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Hon'ble Governor of Assam, Prof. Jagdish Mukhi interacting with the Director of IIT Guwahati Prof. T. G. Sitharam from Raj Bhavan over impending plan of IIT Guwahati to provide respite to the people of the state especially in times of emergency situation arising out of Covid-19 outbreak.

Start-up founded by IIT Guwahati alumni develops and deploys drones for spraying disinfectant in public spaces to prevent Coronavirus

A start-up, Marut Dronetech Private Limited, founded by IIT Guwahati alumni has developed and deployed drones for spraying disinfectant in public spaces to prevent Coronavirus. To control COVID-19 situation, drones have proved to be of great use as seen in countries like China and South Korea.

Marut Dronetech is working with the Government of Telangana and departments across the state to deploy drones for public safety applications. Recently, Karimnagar Municipal Corporation, Telangana, had deployed customised drones of Marut Drones for spraying disinfectants in Mukarampur area of Karimnagar where 10 Indonesians and 1 local had tested positive for COVID-19. Disinfectants were also sprayed at District Collectorate, Municipal Corporation, District Hospital, Bus Station, Auto stand, markets, Police Commissionerate and Rythu Bazars. In a given time, it is seen that drones disinfect 50 times more area than traditional methods and can keep human operators out of harm. Thus, they prove to be efficient, avoids any cross infections and stops the spread of a pandemic.

Speaking about his start-up and the way it can contribute in this situation, Mr. Prem Kumar Vislawath, Co-Founder and CEO of Marut Dronetech Private Limited, said, "At a time when countries across the world are submitting to mass lockdowns owing to the ongoing pandemic, Drone has emerged as a fresh breath of air, by proving to be an alternative and plausible lifeline for stranded populations advised social-distancing, at the time of the COVID-19 crisis. Nations across the world have imposed quarantines in an attempt to control the spread of the novel coronavirus (COVID-19).

Drones could be the best solution to spray disinfectants and reduce infections, monitor people movement for crowd control, emergency delivery of medicines to those quarantined and elders. The contactless, fast-paced operations will strengthen anti-COVID-19 efforts of the government."

Marut drones have also developed Public Monitoring and Warning Drones which are fitted with a camera and speaker. These can be used by personnel to monitor places especially with high disease prevalence for crowd gathering and give appropriate instructions, using fitted loudspeakers, to people. As this is much faster than regular patrolling operations, it can be very efficient not only for patrolling but also to spread the message. These drones can be used in places where people are still seen moving around streets and government personnel are having a hard time implementing a strict lockdown.

Mr. Prem Kumar Vislawath has also identified new ways in which drones can be deployed to combat the virus. According to him, drones can also be used for:

1. Temperature Check – Thermal Imaging

To limit the risk of the personnel getting infected while conducting the temperature checks, drones equipped with infrared cameras to test temperature measurements can be used. While these kinds of drones are commonly used for public safety operations or inspections, with proper calibration, these drones can instead help measure body temperature. Any abnormalities can be marked as suspects for COVID-19. This information can be used by health workers and officials to take further measures. This helps in the identification of infection in a person at a much early stage and can prove to be vital in the present scenario.

Marut Drones team tested different ways to calibrate airborne infrared cameras to measure body temperature. Results showed that by installing a cotton swab within the field of view of the thermal camera, the camera can get an accurate reading. The calibrated drone camera can then be used to measure body temperatures while the officer remains at a safe distance away. While the results are encouraging, it is essential to mention this solution is not designed to be used for standard medical procedures and data needs to be reverified with manual methods before taking any action.

2. Medical Delivery Drone of Critical Supplies

Drones can be used to deliver medicines and other critical supplies to reduce unnecessary human contact. It also speeds up the process significantly. During a recent trial, it was observed that a drone covered a distance of 12 kms in 8 minutes, which is 80 times faster than traditional delivery. Drone delivery will enable affected households to receive medicine and supplies without risking the spread of infection.

