

# **e-Yantra Summer Internship Program (eYSIP): a Priceless Prize for Students**

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## **1. Introduction**

Given over 5000 engineering colleges in India and almost 1 Million engineering students being trained every year, the level of practical training amongst them is quite low. The e-Yantra Summer internship Program is an attempt to build a scalable model for engaging with students who are prize winners in the annually held e-Yantra Robotics Competition (eYRC). Our internship program is an in-house 6-week training at IIT Bombay managed by the e-Yantra project staff. The key features of eYSIP include: (i) Designing and implementing a project (ii) Learning to analyze a problem and finding and defending an efficient solution (iii) Polishing team work, presentation and writing skills and (iv) Broadening skillsets through field trips, talks by eminent speakers, and historical tours.

### ***e-Yantra and its Initiatives to Promote Robotic Education***

Most engineering college students are passionate about participating in Robotic competitions. While, most competitions expect students to build a robot from scratch where students invest in building the robots, e-Yantra does things differently. Teams participating in the e-Yantra Robotics Competition (eYRC) are given a robotic kit with sensors / actuators and all required accessories and all the training to compete in the competition.

e-Yantra is a project sponsored by the Ministry of Human Resource Development (MHRD/GoI) under the National Mission for Education through Information and Communication Technology (NMEICT), to promote robot enhanced education in undergraduate engineering colleges.

In eYRC, students participate as a team of four students from one college. These teams have to register, qualify to participate through an online selection test and are given robotic kits to solve a scaled down version of a real world problem and demonstrate their prototypes on 6ft to 8ft flex-sheet arenas.

Participation in the competition amounts to learning programming, thinking innovatively to design structures on the robot to solve a given problem in an efficient and effective manner. This has been achieved through a Project Based Learning (PBL) exercise which requires us to (i) train students in the basics of embedded systems and micro-controller programming, (ii) provide them with a platform to implement a project and (iii) a methodology imparting PBL at a distance through the Internet in a step-by-step manner [1, 2].

e-Yantra Robotics Competition has been running successfully since it's inception in 2012, with increasing numbers of students and colleges registering and participating in these competitions. Currently into its fourth year eYRC-2015 is in progress.

Themes assigned in the competition and the extent of participation is given in Table 1. Teams participate in the competition online over a period of 4 months – completing tasks such as Theme Analysis, Implementation Analysis, Video Submission of a working demonstration, and Code & Documentation – that form the steps in the project life cycle. Based on their cumulative scores, top performing teams from each theme are selected as “Finalists” to come to IIT Bombay and demonstrate their solutions in front of a panel of judges and students.

**Table 1: Themes and Participation Statistics**

Competition	Domain	Themes	Number of students
eYRC-2012	Automation	Pothole filler Pick Placer Room Cleaner White line follower	Registrations: 4384 Selected: 500 (131 Teams) Finalists: 80
eYRC-2013	Urban Agriculture	Seed Sowing Weeding Fertilizing Fruit Plucking	Registrations: 6324 Selected: 640 (160 teams) Finalists: 80
eYRC - 2014	Urban Services	Caretaker Robot Cargo Alignment Cargo Sorting Fire Fighting Warehouse Management Waste Segregation	Registrations: 12428 Selected: 1444 (361 teams) Finalists: 132
eYRC-2015	Smart services	Themes such as Pizza Delivery, Hazardous waste Disposal, and Puzzle Solver are being designed.	Registrations: 19572 Selected: In process

## **2. A Priceless Prize**

Unlike other competitions, first prize awarded (top teams in each theme are selected) is a 6-week summer internship at IIT Bombay. For students, **the most important and most relevant aspect of the competition is an opportunity to be a summer intern in the Robotics Lab at IIT Bombay, which the students cherish more than the cash prize.**

**The aim of the e-Yantra Summer Internship Program (eYSIP) is to provide winners of the e-Yantra Robotics Competition:**

- A platform with facilities and guidance to work on projects covering the varied spectrum of web-development, image processing and embedded systems
- A chance to experience a research environment and put on their thinking hats

- An opportunity to mold themselves into confident individuals through talks by experts, exploratory trips to nearby historical places and interactions with eminent personalities.

The number of students offered internships is shown in Table 2.

**Table 2: Number of students offered summer internship.**

Summer Internship	Number of students offered Internship	Number of students accepted internship
eYSIP – 2013	16	13
eYSIP – 2014	36	13
eYSIP – 2015	32	29

### ***Projects***

We have floated more number of projects with increased complexity over time. Again, the focus has been on individual mentoring of the students and the ability of students to work in a team. In the first two years, interns worked in a team of four members. The last year (eYSIP- 2015), more projects were conceptualized and every team had only two members in order to give them more individual attention.

The projects given have been indeed challenging and provided an opportunity to learn something new that they had not managed to in their curriculum.

For instance, some of the projects namely Marker based Robot Localization, Attendance System using Face Recognition, used concepts of image processing, which to most of the students was an unexplored subject.

For most of the interns this internship period has been a valuable learning experience both technically and socially. Working in a team, sharing their ideas and putting heads together to solve a problem, working long hours in a mind-open environment. One of the interns Niharika says that the 5 weeks of training has changed her from being a skeptic to a confident person and now understands learning is possible by believing in one self. She learnt image processing during her internship, and is sure that she will be able to learn even more difficult topics.

