B.M.S. College of Engineering, Bengaluru -560019
Autonomous Institute, affiliated to VTU

1. Name of the lab: Robotics and Embedded Systems (Propel-1 Lab)

2. Department: Research and Development

3. Location of the lab: PG Block, 6th Floor.

4. Faculty in charge:

Dr. Rajath Vasudevamurthy
(Email: rajathv.ece@bmsce.ac.in)

Dr. Maligi Anantha Sunil
(Email: sunil.ece@bmsce.ac.in)

Mr. Narahari
(Email: narahari.mech@bmsce.ac.in)

5. Associated with industry, if any:
   a) IIT-B
   b) M/S Solar Green Club
   c) Nuetech
   d) ALS
   e) Mediatech
   f) Nuvoton
   g) NGX
   h) ARM

6. List of Equipments/facilities along with specifications and photographs + software with versions:

FACILITIES IN LAB:

- 30 ft x 30 ft space
- 1 store room
- 1 staff / discussion room
- 10 desktops & 2 tablets
- 1 Soldering station
- 1 Digital Multi-meter
- 1 Oscilloscope
- 1 Variable Power supply
- 1 Samsung TV(48")
- 1 Projector with presenter
- 1 pair of speakers
- 1 Biometric access control
- 1 DLS camera
- 1 UPS(10KW) & 1 Power meters
- 1 Network Switch (40 port)
- 2 Motor operated curtains
- 5 cupboards & 50 chairs
- 1 Fire extinguisher (5Kg)
- 1 First aid kit
- 1 Shoe stand

Fig 1: Workspace in the Propel lab-1 (30ft x30ft)

Fig 2: Variable power supply and Oscilloscope

Fig 3: Different types of sensors for projects
(From Left: Soil moisture sensor, IR sensor, Light sensor, Ultrasonic sensor, LPG Gas sensor and Temperature and Humidity sensor)

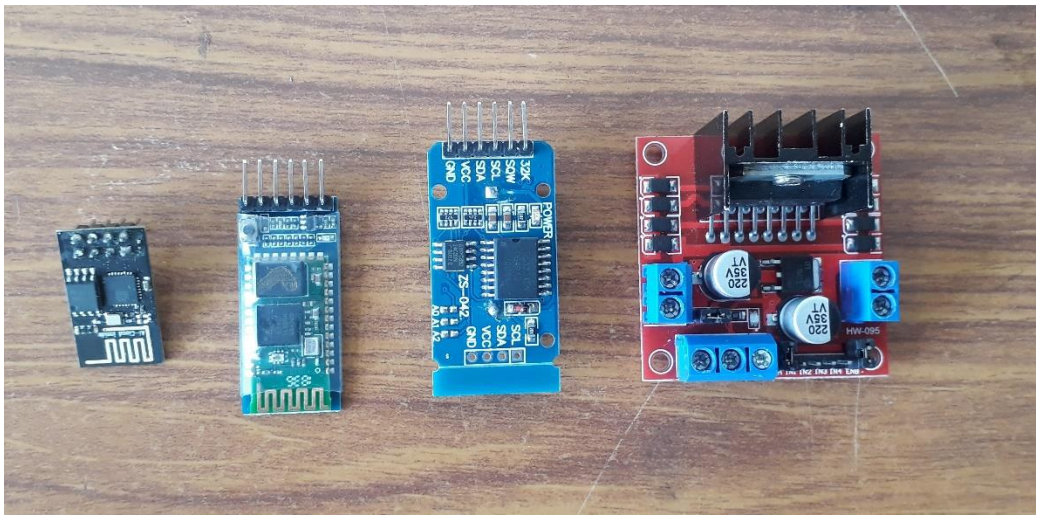


Fig 4: Different types of Modules and motor driver
(From Left: Wi-Fi module, Bluetooth module, Real time clock and motor driver)

