Projects initiated by IIT Bombay for COVID-19 mitigation

Status updates
28th April 2020
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<th>Sr.</th>
<th>Project Title</th>
<th>Faculty</th>
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| 1   | Antibody based capture of 2019-nCoV and its inactivation using lipid based in-situ gel | • Prof Kiran Kondabagil, BSBE  
• Prof. Rinti Banerjee, BSBE  
• Prof. Shamik Sen, BSBE  
• Prof. Ashutosh Kumar, BSBE | • DST funded 1 year project  
• Bioinformatic analysis completed  
• Funds awaited                       |
| 2   | Identification of global metabolite biomarkers in COVID-19 infected patients for targeted therapy | • Prof. Sanjeeva Srivastava, BSBE                                                             | • DST funded 1 year project  
• Kasturba hospital IRB approval received  
• Proteomics/metabolomics analysis of COVID +ve / COVID –ve patients initiated  
• Funds awaited                       |
| 3   | Plasma proteomic analysis of COVID-19 patients to identify the potential biomarkers and therapeutic targets: A pilot study | • Prof. Sanjeeva Srivastava, BSBE                                                             | • IITB funded project for preliminary studies  
• Pilot project to be submitted to DST soon |
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<tr>
<td>4</td>
<td>PICOVRID technology: Antiviral prophylactics and therapy</td>
<td>• Prof. Rinti Banerjee, BSBE</td>
<td>• Formulations developed as nutraceutical drinks and phytopharmaceuticals</td>
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<td>• FSSAI registration filed</td>
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<td>• Strong antiviral and RNAse activity</td>
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<td>• Studies on efficacy against coronavirus samples, in 10 days</td>
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<td>• Inactivates coronavirus sample in clinical swabs within one hour</td>
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<td>• Pilot clinical trial being planned with partner hospitals</td>
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<td>• Available for licensing, scale up</td>
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<td>5</td>
<td>NANOSURF Technology: Aerosols for adult respiratory distress syndrome complications of COVID 19</td>
<td>• Prof. Rinti Banerjee, BSBE</td>
<td>• Aerosol formulations optimized and validated at lab level and in rat models</td>
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<td>• Significantly reduces cytokine storm; mortality</td>
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<td>• All ingredients GRAS approved</td>
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<td>• In discussion with Pharmaceutical GMP manufacturer MKPPL</td>
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<td>• Formulation validated and ready for licensing</td>
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| 6   | TGuard technology: Antiviral nutraceutical and phytopharmaceutical             | • Prof. Rinti Banerjee, BSBE    | • Prototype of oral formulations inspired on palm based constituents  
• Strong antiviral properties of actives  
• Partnering with IIT Alumni Council, IITB and Fine Organics  
• In vitro and in vivo evaluation planned  
• Licensing and clinical trial as prophylactic and early stage therapeutic |

