Smt. S. R. Patel Engineering College, Dabhi

Report
on
ROBOCON 2016

Date: 3 – 5 March, 2016

Basic-Introduction about the competition

- **The Asia-Pacific Robot Contest** (ABU Robocon) is an Asian Oceania College robot competition, founded in 2002 by Asia-Pacific Broadcasting Union. In the competition, robots compete to complete a task within a set period. The contest aims to create friendship among young people with similar interests who will lead their countries in the 21st century, as well as help advance engineering and broadcasting technologies in the region.

- The event is broadcasted in many countries through ABU member broadcasters. Robotic Contests (Robocon) organised by Asia Pacific Broadcasting Union (ABU) and its member countries including Doordasrshan (Prasarbharati) of India offer young engineers a platform to innovate and excel in creative thinking.

- Here, they demonstrate their technical ideas in robotics, as well as establish cross cultural contacts in an environment. These events also offer great opportunity to broadcasting agencies for advancing their technological skills and international cooperation.

- The Abu Robocon-2016 will be held at Bangkok, Thailand. The theme is "Clean Energy Recharging the World". The concept behind the theme is the utilization of renewable energy sources, the theme is available at the match is between 2 teams (viz. red and blue), each team consisting of two robots.

- The game of ABU Robocon 2016 is designed in order to create the awareness of efficient energy consumption and clean and renewable energy utilization. Each team has to build two robots; Eco Robot and Hybrid Robot. Eco Robot doesn't have an actuator to drive. It receives the driving energy from Hybrid Robot.

- Eco Robot has to use only one steering actuator to control its direction, to track the path containing Slopes and Hills, River, and Down Hill. Besides providing driving energy to Eco Robot, Hybrid Robot has to take Wind Turbine Propeller from Eco Robot and climb up Wind Turbine Pole in order to assemble Wind Turbine.

How we come to know about Robocon

- At first our 6th mechanical students Kenil Patel &Dhaval Patel got information about this event from GTU, Gandhinagar. They registered their name for the event. For the selection of the team of GTU, there were two rounds first was hand-written test & second one was personal interview.

- Both of them passed the first round of hand-written test & became able to appear in the interview round. In that round, Kenil was being selected by the interviewers for the team of GTU.

- Kenil started to go there for the practice of the event. He went there for approximately 4 to 5 days. There he realized that, our college team should have to participate for the event.

So, He came back to the college & informed about all this to HCP sir & sir helped him to make the team of around 8 to 10 people.

- They made a budget of 1,05,000/- , went to the principal mam & asked for the support & financial help from her. Mam was impressed by it & mam asked about it to trustee Mr Kalpesh sir &He was also interested in it. So, he told HCP sir that college was ready to support him & all the Robocon team &all the expenses would be taken by the college.

- Thus, our work for the event got initial torque by the help of college & HCP sir.

Selection of Team

- First we circulate a notice providing the information of Aburobocon-2016 & also mailed it to the every students of the college. Then, interested students came to us to know more about it & also registered their name. We announced a meeting for the selection of the team.

- After some discussion, the team was being selected. The students who were able to participate & having some basic knowledge about how to work in team were selected. Thus the team was being made from 1st, 3rd, and 4th year's students. After working for some days principal suggested some 2nd years students who were also keen to take part in the event.

Robocon 2016								Savan Patel (9924166190) Management
(1) Darshan-Progm	9714398022	(2) Jalilkhan-Design	9429418785	(3) Pranshu-(Fab,mgf)	9722978220	(4) Darshit Thakkar-Mrkt	9825824210	Genral
Khushil Khatri		Dhaval		Alpesh Mali		Pranav		Bhavya
Harsh Patel		Gautam		Rihen Modi		Parth		Nisha
Kalpesh Chaudhry		Kenil		Priyank Patel		Mukesh		Happy
Jay Maheta						Arth		Tirtha
Shivani Patel				Beena				Peri
Bhoomika				Maitri				Zil
Dhruvi				Hetashvi				Nidhi
Shaila				Hardi				Priya

- After seeing some quality work and dedication of the students, the selection finale team was being done by sir & team leaders & also were divided into sub-division as per their knowledge & interested area.

