



**SOCIETY OF ROBOTICS AND
AUTOMATION**

**ANNUAL REPORT
17-18**



Who are we?

Passionate Engineers! We specialize in building all kinds of robots : from line followers to self balancing vehicles, from mini quadcopters to drones that can swim, from all terrain hexapods to humanoids that mimic your movement. We are also exploring the software domain, using computer vision, machine learning, Robot Operating System (ROS) to give life to our robots.

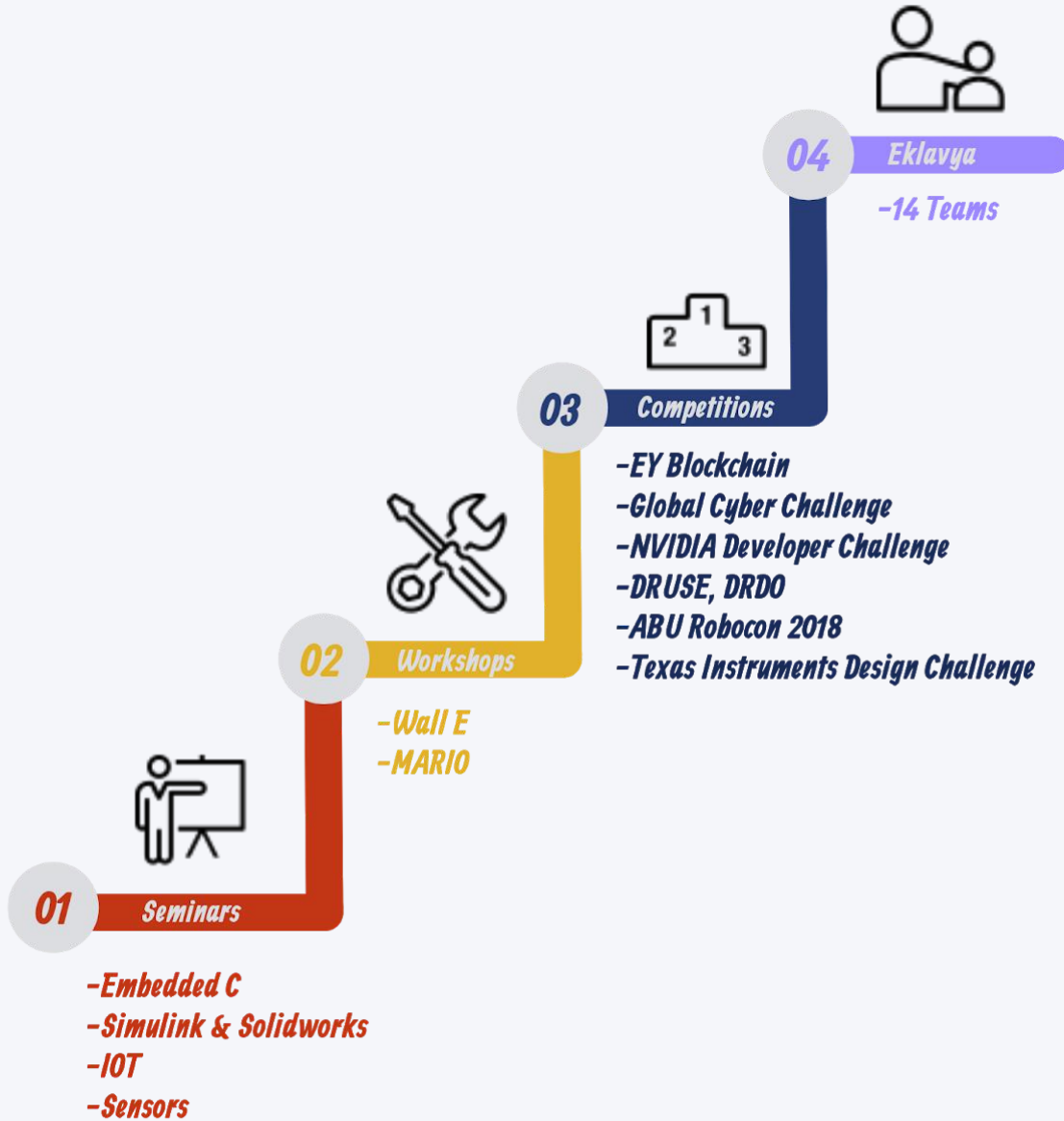
Our Mission?

