Creative Engineering Design Course at Seoul National University

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Objectives of the Course

Teach basic skills to design, fabricate and test electro-mechanical device through hands-on experience.

The major efforts in this course are on two aspects:

Creativity

Engineering experience.

Organization of the Course

Mechanical and electrical engineering freshman (or sophomore) course

3 credit course
2 hours of lecture and 2 hours of laboratory

Form teams of five students
For 2 weeks, each team makes a simple linkage.
At the 6th week, game rules are announced.
Material kits are distributed.
At the 12th week, head-on competition.

Lecture Schedule

Week	Contents
1	Introduction to the Course, Team Assignment
2	Principles of Kinematics
3	Introduction to Mechanical Engineering, Linkage Project Assignment
4	Introduction to Mechanical Engineering,
5	Engineering Design Principles
6	Actuators: Motor and Pneumatic Systems Main Project Assignment
7	Programming,
8	Manufacturing Process, Assembly Tolerance, Spot-welding, Bolt, Glue Preliminary Design Submission
9	Autonomous Robot Test Run
10	Manual Robot Test Run
11	Preliminary Contest
12	Main Contest
13	Design Review

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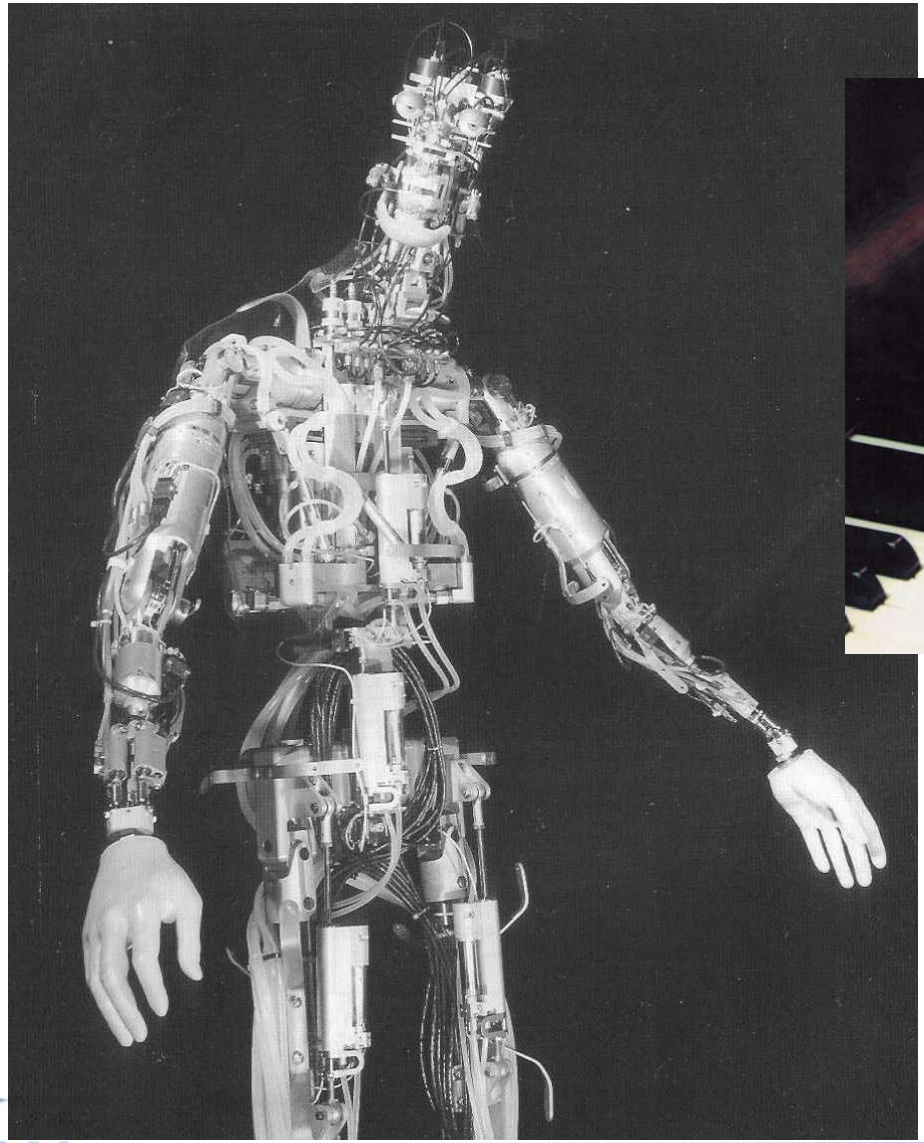
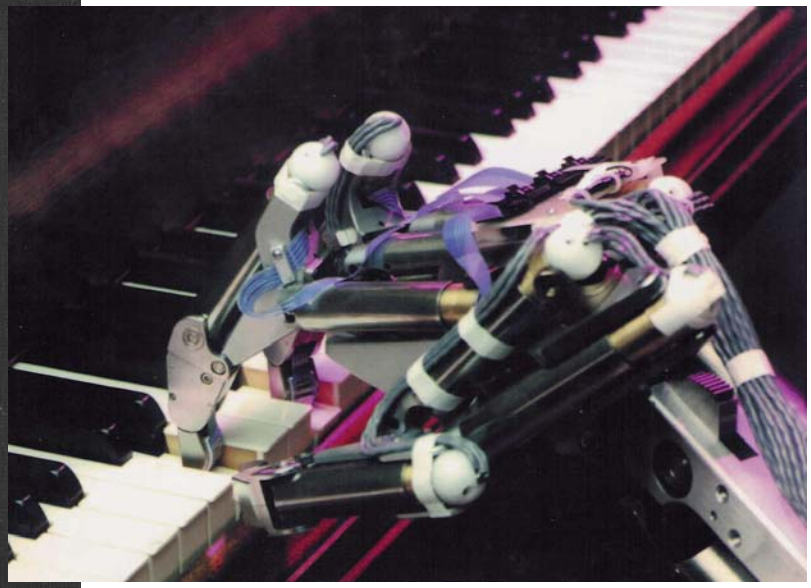
Lab Schedule

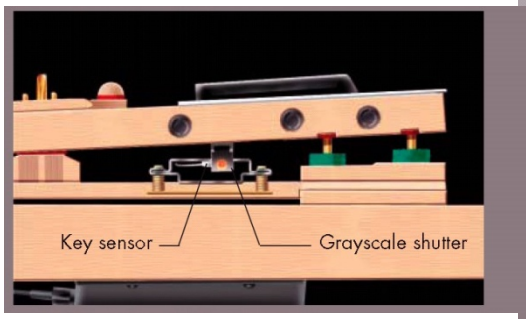
Week	Contents
1	No Lab
2	Lab Cleaning, Safety
3	Machining Skill, Assembly Skill
4	Linkage Project Assignment and Design
5	Linkage Project Manufacturing
6	Main Project Assignment and Conceptual Design
7	Air Cylinder, Motor, Preliminary Design Submission
8	Main Project Manufacturing
9	Main Project Testing, Debugging
10	Main Project Testing, Debugging
11	Preliminary Contest
12	Main Contest
13	No Lab
14	Disassembly

Robot?





Robot?



