

Progress report of the Propel lab-1 for the Academic Year 2021-22

- a) Projects done in the lab and their current status
- b) Achievements
- c) Conferences and Webinars
- d) Publications
- e) Spending
- f) Consultations
- g) Outcome

a) Projects being done in the lab are briefly explained as below

1) RAAM: - Road Accident and Alert Mitigation

The project is held by IIT-B through their E-yantra innovation competition.

The task is to detect the surroundings of the vehicle and constantly monitor whether it is going to collide or not at speed. Vehicles moving in the front and sides, barriers, barricades, road abnormalities etc. will to be monitored using obstacle detecting sensors like ultrasound or infrared and cameras. Using a gyroscope and accelerometer, we can monitor the orientation of the car as in some cases, the car rolls over.

For that three courses of action

- a) Pre collision phase
- b) Post collision phase

An automobile is fitted with cameras which work on Raspberry pi microcontroller which will detect the road signs using open cv software. Also, the automobile is made to stay within limits before it collides with an obstacle in the course by different methods. The location of the vehicle is ensured all the time through a GPS module embedded in it.

In case if the target vehicle collides with another vehicle, then a trigger algorithm will ensure that it gets a fresh and live location and send the same to the nearest local authorities like hospitals and police station.

Concept:

First task is to detect the surrounding of the car and constantly monitor whether it is going to collide or not. Cars moving in the front and sides, barriers, barricades, road abnormalities etc need to be monitored. Using an accelerometer, we can monitor the orientation of the car as in some cases, the car rolls over.

Process:

- 1) Using a Raspberry Pi and camera, get live footage of the surrounding. Now with a ML model, analyse the things around and build a virtual environment. Tag things like signboard, lanes, boulders etc. Perspective vision can be used to get the distance of various objects. Use softwares like OpenCV to do it. If you detect a collision, send a signal to the microcontroller.

- 2) Using any distance measuring module, measure the distance of the car in front. Apply collision distance algorithm and get the braking distance.
- 3) Lidar can also be used to map the surroundings helping the camera. Accurate distances can be achieved using this method. Use Lidar with raspberry pi as advanced calculations need to be done and the microcontroller may not be able to handle it.
- 4) An accelerometer will monitor the aspects like yaw, pitch, roll. Accelerometer is being used because sometimes in case of collision, the car rolls over. This can be detected with an accelerometer. If a car is in any position apart from its natural orientation, actual values of the accelerometer can be used to detect collision. If the car rolls back to its natural orientation, past values can be used to check it. Sudden jerks will also help in detecting collision. Storing values received within 30 seconds would be enough.

Status of the project: - Qualified to stage three.

2) Flipkart Grid 3.0:-

This robotics competition started with a team consisting of 14 members in total on 15th July 2021. The problem statement that we were assigned was to build robots for an e-commerce industry to build a sophisticated system of automation and robotics to help bring down costs and deliver goods to customers at the fastest speeds possible. So they were given an arena design on which our bots should be able to run within the given constraints to increase throughput.

The team worked on multidisciplinary engineering domains to complete the given task. The task that we were given was to build four bots that carry packages and drop them at a particular location. Initially, we as a team started working on the design and structure of the moving bot. All the four bots were built using the metal chassis. By the mid-week of September we were able to build all the four bots completely. The project was submitted on 25 Sept and they were able to qualify for the second phase of the competition. Out of nearly 2000+ teams all over India, our people were able to qualify among 74 teams.

Status of the project: - Qualified to stage three.



Fig- Robot for the project (Left) and Arena and the Camera at the top (Right)

3) Ropet: - A hand Gesture Bot Publication in IEEE-CCEM competition

To control the movement of the bot effectively from the gestures depicted by OpenCV. The Gesture Controlled robot detects the hand gesture shown through a live front camera. It can move front, back, right and left. It includes some special gestures which make it move 360 degrees.

The speed for forward motion can also be controlled by another special gesture that varies the speed of the bot when the distance between the index finger and thumb finger varies proportionally. The code is written to recognise a specific gesture like and perform specific tasks.

