Robotic Systems & COVID-19

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Problem

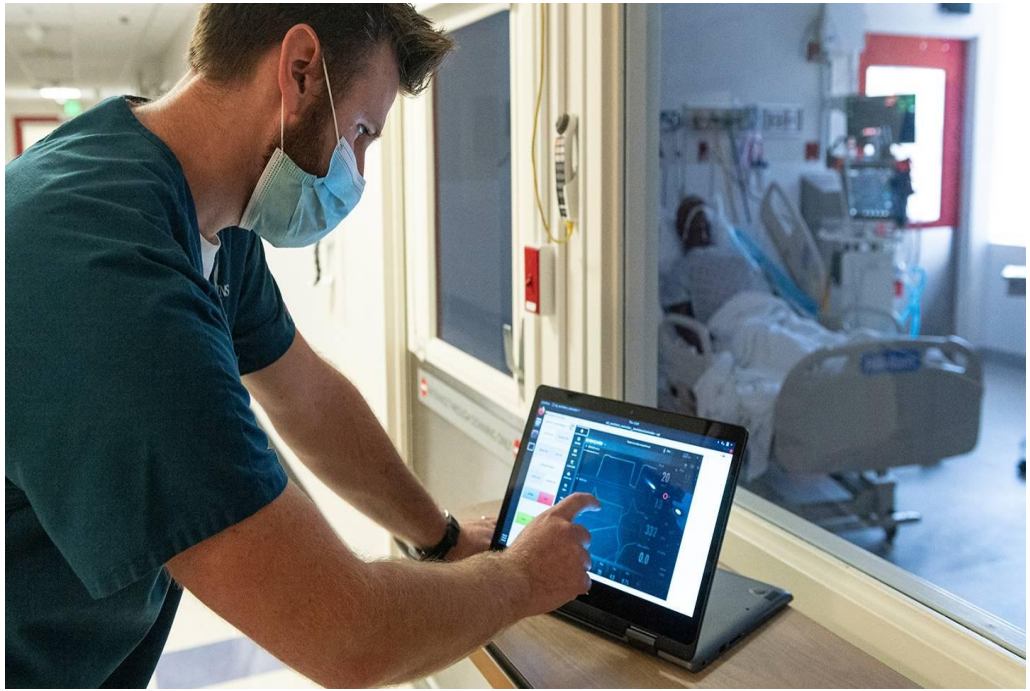
- focus on hardships to provide sufficient mechanical ventilation in ICU rooms
- limited amount of PPE and medical staff but rising cases of COVID-19
- taking time to adjust patient ventilators
- simple adjustments to medical equipment would require
  - staff help
  - risk of staff getting infected
  - use of PPE
- takes away time and effort from taking care of patients

Food for thought

- putting on and removing equipment and gear takes an additional six minutes, while routine adjustments should be short and just take about 3-5 minutes
- changing gear 10 times takes away an entire hour that could've been spent on delivering patient care

Solution

- decided to build a robotic system to remotely control ventilators
- collab between Hopkins Hospital, Laboratory for Computational Sensing and Robotics and the University of Maryland



- idea came from Dr. Sarah Murthi from the University of Maryland Medical System
- complained about how staff constantly had to enter high-risk infection areas just to make small changes to ventilators

How it works

- attached to ventilator on a horizontal bar
- stylus on arm is able to move across the screen
- camera is attached to robotic system
  - takes picture of screen and sends it to operating tablet
- staff taps tablet screen and robot will move to requested position on the ventilator screen

Quick Demo

System Designs

prioritizing efficiency, weight, and cost

- Six degrees of freedom robotic arm
  - similar to a human hand operating ventilator
- cartesian robot fixed on the screen
  - 6-DOF concept is more challenging to implement

First Prototype

- due to COVID-19 restrictions
  - first prototype was built in the basement of Mikhail Khrenoc (UoM CS grad student) with limited materials including a 3D printer
  - Balazs Vagvolgyi (Hopkins research scientist) worked on controller algorithm to ensure correction for robot's possible errors
- initial testing phase
  - again, phase was restricted by the pandemic
  - limited ventilation systems

- testing was successful
- even though it is in testing phase, it has the potential to become very successful in the future and to battle against COVID-19 effects
- still working on making robot more robust and adaptable to ventilators but will soon be tested with real patients

Review

real-life solutions through a mix of computer science and medical technology

- great use of technology in making a change in the world
- obvious that technology is a big part of our lives and will continue to constantly improve and solve solutions