



**TRS BVM Student Chapter Inaugural Function
And
TEQIP – III Sponsored Guest Lecture
On
“Autonomy for Robots – Challenges and
Opportunities”**

Report

THE ROBOTICS SOCIETY STUDENT CHAPTER

Reg. No.: TRS-SC/20/007

BIRLA VISHVAKARMA MAHAVIDYALAYA

[AN AUTONOMOUS INSTITUTION]

MANAGED BY CHARUTAR VIDYA MANDAL

ENGINEERING COLLEGE, VALLABH VIDYANAGAR: 388 120

|| INAUGURATION EVENT

The Robotics Society BVM Student's Chapter is glad to announce its very own inaugural ceremony which was followed by a technical session. The inauguration event was on Google Meet/YouTube where many chief guests and students were invited. The event included its Inauguration, a tour on our Website, and a Technical Session on "Autonomy for Robots - Challenges and Opportunities" by the Chief Guest. Everyone including members and faculties associated with The Robotics Society was excited for their enrollment under The RSI (Robotics Society of India).



Date: 18th July 2020

Time: 11 am onwards

Chief Guest: Dr. T. Asokan

The event was blessed by

- Er. Bhikhubhai Patel - Chairman CVM
- Dr. T Asokan, Secretary TRS & Head, and Professor at IIT Madras.
- Prof. (Dr.) I N Patel - Principal, BVM
- Prof. PM George - Head and Professor Mechanical Department, BVM
- Prof. (Dr.) Vinay J Patel - Faculty Advisor, TRS BVM
- Prof (Dr) DM Patel -Faculty Advisor TRS BVM

by their inspiring words

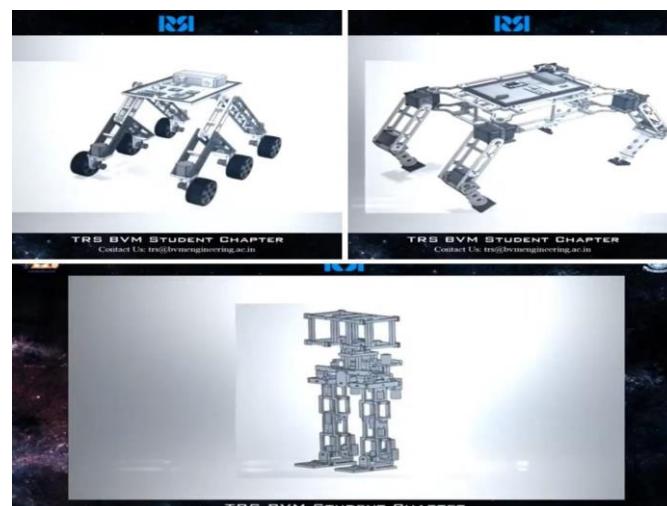
The Ceremony started with the blessings of God through Prayer. Later an Introductory Message was given by Head of Mechanical Department; P.M.George. He also introduced our Chief Guest Dr. T. Asokan- secretary, TRS head and professor, IIT Madras.

Prof (Dr) I N Patel Sir, Principal of Birla Vishvakarma Mahavidyalaya shared his views by starting his speech by showing the greatness of the college and its students and their enthusiasm for participating in many events related to technology, sports or cultural event throughout the nation. He mentioned how students worked under the guidance of Er. Bhikhubhai Patel, chairman of Charutar Vidya Mandal, and how he always mentored all the students for their future. He even said, "BVM always works, always tries hard to focus on advance core values and keep a cope with the trend going in the current time". Even he was interested in the field of robotic for the past few years and wanted to make it the main subject for students to study because of the growth of robotics for the past few years which he explained by pointing out various examples of robots used nowadays. Even during this pandemic robots are being used in hospitals for serving and many other purposes. He concluded his speech by thanking each and everyone for their time and support.