Status of the project: - Won Student Project Showcase Proposal Sponsors' Award

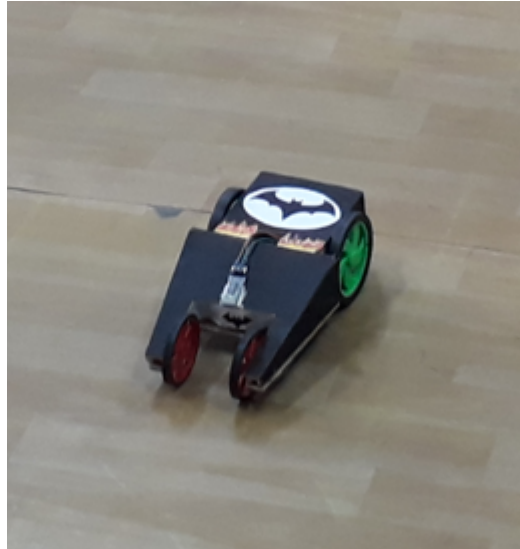


Fig- Hand gesture robot

4) COBOT: - Industrial bot: -

Our idea basically focuses on Pick and place tasks using robotic vision technology. To detect the objects and to perform the classification task, few shot object detection with an attention network is used. Designer will be using FSOD dataset to train our model which contains 1000 different categories. Our method is general and has a wide range of potential applications. We produce a new state-of-the-art performance on different datasets in the few-shot setting.

Status of the project: - The scientific paper is accepted and published in Science Direct.

