PROJECT REPORT ON

ABU Asia-Pacific Robot Contest 2014 Pune, INDIA

ROBOCON'14

INTERNATIONAL ROBOTICS COMPETITION

INDEX

PAGE NO.

ACKNOWLEDGEMENTS

We take opportunity to express our deep sense of gratitude and regard to **Dr. R. K. Agarwal, Director** & **Prof. Ashiv Shah**, Head of Department, TIFAC CORE, Ajay Kumar Garg Engineering College, Ghaziabad for his continuous encouragement and able guidance, we need to complete this project.

We are also grateful to **Mr. Gaurav Srivastava** for his valuable support throughout this project.

We would also pay our sincere gratitude to **the Review team** and the **concerned faculties** for their precious and enlightening words of wisdom which motivated us throughout the project work.

PREFACE

The most important focus of this diary is the National Robocon, 2014. It provides you with an insight into the details of each robot, new technologies used and further improvements.

This was the first time Ajay Kumar Garg Engineering College participated in the National ROBOtics CONtest organised by ABU and MIT College of Engineering, Pune.

We learnt a lot, not only in the field of robotics but also about project management, time management and most importantly, about team work. Apart from Robocon, the robotics club, AKGEC made its presence felt all across the campus and in technical festivals of various other universities.

This was possible only with the sincere efforts of Prof. Ashiv Shah and help from the Robocon team.

THE ROBOCON

Robocon, short for Robotic Contest, is an interesting game - cum - intellectual exercise for budding engineers and their enthusiastic instructors, determined to innovate and create machines for 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; all this according to a Theme declared by the Host Country.

International Robocons are mainly sponsored by Asia Pacific Broadcasting Union (ABU) which includes Doordarshan (Prasarbharati) of India as a member which has been organizing all activities in India for last Nine years with collaboration with MIT Group of Institutions Pune, India.

Robotic Contests (Robocons) organized 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 International and National Robocons have started from 2012.

The first year international host country is Tokyo, Japan with the theme "Reach for The Top of Mt. Fuji" and ABU Winner was Ho Chi Minh City University of Technology, Vietnam, and the Indian contest organized by IIT Kanpur with Institute of Technology, Nirma University as a National winner.

Last year international host country is MIT AOE Pune, India (Scheduled on 24thAugust 2014) with the theme "A Salute to the Parenthood" and ABU Winner was Lac Hong University, VIETNAM, and the Indian contest organized by MIT AOE, Pune with Institute of Technology, Nirma University as a National winner.

From the last 11 year, MIT AOE, Pune was the national organizer of this event.

THEME & RULE

Introduction

Parenthood is the greatest boon offered to mankind by Mother Nature. Parents promote and support physical, emotional, social and intellectual development of child from infancy to adulthood. Parenthood bestows a wide range of experiences that offer love, security, stimulation, encouragement and opportunities to help a child flourish and grow to achieve its full potential.

Robocon India honors parents for their immense contribution by announcing the Robocon 2014 theme as: "A SALUTE TO PARENTHOOD"

About Safety

1.1. Foreword

1.1.1. Safety is the most important issue to continue the Robot Contest to the future.
Therefore every participant has a duty of developing robot safely.

1.1.2. Besides an ethical aspect, keeping workplace safety will not only minimize the delay of robot development but also promote the completion of robot according to the schedule in case of accident. *(An accident could lead to discontinuation and/or delay of project due to workers' injury, investigation of the accident and implementation of the recurrence preventive measures)*

1.2. Observance of a statute:

Every participant in the Robocon project who builds robot must observe the related laws, regulations and 'Safety and Health Guidelines' defined by the participant's university or equivalent regulations. Participants must develop, build and practice robot safely under the supervision and instruction of the university instructor. On the contest day, sufficient safety should be considered to the staff and the audience in the venue.

1.3. Safety measures

Due to robot operator's operation mistake or by a reckless run of a control system or fracture of parts, the robot could stop, accelerate and turn suddenly causing the operator to collide with the robot's sharp parts (cut surface of the structure) or come into contact and be caught in the movable parts (such as gears) and crush the ambient environment. Therefore, in addition to following examples, please take necessary safety measures.

1.4. Proposals for measures (examples)

1.4.1. As structural measures, securing front view, covering sharp parts or attaching cover to movable parts, should be considered.

1.4.2. As personal protective measures, wearing helmet protective glasses, gloves and clothing which is not easily caught in the robot, etc., should be considered.

1.4.3. As operational measures, placing emergency staff who can carry out emergency stop in addition to the operator, avoiding practice alone so that members can immediately respond to an accident, implementation of various checks, re-examination of practice environment, keeping the workplace clean and etc., should be considered.

1.5. Due to design mistake or reconstruction of the robot, over-current to a circuit, short circuit of the battery by a shock or a fire could cause a major accident. In addition to the following examples, please take necessary safety measures.

1.6. Proposals for measures (examples)

1.6.1. As structural measures, re-examination of fuse, wiring of suitable thickness, attachment position and isolation from combustibles etc., should be considered.

1.6.2. As operational measures, prohibiting disapproval reconstruction and using suitable battery charger etc., should be considered.

1.7. Other

1.7.1. In addition to above, various dangerous events could be triggered by the unique feature of each robot. Please take effective safety measures according to the characteristics of an individual robot.

1.7.2. To ensure safety, when using a laser beam, it must be less than a Class 2 laser, and used in a way that will not harm any operators, the referees, match officials, audience, opponent's equipment and the game field.

2. Game and Rules

"The Objective" Two (2) teams play various game activities in the park with their Parent robot and Child robot.

The Parent robot has to carry Child robot up-to the play zone and the Child robot plays game activity. Each team plays three (3) game activities such as Seesaw, Pole walk and Swing. Once the Child Robot completes three (3) activities, it can challenge the fourth game activity, which is set in the middle of the park. The team successfully completing the fourth game activity first; accomplishes "SHABAASH" (appreciation) and is declared "The Winner". If no team is able to perform abovementioned winning task, the winner will be decided as per the stated rules.

Game field and Objects
(Refer game field Figure-1and Figure- 2 for titles and dimensions)

3.1. The field consists of an area having the dimension of 12000 mm x 12000 mm surrounded by a wooden fence with a height of 50 mm and a thickness of 30 mm.

3.2. The competing teams are Red and Blue teams. The game field has two (2) Parent zones [one (1) Red and one (1) Blue] and five (5) Child zones (game activity zones). A child robot plays game activities in the Child zones. The first game activity for both teams (Red and Blue) is identical and at separate location in the respective zones. For remaining activities each Child

zone is divided into two (2) halves by 30 mm wide non shiny white tape. Every team is supposed to play in their own Child zone area.

3.3. The game field also consists of one (1) Blue and one (1) Red start zone for each team. The area of each start zone is 1000 mm x 1000 mm.

3.4. Game activities to be played in Child zones are listed as

3.4.1. Seesaw child zone: Separate for Red and Blue team (Refer Figure-3)

3.4.2. Pole walk child zone (Refer Figure-4)

3.4.3. Swing child zone (Refer Figure-5)

3.4.4. Jungle gym child zone (Refer Figure-6)

3.5. Jungle gym child zone is placed at the centre of the game field.

4. Teams

4.1. Each team comprises of four (4) members consisting of three (3) students and one (1) instructor, all from the same university, polytechnic or college. Only three (3) students are permitted to enter the game field.

4.2. Team members must be enrolled in their University/Polytechnic/College at the time of the international contest. Exceptions to this rule are those who were enrolled in a University /Polytechnic /College at the time of the domestic contest.

4.3. Postgraduate students are not eligible to participate in the competition.

5. Robots

Each team must design and construct by itself one (1) Parent robot (manually operated) and one (1) Child robot (autonomously controlled)to compete in the contest.

5.1. Parent robot

5.1.1. The Parent robot should be operated through a cable connected to it. Wireless radio control is not permitted. Operators are not permitted to ride on their robot.

5.1.2. When operating via cable, the point where the cable is connected to the robots must be at least 900 mm above the ground. The length of the cable from the Parent robot to the control box should at least be 1000 mm or more but should not exceed 2000 mm.

5.1.3. In the Starting zone, just before the game begins the size of the Parent robot loaded with Child robot cannot exceed (1000 mm L x 1000 mm W x 1000 mm H). Once the game begins the Parent robot may change its form but the size of the Parent robot including the Child robot cannot exceed the size of a cube of 1500 mm during the game.

5.1.4. Team members are not allowed to touch the Parent robot once the game has begun except for the “retry”

5.1.5. A parent robot is permitted to operate in its own Parent zone (Red or Blue)

5.1.6. A portion of a Parent robot can enter the air space of its own Child zone but cannot touch its floor.

5.1.7. Robots of a team are not permitted to touch any of the opponent’s robots.

5.1.8. Parent robot cannot split or separate into two (2) or more units.

5.1.9. Space for pasting stickers /tags (by organizers of the contest) is to be provided on Parent robot. This space should be the size 150 mm x 100 mm.

5.2. Child robot

5.2.1. A child robot will neither have wheels nor tracks for locomotion. It can have arms and legs.

5.2.2. A child robot is not permitted to touch the floor area of the Start zone and Parent zone.

5.2.3. Child robot must operate autonomously.

5.2.4. After placing the Child robot in the Child zone, the Parent robot starts the Child robot through a single action.

5.2.5. Once the Child robot starts, no team member is permitted to touch the robots except in the case of “retry”.

5.2.6. The child robot’s size and form may undergo a change during the game, but it should fit into a cube of 500 mm at all times.

5.2.7. Child robot cannot split or separate into two (2) or more units.

5.2.8. Space for pasting stickers /tags (by organizers of the contest) is to be provided on Child robot. This space should be the size of 150 mm x 100 mm.

5.3. “Retry” of Parent and Child robot.

5.3.1. For Parent and Child robot, any number of “retry” is permitted.

5.3.2. During a “retry”, a Child robot has to take a “retry” by loading itself on the Parent robot in the Parent zone.

5.3.3. After the Child Robot asked for a retry and it is granted, the Child Robot must restart on the Parent Robot. The point of restart is where the Child Robot asked for a retry.

5.3.4. Strategies based on “retry” are not permitted.

5.3.5. On a “retry”, no parts of the robot should be replaced; power sources of the robots should not be recharged. One cannot add a power source also.

5.4. Power Supply for robots

5.4.1. Each team shall prepare its own power supply for its robots.

5.4.2. Voltage of the power supply for robots shall not exceed 24 V DC on load.

5.4.3. A power supply that is considered dangerous or unsuitable by the contest committee shall not be permitted.

5.4.4. The pressure of the compressed air power (if any) must be less than 6 bars.

5.5. Weight

Parent and Child robots including their power sources, cables, remote controller and other parts of each robot shall be weighed prior to the competition. The total allowable weight of all robots and above accessories for each team to be used throughout the contest must not exceed 40 Kg. The total weight of 40 Kg does not include spare batteries and components with same specifications.

5.6. Robot Specifications

Size and weight of each robot will be measured before the competition. Robots that are not made in conformity with this rulebook will not be allowed to participate in the contest.

6. The Competition and Scoring

6.1. Matches

6.1.1. Each match shall last for a maximum of three (3) minutes.

6.1.2. Both the teams have to play Seesaw as their first game activity during the match. The team which completes Seesaw can attempt either Swing or Pole walk as per their choice. However, completing the Swing and Pole walk is must for a team to be eligible to attempt Jungle gym.

6.1.3. The team which completes the fourth game (Jungle gym) first, accomplishes “SHABAASH” and will be declared a winner and the match ends there itself.

6.1.4. In-case, none of the teams is able to complete the fourth game(Jungle gym) or a tie happens for “SHABAASH”, winner will be declared as per the following order of priority:

6.1.4.1. Team with maximum score after considering violations

6.1.4.2. Team completing all three (3) games (Seesaw, Pole walk and Swing) in minimum time

6.1.4.3. Team completing two (2) different games in minimum time with the first activity being See saw.

6.1.4.4. Team completing Seesaw in minimum time

6.1.4.5. If there is a tie after that also, the Judges and Referees decide the winner.

6.2. Competition Rules

A parent robot holding a Child robot starts from the Start zone and reaches to its own Seesaw child zone and completes the activity as follows.

