge, stovetop, and sink); place on non-countertop walls to avoid snags created by countertop appliances or hoses getting in the way of cutting or other sharp objects.
8	Gas appliances	Never place ports close to gas appliances including stoves, cooktops, fireplaces, etc.

User Operator Guide: Once the installer has completed the setup of your system, they will walk the user thought the use of your system. That same information and more can be found in this document including:

1. Quick Start Guide
    a. Turn on our preferred oxygen concentrator.
    b. Turn on your regulatory panel and connect oxygen concentrator to the INPUT of the regulatory panel.
    c. Attach preferred delivery device (mask or nasal cannula).
    d. Find a place to plug in and enjoy.
2. Safety Instructions
3. Alarm Indicators and Instructions
4. Cleaning and Maintenance
    a. Follow all cleaning, care, and maintenance procedures for your at home oxygen concentrator.
    b. User should perform periodic visual inspections of the tube to identify potential issues, including the following:

i. Disconnections between any tubing, port, split, plug-in, etc.
ii. Broken or damaged tubing including visual tears, breaks, cracks, etc.
iii. Broken or damaged ports, splits, fire protectors, sensors, etc.
iv. Moisture building up within the tube.
v. Discoloration of the tube.

c. The device should be inspected, and tubing should be replaced every 4-6 months via appointment with a service provider. (*,**)
d. O_2 sensors should be replaced every 6 months by service provider.

5. Repair and Disposal
    a. This device is not intended to be repaired by an individual without prior knowledge of the system. Spare parts such as splitters, ports, fire protectors, sensors, etc. can be provided, but deviation from originally installed system schematics is in violation of product warranty.
    b. If the device is no longer needed, dispose of the device in accordance with local regulations.
6. Warranty Information

Relevant setting/use environment:

This device is intended to be used at home only, particularly in high frequency rooms like bedrooms, bathrooms, kitchens, living rooms, dining rooms, offices, and/or any other rooms that the user will frequently visit. Guest bedrooms or basements rarely visited should be excluded due to the additional cost and increased risk.

Medical specialty of use:

Use of the device does not require technical expertise. A short training session provided by the installation crew for the user, and any caregivers should be included. The exchange of parts in the existing system can be performed by the end user. However, installation of the system requires a professional installer. General inspection and light cleaning of the system can be performed by the user, but inspections, part replacements, or system modifications (including adding or removing rooms from the system) should be carried out by the service provider.

Patient population inclusion/exclusion criteria:

This device is intended for patients diagnosed with chronic hypoxemia, classified as Group I under Medicare's National Coverage Determination (Section 240.2, Home Use of Oxygen). Group I is generally defined as a PPO_2 of 55 mmHg or below, or an oxygen saturation below 88%.

This system is not intended for use beyond Group I, including but not limited to Group II patients, non-chronic individuals, or those experiencing exhaustion or fatigue who do not meet Group I criteria.

Other Requirements:

1. Will require the ability to be off oxygen for 5+ minutes depending on how long it takes them to move.
2. Will require fine enough motor skills to plug and unplug the tube.
3. Will require all the skills of using traditional oxygen concentrators / other home oxygen systems.
4. Adults or youth ages 16+.

User interface/ergonomics considerations:

1. One handed, easy, and quick to use plug-ins.
2. Any prior considerations for other home use oxygen systems.
3. "Ports" can be placed at any height for those in need of a wheelchair or other physical metrics that affect that.
4. Cannot be used while operating gas appliances and should not be used around gas appliances.
5. Not to be used with humidifier, nebulizer, CPAP, or in series or parallel with any other device (**).
6. The controller panel should include user-friendly physical buttons and energy efficient LED panels to display useful information for users.