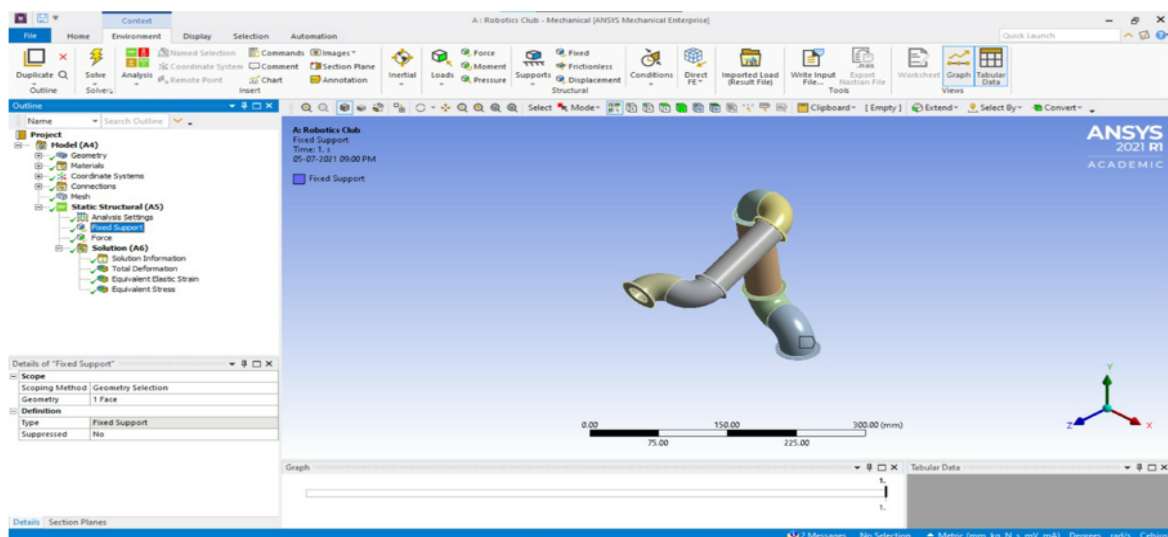


Fig- Mechanical Design of COBOT

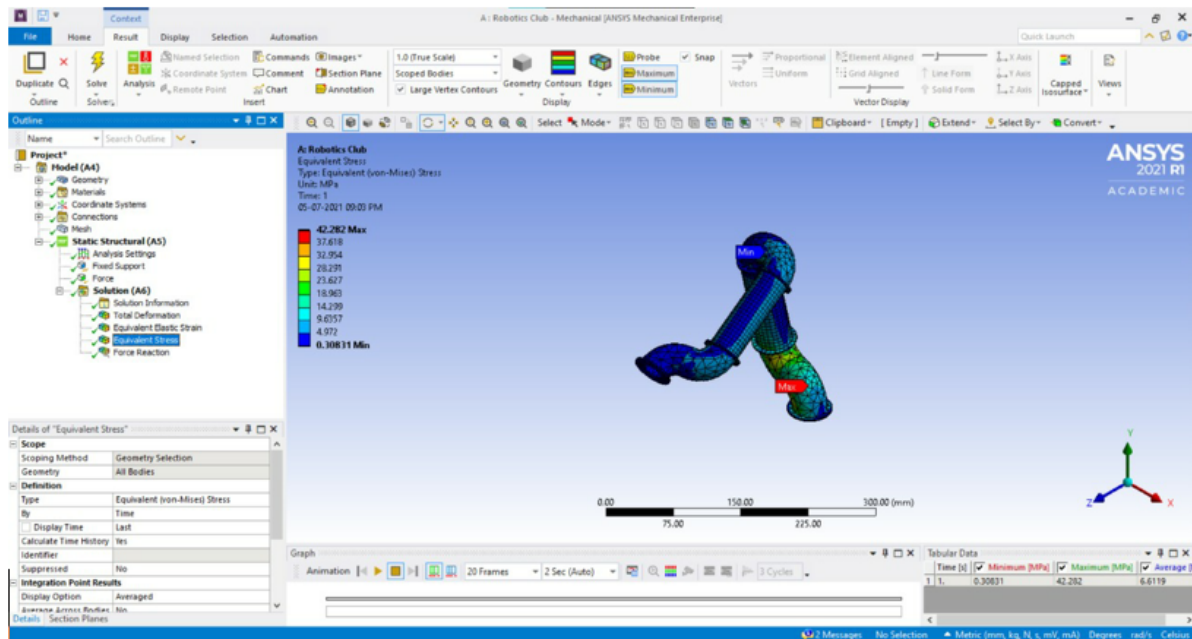


Fig- Von mises result of COBOT after applying load

5) Soil monitoring bot:-

In this theme, students build the SM bot for deployment on an arena that abstracts an agriculture field. The brain of the robot is powered by an FPGA (Field Programmable Gate Array) that controls its sensors, actuators and pick and place mechanism. Challenges and learnings in this theme include building a soil monitoring bot from scratch using an FPGA. The robot traverses the arena, senses the environment, picks and places necessary supplies from supply unit to the field. It uses wired and wireless communication. IIT-B helps teams to build a sophisticated architecture using Verilog HDL to unveil the powerful parallel processing capabilities of FPGAs.

Status of the project: - One group of students have qualified to finals.

6) Agribot from E-yantra IIT B: -

This theme inspires engineers in the area of agricultural automation. Agribot uses an autonomous Ground Vehicle (AGV) to traverse in a simulated greenhouse environment, find the target yield and correctly pick and place. The AGV is retrofitted with a customised gripper to plug yields easily, and so is the created environment ensured to compile with the gripper. The theme is divided into tasks to build the Agribot system step by step system under the guidance of e-yantra mentors.

Status of the project: - One of Groups have qualified to finals.