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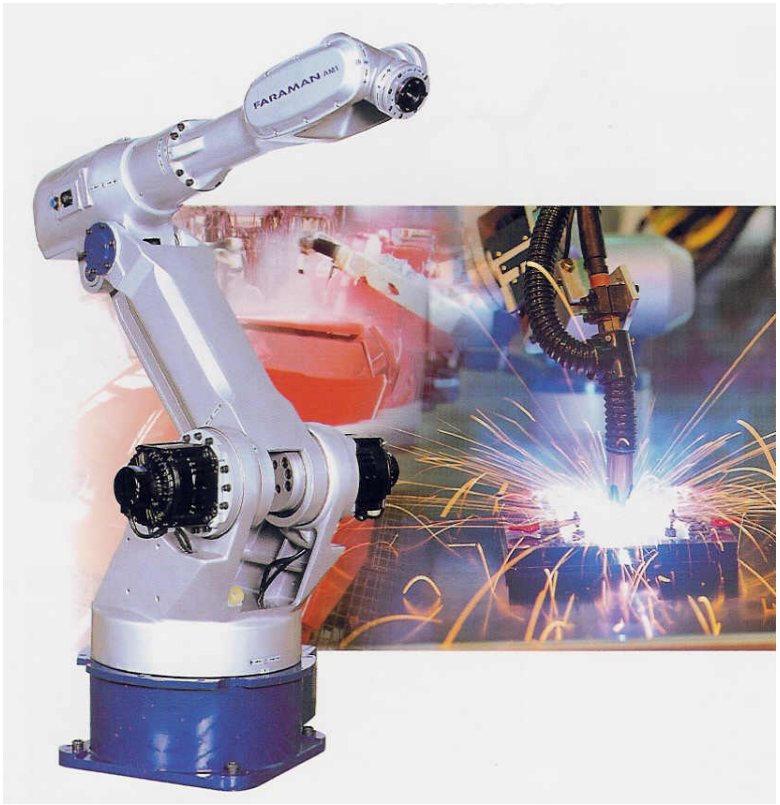
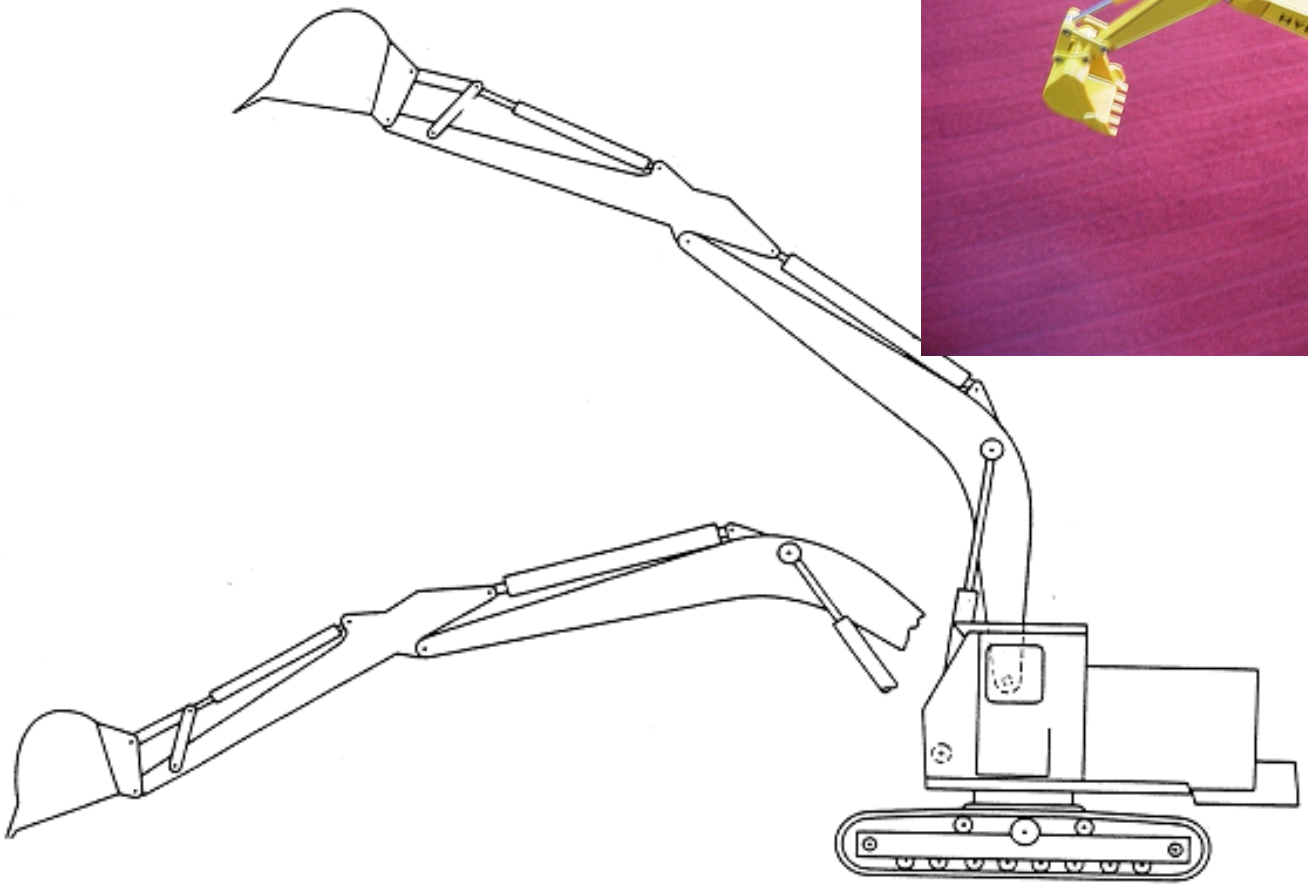
Industrial Robot



Excavator



Material

Part List

Item	Dimension	Number
PVC Tube	Φ50×340, t 3 mm	2
PVC Tube	Φ150×90, t 5 mm	2
Wood Bar	50×12×900 mm	2
Wood Bar	40×9×800 mm	2
Wood Plate	300×300×6 mm	4
Aluminum Plate	300×65×6 mm	2
Aluminum Plate	150×150×1 mm	4
Aluminum Plate	150×150×3 mm	2
Aluminum Box Section	25×25×300, t 2.3 mm	2
PVC Plate	155×300×5 mm	2
PVC Plate	300×300×3 mm	2
Steel Wire	Φ3×1000 mm	2
Brass Rod	4×4×15 mm	6
Coil Spring		4
Rubber Belt		20
Electric Connector		2
Bosch Gear Motor		3
Air Cylinder with Control Valves		2

Work Shop

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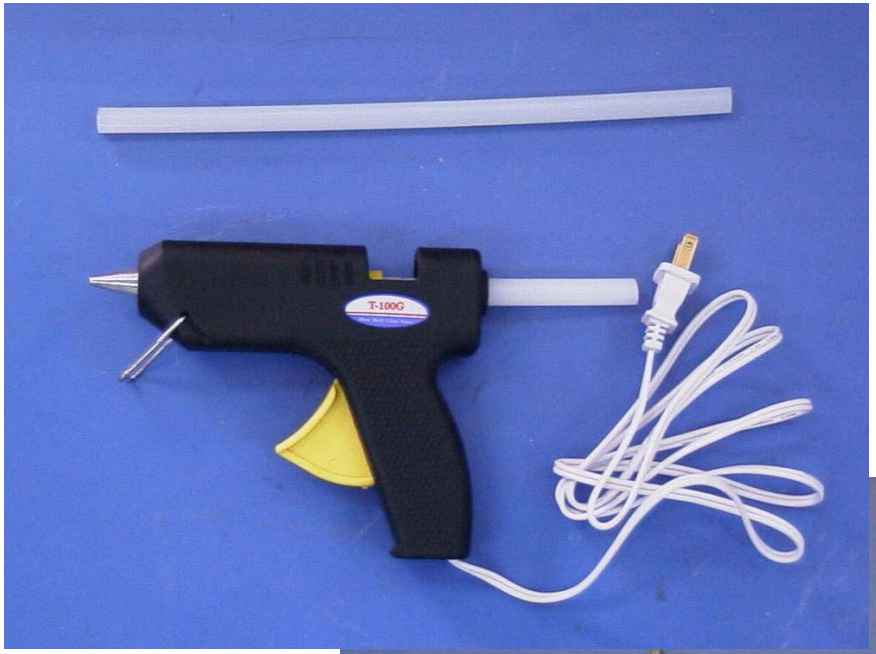
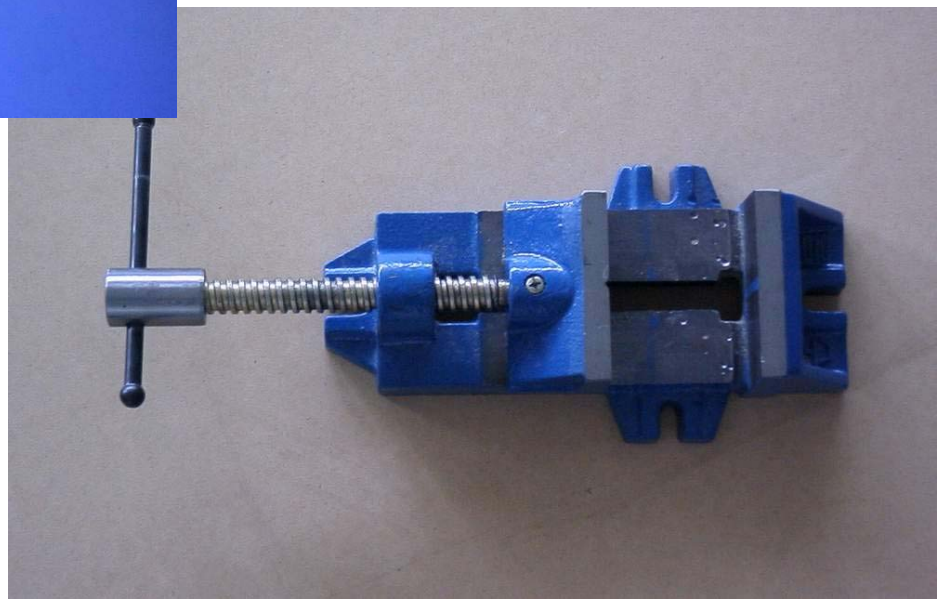
Drill and Band Saw

