E-Yantra: EMBEDDED SYSTEMS AND ROBOTICS LAB

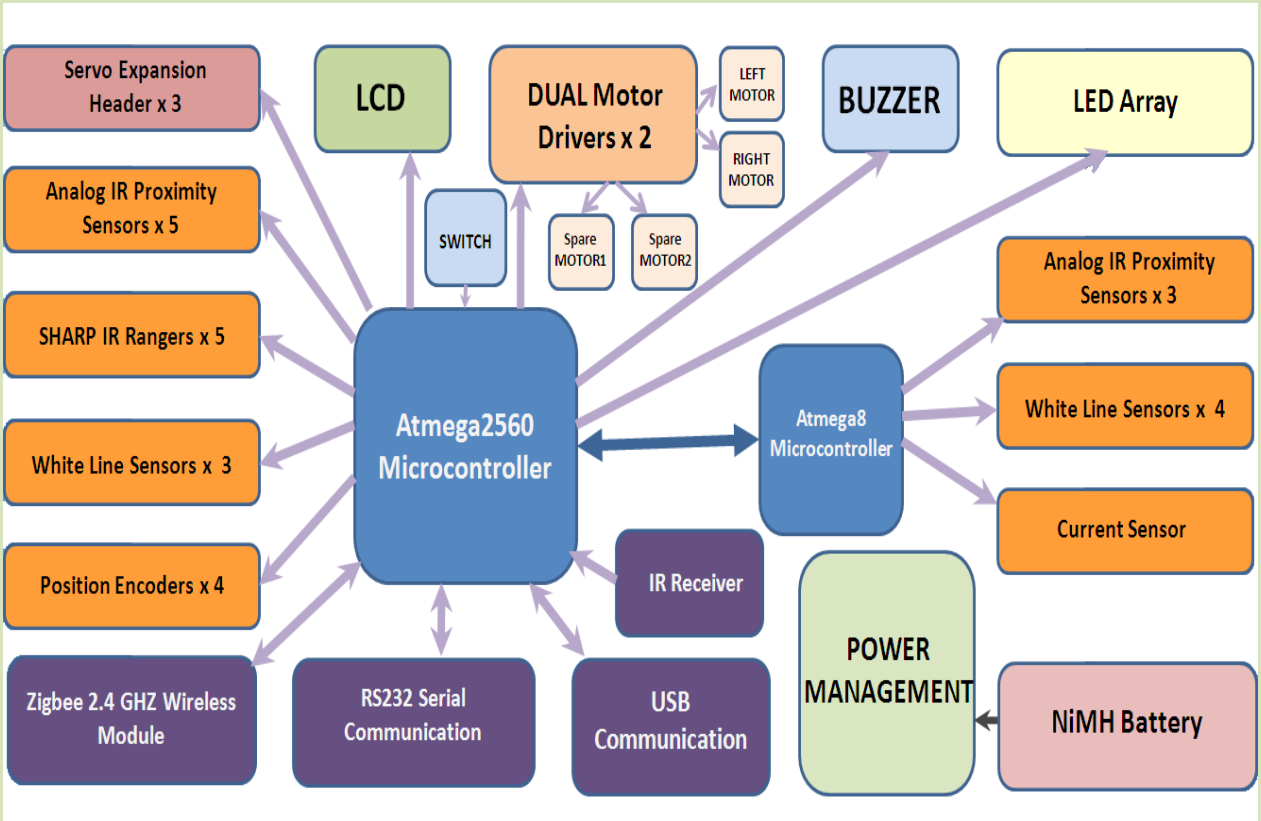
About the lab:The Lab provides the students the Robotic Research Platform based on Fire Bird V robot equipped with Atmega 2560 processor. It gives opportunity for acquiring hands on experience on some areas like Embedded Systems, Robotics, Sensor Networks, Image processing. We have Fire Bird V RoboticKits on which students are working on their own ideas as well as on different ideas allotted them by IIT, Bombay.

This lab is interdisciplinary open to all departments of college and maintained by Electronics Engineering Department. It is situated in AB-3.