Recently, the start-up successfully demonstrated its idea to the Directorate General of Civil Aviation and the Ministry of Civil Aviation. In collaboration with the Emerging Technologies wing of Telangana government, Apollo Hospitals and World Economic Forum, Marut Drones demonstrated with blood, vaccines, diagnostic medical samples and long-tail medicine.

The delivery works on a hub-and-spoke model. The team gets a message on the inventory needed. After the regular pre-flight tests and checks of wind condition, audio pilot systems, GPS tracker, the package is loaded at the central hub and the drones take off. The coordinates are fed into the system and health examiner picks up the vials at the drop-off point.

Such ways can complement disease control measures undertaken by the Government and make the fight against COVID-19 effective, efficient, fast and with less externalities.

The alumni have been featured in the Forbes list of '30 Under 30 - Asia - Industry, Manufacturing & Energy 2020'(https://www.forbes.com/30-under-30/2020/asia/industry-manufacturing-energy/#2c8179b86dbc)

A sample package for Medical Delivery Drone of Critical Supplies

Medical Delivery Drone of Critical Supplies carrying the sample package

Drone to disinfect public spaces

IIT Guwahati develops low-cost UVC LED system to disinfect areas amid COVID-19

Indian Institute of Technology Guwahati has developed a low-cost UVC LED based disinfection system amid the Coronavirus outbreak in the country. The team is also addressing the critical need of the material required for the Personal Protective Equipment (PPE) i.e. fabrication material should have a waterproof ability.

Prof. T. G. Sitharam, Director, IIT Guwahati, has formed a research team lead by Dr. Senthilmurugan Subbiah, Department of Chemical Engineering, IIT Guwahati, to work in collaboration with M/s Excel Tech based in Bangalore and Ultimate Aeroaqua Filter Private Limited based in Guwahati to develop the two technologies.

Speaking about the efforts that are being made by the research team, Dr. Senthilmurugan Subbiah, Department of Chemical Engineering, IIT Guwahati, said, "IITG community is focused to work closely with government agencies and industrial partners to develop smart and low cost technologies to fight against COVID 19 under the leadership of Prof. T. G. Sitharam, Director, IIT Guwahati."

UVC LED system to disinfect areas:

UVC system is a proven technology to sanitize the microorganism infected non-porous surface. 90 % killing rate can be achieved by UVC for one of the highly stable virus MS-2 Coliphase with 186 J dose, whereas 36 J dose is needed for Influenza virus which is similar to COVID-19. In this project, the team has developed a UVC LED system capable of providing 400 J dose in 30 seconds, such that virus-infected surface will be sanitized. The unique design of this UVC system will ensure uniform UVC exposure in virus-infected non-porous area. Further to adopt this technology to porous surfaces, the team is improving the design by integrating UVC with Ozone system such that surface with porous nature also can be sanitized.

Another critical aspect of the technology is the safe usage of UVC system while sanitizing. The system is equipped with an object movement identification feature so that UVC exposure to human skin is avoided during the operation.

The primary role of IIT Guwahati is to develop the UVC system design, prototype (using 3D technology), and testing it in its laboratory.

Three of them are designed for household sanitization and one of them for sanitizing bigger spaces like hospital wards, buses, metros, and railway compartments, including those transformed for COVID-19 care.

UVC LED system is under design and prototype development. The industrial partner was able to source required raw material to produce 5000 number of floor sanitization UVC system. The industrial partners are in the process of getting special approval from the government agencies to start production during the lockdown period.

Personal Protective Equipment (PPE)

According to the research team, one of the critical requirements that COVID PPE fabrication material should have is a waterproof ability. As a research institute, IIT Guwahati is providing technical support to identify the best waterproof material from the Indian market and its performance concerning waterproof. With identified material, the industrial partner has produced a sample PPE for further waterproof testing. Further, IIT Guwahati team will be exploring

potential technology for antimicrobial coating on PPE to reduce the viral load on PPE during exposure to COVID-19.