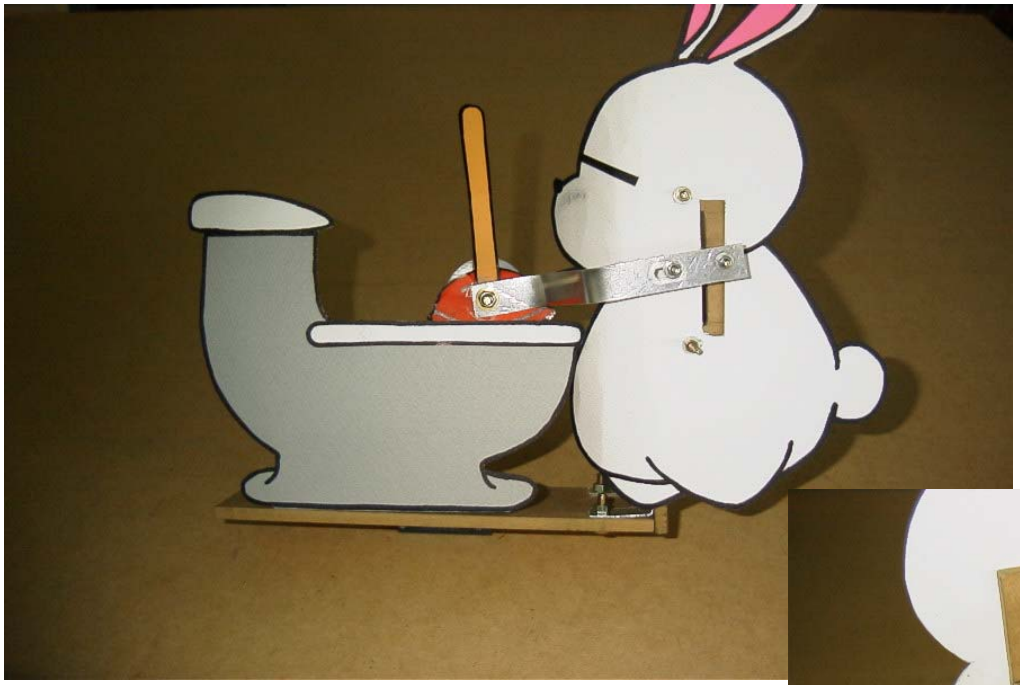
Hand Tools

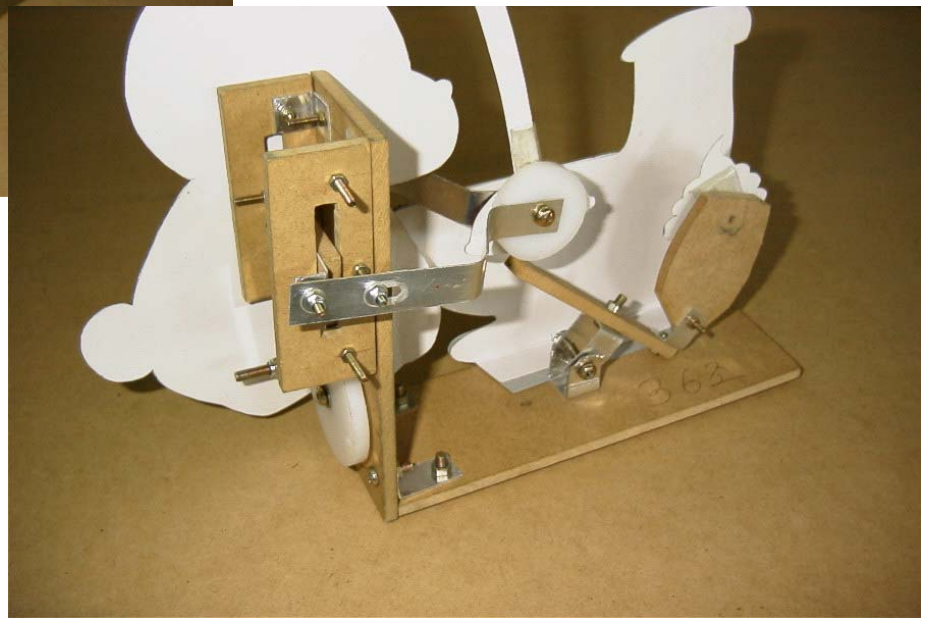


Hand Tools and Vise



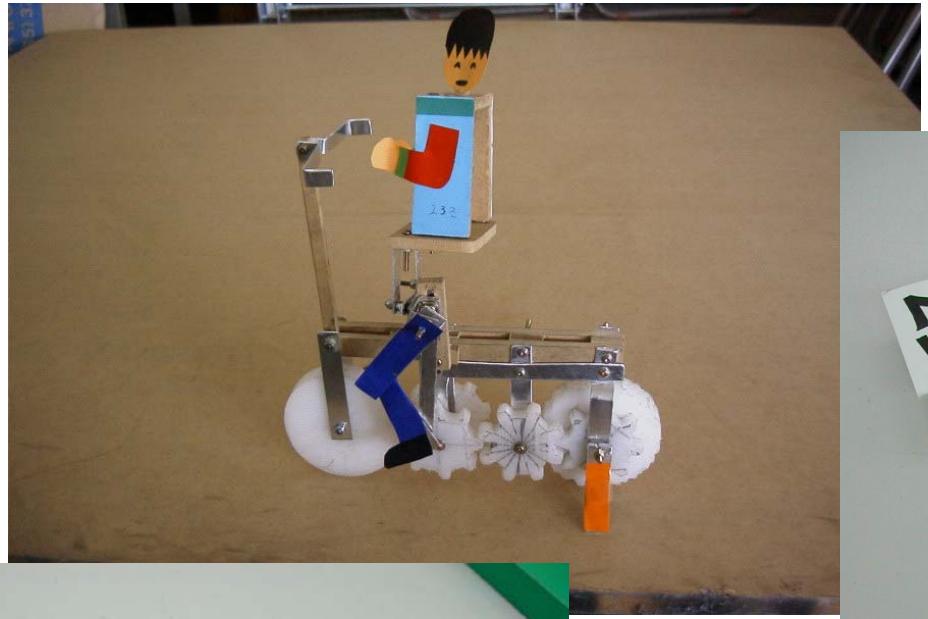
Linkage



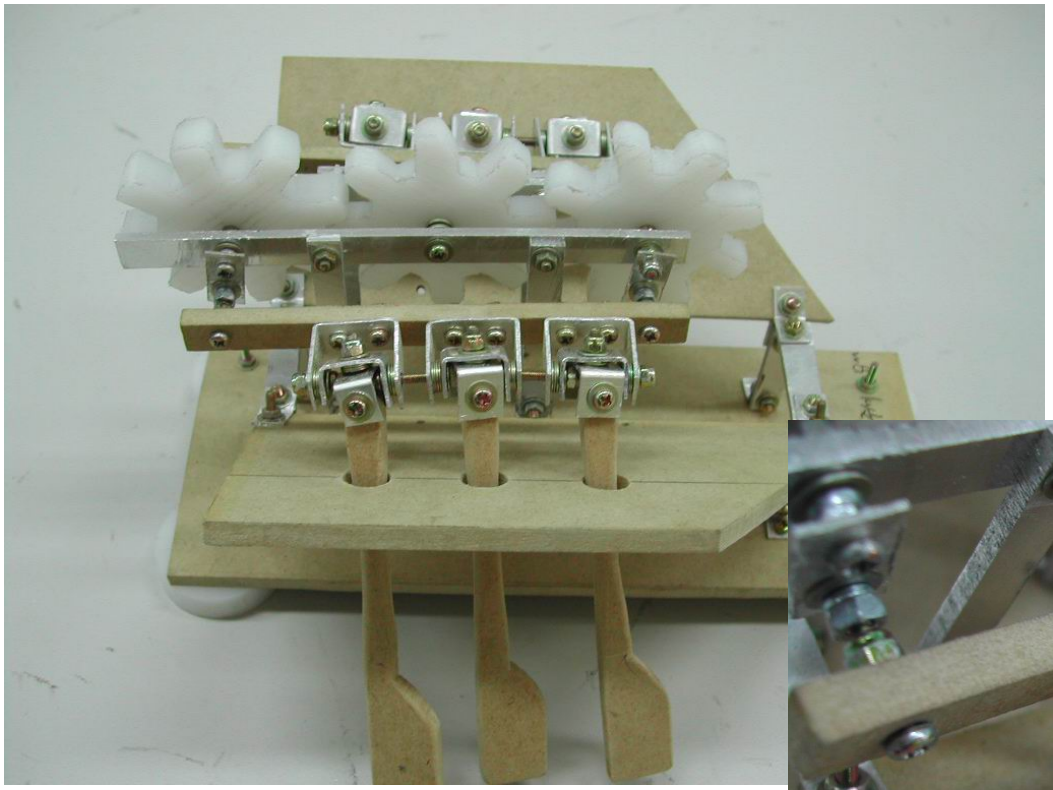


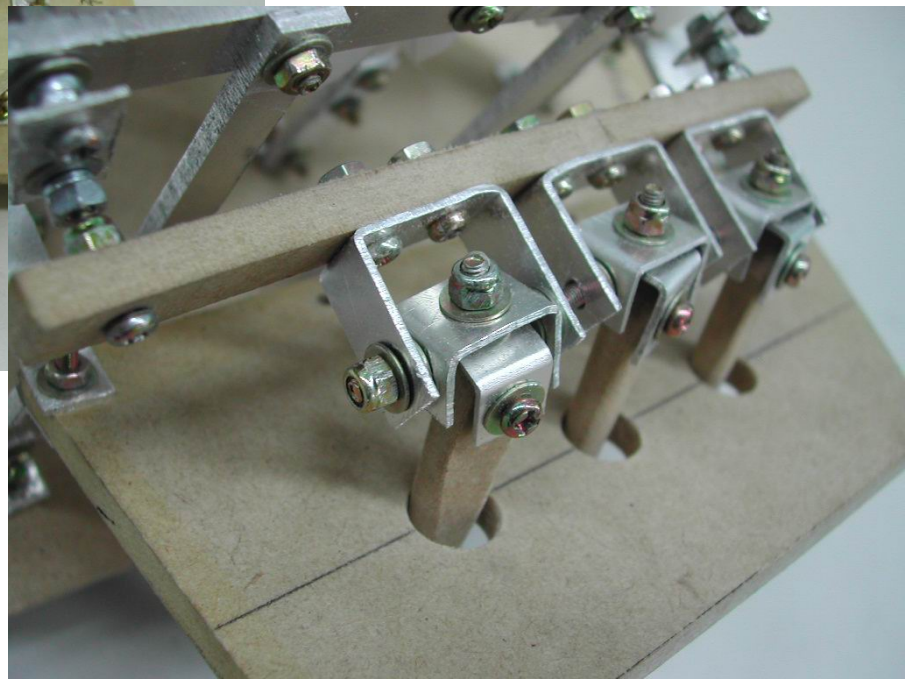
Aluminum Plate
Plywood
Polyethylene Rod

Linkage



Linkage





Contest List

Year	No. of Students	Theme
1993	94	Clean up the Lake
1994	110	Robot Soccer
1995	114	Acquire Food
1996	150	Trash Recycling
1997 (1)	176	Trade War 1
1997 (2)	158	Trade War 2
1998 (1)	226	Gold Collection
1998 (2)	214	Clean up the Stadium
1999 (1)	228	Fishing Treaty
1999 (2)	166	Missile War
