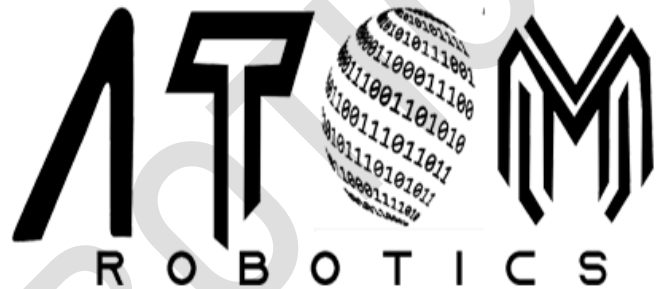**VIT®**

Vellore Institute of Technology

(Deemed to be University under section 3 of UGC Act, 1956)

CHENNAI

ATOM ROBOTICS

Intelligent Robots and CanSat Exploration Team

TEAM REPORT

ABOUT US

We, ATOM Robotics of VIT Chennai is an official team consisting of 40+ passionate students from different field of study with an unconditional love for Robotics. We as a team focus on acting as a platform for young aspiring minds to prosper in the said field. We have been participating in several competitions for the past two years, conducted in varies universities and by varies organizations across India and made impressing marks in those competitions, thereby winning 15+ competitions till date.

Our major targeted competitions are the IGVC and CanSat, which makes us the only team of Vellore Institute of Technology to compete in these international competitions held in United States of America. We are also a team working in several fun filled project activities and research-oriented studies. The major domains of study under Atom Robotics and the prominent skills an individual can master as part of Atom Robotics are:

- Mechanical- Solidworks, Fusion360, Catia, ANSYS, Cura, Rhinoceros.
- Electrical- PCB designing and testing, Communication, Controllers Coding.
- Computer Science- ROS, C, C++, Python, Vision and ML, Linux, GUIs.

Some of the interesting projects we have made so far are autonomous stair climbing robot with actuators, gyro intended to deliver packages from a place to another; X-Ray detection, Retinal OCT detection, Retinopathy detection used for differentiating between various diseases using custom training using pre-trained networks and data augmentation with an IOU of 85%. Other computer vision projects done are Tennis Ball tracking, Accident alarming system, forest fire detection etc. Semantic Segmentation was another domain we have excelled. We implemented a concept called Conditional Random Fields on the custom Semantic Segmentation models thus enhancing its accuracy.

We also work on various ROS based projects including ROS industrial packages for KUKA 530 using Moveit; Inverse kinematics for 6-DOF manipulator with anti-collision algorithms were made; SLAM concepts for navigation using Gazebo Simulator and RViz (Linux-based). Our team also focusses on improving the efficiency of mechanical simulations using ML algorithms. For example, we recently made a neural network model for prediction velocity distribution around a circular cylinder using pressure contours. ANSYS Fluent simulations of flow around a cylinder were carried out to establish a dataset to establish mapping relationship between pressure and velocity. The network layers can thus process the pressure information by features extraction to obtain the velocity distribution.

ABOUT IGVC

The IGVC offers a design experience that is at the very cutting edge of engineering education. It is multidisciplinary, theory-based, hands-on, team implemented, outcome assessed, and based on product realization. It encompasses the very latest technologies impacting industrial development and taps subjects of high interest to students. The deadline of an end-of-term competition is a real-world constraint that includes the excitement of potential winning recognition and financial gain. Students solicit and interact with industrial sponsors who provide component hardware and advice, and in that way get an inside view of industrial design and opportunities for employment.

ABOUT CanSat

The American Astronautical Society (AAS) has organized an annual student design-build-launch competition for space-related topics. Although similar competitions exist for other fields of engineering (robots, radio-control airplanes, racing cars, etc.), most space-related competitions are paper design competitions. While these are worthwhile, they do not give students the satisfaction of being involved with the end-to-end life cycle of a complex engineering project, from conceptual design, through integration and test, actual operation of the system and concluding with a post-mission summary and debrief. This competition fulfills that need!

