Information about Alternative Ventilation Systems V.5

29/3/2020

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1 General

In the world there is a major effort to build alternative ventilation solutions to fight Coronvirus.

In this document I try to collect all information available to help people understand what is available and to foster collaboration.

I really hope this information will help to save lives

I'll be happy to update with more information (oriav2@gmil.com)

2 Analysis of Open Source COVID-19 Pandemic Ventilator Projects

<mark>Currently compares 38 projects !</mark>

In a public GitHub repo, volunteers at Public Invention and EndCoronaVirus.org have compiled a list of resources and all known open source mechanical ventilator projects. This list is changing every day. Anyone can suggest an improvement or update by entering an issue.

In order to allow volunteers to understand the state of these projects, we have analyzed each of these projects along seven attributes to provide information, transparency, and guidance. These values are purely our own opinions, and are not meant to disparage any project. We have focused not on technical cleverness but on the chance that medical professionals would actually have enough confidence in a particular ventilator to deploy these life-critical devices to patients who need them as a last resort. We have articulated a draft process that we hope is holistic and practical for actually testing and fielding these devices.

Some of the items covered in in the above list are also covered below and some are not.

https://medium.com/@RobertLeeRead/analysis-of-open-source-covid-19-pandemic-ventilator-projects-27acf9075f7e

Link to The spreadsheet

Analysis of Open Source COVID-19 Pandemic Ventilator Projects											
March 24, 2020 Public Invention		https://www.pubinv.org									
Link to definition of evaluation criteria:	https://docs.google.com/docum										
Project Name	Project Link	Openness	Buildability	Community Support	Functional Testing	Reliability Testing	COVID-19 Suitability	Clinician Freindly	Average	Notes	
Beatmungsgerät [Respirator]	https://devpost.com/software/d	5	4	3	3.5	1	3	3	3.21	In German, may be misreading. Ma	
Low-Cost Open Source	https://github.com/jcl5m1/ventil	5	4	4	3	0	2	2	2.86	Has a good repo and community b	
VentilAid	https://www.ventilaid.org/	5	4	4	3	0	2	2	2.86	Great open source project that has	
Rice OEDK Design: ApolloBVM	https://docs.google.com/docum	3	3	2	3	3	2	3	2.71	Good documented solution created	
Jeff Ebin's Prototpye	https://www.ebcore.io/?fbclid=I	5	4	3	1	0	2	3	2.57	Created by MD, Worth a look	
A low oxygen consumption pneun	https://onlinelibrary.wiley.com/d	4	3	2	4	1.5	1	2	2.50	Very good research topic with laye	
Protofy Team OxyGEN	https://oxygen.protofy.xyz/	4	4	4	1	0	2	1	2.29	Easy mechanical build	
Electric Blower Based Portable Er	https://digitalcommons.usu.edu	3	3	2	3	1	2	1	2.14		
MIT E-Vent	https://e-vent.mit.edu/	2	1	2.5	3	1	3	1	1.93	Apparently tested on a live porcine	
Saving Babies' Lives Starts With /	https://www.npr.org/sections/he	1	1	2	5	0	0	4	1.86	CPAP for infants	
CoronavirusMakers	https://gitlab.com/coronavirusm	4	2	4	0	0	2	1	1.86	In Spanish, can only read a little, m	
The Pandemic Ventilator	https://docs.google.com/docum	4	2	3	0	0	4	0	1.86	Good document for design, not fini	
VentilatorPAL	https://freebreathing.org/	2	1	3	1.5	1	1.5	2	1.71	Pre-orderable. Large but somewha	
The Pandemic Ventilator (older)	https://www.instructables.com/i	3	4	1	1	0	1	1	1.57		
MIT Low Cost Ventilator	https://github.com/RuairiSpain/	3	2	2	1	0	0	2	1.43		
Dr. Mujeeb ur Rahman design	http://www.technologyreview.pk	1	1	2	1	0	2	3	1.43		
Hackaday Rex Ventilator V1	https://www.youtube.com/watch	2.5	2	2.5	1	0	1	1	1.43	Repo but no license, great photos	
Pandemic Ventilator	https://www.cbc.ca/news/canad	1	1	2	2	0	2	1	1.29	Inventor says may open source	
Simple device from www.POMO.c	https://www.facebook.com/grou	1	2	3	1	0	0	1	1.14		
Open Source Ventilator - OpenLu	https://gitlab.com/TrevorSmale/	1	1	4	0	0	0	1	1.00		
Cuirass Ventilator the DIY way	https://www.youtube.com/watch	2	2	1	1	0	0	1	1.00		
Pandemic Ventilator Project	https://panvent.blogspot.com/2	2	1	1	2	0	0	0	0.86		
Mechanical Ventilator Milano (MV	https://arxiv.org/pdf/2003.10405	1	2	1	1	0	0	1	0.86		
Low-Cost Ventilator Wins Sloan H	https://www.medicaldesignando	1	1	1	0	0	2	0	0.71	Very little information	
Response to the COVID-19 Pandemics		Licensed under CC0									