2000 (1)	228	Block the Mountain Fire
2000 (2)	135	North/South Economic Cooperation
2001 (1)	209	Energy War 1
2001 (2)	119	Energy War 2
2003 (1)	70	Saving Private Ryan
2003 (2)	123	Get the 56th Home Run Ball
2004 (1)	82	The Lord of the Rings
2004 (2)	96	War against Terror
2005 (2)	74	Saving Hurricane Refugee
2006 (1)	107	Secure German Soccer Stadium
2006 (2)	47	The Host
2007 (1)	163	300
2007 (2)	178	Prison Break
2008 (2)	165	The Dark Night
2009 (1)	X	?

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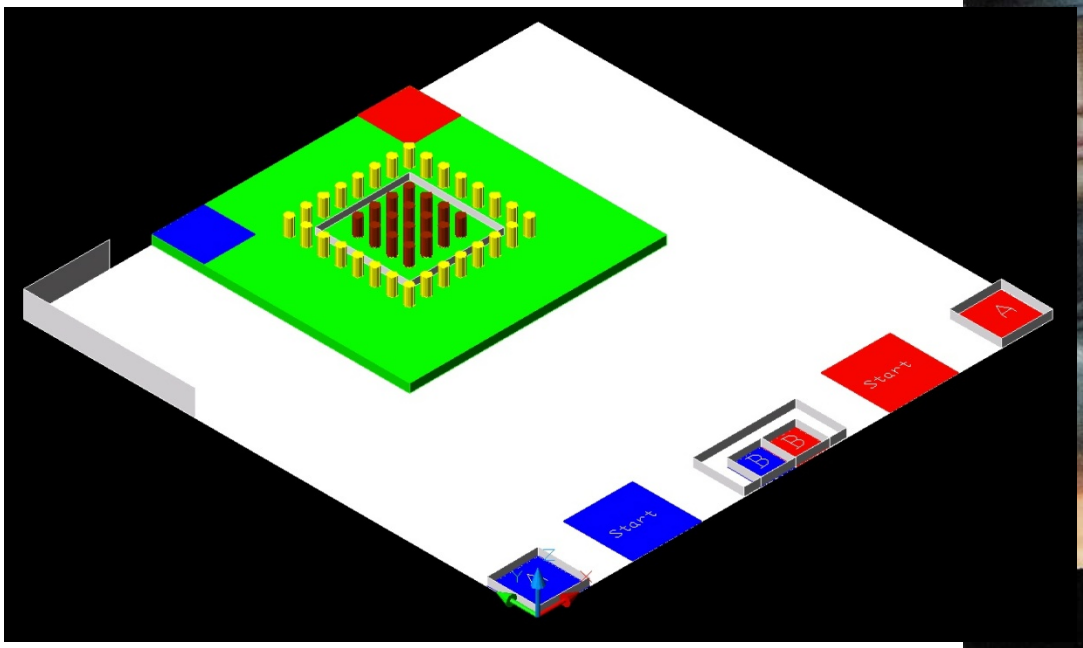
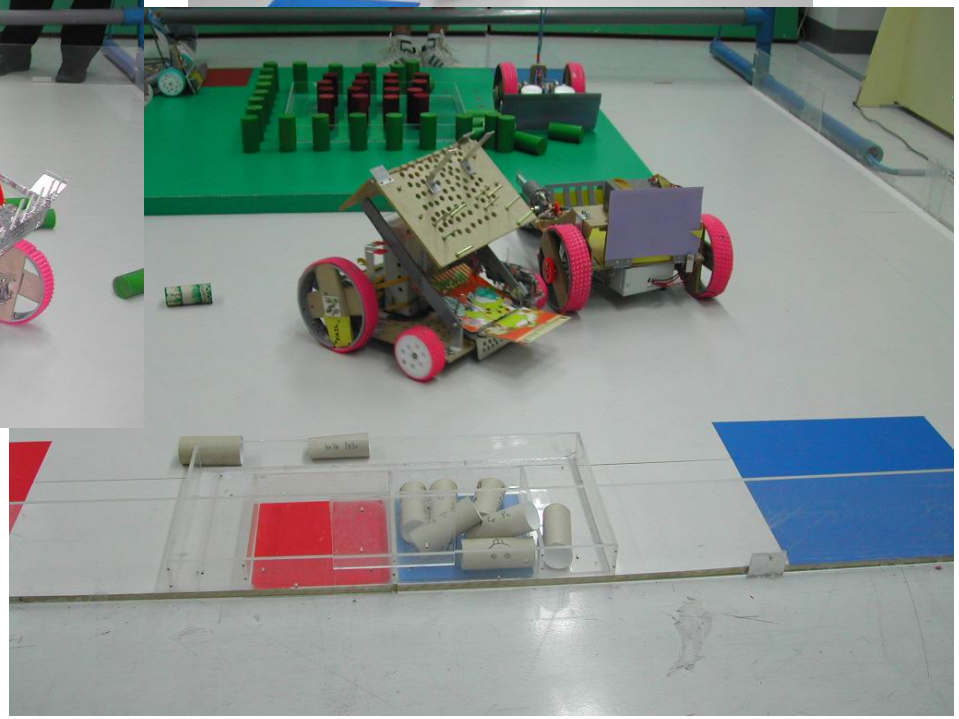
Domestic Robocon

