

# THE ROBOTICS SOCIETY



## AT A GLANCE..



Report on International FDP  
at NIT Calicut



Report on GBM of The  
Robotics Society



Online Webinar Series by  
The Robotics Society



Activities @VIT, Chennai

## ANNOUNCEMENTS

- The 5th international conference on Advances In Robotics (AIR 2021) to be held at IIT Kanpur from June 30 - July 4, 2021. (See the details on Page 2)
- If you are interested in publishing robotic activities of your institution in TRS Newsletter, kindly write us at 'apsudheer@nitc.ac.in'.

### Faculty Development Programme on Robotics, Artificial Intelligence and Control (RAIAC 2020) - NIT Calicut

A six-day Faculty Development Program (FDP) was conducted successfully at the National Institute of Technology Calicut (NITC) on 3rd to 8th February 2020, by the Department of Mechanical Engineering, NITC. The program was held in association with the Indo-Korea Joint Network Centre for Robotics (IKJNCR) and TEQIP-III NITC. The FDP program received an overwhelming response with 40 participants coming from top institutions in South Korea, Russia and India. The program was aimed to provide opportunities to faculty members, research scholars and postgraduate students to enrich their teaching and research skills in the field of Robotics, Artificial Intelligence and Control. The program also intended to develop knowledge of participants with relevant simulation software's by including hands-on training sessions to experience the latest research tools used in the field.

The FDP was inaugurated in the presence of eminent professors namely Dr. Sivaji Chakravorthy, Director, NIT Calicut; Prof S K Saha, Professor, IIT Delhi; Prof Jose Mathew, Head of Mechanical Department, NIT Calicut; Prof Seul Jung, Professor, Chungnam National University, South Korea; Prof Evgeni Magid, Professor and Head, Kazan Federal University, Russia; Prof Pushparaj M Pathak, Professor, IIT Roorkee; Dr. Sudheer A P (Coordinator RAIAC 2020) and Dr. G Varaprasad (Coordinator RAIAC 2020). Prof. S K Saha gave the presidential address and congratulated the Department of Mechanical Engineering, NITC for organising this program that promotes robotics. Dr. Sivaji Chakravorthy, alongside the other dignitaries, inaugurated the FDP by lighting the candle and he shared his perspectives regarding the program afterwards. He gave a motivational and inspirational talk to all participants and asked them to get actively associated with research. Prof Seul Jung, Prof. Evgeni Magid and Prof. P M Pathak also congratulated the Department for organising such an event and requested all the participants to enrich their knowledge by actively participating in this program. The other invited speakers for the FDP were Prof. Ashokan T from IIT Madras; Prof. Ashish Dutta from IIT Kanpur; Dr. Santhakumar Mohan from IIT Palakad; Dr. Dwarakanath from DRDO, Pune; Dr. Praveen Sankaran from NIT Calicut; Dr. Lijiya A from NIT Calicut; Dr. Sreekanth M, CEO, Kabani Tech, Shornur and Mr. Rajeev Lochana from Amrita School of Engineering, Bangalore, India.



The Indo-Korean meeting was held on 5th February 2020 at the MED seminar hall, NITC to evaluate the progress of Indo-Korean Joint network projects. Shri. Rajiv Kumar, DST welcomed all speakers and participants to the meeting over the phone. Prof. S K Saha spoke on the history, structure and objectives of Joint Network Centres. Further, the current status of the fund was also presented. Prof. P M Pathak detailed on the progress of the collaborative work. Dr. Shanmugam, Scientist, NAL Bangalore, India, briefed on the progress of the project titled "Morphing wing technology for flying robot". He detailed on the formulation of the research gaps, conceptual model, experimental works carried out till date and the budget summary. Prof. Seul Jung presented the progress from the Korean side and listed the various nodes and counter nodes. He also showed the work progress of summer interns from India in the projects: Joint motion using ROS; Solar panel detector. Prof. S K Saha concluded the session by conveying his thanks to all the nodal representatives and the audience.

The FDP concluded with a valedictory function on 8th February 2020 in the presence of Prof Evgeni Magid, Dr Dwarakanth, Coordinators RAIAC 2020, organising committee members and all participants. The participants were distributed with certificates on successful completion of the six-day training program. The vote of thanks was given by Dr Sudheer A P, RAIAC 2020 Coordinator. He highlighted the immense contribution of the organising committee members and experts. He heartily thanked all the speakers and the participants for making this event a grand success. The valedictory session ended with the national anthem.