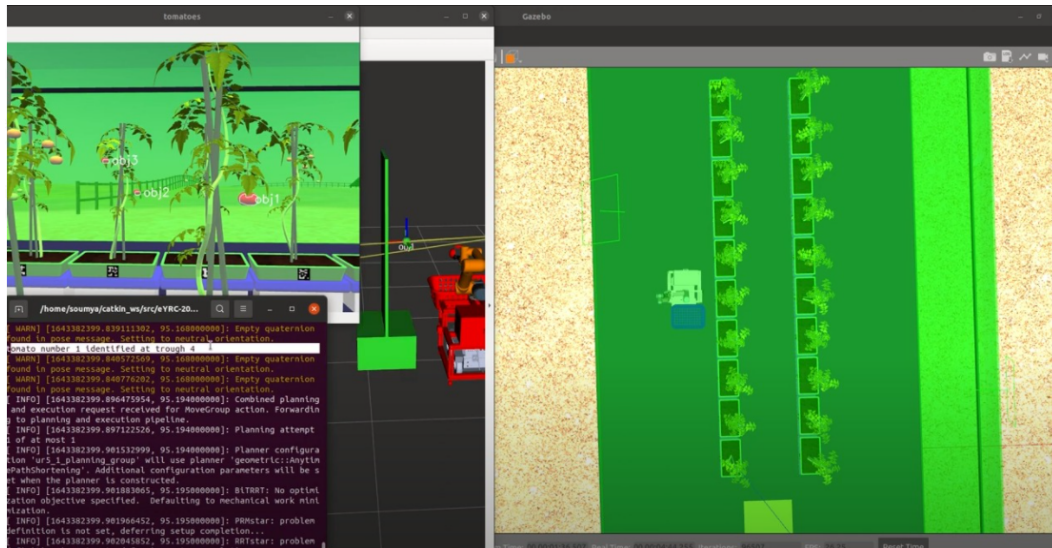


Fig- Simulation of the setup or arena given by IIT-B in Robot operating system and governing the physical robot in IIT-B from BMSCE (below)



7) National hackathon organised by IIT Madras & Sony to come up with solutions using IOT sensor board:-

The project is regarding the smart irrigation through using Sony Spresence board as its brain. A camera attached to the board will capture the different the different plants and their status of growth to the farmer and process it. The information gathered thus can be used by the farmer to ascertain that his plants are in good condition or not. In addition, it has the facility to self-irrigate by finding the moisture in the soil in which through a moisture sensor embedded in the soil. The entire setup is then placed in a small green house to ensure the quality of the project.

Status of the project: - One of the groups have qualified to semifinals. Waiting for final nod from IIT-Madras for finals.

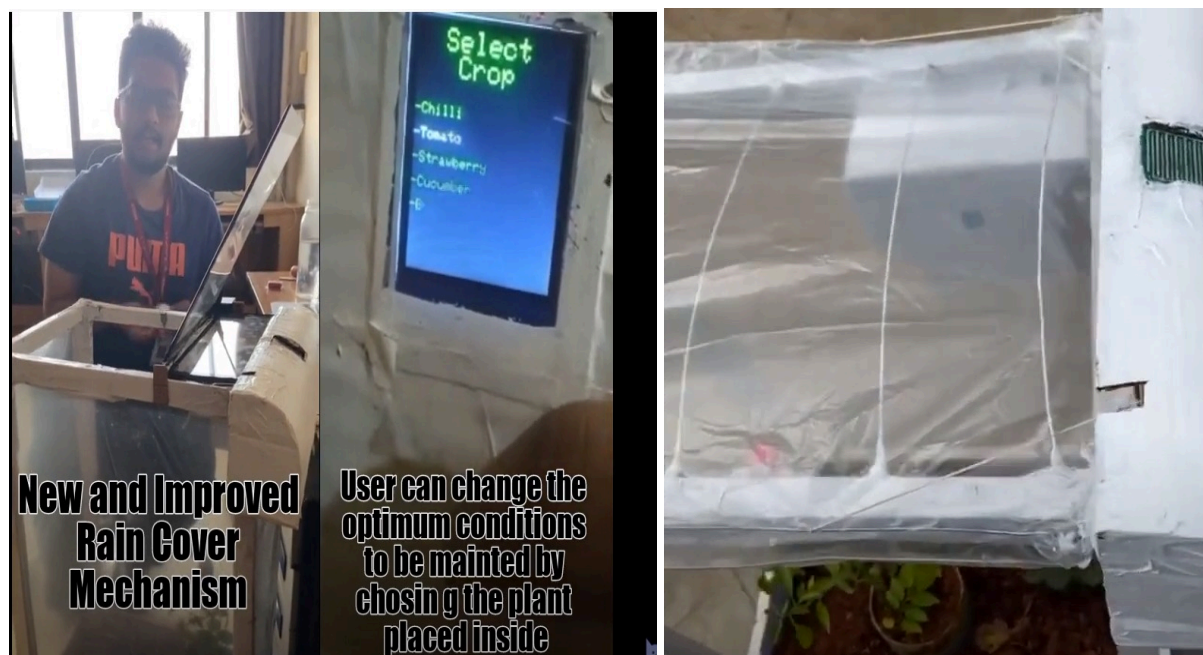


Fig- From left; setup of the system with user interface and Rain sensor attached

8) Hardware Hackathon I Phase shift organised by BMSCE:-

The project is regarding the smart irrigation through using Raspberry board as its brain. A camera attached to the board will capture the different the different plants and their status of growth to the farmer and process it. The farmer to ascertain that his plants are in good condition can use the information gathered thus or not. In addition, it has the facility to self-irrigate by finding the moisture in the soil in which through a moisture sensor embedded in the soil. The entire setup is placed in a small green house to ensure the quality of the project.