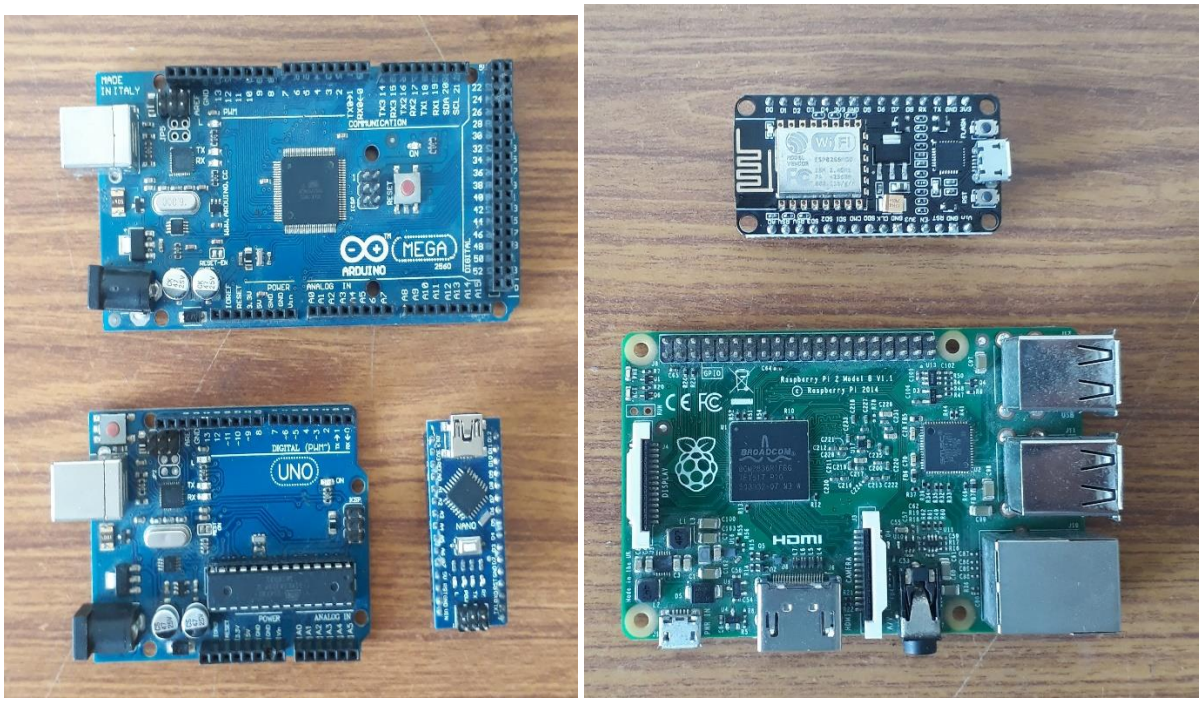


Fig 5: Different types of Processors
(From Left: Arduinos of different types, ESP 8266, and Raspberry pi)