## AIR 2021 NOTIFICATION

**Advances in Robotics (AIR)** is a series of biennial conference organized by The Robotics Society. The conference aims to create a forum to present and exchange new ideas by researchers and developers from India and abroad working in the fields of robotics and its applications. The conference would have plenary talks, oral and poster presentations, and special industry oriented sessions.

AIR 2021, the 5th conference of the series, will be conducted in "Fully Online Mode" by IIT Kanpur, Kanpur, Uttar Pradesh, India during **June 30-July 4, 2021**.

The organizers of the conference invite unpublished research work in the various fields of Robotics. The conference follows a strict double-blind review process. All the accepted and presented papers will be published as ACM (Association for Computing Machinery) as International Conference Proceedings Series (ICPS) with ISBN No. 978-1-4503-8971-6.

For updates visit : <https://advancesinrobotics.com/2021/>

# MINUTES OF GENERAL BODY MEETING (GBM) OF THE ROBOTICS SOCIETY (TRS)

## 19TH SEP. 2020 (ONLINE)

The General Body Meeting (GBM) of The Robotics Society was held on 19th Sept. 2020. Prof. T. Asokan (Secretary) welcomed the members present. Prof. Santanu Chaudhury (President) delivered the presidential address and emphasized the importance of having regular activities of the TRS and requested all members to actively participate in TRS programs.

Important discussion points and decisions.

1. Prof. T. Asokan (Secretary) presented the previous GBM meeting minutes and the decisions. The minutes of earlier GBM were circulated over email and the members approved the minutes of the GBM. The minutes of the previous GBM is enclosed as Annexure 1.
2. Prof. T. Asokan (Secretary) presented a report on the activities of the society in the last one year and provided the current status of the membership. The report is enclosed as Annexure 2.
3. Prof. Mohd Suhaib (Treasurer) presented the statement of last one year accounts and the general body approved the same (Annexure 4).
4. Secretary presented the decisions taken by the TRS GC during the governing council meetings (13th April, 3rd June in 2020). Some of the major decisions are:
  - a. TRS Governing council has decided to accept the 50% or more of the profit generated in AIR 2017 (IIT Delhi) and AIR 2019 (IIT Madras) as contribution to TRS from the organizing Institutes.
  - b. It was decided that TRS will extend financial support to conferences/workshops organized by Institutes on behalf of TRS. An MoU will be signed by the organisers and TRS for this purpose, detailing the support provided by TRS and the profit sharing method.
  - c. TRS will organise online seminar series, primarily for the benefit of TRS members. Some of the seminars will be made open to public to publicise the activities of TRS to a larger audience and to attract more members.
  - d. TRS will collaborate with the Technology Innovation Hubs (TIH) for skill development and extension activities related to Robotics.
5. Validity of the student members (B.Tech, M.Tech and PhD) will be capped at 5 years. All the student memberships issued more than 5 years ago will be terminated. They will be given an option to convert to full membership, failing which the memberships will be cancelled.
6. In order to smoothen the process of membership management, it was decided to go for an online portal for membership. Dr. Buddhadeb Pradhan volunteered to create online members portal. A sub-committee of Dr. Shital Chiddarwar, Mr. Rajeevlochana and Dr. Buddhadeb Pradhan has been created to implement the same.
7. Proposal for a Journal by the Society: A sub-committee to be formed to look into the feasibility.
8. Three Student chapters (of erstwhile RSI): Punj Robotics (IIT Ropar), Army Institute of Technology (Pune) and NIT Calicut will have to fill up new Student Chapter form and reapply. Their older student chapter number (if it existed) can be assigned or it can be considered as new entries.
9. A proposal to let student chapter have a validity of 5 years was proposed. At the end of the term, their performance can be checked and then be continued.
10. Newsletters in 2019 (2 editions were released). In 2020, the first edition of newsletter will be finalized in next 1-2 weeks.
11. Standardisation cell in TRS: Prof. Saha suggested working in coordination with the Bureau of Indian Standards (BIS) for creation of a standardisation cell in TRS to develop/suggest standards for robotic systems. Secretary informed that currently Prof. S Ohol (COEP Pune) and Prof. Vinod (PSG Tech Coimbatore) are members of the BIS PGD 18 committee. The proposal to form a sub-committee/panel within BIS for robotics related activities, spearheaded by TRS, will be discussed further with BIS and suitable action will be initiated.
12. It was proposed to organize a Grand Challenge, open to students, by TRS. The competition could be Robotics hackathon. It can be