PPE kit includes a jumped suite, face shield, mouth mask, head covers, gowns and shoe covers.

M/s Excel Tech Bangalore and Ultimate Aeroaqua Filter Private Limited foresee a need for at least 1 million PPE kits soon for India and both the companies are working together to meet this demand, with a separate task team assigned for this project. The initial trial for the production of 15,000 PPEs has been completed successfully and 200 PPEs are ready for shipment to IIT Guwahati for further improvement study. Another 2000 PPEs are ready for supply to Northeast hospitals. Both industry partners are working together to ramp up the production by sharing IIT Guwahati's PPE design with mass production vendors across India. The PPE's designed in a more sealed manner using the existing manufacturing facilities in India, unlike the current existing PPEs, along with impregnating the materials used with anti-microbial substance.

These solutions will not only minimise the spread of COVID-19 but also help in eradicating the traces of the disease at a faster pace. This implementation would also increase the sanitary standards of the country in the long run.

Low-cost UVC LED system developed by IIT Guwahati

IIT Guwahati researchers develop affordable antiviral/antibacterial spray-based coating for Personal Protective Equipment to prevent spread of infection

A team of researchers of Indian Institute of Technology Guwahati has developed affordable antimicrobial (antiviral/antibacterial) spray-based coating for Personal Protective Equipment and 3D printed Ear Guard for comfortable use of face masks by healthcare workers.

The Institute has been working relentlessly to fight against COVID-19 pandemic. The concepts have been developed by Dr. Biman B. Mandal, Professor, Department of Biosciences and Bioengineering, IIT Guwahati, along with his PhD scholars, Mr. Bibhas K. Bhunia and Mr. Ashutosh Bandyopadhyay.

Talking about the work, Dr. Biman B. Mandal, Professor, Department of Biosciences and Bioengineering, IIT Guwahati, said, "Effective yet affordable technologies are need of the hour for India. We at IITG under the leadership of our Director, Prof. T.G. Sitharam, are committed to contribute to the nation's immediate need at this hour of COVID-19 crisis."

Affordable Antimicrobial Spray-based Coating for Personal Protective Equipment:

Personal Protective Equipment (PPE) that are being used presently are designed to protect the wearer from infectious microbes/aqueous virus droplets acting as a barrier. However, these PPE, generally, do not have the ability to prevent the spread of microbes as the surface of the fabric readily allows adherence and accumulation of microbes with time. This leads to further spread of the microbes due to negligent handling of PPE and wrong disposal protocols.

In an attempt to safeguard healthcare workers and citizens from current Coronavirus crisis and other infectious diseases, the research group has developed an affordable antimicrobial (antiviral/antibacterial) spray-based coating for Personal Protective Equipment (PPE) kits to kill and prevent the spread of microbes once they come in contact with the coated PPE surface. The strategic association of metal nanoparticle cocktail, such as copper, silver and other active ingredients, present in the spray acts as an antimicrobial agent. This ensures limited penetration and accumulation of microbial contaminants on PPE. Thus,

the coating has the potential to reduce the risk of secondary infection by limiting the transmission of the microbes.

The innovation is affordable and readily deployable using existing infrastructure available with PPE manufacturers. It can be spray/dip-coated onto any kind of surface including textiles and other medical device surfaces to get rid of microbial load. This will allow reusability of PPEs and easy containment of the microbes.

The research team has developed the prototype of the technology. Further validation of product safety is ongoing and antimicrobial action specifically against Coronavirus will be done at a government facility. The team has filed for a Provisional Patent for the technology.

The technology has several advantages like:

- Killing of microbes will allow reusability of masks and other PPEs. Hence, less burden will be on the manufactures for making millions of masks which are generally thrown away after single use
- Restrict spreading of microbes to fingers and other individuals due to negligent usage of masks where users tend to touch them while removing
- Reduce bioburden and transmission after disposal
- The affordable technology can be implemented through a one-step facile spray/dip method using existing industry infrastructure to coat fabric materials which are commonly used for mask/bodysuits

The technology has been developed by Dr. Biman B. Mandal along with his PhD scholar, Mr. Bibhas K. Bhunia.