**Area of Work: Antiviral drug / molecule synthesis**
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<td><strong>Area of Work: Sanitization approaches</strong></td>
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</table>
| 7   | Development of incineration device for safe disposal of masks / gloves in     | • Prof. Sandeep Kumar, ESE    | • Prototype fabrication completed  
     | hospitals and quarantine centres                                             | • Prof. Sanjay Mahajani, ChE | • Successfully tested with N95/cloth mask and rubber gloves  
     |                                                                              |                                | • Testing to be done at a quarantine center in Dhule Municipal Corporation |
| 8   | Portable UVC germicidal unit for disinfection                                 | • Prof. Ambarish Kunwar, BSBE | • Prototype developed and technology ready for licensing  
     |                                                                              | • Prof. Kiran Kondabagil, BSBE| • Efficacy tested using MS2 Phage  
     |                                                                              | • Prof. P. Kumaresan, IDC      | • Consultancy projects with Thermax & W2 Why Wait  
<pre><code> |                                                                              | • Prof. Purba Joshi, IDC       | • In discussion with Indokrishna Eco Solutions, Godrej Security Solutions, Taj Hotels, Frontech Engineering Services for licensing |
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| 9   | Surface spray for decontamination and antiviral action | • Prof. Soumyo Mukherji, BSBE  
     |                                                  | • Prof. Suparna Mukherji, CESE               | • Time dependent analysis of synthesized nanoparticles showed complete disinfection of MS2 Phage within 2 hours  
     |                                                  |                                              | • Funding of 25,000 USD sanctioned by Applied Materials  
     |                                                  |                                              | • In discussion with Manipal Hospital for testing |
| 10  | Sanitization solution for hands for Institute personnel | • Prof. Soumyo Mukherji, BSBE                 | • IITB funded hand sanitizers produced as per WHO protocol  
<pre><code> |                                                  |                                              | • 50 litres distributed to IITB Hospital, Security personnel and PHO |
</code></pre>
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| 11  | ECORSANI: Phytoformulations for walk through sanitizers | • Prof. Rinti Banerjee, BSBE  | • Formulations developed  
• Collaboration with Thermax  
• To be evaluated as aerosol sprays in tunnels  
• Testing being done by Thermax  
• Hand-rub version also developed  
• Indian patent filed  
• Available for licensing |
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<tr>
<td></td>
<td><strong>Respiratory support devices for COVID19</strong></td>
<td></td>
<td><strong>Three low cost ventilators being developed:</strong></td>
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</table>
|     |                                                   | Prof. Ramesh Singh, ME  
Prof. Soham Mujumdar, ME  
Prof. Ankit Jain, ME |         | (A) **CPAP Helmet**  
• For patients with mild distress level  
• Collaboration with Thermax  
• Prototype near completion, test protocols developed  
• Product assembly and testing to be conducted at IITB; Manufacturing to be carried out by Thermax |
|     |                                                   |         | (B) **Mechanized Ambu-bag**  
• For patients with moderate difficulties  
• Collaboration with Technocraft  
• Prototype near completion, test protocols developed  
• Product assembly and testing to be conducted at IITB; Manufacturing to be carried out by Technocraft |
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<tr>
<td></td>
<td><strong>Area of Work: Medical Devices (contd.)</strong></td>
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<tr>
<td></td>
<td>Respiratory support devices for COVID19 (contd.)</td>
<td>Prof. Ramesh Singh, ME</td>
<td>(C) Advanced Ventilator</td>
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<tr>
<td></td>
<td></td>
<td>Prof. Soham Mujumdar, ME</td>
<td>• For severely critical patients</td>
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<td></td>
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<td>Prof. Ankit Jain, ME</td>
<td>• Collaboration with Dr. Deopujari (Director, Shree Clinics, Nagpur)</td>
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<td>• Specifications and control parameters identified</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Design iterations underway</td>
</tr>
<tr>
<td>13</td>
<td>BETIC VI-SVAS: Ventilator for India</td>
<td>Prof. B. Ravi, ME</td>
<td>• Collaboration with IITPL, Bangalore (Innovations Imaging Technologies)</td>
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<td>• Shortlisted by GoI to supply 2000 ICU ventilators by June 2020</td>
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<td>• Prototype developed</td>
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<td>• Tested successfully in D. Y. Patil Hospital</td>
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<td>• Final testing to be done at IITPL, Bangalore</td>
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<td>14</td>
<td>Low cost ventilator</td>
<td>Prof. Ashutosh Gupta, CSE</td>
<td>• Prototype developed, along with an app and web server</td>
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<td>• Collaboration with Williburg Electronics</td>
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<td>• CAD design, circuit design, part sourcing being documented currently</td>
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<td>• To be tested in hospitals, after controls are made more precise</td>
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<td>• Expected cost: Rs. 30,000 - 40,000</td>