### Agenda

1. Welcome Address
2. Address by the President, TRS
3. Approval of minutes of previous GBM (Annexure 1)
4. Presentation of report of activities: Secretary (Annexure 2)
5. Ratification of decisions taken by Governing Council (Annexure 3)
6. Presentation of statement of accounts: Treasurer (Annexure 4)
7. Discussion on
  - a. TRS news letter
  - b. Membership and database
  - c. Creation of Standardization Cells in TRS
  - d. TRS activities for 2020-21
  - e. AIR 2021
  - f. Election of new Governing council.



publicised to the Student Chapters and others also open to others. Prize money will be provided by TRS. A committee comprising Dr. Debanik Roy, Prof. Ohol, Dr. Srijan Bhattacharya, Dr. Saravana Perumal, and Prof. Vinay Patel has been formed to plan and conduct this event.

13. Prof. Saha requested for Rs. 100,000/- per annum for running the TRS offices at IIT Madras and IIT Delhi. This will be equally shared between IITM and IITD for staff and other expenses. GBM approved this request.
  14. AIR 2021- Prof. Ashish Dutta informed that the website for AIR 2021 is ready and can be accessed at <http://www.advancesinrobotics.com/2021/>. Organizing Committee to be formed.
  15. After a debate on to host AIR2021 offline (physical conference) or online, it was decided that the conference can be made completely online as the Covid pandemic has caused lot of travel and logistic restrictions. Changes to be made on the website accordingly.
  16. Election of new Governing Council.
    - a. During AIR2017, a new Governing Council (GC) was created for the duration July 2017 to June 2020.
    - b. Secretary informed the need for electing a new Governing Council and explained the rules/regulations for the same.
- After discussion, the GBM approved the continuation of the current GC for another term of three years with the inclusion of 4 additional members in place of those who completed 6 years as members.
- i. Prof. G C Nandi, IIIT Allahabad
  - ii. Prof. Ekta Singla, IIT Ropar
  - iii. Dr. Vinod B , PSG College of Technology Coimbatore
  - iv. Dr. Budhadeb Pradhan, NIT Jamshedpur

**The new GC is given below:**

|   |   |   |
|---|---|---|
| <p><b>President</b><br/>Prof. Santanu Chaudhury<br/>Director, IIT Jodhpur and Professor (Electrical Engg)<br/>IIT Delhi, Delhi, India</p> <p><b>Vice-President(Academic)</b><br/>Prof. Subir K. Saha<br/>Dept. of Mechanical Engg.<br/>IIT Delhi, Delhi, India</p> <p><b>Vice-President(R&amp;D and Industry)</b><br/>Dr. Debanik Roy<br/>BRNS/BARC, Mumbai, India</p> <p><b>Secretary</b><br/>Prof. T. Asokan<br/>Dept. of Engineering Design<br/>IIT Madras, Chennai, India</p> <p><b>Treasurer</b><br/>Prof. Mohammed Suhaib</p> | <p>Dept. of Mechanical Engg.<br/>Jamia Millia Islamia University, Delhi, India</p> <p><b>Editor (Newsletter)</b><br/>Dr. Sudheer A. P.<br/>Dept. of Mechanical Engg.<br/>NIT Calicut, Kozhikode, Kerala, India</p> <p><b>Membership</b><br/>Dr. Shital Chidwar<br/>Dept. of Mechanical Engg.<br/>VNIT Nagpur, Nagpur, India</p> <p><b>Student Activity Coordinators</b><br/>Dr. Pushparaj M. Pathak<br/>Dept. of Mechanical Engg.<br/>IIT Roorkee, Roorkee, India<br/>Dr. Shantipal S. Ohol<br/>Dept. of Mechanical Engg.<br/>College of Engineering, Pune, India</p> | <p><b>Web Coordinator</b><br/>Mr. Rajeev Lochana G. Chittawadigi<br/>Dept. of Mechanical Engg.<br/>Amrita Vishwa Vidyapeetham University, Bangalore, India</p> <p><b>Additional Members</b><br/>Mr. Manjit Singh (BARC Retired)<br/>Prof. Ashish Dutta (IIT Kanpur)<br/>Prof. Shibata Tomohiro<br/>(Kyushu Inst. of Tech., Japan)<br/>Prof. G C Nandi, IIIT Allahabad<br/>Prof. Ekta Singla, IIT Ropar<br/>Prof. B Vinod,<br/>(PSG College of Technology, Coimbatore)<br/>Dr. Budhadeb Pradhan, NIT Jamshedpur<br/>Mr. Amudhan AN (NIT Calicut)<br/>Mr. Ashish Majithiya (Nirma University)</p> |
|---|---|---|