Domestic Robocon

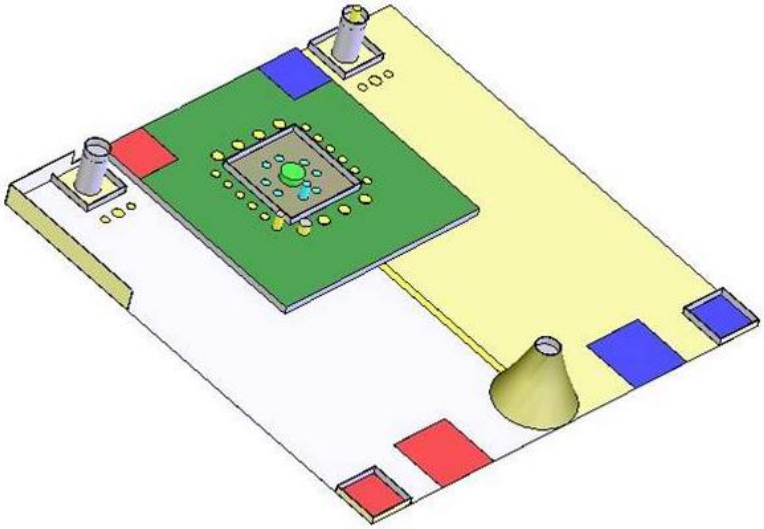
2003 Contest: Saving Private Ryan



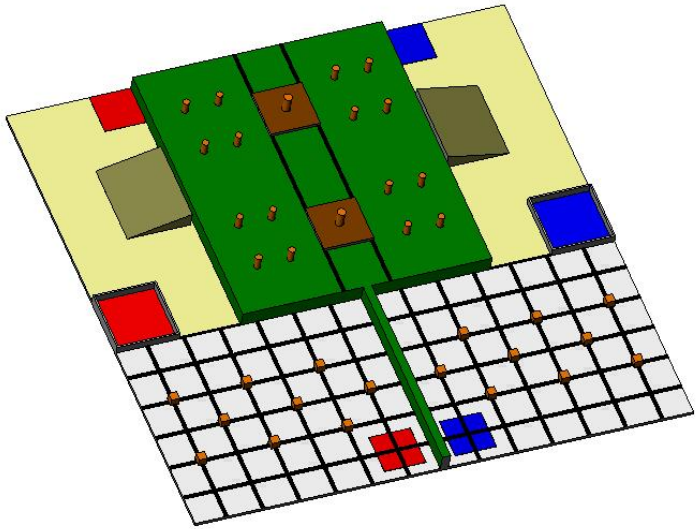
2003 Contest: Saving Private Ryan

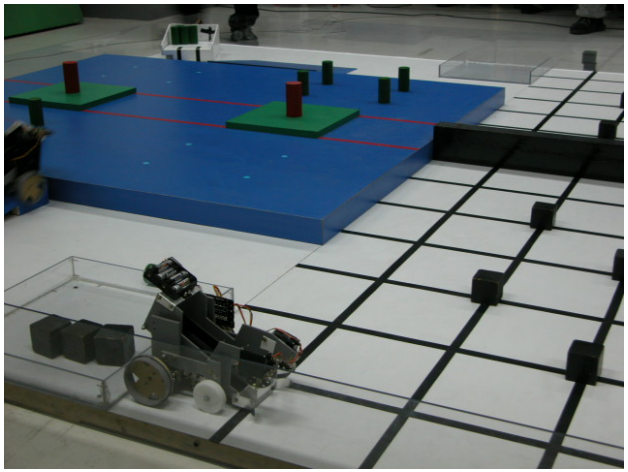


2004 (1) Contest: The Lord of the Rings



2005 (2) Contest: War against Terror

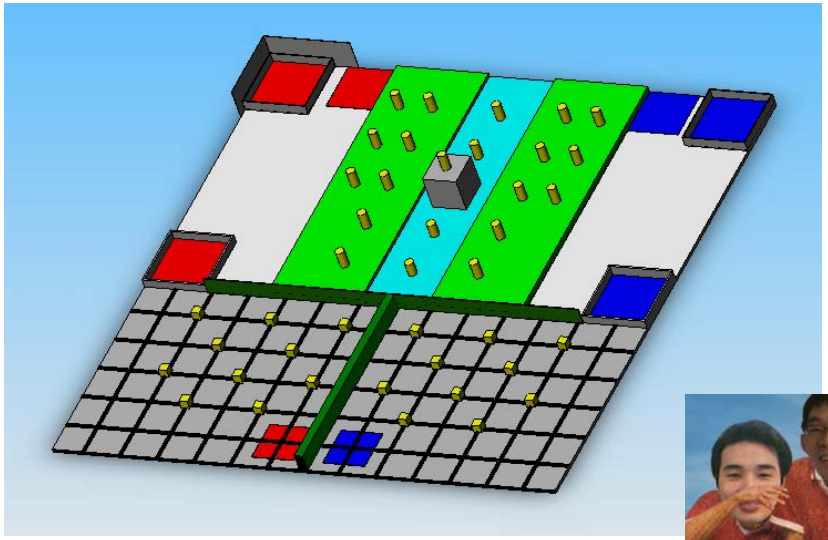




제 18 회 ROBOCON 2004

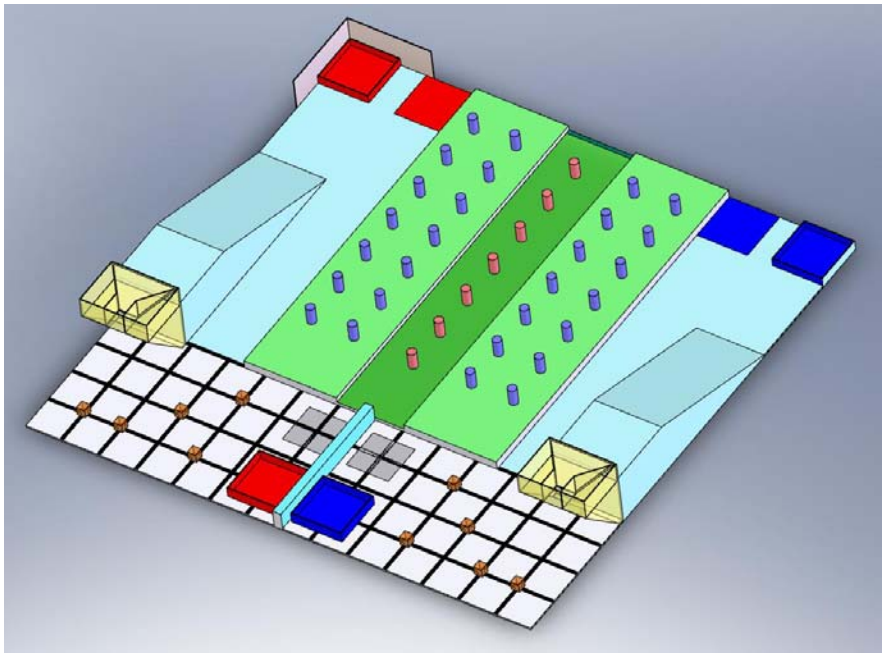
주 제 : 테러와의 전쟁
일 시 : 2004년 11월 25일(목) 오후 6시
장 소 : 서울대학교 302동 217호
주 최 : 서울대학교 기계항공공학부