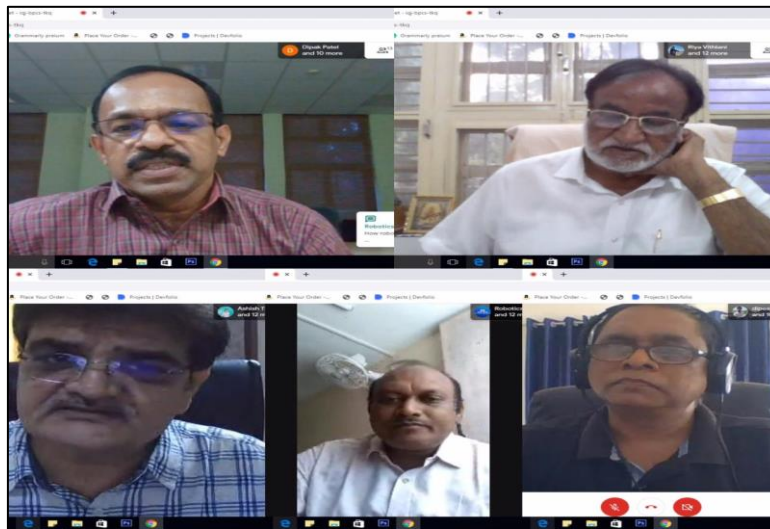
Later, the chairman of Charutar Vidya Mandal Er. Bhikhubhai B Patel shared his views. He started by launching the website and giving us a quick demonstration of the same. "BVM is always a step ahead in justification and addresses the challenges of making progress", he quoted. He even said about the encouragement we students get by such a platform which organizes co-curriculum activities which are noticed in national as well as international level, it helps students to bring the hidden talent within them, express innovative thoughts, demonstrate their creativity and apply technology for inventions. Even he showed the importance of robotics by noting the various application of it in many fields such as medical, factories, military, etc. He then concluded his speech by congratulating everyone and mentioning that these chapters will motivate other colleges in CVM to make progress.

After the motivating words of chairman sir, Prof (Dr.) Vinay J Patel, faculty advisor TRS BVM student chapter, Professor in the mechanical engineering department, BVM talked about the foundation of TRS that originally there were a couple of postgraduate students and few faculty who used to work on their projects that were related to robotics and had a meeting once a week. Later as Robotics is a multidisciplinary subject they took help from faculties of other departments such as a computer, electronics. After a few weeks, even undergraduate students took interest and started attending the meeting. Later when the challenges increased they took help from faculties of other colleges in Vidyanagar and started meeting once a month. Later on, they named the group The Robotics Group, Vallabh Vidyanagar. With the help of TEQIP-III, SSIP, and CVM funds these funds started organizing seminars and workshops for students and make them more attracted to the field of Robotics. In the year 2019, three teams from BVM participated in various hackathons and competition starting with a total of three projects which were,

- **Quadruped**-As its name suggests, Quadruped Robots have four legs or limbs and follow the gait patterns of quadruped animals. Quadruped robots can mimic animal walking gait and they have certain advantages like walking on terrain and extremely rough surfaces.
- **Rover**-A rover (or sometimes planetary rover) is a planetary surface exploration device designed to move across the solid surface on a planet or other planetary-mass celestial bodies.
- **Painting Robot**-A painting robot is a fully automated robot which works based on 2D Plane Coordinates and can draw a sketch of any image using the tool changing mechanism.



These projects were not a part of the student's academic everyone did this because of their interest in the field of Robotics. In these competitions, the students even won prize money by qualifying all the rounds. This is when everyone decided to enrol themselves in RSI (Robotics Society of India). Later on, when students participated in the group a lab was created where students could work after college hours and the lab was accessible 24×7 with various facilities such as Internet connection, computer, various circuits, and lot more. Now The Robotics Society BVM is looking forward to making a maker's space in the college where students can explore different techniques and concepts with Industrial exposure. He then concluded his speech by showing the introductory video of the TRS BVM student chapter.



|| GUEST LECTURE BY DR. T ASOKAN

After the inaugural ceremony, our chief guest Dr. T Asokan Secretary of TRS India Head & Prof at IIT Madras headed with a Technical session on the topic "Autonomy for Robotics: Challenges and Opportunities". The main objective of the webinar was to make everyone aware of the increasing scope and challenges for the same in the field of Robots. Beginning with a brief history of Robotics Society found in the year 2011 by only a few students and teachers working in the area of robotics, sharing their ideas & knowledge by working together; this was just the beginning of it. International conferences, National workshop, Hackathon plays a key role in spreading awareness as well as bringing up hidden knowledge among students & teachers.