17. Other matters
  - i. TRS journal: Prof. Santanu suggested for exploration of TRS publishing a journal in association with reputed publishers. It was suggested to have a committee to look into this possibility.
  - ii. Mr. Rajeev Lochana mentioned that the TRS will be having its 10th year in 2021. It will be good to announce the journal during the 10th year celebration.
  - iii. Dr. Shibata suggested having a special issue in Advanced Robotics journal to commemorate the 10th anniversary. This was welcomed by everyone and Prof. Shibata volunteered to explore further.
  - iv. It was suggested to have online webinar series for undergraduate students. It was decided to have a series on ROS. Dr. Suril Shah volunteered to coordinate this activity.
  - v. Prof. Ashish Singla offered to share his teaching videos through TRS platform for the benefit of students. This was accepted by the members.

Without any further matters to discuss, the meeting ended with a vote of thanks.

# ONLINE LECTURE SERIES BY THE ROBOTICS SOCIETY

In the times of COVID-19 and Lockdown, the academic learning and research has taken a hit. To ensure the robotics research progresses, TRS has planned Online Lecture Series, The webinars in this series were planned and held as detailed below. All the webinars were open for the members of The Robotics Society and also for general public. More details about the registration and detailed information about the webinars can be found at <http://rs-india.org/online-lectures/>. The videos recorded during the webinars are available on the above website and are also available on the YouTube channel of TRS at <https://youtube.com/channel/UCLL8oRHXPZf3q10dklBqIq>

## Webinar 1: Robotics in the Times of COVID-19

July 16, 2020

Welcome Address by Prof. T. Asokan (IIT Madras), Secretary of TRS.

“Role of Robotics in Pandemics like COVID-19” by

Prof. Santanu Chaudhury (Director, IIT Jodhpur), President of TRS.

“The Role of Autonomous Systems in a Socially Distant World” by

Prof. Chiranjib Bhattacharyya, IISc Bangalore.

“Tele-robotics for Remote Diagnosis” by Prof. Chetan Arora and Prof. S. K. Saha, IIT Delhi.

“Robotics Technologies Developed at IIT Jodhpur to tackle COVID-19” by

Prof. Suril V. Shah, IIT Jodhpur.

“Collaborative Mobile Robots and their Impact in Manufacturing, Warehousing, and Healthcare

Sectors during these Unprecedented Times of COVID” by Mr. Rishabh Agarwal,

Co-founder and CEO, Peer Robotics

Concluding Remarks by Prof. Subir K. Saha (IIT Delhi), Vice President (Academic) of TRS

**Robot in operation**

**Robotic Swab Sample Collection**

Using two Universal Robots UR3 cobot arms and a custom 3D-printed end effector, it picks up the swab after the patient has scanned an ID card. The robot then uses its vision system to identify the right points to swab in the patient's throat. (Lifetime Robotics, SDU, Denmark)

An start-up based at the Indian Institute of Management, Kozhikode, (IIM-K), has developed a functional prototype of a robotic swab sample collection arm that can be remotely controlled to collect a speedy swab sample.

**RCM with Linear Motion Guide**

Linear Slide  
Pitch  
Roll  
Translation  
3 DOF Surgical Tool  
Linear drive motor

Features

- Reduced inertia due to rope drive
- Preloaded to negate backlash

**Smart Hospital Robots**

Temperature Screening  
Conversational AI  
Helping

**Using AI to Decode COVID-19**

Class Confidence

|           |     |
|-----------|-----|
| Normal    | 0.5 |
| Bacterial |     |
| Viral     |     |
| COVID-19  |     |

**Positioning Robotics**

Positioning Robots used for Minimally Invasive procedure

**Mazor Robotics**

**ROSA Robotics**

Robot Positions the arm as per the Plan created By the Surgeon.