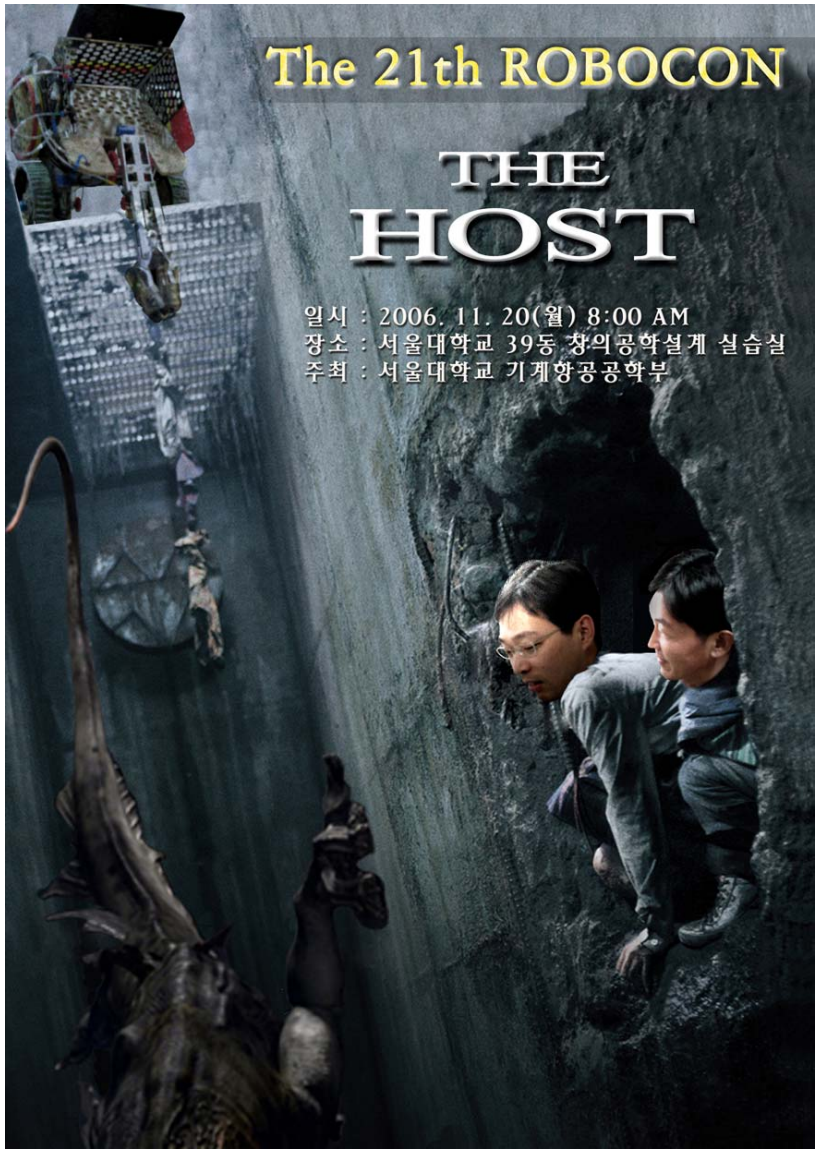
2006 (1) Contest: Secure German Soccer Stadium



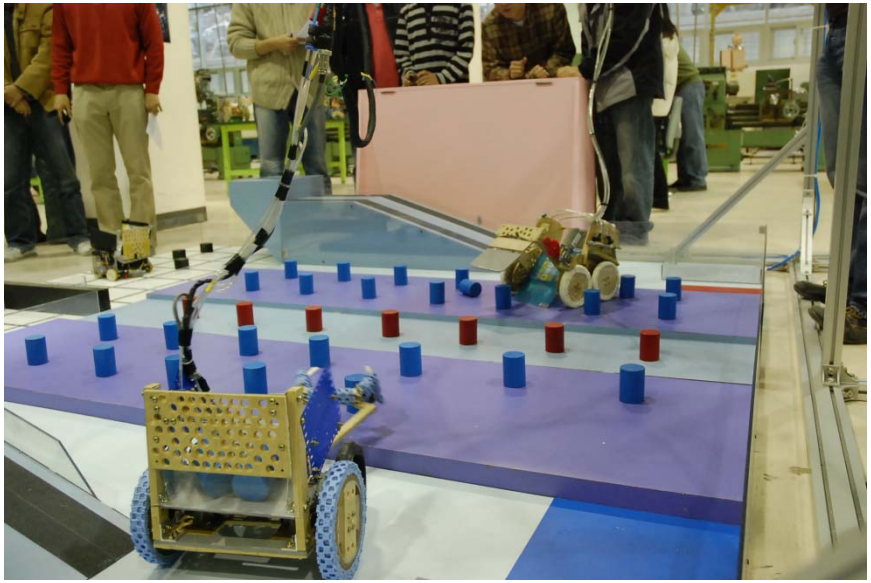
2006 (1) Contest: Secure German Soccer Stadium

