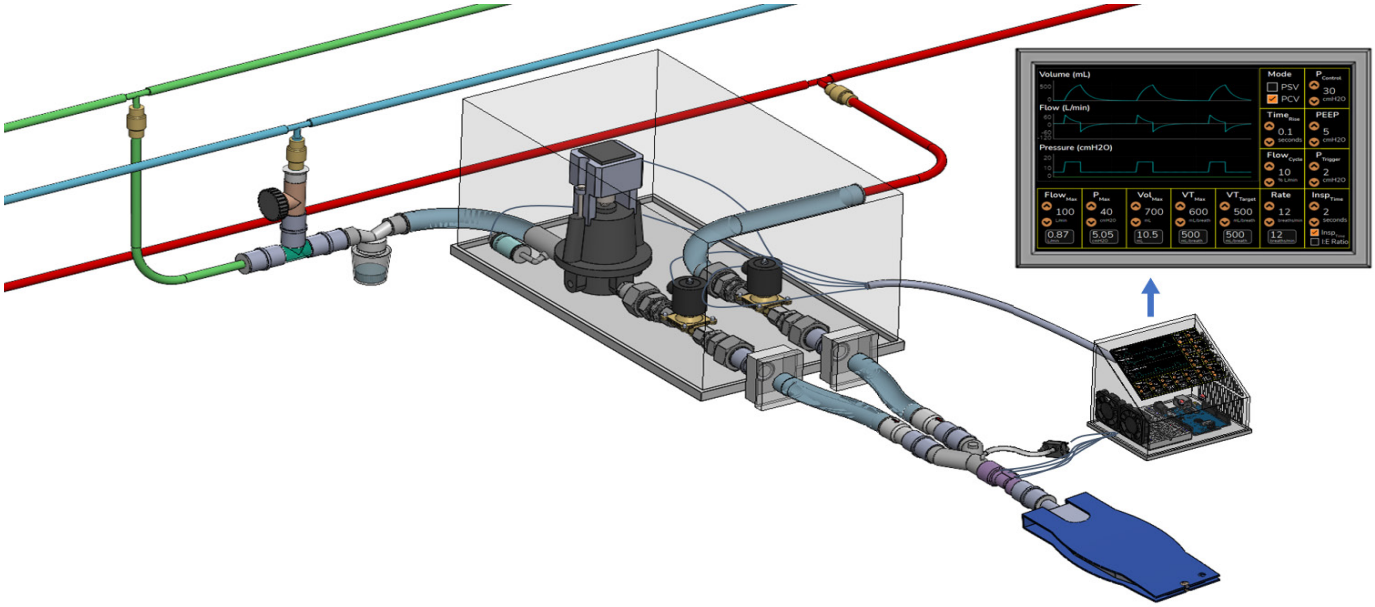

Multi-Patient Ventilator

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The Need for 100-PV and its Global Impact

In response to the ventilator shortages due to the COVID-19 pandemic, we were inspired to design a multi-patient ventilator that can provide mechanical ventilation to multiple respiratory illness patients through a single centralized gas processing system. Further, we challenged existing multi-patient ventilators' inability to provide per-patient tunability, and aimed to deliver a product whose output is individualized to meet the needs of each patient. The success of the 100-PV will mean that ICUs can alternatively operate at a lower cost by replacing the premium $25,000 ventilators with the new $1500 (per-patient) multi-patient design. This implies economical savings on the scale of roughly $23,500 or more per-patient in hospitals worldwide. These savings may even continue post-pandemic.

The Novelty Behind 100-PV and its Potential

100-PV employs pressure control with a pressure-regulator, pressure-sensor and flow-sensor (all per-patient). To meet affordability, conventions of modern ventilators were broken; 1) replace sophisticated components (electronic regulators & valves) with manual counterparts and motor actuators, 2) replace the electronic oxygen-blender with a manual oxygen-valve, 3) replace the standard per-patient humidifier with a humidifier scaled to supply upto 10 patients. Yet, this design is still versatile, providing all the minimally required ventilation modes for the full treatment. A typical treatment starts with pressure control (ventilator controlled breath rate with some patient triggers) and ends with pressure support (breath rate controlled by patient with ventilator preset pressure assistance). All functions are controlled per-patient through a bedside interface connected to an Arduino. Test results validated that ventilation modes and delivered breath rates match the operator inputs. The design also demonstrated the ability to synchronize with the patient's breath rate. Overall, the 100-PV meets the primary objective of affordability while achieving what existing multi-patient ventilators couldn't: per-patient tunability.