**Mazor Robotics**

**Globus Robotics**

**Cable-Driven Robot (CDR) Modeling and Analysis**

- Actuated by lightweight but unidirectional force elements
- Adaptable cable routing: co-shared architecture
- Actuation redundancy: at least  $n+2$  cables for  $n$  DOFs
- Cables can pull but not push: conventional manipulators analysis not directly applied
- CDR workspace: taskspace region where cables of the mechanism remain in tension

**CDR Setup**

$$\tau = AT$$

$$T = A^{-1} \tau + \eta(A)z$$

$$A^* = A^{-1} + (A + A^*)^{-1}$$

Vineet Vashista

## Webinar 2: Healthcare Robotics

Aug 13, 2020

Welcome Address

Prof. Suril V. Shah, IIT Jodhpur

Design and Control of Surgical Robots

Prof. T. Asokan, IIT Madras

Design of Healthcare Robots

Mr. K. Puhazhendi, Director – Engineering, M/s Perfint Healthcare Pvt. Ltd., Chennai

Rehabilitation Robotics: A focus on human-centric gait rehabilitation

Prof. Vineet Vashista, IIT Gandhinagar

Question & Answer Session and Panel Discussion

Vote of Thanks

Prof. A. P. Sudheer, NIT Calicut

**Webinar 3 Legged Locomotion in Robotics:**  
 Biped and Quadrupeds  
 Oct 30, 2020

**Welcome Address**

Prof. T. Asokan, IIT Madras (Secretary, TRS)

**Biped Locomotion-Design and Control**

Prof. Ashish Dutta, IIT Kanpur

**Quadruped Locomotion**

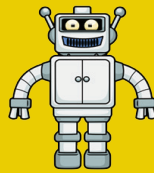
Prof. Pushparaj M. Pathak, IIT Roorkee

**Question & Answer Session and Panel Discussion**

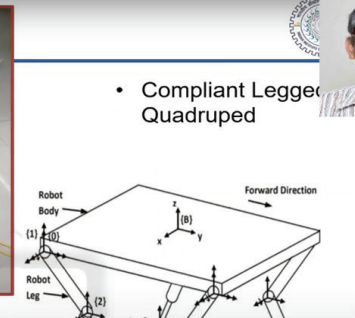
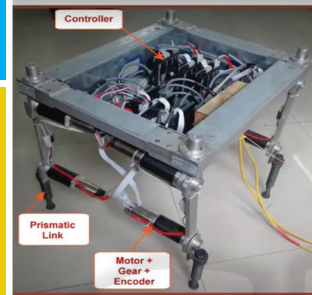
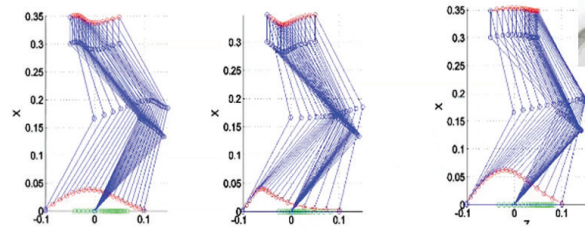
**Vote of Thanks**

Prof. Suril V. Shah, IIT Jodhpur

Recent studies show that loneliness and isolation due to coronavirus has created a global threat among people of all age groups. The BeamPro robot housed at Alexandra hospital, Singapore is programmed to chat in four different languages with patients under isolation. This robot also makes it possible for the doctors to remotely monitor the patients.