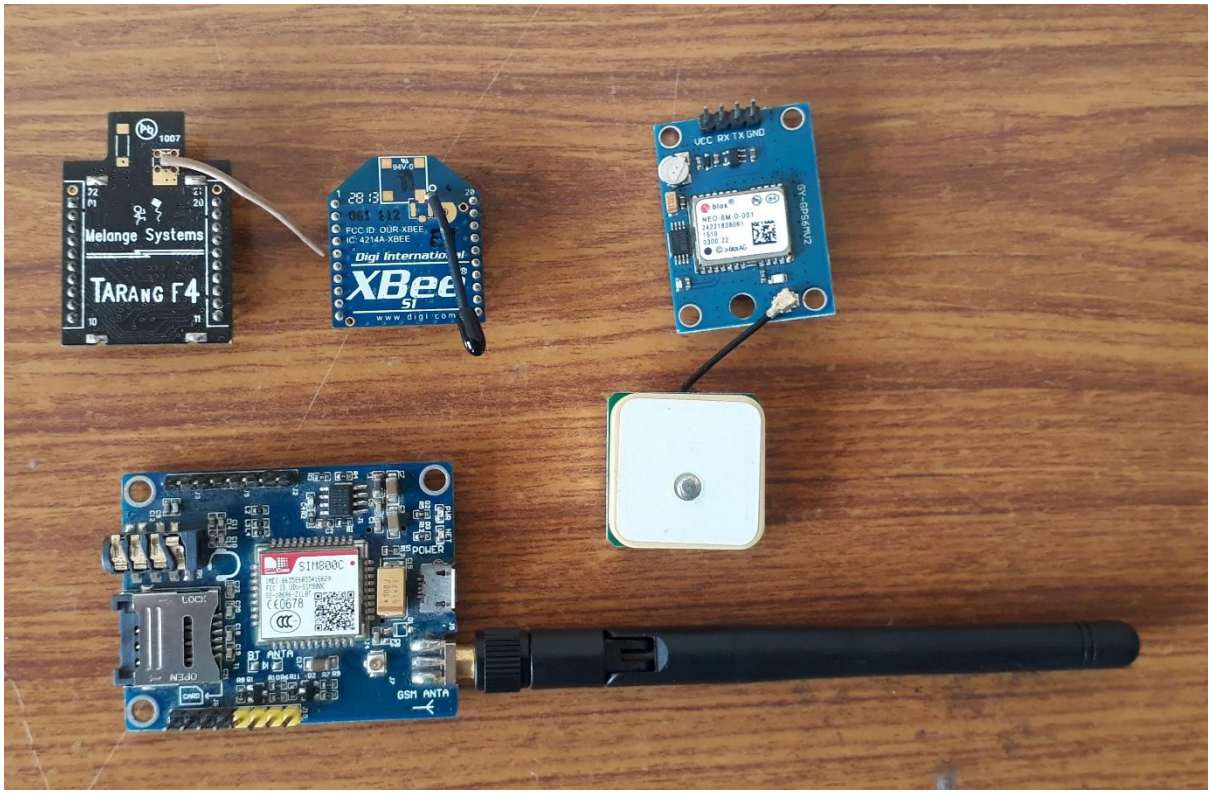


Fig 6: Different communication boards

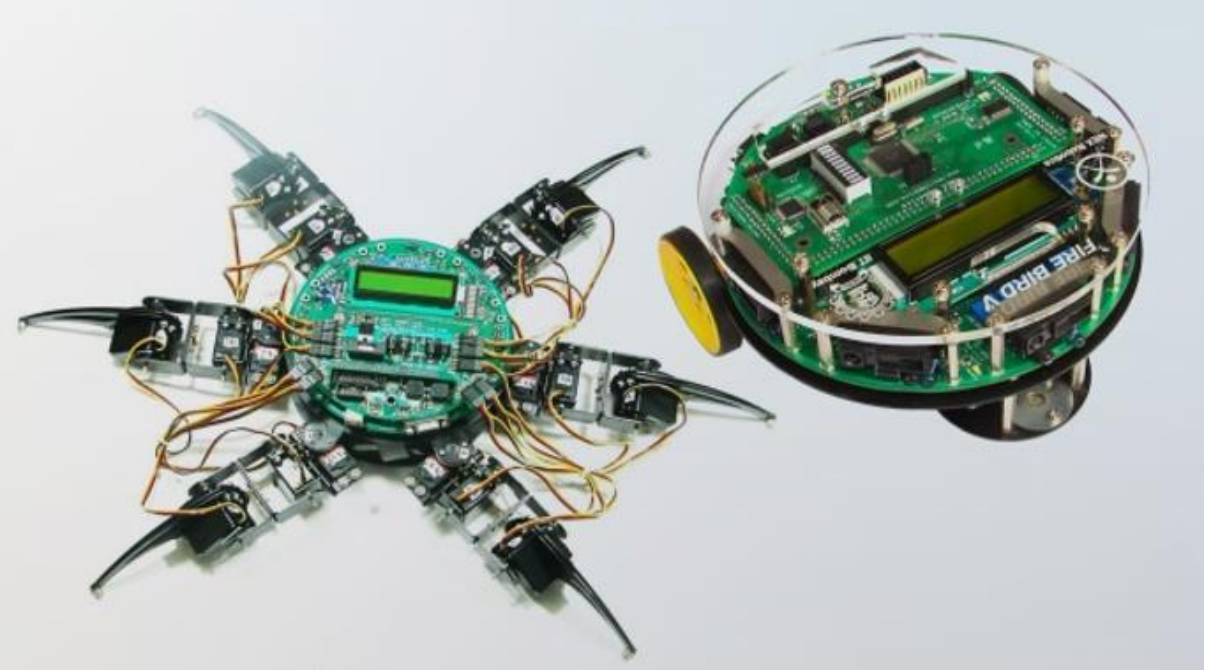


Fig 7: Hexapod and Firebird V

Fig 8: Quad copter

Television

Projector screen

Audio System

Epson Projector

Biometric access control

First Aid box

Centralized switch board with 10KV backup

Fire Extinguisher (CO_2 of 2Kgs Capacity)

Fig 8: Other facilities in the lab

Softwares in use:

Most of the softwares used in the lab are OPEN-SOURCE softwares for which libraries are readily available through internet. Students make maximum use of softwares and also most of the computers work through MS windows operating system installed by BMSCE data center.

a) Arduino IDE 1.18.19
b) LINUX-UBUNTU 18.04.5
c) Gazebo 11.0.0/9.X
d) Robot Operating Systems
e) Python 3.8.2

Students have been given some degree of flexibility in using either MS windows O.S or some may use Linux O.S (UBUNTU) based on their requirements.

Major Achievements till date:

