Foreword from the President:

We at RMI take pride in being able to innovate in various fields within robotics. As a testament to this spirit, we were able to work on multiple exciting projects this year that pushed the boundary of what was possible.

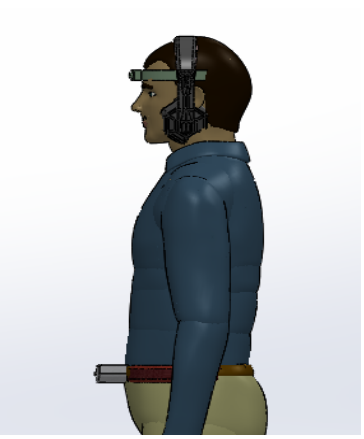
None of this would have been possible without the great minds in our club, who I am deeply proud to work with. I am also truly grateful to our faculty advisor Dr. K. Pannirselvam whose inputs were invaluable to us.

I am confident that in the upcoming years we will continue to work hard on our goal to advance the reach of robotics and make robotics more accessible to students at NIT Trichy.

Initiatives/Projects taken up this year:

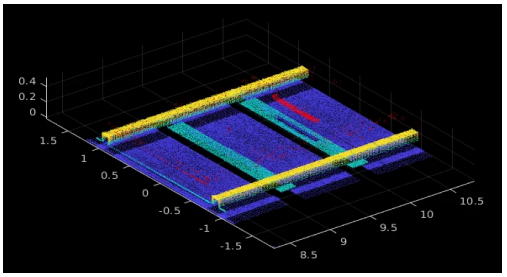
1. Sangam Projects:
    a. Project ANVI:
    Link - https://youtu.be/aEJdZoTE7Lg
    Our project aims to provide navigation assistance to individuals with visual impairment by providing instructions in audio format. The proposed solution consists of a specially designed wearable belt and a headset cum goggle. It uses state-of-the-art Machine-learning models to extract useful information from images in order to empower the visually impaired with a better life.

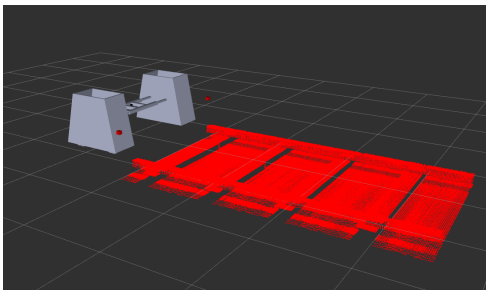




    b. **Project Aribot:**
    Link - https://youtu.be/ISmpOIQ-FIQ
    Traditional inspection of which is practically difficult, time-consuming, labor-intensive, and prone to errors. Cracks or defects in rail track causes track failure which leads to incidents like derailment.
    Autonomous Railway Inspection Robot(ARIbot) is a four-wheeled robot that traverses rail tracks to conduct regular inspection of rail tracks, sleepers, fasteners, and ballast with an array of sensors. The primary objective of this project is to look for defects in rail tracks and the supporting structures in a way that significantly reduces the need for manual inspection of railways. This

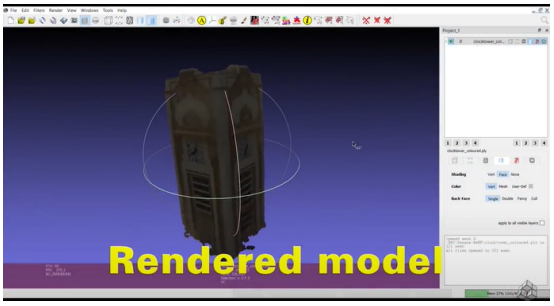
improves the efficiency and accuracy of inspection, which will have a positive impact on the safety of railways.

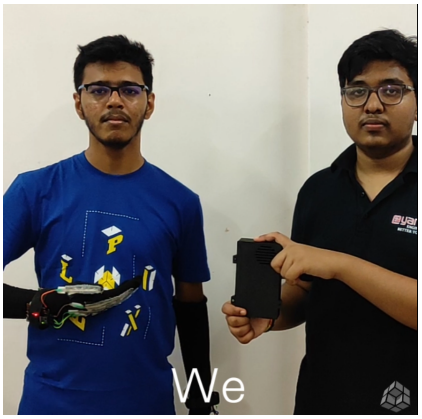


c. **Project LEWI:**
Link - https://youtu.be/m6im07cH6Q4
Our project LEWI aims to map an unknown environment for example a terrorist-prone building, without entering inside the building by just using WiFi signals. Maps of indoor spaces can be obtained without entering inside. LEWI uses the Received Signal Strength Indicator (RSSI) of the WiFi signals to create the map. This estimated map of the indoor space helps soldiers to strategize a proper plan.