Equipment:

Fire Bird V Robotic Kit: It will help students to gain exposure to the world of robotics and embedded systems. With help of its innovative architecture and adoption of the 'Open Source Philosophy' in its software and hardware design, students will be able to create and contribute to complex applications that run on this platform, helping them acquire expertise as they spend more time with this platform.

All the Fire Bird V series robots share the same main board and other accessories. Different family of microcontrollers can be added by simply changing top microcontroller adapter board. Fire Bird V supports ATMEGA2560 (AVR), P89V51RD2 (8051) and LPC2148 (ARM7) microcontroller adapter boards. This modularity in changing the microcontroller adapter boards makes Fire Bird V robots very versatile.



Fire Bird V ATMEGA2560 (AVR)

Technical Specifications:
Microcontroller:
Atmel ATMEGA2560 as Master microcontroller (AVR architecture based Microcontroller)
Atmel ATMEGA8 as Slave microcontroller (AVR architecture based Microcontroller)
Sensors:
Three white line sensors (extendable to 7)
Five Sharp GP2Y0A02YK IR range sensor (One in default configuration)
Eight analog IR proximity sensors
Two position encoders (extendable to four)
Battery voltage sensing
Current Sensing (Optional)
Five MaxBotix Ultrasonic Range Sensors (Optional)

Indicators:
2 x 16 Characters LCD
Buzzer and Indicator LEDs

Control:
Autonomous Control
PC as Master and Robot as Slave in wired or wireless mode

Communication:
USB Communication
Wired RS232 (serial) communication
Wireless ZigBee Communication (2.4GHZ) (if XBee wireless module is installed)
Wi-Fi communication (if Wi-Fi module is installed)
Bluetooth communication (if Bluetooth wireless module is installed)
Simplex infrared communication (From infrared remote to robot)

Dimensions:
Diameter: 16cm
Height: 8.5cm
Weight: 1100gms

Power:
9.6V Nickel Metal Hydride (NiMH) battery pack and external Auxiliary power from battery charger.
On Board Battery monitoring and intelligent battery charger.

Battery Life:
2 Hours, while motors are operational at 75% of time.

Locomotion:
Two DC geared motors in differential drive configuration and caster wheel at front as support
Top Speed: 24 cm / second
Wheel Diameter: 51mm
Position encoder: 30 pulses per revolution
Position encoder resolution: 5.44 mm

Other features of Lab:

- ✓ Along with these kits we are having other accessories according to the projects worked out in the lab.

The Low-power three-axis angular rate sensor able to provide unprecedented stablility of zero rate level and sensitivity over temperature and time. It includes a sensing element and an IC interface capable of providing the measured angular rate to the external world through a digital interface.

For the purpose of processing of data and providing a simultaneous internet access to the remote user the need of a computing device is indispensable. To efficiently solve the purpose we plan ahead using a credit card sized arm processor based microcomputer popularly known as Raspberry Pi.

High Torque Standard Servo Motor with Dual Ball Bearing and Metal Gears.Required Pulse: 3-5 Volt Peak to Peak Square Wave.

- ✓ **24X7 internet connection is available in the lab**
- ✓ **18 workstations are available where students can work till 8:30 pm.**

Embedded Systems and Robotics Lab Activities

Inauguration: 15th October 2015

Robotics and Embedded system lab was inaugurated under e-LSI lab setup initiative by Ministray of Human Resource &Development government of India to motivate students of electronics in the field of Robotics and improve participation in e-Yantra Robotics Competition, IIT Bombay.

Vision of this lab is problem solving through multidisciplinary approach, so lab is open for students of all the department while it remains under Department of Electronics, JSSATE Noida.

e-Yantra

Progress Report: 2016

e-Yantra (Sponsored by MHRD under the National Mission on Education through ICT program) is an initiative by IIT Bombay that aims to create the next generation of embedded systems engineers with a practical outlook to help provide practical solutions to some of the real world problems. JSSATE, Noida supports a full-fledged laboratory for its students to learn and implement their embedded knowledge into fully functional machinery prototypes.

The following events took place during year 2016 which contributed over all development of the lab.

1. e-Yantra Robotics Competition 2015

Date: Finals held on 18th and 19th March, 2016.