INDUSTRY / ORGANIZATION INTERACTION:

a. More than 10 Industry / organization Interaction are engaged

MAJOR PROJECTS:

a. Embedded Systems : IoT for irrigation scheduling

b. Robotics : ARDOP, A Humanoid Robot

ACADEMIC COURSES DESIGNED & DELIVERED:

1. Robotics (2011 - 2013)
2. Advanced Microcontrollers (2013-2015)

PUBLICATIONS:

1. 17 publications including 3 patents, 1 copyright, 7 international and 6 national journals / conference

WORKSHOPS:

1. 50 workshops delivered and trained more than 2500 participants
2. More than 10 workshops / seminars organized

COMPETITION & AWARDS:

1. Received 12 awards
2. Participated in more than 2-3 competition every year organized by IITB and IITM and other organisations

CLUBS SUPPORTED & EVENTS:

1. Robotics Club
2. Fury Road

Overall view of the lab

Fig 9: Workspace in the Propel lab-1 (30ft x30ft)

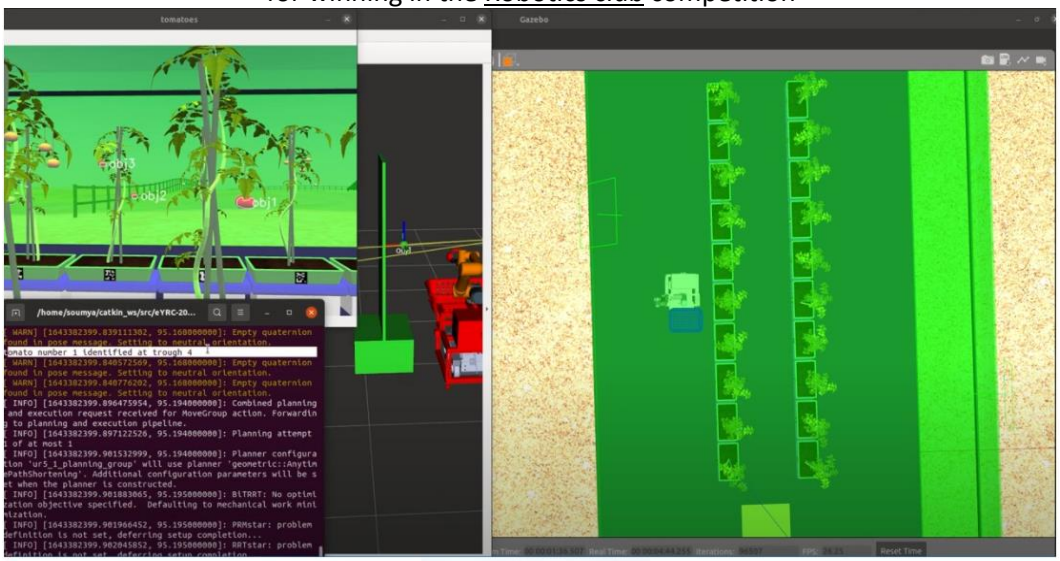
Fig 10: Faculty explaining students regarding the project

