National Institute Of Technology

RAIPUR

National Institute Of Technology Raipur

B. Tech.: 1 Semester,Biomedical Engineering

ASSIGNMENT 06

5 Solutions To Covid19 Provided By Biomedical Engineers

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1 Introduction

The cure for the COVID-19 virus lies in its molecular biology and to explore it, there is an all-time high demand for biomedical engineers. Hospitals are increasing their capacity for beds, ventilators, and other biomedical equipment. But, at the same time, there aren't enough medical personnel trained to operate these devices. Medical technology is being used at the forefront of this fight against COVID-19, and the lesser-known heroes on the field are the biomedical engineers.

The COVID-19 pandemic has shone a light on the critical role medical technology plays in patient care. As demand for ventilators and patient monitoring equipment has surged, biomedical engineers are working around the clock to keep patients safe.

2 The Role of Biomedical Engineers in COVID-19 Treatments

Advancements in medical technology have improved the quality of patient care for coronavirus patients. To use these technologies effectively, hospitals and treatment facilities need qualified biomedical engineers. These devices have a direct impact on the survival rate of critical coronavirus cases. Any miscalibration while using such equipment can hamper the health of patients and even lead to fatalities. Hence, the need for biomedical engineers is certainly critical and evident at this juncture of the global health crisis.

In the past two months, thousands of biomedical engineers working in the fields of medical research, device manufacturing, and drug development have come to the rescue. Indian biomedical engineers have actively responded to this crisis by adapting their knowledge, skills, and equipment for the treatment of COVID-19 patients.

3 Biomedical Engineers At Ground Level

Next, these engineers are using their in-depth knowledge of biology, computing, and genetic engineering for drug administration. The Indian Council of Medical Research (ICMR) is deploying a vast number of biomedical engineers across hospitals around the country. Under the ICMR protocols, these engineers guide the doctors and medical staff with the operations of ventilators and biomedical devices at Intensive Care Units. They are helping in the purposeful use of these devices, where these machines are able to effectively treat the maximum number of COVID-19 patients within the required time periods.

4 Instrumenting Biomedical Innovations

In addition to their significance in the actual fight against COVID-19, some of the country's top biomedical engineers have teamed up for developing new techniques of biomedical device manufacturing. Leading biomedical manufacturers in India are using 3D printing innovations to make accurate copies of delicate biomedical devices such as stents and capillaries. These techniques are also being used for the production of surplus visors and surgical face masks for healthcare workers.

5 Medical Devices and Technologies by Biomedical Engineers

5.1 Ventilators

Patients who cannot breathe spontaneously need to be put on a ventilator. Ventilators are capable of replacing the breath function and patients in an advanced state of respiratory distress are usually intubated and sedated at the beginning of the treatment.

Ventilators are capable of replacing the breath function and patients in an advanced state of respiratory distress are usually intubated and sedated at the beginning of the treatment. They are complex systems providing the healthcare professionals with a lot of flexibility to adapt the assisted breathing settings and to be able to wean recovering patients off the ventilator gradually.

Figure 1: Ventilator

Modern ventilators are typically closed loop pressure controlled and capable of detecting spontaneous breathing to synchronise assistance for recovering patients.

They also enable the control of the composition of the gas the patient breathes from normal air to 100 percentage oxygen, usually taking their supply from the hospital's gas supply network but can also be coupled to oxygen tanks or oxygen concentrators if used in a setting where there is no gas network.

5.2 Patient Monitoring

An essential element of the ICU equipment is the monitoring equipment that keeps track of some of the patient vitals especially when they are ventilated and sedated but also during their recovery phase to ensure the regime of ventilation is optimised for their condition. Ventilators already provide their set of patient parameters, but usually patient monitors are separate devices as they continue to be useful after the patient can resume breathing on their own unassisted.

Figure 2:Patient Monitoring

One of the key parameters for COVID-19 patient is the amount of oxygen in their bloodstream (SpO2), measured by pulse oximetry which uses optics within a finger clamp. Pulse oximetry tends to be used for the duration of the patient's stay in ICU.

Modern patient monitors provide many more patient parameters all the way to breathing waveforms to enable clinicians to fine tune their care of the patients.

5.3 Artificial Intelligence

rtificial intelligence (AI) takes on many different forms in healthcare. The primary trend for AI in healthcare 2022 will be in utilizing machine learning to evaluate large amounts of patient data and other information. By creating tailored algorithms, programmers can mimic human thought and write programs that can seemingly think, learn, make decisions, and take action.

AI techniques are applied for monitoring patients in clinical settings and prediction of course of treatment. Based on the data derived from vital statistics and clinical parameters, AI may provide critical information for resource allocation and decision-making by prioritizing the need of ventilators and respiratory supports in the Intensive Care Unit. AI can also be used for predicting the chances of recovery or mortality in COVID-19 and to provide daily updates, storage and trend analysis and charting the course of treatment.

5.4 3D Printing

3D bioprinting is a process that employs 3D printing for biological processes such as combining cells or biomaterial to thereby create an item that features tissue properties. Similar to non-biomedical 3D printing, it's a process wherein material, in this case, biological rather than filament or resin, is deposited layer by layer comprising biolinks. These tissue-esque formations may then be used for various applications within the biomedical field.

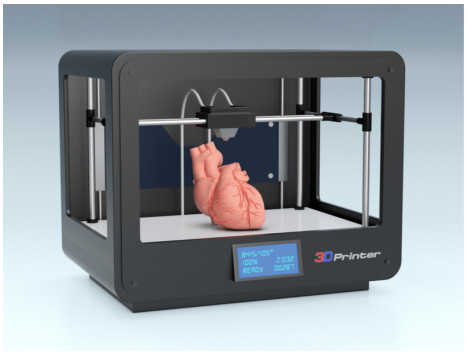

Figure 3: 3D Printing

The accessibility and fast prototyping capabilities of 3D printing have crucially helped the global shortages of medical and protective equipment. People with access to 3D printers assisted the fight against the COVID-19 pandemic by designing and producing preventive, diagnosis and treatment devices from brainstorming to implementation instantly . For this purpose, people are gathering globally in online communities to share/exchange ideas and designs.