6.2.1. Seesaw

6.2.1.1. Parent robot makes the Child robot sit on the Seesaw seat leaving the Child robot untouched.

6.2.1.2. Child robot should sit on the seat of Seesaw. Child robot is permitted to touch the seat and the handle next to the seat, in order to remain seated on Seesaw.

6.2.1.3. Parent robot should move to opposite side and without sitting on the Seesaw it has to play with Child robot and complete three (3) continuous laps.

6.2.1.4. Parent robot reloads the Child robot upon itself.

6.2.1.5. 'Completion of a lap' means that: Seesaw seat of Child robot and seat opposite to that should touch the floor one after the other for each lap.

6.2.1.6. The counting of lap starts, once the seat at Parent robot side touches the Seesaw child zone for the first time after successful placement of Child robot.

6.2.1.7. During the laps the Child robot should not touch the floor area of Seesaw child zone.

6.2.2. After completing the Seesaw activity, a team is eligible to play either Pole walk or Swing.

6.2.3. Pole walk

6.2.3.1. The Parent robot places the Child robot on its own color disc and leaves the Child robot untouched.

6.2.3.2. Child robot should remain on the disc of its own color.

6.2.3.3. Child robot is allowed to touch the disc and portion of the pole above the disc while performing the act of disc walk.

6.2.3.4. The Child robot has to walk (travel) on discs and complete the path from disc to disc without skipping any one of its own colour discs and also without touching the floor area of Pole walk child zone.

6.2.3.5. Parent robot reloads the Child robot upon itself.

6.2.4. Swing

6.2.4.1. Parent robot places Child robot on its own color seat of swing and leaves the Child robot untouched.

6.2.4.2. Child robot is permitted to touch the seat of swing and side chains.

6.2.4.3. Parent robot can initiate swinging for the first lap without touching the Child robot. Next two (2) laps should be performed by the Child robot by itself. However Parent robot can assist Child robot to stop the swinging.

6.2.4.4. Parent robot reloads the Child robot upon itself.

6.2.4.5. 'Completion of lap' means that: Any part of the Child robot has to touch the flag kept next to the Swing in order to complete one (1) lap and complete such three (3) continuous laps.

6.2.4.6. No part of the Child robot is allowed to touch the floor area of Swing child zone during the laps.

6.2.5. Only after completing all the three (3) earlier games, a team is eligible to play Jungle gym.

6.2.6. Jungle gym

6.2.6.1. Parent robot keeps Child robot on or near the first step of ladder and Parent robot leaves the Child robot untouched.

6.2.6.2. The Child robot climbs the ladder without touching side rails and places itself completely on the top platform of Jungle gym.

6.2.6.3. A preloaded flag (Refer Figure-7) is to be raised by Child robot after getting placed itself on the top platform. Action of raising the flag will enable the team to achieve "SHABAASH". The teams should make their own flags as per Figure-7

6.2.6.4. In order to achieve "SHABAASH" the flag should be raised above the topmost point of the Child robot.

6.2.6.5. After successfully completing the Jungle gym by a team first, it accomplishes "SHABAASH" and is declared as winner and the match ends there itself.

6.3. Scoring

6.3.1. Only after successfully completing all the tasks of any game; the game will be considered as "complete" and teams earn points specified for that game.

6.3.2. To earn additional points, Seesaw maybe attempted for maximum three (3) times (of three (3) laps each). To earn additional points Pole walk and Swing maybe attempted for maximum two (2) times.

6.3.3. On a “retry” for Seesaw and Swing, counting of lap will restart from the first count. Prior lap(s) in this case will not be counted.

6.3.4. Points are awarded:

6.3.4.1. Completion of the first game (Seesaw) = 10 points for every completion (Can be attempted for maximum of three (3) times to earn additional points)

6.3.4.2. Completion of the second game (Pole walk or Swing) = 20 points for every completion (Can be attempted for maximum two (2) times to earn additional points)

6.3.4.3. Completion of the third game (remaining out of Pole walk or Swing) = 50 points for every completion (Can be attempted for maximum two (2) times to earn additional points)

6.3.4.4. Completion of the fourth game (Jungle gym) makes the team accomplish **“**SHABAASH”. No point for this game and the match ends there itself.

7. Violations and Deduction of Points

Once a game begins, the following actions will be regarded as violations and two (2) points will be deducted for each occurrence.

7.1. A violation occurs if any robot of a team touches an opponent’s robots

7.2. A violation occurs when a Parent robot or a team member touches the floor area of Child zone except in the case of “retry”.

7.3. A violation occurs when Parent robot operator enters the air space of the Child zone except in the case of “retry”.

7.4. A violation occurs when Parent and/or Child robot of any team enters into an opponent’s zone or air space above it.

7.5. A violation occurs when Child robot touches the floor area of Start zones, and Parent zone.

7.6. A violation occurs when Child robot during the action intentionally touches the floor area of Seesaw, Swing and Pole walk

7.7. A violation occurs when a team performs prohibited act as stated in rulebook and FAQs.

8. Disqualification

The following behaviors shall be considered as “disqualifications of the team” by the judges and Referees for a particular match. The team will cease to continue with game and the score for that match for that team will not be recorded.

8.1. Causing or attempting to damage the game field, the equipment on the field or the opponent’s robots.

8.2. Members of a team touching their own robots intentionally during the game.

8.3. A robot or any team member(s) intentionally blocking, touching or attacking the opponent’s robots directly or indirectly. However if the robots of any team move or fall into restricted areas by an accident it should be removed immediately as per Referee's instructions. (The referee is empowered to determine whether it is an accident or not) Retry may be allowed after that.

8.4. Two (2) False Starts in a match (Parent robot being started before the Referee signals a start.)

8.5. Performing any act against the spirit of fair play and friendship between participating teams.

8.6. Persistently using the cable to guide or pull the Parent robot.

8.7. The team that does not follow the instruction or warning of the Referee.

8.8. Use of communication (such as IR, RF, LASER etc.) between the robots.

8.9. Team not complying point number 6.2.2 and 6.2.5

9. Others

9.1. For any other behavior not specified in the rules, referees are given full authority to make a decision and their decision is final in the event of a dispute.

9.2. Any amendments to these rules will be announced by the Contest committee and be updated on website <www.roboconindia.com> under FAQ.

9.3. All teams are encouraged to decorate the robots to reflect the culture, aesthetics and styles of their respective countries.

9.4. All robots must be designed and made by student teams. Readymade commercial robots will be disqualified from being used. Teams are not allowed to have sponsor’s logo anywhere on the robots or on the uniform.

9.5. When requested by the contest committee, each participating country will be asked to provide information on their robots, including the video, which explains the structure and the movement of the participating team's robots. The contest committee will verify whether each participating robots complies with the rules through viewing the videos, prior to the shipment of the robots.

9.6. When using optical sensors teams must consider the fact that there will be very bright lights on the game field for video recording and broadcasting purposes.

9.7. Domestic winner teams should take into account the constraints of transporting batteries via airline services before sending robots for international event.

9.8. The allowable margin of error to the objects in this Rulebook wherever not mentioned is ± 5% both in weight and size.

9.9. Teams should consider the operational height of the Child robot during the game activity and must design the Child robot to avoid probable damage in the case of accidental fall from height by providing suitable cushioning means.