3   FDA Letter about "hacked" systems

The U.S. Food and Drug Administration (FDA) recognizes that the need for ventilators, ventilator accessories, and other respiratory devices may outpace the supply available to health care facilities during the Coronavirus Disease 2019 (COVID-19) outbreak.

https://www.fda.gov/medical-devices/letters-health-care-providers/ventilator-supply-mitigation-strategies-letter-health-care-providers

4 In Israel

4.1 MAFAT - Israel

פתרון ישראלי יצירתי למחסור במכונות הנשמה בבתי החולים

המחסור במכונות הנשמה, שלפי נתניהו חובק עולם ומטריד מדינות רבות, עשוי להיפתר בצעד מפתיע. בוגרי יחידה מובחרת חברו לרופא והציעו אפשרות להסבת מכונות הנשמה ידניות למערכות אוטומטיות: הניסויים יחלו כבר היום

https://www.mako.co.il/news-lifestyle/2020_q1/Article-a4addb59b8ff071026.htm?Partner=rss

4.2   AmboVent IAF & FIRST - Israel

Emergency Ventilation System / First / IAF - Israel Innovative Israeli makers group just hacked this Ambu bag into a basic life saving breathing machine. Based on design thinking, rapid prototyping and open code source mentality this team of 40 makers, engineers and physicians led by Dr. Alkahar build this new machine in just 5 days. They defined the bottleneck of hospitals in Israel: lack of ventilators in ICU units. So they **transformed this manual resuscitator into a new breathing machine**. It is expected that within a week to 10 days Israel will have **700+ new units** for its growing Coronavirus patients. Cost per unit is just under 450$. Institutions from Italy England and Canada are now in touch for collaborative manufacturing. Totally free from any IP, sent with love from the Israeli team to heel anyone in need anywhere in the world.
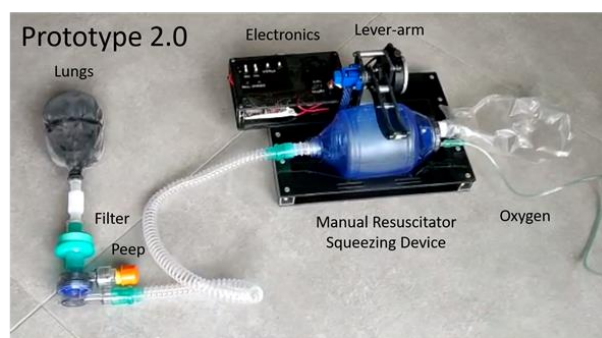