Teams must be able to design and build a space-type system, following the approved competition guide, and then compete against each at the end of two semesters to determine the winners. In CanSat competitions, the payload is required to fit inside the volume of a typical soda can (66mm diameter and 115mm height) and have a mass below 350g. Antennas can be mounted externally, but the diameter can't increase until the CanSat has left the launch vehicle. The CanSats are deployed from small rocket at height which varies depending on the competition. CanSats are equipped with a recovery system, usually a parachute, to limit damage upon recovery and to allow the CanSat to be reused.

ABOUT World Robotics Olympiad (WRO)

World Robot Olympiad (WRO) is one of the largest Robotics competitions in India for students between the age group of 6 to 19 years, held since 2006. It is a not-for-profit competition organized by India STEM Foundation. WRO is an event for science, technology and education which brings together the young people all over the world to develop their creativity and problem-solving skills through challenging and educational robotics competition. Participating teams need to create, design and build the robot model that looks like a human athlete.

ABOUT OUR AERIAL ROBOTICS

We Atom Robotics, also work on research activities and development of aerial robotics. We have in fact published research papers and wrote packages for the navigation of autonomous drones. The major domains of aerial robots we work on are Navigation and SLAM, Sensor fusion for increasing the performance, efficient usages of firmware architectures like AEROSTACK etc.

A lot of SLAM techniques including Gmapping, Karto, Hector, Cartographer using Extended Kalman Filter, Monte-Carlo Filter localization; Navigation, path planning (A*, Dijkstra's, Theta* algorithms) and 3D mapping for aerial robots using gazebo simulator, RtabMap and Visual-SLAM were done.

Our current research emphasizes on an invention of a firmware for navigation that can be done using SLAM techniques. This firmware will be used as an alternative for GPS, which causes reception glitches due to failures.

Below we have mentioned the research paper published along with a copy of the paper, ROS packages written for navigation of Autonomous Aerial Vehicles and articles we have written based in SLAM concepts for aerial robotics.

RESEARCH PAPER PUBLISHED

- Jerrin Bright, R Suryaprakash, S Akash, A Giridharan **(2020)** Optimization of a quadcopter frame using generative design and comparison with DJI F450 drone frame.

This paper was based on generative designing, where we GD a UAV frame and compared it with traditionally designed frames and logged the results attained comparing both the frames.

- Research paper link: https://doi.org/10.1088/1757-899X/1012/1/012019

PACKAGE PUBLISHED

- https://github.com/jerrie-bright/QuadX

RESEARCH ARTICLES

- https://github.com/atomrobotics/atomrobotics.github.io/blob/master/SLAM-REPORT.pdf

TEAMS UNDER ATOM ROBOTICS

CATEGORY I

    I. Line Follower
    II. Robo Race
    III. Maze Runner
    IV. Robo-Clench
    V. Robo-Soccer
    VI. Water Rocket
    VII. Robo-Sumo

CATEGORY II

    VIII. Can-Satellites
    IX. Battle Bots
    X. Autonomous Robo-Soccer

CATEGORY III

    XI. Intelligent Ground Vehicles

MAJOR COMPETITIONS AIMED

NATIONAL COMPS

#	Competition Name	Hosted by	Tentative Timeline
1	APOGEE	BITS Pilani	February
2	ROBOVEDA	SNIST, Hyderabad	September
3	WRO	India STEM Foundation	March
4	ATMOS	BITS Pilani Hyderabad	November

INTERNATIONAL COMPS

#	Competition Name	Hosted by	Tentative Timeline
1	IGVC	Oakland Uni, AUVSI, GL S&T	June
2	CanSat	American Astronautical Society	July

OUR TEAM

We consist of 50 students till date with passion and vigor to learn and excel in robotics. The list of the core team and our faculty coordinator and Senior Advisory is listed below for the documentation.