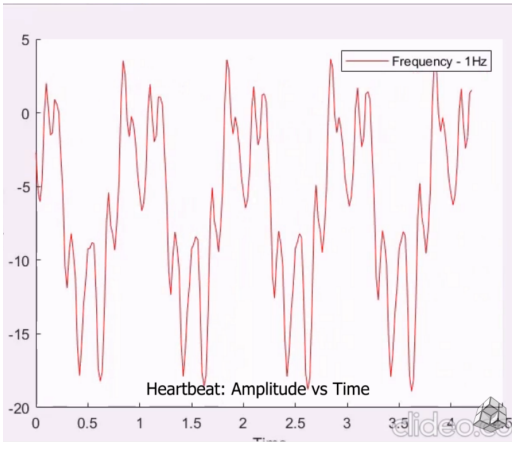

d. **Project SPARO:**
Link - https://youtu.be/JsgvouODmeI
This project aims to create 3D models of objects without using any expensive equipment with complicated parts.
The images of an object are taken and fed to a variant of NERF. The neural network renders the points from images into 3D space and interpolates between the same. A loss is imposed on the position of points in space and minimized, forming a 3D mesh.

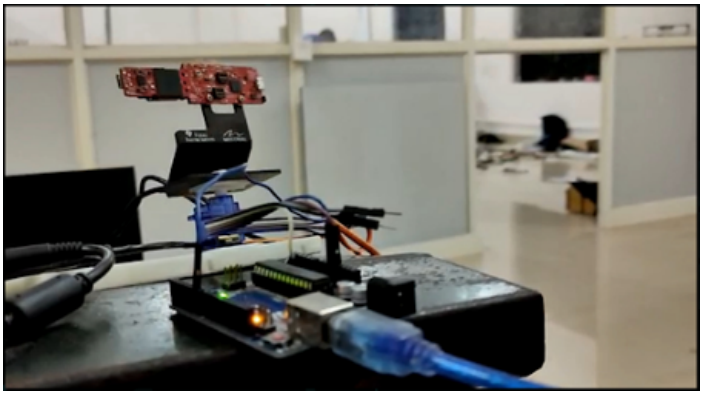


e. **Project SSC:**
Link - https://youtu.be/jtPz5BjOHhI
Project SSC is a device that can read signs and gestures of a person and convert them to simple speech.
The signs, based on finger movements and angle of the hands, are decoded to specific words using a Deep Learning model deployed on a microcontroller, which is further fed to a speaker. The product is much more mobile and **on the edge**. It is also very cost-effective compared to existing solutions in the market.

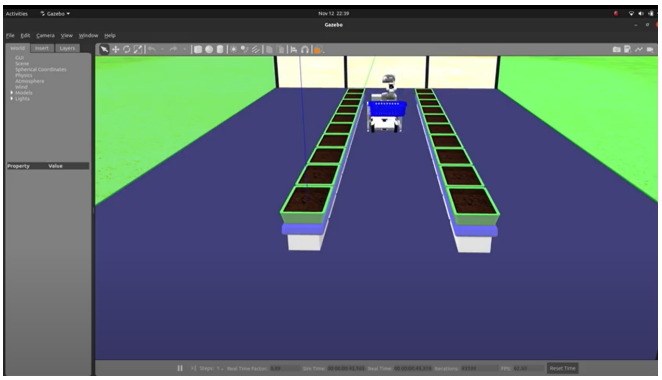
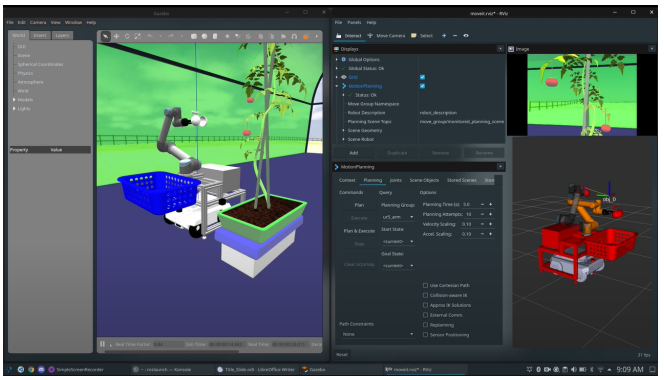


f. **Project Star:**
Link - https://youtu.be/B4_3eNBpYJo
STAR aims to prevent illegal poaching and trafficking of animals in sanctuaries. Our approach towards this problem statement is by detecting vital signs like heartbeat and respiration rate. Moreover, range and velocity estimation can be performed using this technology.
This project proposes the use of Frequency-Modulated Continous Wave (FMCW) radar to send and analyze signals to detect and estimate respiration and heartbeat frequencies. Being capable of measuring vital signs(through non-contact methods) and having a wider field, is more advantageous than the existing alternatives. Through its implementation, the detection of human activity and the vital signs of the animals in the reserves can be easily monitored.