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<td><strong>Area of Work: Personal protection</strong></td>
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| 15  | Design and development of PPE solutions           | • Prof. P. Kumaresan, IDC  
• Prof. Purba Joshi, IDC  
• Prof. B. K. Chakravarthy, IDC                                  | Collaboration with Ecostyle, Padmavati Tapes & AS Industries  
(A) Face Masks  
• Original design created, along with 9 DIY videos  
• 34,000 pieces distributed to IITB community and NGOs  
(B) Low cost face shields  
• Original design created  
• 100 pieces distributed  
(C) Aerosol Box for hospitals  
• Original design created  
• Collapsible prototype developed  
(D) Washable PPE coverall suit  
• Original design created  
• Prototype sent for certification |
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| 16  | Wash resistant antibacterial coatings on textiles                              | Prof. Rinti Banerjee, BSBE                   | • Develop wash resistant antibacterial coatings for textiles  
• Technology developed and validated by AATC regulatory standards  
• Effective after 20 wash cycles  
• Under licensing to Liveco, Meemansa  |
| 17  | Wash resistant antiviral coatings on textiles: Improving functionality of masks | Prof. Rinti Banerjee, BSBE                   | • Enhance functionality of regular 3 ply masks  
• wash resistant coatings on textiles with antibacterial and antiviral properties  
• Indian Patent filed  
• Prototypes developed  
• IEC approval from Kasturba Hospital for validation against clinical swabs  
• Regulatory validation to be taken up  
• Licensing discussions with Liveco, Meemansa  |
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</table>
| 18  | Biodegradable antiviral plastic like films for face shields                    | • Prof. Rinti Banerjee, BSBE | • Environmentally friendly alternatives to plastic based PPE – face shields  
• Prototypes films ready  
• Antiviral properties of components ongoing  
• Scale up required through industry partner,  
• Regulatory validation required |
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| 19  | Use of ‘SAFE’ app for Quarantine adherence                                     | • Prof. Bhaskaran Raman, CSE  
• Prof. Kameswari Chebrolu, CSE  | • App developed and shared with several agencies; awaiting response     |
| 20  | Privacy preserving contact tracing                                             | • Prof. Bhaskaran Raman, CSE                | • Software developed and released in open source domain                |
| 21  | CORONTINE: Tracking and tracing of asymptotic carriers during pandemic        | • Prof. Ganesh Ramakrishnan, CSE  
• Prof. Manjesh K Hanawal, IEOR   | • Tracking asymptomatic persons through GPS tracking systems  
• CORONTINE platform developed  
• Work order received from Govt. of Orissa, used by Meghalaya Govt.  
• In process of integrating with Arogya Setu  
• Complementing with telecom data for tracking / tracing |
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|     | Contactless (video) surveillance at COVID-19 quarantine facilities | Prof. Ganesh Ramakrishnan, CSE | • RTA (real-time application) solution deployed at different quarantine locations at IITB  
• Collaboration with SrivisifAI Technologies |
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| 23  | World Wide Help: IT solution for user-friendly, cost effective and customized information access on any topic and in any domain with humans-in-the-loop | • Prof. Kameswari Chebrolu, CSE              | • App developed to connect people requiring help to those providing help via Phone calls / Whatsapp  
• Helpline operational at KEM Hospital: Medical advice to public by 40+ doctors across all specialities  
• Helpline set at IITB Hospital for telemedicine services  
• In process of setting up palliative care helpline for Kokilaben Hospital, with help of NGOs  
• Setting up of demand-supply hospital network (MIT, Stanford & Maharashtra Govt.) |
<p>| 24  | Short-term projection of COVID-19 medical resources and inventory             | • Prof. P. Sunthar, ChE                       | • Web application developed to provide a four-week projected requirement for various medical inventory across districts, states and at national level <a href="https://covid19medinventory.in/">https://covid19medinventory.in/</a> |</p>
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<td><strong>Area of Work: IT Solutions (contd.)</strong></td>
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| 25  | E-token and online ordering system | Prof. Bhaskaran Raman, CSE | • Implemented at IITB and local grocery stores  
• Requests from IIT Bhilai and IIT Bhubaneswar  
• Need help for outreach |
| 26  | Lokacart      | Prof. Ganesh Ramakrishnan, CSE | • Client & Admin apps, Admin web portal developed:  
  - Lokacart App (B2C)  
  - Lokacart Admin App  
  - Lokacart Plus App (B2B)  
• Used by 15-20 farmer groups  
• Available in PlayStore  
• Tutorials in English, Hindi, Marathi  
• In discussion with several local grocery stores for further scale up |
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<td>27</td>
<td>Lokavidya: Knowledge sharing platform for educational institutions</td>
<td>• Prof. Ganesh Ramakrishnan, CSE</td>
<td>• Deployed at Ekal Vidyalaya, one of India’s largest Educational NGOs to train their village level teachers (Link)</td>
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<td>• Prof Preethi Jyothi, CSE</td>
<td>• Lokavidya (LV) has helped 55,646 Ekal Vidyalayas’ trainers for educating 14,79,375 children</td>
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<td>• Using LV, Ekal has achieved knowledge retention, delivery and planning, effective training and tracking</td>
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<td>• Collaboration with Aify Innovation Labs, Lokavidya Technologies, SrivisifAI Technologies, and STARS Forum</td>
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<td>• Platform is actively being used by Ekal even during Covid-19 lockdown</td>
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Presentations