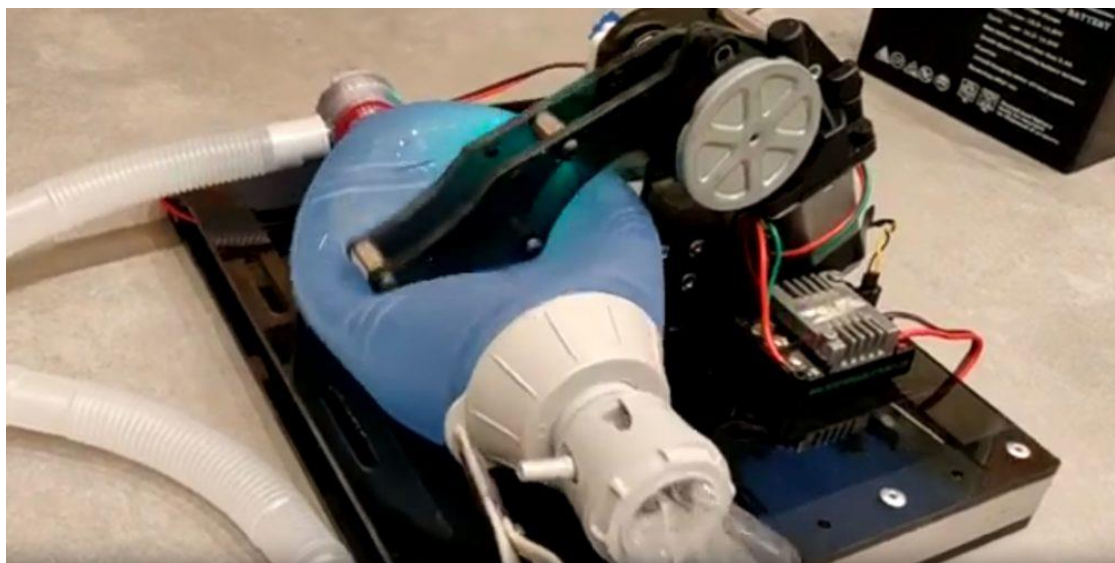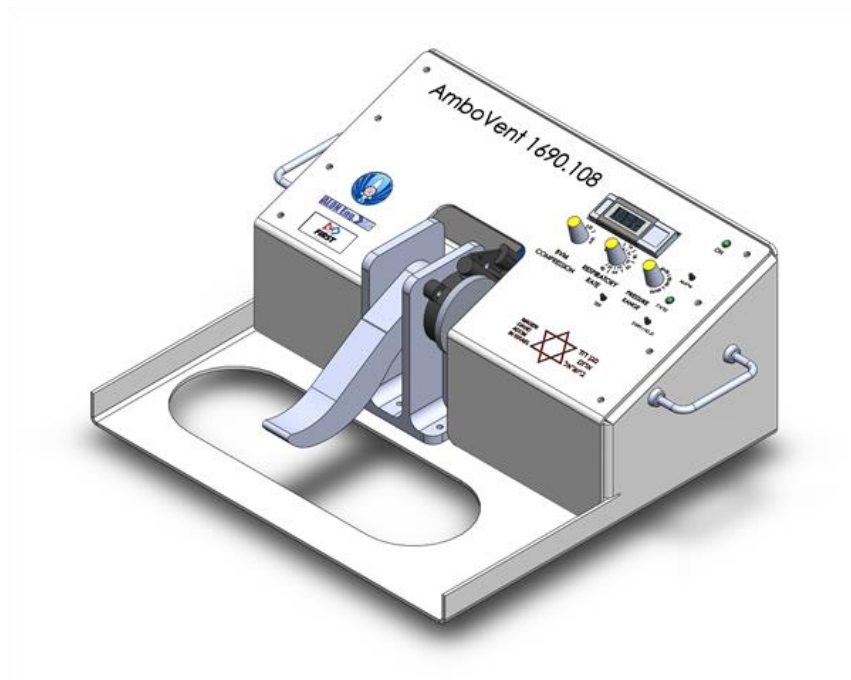https://members.smoove.io//view.ashx?message=h44798251O122335815O219654O122397585&r=1009

https://www.israeldefense.co.il/he/node/42276

https://haipo.co.il/item/188662

https://www.youtube.com/watch?v=xohUDG607s0

4.3   Unit 81

Coronavirus Fightback: Even Israel's Top Secret Unit 81 Has Just Broken Cover For COVID-19

https://www.forbes.com/sites/zakdoffman/2020/03/20/coronavirus-fightback-even-israels-top-secret-unit-81-has-just-broken-cover-for-covid-19/#4167d6785f24

https://www.israeldefense.co.il/he/node/42275

4.4 MDSG – Nacht

מספר החולים הקשים הולך וגדל - ומספר המונשמים מזנק. הבעיה
היא שבישראל יש רק כ-1,500 מכונות וזה לא מספיק. איש העסקים
מריוס נכט, ממייסדי צ'ק פוינט, רתם צוות קטן של יוצאי תלפיות כדי
למצוא תוך זמן קצר דרך לייצור המוני של מכונות הנשמה. כך הם
מתכננים להביא את הבשורה שכל העולם מחכה לה

https://www.mako.co.il/news-israel/2020_q1/Article-
53d5a7bd41d1171026.htm?partne=rNewsChannelTwitter

4.5 Ventway – Invoytec

Ventway is a quantum leap solution that provides a new effective way of ventilation in a wide range of acute respiratory emergencies. Its unique combination of high performance functionality along with lightweight and compact characteristics, positions the Ventway in the top row of transport and emergency ventilators.

http://www.inovytec.com/ventway/

https://www.calcalist.co.il/local/articles/0,7340,L-3802770,00.html

5   OXFORD

Engineers, anaesthetists and surgeons from the University of Oxford and King's College London are building and testing prototypes that can be manufactured using techniques and tools available in well-equipped university and small and medium enterprise (SME) workshops.