Product Characteristics

Functional Characteristics:

1. Requires a pre-existing oxygen concentrator that allows for a minimum O_2 flow of 0.21l/min and reserve O_2 cylinder as prescribed by a physician.
2. Able to deliver gas up to 100% aviation grade oxygen.
3. Control regulator circuit
    a. No greater than 12in x 7in x 4in (shoebox size)
    b. Holds electrical logic board (Arduino sized)
    c. O_2 input sensors
    d. Tube pressure/flow sensors to detect usage
    e. Primary and backup oxygen sources plug into the device
    f. Regulator with electrical valve on backup compressed gas line
    g. Speakers to alert user of problems
        i. Max sound power of 59 dBA (*)
        ii. Max sound pressure of 51dBA (*)
        iii. Typical alarm sound of 53dBa and measured per ISO 3744 (*)
    h. LED display panel about 5in x 5in to display warnings, setup instructions, functional data and system specifications, etc.
    i. In-line fire stops
4. Oxygen tubing and connectors:
    a. Clear O_2 tubing
    b. Light grey/blue or white 90-degree bends and T-offs (oxygen safe)
    c. Viton O-rings
    d. CHRISTO MCG 111 lubricant
    e. In-line fire stops at all ports
5. Operating temperature, altitude, and humidity based on 1 atm pressure (*)
    a. Temperatures between 40 and 104 degrees Fahrenheit (*,**)
    b. Altitude between 0-10,000 feet (**)
    c. Humidity between 15% and 90% non-condensing (**)
6. Shipping temperature and humidity based on 1 atm pressure
    a. Temperatures between -13 and 158 degrees Fahrenheit (*,**)
    b. Humidity between 5% and 90% non-condensing (*,**)

(*Inogen Inc, 2023)(** Respironics Inc, 2008)

Engineering Specifications

Table 2: Engineering Specifications Table

No.	User Need	Design Input	Design Output
1	Supply oxygen or concentrated oxygen to user.	1. A minimum flow disruption of 0.02L/min. 2. A minimum flow rate of 0.2L/min should be maintained. 3. Standard medical grade oxygen tubing should be used (diameter of 3/16 in).	1. Measure flow output of oxygen concentrator and all port outputs to determine difference in flows. 2. While an oxygen concentrator is on flowing at 0.2L/min, measure flow at all ports to ensure oxygen or oxygen enriched air is flowing. 3. Use and be compatible with 3/16in oxygen tubing and associated with current market standard nasal cannula and masks.
2	The device should not create a hazardous environment for the user or others around them.	1. Tube should not interfere with doorways or other open spaces in the user's home. 2. Tube should not cause tripping hazards. 3. Each port and the control box should have an in-line fire protector.	1. Verify tube is routed over doorways and ceilings. 2. Tube is not placed within 10in of the floor 3. Installer needs to check each port and the control box for in-line fire protectors.
3	Ports should be easy to use.	1. Connection and disconnection of user's oxygen tubing should be carried out in less than 5 seconds. 2. Ports should be placed at optimal heights for end user, within 1ft of standard operational height of user shoulder for specific room (see images below).	1. Clinical study evaluation duration of connection and disconnection within 5 seconds (each). 2. When training installers, give examples and test for proper placement locations.
4	Device should allow for user-replaceable parts.	1. Tube, joints, splitters, and quick disconnect adapters should be part of an open ecosystem.	1. Use 3/16in barbed connections to all ports, quick disconnects, and splitters. Use 3/16in compatible tubing.

Initial Design

The Total Home Oxygen System is a home-based oxygen delivery management solution designed to address the safety and usability challenges associated with traditional long-term oxygen therapy (LTOT). The system operates by connecting to a pre-existing oxygen source and distributing oxygen throughout the home via tubing routed along walls and into key living spaces. Each room is equipped with a dedicated “port” near common activity areas. The user connects a short 6–10-foot oxygen tube with a nasal cannula or mask to the port in the room they are occupying, and simply disconnects and reconnects when moving between rooms.

This design significantly reduces excess tubing on the floor, thereby minimizing tripping hazards and eliminating issues such as backtracking and tube entanglement. It also reduces reliance on heavy portable oxygen systems and removes the need for active tube management systems like reels or manual routing. By allowing users to maintain shorter tubing lengths and simplifying movement throughout the home, the system lowers both physical and cognitive burden.

Overall, the Total Home Oxygen System represents a shift from user-managed tubing to an integrated, home-wide distribution network. It improves safety, enhances ease of use, and better supports the daily mobility needs of patients requiring long-term oxygen therapy, while remaining compatible with existing oxygen delivery technologies. Below are initial design sketches, firstly a basic home layout with the proposed system in blue. Second is a series of images to help installers understand where ports should be placed in various scenarios. Lastly, example images of ports and the control box.