Fig 11: Student and Faculty interaction

Fig 12: Student and Alumni interaction

Fig 13: First year students working on their assigned robots under the robotics club

Fig 14: Students of Higher semesters (Mentors) handing over certificates to lower semester students for winning in the Robotics club competition



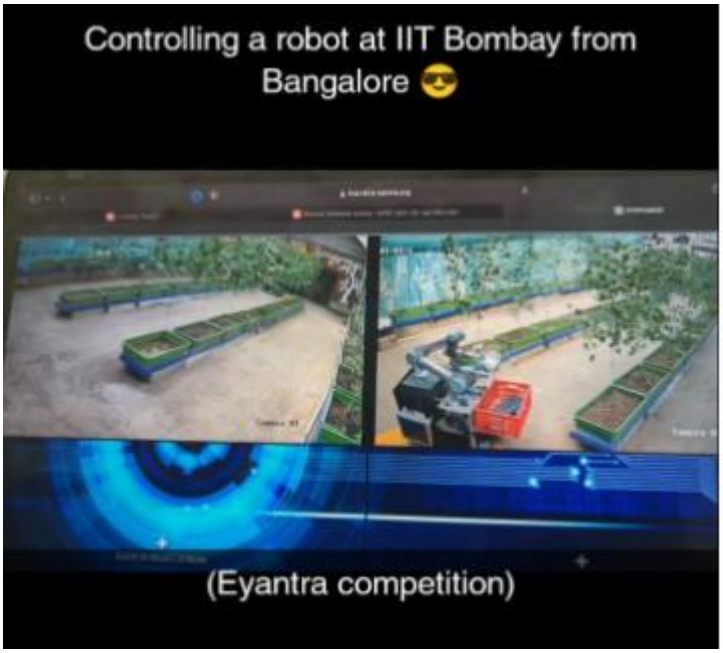


Fig 15: Simulating a greenhouse using ROS, Open CV, Python softwares and controlling a physical robot located in IIT-B from BMSCE

Fig 16: Students working on E-yantra competitions

Achievements: -

- Every Year around 100 students participate in e-yantra competition organized by IIT-Bombay. BMSCE team has been the winners for past 6 years. Students are also encouraged to take part in many other technical competitions. Multidisciplinary competitions are participated by faculty also. Received appreciation letter from more than 30 reputed institutions for delivering informative lecture series on advance microprocessors.

Awards Won by the students working in the lab

Year	Sno	Award
2014	1	Best Project award from TCS(Tata Consultancy Services)
	2	Best runner up booth award in ARM technical Symposium
2015	3	1st place in e-yantra pro competition, IITB
2016	4	3rd place in e-yantra robotics competition, IITB
	5	2nd runner-up prize in ARM Design Contest
	6	1st place in e-yantra robotics competition, IITB
2017	7	1st place in Utkraanti, IIT Kharagpur
	8	1st place in All India Robotics Challenge, Hyderabad
2018	9	Consolation prize e-yantra robotics competition, IITB
	10	2nd place in national level Solar Chulha Competition, ONGC, New Delhi
2019	11	2nd place in e-yantra pro competition, IITB
2020	12	1st place in e-yantra robotics competition, IITB
2021	13	1st and 2nd place in e-yantra robotics competition, IITB
	14	Reached semifinals in Samvedan hackathon, IITM

1st place in e-yantra robotics competition, IITB

2nd place (Rs 5,00,000) in national level Solar chulha Competition, ONGC, New Delhi

Fig 17: Students and faculty receiving awards in various competitions

Conferences and Webinars in the AY 2021-22:-

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.