3D Printed Ear Guard for Comfortable Use of Face Masks by Healthcare Workers:

Long-time usage of strapped and tight-fitting face masks is painful to the ears. This has been a major concern with healthcare workers who have to wear these masks for hours during duty cycle. Even for commoners during corona crisis, masks are to be worn constantly. To address this critical issue, the research team has 3D printed 'Ear Guard' prototype.

The ergonomical design of the guard holds the face mask strap in a place without giving pressure to the ear. Therefore, masks can be worn effortlessly for hours without pain or discomfort to the wearer. Using 3D printers, these 'Ear Guards' are being made in a free size to fit all.

These are being printed at the Biomaterial & Tissue Engineering Laboratory of IIT Guwahati using polymer resins. The ear guards are affordable, long-lasting and designed to give comfortable wearing experience. Presently, the team is printing thousands of these ear guards to be distributed to hospitals across the Northeast Region and if needed, across India.

3D Printed Ear Guard has been designed and printed by Dr. Biman B. Mandal along with his PhD scholars, Mr. Ashutosh Bandyopadhyay and Mr. Bibhas K. Bhunia.

A 3D Printed Ear Guard for Comfortable Use of Face Masks by Healthcare Workers

3D Printed Ear Guard in use

IIT Guwahati research team develops hierarchically structured graphene oxide nanosheets that can selectively separate oily or aqueous contaminates from respective emulsions

Researchers of Indian Institute of Technology Guwahati have developed a graphene-based superhydrophobic materials that can separate oil and water from both oil-in-water and water-in-oil emulsions, respectively.

Their work has recently been published in the Royal Society's journal, Chemical Science. The research paper has been authored by Dr. Uttam Manna, Associate Professor, Department of Chemistry, IIT Guwahati, along with his research scholars Mr. Avijit Das, Mr. Kousik Maji, and Mr. Sarajit Naska.

Oil–water separation techniques have a number of industrial and environmental applications. Various porous and bulk substrates such as sponge that are made superhydrophobic, have been used to absorb oil from oil-water emulsions. The IIT Guwahati team has shown the efficacy of hierarchically structured graphene oxide nanosheets in removing oil or aqueous contaminates from respective emulsions, thereby effecting separation of oil and water.

Superhydrophobic materials – materials with extreme water repellence – are considered the best materials for removing oil from water, and they are being extensively studied for applications such as water purification and self-cleaning surfaces. The problem with superhydrophobic materials is that they are generally not scalable, or use environmentally toxic products such as fluorinated polymers/small molecules, or have poor mechanical and chemical stability. Moreover, the conventional spongy superhydrophobic materials are inherently less appropriate for separating oil-in-water emulsion due to poor accessibility of the dispersed oil droplets to the oil absorbing superhydrophobic interface.

"The hydrophobicity of materials is largely governed by the physical architecture and the chemical composition, and so such materials can be rationally created by combining low-surface-energy materials with hierarchical roughness", explains Dr. Manna. This is exactly what the group has done in its quest for oil-water separating materials. They have manipulated graphene, a form of carbon, to have superhydrophobic properties suitable for separation of oil from water in emulsions.

The study of graphene for such applications is not unprecedented. Since the award of the Nobel prize to its creators in 2010, graphene – two dimensional structures of carbon – has been extensively studied for a variety of applications. Composed of pure carbon, graphene is similar to graphite but with characteristics that make it extraordinarily light and strong, giving it a moniker of "wonder material" in present day materials science research. Research all over the world have attempted to engineer the structure and composition of graphene to get surface roughness and low surface energy, suitable for use in applications that require superhydrophobicity. Such engineering is challenging and complicated.