BME:5715 Project B Design Sketches

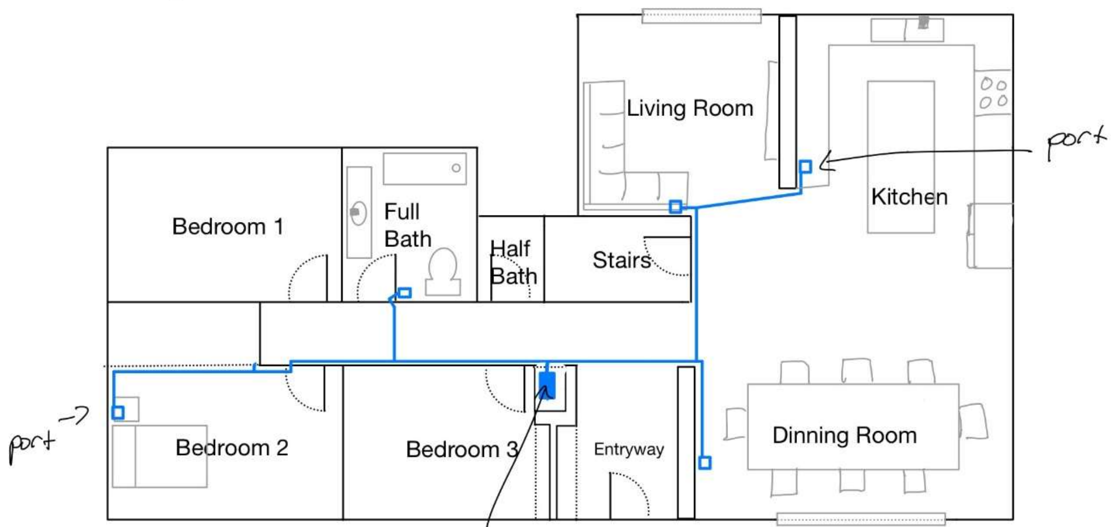
Project Title : Total Home Oxygen Management System

Sketcher : KIAN HAGEMAN

Date : 03/17/2026

Sketch : Ø1

Description : Home Floor Plan Example of Tube Routing



Primary & Secondary oxygen source with control box.

- Oxygen source is generally centralized about the home
- "Ports" are located in high frequency rooms