To change:

“OMG it moves on it’s own. Must have done something **right!**” ~freshie on seeing his autobot move

To

“OMG it moves on it’s own! Must have done something **wrong!**” ~SRA Senior on seeing his autobot move.



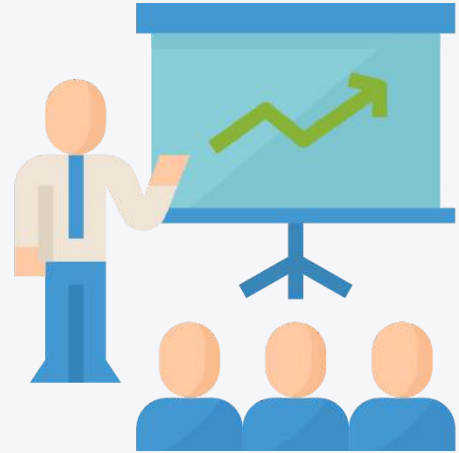


SEMINARS

Orientation: 21st September 2017

An introductory seminar that covered the breadth of robotics related topics so that the FYs got a clear picture of what they will be dealing with in the future. Following topics were covered:

1. Current Sensors
2. Opto Couplers
3. Pulse Width Modulation
4. Encoders
5. Transducers
6. Magneto Sensors
7. Embedded C
8. Simulink & Solidworks introduction
9. Internet of Things (IoT)



Introduction to Linux OS: 14th February 2018

This seminar was conducted as a prelude for the ROS workshop. FYs learnt how to dual boot their machines or use linux via virtual machine. Further, basic concepts of the linux environment were taught. Following topics were covered:

1. Why Linux?
2. How to dual boot /use a virtual machine ?
3. Basic commands





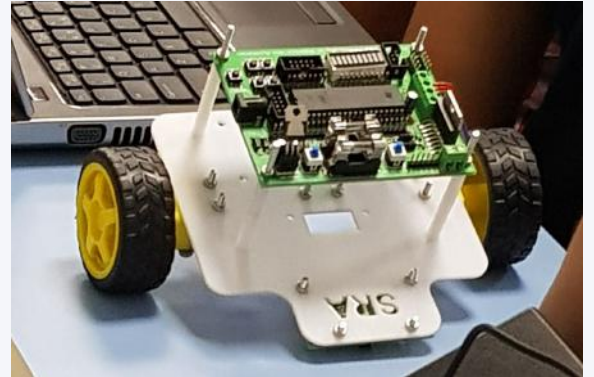
WORKSHOPS

Wall - E :

1st batch - 23rd - 24th September 2017

2nd batch - 30th September - 1st October 2017

Total Teams - 45



Changes:

Compared to the previous years , a major change was brought about in the workshop by incorporating self balancing feature in addition to the usual line following feature. Wall-E could thus now balance itself on two wheels while simultaneously following a line.

The SRA board layout was changed; removing LCD (but i2c LCD can be used)support but adding cp2102 (for serially monitoring the sensor values), MPU 6050 FRC slot, and changing the motor driver to L298N.



Following were the major topics covered:

Basics of electronics

Basics of coding

Introduction to AtMega16 and its registers

Motor Driver, PWM

IR sensors, MPU

ADC, I2C

Complementary filter



Workshop Video → <https://youtu.be/lxGWgHlnZDw>

Ma.R.I.O : (Manipulator on ROS based Input Output)

24th - 25th March 2018

Total Teams - 20

Recognizing the need to turn towards more robust robotic programming systems, we decided to equip our FYs with the most widely used software framework for Robotics programming - ROS. A 3DOF manipulator was used as the tool to teach concepts of ROS.

Following were the major concepts covered:

ROS:

What is ROS?

ROS filesystem

ROS computational graph

Running ROS on multiple machines

ROSSerial

Gazebo - What and Why?