The IIT Guwahati team has developed a facile method to produce graphene oxide-polymer composite with hierarchical topography and low surface energy chemistry in the confined space. Such graphene oxide species showed 'confined-super- water-repellence'. They further deposited iron oxide nanoparticles on the two dimensional nanosheets, which made the entire material magnetically active.

"Our graphene oxide composites were able to separate oil from water in emulsions with high efficiency" says Dr. Manna. The uniqueness was that the separation could be brought about even under extremes of pH, salinity, surfactant contaminations etc., as is seen in real life scenarios. The IIT Guwahati's graphene oxide species was capable of selectively soaking up tiny crude-oil droplets in oil-to-water emulsions with high absorption capacity (above 1000 wt%), as well as coalescing larger oil droplets of emulsions from water-in-oil emulsions.

"Further functionalization of this chemically/magnetically active 2D-nano-interface could help in the development of functional interfaces for various applications related to energy, catalysis and healthcare", says Dr. Manna.

(L to R) Mr. Avijit Das, Research Scholar, and Dr. Uttam Manna, Associate Professor, Department of Chemistry, IIT Guwahati

IIT Guwahati students design and develop low-cost intubation boxes

Indian Institute of Guwahati students have designed and developed a low-cost intubation boxes. The device functions as an aerosol obstruction box which is placed atop the patient bed on the head-side, limiting the flow of virus-laden droplets from the patient to the doctor, especially during the process of intubation.

As in the case of COVID-19, patients develop respiratory failure thus requiring assistance in the form of endotracheal intubation. Given the nature of this process, healthcare providers are at risk of contracting the virus via droplets either exhaled or coughed out by the patient. The device is inspired by the design of Dr Hsien Yung Lai, an anesthesiologist from Taiwan.

It is developed and designed by a student venture for medical innovation named Mitochondrial. Mitochondrial is mentored by Dr. S. Kanagaraj and Dr. Sajan Kapil of the Department of Mechanical Engineering, IIT Guwahati. It is a low-cost alternative to intubation boxes and is easier to manufacture and deliver amid the lockdown. The projected cost per box is INR 2000, which is significantly lower than existing alternatives.

The team has received assistance from the DRDO for prototyping and testing at the Solid State Physics Laboratory, New Delhi, and is consulting Dr. Johann Christopher of Care Hospitals, Hyderabad, and Dr. Abhijeet Bhatia of NEIGRIHMMS Shillong, to ensure the efficacy of the design.

Amid the dearth of PPE such as powered air-purifying respirators (PARPs) and well-sealed face masks, it becomes essential to complement the use of makeshift acrylic face shields, N95 masks and surgical respirators, with a proper obstruction for aerosol spewed via the mouth and nose of the patient. The intubation box allows having this protection in place by limiting the infection within the box's volume around the patient. As opposed to other PPE, this box works effectively for multiple doctors and nurses serving the patient. While the transparent material allows visual access to the head of the patient inside, the arm-holes on the box allow for the care-provider to perform any necessary tasks including intubation and extubation, which are both processes known to be cough inducing. Further, the boxes are reusable, as they may be cleaned thoroughly with 70% alcohol or bleach, to allow use for the next patient.

The primary prototype of the design has been completed at DRDO, New Delhi, and the box is currently being reviewed in the field at major COVID-19 care centres, such as AIIMS, New Delhi. Based on the continuous feedback, the design will be further optimised for improved efficacy, before the first batch is manufactured in Gurgaon, Haryana.

Speaking about the development, Umang Mathur, a BTech student of the Department of Bioscience & Bioengineering, IIT Guwahati, said, "We feel that it is our responsibility to contribute to this fight against a global pandemic and there could not be a better time and opportunity for IIT graduates to start building upon their world class education background and exposure, to provide solutions centred around simplicity and make India self-reliant, instead of being dependent on imported technologies especially at this time of crisis".