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**

Publications by students**:-**

Students who have done the projects have submitted their papers. One of the paper also got published. Some other students 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** (Published in Science direct website and available online from 2-04-2022. Link for the paper = https://doi.org/10.1016/j.gltp.2022.04.024)

Letter of appreciation from more than 30 organizations

1. BMSCE[ML].png

1. Letter appreciation - ARM .jpeg

2. Letter of appreciation - CSI.png

2. MSRIT.jpg

3. CIT, coorg..JPG

3. Letter of appreciation - BIETS.jpg

4. SJBIT[ECE].png

5. SJBIT[CSE].png

6. BMSIT[ECE].JPG

7. DSCE.jpg

8. Letter of appreciation - AMC.jpg

9. BMSCE - Phase shift.jpg

10. KVG.jpg

11. SKSVMACET.jpg

12. SIT, Mangalore.jpg

13. PES, Polytechnic.jpg

14. KLE, Belgavi.jpg

15. JNCCE.jpg

16. Global Academy of Technology.jpg

17. AIET, Moodbidire.jpg

18. BIT[CSE].png

19. BMSIT[ISE].jpg

20. MCE.jpg

21. SIET.jpg

22. BMSIT[CSE].jpg

23. EDUSAT.jpg

24. VVCE.jpg

25. ATME.jpg

26. CITech.jpg

27. DSATM.jpg

27. Letter of appreciation - DSATM.jpg

28. BIT[TCE].jpg

29. CMRIT.jpg

30. BMSCE-ML.jpg

31. BMSCE-ML1.jpg

More information about Robotics and Embedded systems lab (PROPEL-1)

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.

Many students of different branches also come to the lab and work on different projects from the basic level to advanced level according to their capacity and expertise. 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 that was passed from seniors to juniors 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 in future.

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 the other means.

The lab also started a club known as "Robotics club" in the AY 2021-2022.

a) It was opened with an objective to to facilitate students to understand, design, and learn robotics.

b) To provide interested students with opportunities to express their skills, knowledge, and creativity through conceptualizing, designing, and programming robots.

The club is divided into 3 different subgroups namely, Mechanical Design & Fabrication (MDF), Computational Control & Intelligence (CCI), and Electronic Design & Processing (EDP).

- Mechanical Design & Fabrication (MDF):
  The students working under this subgroup will be learning about robot kinematics, mechanical designs, etc.
- Computational Control & Intelligence (CCI):
  The students working under this subgroup will be learning about robot control using different programming languages, and exploring Artificial Intelligence, Machine Learning, etc.

- Electronic Design & Processing (EDP):
  The students working under this subgroup will be learning about circuit design, PCB designing, exploring various actuators and sensors, exploring IoT for the robot, etc.

Also, the lab gave themes to first year students to do their mini projects on

1. DIY LIDAR (LIght Detection And Ranging).
2. Snake bot.
3. Gesture controlled bot.

The students have finished them in a very good way and the knowledge that they acquired will help them in their future competitions and also make them carry on them industrial level projects or for their future internships.