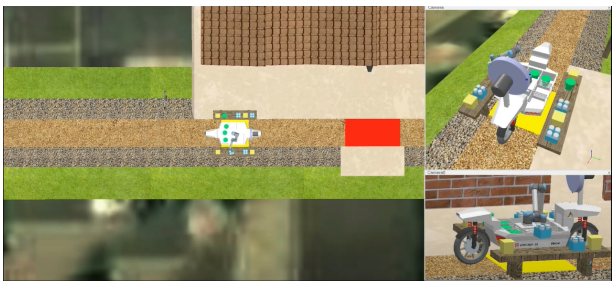
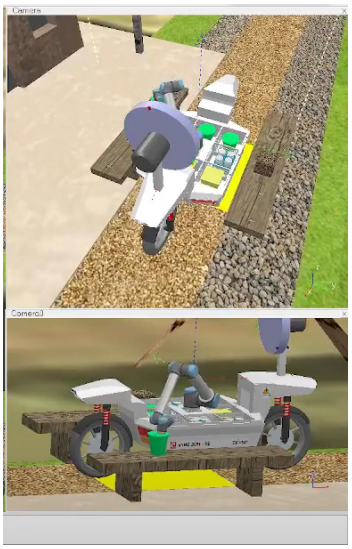




2. **E-Yantra- Agribot:**
Link - https://youtu.be/gEU5Ap2P5V4
An autonomous ground vehicle (AGV) that can move and pluck ripe fruits from the field was designed and simulated in ROS and Gazebo. We developed ROS nodes (python) for autonomous navigation around the field, detected ripe fruit using color detection filtering, and performed pick and place of UR5 arm using Moveit.

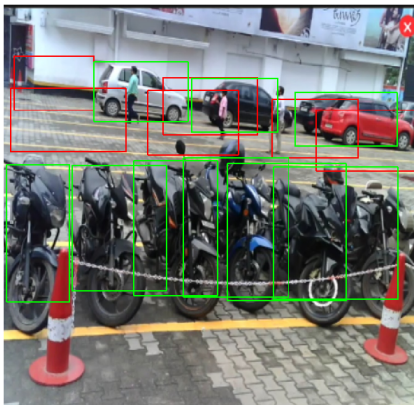
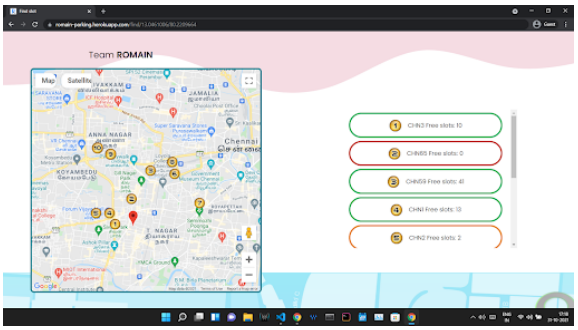



3. **E-Yantra- DairyBike:**
Link - https://www.youtube.com/watch?v=NBQi-QkFnZQ
We design a Dairy Bot comprising a Two Wheeled Self Balancing Robot. The robot loads/unloads dairy products from a dairy farm to designated delivery points. We use a Linear Quadratic Regulator (LQR) control strategy for balancing the robot equipped with a flywheel mechanism. After building the bot, we navigate it in an arena to complete a set of tasks.