APPENDIX

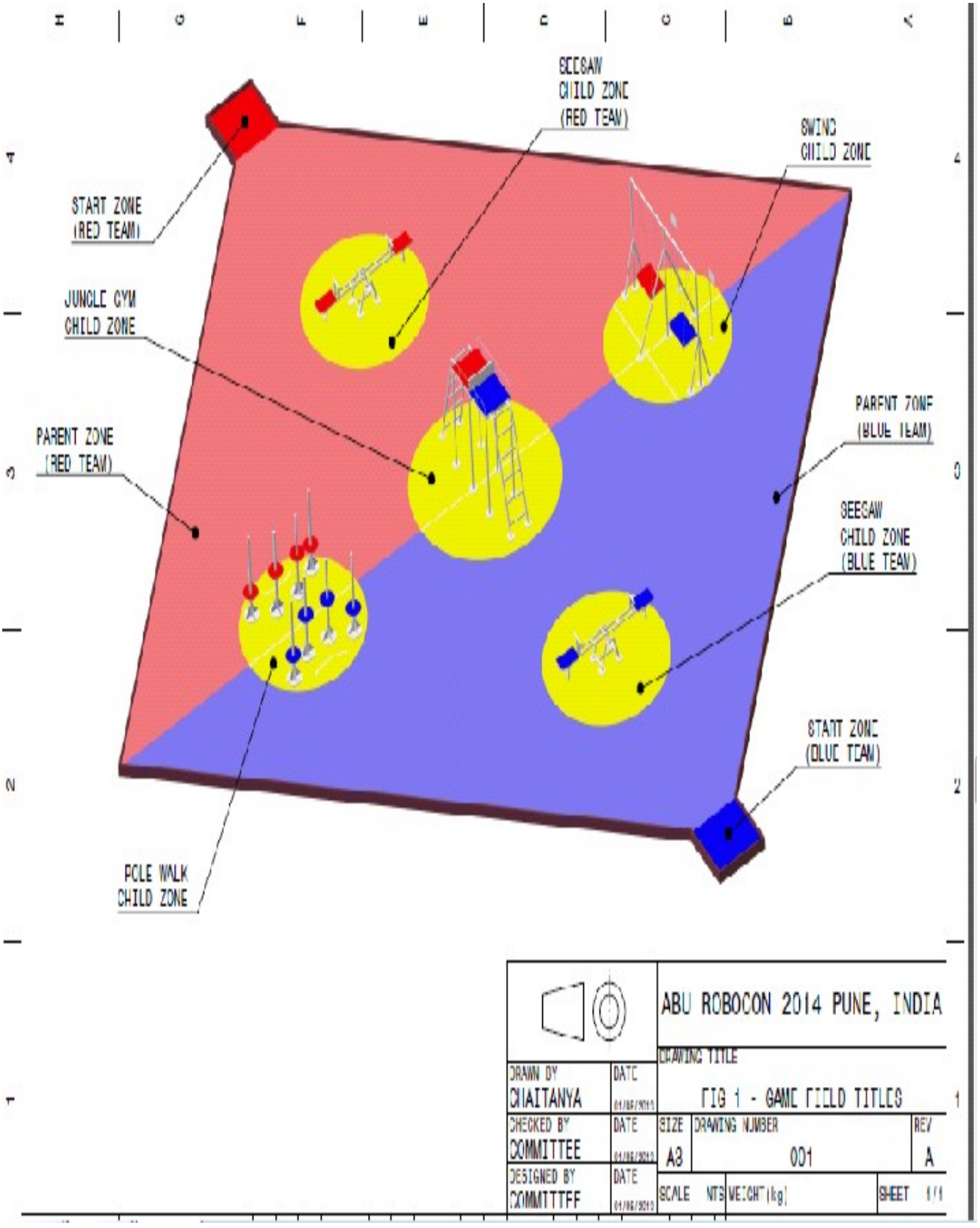
A. MATCHES

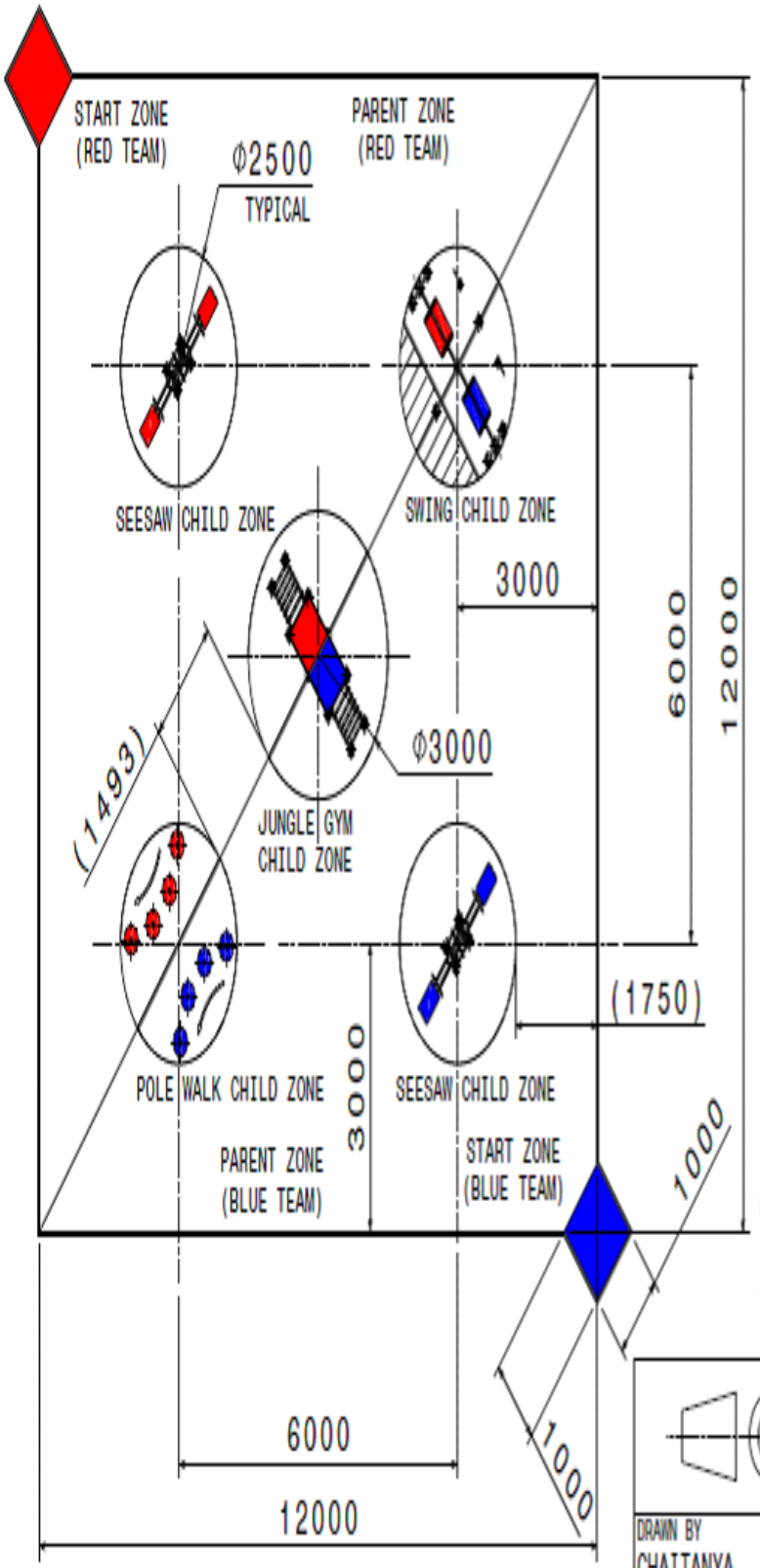
The contest is played according to the following format:
Preliminary Rounds: Round robin within groups.
Winner from each group shall advance to the Quarter-Final.
Quarter-finals: Knock out matches.
Semi-Finals: Knock out matches.
Finals: Knock out match.

B. AWARDS

Prizes shall include awards for the winners, runner-ups, best idea, best technology, and best design and ABU Robocon award, Sponsors' awards.

Drawing of Theme/Arena





NOTES:
1) ALL DIMENSIONS IN mm
2) ALL STRUCTURES TO BE PAINTED IN SILVER COLOR (EXCEPT FOR SPECIFIED SURFACES)

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		DRAWING TITLE		
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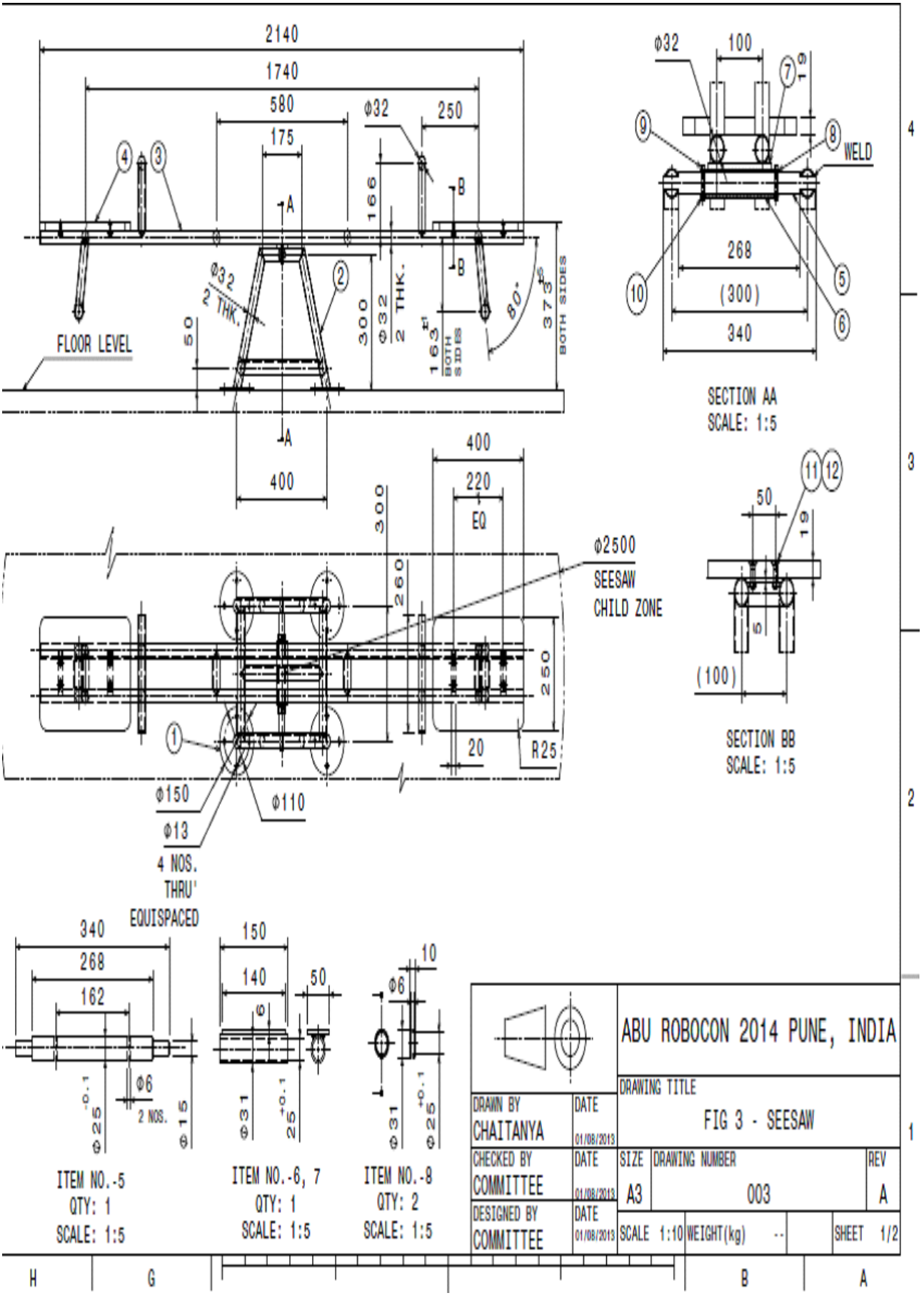
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1740
580
175
Φ32
250
166
FLOOR LEVEL
50
Φ32
2 THK.
300
Φ32
2 THK.
163±1
BOTH SIDES
60°
373±5
BOTH SIDES
400
400
220
EQ
300
260
250
Φ2500
SEESAW
CHILD ZONE
20
R25
Φ150
Φ110
Φ13
4 NOS.
THRU'
EQUISPACED
Φ32
100
WELD
268
(300)
340
SECTION AA
SCALE: 1:5
50
(100)
SECTION BB
SCALE: 1:5
340
268
162
Φ6
2 NOS.
150
140
50
10
Φ6
ITEM NO.-5
QTY: 1
SCALE: 1:5
ITEM NO.-6, 7
QTY: 1
SCALE: 1:5
ITEM NO.-8
QTY: 2
SCALE: 1:5
ABU ROBOCON 2014 PUNE, INDIA
DRAWING TITLE
FIG 3 - SEESAW
DRAWN BY
CHAITANYA
DATE
01/08/2013
CHECKED BY
COMMITTEE
DATE
01/08/2013
DESIGNED BY
COMMITTEE
DATE
01/08/2013
SIZE
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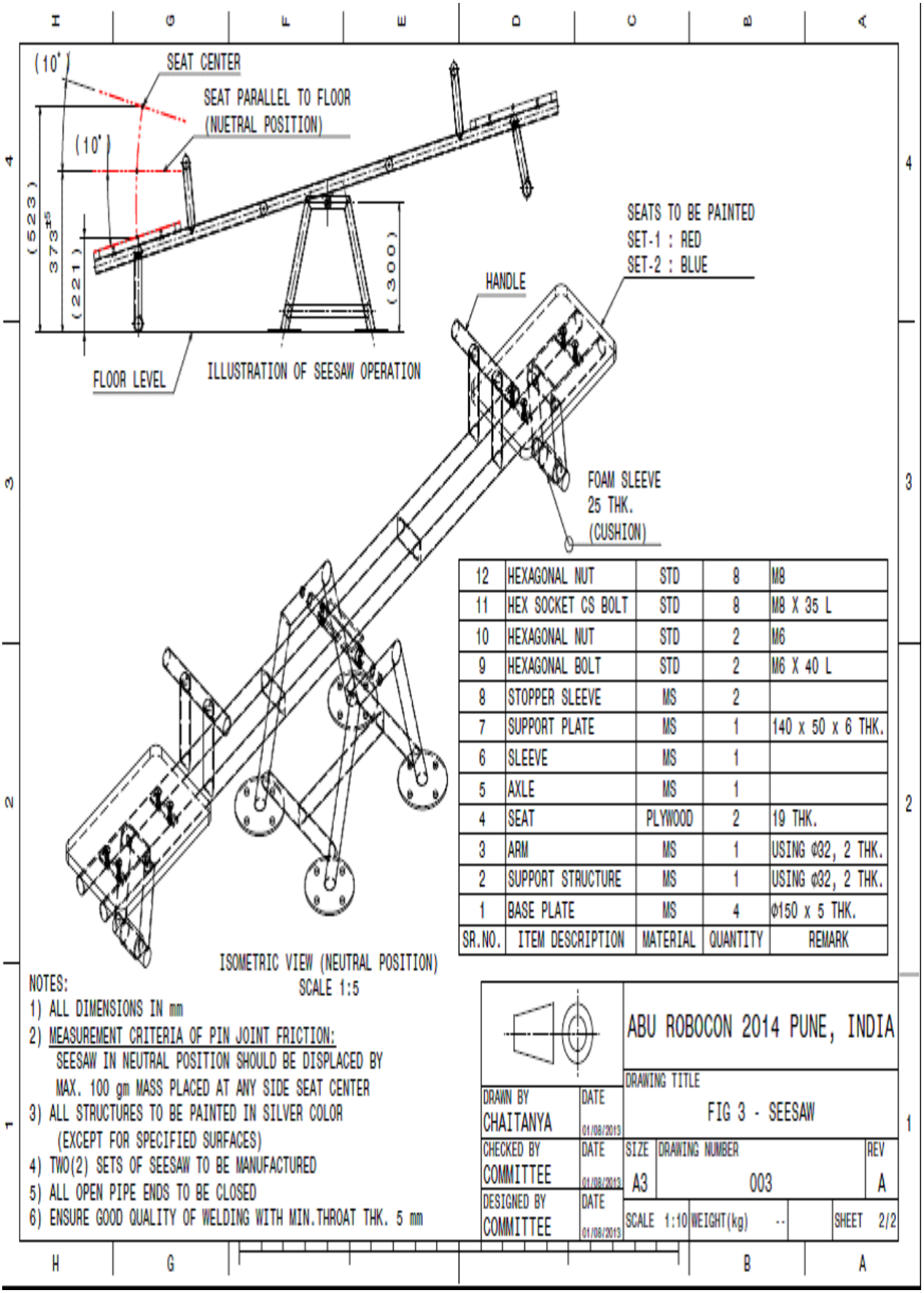

SR.NO.	ITEM DESCRIPTION	MATERIAL	QUANTITY	REMARK
12	HEXAGONAL NUT	STD	8	M8
11	HEX SOCKET CS BOLT	STD	8	M8 X 35 L
10	HEXAGONAL NUT	STD	2	M6
9	HEXAGONAL BOLT	STD	2	M6 X 40 L
8	STOPPER SLEEVE	MS	2	
7	SUPPORT PLATE	MS	1	140 x 50 x 6 THK.
6	SLEEVE	MS	1	
5	AXLE	MS	1	
4	SEAT	PLYWOOD	2	19 THK.
3	ARM	MS	1	USING ø32, 2 THK.
2	SUPPORT STRUCTURE	MS	1	USING ø32, 2 THK.
1	BASE PLATE	MS	4	ϕ150 x 5 THK.