Description:

(eYRC) is a unique annual competition for undergraduate students in science and engineering colleges.Out of 19,568 registered students 3076 students in 769 teams were shortlisted and 44 teams became finalists. Under the guidance of Prof. K Kamal, principal of JSSATE, Noida and Dr. Sampath Kumar V, HOD, Electronics Engineering department, JSS students had participated and won meritorious awards in this competition. We proudly announce that 120 students in 30 teams participated from JSSATE, Noida, out of which 13 teams were shortlisted. 12 students in 3 teams became finalists and won outstanding positions.

Participants: Winners

S.No.	Theme	Team Members	Rank	Awards
1	"Gas leakage detection"	Karan Malhotra, Prerit Dewan, HarshitSaxena and Deepesh Singh	1	6 week internship at IIT Bombay, certificate of merit and a cash-price of Rs20,000.
2	"Courier Service"	Ved Vasu, ArunSoni, Diksha Tripathi and AbheetDevasthale	2	Certificate of merit and cash-price of Rs16,000.
3	"Recyclable waste management"	Kshitij Trivedi, SakshiTandon, Abhay Rawat and Abhyudai Pratap Singh	5	certificate of merit

2. SDP on 'FIREBIRD V'

Date: 27th April, 2016

Description:

e-Yantra lab coordinators along with students organised a student development program on 27th April, 2016, on ARDUINO. Students were also introduced to e-Yantra bot 'FIREBIRD V'.

Participants:

This was an open discussion forum where students of all branches were invited.

3. Presentation by faculty coordinators

Date: 28th September, 2016.

Description:

Getting an overwhelming response in the campus, the department decided to invoke more enthusiasm from the faculties too. GayatriSakya and Monika Mallik, coordinators of the eYantra laboratory gave a presentation on 28th September, 2016 on 'e-Yantra Robotic kits' and experiments which can be performed as extra-curricular activities. Introduction to projects currently taken up by students were also discussed upon.

Participants:
All faculty members of electronics engineering department.

4. **Paper Published:** "Smart Agriculture System using Adhoc Networking among Firebird V Bots"

Description:

GayatriSakya with one of her final year student Ankit Gautam, has also published a paper on "Smart Agriculture System using Adhoc Networking among Firebird V Bots" in International Journal of Innovations & Advancement in Computer Science IJIACS ISSN 2347 – 8616 Volume 5, Issue 10 October 2016. The paper talks about how the increasing population and its increasing demand of resources have made it necessary to utilize the embedded technologies effectively.

Participants: GayatriSakya (Faculty Coordinator) and Ankit Gautam (Final Year Student)

5. **Workshop by 3ST Technologies:**

Date: 9th November, 2016.

Description:

3ST Technologies organised a workshop for 3rd year electronics students of JSS. 3ST is a Technology, Consultancy, Services, Training & Research organization, founded by professionals from IIT-Delhi, having rich experience in the key areas like Semiconductor, Embedded System & Robotics, Software Engineering and Development. Workshop consisted of the following program modules:

a. Embedded Industry Awareness
b. Embedded Technical Awareness
   - Need of Programming ii. Introduction of Embedded C
   - Introduction of MCU (microcontroller)
   - Basic peripherals interfacing with MCU
   - Port programming

c. Hands-on was conducted on Simulator software and IDE software
d. Live demonstration of few Advance sensors, display communication protocol and motors was also given.

Participants:

40 students of 3rd year EC department

6. **SDP on introduction to e-Yantra robotics kits**

Date: 19th October, 2016

Description:

Student development program was organised by 4th year students under the guidance of laboratory coordinators. The students were introduced about the e-Yantra completion and were also exposed to some robotic kits such as: Firebird V (Atmega 2560).

Participants:

This SDP was especially for 2nd and 3rd year students. About 25 students participated in the event.

7. **e-Yantra competition 2016**

Date: Finals to be held in March 2017

Description:

Every year students participate in the e-Yantra competition, and therefore this year too, saw the same dedication and excitement by the students. E-Yantra competition 2016, received great number of registrations. Thereby, after screening from IIT Bombay 25 teams (each team consists of four members) from JSSATE, Noida got selected and are allotted tasks based on various themes. Some of the themes are Model A: terrain, Launch a module, navigate a terrain and explorer Bot. Finals of this completion will be held in March, 2017 at IIT Bombay campus.