Area of Work: Antiviral drug / molecule synthesis
Identification of global metabolite biomarkers in COVID-19 infected patients for targeted therapy

Project funded by: SERB-DST

Presentation by –
Prof. Sanjeeva Srivastava
BSBE, IIT Bombay

Co-PI
Dr. Jayanti Shastri, Kasturba Hospital & Nair Hospital
Dr. Om Shrivastav, Kasturba Hospital & Jaslok Hospital

Collaborator
Dr. Mala Kaneria, Kasturba Hospital & Nair Hospital
Objectives

• Metabolomics analysis of COVID+/COVID- patients plasma and NP swab samples to understand metabolic alteration & identification of novel targets

• Comparison of COVID+ non-severe (Group-I/II) and severe (Group-III/IV) patients; understanding disease pathobiology & prediction of severity
Current Status of Project

- IRB approval for sample collection is obtained from collaborating hospital and IITB-IEC
- SOPs for metabolomics investigation standardized
- Grant sanction from DST-SERB is in process
- Manpower recruitment for project and sample collection to be initiated
Plasma proteomic analysis of COVID-19 patients to identify the potential biomarkers and therapeutic targets: A Pilot Study

Seed Project funded by: IRCC

Presentation by –
Prof. Sanjeeva Srivastava
BSBE, IIT Bombay

Clinical Collaborators
Dr. Om Shrivastav
Dr. Jayanti Shastri
Dr. Mala Kaneria

IITB Co-Investigators
Prof. Kiran Kondabagil
Prof. Rahul Purwar
Objectives

• A pilot study of proteomics investigation of COVID+/COVID- patients plasma samples to identify pathways and host response in COVID patients
Proteomics: Discovery & Validation Workflows

C. MS Data Analysis:
- Proteome Discoverer
- Raw data
- MSstats TMT
- Run-to-run normalization
- Quantile normalization

D. Machine Learning:
- Variables
- Data
- Pre-processing
- ML Algorithm (Elastic Net Regression)
- ML Model with Nested Cross-validation
- Results (Kappa, F1 Score, AUC, Balanced Accuracy)

E. Validation Phase:
- Digestion
- Multiple Reaction Monitoring

28-Apr-20 COVID IITB 25/26
Current Status of Project

• IRB approval for sample collection is obtained from collaborating hospital and IITB-IEC
• SOPs for proteomics investigation standardized
• Sample collection to be initiated in hospital after regulatory approval
PICOVRID Technology: Antiviral Prophylactics and Therapy_ RB 1

• Objectives
  • Develop antiviral formulations based on spices and edible emulsifiers

• Mechanism of action:
  • Direct breakdown of viral envelope due to surface active nature

• Activities carried out till date
  • Formulations developed as nutraceutical drinks and phytopharmaceuticals
  • High absorption, Stable formulations, taste masked
  • FSSAI approved constituents according to Schedule VI, FDA approved GRAS status
  • In vitro effectiveness against HSV1, HSV2, Parainfluenza virus 0.1 to 20 micromolar
  • Strong antiviral and RNAse activity
  • IEC approval obtained from Kasturba Hospital for testing on clinical swabs of coronavirus
  • Indian Patent filed
  • FSSAI registration filed
PICOVRID Technology: Antiviral Prophylactics and Therapy_RB1

- Details regarding partnership with Industry if any
  - FSSAI registered manufacturer
  - Pharmaceutical GMP manufacturer

- Status as of today
  - Studies on efficacy against coronavirus samples, expected in 10 days
  - Pilot Clinical trial being planned with partner hospitals
  - Available for licensing, scale up

- Future plans/deliverables
  - Two products for licensing and deployment: 3 months time
    - PICLOVRID_N: Nutraceutical drink for prophylaxis
    - PICLOVRID_P: Phytopharmaceutical for treatment of early stage cases of COVID 19, as a Ayurvedic medicine
NANOSURF Technology: Aerosols for Adult Respiratory Distress Syndrome Complications of COVID 19_ RB2

• Motivation: Mortality associated with ARDS complications of COVID 19, Unmet medical need, No known treatment

• Objectives
  • Develop aerosol formulations that address the cytokine storm of ARDS

• Mechanism of action
  • Acts on alveolo-capillary membrane, Reduces cytokine storm
  • Pulmonary surfactant mimetic

• Activities carried out till date
  • US Patent Granted
  • Indian Patent Granted
  • Formulations optimized and extensively validated at laboratory level
  • Validated against LPS induced ARDS models in rats
  • Significantly reduces bronchoalveolar IL6 levels, bronchoalveolar protein levels, bronchoalveolar oxidant levels
  • All ingredients GRAS approved
  • GLP Acute inhalation toxicity done, Safe in accordance with OECD 463
NANOSURF Technology: Aerosols for Adult Respiratory Distress Syndrome Complications of COVID 19_ RB2

• Details regarding partnership with Industry if any
  • In discussion with Pharmaceutical GMP manufacturer MKPPL

• Status as of today
  • Formulation validated and ready for licensing
  • To apply for DCGI abbreviated approval/waiver for clinical trial

• Future plans/deliverables
  • Licensing and clinical trial as IND with DCGI approvals
  • Novel life saving formulation for ARDS complications of COVID
  • Reduce mortality
TGuard Technology: Antiviral nutraceutical and phytopharmaceutical RB6

• Objectives
  • Develop formulations inspired on palm based constituents

• Activities carried out till date
  • Prototype oral formulations developed syrups, gels, mouthwash
  • Strong antiviral properties of actives
  • GRAS approved, high safety margins
  • Antiviral evaluation against coronavirus to be undertaken
  • Patent to be filed

• Details regarding partnership with Industry if any
  • IIT Alumni Council, IITB and Fine Organics
TGuard Technology: Antiviral nutraceutical and phytopharmaceutical RB6

• Status as of today
  • Prototype oral formulation developed
  • Stable, taste masked
  • Agreements, patent filing to be undertaken
  • In vitro and in vivo evaluation planned

• Future plans/deliverables
  • Licensing and clinical trial as prophylactic and early stage therapeutic
Presentations
Area of Work: Sanitization Approaches
Development of Portable Incineration device for safe disposal of Masks/Gloves in Hospitals and Quarantine Centers

- Prof. Sandeep Kumar/ Prof. Sanjay Mahajani

- Prototype fabrication is complete with the in-house available material

- Successfully tested with N95/Cloth mask and rubber gloves

- Dhule Municipal Corporation has agreed to support and coordinate for the testing in one of their Quarantine Center.