ISOMETRIC VIEW (NEUTRAL POSITION)
SCALE 1:5

NOTES:
1) ALL DIMENSIONS IN mm
2) MEASUREMENT CRITERIA OF PIN JOINT FRICTION:
   SEESAW IN NEUTRAL POSITION SHOULD BE DISPLACED BY MAX. 100 gm MASS PLACED AT ANY SIDE SEAT CENTER
3) ALL STRUCTURES TO BE PAINTED IN SILVER COLOR (EXCEPT FOR SPECIFIED SURFACES)
4) TWO(2) SETS OF SEESAW TO BE MANUFACTURED
5) ALL OPEN PIPE ENDS TO BE CLOSED
6) ENSURE GOOD QUALITY OF WELDING WITH MIN.THROAT THK. 5 mm

ABU ROBOCON 2014 PUNE, INDIA

DRAWN BY: CHAITANYA	DATE: 01/08/2013	DRAWING TITLE: FIG 3 - SEESAW		
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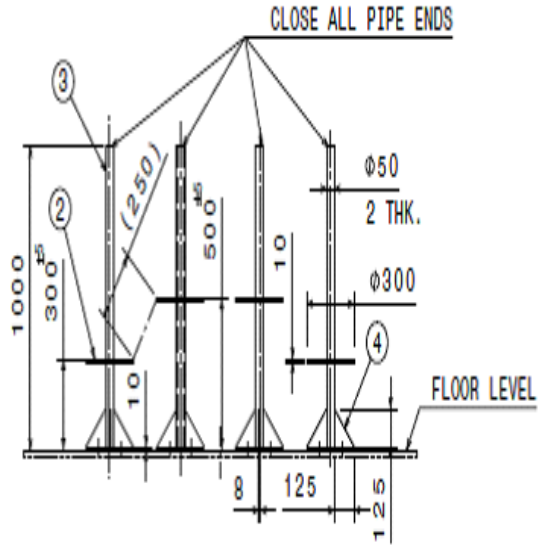
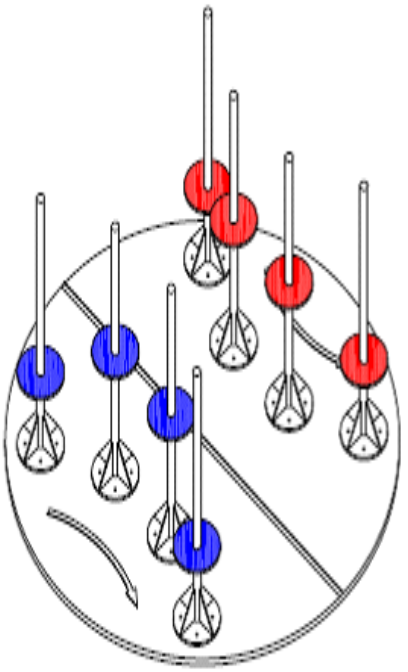
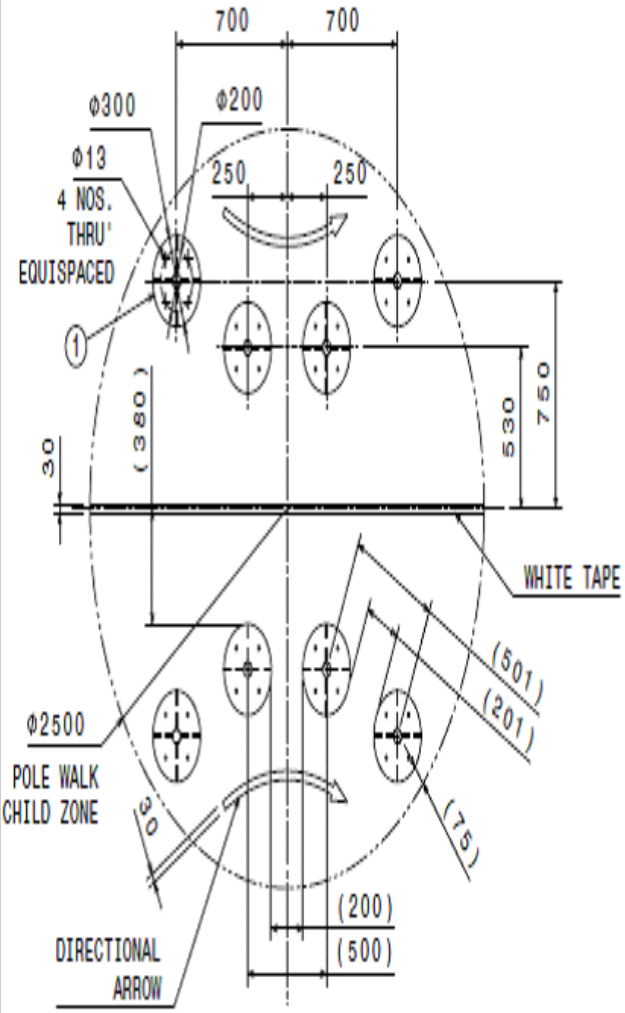




ISOMETRIC VIEW



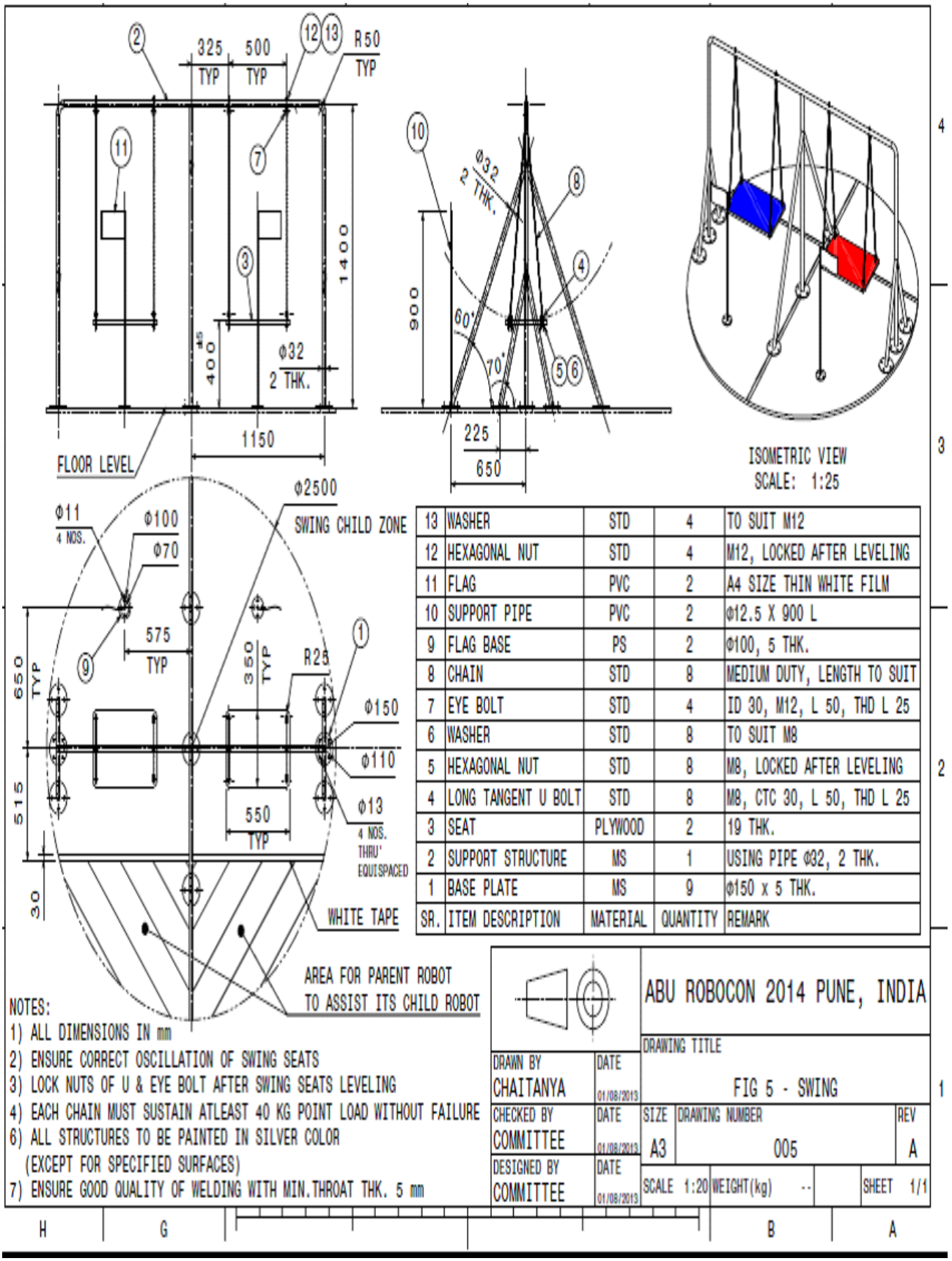
SR. NO.	ITEM DESCRIPTION	MATERIAL	QUANTITY	REMARK
4	WEB	MS	32	125 x 125 x 8 THK.
3	POLE	MS	8	USING Φ50, 2 THK.
2	WALKING DISC	MS	8	Φ300 x 10 THK.
1	BASE PLATE	MS	8	Φ300 x 10 THK.