Manipulator:

Kinematic Modelling using DH parameters

Forward kinematics

Inverse Kinematics



Workshop Video → <https://youtu.be/qkdTsRB-te4>



COMPETITIONS

Ernst Young Blockchain Hackathon

Date: 28th - 30th July, 2017

Theme:

This was a 36hr hackathon for Blockchain based solutions conducted by EY in association with IBM and Microsoft at Zone Startups, Mumbai.

Project:

Peer to Peer renewable energy trading solution using blockchain.

Description:

A live demonstration was presented for P2P energy trading in Microgrids using the Ethereum Blockchain Client along with a hardware implementation using PV emulators and smart meters.

Finishing position:

Winners!! Each member awarded a MacBook Air.

Team:

Ashish Kamble, Awadhut Thube, Jheel Nagaria and Saurabh Gupta.



Global Cyber Challenge - Peace-a-thon

Date: 20th - 21st November, 2017

Theme:

Global Cyber Challenge was an important part of Global Conference on Cyber Space (GCCS), 2017, inaugurated by the Hon'ble Prime Minister of India. Peace-a-thon is to build ideas and technological solutions based on identified themes and is based on different problem statements to which participants will render an effective solution in the form of a Proof-of-Concept/App.

Project:

Mitigating Public Sector Cyber Cascades.

Description:

A real time intrusion detection system (IDS) for the critical infrastructure of power grid which can detect internal as well as external attack vectors in real time.

Finishing position:

Hon'ble Prime Minister Shri Narendra Modi felicitated our team that won the challenge.

Team:

Tanay Shah, Rohit Bhaskar and Sachin Parekh.



NVIDIA Jetson Developer Challenge

Date: 23rd October, 2017 - 18th February, 2018

Theme:

Today's AI is empowering the world's brightest minds to create amazing breakthroughs. If this sounds like you, we've got the perfect challenge. Show us how you can transform robotics, industrial IoT, healthcare, security, or any other challenging application with a powerful AI solution built on **NVIDIA® Jetson™**.

Project 1:

Avitra - Reconnaissance Robot

Description:

It is designed to mitigate and work in disaster situations like nuclear and chemical leakages, hostage situations and other emergency situations where sending human is not possible. It uses AI and Deep Learning tools for simultaneous localization and mapping. It possesses a humanoid upper body controlled by imitation-based technique that provides it with unique dexterity and versatility. It also provides a video and audio live streaming to a remotely located operator.

Finishing position:

AVITRA, Human-in-Loop AI Robot of VJTI won People Choice Award of NVIDIA Jetson Developer Challenge 2018. The team was awarded with 1000\$ cash prize, NVIDIA Jetson TX2 GPU, NVIDIA Titan XP and Deep Learning Institute Training.

Team: Amit Kharwandikar, Awadhut Thube, Pranav Udupa, Saurabh Gupta, Jay Sawant and Sachin Parekh.



Working video -> <https://challengerocket.com/nvidia/works/avitra--reconnaissance-robot-bbc561>



Project 2:

Smarter Office Automation system

Description:

People say "AI is the new Electricity", we wholeheartedly believe in this Quote. The commercial office sectors are said to consume about 30% of world's total electricity but seeing around in offices we can clearly predict that there is a lot of power being wasted. The purpose of our project is to use the power of Deep Learning and Artificial Intelligence to solve the problem of Electricity Wastage and provide an efficient way of saving Electricity in offices. As the whole project is built around saving electricity in offices, we have also developed few other Deep Learning models to increase the productivity and security in offices which has led us to build a complete Office Automation and Security System. The things which set apart our office automation system with few others that are available today is that the present automation system still requires an Android/iOS app for getting things done, so this completely rips off the idea of being automated. The present office automation systems are also very costly. Our office automation system takes care that the hardware is capable enough of handling the complete task with minimal human interaction/interference thus making the system automated in true sense. Relative to present automation systems our product is cheaper.

Finishing position:

Smarter Office Automation system of VJTI was second People Choice Award of NVIDIA Jetson Developer Challenge 2018.