**Optimal trajectories for rigid joints for different time step**



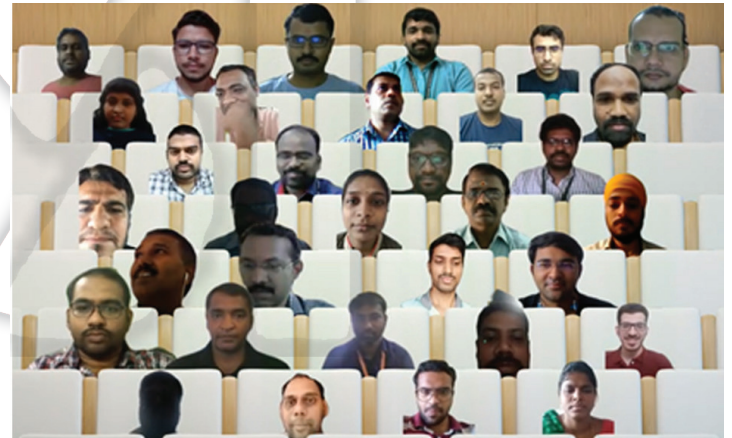
**Compliant Legged Quadruped**



**REPORT ON AICTE SPONSORED ONLINE STTP ON “EMERGING RESEARCH TRENDS ON ROBOTICS AND APPLICATIONS (ERTRA) 2020” AT MEPCO SCHLENK ENGINEERING COLLEGE**

The Department of Electronics and Communication Engineering organized online Short Term Training Programme (STTP) on “Emerging Research Trends on Robotics and its Applications (ERTRA)”. This programme was sponsored by AICTE and conducted in three phases. Dr.J.Senthil Kumar, Associate Professor and Mr.G.Sivasankar, Assistant Professor (Sr Grade) were the co-ordinators and Dr.R.Shantha Selva Kumari, Sr.Prof. & Head was the convener for this STTP. This STTP provided a platform for the researchers, industry persons and academicians to enhance their knowledge in Robotics research. The Robotics Society (TRS) experts supported this STTP by sharing their expertise in the field of Robotics.

ERTRA Phase I was organized from 03rd to 08th August 2020 and focused on Manipulator Kinematics & Dynamics, Trajectory Planning, Multibody design and Reliability Analysis of Safety Critical Robotic Systems. Hands-on RoboAnalyzer, Proteus, Raspberry Pi and python programming were done. Phase II was conducted from 24th to 29th August 2020 with Autonomous Mobile Robots and navigation as the main theme. Dr.Yuichi Kobayashi, Associate Professor, Dept. of Mechanical Engineering, Shizuoka University, Japan delivered the inaugural address. The expert lectures focused on Mobile Robot Kinematics, Maneuverability, Modelling, Simulation and control, Path Planning, Visual odometry and SLAM, Bio Inspired Mobile Robot, Service Mobile Robot, Robotics Driven Neuro rehabilitation, Cognition in Autonomous Mobile Robot and Design and Control of Autonomous underwater Vehicles. Hands-on Webots Simulator, V-Rep and MATLAB were also carried out. Phase III was conducted from 5th to 10th October 2020. The theme was Advancement in Robotics, which included Robot Operating Systems (ROS), Vision based Planning and control of Unmanned Aerial Vehicles (UAV), Interactive Social Robots, Cobots, Soft Robotics, Sensor Fusion, Reinforcement Learning, Deep Learning and Internet of Robotic Things. Dr.Tetsuya Ogata, Director, Institute for AI and Robotics, Waseda University, Japan delivered the Inaugural address and Dr.Yusuke MAEDA, Professor, Division of Systems Research, Yokohama National University, Japan delivered the Key note address. Hands-on training in ROS, Gazebo Simulator using TurtleBot3 and Rviz tool were done.



**How to become a TRS member : Visit → <http://rs-india.org/membership/>**  
**How to start TRS Student Chapter : Visit → <http://rs-india.org/student-chapter/>**



## ACTIVITIES @ VIT, CHENNAI

Robotics group (VITCC), the official robotics group of Vellore Institute of Technology Chennai is a community of both UG and PG students from various branches of engineering. These students are active in developing industrial robots for multiple applications such as pick and place, palletizing and de-palletizing, surveillance and quality inspection of underwater pipeline systems to find the cracks, etc. The VITCC group encourages students to participate and organize various workshops and seminars to procure creativity and knowledge in robotics. A brief report on few of the works carried out are given below.