NOTES:
1) ALL DIMENSIONS IN mm
2) ALL STRUCTURES TO BE PAINTED IN SILVER COLOR
   (EXCEPT FOR SPECIFIED SURFACES)
3) ENSURE GOOD QUALITY OF WELDING WITH MIN. THROAT THK. 5 mm

ABU ROBOCON 2014 PUNE, INDIA

DRAWING TITLE: FIG 4 - POLE WALK

DRAWN BY: CHAITANYA	DATE: 01/08/2013	SIZE: A3	DRAWING NUMBER: 004	REV: A
CHECKED BY: COMMITTEE	DATE: 01/08/2013			
DESIGNED BY: COMMITTEE	DATE: 01/08/2013	SCALE: 1:20	WEIGHT(kg): --	SHEET: 1/1

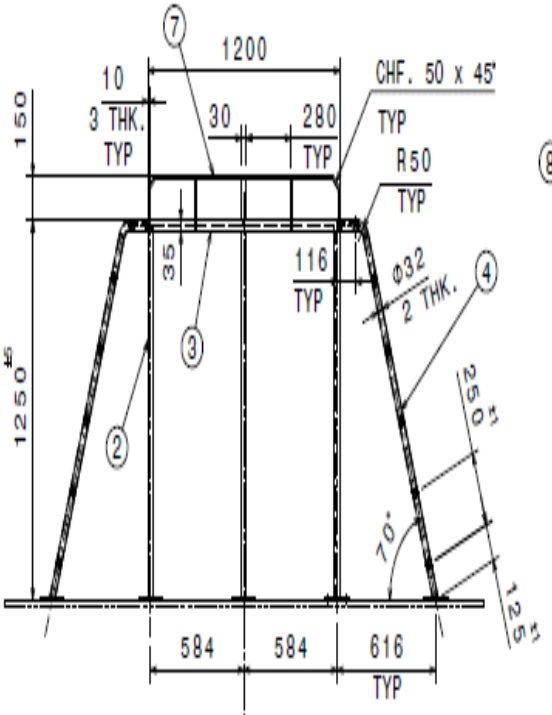


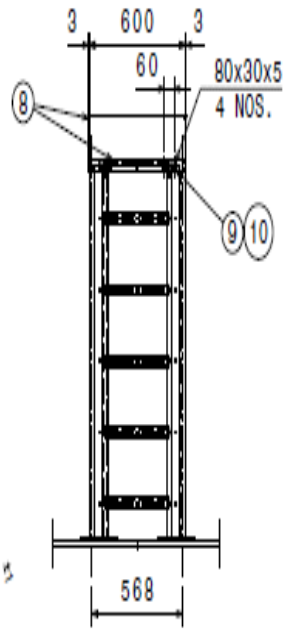
SR.	ITEM DESCRIPTION	MATERIAL	QUANTITY	REMARK
13	WASHER	STD	4	TO SUIT M12
12	HEXAGONAL NUT	STD	4	M12, LOCKED AFTER LEVELING
11	FLAG	PVC	2	A4 SIZE THIN WHITE FILM
10	SUPPORT PIPE	PVC	2	Φ12.5 X 900 L
9	FLAG BASE	PS	2	Φ100, 5 THK.
8	CHAIN	STD	8	MEDIUM DUTY, LENGTH TO SUIT
7	EYE BOLT	STD	4	ID 30, M12, L 50, THD L 25
6	WASHER	STD	8	TO SUIT M8
5	HEXAGONAL NUT	STD	8	M8, LOCKED AFTER LEVELING
4	LONG TANGENT U BOLT	STD	8	M8, CTC 30, L 50, THD L 25
3	SEAT	PLYWOOD	2	19 THK.
2	SUPPORT STRUCTURE	MS	1	USING PIPE Φ32, 2 THK.
1	BASE PLATE	MS	9	Φ150 x 5 THK.

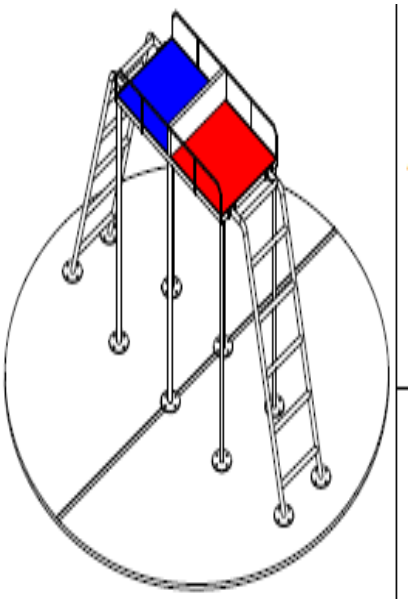
NOTES:
1) ALL DIMENSIONS IN mm
2) ENSURE CORRECT OSCILLATION OF SWING SEATS
3) LOCK NUTS OF U & EYE BOLT AFTER SWING SEATS LEVELING
4) EACH CHAIN MUST SUSTAIN ATLEAST 40 KG POINT LOAD WITHOUT FAILURE
6) ALL STRUCTURES TO BE PAINTED IN SILVER COLOR
(EXCEPT FOR SPECIFIED SURFACES)
7) ENSURE GOOD QUALITY OF WELDING WITH MIN.THROAT THK. 5 mm

ABU ROBOCON 2014 PUNE, INDIA

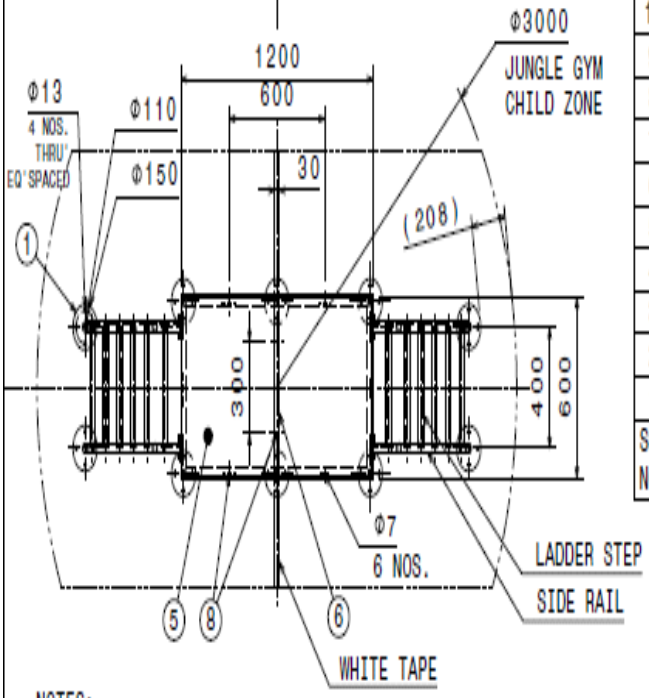
DRAWN BY: CHAITANYA	DATE: 01/08/2013	DRAWING TITLE: FIG 5 - SWING	
CHECKED BY: COMMITTEE	DATE: 01/08/2013	SIZE: A3	DRAWING NUMBER: 005 / REV: A
DESIGNED BY: COMMITTEE	DATE: 01/08/2013	SCALE: 1:20	WEIGHT(kg): -- / SHEET: 1/1







ISOMETRIC VIEW
SCALE: 1:25

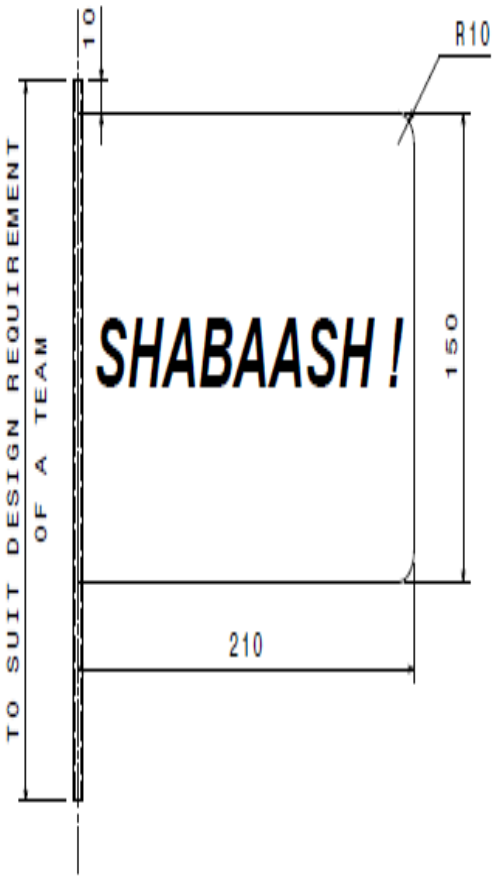


SR. NO.	ITEM DESCRIPTION	MATERIAL	QUANTITY	REMARK
10	HEXAGONAL NUT	STD	8	M10
9	HEXAGONAL BOLT	STD	8	M10 x 15L
8	WOOD SCREW	STD	11	Φ6 x 15 L
7	RAILING	MS	2 SETS	USING FLAT 10 x 3 THK.
6	PARTITION	PLYWOOD	1	FIXED WITH PLATFORM TOP
5	PLATFORM TOP	PLYWOOD	1	TO SUIT FRAME (INSIDE)
4	LADDER ASSY	MS	2 SETS	USING PIPE, Φ32, 2 THK.
3	FRAME	MS	1	35 x 35 x 5 THK. ANGLE
2	SUPPORT PIPE	MS	6	Φ32, 2 THK.
1	BASE PLATE	MS	10	Φ150 x 5 THK.

NOTES:
1) ALL DIMENSIONS IN mm
2) IT IS OPTIONAL TO WELD OR FASTEN LADDER ASSY TO THE FRAME
3) ALL STRUCTURES TO BE PAINTED IN SILVER COLOR
(EXCEPT FOR SPECIFIED SURFACES)
4) ENSURE GOOD QUALITY OF WELDING WITH MIN.THROAT THK. 5 mm

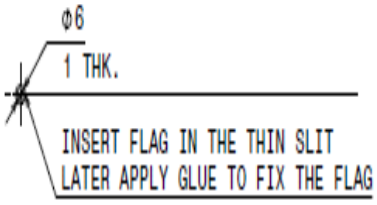
ABU ROBOCON 2014 PUNE, INDIA

DRAWN BY: CHAITANYA	DATE: 01/08/2013	DRAWING TITLE: FIG 6 - JUNGLE GYM	
CHECKED BY: COMMITTEE	DATE: 01/08/2013	SIZE: A3	DRAWING NUMBER: 006 / REV: A
DESIGNED BY: COMMITTEE	DATE: 01/08/2013	SCALE: 1:20	WEIGHT(kg): -- / SHEET: 1/1



SR. NO.	ITEM DESCRIPTION	MATERIAL	QUANTITY	REMARK
2	FLAG	PVC	1	A5 SIZE WHITE THIN FILM
1	SUPPORT PIPE	AL	1	1 THK.

NOTES:
1) ALL DIMENSIONS IN mm
2) ALTENATE SUITABLE MATERIAL FOR SUPPORT PIPE IS PERMITTED
3) DETAILS FOR BOTH SIDE TEXT ON FLAG:
   VISIBLE TEXT SIZE WITH FONT : ARIAL TT, BOLD AND ITALIC



ABU ROBOCON 2014 PUNE, INDIA

DRAWING TITLE: FIG 7 - "SHABAASH" FLAG (TO BE PREPARED BY TEAMS)

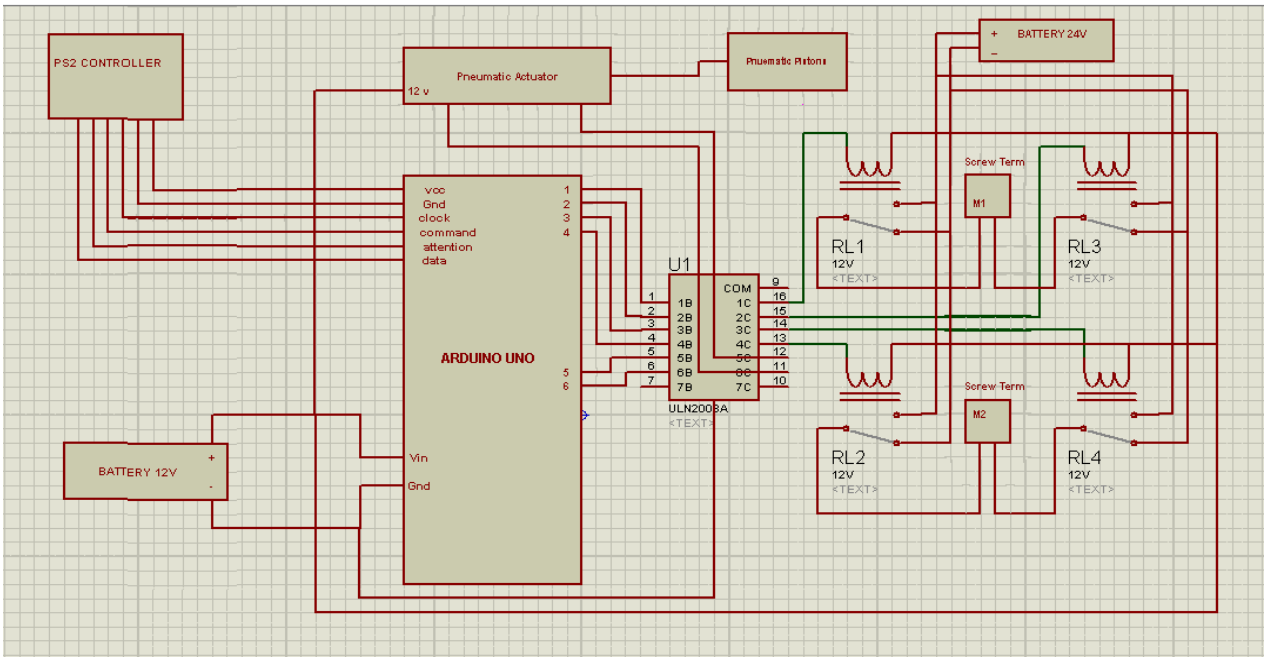
DRAWN BY: CHAITANYA	DATE: 01/08/2013			
CHECKED BY: COMMITTEE	DATE: 01/08/2013	SIZE: A3	DRAWING NUMBER: 007	REV: A
DESIGNED BY: COMMITTEE	DATE: 01/08/2013	SCALE: 1:2	WEIGHT(kg): --	SHEET: 1/1