8. This year also marks the beginning of a team consisting of four faculty members, namely: GayatriSakya, Monika Mallik, Ullas P, Shashi Kumar R who is consistently working towards improvement of the e-Yantra and embedded systems robotics laboratory.

e-Yantra Robotics Competition:2015

e-Yantra robotics competition is organized by IIT Bombay and supported by MHRD Government of India. Main aim of the event is not competition but is to provide students practical skill set which they acquire on their own by following the instructions of e-Yantra team after months of hard work. **Competition Schedule: e-Yantra 2015 (eYRC and eYRC+)**

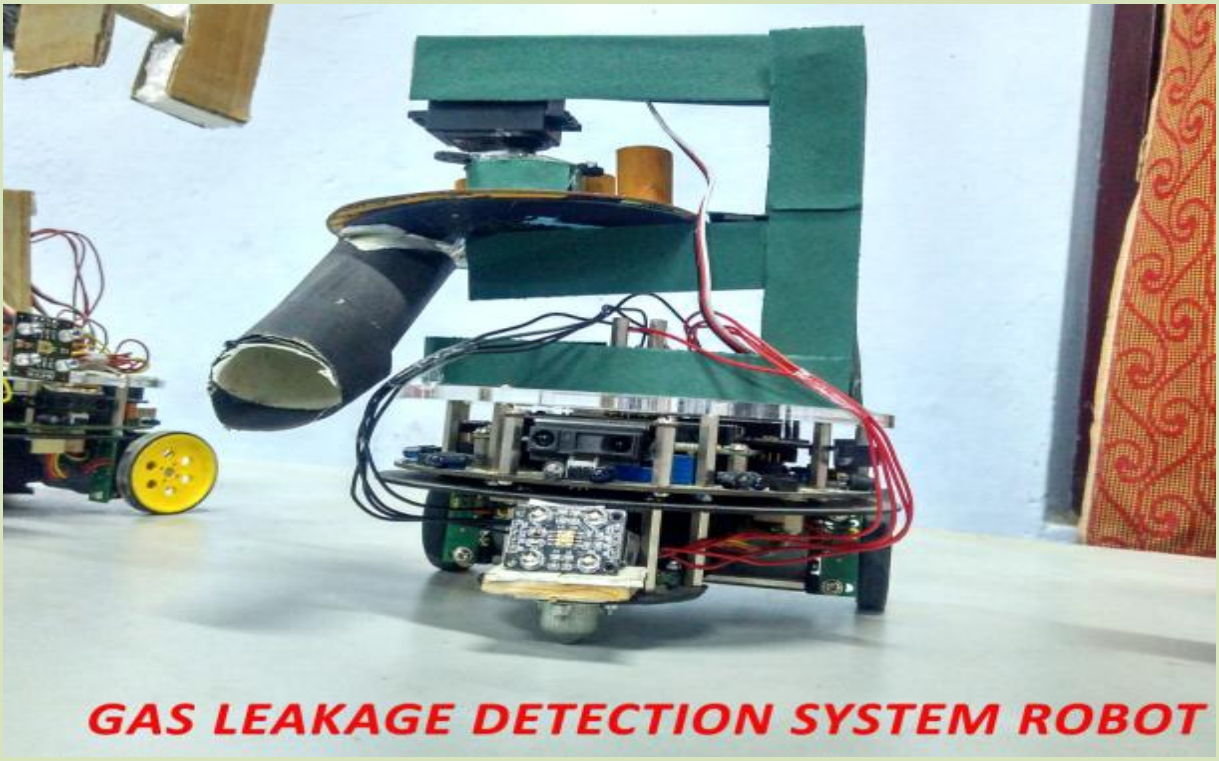
	Task	Duration
Task 0	Software Installation	2nd -8th Nov
Task 1	Image Processing	9th -29th Nov
Task 2	Algorithm Development	30th Nov -20th Dec
	Selection Process & shipping Robots to selected Teams	
Task 3	Arena Set up	28th Dec 10th Jan
Task 4	Theme Implementation and Analysis	4th-25th Jan
Task 5	Video Demo Submission	15th-25th Feb
Task 6	Documented Code submission	
Results	4thMarch	
Finals	18th -19th March	