- A PhD Student (Sujeet Deore), presently in Dhule and working on fabrication there as well, is coordinating with Dhule MC.
• **Future Plans:**
  - Testing at the Quarantine center in Dhule and getting field experience and feedback
  - Testing the incineration of paper cups/ juice tetrapack waste also as per request of Dhule Municipal Corporation
  - Modifying/Finalising the design based on field trial experience
  - Preparing a detail design document and operation manual (Open Source) for wider manufacturing and use

• **Possible Collaborator**
  - The basic motive is to create a simple and open design for anyone to fabricate
  - One of the manufacturer from Pune has shown interest:
    
    Technodry System Engineering Pvt. Ltd.,
    Gat no 2021,2022/5, Dawad mala,
    Behind Mahalaxmi weigh bridge, Chakan Ambethan Road,
    Chakan, Tal. Khed, Pune - 410501
    (GST no:27AAECN3199E1ZB)
Technology for portable / wheeled UVC germicidal unit / station for disinfection

Ambarish Kunwar, Kiran Kondabagil, P. Kumaresan, Purba Joshi
• **Objective:** Technology for portable/wheeled UVC germicidal unit/station for disinfection

• **Activities carried out till date:** Prototype developed and efficacy tested for portable unit using MS2 Phage which is supposed to be more stable than coronavirus.

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<th>10-fold dilutions</th>
<th>Plaque forming Units per ml</th>
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<tr>
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<td>No UV exposure</td>
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<td>1</td>
<td>24000000000</td>
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<td>2</td>
<td>24000000000</td>
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<td>4</td>
<td>240000000</td>
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<td>1100000</td>
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<td>2400000</td>
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Inactivation studies also done with *E. Coli*

• **Details regarding partnership with Industry if any:** Consultancy Project Proposal (Thermax Limited, W2 Why Wait)

Licensing of Technology (Indokrishna Eco Solutions, Godrej Security Solutions Division, Taj hotels, Frontech Engineering Services)
• **Details regarding partnership with Industry if any:** Consultancy Project Proposal (Thermax Limited, W2 Why Wait)

Licensing of Technology (Indokrishna Eco Solutions, Godrej Security Solutions Division, Taj hotels, Frontech Engineering Services)

• **Status as of today:** Technology ready for licensing

• **Future plans/deliverables:** Working on promoting wheeled sterilization unit
Surface spray for decontamination and antiviral action

Prof. Soumyo Mukherji
Prof. Suparna Mukherji
Prof. Kiran Kondabagil
Indian Institute of Technology, Bombay
In collaboration with Applied Materials
Hypotheses and Objectives

• Nanoparticle based surface sprays and coating systems have shown bacteriocidal and virucidal properties

• These maybe used on surfaces which are commonly touched by people

• Virucidal action will be there as long as the nanoparticles are there on the surface

• Testing with model non-pathogenic virus (bacteriophage MS2)

• Testing with respiratory pathogens (H1N1, XDR bacteria, select fungi) in hospital settings and finally SARS-COV2

• Testing sprays on metallic and non-metallic surfaces

• Complete disinfection was observed within 2 hours
ECORSANI: Phytoformulations for Walk Through Sanitisers _ RB7

• Objectives
  • Develop safe alternatives for walk through sanitisers and handrub sanitisers

• Activities carried out till date
  • Indian Patent filed
  • Formulations developed
  • All formulations food grade, GRAS approved
  • To be evaluated as aerosol sprays in tunnel
  • Residence time on clothing
  • Effectiveness as a sanitizer, time required for action
  • Hand rub version also developed, moisturising, safe to skin

• Details regarding partnership with Industry if any
  • In collaboration with Thermax
ECORSANI: Phytoformulations for Walk Through Sanitisers _ RB7

• Status as of today
  • Formulations developed, being sent to Thermax for evaluation
  • Regulatory validation will be undertaken

• Future plans/deliverables
  • Licensing, scale up. Deployment
Presentations

Area of Work: Medical Devices
Objective

- To develop respiratory support solutions for COVID-19 patients across all the distress levels, i.e. mild, medium and severe
- Based on patient criticality, three kinds of respiratory support will be required