H G B A

DESIGN & ANALYSIS

Microcontroller and motor Drivers Using Electromagnetic Relays

MOTHER ROBOT CIRCUIT :



Components Used

1. 12 V relays
2. PS2 Controller \
3. Lead Acid Battery 12V
4. ULN2003A (Darlington Transistor array)
5. Screw Terminals
6. Arduino MEGA

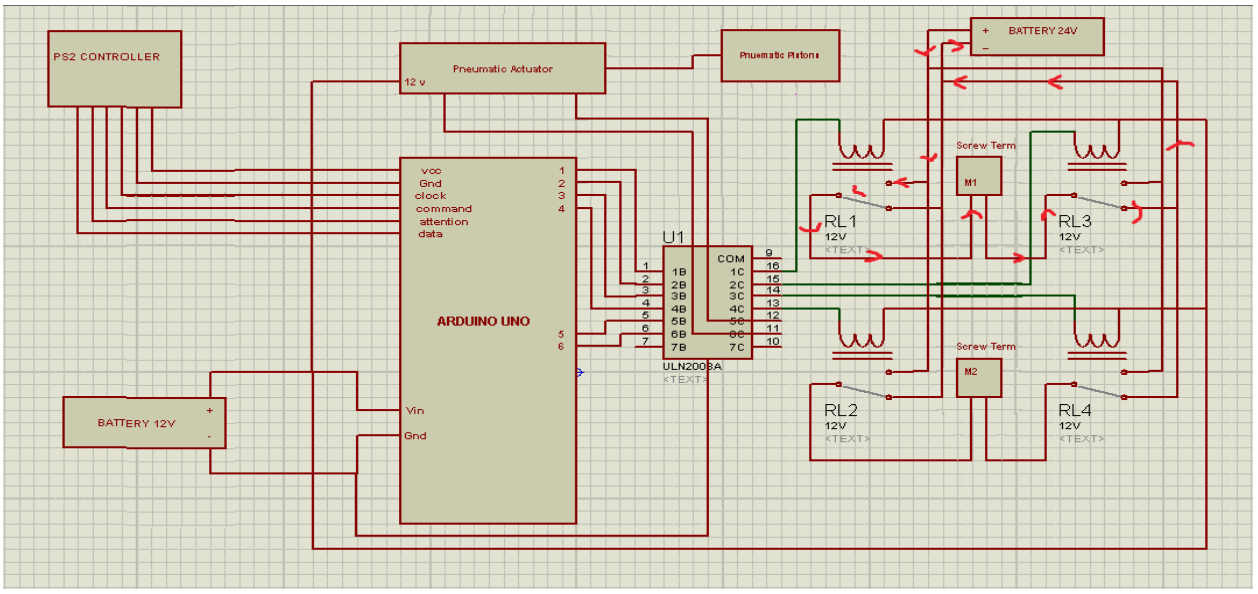
Working

In this circuit we have used An Arduino MEGA as a main Microcontroller Unit .

To drive the motor Bidirectionally we have to use 2 Relays which acts as a H bridge . Since arduino output current is not sufficient to actuate the relays We have used a ULN2003A which is a darlington transistor array.

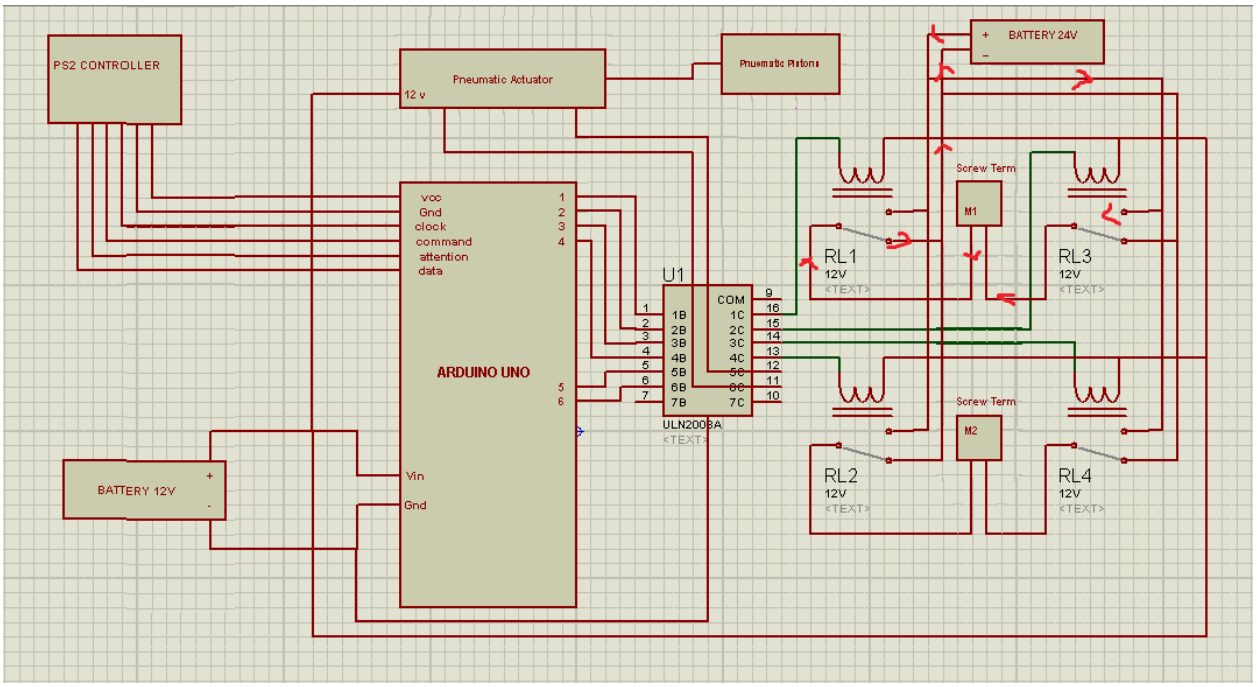
CLOCKWISE MOTION:

To drive the motor M1 in one direction we have to make 1B of ULN2003A logic HIGH which will provide ground at the pins 1C of the IC. Same goes for motor M2 by making 4B logic HIGH



COUNTER CLOCKWISE MOTION :

To drive in another motor in direction we have to make 2B ULN2003A logic HIGH which will provide ground at the pins 2C of the IC. . Same goes for motor M2 by making 3B logic HIGH



PNEUMATIC MOTION :

For Pneumatic Piston which is a double acting cylinder relays are used to actuate solenoid valves.

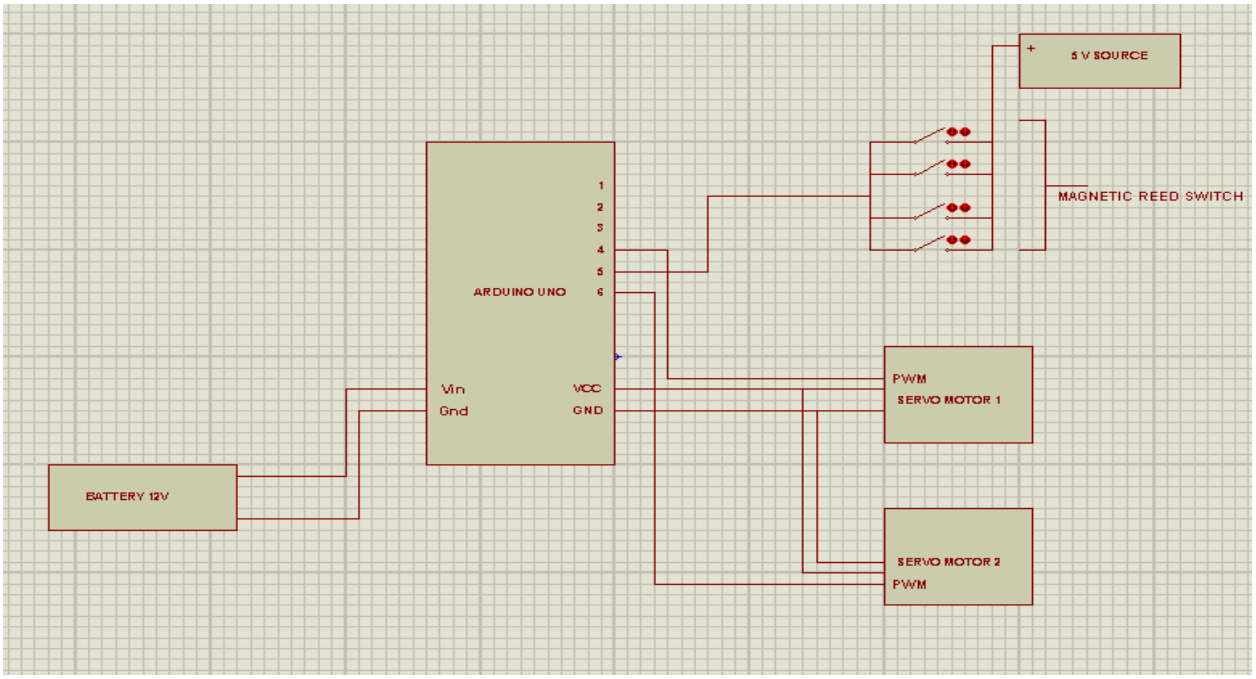
FORWARD STROKE :

For forward stroke of pneumatic piston pin 6B is to be made logic HIGH which will provide ground to valve via 6C

BACKWARD STROKE :

For backward stroke of pneumatic piston pin 5B is to be made logic HIGH which will provide ground to valve via 5C

CHILD ROBOT CIRCUIT :



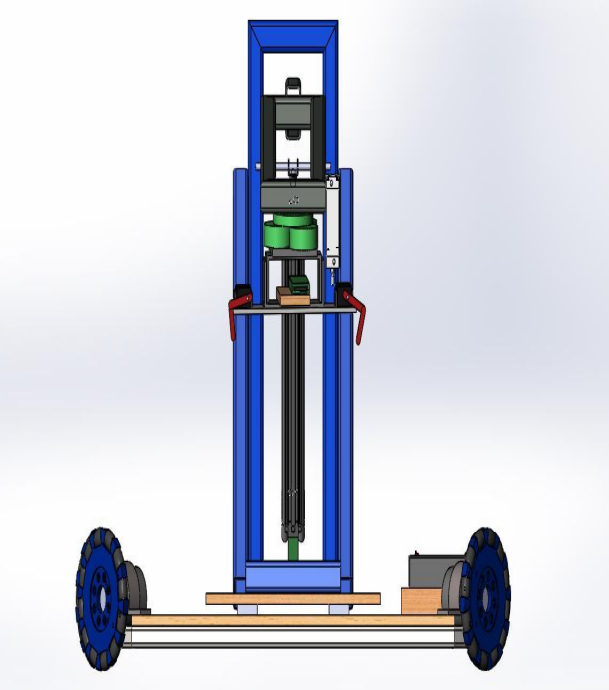
Components Used

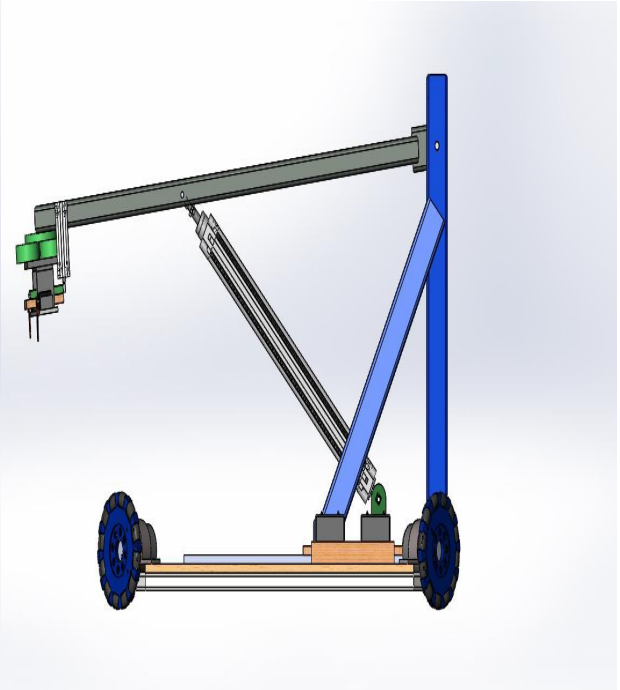
1. Arduino UNO
2. Servo Motors
3. Magnetic Reed Switches
4. LIPO Battery