FAQ

FAQs

FAQs 1

Post your queries related to Rules and Game Field of ROBOCON (INDIA) 2016 to faqrobocon16@mitaoe.ac.in

Q.1. Can we use an actuator for a mechanism apart from that which will steer the robot if the secondary mechanism will not drive the Eco robot?

Ans: Refer 'E9' of FAQ at http://www.aburobocon2016.com/download/

Q.2. Is it necessary to trace the lines on the arena (mainly Hills 1, 2, 3 etc) by the eco bot?

Ans: Refer 'A16' of FAQ at http://www.aburobocon2016.com/download/

Q.3. Any type of electromagnet can be used in the eco bot?

Ans: Yes, refer 'E8' of FAQ at http://www.aburobocon2016.com/download/

Q.4. What is the maximum extension of the hybrid robot, meant what is the workspace of the hybrid bot?

Ans: Refer rule no. 4.3.1 and violations under rule no. 5 of updated rule book at http://www.aburobocon2016.com/download/

Q.5. If eco bot hits the pole (wind turbine station) by chance then is it a violation?

Ans: No, refer 'A19' of FAQ http://www.aburobocon2016.com/download/

Q.6. What are the specifications of the wind turbine pole?

Ans: Refer rule no. 11 of updated rule book and updated figure no. 5 at http://www.aburobocon2016.com/download/

- If there was any type of query & the solution was not given in rulebook as well as sir & team members were not able to solve the query then the problem was being mailed to the Robocon authority's .In the aburobocon's official website's homepage there had been given a point for FAQ.
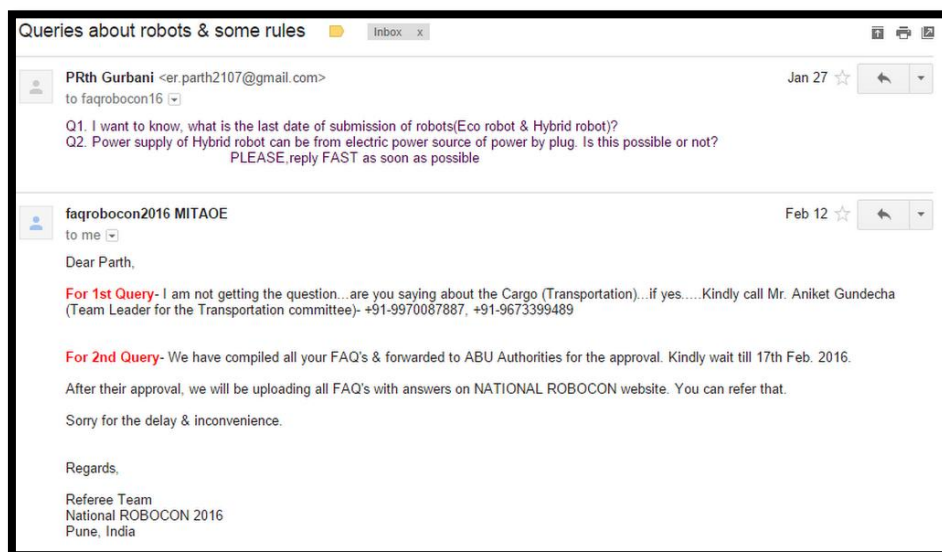
- Any type of queries could be solved from there. Then, there has been provided proper space where you have to put your query &after that you have to submit you're FAQ & you will get a thank you quote.

- The solutions of that queries were being shown on their official website.