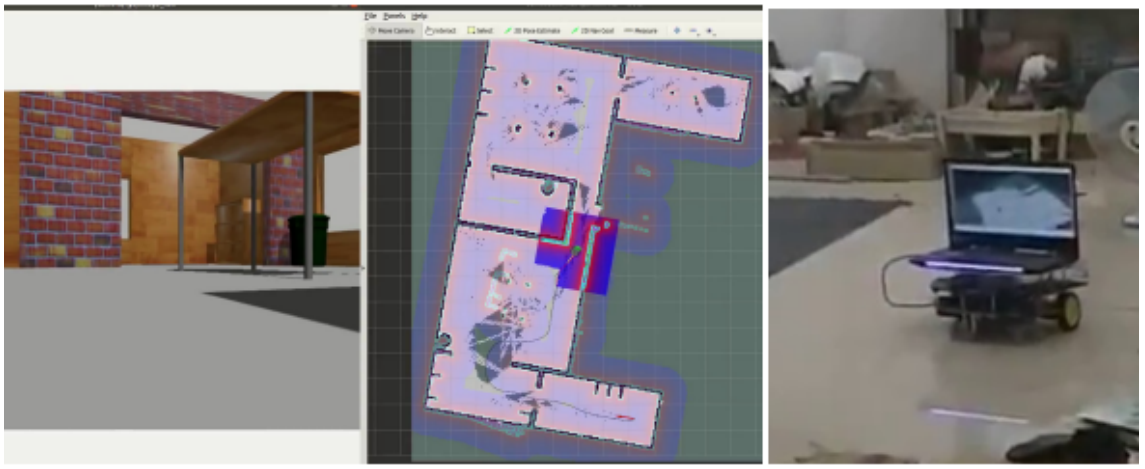



4. **Project SPS:**
Link - https://github.com/RMI-NITT/Smart-parking-system
The project proposes to install low-cost camera modules in multiple parking lots across the city, which stream the live image to the corresponding remote server. The remote server processes the data from the camera module and decides on the number of vacant parking spaces available in the parking lot. The remote server updates the number of vacant parking

slots and the number of filled parking slots in a cloud database. The number of vacant parking slots and their location is displayed in a web application accessible to the general public and free to use. The database is updated continuously, ensuring a pristine user experience.

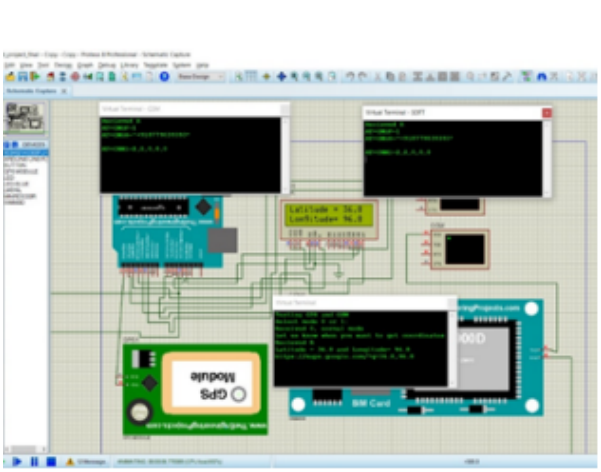
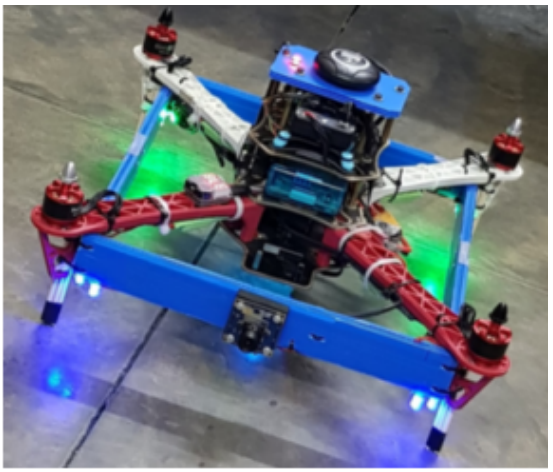



5. **Project PEPPER:**
Pepper is a mobile robotics framework implementing machine learning and AI techniques in multi-agent systems to map and interact with a dynamic environment. We established decentralized multi-agent coordination and implemented exploration of agents, and implemented path planning in an explored environment. Formulated a decentralized policy for multiple agents to explore the given map in an efficient manner. Created an environment in which we have a map and agents in it. We have various options to alter this environment.