### Stereo Vision based robot for Remote Monitoring with VR support

We have developed a robotic system for remote visual monitoring that mimics a human head function with the help of stereovision, deep learning, internet devices with mobility of 3-DOF to mimic the movements of a human head. This project provides a realistic visual monitoring system apart from the regular TPZ cameras available. With the help of stereo cameras and image processing, we were able to achieve a quality real-time 3D experience in VR with two webcams for stereovision. The 3-DOF robot manipulator offers a low-cost VR box for remote monitoring. Deep learning permits us to train different models combining object detection, facial recognition, and depth perception information to make advanced predictions and perception about the environment. The homemade 3D printed stereovision system after proper calibration was able to depth map up to 17 feet in outdoors, which proves to be a reliable, low-cost depth sensing technique. An android application was created to interface with the cloud using HTTP in LAN. A latency of about 100-150 milliseconds was achieved with deep learning and video transmission to the VR Set up. The user-friendly android application for VR view is a very versatile software that receives the stereo images feed and also sends the user head position in real time to the robot with low latency as 60 milliseconds. This project is a concept proof of how an IOT system with computer vision can be used for advanced and realistic monitoring solutions in homes and industries. In future, the fail proof MQTT protocol can be used for active peer to peer communication. Figure 1 shows the conceptual design of the 3 DOF Stereovision robot and its video feed using Deep Learning.

### IoT Based Multi-Terrain Rover for Urban Search and Rescue Application

A novel design of a multi-terrain multi-purpose rover is fabricated and implemented for rescue and surveillance applications in rocky and muddy environments by the aid of its modular drive systems. The rover has an empirical range of incline up to 47 degrees because of its optimized chassis design which supports the rover to achieve this result. The maximum operable range is 300m with an external high gain antenna in general conditions with an endurance rating of around 2 hours. The charging time required is 4 hours using a regular 12V DC power supply. The arm supports a payload of 25 Kg which can be lifted over a height of 50 cm. A transmitted feed can be adjusted based on its variable resolution it has minimum latency while transmitting at 1280\*720 resolutions with the video quality set to medium. Higher FPS is observed at QVGA (320\*240) resolution. The feed can be modified extensively with ability to stream in Flash, native Browser, Java and JavaScript, respectively. It is designed with the ability to control exposure and gain alongside manual routine trigger for focus. Modification of ISO sensitivity is possible with anti-banding, white balance and lock-exposure being an addition. A combination of rovers acting in a cobot system helped to rescue a test object weighing 75 kg in stimulated conditions. Figure 2 shows the prototype of the multi-purpose rover system.

### Obstacle avoidance system and wireless communication for an unmanned underwater vehicle UUV for low depth water surfaces

An obstacle avoidance unmanned underwater vehicle for the known environment is fabricated. Various simulations and experimental studies were conducted for the low depth water sources applications. A simplified unmanned vehicle model is chosen as a standard model for the analysis. Figure 3 shows the prototype of the developed UUV. The developed model is configured with four-thruster structure. The CFD analysis is conducted to study the hydrodynamic performance of the underwater vehicle with different motion tests. The independent mesh analysis is carried to find the optimum mesh size

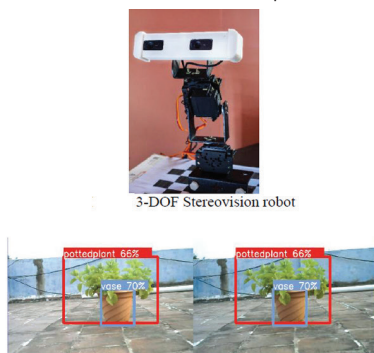


Figure 1 Stereo Vision set for remote monitoring

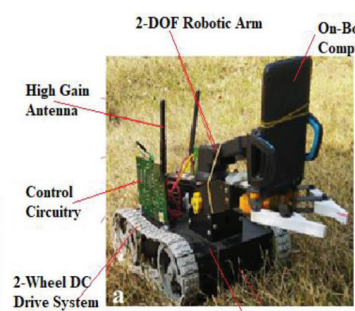


Figure 2 IoT Based Multi Terrain Rover

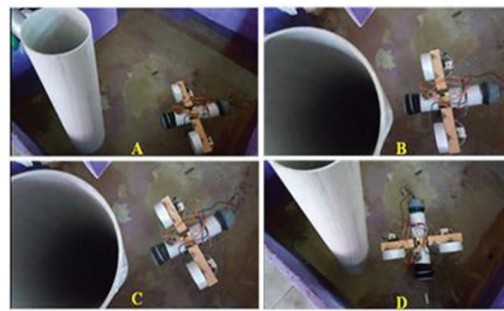


Figure 3 Obstacle avoidance UUV

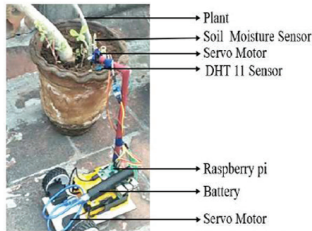
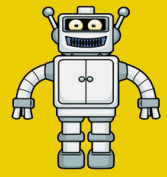


Figure 4 IoT controlled Agri-Robot for Roof Gardening



Figure 5 Mars Rover By TECHNOCRATS

A government hospital in Ernakulam, Kerala has deployed a robot to serve food and medicines to coronavirus patients with an aim to reduce the risk of infections for doctors and health workers. The robot named 'KARMI-Bot' is actively being used at the medical college's isolation ward. The robot is developed by ASIMOV robotics, a company working under maker village of Kerala start-up mission.