Registration & Accommodation

➢ First of all GTU mailed the proper information &registration form of Aburobocon-2016 to the all the students. So some students of our college registered their name for it amongst them Kenil Patel (6thmech) was selected by GTU to take part in GTU team. Instead he made a team for our college with help of HCP sir. Thus, our team for Aburobocon-16 was being made. The registration of the college was done by paying 25,000/- Rs. to the MIT very earlier.

Design

- Design is the most important factor for the strong structure of the robot. At that time, we had to make robot & we were not preparing any type of basic design& we were just working on the different ideas. By not making proper design &method, we were facing too many problems for the robot making. So, finally we decided to make the design in proper method first & then start the work for fabrication & controlling process.

- Thus, we started making a design by using the creo2.0 software. All the parts of the robot were designed in the software& also everything was defined in the design. Then, wedis-assembled all the parts of the robots which we had assembled only on our ideas started assembling the robot as per design.
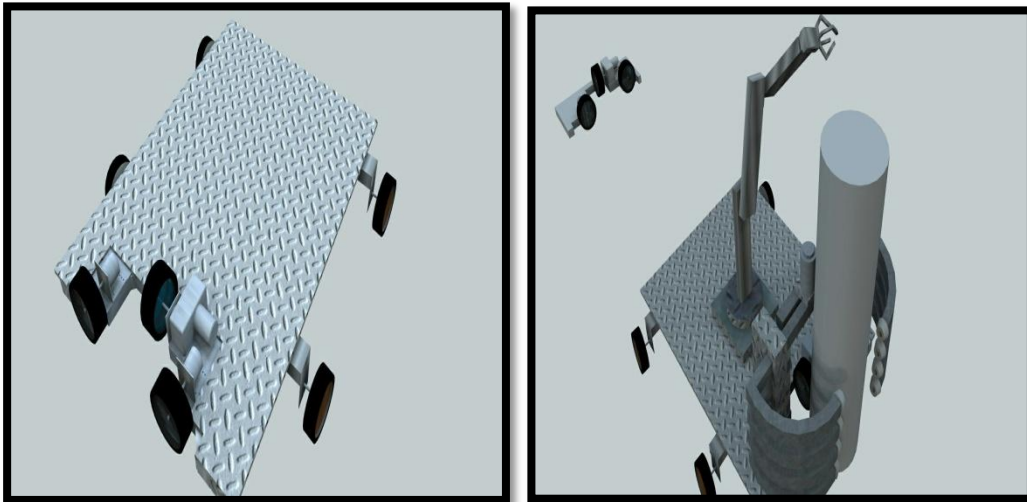
[Hybrid Design]

Track designing

Working Hours of Members

- Our team started the work for the Robocon-2016 on 23rdDecember, 2015. At that time our team was only of only 8 to 10 students. At first, we started work for track for the practice. The cutting of plywood sheets, it's rounding, shaping, panting etc. was done by team members in the night hours and the track was ready in approx. 2 weeks. First they made the eco robot structure and designed the base of hybrid robot.

Base of eco robot

- After the track wasa completed, the fabrication work was started by mechanical branch's students from our team. They tried too many mechanisms to make and run the Robot. They made demo mechanism for the Robot and after getting the approval from sir & team leader; the demo was being converted into working model which could work more effectively. Thus our fabrication work was going on.

(Making of Force ARM)

(Wiring of Hybrid)

Controlling

- After Mechanism of both Eco and Hybrid Robot, Controlling team started work for controlling those both Robots.
- Controlling team members were being divided into two teams; first team to work on Eco Robot and second team to work on the hybrid Robot.Both teams gave their full effort & dedication to achieve their goal. They had worked in late nights.
- Different types of sensors and as well as motors were used by both the teams.
- Our guide H.C.P sir helped us & provided us proper guidance.
- Sensor that are used in robots:

❖ **RGB Sensor:**

- RGB sensor is used to recognize colour. In real world it gives its output in digital form. We have used different combination of colour in Eco Robot to follow a path. This sensor was also been used in hybrid robot.