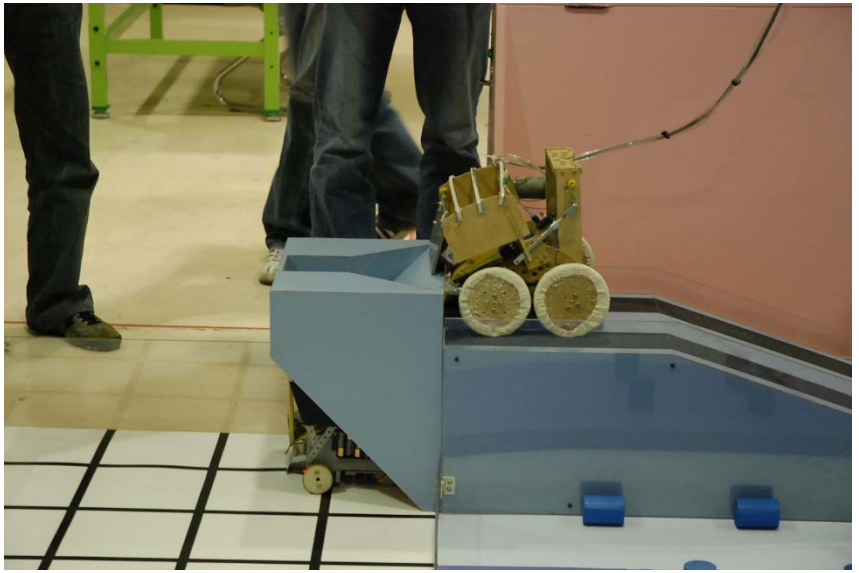
2006 (2) Contest: The Host

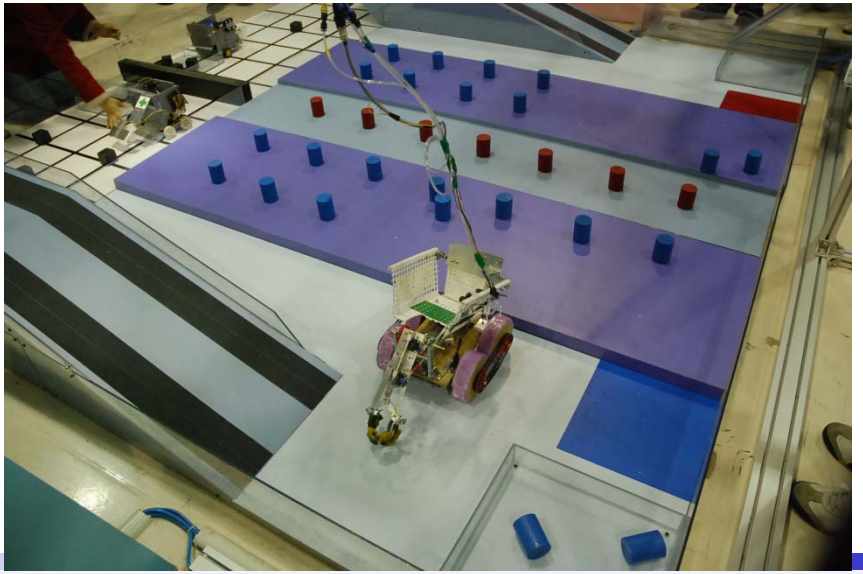




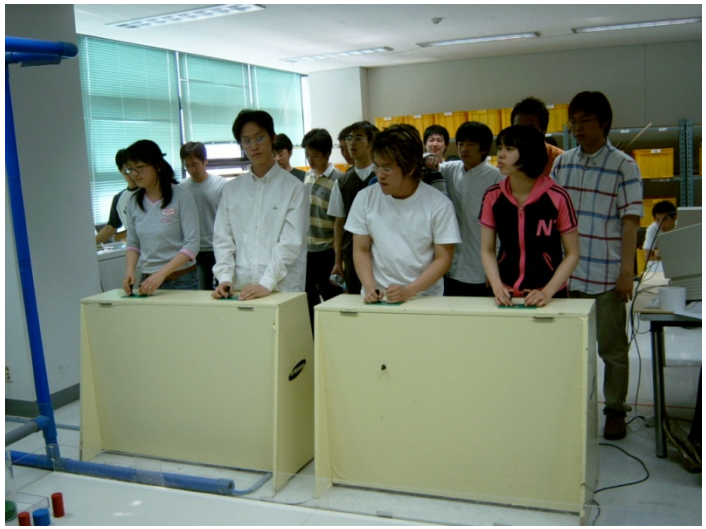
2006 (2) Contest: The Host

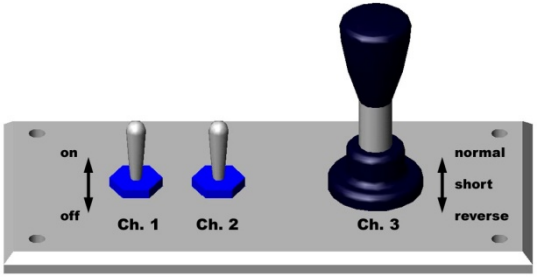


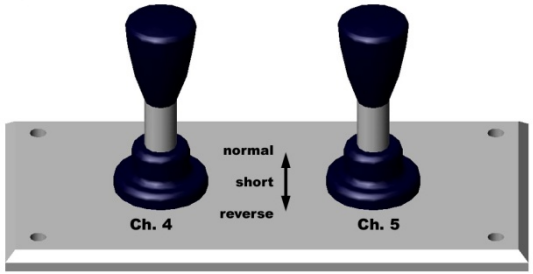


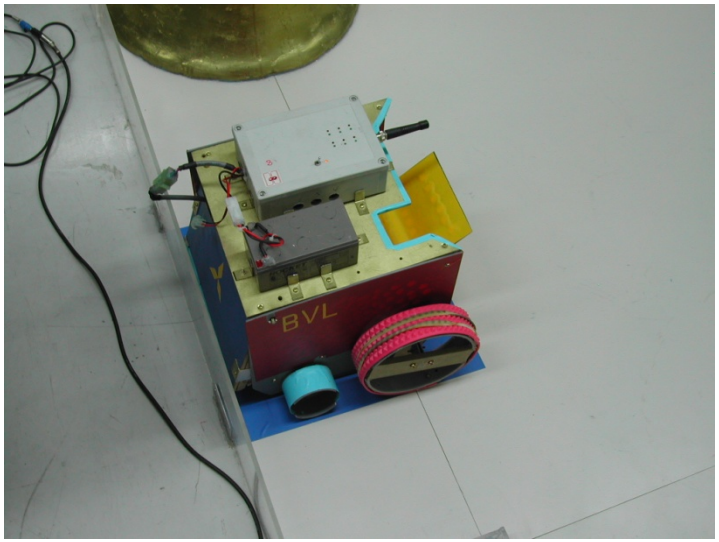


Controller and Power









Game Rule

To design and build autonomous and wireless manual robots to capture insurgents and terrorists. Each team should make one wireless manual robot and one autonomous robot.

Insurgents (wood cylinders, 64 g, 40 mm diameter, 80 mm height) are in Iraq (upper deck) and two insurgent leaders (wood cylinders, 125 g, 50 mm diameter, 100 mm height) are in the remote area in Iraq. Terrorists (wood blocks, 80 g, 50 mm cube) are spread out in the world (lower deck).

Each insurgent moved to the prison is worth 1 point.
The insurgent leader moved to the prison is worth 4 points.
Each terrorist moved to the prison is worth 2 points.
The winner is the team who scores more within 2 minutes.

Material

With the following exceptions, each machine must be constructed solely from materials provided in the "Kit."

Fasteners and adhesives (not tape) used only for fastening and joining

Washers used as simple bearing and/or parts of fastening systems

Bolts no longer than 30 mm used as posts of pivot joints, but not as structural elements

Tape used only for electrical insulation

Electrical wires for electric connection

Nonfunctional decorations

Energy Source

The energy used by the devices in the competition must come solely from:

Electrical energy from the given battery

Electrical and pneumatic energy derived through the umbilicals during the 2minutes when the remote control system is energized.

Change in the altitude of the center of gravity of the device

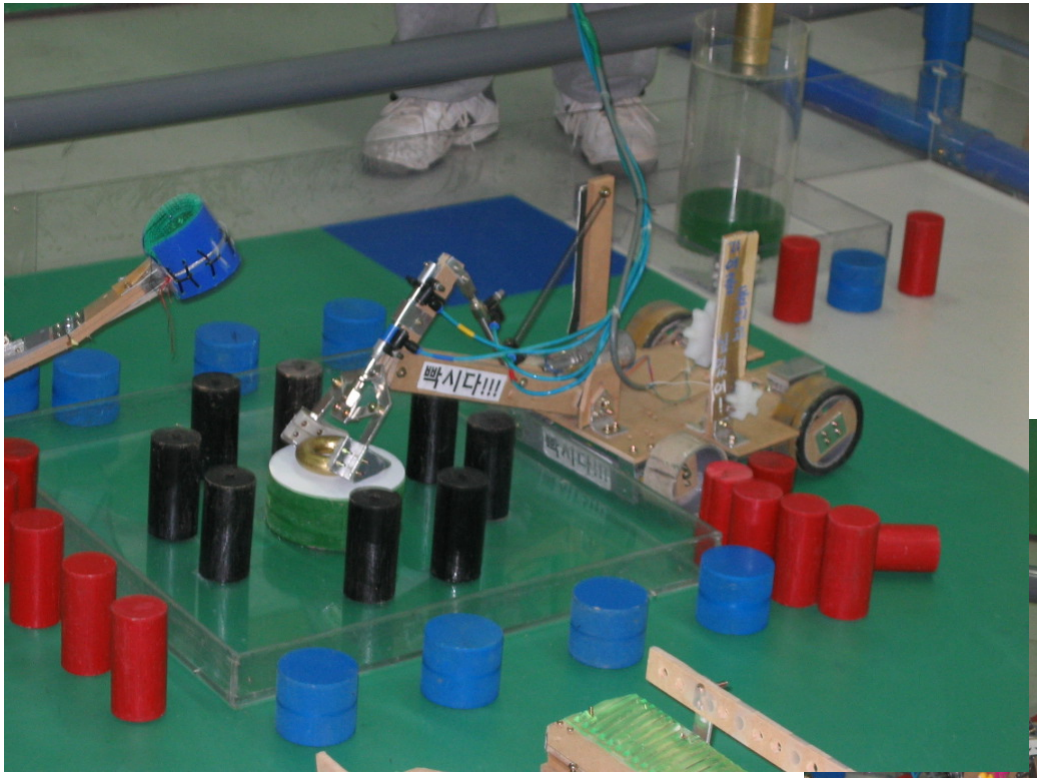
Storage achieved by deformation of the springs provided in the kit