The fine-mesh method is used with 0.9 million cells. The largest possible time-step to successfully carry out the simulation for the selected mesh is 0.0001 s. The CFD analysis for pure surge motion, heave motion and the moving obstacle is carried out for the fine-mesh method. The drag value for each motion is calculated. Due to the upthrust experienced by the vehicle, the drag of the heave motion in the downward direction is found to be more than surge motion. In experimental studies, motion testing is successfully carried out for surge motion, yaw motion and heave motion with respect to time. The heave motion velocity is found to be more than the surge motion velocity because of the buoyancy force. An IR sensor is deployed for obstacle detection in the underwater environment, and the obstacle detection is found to be satisfactory when the UUV speed is 0.01 m/s.

### Development of IoT controlled Agri-Bot for Roof Gardening Application

Roof Gardening is one of the quite upcoming trend and hobby among the people of urban areas. With the increasing number of the population over the world, the demand for agricultural products has also increased. This work presents an IoT based bot for growing plants and the condition of the plant can be monitored based on the report generated from sensors via email or SMS messages to mobile phone. This helps the person to monitor the condition of the plant from far distances. Based on the sensor data, the moisture content in and around the soil can be determined. Accordingly, watering can be done to the plant as per the need. To water the plant, a reverse L-structure is provided, and the valve is controlled through a servo to cut-off the water supply, as shown in figure 4. The VITCC Robotics club takes part in organizing workshops and exhibitions in other schools and colleges. The student club has proved its active participation in international Robotics competitions. The group has also been a constant participant in International Robotic competition, since 2013 like Robocon. Figure 5 shows the TECHNOCRATS – MARS ROVER Team students' participation in Indian Rover Challenge 2019 competition organized by 'Mars Rover Manipal' of Manipal Institute of Technology and out of 32 teams around the world this team secured the 5th place in the competition. Similarly, the Indian Rover Challenge 2020 competition was organized by Vellore Institute of Technology, Chennai in which the TECHNOCRATS – MARS ROVER Team won best Emerging Team award

## STUDENT CHAPTER ACTIVITIES/ACHIEVEMENTS

A team of students of BVM Engineering College and members of TRS Students Chapter, BVM were selected as the Joint Winner for the final submission of working prototype of six wheeled rover in the ROBOFEST- 1.0 competition - Category VI organized by GUJCOST, Gujarat. The team is awarded cash prize of Rs. 2.5 lakhs with certificates. The team has been awarded total cash prize of Rs. 5 lakhs in the various stage of the competition. The Rover, submitted by the students of BVM, has been selected for display in Robotic Gallery at Gujarat Science City/Regional Science Museums. The rover is an all-terrain, six-wheeled vehicle with Rocker Bogie mechanism, controlled by NVIDIA Jetson Nano board through IoT based commands and powered by Li-Po batteries.



The rover is equipped with LiDAR sensors (2D mapping), ultrasonic sensors (Obstacle avoidance), GPS module, compass and camera (visual data) to explore the site where human accessibility is negligible or nil. To avoid obstacles during the exploration, four ultrasonic sensors are used. The GPS module and compass mounted on it helps to reach the required location and camera mounted on it gives real time pictures of the site. The Jetson Nano board has in-built GPU and helps to carry out exploration of the site with the help of LiDAR (360 Degree, 2D mapping) sensor. This rover will help in exploring sites like mines, fire hazards, etc. where terrain could be uneven, low lights, unknown environment etc.

Hussain Badri, Harshil Patel and Jay Prajapati from Mechanical Engineering Department and Dhairya Parikh and Ishwariya Joshi from Electronics Engineering Department have completed this project under the guidance of Prof. Vinay J. Patel.