- We had used two types of RGB sensor;

  1. Normal RGB Sensor: Normal sensor gives output in analogue signal and wecandirectly take that input
  2. TCS3200 Sensor: TCS 3200 Sensor will get input using pulse in function.

❖ Key Features

TCS 3200 Sensors are
- Programmable color light-to-frequency converter
- Output Enable (OE) pin
- Output frequency scaling
- Available in 5mm x 6.2mm SOIC (D) package

❖ Drawback:

1. The biggest drawback of RGB sensor is that, it is a light Sensitive.
2. RGB sensors are also high sensitive

❖ IR Sensor:

- IR sensors are normally used to sense a black and white colour. Normally, IR sensor gives (+) output on white colour and (-) output on black colour.
- An **infrared sensor** is an electronic device that emits in order to sense some aspects of the surroundings. An **IR sensor** can measure the heat of an object as well as detects the motion. These types of **sensors** measures only **infrared** radiation, rather than emitting it that is called as a passive **IR sensor**.
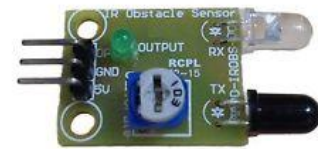
❖ Drawback of IR Sensor:

- The main disadvantage of this sensor is; it will take a light colour as white and dark colour as black colour.

❖ Proxy Sensor:

- Proxy Sensor is used to track obstacles occurred in its Range. If any obstacle will occur in its path than it will give a (+) output or normally it set (-) output.
- Proximity Sensors are available in models using high-frequency oscillation to detect ferrous and non-ferrous metal objects and in capacitive models to detect non-metal objects. Models are available with environment resistance, heat resistance, resistance to chemicals, and resistance to water.

❖ Features

1. No contacts are used for output, so the Sensor has a longer service life (excluding sensors that use magnets).
2. Unlike optical detection methods, <u>Proximity Sensors</u> are suitable for use in locations where water or oil is used.

❖ Mini Encoder:

- The Mini-Wheel encoder is waterproof and compatible with the HST-X04 scanner, as well as Olympus standard PA wedges on which it can be mounted using the included bracket kit. This miniature encoder is entirely made of stainless steel and features sealed bearings for long lasting smooth operation. The custom electronic circuit has been designed to prevent noise induction in UT signals.

❖ Features

- Waterproof (IP68)
- Stainless steel construction, resistant to harsh environments
- Minimal noise induction
- Small dimensions
- Encoder resolution is engraved on the wheel (12 steps/mm)
- Removable encoder wheel
- Double O-ring tire for better adherence
- Sealed bearing for long lasting smooth wheel rotation
- Strain relief for cable protection

❖ Rotary encoder

- A rotary encoder using optical sensing technology relies on the rotation of an internal code disc that has opaque lines and patterns on it.
- The disc is rotated (hence the name rotary encoder) in a beam of light such as an LED and the markings on the disc act as shutters blocking and unblocking the light.

- An internal photo detector senses the alternating light beam and the encoder's electronics convert the pattern into an electrical signal that is then passed on to an external control system through the encoder's output
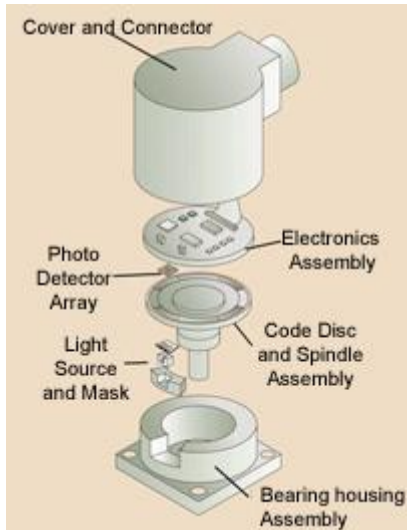
❖ Ultrasonic Sensors

- In industrial applications, ultrasonic sensors are characterized by their **reliability** and **outstanding versatility.** Ultrasonic sensors can be used to solve even the most complex tasks involving **object detection** or **level measurement** with **millimetre precision**, because their measuring method works reliably under almost all conditions.

