



Memorandum of Agreement (MOA)



This Agreement made on 20th May, 2021

for the project entitled

“Auto -tuned Ventilator: A contactless treatment machine especially for COVID-19 scenario”

Between

Indian Institute of Technology (IIT), Mandi, Himachal Pradesh, India, which is a technical and research university through its authorized Signatory

And

Vardhman Mahavir Medical College (VMMC) & Safdarjung Hospital (SJH) having its premises in New Delhi, through its authorized Signatory

which expression shall unless it be repugnant to the context or meaning thereof be deemed to mean and include its successors administrators’ executors and assigns representatives.

And both the above parties after discussion having signed the Memorandum of Agreement (MOA) which will lay the foundation for cooperation and joint action related to matters of mutual interests and decide to deduce their respective roles.

1. Project Background & Purpose

COVID-19 reveals acute shortage of ICU skilled specialists, ventilators and hospital beds especially in populated countries like India and in its under developed neighbouring countries. According to OECD (2019) report, India has second highest number of COVID patient after US having, 0.23 beds and 8 doctors per 10,000 persons. COVID spreads due to prime contact with the infected person, unfortunately leads to 734 death of doctors in India by IMA report (Sept,2020) and government advice to prefer home isolation for moderate symptomatic patient due to shortage of facilities and contact transmission issues with COVID. Hence, we a group of engineers from IIT Mandi along with faculty in VMMC and SJH New Delhi are going to collaborate to make ICU equipment particularly low cost Auto -tuned ventilators. Existing ventilators are costly, and not adaptable to do changes in itself (like tidal volume, Fraction of Inspired Oxygen (FIO₂), modes, humidification, plateau pressure etc.), according to patient breathing dynamics like oxygen saturation (SPO₂), exhaled carbon dioxide concentration (SPCO₂), type of pulmonary disease etc., and totally depend on pulmonary specialist to do changes manually, hence chances of COVID transmission. To avoid it we are planning to develop an intelligent ventilator having close loop sensor network to do real time monitoring of patient dynamics and take feedback from patient and do necessary changes of its own as per patient lung dynamics. This will lead to reduction in the dependency of ventilator settings on doctors, hence minimizing the risk of COVID transmission.

V. Krishnan 



It might be well suited for use in home isolation. In hospitals it will reduce the burden on the specialist. In addition, the real time monitoring and immediate adjustments might avoid Ventilator Induced Lung Injuries (VILI) which may be occurring due to delay in adjustments. Also, this ventilator will have features like humidification, temperature adjustment, spontaneous ventilation sensing, automatic mode shifting (Auto-tuned), default mode in alarming situation etc. Portability and cost optimization are prior concern to make it affordable.

2. Project Supervisors & Team Member of both parties

(1) Dr. Rajeev Kumar, Professor, School of Engineering, IIT Mandi, is overall principal supervisor of this project in IIT Mandi. Auto -tuned ventilator is a project cum M.S. Thesis work of **Rishi Kant Thakur**, a research scholar under supervision of Dr. Rajeev Kumar.

(2) Dr. Rohit Kumar Assistant Professor, Department of Pulmonary, Critical Care & Sleep Medicine, VMMC & SJH New Delhi will co-supervise the above-mentioned research project from VMMC & SJH New Delhi.

3. Roles & Responsibilities of both parties

(1) Both the parties decided to work collaboratively on project entitled "Auto -tuned Ventilator: A contactless treatment machine especially for COVID-19 scenario", initially which is a thesis work but in future if funding is required than both parties will work on project proposal preparation, arranging funds & industrial collaborations.

(2) Design, Analysis and fabrication of Auto -tuned ventilator setup will be done by Dr. Rajeev Kumar and his research scholar in Smart Material and Structure lab premises at IIT Mandi.

(3) Dr. Rohit Kumar, the medical expert, will provide his medical advice to make ventilator adaptive as per patient lung dynamics (Auto -tuning) which is essential for the successful completion of this project.

(4) Dr. Rohit Kumar along with VMMC and SJH New Delhi, will provide the Arterial Blood Gas (ABG) data and other input data corresponding & ventilator settings having 7000 patient conditions (count may vary depend upon accuracy of algorithm). Further for real time adjustment, data attributes may include oxygen saturation and End Tidal carbon dioxide (ETCO₂) or transcutaneous carbon dioxide for Fraction of Inspired Oxygen (FIO₂) and Positive End Expiratory Pressure (PEEP) adjustment. Data features like attributes and other information required may change in future as this is a learn and go process. Prospective data is preferred for this study.

(5) Both the parties will mutually work on publications in journals and thesis work related to this project.

4. Conditions of Agreement

(1) Both the parties with mutual understanding will allow the visit of participants to their campus/hospital for study purpose related to this project.

(2) Both the parties will have only academic and no commercial interest in this project. The important research findings arising out of the activities covered under this may be published in peer reviewed National

and International journals. Research Scholar involved from IIT Mandi will be the first author followed by supervisors from both parties. This may change in future depend upon level of contribution as per mutual consent.

(3) This study will not involve any type of radioactive material.

(4) All the documents & information in any form which will be shared between both the parties will remain confidential and non-sharable to any other third party.

(5) After all necessary regulatory approvals, VMMC & SJH New Delhi may allow the testing of ventilator over their patients under their supervisions.

(6) The right of intellectual property arising from the collaborative project will be in principle, the joint property of IIT Mandi and VMMC & SJH New Delhi.

5. Amendment to the agreement

During the project work situations compelling any alterations or modifications of this agreement shall be operational following mutually discussed and agreed upon in writing.

6. Interpretation/matters not provided herein

In case of difficulties/doubts towards the interpretation of the provisions of this agreement or those matters not provided herein, the collaborating institutes/parties shall resolve such doubts in good faith after consulting with each other.

In witness whereof the parties here to have duly executed this agreement on 20th day of May, 2021.

Witnesses:

First Party:

V. Krishnan
Dean SRIC
IIT Mandi
Kamand - 175005,
H.P., India



**Dean (Sponsored Research & Industrial
Consultancy)**

IIT Mandi, Himachal Pradesh

Rkumar

**Dr. Rajeev Kumar
Supervisor**

Professor, School of Engineering IIT
Mandi, Himachal Pradesh

Second Party:

[Signature]
20/05/2021

**Medical Superintendent/ Principal
VMMC & SJH Hospital New Delhi**

[Signature]
DR. ROHIT KUMAR
DM, MRCP (UK)
Assistant Professor
Department of Pulmonary,
Critical Care & Sleep Medicine
VMMC & SJH Hospital, New Delhi - 29

**Dr. Rohit Kumar
Co-Supervisor**

Assistant Prof. Department of Pulmonary,
Critical Care & Sleep Medicine
VMMC & SJH Hospital