Status of the project: -Won first prize in the theme a got cash award of Ten thousand rupees (Rs 10,000).

b) Achievements:-

We have opened a club called as Robotics club dedicated to the students interested in this field as it is one of the most in-demand and sought-after fields in today's word. The goal of the robotics club at the renowned BMS College of Engineering is to build its own humanoid robot and to provide a platform for enthusiasts to explore the varieties in robotics, as it takes strong fundamentals of multidisciplinary courses to become a roboticist.

The club has 30 number of students from different disciplines. To filter the students genuinely interested were given four themes that they had to work on. The interested students were given guidance and material facilities of the lab and from the senior students.

More information is attached along with this document.

c) Conferences and Webinars:-

Students making use of the lab have published papers and attended conferences. The projects they do in the lab on different areas are well documented and provide more information to the students

interested in the field in future use. Not only the third year students but also, also the juniors who joined the Robotics club have followed the suit.

The papers published and the conference certificates are attached along with this document.

Conferences attended by students:-

- a) IEEE CCEM: - Appreciation of presenting the Student project proposal titled, 550 nm Grower, A Smart Rooftop Gardening System information shortage on 27-09-21.
- b) IEEE CCEM:- Appreciation of presenting the Student Project Showcase Proposal, titled LiDAR Bot on 27-09-21.
- c) IEEE CCEM:- Appreciation of presenting the Student Project Showcase Proposal, titled Serpent Bot on 27-09-21.
- d) IEEE CCEM: - First Prize in 'Student Project Showcase Track, titled **Road Accident Alert and Mitigation** 27-02-21.
- e) IEEE CCEM: - **The IEEE CCEM Student Project Showcase Proposal Sponsors' Award** titled, **ROPET: A hand-gesture controlled bot** on 27-09-21.

Webinars attended by students:-

- a) Attendance Certificate awarded to **V Pavan** for attending “**Technical Session on Robot Operating System (ROS)**” conducted through the **e-Yantra Lab Setup Initiative (eLSI)** on 03-08-21
- b) **Technical session organised by IIT-B on Introduction to Digital VLSI Design and FPGA Implementation**

d) Publications by students:-

Students who have done the projects have submitted their papers. Some of them have also given conferences. They are waiting for the papers to get accepted.

- a) ScienceDirect:- **Application of Few-Shot Object Detection in Robotic Perception by Shashank T K, Hitesh N, Gururaja H S** (Accepted and will be published within March 2022)

e) Expenditure from the lab:-

Account of Sanctioned and Expenses amount for PROPEL-1 Lab for year 2020-21				
Sl no	Year of Sanction	Heads	Sanctioned	Expenditure
	2021-22	Recurring Expenditure		
1		Reimbursement for attending Workshop	Through ICRD Office Budget for Propel lab-1	1850
		Flipkart Competition		5988
		Eyantra Competition Team No 1643		1180
		Eyantra Competition Team No 1643		1180
		Inauguration of Robotics Club		3500
				13698

f) Consultancy:-

g) Outcome:-

The output from the lab has been great as it lab provides a platform for students having interest in the field of Robotics and Embedded Systems. Major projects in the lab are evolved from basic line following robot to the Machine Learning in Robotics and simple ON/OFF control to Internet of Thing (IoT) in Embedded Systems. Through these advanced projects faculties and students get to experience the cutting edge technologies.

Students learn how to program a micro-controller, design a robot using many equipment's which are at the disposal of propel lab. The students pass on the knowledge gained by working in the lab to their juniors and they pass it on to theirs. This chain of knowledge had been cut due to the COVID-19 for nearly 1.5 years. Now it is slowly getting connected and we can expect projects that can be implemented in the industrial field also.

Propel lab has also set up an irrigation system in the college campus. All the projects running in the lab are facilitated and funded by one or other means. Every year the field of robotics is improving and propel lab makes it possible for the students to stay updated.