The topics covered in the session are listed below:

- Autonomy for Robotics
- Unmanned Robotic Vehicles
- Remote Operation
- Autonomous robots
- General control system
- Case study: Autonomous Underwater Robot
- Modelling and simulation
- Design of controllers

- Path planning and Obstacle avoidance

Speaker enlightened us about the evolution of Robotics Research how with passing time there is advancement in its structure, work, and complexity.

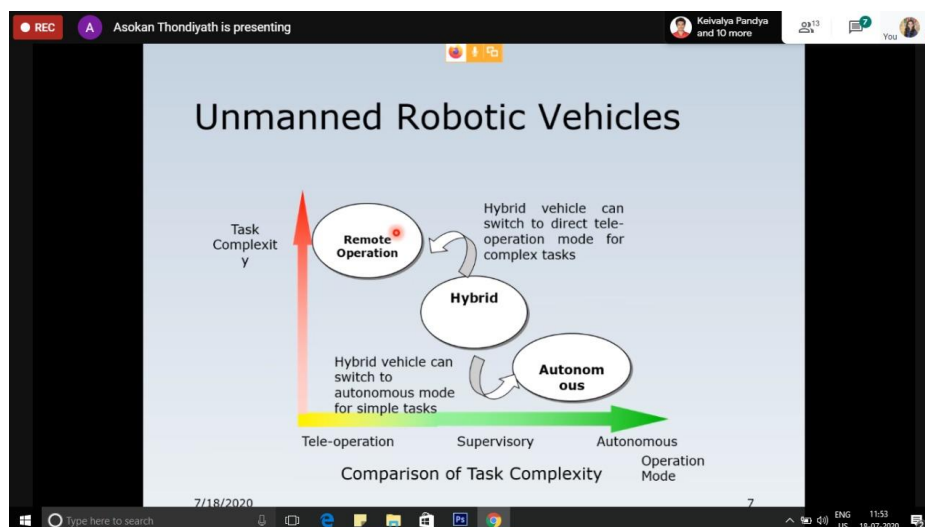
- 1960: Era industrial Robots
- 1970: Robots with mini size handling multi-tasks like mobile, humanoid robots
- 2000: Time when research papers were converted into the application; field service robots applicable for the daily purpose for security, service which increases productivity.

Speaker gave a brief intro to Unmanned robots; Tele-operation (Tele operation & Tele-presence). How just from distance robots can be operated with just a simple device or a wireless network (Wi-Fi, Bluetooth, tethered connect) semi-autonomous like tank operating from distance without getting physically present in it. Nowadays it is also possible to communicate with remote people & present to place being physical absence with the advancement of robots. Tele surgery is a great step in medical; robots conducting surgery by just a few simple commands living far from that operation there.

The next topic of the session was Autonomy of robots; it's our future and it has immense applications in the field such as spaceflight, factories, household, maintenance (such as cleaning), wastewater treatment, and delivering goods and services. Robots are made by considering 3 aspects:-

- 1) The design should be innovative
- 2) Dynamics shows how it should behave when applied with force, pressure, temperature, how it resists or reflexes
- 3) Control it should ensure the system work according to our wish & operate