Figure 7: Home Floor Plan Example of Tube Routing

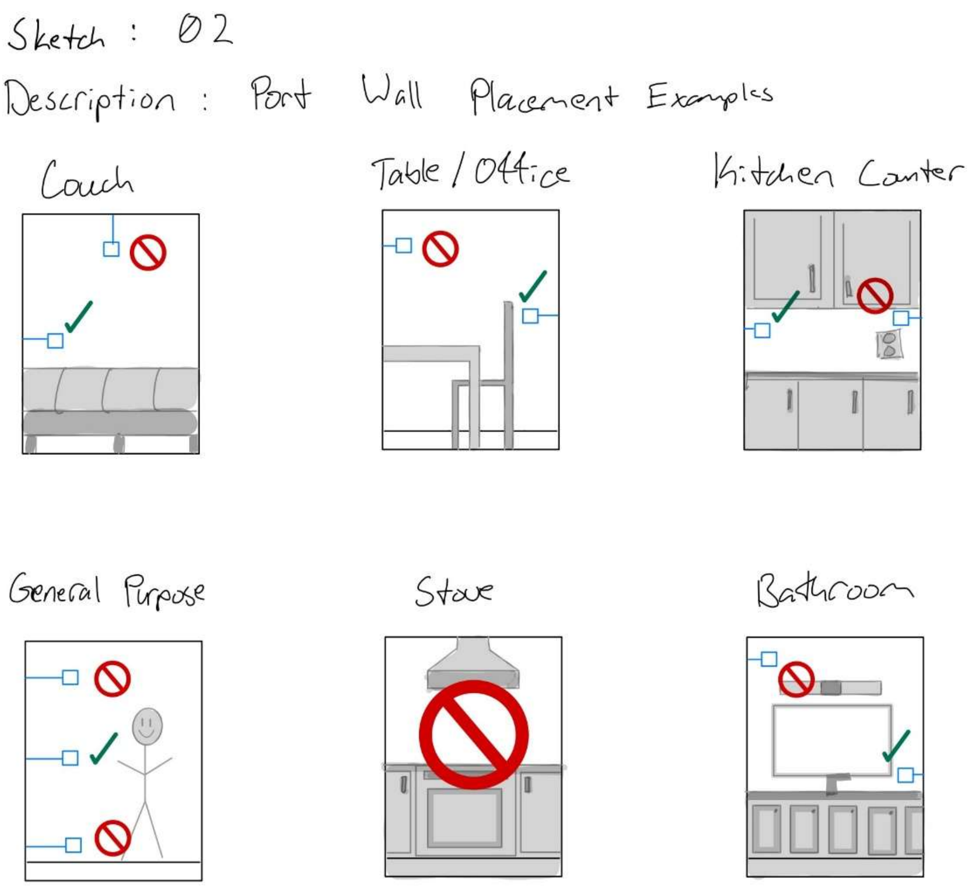


Figure 8: Port Wall Placement Examples

Sketch : 03

Description : Sketches for Port & Control panel

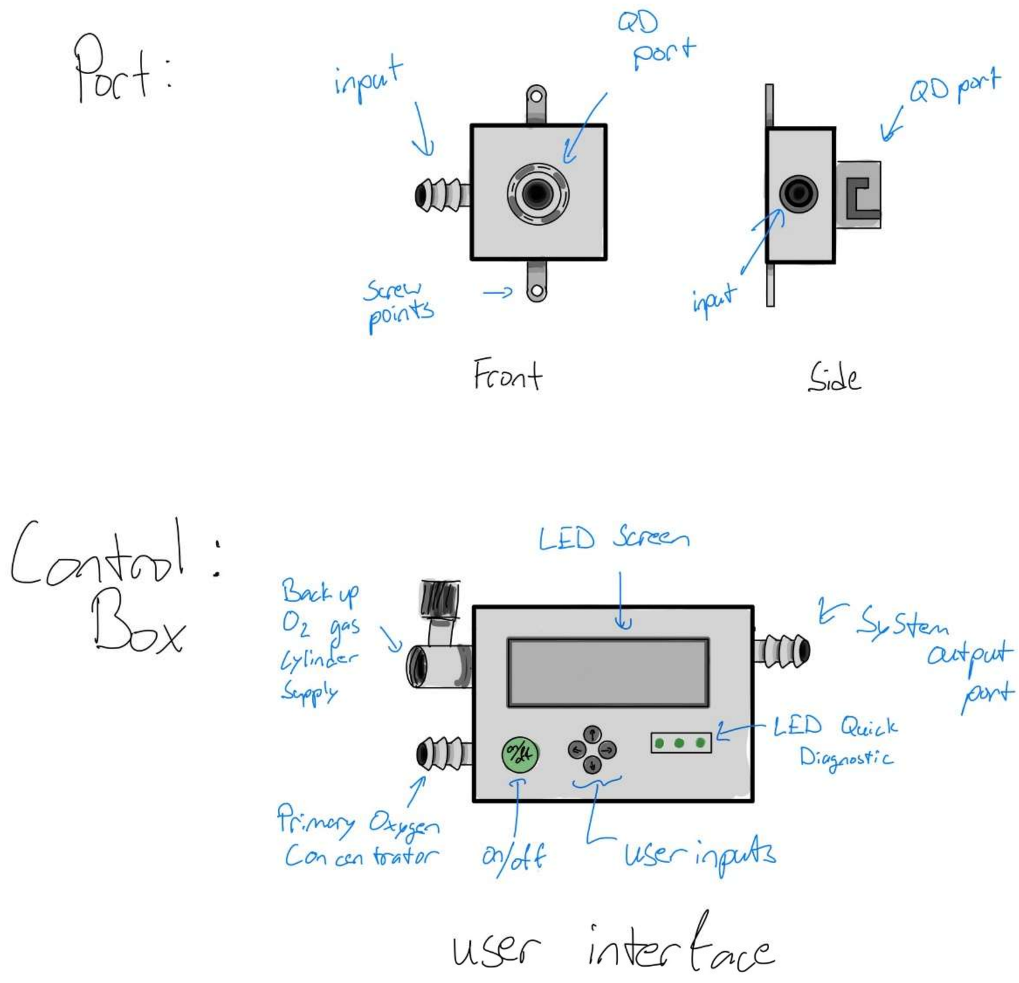


Figure 9: Sketches for Port & Control panel

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