<table>
<thead>
<tr>
<th>CPAP Helmet</th>
<th>Mechanized Ambu-bag</th>
<th>Advanced Ventilator</th>
</tr>
</thead>
<tbody>
<tr>
<td>To provide a positive pressure of O2-rich air with minimum leakages</td>
<td>Cost-effective volume-controlled ventilation for patients with moderate difficulties</td>
<td>Advanced ventilator design with multiple modes of delivery</td>
</tr>
<tr>
<td>Oxygenation for patients with mild distress level</td>
<td>Patient-triggered vs Mandatory mode, Continuous PEEP, Sensor for monitoring device performance and patient condition, Failsafe mechanisms</td>
<td>For severely critical patients</td>
</tr>
<tr>
<td>Collaboration with Thermax</td>
<td>Collaboration with Technocraft</td>
<td>Collaboration with Dr. Deopujari (Director, Shree Clinics, Nagpur) and team</td>
</tr>
</tbody>
</table>

https://www.intersurgical.com/info/starmed
## Activities, Future Plans

### CPAP Helmet
- Design has been finalized
- Preliminary CFD simulations conducted to streamline the flow and minimize CO2 build-up
- Prototype is near completion
- Test-protocols have been developed

**Next Steps:**
- Product assembly and testing will conducted at IIT Bombay
- Based on the test results, regulatory approval will be sought if required
- Manufacturing will be carried out by Thermax

### Mechanized Ambu-bag
- Design has been finalized
- First-principle calculations made to ensure desired performance
- Necessary control and failsafe mechanisms have been developed
- Prototype is near completion

**Next Steps:**
- Product assembly and testing will conducted at IIT Bombay
- Based on the test results, regulatory approval will be sought if required
- Manufacturing will be carried out by Technocraft

### Advanced Ventilator
- Specifications and control parameters have been identified
- Design iterations underway

**Next Steps:**
- Prototyping and instrumentation
- Testing
- Manufacturing

**Deliverables**
- Design specifications, detailed bill of materials, and working prototypes of all the three devices
- MOUs with respective collaborators are being negotiated through IRCC for further developments and IPs

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**Team from IITB:** Prof. Ramesh Singh (lead), Prof. Ankit Jain, Prof. Soham Mujumdar
Full-Specifications ICU Ventillator

IIT Bombay – BETIC Lab (ISO 13485)
Industry Partner – IITPL, Bangalore

April Status – Design, prototyping, software, simulation (at DY Patil Hospital) complete.

May Plan – Certification, manufacture

Ventilator modes: PC-CMV, PC-SIMV, PSV, VC-SIMV, CV-CMV, PRVC, ACV, CPAP, BPAP

With display, alarms, history, battery backup
Presentations

Area of Work: Personal Protection
C19 IITB PPE project

Prevention is better than cure

The team:
Prof. Kumaesan  Mrs Jaya Chakravarthy
Prof. Chakravarthy  Dr Shanmuga Priya
Prof. Purba  Dr Shubha
Prof. M Atrey  Dr Madhavi
Prof. B Ravi  Dr Nisha
Prof. Bapat  Dr Sujata
Nitesh Bhuyal

The objective, Started as
‘To make Face masks for IITB hospital, security and residents’
‘To publish DIY mask videos in regional languages’

and is Evolving into
‘To design and enable local industries to make PPEs’

The external collaborators:
Ecostyle garments
Padmavati tapes
Swastik hardware agency
Harsiddhi agency
Bharat suppliers
AS industries

the first set of masks were made in PoC lab, using available materials and manpower
Total of 34,000 masks have been supplied to IITB, various hospitals, NGOs.

Masks sold in IITB @ Rs 15

IITB Security

Masks to Sakinaka Police

IITB Hospital

@ Ecostyle factory

Variety of designs

10 DIY videos in Regional languages & English, made by students have been uploaded in IITB Youtube channel.
To Design, Develop and Enable local industries to make PPE solutions

1. Face shields
   - Low cost face shield design prototypes

2. Aerosol box for hospitals
   - Collapsible design prototype

3. Washable PPE coverall
   - Easy to make PPE prototype
Wash Resistant Antibacterial Coatings on Textiles _ RB3

• Motivation: Reduce secondary opportunistic bacterial infections in multiuse masks and gowns

• Objectives
  • Develop wash resistant antibacterial coatings for textiles

• Mechanism of action
  • Easily Crosslinked to textile, Acts on bacterial cell wall

• Activities carried out till date
  • Indian Patent filed
  • Technology developed and validated by AATC regulatory standards
  • Effective after 20 wash cycles
  • Ready for licensing
Wash Resistant Antibacterial Coatings on Textiles _ RB3

• Details regarding partnership with Industry if any
  • Licensing ongoing
  • Liveco
  • Meemansa