Fig 18: Inauguration function of the Robotics club

Fig 19: Students and faculty (mentors) who participated in the Robotics club

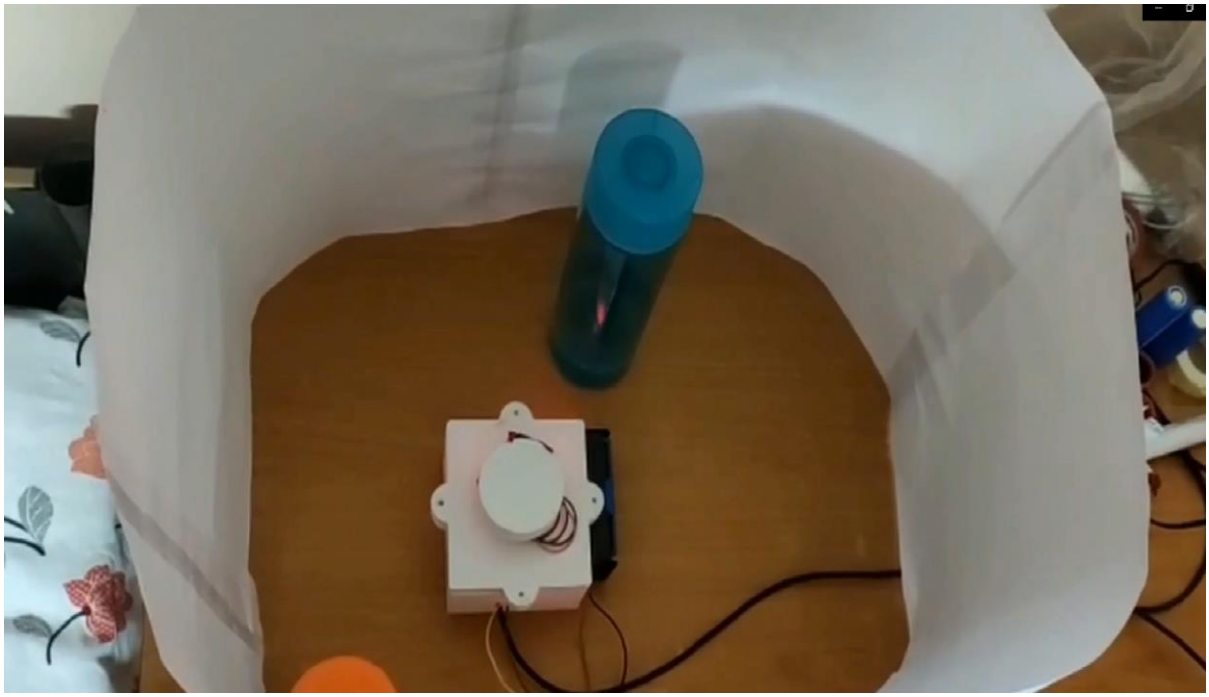


Fig 20: DIY LIDAR (Light Detection and Ranging) designed by students.