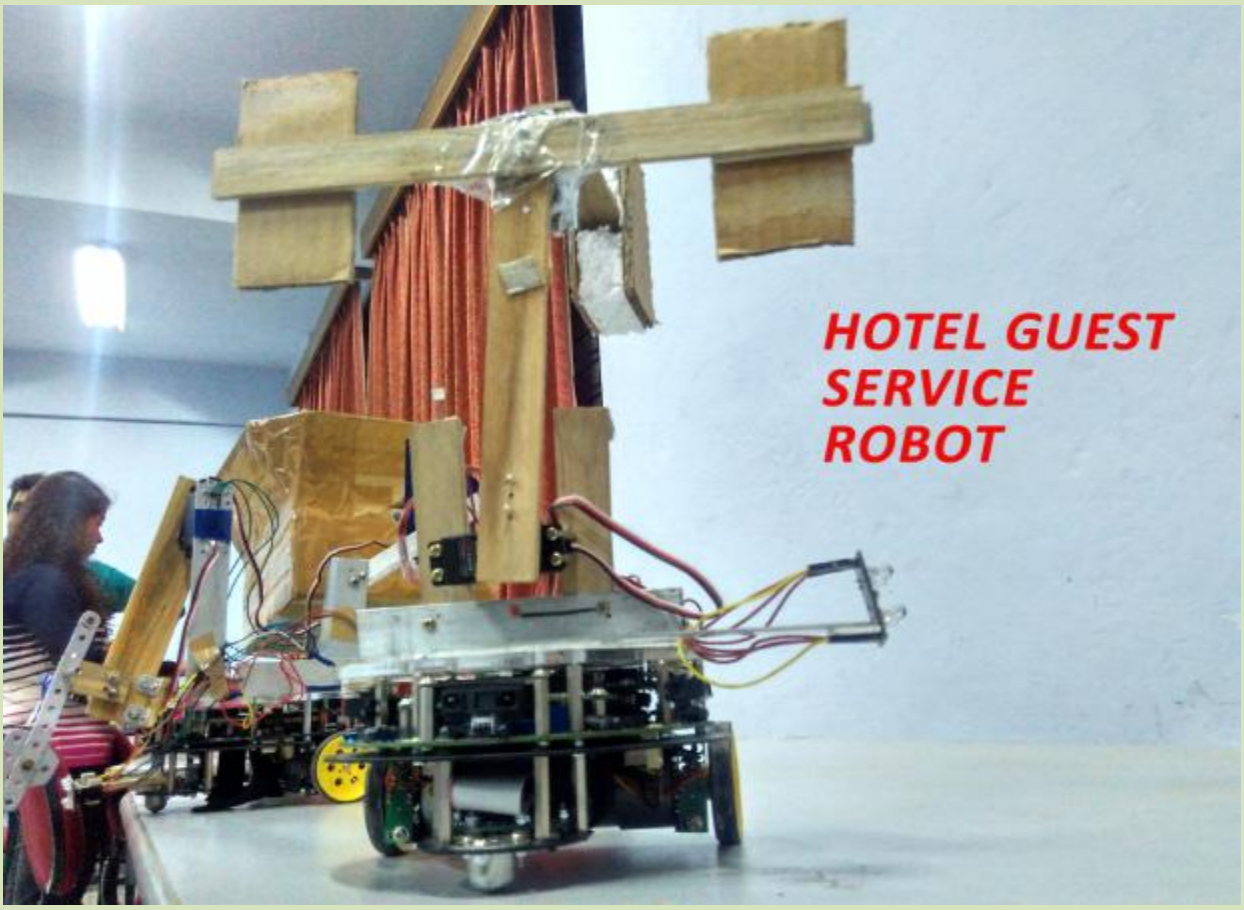
Overview : Themes : 9 in Total

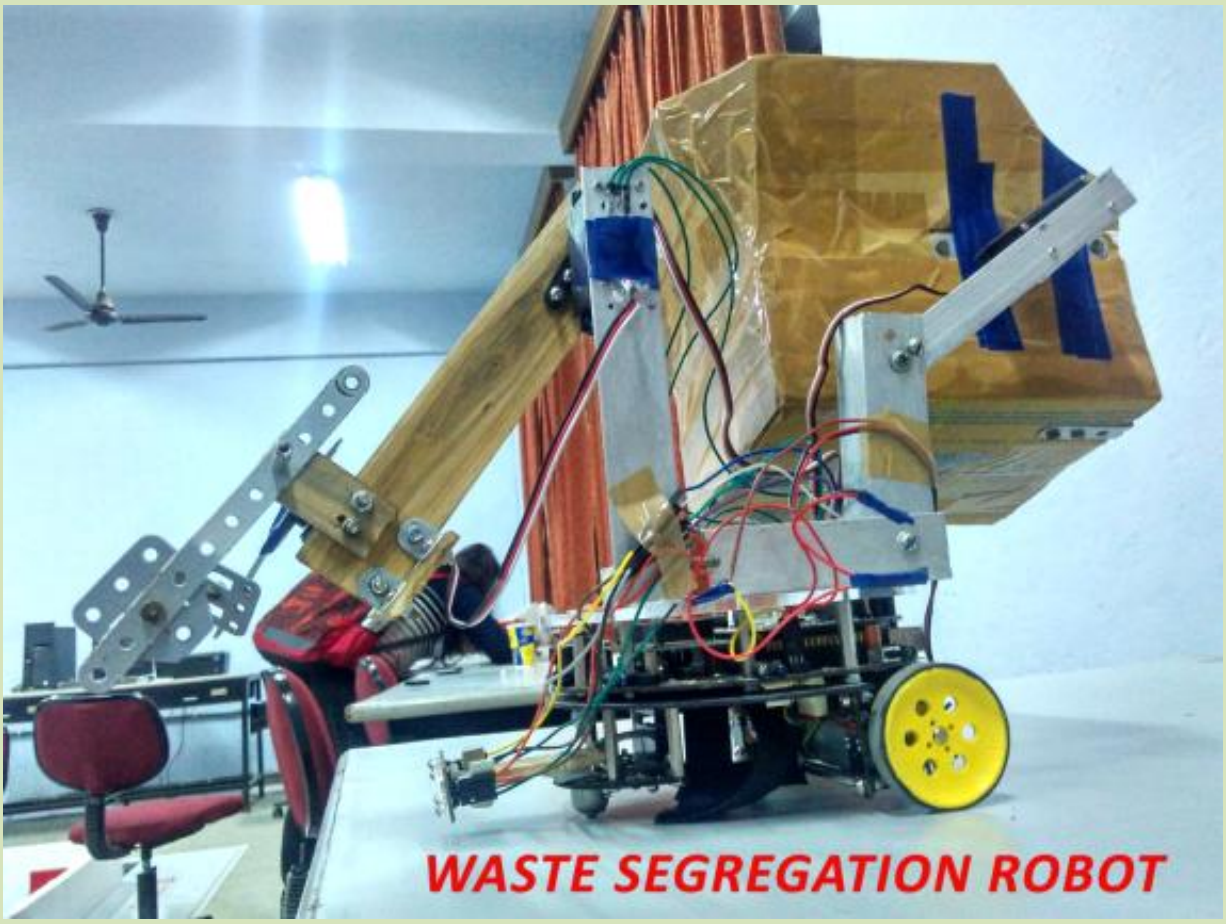
- Hotel Guest Service
- Pizza Delivery Service
- Gas leakage Detection Robot
- Recycle Waste Management
- Hazardous Waste Management
- Search & Rescue (e-Yantra+)
- Courier Service (e-Yantra+)
- Puzzle Solver using ARM(e-Yantra+)
- Puzzle Solver using GLDC(e-Yantra+)

Registrations:19,568 students in 4892 teams
Finalists: 176 Students in 44 teams

Solutions for the theme problems developed in the e-Yantra Lab:






WASTE SEGREGATION ROBOT