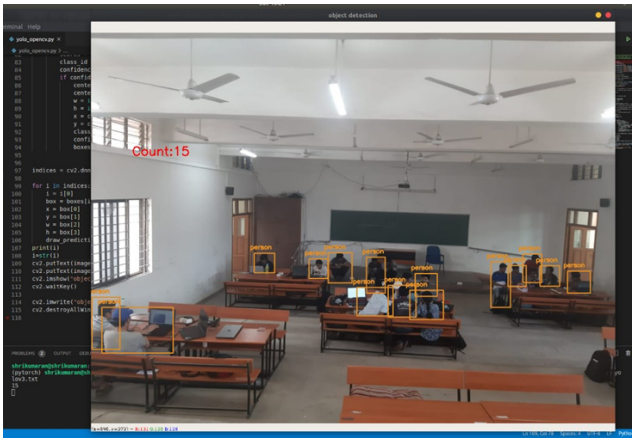


6. **Project OpenQuad:**
The project was designed as a platform for implementing various deep learning and computer-vision algorithms such as person tracking, Gesture recognition, Optical flow stabilization, Human Pose estimation, obstacle avoidance, and depth estimation using monocular vision. The drone uses a pixhawk flight controller with RaspberryPi as a single board computer. DJI flame wheel is used for the quadcopter structure with custom mountings for safety measures. Serial communication is used to communicate between

Pixhawk and RaspberryPi. RaspberryPi runs a ROS node that communicates with the ROS node running on the host PC to transfer videos over Wi-Fi. To make the project open-source, easy to develop, and reproducible, the simulation environment setup has been dockerized using docker containers. Gazebo is used for simulation.

7. **Campus Development Initiative:**
We present a solution where the camera feed from the CCTV cameras inside SCIENT or in SAC building is being processed using a machine learning algorithm fine-tuned to identify humans (eg YOLO algorithm) to keep track of a number of students inside the lab. After this, the students are classified based on which room they are in, for example, if the person is in 1st floor conference room, then he will be part of that zone.
If a particular zone is empty for more than 2 minutes(time delay can be adjusted) the lights and fans in that room will be turned off. This allows saving of electricity in our campus.



8. **Genesis/NITT Conclave Workshop:**
Genesis is the annual workshop of Robotics and Machine Intelligence (RMI). This year, the workshop was conducted online through Microsoft Teams for free of cost to introduce 1st years to various domains of Robotics. This year we collaborated with Technical Council to organize Genesis for both first years and as a workshop for NIT Conclave. We received over a total of 200 registrations for the workshop where we taught the students how to use ROS and solve a micro mouse challenge.

Upcoming Initiatives:

1. RMI Hackathon:
   Hackathon-based competition planned for 1st years which might be clubbed along with InHotts by Pragyan which will be used for pre-inductions for next academic year.

2. SIH Teams:
   3 teams from RMI are participating in SIH as the main teams representing our college. The project work will continue for these teams preparing for SIH.

Achievements/Collaborations:

- The following projects have won prizes in Sangam'22, Pragyan's annual hardware hackathon:
  - LEWI (1st Place in Defence and Industry)
  - Aribot (2nd Place in Defence and Industry)
  - SSC (1st Place in Healthcare and Natural Sciences)
  - ANVI (3rd Place in Healthcare and Natural Sciences)

- **2nd** place in E-Yantra 2021-22, All India Robotics competition held by IIT Bombay with over 35k competing teams. Project - Dairy Bike.

- **16** prizes won at Invente 6.0 by SSN college of Engineering,Chennai.
- **3rd** place at IdEEaVolt 2.0 at IIT Roorkee
- **1st** place in Amrita Smart City Hackathon, an event with cash pool of 3 Lakhs.
- **3rd** place in Ideavation'21 by Shri Shivaji Memorial Society's Institute of Information Technology, Pune.
- **1st** place at Project Presentation at Chaitanya Bharathi Institute of Technology (CBIT), Hyderabad
- **2nd** place at Colloquium, Currents'22 NIT Trichy.
- **1st** place at Ideathon by WIN-NITT organized by NIT ConclaveX 2022.
- **1st** place at Ideathon'22 organized by Github Developers Community, IIT Madras.
- Participated in Flipkart GRID 2.0 Challenge
- Collaborated with Pragyan'22 events team to organize the event **Simroid** under the Roborex cluster. Link: Website
- Collaborated with Robotics Society, NIT Hamirpur as their **community partner** for Roboweek 2.0 Link: Instagram
- Published 3 club projects as papers in various conferences mentioned below:
  - Project Marko (https://doi.org/10.1109/MASCON51689.2021.9563370)
  - Project SRF (accepted at ICCET-2022 and in process of publishing)
  - Project HIDQ (accepted at ICCET-2022 and in process of publishing)

Core Members:

President - Shrikumaran PB (114118083)
Vice President - Viekash VK (110118104)
Vice President - Akshat K (108118010)
Treasurer - Kailash J (111118045)
Treasurer - Hemangani N (110118031)

Head of Alumni Relations - Shubham Agarwal (108118092)
Head of Publicity - Pramoth Arun (107118074)
Head of Workshops - Loahit K (107118052)

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