Team: Shubham Patil, Nipun Suradkar, Ashish Agarwal, Rajneesh Katkam, Swapnil Parekh

Working video ->

<https://challengerocket.com/nvidia/works/Smarter-Office-Automation-system-563b0b>

I_Hack

Date: 26th - 28th January, 2018

Theme:

This was a 48-hour hackathon with a variety of problem statements split into software and hardware tracks. It was held at E-Summit 2018 at IIT-B, organised in association with Texas Instruments and Pepipost.

Project Chosen and Implemented:

Our team developed a web application for accurate classification of emails into useful and spam categories.

Description:

A variety of not only naive machine learning algorithms like the random forest and the naive bayes classifier, but also deep learning algorithms including 1D Convolutional Neural Networks and LSTMs with varied hyperparameters were implemented and tested, and the best performing model was selected and interfaced with using a simple Flask server and web UI.

Finishing position:

Winners! Our team's implementation (an augmented 1D ConvNet) outperformed all the other competing models with a validation accuracy of 95.2%, and hence was declared the overall winner of the software hackathon.

Team:

Apoorva Gokhale, Chirag Trasikar, Aditya Malshikhare, Rahul Singh



DRDO Robotics and Unmanned Systems Exposition

Theme: DRDO Robotics and Unmanned Systems Exposition (DRUSE) is designed to serve as an open platform to popularize and synergize the national talent in the areas of robotics amongst Students for conceptualization, design & development of Unmanned Systems for defence applications.

Project 1: Avitra - Reconnaissance Robot

Description: It is designed to mitigate and work in disaster situations like nuclear and chemical leakages, hostage situations and other emergency situations where sending human is not possible. It uses AI and Deep Learning tools for simultaneous localization and mapping. It possesses a humanoid upper body controlled by imitation-based technique that provides it with unique dexterity and versatility. It also provides a video and audio live streaming to a remotely located operator.

Team: Amit Kharwandikar, Awadhut Thube, Pranav Udupa, Saurabh Gupta, Jay Sawant and Sachin Parekh.

Project 2: PUSH PAC

Description: It is a hybrid vehicle which was proposed to traverse in all three mediums viz. air, water and land. The prototype was successfully able to maneuver in air and in water. It's applications range from marine and aerial surveillance for defense purposes to various exploratory tasks which currently use UAVs or AUVs.

Team: Pradeep Suresh, Mujammil Patel, Rishabh Shah, Apoorva Gokhale and Prajwal Poojari



working video -><https://youtu.be/IH6M7X4LKLE>

ABU ROBOCON, 2018

Problem Statement -> https://youtu.be/GAjVA2u-_1s

Achievements:

- Finished 4th Overall in National Robocon
- Third fastest task completion in 1:06 minutes
- Won the best Manual Robot Operator Award



SRA, VJTI Task Completion in Top 24:

https://drive.google.com/open?id=1htzcT6oN4mUHgDhkCWH1S1Q_WvyecAZd



TIIDC 2017, Texas Instruments

Theme: 2 Teams from SRA participated in the competition where the teams are expected to design a product from the viewpoint of a startup.

Project 1: Device failure prediction using time series modelling.

Team: Suyash Junnarkar, Viraj Sonawane, Atharva Khadtare, Atharva Bhawe, Chinmay Khopde

Final Position: Reached the quarter-finals of the competition.

Working video -><https://www.youtube.com/watch?v=Dlc2OBamcsw>
->https://www.youtube.com/watch?v=e-QNsDYf_iY

Project 2: Complete Farm automation solution including Seed Selection, Seed Sowing, Irrigation automation, Crop disease detection and crop growth monitoring.

Team: Mujammil Patel, Pradeep Suresh, Shubham Patil, Rajneesh Katkam, Ashish Agrawal

Final Position: Reached the semi-finals of the competition.

Working video -><https://www.youtube.com/watch?v=5DmQSIQV7c8&t=8s>
-> <https://www.youtube.com/watch?v=s6azxXXAnnU>

AICTE-SMART INDIA HACKATHON, 2018

Theme: It is a non-stop 36-hours digital product development competition, where problems are posed to technology students for innovative solutions.

Project: Telecom Connectivity Analysis and Predicting the health of the Optical Fiber based on past history.