### ***Process followed to encourage teamwork, presentation and writing skills***

The processes we used in engaging the interns for the 6 weeks with us are born out of our teaching of the CS684 Embedded Systems course at IIT Bombay. Having prepared a set of interesting projects useful to us beforehand we prepared and vetted 1-3 page summaries listing the goals and difficulty level and deliverables and a list of deliverables with an estimated time for each. We mimicked a professional work place where we broke up the original teams and reallocated them to work with randomly

allocated members from other teams. Each team had to make a presentation in the lab every fortnight and was given presentation templates. At the end of the project they were given templates for the final presentation and coding standards for delivery of documented code and a template for a final report. The process is elaborated below.

Each project was video-recorded by a professional team such that the closure had all the work products such that another team might continue the work. This “industrial” exposure we believe makes the raw students more amenable to being productive and professional when employed.

#### *Steps in the e-Yantra Summer Internship Programme (eYSIP)*

- The interested students have to follow the official procedure of submitting requested documents to the academic office at IIT Bombay.
- The interns are provided accommodation and a stipend at the end of the tenure of their internship that covers all incidental expenses.
- The interns are sent information regarding joining date, reporting and accommodation.
- They are sent tutorials on LATEX and Github, Piazza forum through which they communicate with the group and their mentors.
- When the interns join, they are provided an orientation session and given an overview of their projects.
- The project engineers, who have created and suggested the projects, interview the students.
- The objective of the interview is to assess the aptitude of the interns, their interests and accordingly assign summer internship problem that they will work on during the summer under the mentorship of one or two project staff.
- Conception of a problem requires a lot of thinking and planning on the part of the e-Yantra team. It is designed in a way that there is something new to learn for the intern and the project be completed in 6-7 weeks time.
- Importance is given to presentation skills. In order to train the students to improve their presentation and documentation, they are asked to make a presentation before the lab to solicit critical comments and suggestions.
- The interns are provided a format for making a presentation.
- The template for final report writing is also provided
- There is a final demo and presentation to mark the conclusion of the internship

#### ***Fun and Frolic with a Purpose -- Trips, Talks and more....***

We wanted the internship experience to be “transformational” in that we wished to expose students hitherto subject to almost rote learning to be exposed to a new liberal ethos where they would be trained to be leaders and potential researchers. We expose them to an open atmosphere where they work hard and in their spare time given opportunities to explore other non-engineering subjects that encourages them to think. True this is a tall order for a 6-7 week program, but the results are encouraging. We have had unequivocal success in attracting talented youngsters willing to work

hard and with minds curious to imbibe ideas outside the engineering space. Consider the following events on their agenda:

- 1) A series of talks by a History professor from Panjab University on:
  - a. Soft Skills illustrated by the examples of Mahatma Gandhi and BR Ambedkar
  - b. “The Making of a country – what goes into a constitution?”
  - c. “The Indian Economy through the Millennia”
  - d. “The Meaning of being an Indian”
- 2) Visits to historic monuments with the Head of Dept, of Ancient Indian Culture from Xavier’s College in Mumbai.
  - a. Trip to the Buddhist Kanheri caves dating back to 1<sup>st</sup> Century AD
  - b. Trip to the Prince of Wales museum
- 3) Talk by a Humanities Professor on the importance of reading fiction
  - a. This was accompanied by gifts of classic novels such as “To Kill a Mocking Bird” with an exhortation to review and discuss these books.
- 4) Workshop on Soft Skills by a former Miss India
  - a. They were taught body language, etiquette, how to manage public situations such as interviews, etc.

We may argue that this was a capsule of a “Liberal Arts” program. Details may vary from program to program and year to year but the important thing we believe is to expose the students to think about contexts of problems. Whereas engineers are good at solving problems, a liberal arts exposure helps them think about “which problems to solve?” Weekdays were devoted to slog in the labs and weekends were for fun. We daresay that the interns found the experience most rewarding.

### ***An Opportunity to work with e-Yantra***

The students who were doing the final year of the B.E and were finalists in the e-Yantra Robotics Competition are given the choice to work on the e-Yantra project. Such fourth year B.E students who were among the finalists and interested in working on the e-Yantra project are interviewed and, if found suitable, are offered job appointment on the project. We recruited 13 such students who are part of e-Yantra team now. This is a win-win situation for all concerned, as the students immediately pick up where they left off in the competition and for e-Yantra with minimal overhead we hire staff who are ready to take on the challenge with no need for training!!!

This provides an opportunity to these bright students to work, study and interact with faculty and students and take a more rational decision on their career or further education options.

Over time several such finalists have spent a year in the lab and then joined a job or moved on for a Master’s degree. We are happy to note that most of them have either moved to good jobs or to good postgraduate schools in India, in IIT-Bombay itself or to graduate study programs in places such as CMU, Cornell, in the USA.

### ***Summary***

Through the e-Yantra Robotics Competition (eYRC) students learn to be innovative in their thinking and apply their learning to solve real world problems. Then they continue

their training and hone their newly developed skills through eYSIP at IIT Bombay as interns. Through the e-Yantra Summer Internship Program (eYSIP) e-Yantra reinforces its goal of providing an overall experience to students to help to become innovators, thinkers and industry-ready. The importance of working as a team cannot be underrated. In fact, once students get into employment, such training will help them adapt easily to their new environment.

Those who are found eligible to work as project staff on the project are appointed to work for a year. Working as a project staff, gives them both work experience and an opportunity to study at IIT and explore other opportunities like further studies or seek a job.

We have created an **e-Yantra ecosystem**, where we provide a complete cycle of learning, mentoring and working -- each feeding into the other such that we can touch many more students across the country in a scalable manner.

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