- No other measuring method can be successfully put to use on such a wide scale and in so many different applications. The devices are **extremely robust**, making them suitable for even the **toughest conditions**. The sensor surface cleans itself through vibration, and that is not the only reason why the sensor is insensitive to dirt. The physical principle—the propagation of sound—works, with a few exceptions, in practically any environment.
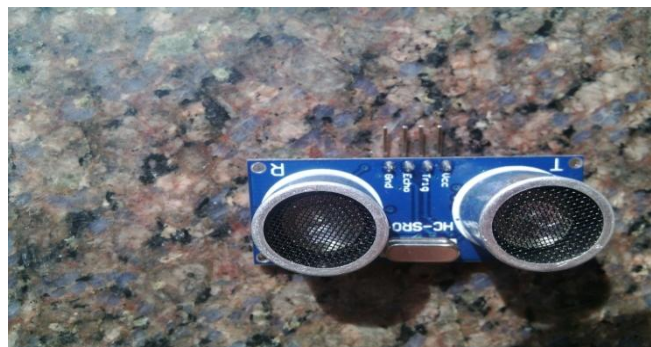
❖ Key Features:

- Provides precise, non-contact distance measurements within a 2 cm to 3 m range
- Ultrasonic measurements work in any lighting condition, making this a good choice to supplement infrared object detectors
- Simple pulse in/pulse out communication requires just one I/O pin
- Burst indicator LED shows measurement in progress
- 3-pin header makes it easy to connect to a development board, directly or with an extension cable, no soldering required

❖ Application Ideas:

- Security systems
- Interactive animated exhibits
- Parking assistant systems
- Robotic navigation

❖ Ultrasonic Disadvantages

- Ultrasonic sensors must view a surface (especially a hard, flat surface) squarely (perpendicularly) to receive ample sound echo. Also, reliable sensing requires a minimum target surface area, which is specified for each sensor type.
- Ultrasonic sensors have a minimum sensing distance.
- Changes in the environment, such as temperature, pressure, humidity, air turbulence, and airborne particles affect ultrasonic response.

Management Of accommodation

- When we reached to the place where the competition was going to held, some students of general committee went to the registration table & got registered the whole Robocon team by paying 4750/- per head. By use of the registration payment receipt, we got room for accommodation. Still there were many problems in accommodation like lake of basic facilities, proper information of accommodation place but, we solved it anyway.

Practice Session at Pune

- For the practice, there was provided single couple of track containing red and blue track. There were around 105 teams from all over the India. So there were too many crowds and because of that each and every team had to book their slot of 5 min to practice on their robots.

- In the practice session, first we took
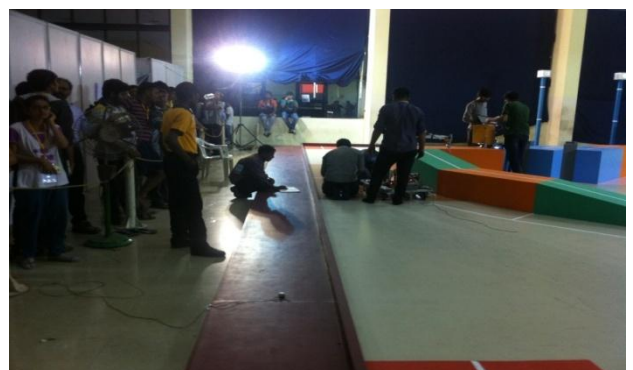
readings of both Hybrid and Eco Robot & then, we ran both the robots.

- We were getting duration of only 5 min time in a single practice session &in that duration of 5 min we took reading of both robot and also ran both robots in parallel. During the practice session we faced problems like;

    o Many times Robot was going away from the line because of change in the reading& lighting.
    o The donkey motor was not working properly in practice session because of change in the surrounded area, that's why both the robots were not running properly in parallel way.
    o There were provided many slots for practice session, but reading of sensor was changing in every session.