Speaking on the latest development related to COVID-19, Dr. T. G. Sitharam , Director, IIT Guwahati, "It is a matter of great pride that after the major initiatives taken by faculty members and alumni of IIT Guwahati to develop various products for the containment of COVID-19 and major research initiatives, IITG students are also coming up with novel products and immediate solutions for protecting doctors, nurses and healthcare workers in this national effort against COVD-19. At IIT Guwahati we have initiated the COVID-19 Grand Challenge for encouraging the students to come forward with ideas and solutions to fight this pandemic and we are expecting several products in the near future."

The team has started a crowdfunding campaign in order to manufacture these boxes and provide them to government hospitals for free. The campaign raised a record INR 50,000 within six hours of launching.

IIT Guwahati collaborates with Hester Biosciences Limited to develop vaccine against COVID-19

Indian Institute of Technology Guwahati is collaborating with Hester Biosciences Limited, a pharmaceutical company based in Ahmedabad, Gujarat, to work on the vaccine development against COVID-19. The agreement between the two parties was signed on 15th April 2020.

The vaccine will be based on recombinant avian paramyxovirus based vector platform. The recombinant avian paramyxovirus-1 will be used to express the immunogenic protein of SARS-CoV-2. The recombinant avian paramyxovirus-1 expressing the SARS-CoV-2 protein could be used as a vaccine candidate for further study.

The avian paramyxovirus-1 has been explored as a vaccine vector for various animals and human pathogens. The avian paramyxovirus-1 has been used to express the immunogenic protein of human pathogens such as HIV, avian influenza virus, human parainfluenza virus, SARS-CoV. Similarly, it has also been explored as a vaccine vector for animal pathogens such as infectious bursal disease virus, infectious laryngotracheitis virus, bovine herpes virus, Nipah virus etc.

The team at IIT Guwahati is headed by Dr. Sachin Kumar, Associate Professor, Department of Biosciences and Bioengineering. The team has generated the recombinant avian paramyxovirus-1 based vaccine flatform for Classical Swine Fever and Japanese encephalitis. The role of the Institute is to produce the recombinant vaccine candidate.

Speaking about the vaccine for COVID-19, Dr. Sachin Kumar, Associate Professor, Department of Biosciences and Bioengineering, IIT Guwahati, said, "It is too early to comment on the efficacy and immunogenicity of the vaccine, however, we will be able to reveal more details about this vaccine after the results of animal studies are obtained."

Speaking about the collaboration and role of Hester Biosciences Limited, Mr. Rajiv Gandhi, CEO and MD, Hester Biosciences Limited, said, "In the current pandemic situation of COVID-19, the world is looking at developing preventive and curative measures to safeguard mankind. IITG & Hester have collaborated to develop and manufacture a recombinant vaccine against COVID-19 disease as a preventive measure. Hester's involvement would be from master seed development up to release of the commercial vaccine".
He further added, "Hester has 23 years of experience in vaccine manufacturing on the veterinary side. It manufactures vaccines by using fermentation, tissue culture, continuous cell line and chick embryo origin methods. Hester is also currently working towards developing next generation recombinant poultry vaccines. Being in veterinary vaccine manufacturing, as well as working towards developing recombinant vaccines, Hester has a fairly good understanding and the capability to get into human vaccines, specifically into a vaccine against the COVID-19 disease."
IIT Guwahati and Hester Biosciences Limited expect the vaccine to be ready by the end of this year to start animal studies. The work is currently in its early stage of development.
Prof. T. G. Sitharam, Director, IIT Guwahati, is hopeful that the outcome of this important collaboration will be a win-win situation for the country and will lead to breakthrough results in prevention of COVID-19 as well as provide leads for vaccine developments against other diseases as well in immediate future.

Visit of the Doordarshan NE team to IIT Guwahati to document the details of COVID-19 Research and Product Development. The team visited various departments and centres across the Institute, which included, Nanotechnology, Chemical Engineering, Biosciences and Bioengineering, Electronics & Electrical Engineering and Design. They also interacted with the Director and the Deputy Director of the Institute

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