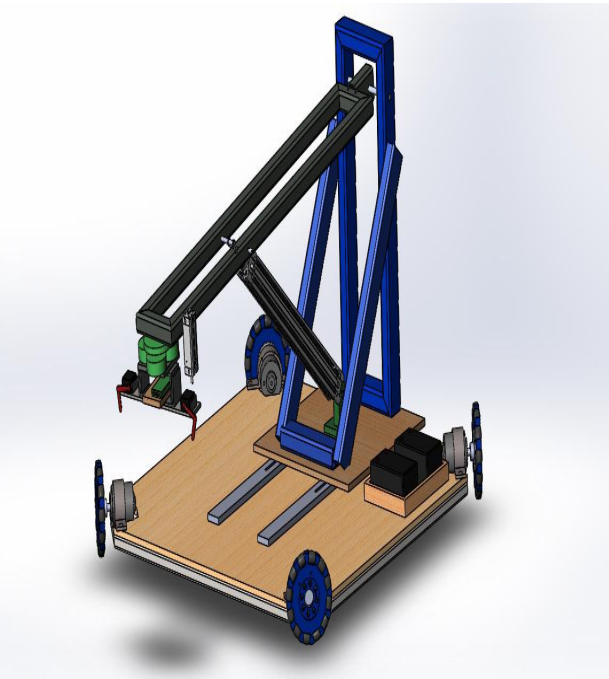
Working

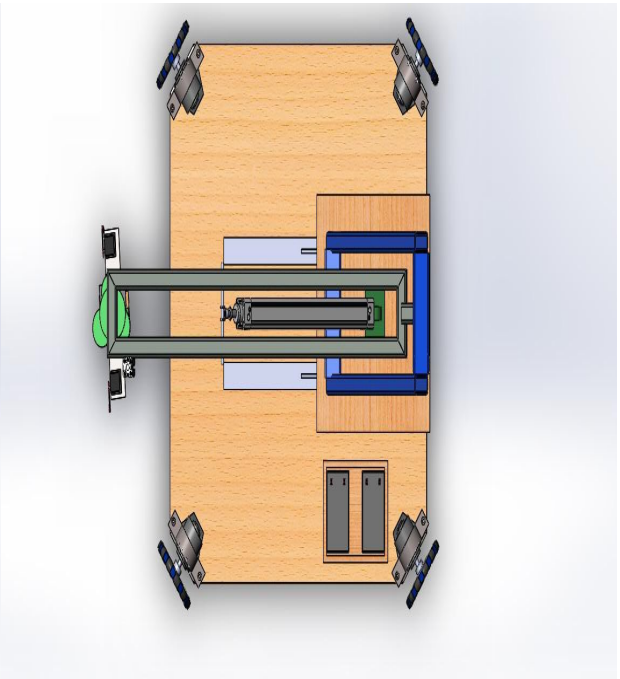
Arduino UNO is used as main microcontroller . Since robot is autonomous it should work on its own.

Whenever Electromagnet is used to grab the robot Magnetic reed switches gets on and gives signal at one of the digital Pins .
Whenever that digitalPin gets a signal of logic HIGH its turns the motor at 180 degrees using Pulse Width Modulation and leaves the seat on which it is grabbed .









Design Review

The proposed design of Robocon-2014, team of following member was evaluated at the time of starting

- Mr. Devender Singh, Astt Prof ME Dept
- Mr. Pradeep Jain, Head RICC & Asstt Prof- ME Deptt
- Mr. D. K. Singh. Scientific Office, TIFAC-CORE & Asstt Prof-ME Deptt
- Ms. Shilpa Sambhi, Scientific Office, TIFAC-CORE & Asstt Prof-EN Deptt
- Mr. Devvrat Tyagi, Scientific Office, TIFAC-CORE & Asstt Prof-EC Deptt
- Mr. Brijesh Kumar, Scientific Office, TIFAC-CORE & Asstt Prof-EI Deptt
- Mr. Sudhanshu Kantoor, Project Managar, P&F India
- Mr. Brijesh Poddar, Senior Managar, Jantics India Pvt Ltd

After individual comments, their design is corrected time to time and evaluated it. Their some comments are as follows and these are implemented in the project:

- The pulses provided by microcontroller to actuate pneumatic cylinder, may not provide accurate stroke length to climb ladder, etc.
- Sensors should be used for proper control.
- Pneumatic part should be controlled smoothly.
- Stepper motor should be used in place of servo motors to optimize cost.
- Designs of mother and child robot are good.
- Length of gripper arm may be optimized, so that torque requirements at gripper joint become min.

DEVELOPMENT

The designs of Mother & Child Robot are follows:

MOTHER BOT

STRUCTURAL SPECIFICATIONS

- ✓ The bot houses two assembly
  - Base assembly
  - Actuator assembly

Base assembly

- ✓ The base assembly provides 2 degree of freedom.
- ✓ It involves 4 omni wheels that provides motion of the bot in all the directions.
- ✓ All the electronic circuitry along with power supply is placed over it.

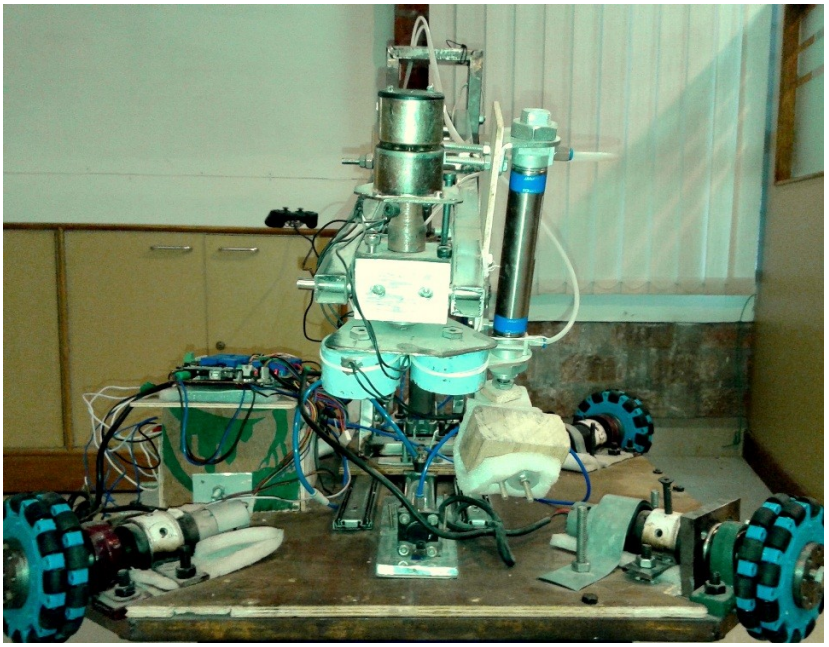


Fig 1: Front View of Mother Bot

Actuator assembly

- ✓ This assembly provides 3 degrees of freedom.
- ✓ The major task of pick and place the child bot is accomplished with this assembly.
- ✓ It involves two pistons for providing actuation one each for the swing task and the see saw task.
- ✓ The far end of the assembly bears a gripper end effector powered by electromagnets that helps in picking the bot.

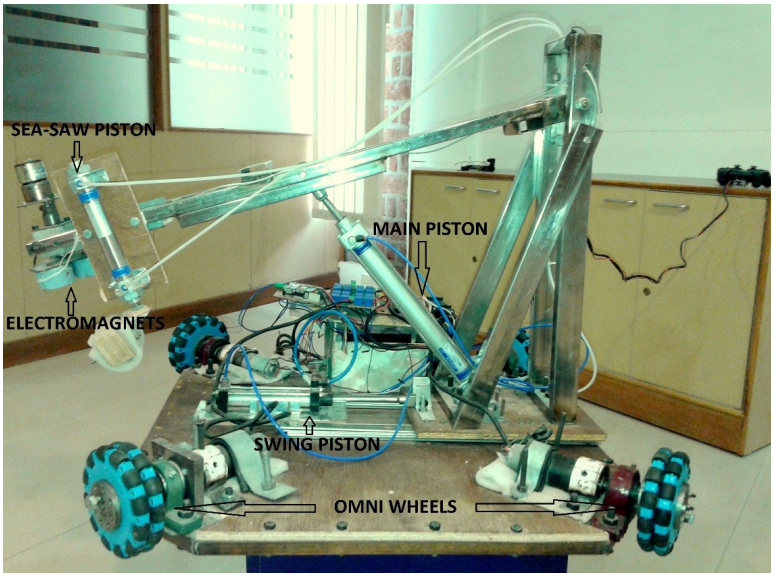


Fig 2: Side View of Mother Bot

ELECTRONICS AND EMBEDDED SPECIFICATIONS

- Relay Based Motor Drivers.
- Arduino Uno is the main Controller.
- Arduino uno also controllers 3-5/3 solenoid direction control valves for pneumatic cylinder by controlling relays.
- 24V DC supply by Lead-Acid battery.

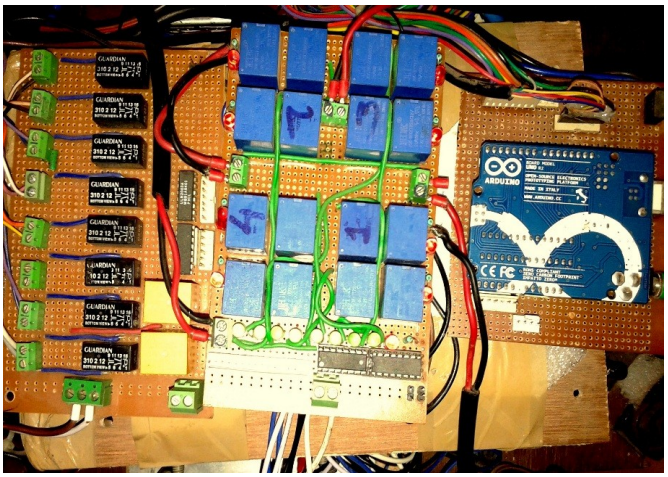


Fig 3: Electronics Circuits

CHILD BOT

STRUCTURAL AND ELECTRONICS SPECIFICATIONS

- ✓ Two Servo controlling mechanism for gripping Sea-Saw and Swing.
- ✓ Series of reed switches for sensing actuating signal from mother bot through electromagnets

Fig 4: State of Child Bot before gripping

- Arduino Uno is the main Controller.
- 12V DC Lithium Polymer Battery to supply power to arduino.
- Arduino controls the actuation of servo motors.

Fig 5: State of Child Bot after gripping

PRACTICE ARENAS

Fig 6: Sea-Saw Practice Arena

Fig 7: Pole Walk Practice Arena

CONDITION OF ROBOTS BEFORE LEAVING PUNE

Both the mother robot and the child robot were ready before leaving to Pune. Instead of late delivery of some of our key components like omni wheels, our team managed to finish task in time. The days just before leaving Pune were very important. Day and night efforts of whole team made it possible. Robot was doing all the three tasks. Our problem was not able to do the fourth task because of problems associated with magnets that are later discussed. The issue was all the components like motor drivers and the pneumatic assembly were made by us and there was no proper testing for them.