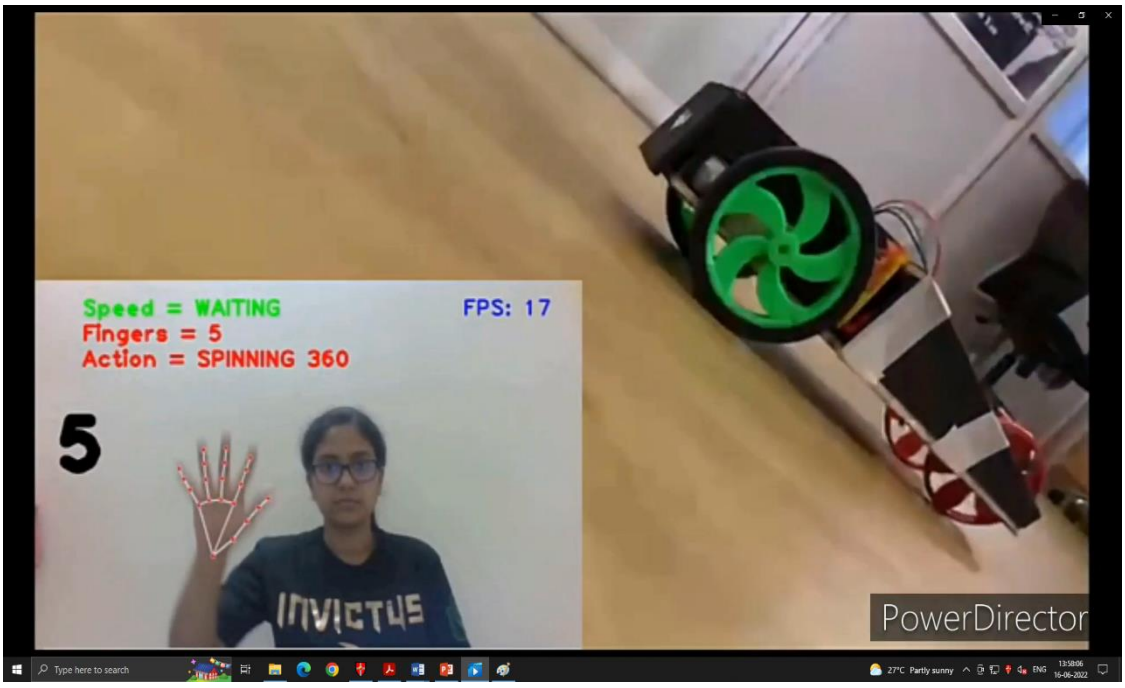


Fig 22: Gesture control bot designed by students

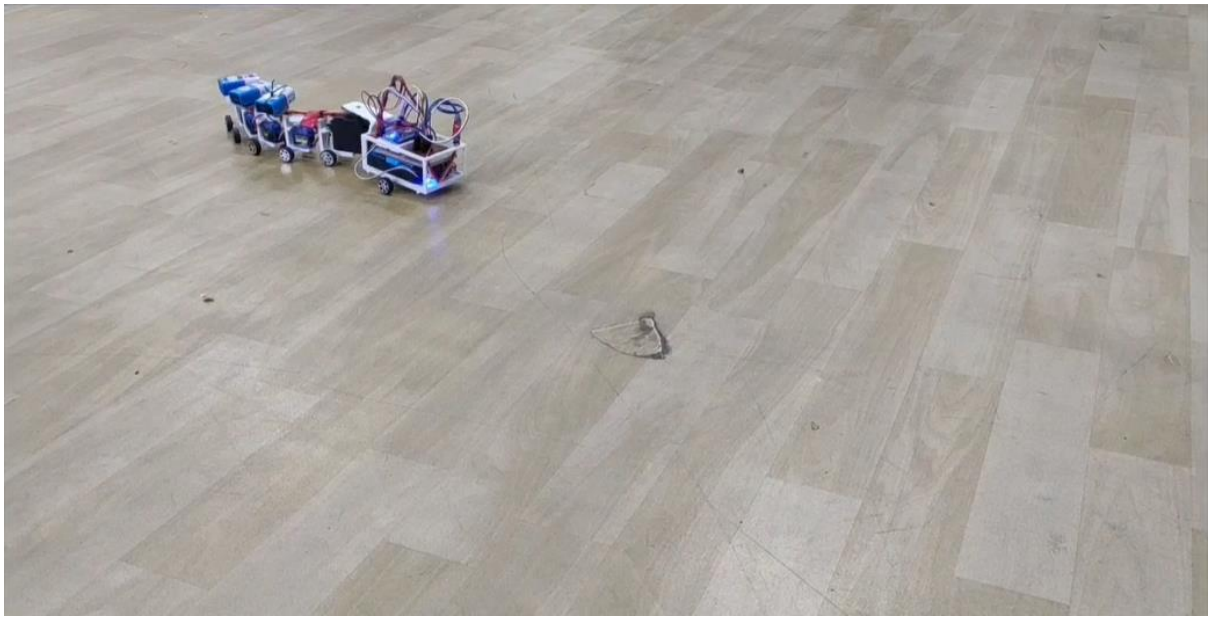


Fig 23: Snake bot designed by students

The lab works in the interdisciplinary area; students get more knowledge in other areas apart from their discipline. It meets the necessary parameters as expressed in the New Education Policy (NEP) which lays more stress on STEM areas. This makes them more market worthy than the other students. Every year the field of robotics is improving and propel lab makes it possible for the students to stay updated.