http://www.ox.ac.uk/news/2020-03-20-oxford-and-king-s-developing-prototype-rapidly-deployable-ventilator#
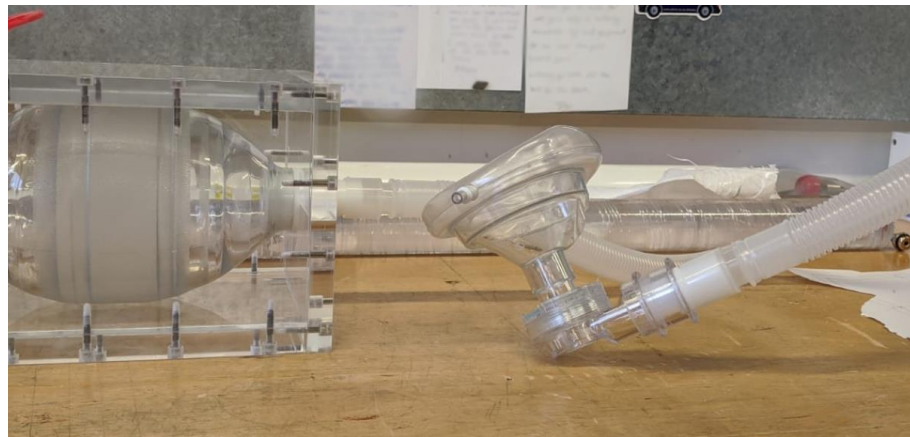
6   SPAIN

COVID-19: Spain approves first medical 3D printed ventilator – next step is to produce 100 ventilators per day

https://3dadept.com/covid-19-spain-approves-first-medical-3d-printed-ventilator-next-step-is-to-produce-100-ventilators-per-day/


http://www.ox.ac.uk/sites/files/oxford/styles/ow_medium_feature/public/field/field_image_main/image.png?itok=Dh50KE1l

7   Ireland

There's A Shortage Of Ventilators For Coronavirus Patients, So This International Group Invented An Open Source Alternative That's Being Tested Next Week

https://www.forbes.com/sites/alexandrasternlicht/2020/03/18/theres-a-shortage-of-ventilators-for-coronavirus-patients-so-this-international-group-invented-an-open-source-alternative-thats-being-tested-next-week/#3d09a0c83ba0

NC sandwich pulley concept   Model and Illustration by Trevor Smale
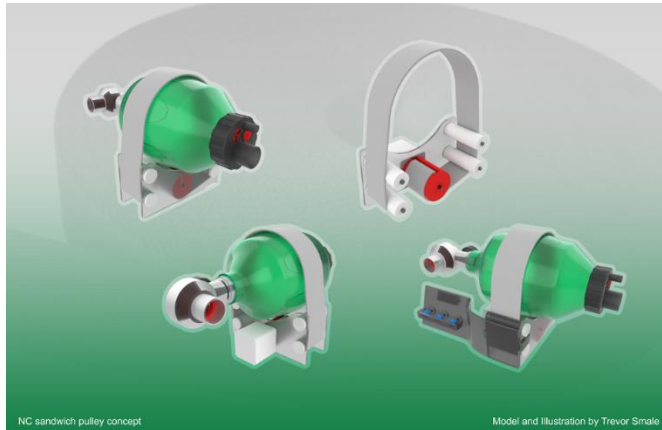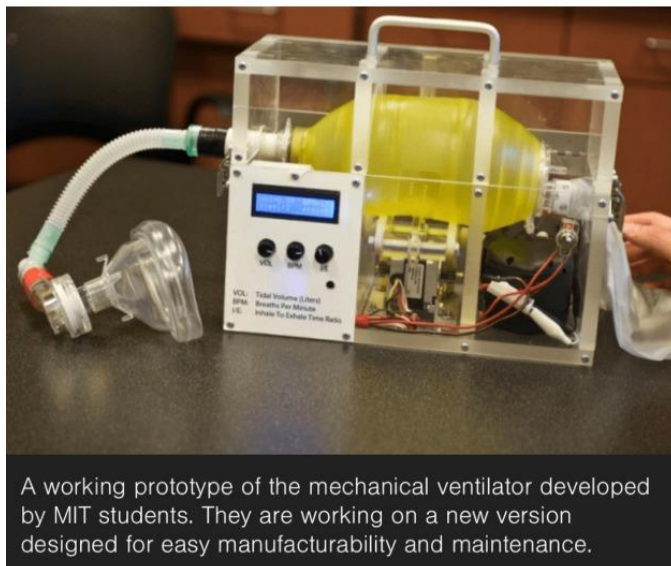
8   UK Government