Main Event

- After completing last practice session, we went for the main event. Before we entered in the main field area the experts of that event who were on the entrance took the mesarment of both robot according to rule book.

- The total wieght of both the robots must not be greater than 40kg and wieght of our robotswere around 34kg. So, they tagged a striker on both of the robots and then we got entry in the main field.

- After entering in the main field, we saw matchesof some team very closely and got to know which type of problems they faced during the match. Thus we observed it very well.

- Thier was the time when our team name was announced and our team was MIT,PUNE.befor match was startd both team got one min time to set the robot on the track and only 3 student were allwed in the game fild ,2 for the hybrid robot and one for the eco robot.

- During the match, we got problem in sensor. Reading of the sensor were changed with compare to the readings which we earlier got in the practise field. They were not sensing the track also were not working as per our expectation.

- But on the other side, Our opponent team was doing well with their robots. Their robots were runnig huriddly on the track.After the time of 3 minutes, we scored less then the opponent team.

- Our second round was with St. Fransis college of enginnering, Mumbai(W). Unfortuanately, same thing happened in that round. Sensor got manuplated in the round & thus, we were out of the competition.
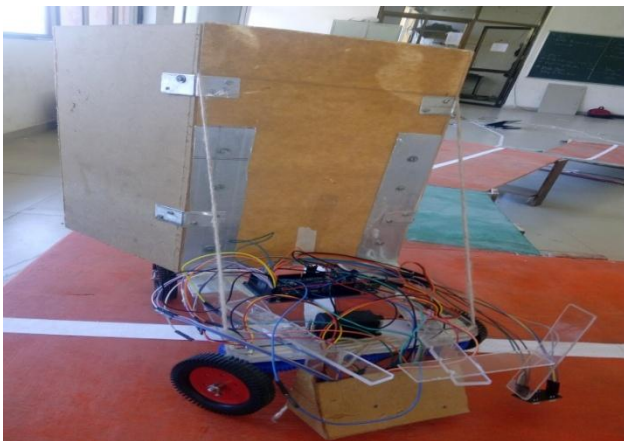
(Eco Robot)

(HYBRID robot)

Learned New Technology From Competitive Team

LSA08 Line following Sensor

- LSA08 (Advance Line Following Sensor Bar) consist of 8 sensors pair. LSA08 is typically used for embedded system or robots for line following task. The specially selected wavelength of **super bright green LED** as the sensor's transmitter enables LSA08 to operate on various different colour surfaces.

- LSA08 is capable to operate on surface with colour of Red, Green, Blue, White, Black, Gray and possibly other colours with distinct brightness different. LSA08 has several different output modes, for the convenience of use for any system. Namely, the digital output port (8 parallel output line), the serial communication port (UART) and the analog output port.

❖ **Features**:

- 8 sensor pairs spaced 16mm.
- 12V input power
- On board Mode and Select button for instant configuration of LSA08
- 3 Different output mode (digital output port, UART output port, analog output port)
- LCD display unit showing 8 sensors analog value with bar chart and line position.
- Simple Auto-Calibration function to the line following surface.
- Junction Pulse (JPULSE) for detecting junction crossing and junction counting
- Power polarity protection
- Low current consumption (typically 26mA)
- Works on glossy or reflective surface
- Refresh rate up to 200Hz.

Air Compressor

- An air compressor is a device that converts power (using an electric motor, diesel or gasoline engine, etc.) into potential energy stored in pressurized air (i.e., compressed air). By one of several methods, an air compressor forces more and more air into a storage tank, increasing the pressure.

Raspberry Pi

Specifications

❖ **Processor**

- Broadcom BCM2387 chipset.
- 1.2GHz Quad-Core ARM Cortex-A53 (64Bit)
- 802.11 b/g/n Wireless LAN and Bluetooth 4.1 (Bluetooth Classic and LE)

❖ **GPU**

- Dual Core Video Core IV® Multimedia Co-Processor. Provides Open GL ES 2.0, hardware-accelerated OpenVG, and 1080p30 H.264 high-profile decode.