FACULTY COORDINATOR

Dr. Arockia Selvakumar [Snr Associate Professor]

SENIOR ADVISORY

Mani Bharathi

CORE TEAM

|		
1. Jerrin Bright	Team Captain, Co-Founder	18BME1004
2. Surya Prakash	Vice-Captain, Co-Founder	18BME1183
3. Nishanth R	Team Lead, Co-Founder	18BME1024
4. Mahendar Kumar	Mechanical Head	18BME1021
5. Shalen Brisil	Mechanical Jnr Lead	18BME1002
6. Akshaya V	Electrical Head	18BME1020
7. Karthikeyan E	Electrical Jnr Lead	18BME1021
8. Akash V	Computer Science Head	18BME1028
9. Gaurav Prasanna	Computer Science Jnr Lead	19BEC1315
10. Venkat Kiran	Designing Head	18BME1165
11. Rithwik	Designing Lead	18BME1321
12. Naveen Raj	Content Head	18BME1011
13. Chamala Vaishnavi	Content Lead	18BME1008
14. Gregory Jaison	Marketing Lead	18BME1027
15. Akash S	Management Lead	18BME1034

COMPETITIONS WON

We have participated in numerous competitions and have made a mark in many of those competitions including some national level competitions. The competitions we have won from the Jan of 2019 to March of 2020 are listed below:

I. Winner of Autonomous Line follower, CURRENTS'20 @ NIT Trichy.

II. Winner of RoboZest, KURUKSHETRA'20 @ CEG, Anna University.

III. First runner up of Line follower @ Chennai International Youth Fest conducted by Youth development Consortium.

IV. Fourth runner up in Autonomous Law follower ATMOS @ BITS Pilani.

V. Winner of Autonomous Line follower RoboPrix 2019 @ VIT Chennai.

VI. Winner of Autonomous Line follower Vashisht 2019 @ IIITDM Kanchipuram.

VII. Winner of Autonomous Line follower Invente 4.0 @ SSN, kalavakkam.

VIII. Winner of Autonomous Line follower Jarvis 2019 @ CIT, kundrathur.

IX. Winner of Autonomous Line follower McAdroit 2020 @ SRM Easwari.

X. Winner of Autonomous Line follower, Maze Runner and Mr Coder SCARA 2020 @ Jeppiar College of Engineering, Padur.

XI. Winner of Autonomous Line follower EMFISIS 2020 @ KCG College of Technology, karapakkam.

XII. Winner of Autonomous Line follower ELECTROFOCUS'20 @ MIT, Chromepet.

XIII. Winner of Autonomous Line follower ROBOPRIX'20 @ VIT Chennai.

XIV. Winner of Autonomous Line follower PISTOBOLTZ'20 @ MIT, Chromepet.

XV. Winner of Autonomous Line follower PRAGYOTSAV'20 @ SRM Easwari.

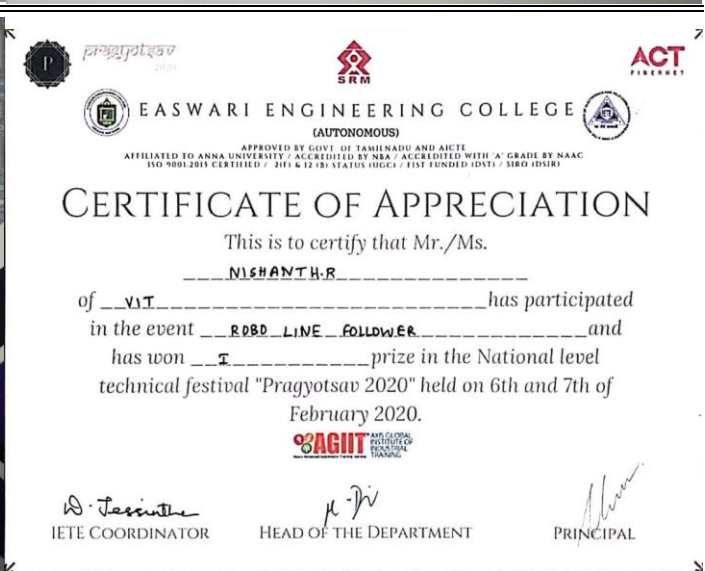XVI. First Runner-up of Autonomous Line follower DEXBOT'20 @ MIT, Chromepet.