UK Government Ventilator System Specification:

This is a specification of the minimally (and some preferred options) clinically acceptable ventilator to be used in UK hospitals during the current SARS-CoV2 outbreak. It sets out the clinical requirements based on the consensus of what is 'minimally acceptable' performance in the opinion of the anaesthesia and intensive care medicine professionals and medical device regulators.
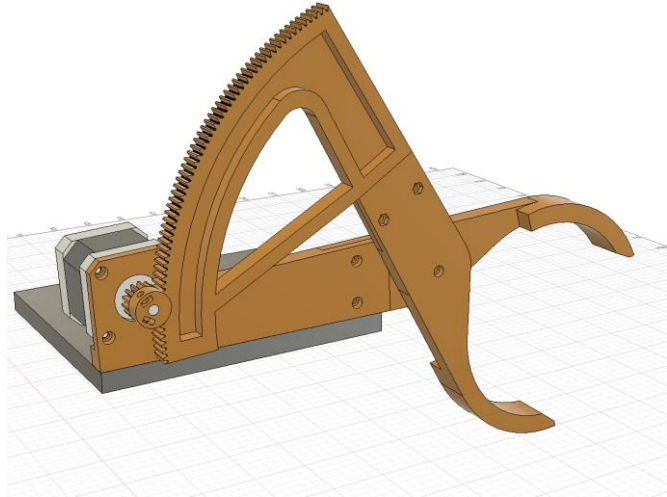
https://engineersassemble.tribe.so/user/sam

I will be posting CAD and Engineering drawings for something like this tomorrow. Developed by MIT for disaster situations.

A working prototype of the mechanical ventilator developed by MIT students. They are working on a new version designed for easy manufacturability and maintenance.