• Status as of today
  • Validated technology available for licensing

• Future plans/deliverables
  • Licensing and deployment after scale up
Wash resistant Antiviral Coatings on Textiles: Improving functionality of masks _ RB4

- Motivation: Enhance functionality of regular 3 ply masks

- Objectives
  - Develop wash resistant coatings on textiles with antibacterial and antiviral properties

- Mechanism of action
  - Easily cross linked to textile, Acts on envelope of viruses and cell walls of bacteria

- Activities carried out till date
  - Indian Patent filed
  - Prototypes developed
  - IEC approval from Kasturba Hospital for validation against clinical swabs

- Details regarding partnership with Industry if any
  - Ready for licensing
Wash resistant Antiviral Coatings on Textiles: Improving functionality of masks _ RB4

• Status as of today
  • Ready for licensing, Liveco, Meemansa
  • Regulatory validation to be undertaken

• Future plans/deliverables
  • Licensing, scale up, regulatory validation, deployment
Biodegradable antiviral plastic like films for Face Shields_ RB5

• Objectives
  • Develop environmentally friendly alternatives to plastic based PPE

• Mechanism of action
  • Biodegradable biopolymer composites

• Activities carried out till date
  • Indian Patent filed for biodegradable plastics for packaging
  • Prototypes available of biodegradable films
  • Antiviral properties of components ongoing

• Details regarding partnership with Industry if any
  • Technology available for development of face shields/PPE
Biodegradable antiviral plastic like films for Face Shields_ RB5

• Status as of today
  • Prototype films ready
  • Scale up required through industry partner, Regulatory validation required

• Future plans/deliverables
  • Licensing to interested partners
  • Can be used for face shields, PPE as ecofriendly alternatives
Presentations
Area of Work: Surveillance
1. **Title**: Tracking and Tracing of Asymptotic Carriers During Pandemic

   Prof. Manjesh K Hanawal, IEOR, IIT Bombay
   Prof. Ganesh Ramakrishnan, CSE, IIT Bombay

2. **Objectives**
   a. Track asymptotics: An Android/iOS based for GPS tracking system with a Linux back-end
   b. Alert if an asymptotic is in close proximity
   c. Trace all peoples who got in close proximity with asymptotics
Activities carried out till date: Corontine Platform

Client App app (can be cell-tower coordinates)

About the App
The purpose of the Corontine app is to help authorities track the asymptomatic carriers and prevent the spreading of disease
1. Details regarding partnership with Industry if any
   ITAkash, Strategic Software Solution
   (Founded by Mr. Ashvin Gami, Alumni of EE, IITB)
2. Status as of today
   Work order received from Orissa Govt.
   Extensively used by Meghalaya Govt
3. Future plans/deliverables
   In the process of integrating with Argyo Setu App
   Complementing with telecom data for tracking/tracing
4. Any other relevant information
   Proposal submitted to Apex committee to funding. Till the funds are sanctioned, some initial funds from IITB will help
Presentations
Area of Work: IT Solutions
WWH: World Wide Help

Kameswari Chebrolu
Department of CSE, IIT Bombay
• Objective: Connect people requiring help to those providing help via Phone calls/Whatsapp messaging

• Activities so far:
  • KEM Hospital helpline: Medical advice to public by 40+ doctors across all specialities (operational)
  • IITB Hospital helpline: Telemedicine services (operational)
  • Palliative Care helpline: Kokilaben Hospital+NGOs (setup stage)
  • Demand-Supply Hospital Network: MIT+Stanford+Maharashtra-Govt (setup stage)
• Industry Interaction: None

• Challenges
  • Advertisement of helplines
  • Scale vs manpower (not actively pushing solution)

• Future plan
  • Require help in outreach
Lokacart

B2C

Consumers

B2B

FPOs

Farmers / wholesalers

B2C Customer app
- Connecting farmers directly to customers where customers can place orders

B2C Admin App
- For Farmers to upload their produce and manage orders

B2B
- Connect all the bulk buyers at a common platform for buying and selling their produce
Lokacart App (B2C)

- Mobile App and Web App
- Connect with your sellers with Reference Code
- No Sign up / Login
- Enable to place new order in just 3 steps - Choose product, enter quantity and process
- History
- Delete/Cancel order
- Automated Bill Generation
- Multiple Organizations
Lokacart Admin App

- Mobile App and Web App
- Admin Manual (PDF): [04_LokaCart](#)
- Manage Products and Stocks
- View placed, processed and cancelled orders
- Generate Bills for Orders
- Manage Members
Lokacart Plus App (B2B)

- It is an upgraded version of lokacart
- It is B2B application
- Bulk orders can be placed
- No bound between customers and organization
- It is open loop structure
- Mobile App and Web App
Contact less Surveillance at Covid-19 Quarantine Facilities