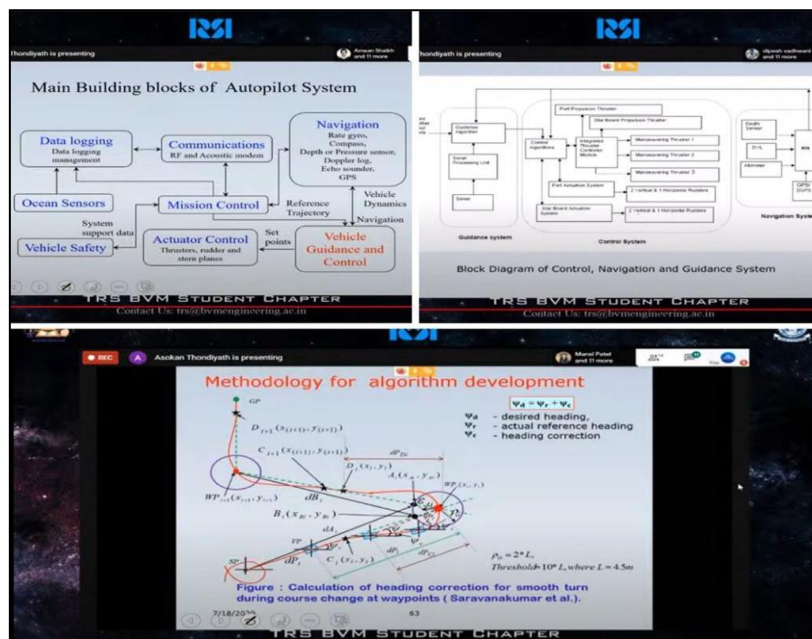
He showed us some examples of dynamic models of robot manipulators, mobile robots, drones (quadrotors), and how to design intelligent controls for the robotic system.



Further, he gave a brief about “THE ERROR PROPAGATION LAW”. So as we know the sensors are used to get the position of the robots. The particular x and y coordinates of the robot are determined using them. So if the measured position has an error the estimated position would also be an error. **This law is used to determine the estimated error in the measured values to get no error in estimated value.**

$$C_Y = F_X C_X F_X^T$$

To determine this error “Multi-Sensor Data Fusion” was used. It is a process of combining observations from several different sensors to provide a robust and complete description of an environment or process of interest.



LOCALIZATION

The encoder fetches the information from the sensor and using “Map data” to predict the position of the robot.

During this process, according to the map data the “Matching” occurs and the position is updated regularly.

This can be clearly understood by the chain diagram below:

Image

There are a few challenges during the process of localization. They are:

- Error in dead reckoning
- Non-Deterministic errors in sensors
- Sensor aliasing
- High processing requirements for data fusion

Continuing to this, he further explained the PROBABILISTIC, MAP BASED LOCALIZATION with an example.

Let’s consider a mobile robot moving in a known environment. As it starts to move (from a known position) it might keep a track of its location using odometers. However, after a certain movement, the robot will get very uncertain about its position. It would update its position

according to the environment. And this observation will lead to an “estimated position” which can be fused with the odometric estimation to get the best possible update of the robot's actual position.

He further explained the importance of SLAM (Simultaneous Localization and Mapping). For an autonomous robot, it is important to explore its environment with its sensor, interpret its scene and build an appropriate map and localize itself and SLAM is the process by which a mobile robot can build a map of an environment and at the same time use it to find its highest probable location.

Continuing to the localization, Dr.Asokan sir gave a gist of the control, guidance, and navigation of autonomous robots. The chart below gives the main building block of the Autopilot System.

As mentioned by him. The two important capabilities for navigation are:

- **Path planning:** To identify the trajectory this will cause the robot to reach its goal.
- **Obstacle avoidance:** Given real-time sensor reading, modulating the trajectory of root to avoid collisions

Further, he explained to us the different path planning assumptions and path planning methods. He gave us a brief idea of the 1st method, the “GRAPH SEARCH” method.