In the coming pages, the list of the above-mentioned competitions is detailed along with competition information and certificates.
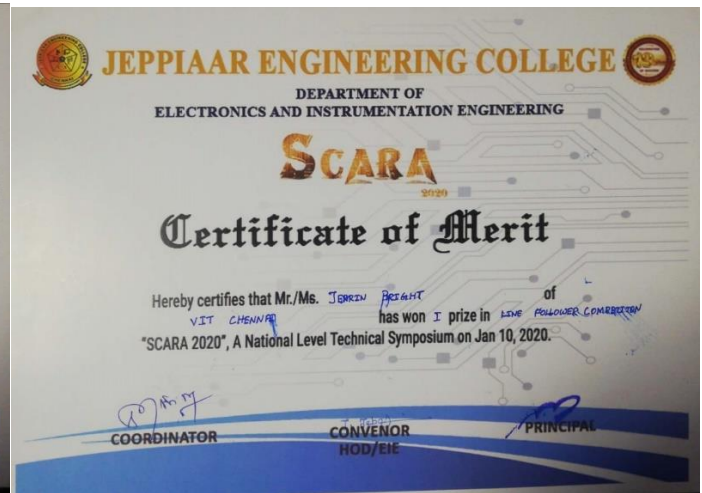
CERTIFICATES
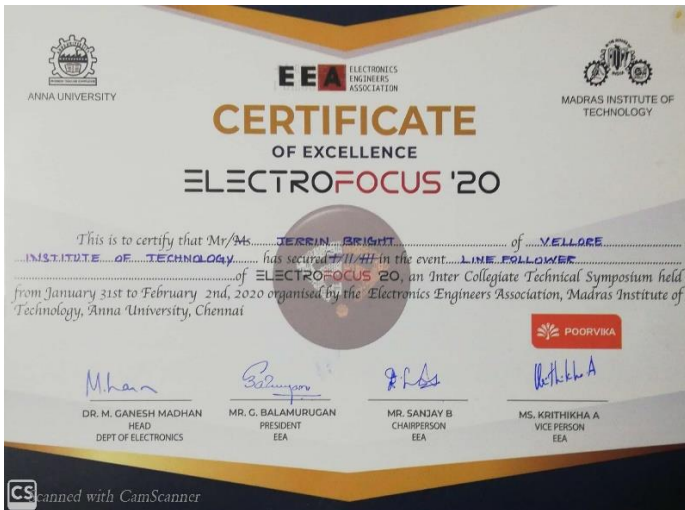
CURRENTS

LOCATION	NIT Trichy
DATE	16th February 2020
CONDUCTED BY	Electrical and Electronics Department
COMPETITION	Autonomous Line Follower
POSITION	1st Place
PRIZE MONEY	Rs 5000 cash
PARTICIPANTS	Jerrin Bright Suryaprakash Nishanth R

KURUKSHETRA

LOCATION	CEG Anna University
DATE	15th February 2020
COMPETITION	RoboZest
POSITION	1st Place
PRIZE MONEY	Rs 5000 cash
PARTICIPANTS	Jerrin Bright Suryaprakash Nishanth R

CHENNAI INTERNATIONAL YOUTH FEST (CIYF)

LOCATION	SRM Ramapuram	
DATE	15th September 2019	
CONDUCTED BY	Youth Development Consortium	
COMPETITION	Autonomous Line Follower	
POSITION	1st Runner-up	
PRIZE MONEY	Rs 10,000 worth of coupons, Medal & Trophy	
PARTICIPANTS	Jerrin Bright	Akash V
	Suryaprakash	Varun Darshan
	Nishanth R	

ATMOS

LOCATION	BITS Pilani, Hyderabad
DATE	18th & 19th October 2019
CONDUCTED BY	Technical and Management Team
COMPETITION	Autonomous Line Follower
POSITION	4th Runner-up
PARTICIPANTS	Jerrin Bright Akash V Suryaprakash Varun Darshan Nishanth R

VASHISTH 2019

LOCATION	IIITDM Kanchipuram
DATE	30th & 31st March 2019
CONDUCTED BY	Electrical and Electronics Department
COMPETITION	Autonomous Line Follower
POSITION	1st Place
PRIZE MONEY	Rs 5000 cash
PARTICIPANTS	Jerrin Bright Nishanth R Suryaprakash Amarnath

ROBOPRIX 2019

LOCATION	VIT Chennai
DATE	8th & 9th February 2019
CONDUCTED BY	Robotics Club
COMPETITION	Autonomous Line Follower
POSITION	1st Place
PRIZE MONEY	Rs 6000 cash
PARTICIPANTS	Jerrin Bright Rohith R Suryaprakash Palaniappan Nishanth R

