

Application Fields and Innovative Technologies

Robotic O2 Generator Carrier for Long-Term Oxygen Therapy Patients Hieu Tran, Temirzhan Mukhambet, Rice Pham, Khanh Quoc Duong, William Kearns, Yu Sun. *Gerontechnology* 25(s)

Purpose Chronic obstructive pulmonary disease (COPD) is a progressive respiratory disorder characterized by persistent airflow limitation and remains a major global cause of morbidity and mortality. For patients with advanced respiratory impairment, long-term oxygen therapy (LTOT) is commonly prescribed to maintain adequate arterial oxygen saturation and improve survival. However, conventional LTOT systems—typically consisting of a stationary or portable oxygen source connected to the patient via a nasal cannula and flexible tubing—can restrict mobility, introduce tripping hazards, and reduce participation in daily activities. Existing mobile carriers and robotic carts alleviate the burden of transporting oxygen equipment but have trouble with cluttered home environment. To address this unmet need, we propose a robotic oxygen-generator carrier based on a quadruped platform and capable of both patient following and active cable management. **Method** We developed a mobile robotic system that integrates modern perception, multimodal sensor fusion, and coordinated motion control to accompany a patient while managing oxygen-tube slack (Shown in Figure 1). The mobile base is built on a quadruped platform selected for its ability to traverse uneven and cluttered indoor environment and maintain stability around household obstacles. A dual RGB-D camera configuration with overlapping fields of view is combined with 3D LiDAR to create a wide-coverage perception system; sensor outputs are fused into a unified spatial representation. For navigation, we implemented a potential-field-based trajectory generator enabling patient following, obstacle avoidance, and smooth motion in cluttered environments. A lightweight robotic arm is mounted on the platform to actively manage the oxygen tubing, preventing snagging on furniture and other household objects. **Results and Discussion** We validated key system components through hardware and simulation experiments. The perception pipeline, including RGB-D stitching and LiDAR alignment, was reliably implemented and tested during patient-following trials in a controlled laboratory environment. Figure 1B and 1C show consistent performance in both following distance and relative heading when tracking a person walking at low speed (>0.3 m/s). Motion planning and cable-management strategies were further evaluated in a high-fidelity simulation created in NVIDIA Isaac Sim. Current results demonstrate feasibility and support continued integration and testing in real-world home-like conditions.

Keywords: long-term oxygen therapy, accompany, robotics, quadruped.

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Acknowledgement: This project is funded by the USF Collaborative Research Excellence And Translational Efforts (CREATE) Award.

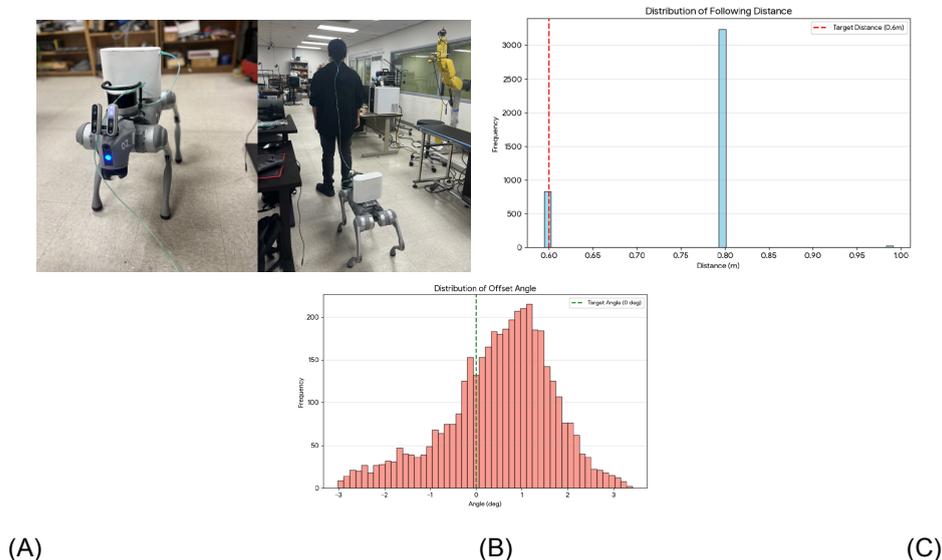


Figure 1: (A) The Robotic O2 Generator Carrier; Histograms of following distances (B) and heading angles (C) between a human participant and a following robotic dog during five trials of slow walking along a straight hallway.