The graph search method has 3 different steps by the construction of:

1. Visibility Graph
2. Voronoi diagram
3. Cell decomposition methods

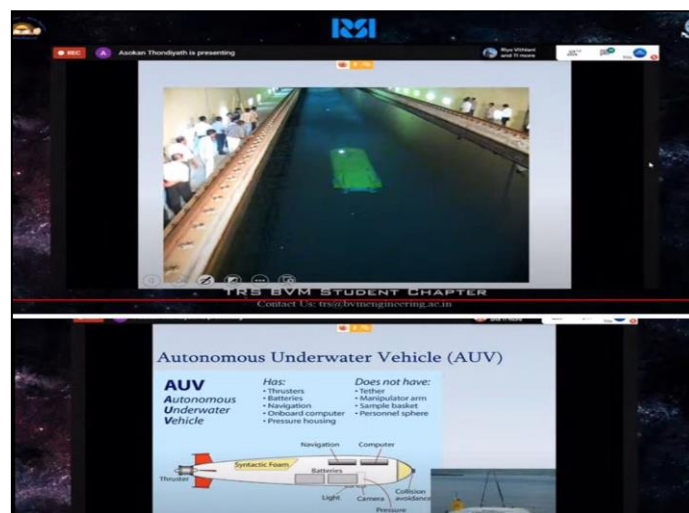
Further, he explained the process of “Obstacle Avoidance” by the bug algorithm.

The session got more excited when he started “THE AUTONOMOUS UNDERWATER VEHICLE (AUV)”. The AUV has thrusters, batteries, onboard computation, and many other systems. The properly defined diagram of an AUV is given below.

Further, he explained the block diagram of the control, navigation, and guidance system of an AUV.

The guidance system receives information from the navigation and generates references for the vehicle control system so as the vehicle can move.

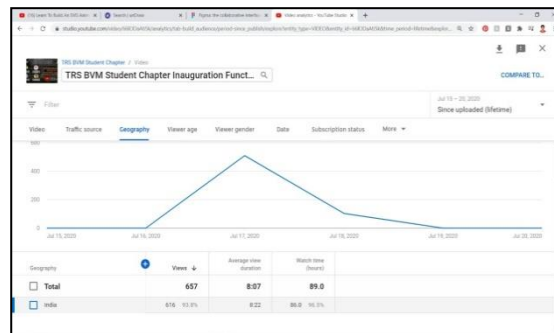
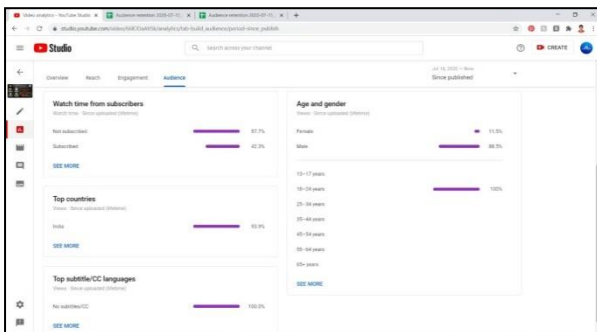
The session was concluded by showing practically the underwater vehicle which was demonstrated by the TRS team.



At the end of the technical session, Dr. T Asokan answered all the questions from the attendees and provided various examples along with the answers. He was delighted to have such an interactive audience. He wished for the success of The Robotics Society BVM and thanked everyone for listening to him. Prof. P.M. George concluded with the vote of thanks to Dr. T Asokan for being the Chief Guest of our inauguration ceremony and for talking about the Autonomous Systems and their challenges. He mentioned that this collaboration will be really helpful for the growth of the students and society. He thanked all the attendees for being a part of this new beginning. The ceremony was a grand success and ended fruitfully for everyone who was a part of it. The full video of the inauguration ceremony and the expert talk is available on TRS BVM YouTube Channel. (<https://bit.ly/TRSBVM-Inauguration>)

|| PARTICIPANTS STATISTICS

As we know the event took place live on YouTube, so the total number of views gained was around 657. Students and Professors from BVM College and other colleges joined the Event. Talking about the strength of attendees, there were around 616 views obtained all over India i.e. 94% and about 41 views internationally i.e. 6%. The event lasted for about two hours, and in this period, few honourable dignitaries of TRS society were also noticed in the Event.



Team TRS BVM Student Chapter, Thanks every viewer who graced the event by their presence.