JARVIS V19.9.4

LOCATION	CIT Institute of Technology	
DATE	4th September 2019	
CONDUCTED BY	Mechatronics Department	
COMPETITION	Autonomous Line Follower	
POSITION	1st Place	
PRIZE MONEY	Rs 2000 cash	
PARTICIPANTS	Jerrin Bright	Nishanth R
	Suryaprakash	Varun Darshan

INVENTE 4.0

LOCATION	SSN College of Engineering	
DATE	13th & 14th September 2019	
CONDUCTED BY	Electrical and Electronics Department	
COMPETITION	Autonomous Line Follower	
POSITION	1st Place	
PRIZE MONEY	Rs 3500 cash	
PARTICIPANTS	Jerrin Bright	Nishanth R
	Suryaprakash	Varun Darshan

SCARA 20

LOCATION	Jeppiaar Engineering College
DATE	10th January 2020
CONDUCTED BY	Electrical and Instrumentation Department
COMPETITION	Autonomous Line Follower, Line Maze and Mr. Coder
POSITION	1st Place, 1st Place, 1st Runner-up
PRIZE MONEY	Rs 2000 cash and 5000 worth of coupons
PARTICIPANTS	Jerrin Bright Nishanth R

MCADROIT 20

LOCATION	SRM Easwari
DATE	3th January 2020
CONDUCTED BY	Mechanical Department
COMPETITION	Autonomous Line Follower
POSITION	1st Place
PRIZE MONEY	Rs 1000 cash
PARTICIPANTS	Jerrin Bright Suryaprakash Rohith R

EMFISIS 20

LOCATION	KCG College of Engineering
DATE	11th January 2020
CONDUCTED BY	Electrical and Electronics Department
COMPETITION	Autonomous Line Follower
POSITION	1st Place
PRIZE MONEY	Rs 2000 cash and Rs 1000 worth coupons
PARTICIPANTS	Jerrin Bright Nishanth R Akash V

ELECTROFOCUS 20

LOCATION	MIT, Anna University	
DATE	2nd February 2020	
CONDUCTED BY	Electrical and Electronics Department	
COMPETITION	Autonomous Line Follower	
POSITION	1st and 2nd Place	
PRIZE MONEY	Rs 2000 + Rs. 1500 cash	
PARTICIPANTS	Jerrin Bright Suryaprakash Nishanth R	Akash V Pranav KS Ashish S

ROBOPRIX 20

LOCATION	VIT Chennai
DATE	21th February 2020
CONDUCTED BY	Robotics Club
COMPETITION	Autonomous Line Follower
POSITION	1st + 2nd Place
PRIZE MONEY	Rs 2000 + Rs. 1000 cash
PARTICIPANTS	Jerrin Bright Amarnath Suryaprakash Rohith R Nishanth R Ashish S

PISTOBOTZ 20

LOCATION	MIT, Anna University
DATE	28th February 2020
CONDUCTED BY	Mechanical Department
COMPETITION	Autonomous Line Follower
POSITION	1st Place
PRIZE MONEY	Rs 3000 cash
PARTICIPANTS	Pranav KS Ashish S

PRAGYOTSAV 20

LOCATION	SRM Easwari Engineering College
DATE	6th February 2020
CONDUCTED BY	Electrical and Electronics Department
COMPETITION	Autonomous Line Follower
POSITION	1st Place
PRIZE MONEY	Rs 4000 cash
PARTICIPANTS	Jerrin Bright Suryaprakash Nishanth R

SOCIAL MEDIA PLATFORM

WEBSITE:

https://atomrobotics.github.io/

OTHERS:

INSTAGRAM: https://www.instagram.com/atom___robotics/

LINKEDIN: https://www.linkedin.com/company/atomrobotics/

FACEBOOK: https://www.facebook.com/atomrobotics.rc

DECLARATION

We Atom Robotics, hereby declare that all the above-mentioned information about the team is true to our knowledge, as of December the 28th, 2020. References available on request.

THANK YOU!!!