Prof Ganesh Ramakrishnan, Dept of Computer Science and Engineering, IIT Bombay & SrivisifAI Technologies Private Limited
Overview of Technology

- Highly Extendable Platform
  - Health / Medical Domain
    - Set it up at hospitals to monitor standards of SoP
  - Nation’s Internal Security / Law Enforcement
    - Monitor any place of interest (high value installations, residences of people of national importance, highly sensitive and critical public locations/facilities) centrally and remotely
    - Set it up on the CCTV camera network of a city to assist in monitoring undesirable activities in real time
    - Thus, any investment in setting up this platform is not an expense which goes waste after Covid-19 pandemic is under control
    - The lifespan of this platform / solution goes way beyond the current situation in the nation of dealing with the Covid-19

- State-of-the-art Machine Learning Algorithms
  - Each analysis can be customized to suit exact user requirement
    - Fast, accurate results
  - Distributed and Highly Scalable Architecture

- Supports GPU for better performance
- C++, Python
- Database
  - Integrate with any existing organizational DB
  - Support for independent DB also
- Language independent fast-paced development infrastructure
- Designed to be deployed both,
  - On-Premise
    - Designed for complete Offline Installation, Deployment, and Operation
  - SaaS
    - Device independent application
    - Secured Data Exchange
- Browser based Desktop Client
- Native Android, iOS Mobile Application
Overview of Architecture
RTA Solution Deployed at IIT Bombay Quarantine Facility
(Snapshot from Tool deployed at a different location)

<table>
<thead>
<tr>
<th>ID</th>
<th>Camera</th>
<th>Created At</th>
<th>Type</th>
<th>Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>55993</td>
<td>GroupUnusualObj:CameraUnusualObj</td>
<td>April 19, 2020, 7:31 p.m.</td>
<td>Unusual Object detected</td>
<td>helmet</td>
</tr>
<tr>
<td>55992</td>
<td>GroupFR:CameraFR</td>
<td>April 19, 2020, 7:31 p.m.</td>
<td>Face recognised</td>
<td>Sudatshan_M</td>
</tr>
<tr>
<td>55991</td>
<td>GroupFR:CameraFR</td>
<td>April 19, 2020, 7:31 p.m.</td>
<td>Face recognised</td>
<td>Neelabh_T</td>
</tr>
<tr>
<td>55990</td>
<td>GroupFR:CameraFR</td>
<td>April 19, 2020, 7:31 p.m.</td>
<td>Face recognised</td>
<td>Abhishek_C</td>
</tr>
<tr>
<td>55989</td>
<td>GroupUnusualObj:CameraUnusualObj</td>
<td>April 19, 2020, 7:31 p.m.</td>
<td>Unusual Object detected</td>
<td>motorcycle</td>
</tr>
</tbody>
</table>
Lokavidya
Knowledge Sharing Platform for Educational Institutions

Prof Ganesh Ramakrishnan
Prof Preethi Jyothi
Department of CSE, IIT Bombay

Lokavidya
Knowledge Sharing Platform for Educational Institutions

Objectives:

- Empowering existing institutions (schools, colleges, coaching centers, skill centers) by providing them a digital learning platform where teachers and learners can interact seamlessly
- Teachers can have better understanding of the learners learning journey
- Providing appropriate learning analytics
Lokavidya: Components

LokaUdyam app and webapp (Link)

- Watch/share/download videos for offline viewing
- Take quizzes
- Give feedback / suggestions

LV Create app

- Create a project
- Create low footprint videos
- Upload / modify videos
- Upload quizzes

LV CMS (Link)

- Single and Bulk upload / modify low footprint videos
- Categorize videos under multiple channels and subchannels
- Report generation for every user / video & analysis of quizzes
- Broadcast, Member and Role management
- Group Management for handling hierarchy

LokaVidya provides an open ICT platform to capture, complement and disseminate knowledge and practices amongst people through what we call as enriched videos.

www.lokavidya.com
Success Story:

Deployment at one of India’s largest Educational NGOs ‘Ekal Vidyalaya’ to train their village level teachers. (Link)

- Lokavidya (LV) has helped 55,646 Ekal Vidyalayas’ Trainers for educating 14,79,375 children
- Using LV, Ekal has achieved Knowledge retention, Delivery and Planning, Effective Training and Tracking.
- Platform is actively being used by Ekal even during Covid-19 lockdown

Future Plans:

- Deployment at more schools and educational and skilling centers
- Self sustainable business model creation and adoption
- Feature Enhancement:
  - Support for Advanced Quizzes and Tests (Online MCQ and Proctored Tests)
  - Live Virtual Classroom with Video Recordings
  - Recordings available for offline and self paced learning usage
  - Advanced Video Analytics
    - Attendance Tracking
    - Facial Recognition for
Thank You