Description:

Currently the methods used to monitor telecom channels are mainly based on limit checking of parameters, where the table of nominal channels is compared against real-time channel values to determine if the values fall within the specified ranges for healthy channel.

The solution for this was to develop a Channel Monitor and Anomaly Detector based on known Machine Learning techniques that seeks to rectify the problems faced by the existing solution. The data is generated continuously from the Health Monitoring systems which can be used to train a Machine Learning model rather than just collecting the data for limit checking purposes. This trained model can then be used to predict the time of the failure of the optical cable and its health in near future. With this approach we reduced the downtime of the system by replacing the cables before getting failed and also reduced the economic losses incurred due to system down state.

Team Members: Rajneesh Katkam, Ashish Agarwal, Siddhesh Gangan, Dipti Kulkarni, Shreyas Gokhale, Yash Jain.

Finishing Position: The team stood 3rd in the India under the Ministry of Railways. The team was awarded with ₹ 50K cheque and a trophy from Ministry of Railways.





EKLAVYA

(Mentorship Programme)



The projects that were undertaken and completed by **first year engineering students**. The projects were completed in a timespan of 60 days.

Project Idea	Description
An Affordable Gimbal	Achieve stabilization in 3-axes for a particular object, using easily available components.
Window Cleaner	Making Bot that can clean windows of skyscrapers, thus replacing high risk job of manually cleaning the windows.
VR for Education	Teaching Kids with learning disabilities to imagine 3D objects using Virtual Reality and Self-immersion.
Car Density based Traffic Signal	Automating the Traffic signals based on the density, therefore optimizing the flow.
Swarm Robotics	Enabling a cluster of robots to work in harmony to achieve a common task.
Smart Spectacles	Spectacles to detect whether a person is sleeping or going to sleep, thus proving it crucial for a driver.
Smart Clothes Trial	Using image processing to enable people to try out different clothes without really putting them on by overlaying the clothes on person's image in real time.
Automated Marker	A bot that marks a sheet of ply with the shapes you want to cut and optimizing for minimal wastage of ply.
Voice Activated Drawer	An automatic drawer that knows what it contains and responds to the user's voice.
AR Glasses	Glasses with augmented reality to help people with partial or color blindness see.
Room Organizer Bot	Making a bot that can detect various objects scattered around and organize a room According to users specifications
Autonomous Soil Data Acquisition and data base management	Enable farmers to check various soil parameters to determine which plants to grow and eventually make a database.
Smart Shoes	Shoes that help in navigation while navigation and data analytics on various walking patterns.
Jumpee	Bot that determines an obstacles (ranging in sizes) and avoids them.
Eye Writer	Eye ball tracking to control the computer for people suffering from ALS.
Automatic Chess	Chess board where pieces move automatically.
Roomba	Automatic Room cleaning Bot.

Eklavya 2017 -> <https://drive.google.com/open?id=0B7Gv3-tG3f0fWVVLTYxRzQxVTg>



CHANGES IN SRA



Changes in the SRA Board:

3 major changes in SRA board for Wall - E 2.0 Workshop:

1. Removed the LCD slot. Provision for CP2102 to use Serial Monitor for debugging
2. Replaced L293D with L298 Motor Driver IC
3. MPU 6050 slot added

Self-Balancing Robot Workshop (1st Workshop):

Line Following Workshop has changed to "Line Following + Self-Balancing".

Things learnt & implemented:

1. Inertial measurement unit (IMU)
2. Filters (Kalman, Complementary, Madgwick)
3. I²C interfacing
4. PID Control

Robotic Manipulator on ROS (2nd Workshop):

Wireless workshop has moved on to the Industrial Standard of ROS and pure robotics concepts

Things learnt & implemented:

1. Linux Terminal Basic Commands
2. Kinematic Modelling of a Robotic Arm (DH Parameters)
3. Basics of Robot Operating System(ROS)
4. Forward and Inverse Kinematics control of robotic arm using ROS framework
5. Introduction to Gazebo Simulation on ROS

SRA Accolades on VJTI Website:

<http://www.vjti.ac.in/index.php/stuacca1>

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THANK YOU

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