EVENT DISCRIPTION

1. The National ABU Robocon 2014 was held in the Badminton Hall of the Shree Shiv Chhatrapati Sports Complex, Balewadi, Pune on the 6, 7 & 8 March 2014. The theme for Robocon 2014 declared by MITAOE was "A SALUTE TO PARENTHOOD".
2. This time the two robots involved in the contest were designated as a child bot and a mother bot. The mother or main bot was the wired bot and the child bot was autonomous.Various tasks in the form of park rides were-
    - ✓ Swing
    - ✓ See-saw
    - ✓ Jungle gym
    - ✓ Pole walk
3. Total 90 teams are participated in Robocon-2014 from 6^{th}-8^{th} March'14 from MIT-AOE, Pune. These teams are divided into thirty groups, three teams in each group.
4. For testing their robot, 5^{th} March is fixed as a testing day for all teams who have interest.
5. All teams play two matches with other teams in their group. 8 min slot for each match is given, where 2 rounds of 3 minutes are played.

6. In our group, teams are follows:
   - ✓ W1: Ajay Kumar Garg Engineering College, Ghaziabad
   - ✓ W2: Veermata Jijabai Technological Institute, Mumbai
   - ✓ W3: L. R. Group of Institute, Solan

7. In first match with W2, our team is not participating due to mother robot electrical control circuit.

8. In second match with W3, our robot is going to arena for participating, due to sudden short circuit in our mother robot during task, we didn't have any score.

9. During inspection, the required weight is 40 kg but our robot weight is 43 kg, so they have removed one battery & one arm motion with motor, so required voltage is not upto their level.

10. Institute of Technology, Nirma University, Gujarat only one institute who have completed all four task during competition within time won the National Contest while Veermata Jijabai Technological Institute (VJTI), Mumbai were the First Runner-up. Both these Institutes got the chance to represent India in the International Contest. MIT Tech Team representing Maharashtra Institute of Technology, Pune were the Second Runner-up.

11. The International ABU Robocon 2014 was held in India. Lạc Hồng University, Vietnam won the International ABU Robocon 2014 held at Balewadi, Pune.

Some Pictures of Robocon-2015 @Pune


ROBOCON
ROBOCON

AFTER REACHING PUNE….

After the long and enjoyable journey, we finally reached the 7th most populous city, Pune. The host of the international event was there at the railway station to receive us. Quarter of our team went with the packed robot to pit area. Pit area is the small working area assigned to every team where they could assemble their bots. Rest of the team members went to complete all the formalities related to lodgings, etc. And then get ready to reach the pit area. The robot was unpacked till all the team reached the pit. Now the time was to assemble the bot. So, the actual work began at around 4pm.

As other teams started arriving their pit areas, it made us curious to look into other designs. With the aim of achieving success, we got down to work in our bot. Our mechanical structure was ready till late 2. Two practice slots were given to each team. In our first slot which was at 3 am, we were dealing with problems of motor drivers and we couldn't even enter the arena because our bot was not moving. In the second slot at 5 am, the bot was ready to enter the arena. But to our misfortune, while practicing, our relays burnt down! We tried a lot to repair the damage. Many of us couldn't even get to sleep there so that they could at least make the bot move. We were able to move the bot, but not completely. It was moving forward and backward but the sideward motions were not coming. After a lot of efforts, we couldn't get success in that part!

This year's event was over for us there! We had two matches in the first round- first with VJTI, Mumbai and then with IIT, Roorkee. Due to the failure of motor drivers in the practice slot, we couldn't even give competition to them. The winner of the ABU Robocon, 2014 was Nirma University. This team had its 6th win in the Robocon, 2014.

NEW TECHNOLOGIES USED:

Electrical:

This was our first time and we successfully applied new technologies in Electrical Departments. There was a need of better controller for Manual robot and then it was required to follow line on three different colours. After doing a lot of research in these fields we were able to implement efficient yet simple solution for the same.

These technologies include PS2 Remote controller, Arduino microcontroller board.

1. We successfully used PS2 Remote Controller without changing its circuit. It improved controlling of the robot drastically. This we did by using Arduino board.

2. **The PS2 Remote**: For the first time, we used a PS2 controller for operating the manual robot. This provided a better speed control and enabled us to incorporate the number of controls we needed for different mechanisms. PS2 controller came as a savior and proved to be one of the most fruitful things we did in winters from electrical point of view.

Mechanical:

1. Four Wheel Holonomic Drive: The holonomic drive system basically consists of 4 omni wheels arranged in such a way that the robot can be driven in all 4 directions without having to rotate the bot. These drives can have 2-3 configurations one of which was used by us. While implementing the four wheeldrive the only thing that was kept in mind that we would be able to reduce the time that we would take to place the objects. The four wheel drive lacked proper suspension system and hence required a very flat surface to have four point contact. This was a major issue as the bot did not work properly on poor fields. It is an important aspect that needs to be implemented in the coming years.

PROBLEMS FACED

In the very beginning, the team, being naïve for such type of projects, faced problems. Though it was further rectified but it required some time and even more toil.

There is no denying that team faced bits and pieces of problems in mechanical aspects of structure and design, but the same implies to the fact that the team overcame it quickly.

Problems in electronics

1. **Problem in magnets:** The Team was working on child robot and the concept was almost finalized but when it materialized, problems started popping up. It was the electromagnets. They were not working as expected. The electromagnets we purchased could bear 78 Kgs, but only when the load (robot) is perpendicular to its surface. As per our task, the load slanted for some times in pole walk, the major challenging task for ROBOCON 2014. After various other modifications, re-designing and incredible amount of work by the team, it was concluded to bring down the proposed child bot design and then, a more apt design which in the timeframe could do maximum possible number of tasks was brought up. Finally, keeping hopes still high, the team switched to a new child robot. It was quickly fabricated, the embedded team bucked up and the team finally brought up a new and functional child bot.

2. **Problem in motor drivers-** The second major problem was the motor drivers. Drivers are the soul to a functioning drive and the core to movement of robots. Due to a fit of passion, which was obvious as a newbie, we decided to make it manually using MOSFETs. The team did succeed, but here too, lack of experience hindered. Hours of work, days and nights, were foiled when the 18Amp current drained from the motors became unbearable for the MOSFETs and as a result, the drivers burnt out. The team though disappointed, but also toughened by successive problems, decided to study upon it thoroughly. This brainstorming resulted in suggestion and development upon the concept of relays. Four relays were used for one motor and eventually, the problem of drain current was overcome.

LESSONS LEARNT

1- Team spirit is the most important thing and a major factor too for the success of the team. At nights when other team members worked, hardly any one of us went to hostels to sleep. We used to sleep on the arena made in front of the club when it became impossible for us to keep our eyes open. This helped a lot in motivating others to keep working.

2- Experience: It was a great experience as AKGEC participated in the event for the first time. Winning is not important. Important is the attitude, the efforts which were put by the team in facing various problems.

3- Motor Drivers: We made motor drivers by our own. And there we made a mistake. Making and managing motor drivers wasn't easy.

4- Timely delivery of material: omni wheels and some other key equipment were delivered very late. This caused a problem. We will ensure that material is ordered timely so that we can give proper time in building robots.

CONCLUSION

A new venture is always the harbinger of opportunity for success as well as a way to learn and mend the ways thus instigating improvisation.

As a first time participation, the college team performance is not good; we were in learning stage and require more learning for such type of event.

At event, our robot is not working, but after returning we complete the task (2 levels) and submitted for demonstration.

I believe from next year we will start our work timely as soon as possible after the theme launching and prepare the model for getting maximum time of testing to find out difficulty or problem arises during the task.

Appendix-I

FACULTY & STUDENT CORDINATOR REPORT

Supervisor Faculty:

Following faculty members are assigned as supervisor for this project, to take up their day to day requirements and evaluate their work:

- Mr. Vikash Kumar, Scientific Office, TIFAC-CORE & Asstt Prof-ME Deptt
- Mr. Gaurav Srivastava, Scientific Office, TIFAC-CORE & Asstt Prof-EN Deptt

The supervisory faculties regular supervise their work and give their best support to team.
The reasons for not working robot at the time of event are follows:

- First time participation in such type of event is main concern, lack of time management.
- Student could not get much time for testing with available hardware.
- Self preparation of Electrical circuit is another parameter.
- Electrical motors of mother robot burns during event due to short circuit.

Name of Team Leader (Student): Mr. Ravi Kumar Gupta (EI-IV Year)

Report of Team Leader for failure: A new venture is always the harbinger of opportunity for success as well as a way to learn and mend the ways thus instigating improvisation. The highly anticipated event of Robocon could not fulfill the expectations as we all hoped for despite of dedication from the zestful Robocon team, the reasons of failure of Robocon 2014 are stated as under:

- The last minute order and delivery of some vital components of the bot like Omni wheels, resulted in short time for testing.
- The PCBs of the motor driver circuit prepared did not worked properly. This was mainly due to manhandling during transportation of the dismantled kit.
- At the ninth hour of the event we come to know about this failure and we had no other choice but to make another motor driver circuit on our own. So we prepared a relay-based motor driver circuit there only.
- Though now we have the circuit prepared but due to no time for prototyping we could not discover the practical shortcomings of the circuit.
- The absence of proper shielding in the circuit resulted in the short circuit of back circuitry.
- Because of this reason the Arduino failed to work thus hindering the microcontroller based bot operations.
- Since we do not have a working motor driving circuit, we failed to perform the basic operation of the motion of the bot.

In concise, failure of motor driver circuit resulted in a motionless bot and we could not proceed with a single task of the contest for which we were prepared and had done the testing before. Thus, concluded the event with an unfortunate result.

Name of Mentor: Mr. Gaurav Srivastava, Scientific Officer, TIFAC-CORE & Asst Prof-EN Dept

Report of Mentor for failure: Explanation of Tam Leader report are as follows:

- Some components order and their late delivery is major concern for developing required model.
- Casual attitude of students for transporting the components.
- Due to non functioning of the circuit they have prepared another circuit at the last moment.
- Main concern for failure of motors are electrical short circuit.

Report of Team Members for failure:

- Magnets did not work as per the expectations. (In tensile mode it was OK, but could handle torque).
- The wheel size was restricted to 135 mm, which resulted in low clearance & eventually failure of bot to work smoothly.
- The model for child was derived from external sources, which led to loss of generality required for tasks to be played.
- Circuit fabrication by hand proved a turning point in the actual failure.
- Lack of information about operating micro-controllers made it non-operational.
- Members were unaware with each other's ability & therefore relied upon promises.
- Failure to access for RIVETING MACHINE (due to delivery problem) led members to leave Aluminium & switch Iron which resulted in higher weight.

Appendix-II

Student Members of Robocon-2014 Team

S. NO	NAME	BRANCH	YEAR	STUDENT NO	ROLE
1	Shubham Gupta	ME	4th	1140017	Fabrication, coordinator
2	Anurag Sachan	EI	4th	1132014	Coordinator, Simulation and electronic tasks
3	Ravi Kumar Gupta	EI	4th	1132064	Team Leader, Electronics tasks and interfacing
4	Namit Srivastava	ME	4th		Designing of model, Coordinator
5	Siddharth Tripathi	EN	4th		Coordinator, Motor related tasks
6	Sakshi Bansal	ME	4th		Fabrication, coordinator
7	Shubham Chaudhary	EI	3rd	1232012	Designing circuit
8	Shivam Agarwal	EN	3rd	1232029	Motor related tasks
9	Harshit Mathur	EC	3rd	1232009	Interfacing Drivers
10	Rajat Singh	CS	3rd	1210072	Coding
11	Shalakha Sharma	CS	3rd		Coding
12	Vishakha Goel	EC	3rd		Interfacing Drivers
13	Gaurav Yadav	EI	3rd		Electronics tasks and interfacing
14	Shweta Rajput	EN	3rd		Motor related tasks
15	Nishika Garg	CS	3rd		Coding
16	Priyanshi Khare	CS	3rd		Coding
17	Ayushi	CS	3rd		Coding
18	Shivam Agarwal	EN	3rd		Motor related tasks

THIRD YEARITES: 7

SECOND YEARITES: 12