8   UK Government
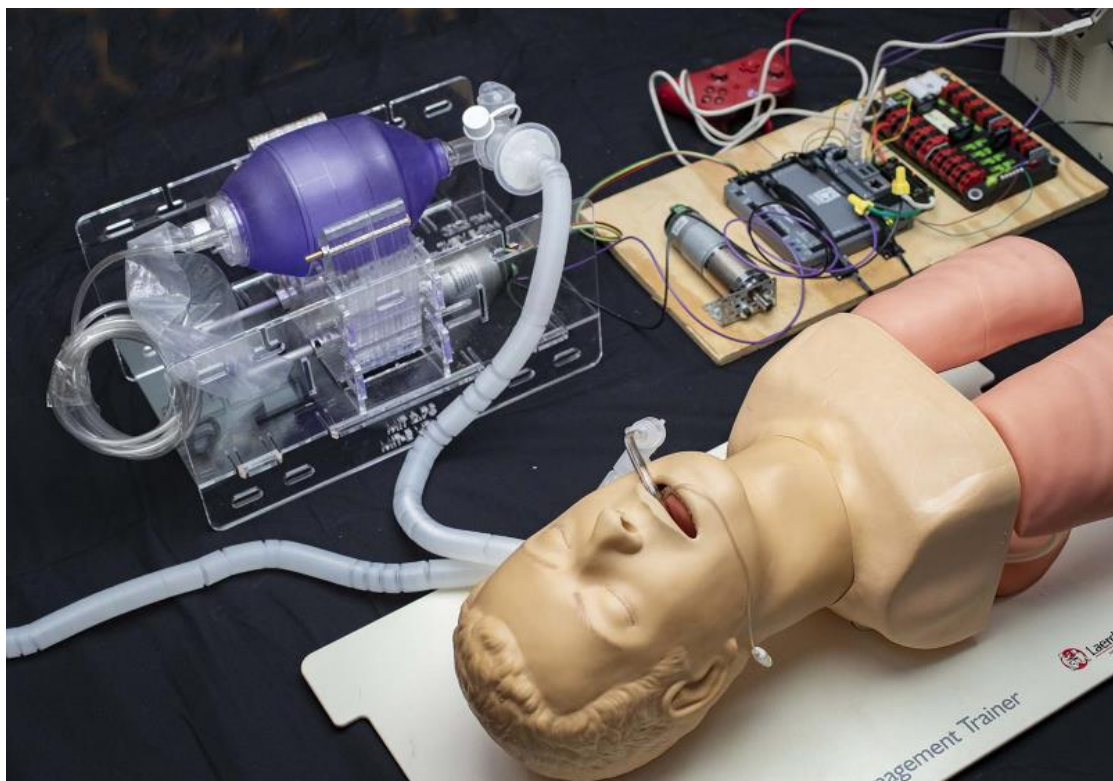
9   3d Printing

10 MIT

We are one of several teams who recognized the challenges faced by Italian physicians, and are working to find a solution to the anticipated global lack of ventilators. In the US alone, the COVID-19 pandemic may cause ventilator shortages on the order of 300,000-700,000 units (CDC Pandemic Response Plans). These could present on a national scale within weeks, and are already being felt in certain areas. An increase in conventional ventilator production is very likely to fall short and with significant associated cost (paywall warning).

https://e-vent.mit.edu/

https://www.technologyreview.com/s/615374/an-mit-team-hopes-to-publish-open-source-designs-for-a-low-cost-ventilator/

https://hackaday.com/2020/03/23/mit-ventilator-designed-with-common-manual-resuscitator-submitted-for-fda-testing/

10 MIT

11 Mechanical Ventilator Milano (MVM)

We present here the design of the Mechanical Ventilator Milano (MVM), a novel mechanical ventilator designed for mass scale production in response to the COVID-19 pandemics, to compensate for the dramatic shortage of such ventilators in many countries. This ventilator is an electro-mechanical equivalent of the old, reliable Manley Ventilator. Our design is optimized to permit large sale production in short time and at a limited cost, relying on off-the-shelf components, readily available worldwide from hardware suppliers. Operation of the MVM requires only a source of compressed oxygen (or compressed medical air) and electrical power. The MVM control and monitoring unit can be connected and networked via WiFi so that no additional electrical connections are necessary other than the connection to the electrical power.
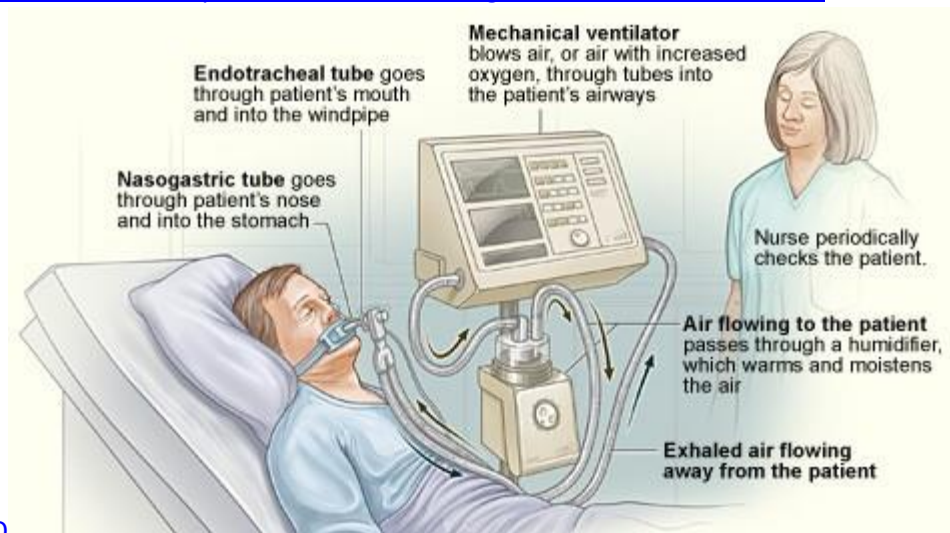
At this stage the MVM is not a certified medical device. Construction of the first prototypes is starting with a team of engineers, scientists and computing experts. The purpose of this paper is to disseminate the conceptual design of the MVM broadly and to solicit feedback from the scientific and medical community to speed the process of review, improvement and possible implementation.

https://arxiv.org/abs/2003.10405

12 Hackaton

https://hackaday.com/2020/03/12/ultimate-medical-hackathon-how-fast-can-we-design-and-deploy-an-open-source-ventilator/?fbclid=IwAR3JD1qQ05n5OscrNf4GK6W1LgZZ837DuS5coYIXvSbVzVCF-

EOCb0515zQ

CPAP, BIPAP, or Hi-Flo oxygen NIV aerosolize the virus

Nasal cannula-based NIV.

CPAP vs BiPAP - Non-Invasive Ventilation EXPLAINED