- Capable of 1Gpixel/s, 1.5Gtexel/s or 24GFLOPs with texture filtering and DMA infrastructure.

Memory

- 1GB LPDDR2

❖ **Operating System**

- Boots from Micro SD card, running a version of the Linux operating system or Windows 10 IoT

❖ **Dimensions**

- 85 x 56 x 17mm

❖ **Power**

- Micro USB socket 5V1, 2.5A

Connectors

❖ **Ethernet**

- 10/100 BaseT Ethernet socket

❖ **Video Output**

- HDMI (rev 1.3 & 1.4)
- Composite RCA (PAL and NTSC)

❖ **Audio Output**

- Audio Output 3.5mm jack
- HDMI
- USB 4 x USB 2.0 Connector

❖ **GPIO Connector**

- 40-pin 2.54 mm (100 mil) expansion header: 2×20 strip
- Providing 27 GPIO pins as well as +3.3 V, +5 V and GND supply lines

❖ **Camera Connector**

- 15-pin MIPI Camera Serial Interface (CSI-2)

❖ Display Connector

- Display Serial Interface (DSI) 15 way flat flex cable connector with two data lanes and a clock lane

❖ Memory Card Slot

- Push/pull Micro SDIO

Personal experiences

It was the first experience for me of an international event & first time I lead the team of 30 students. Because of late registration, we could not get much time & proper method to complete our task in time. I don't have much idea how to select efficient team members & how to distribute work between them. That's why we didn't have skilled team members. We had less number of students for CONTROLLING. By taking too much help from HCP sir, we did our best. I got many problems in working still, I am happy for whatever we did.

At the stadium, I came to know how to do team-work. I observed the other teams there & also talked with other team leaders & learned many more from them. At that time, I had a mis-belief that, we had worked very hard but, after seeing other team's robots, I came to know that, We had done too much less in comparison with them. But yes, my team got inspiration from them.

The most important thing is that, we came to know about too many latest technologies which are at the top level of accuracy & as well as at the efficiency level.

By

Savan Patel

(Team leader)

ROBOCON is a platform to express the technical knowledge & also to learn many more. After taking part in ROBOCON-2016, I realised that how much knowledge, dedication & hard work was required to make & run both eco & hybrid robot to face the challenges of ROBOCON. According to the level of challenge, the dedication of team is most important factor because hard-work of 6 to 8 months is required only to struggle in ROBOCON, which we did as a team.

The NEW thing or I can say knowledge which I got from this competition is that, I learned some advance level sensors and actuator which can perform better than currently sensor which, we are using as a student's mind-set. At last, I must say, I also learned different new & useful mechanism, which will be useful for me in future.

By

Darshan Mewada

Preparation should be done earlier, so that we can get proper time for practice. If we have come to know earlier about the competition in July then, we could have got more time for practice. The most important factor is the selection of the team. It should be done for those students who are ready to do hard work & should be fully dedicated. Negative energies & over-confidence should be avoided. The information of the sensor controllers in a proper way should be taken before like; its advantages, disadvantages& the most important thing; how to use it effectively in any place in any condition.

By

Pranav Patel

Robocon is an interesting game - cum - intellectual exercise for budding engineering students and their enthusiastic instructors, determined to innovate and create machines producing desired results. Participation in this activity is an end - to - end competitive experience from concept design of a system of robots programmed to perform according to rules of the game played on a high precision technical Contest Area and to score a victory beating the competitors.

By

Jalilkhan Bihari

Suggestion for next ROBOCON

- All the team members must know their own responsibilities and skills.
- Proper formation & planning of work.
- Team selection.
- Knowledge about the rules.
- Schedule should be in that way, that we could get minimum one month time for practice.

Thank You