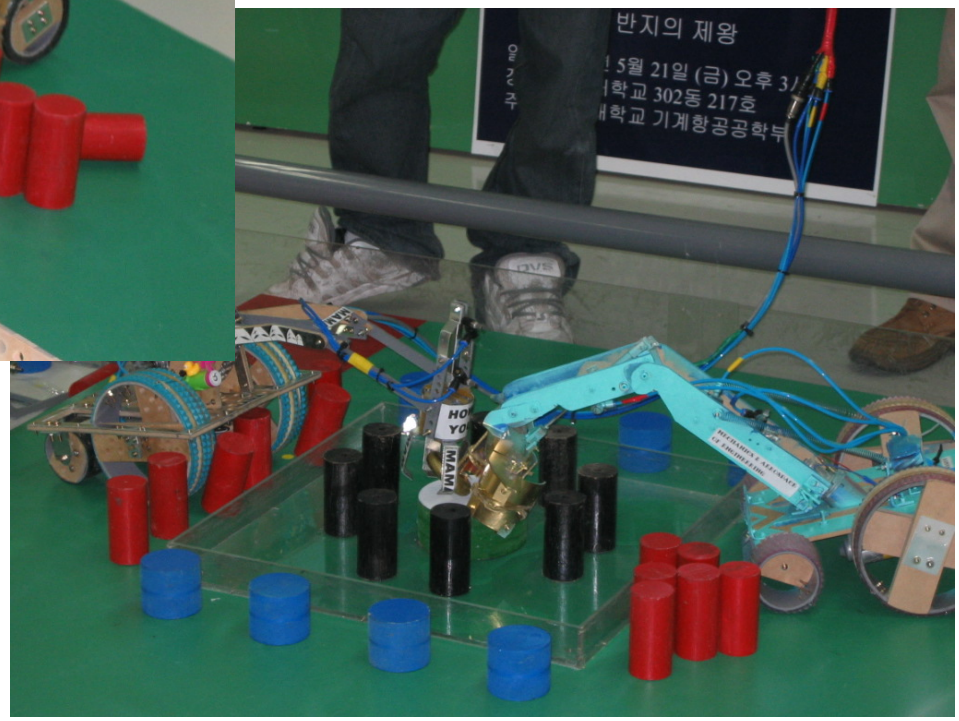
Size and Mass

At the start of each competition, every part of the machine must fit, **unconstrained**, within a 300 mm cube having its base within 300 mm X 300 mm "starting area" on the playing field.

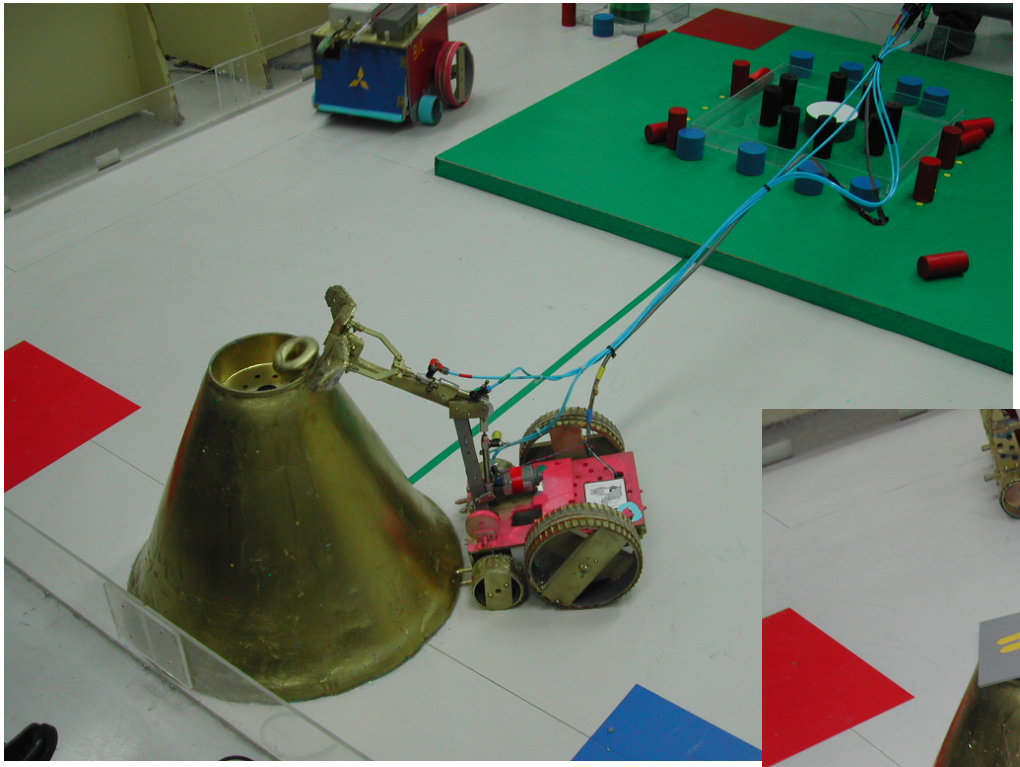
Each team's machine (or machines) must not exceed 4.0 Kg

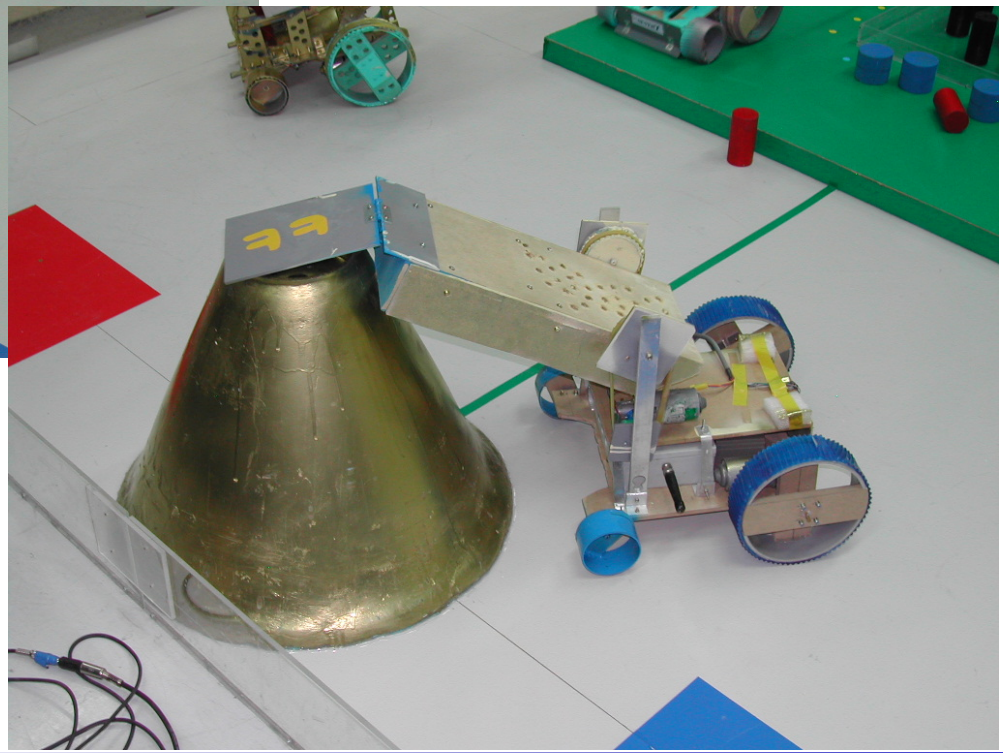
Speed



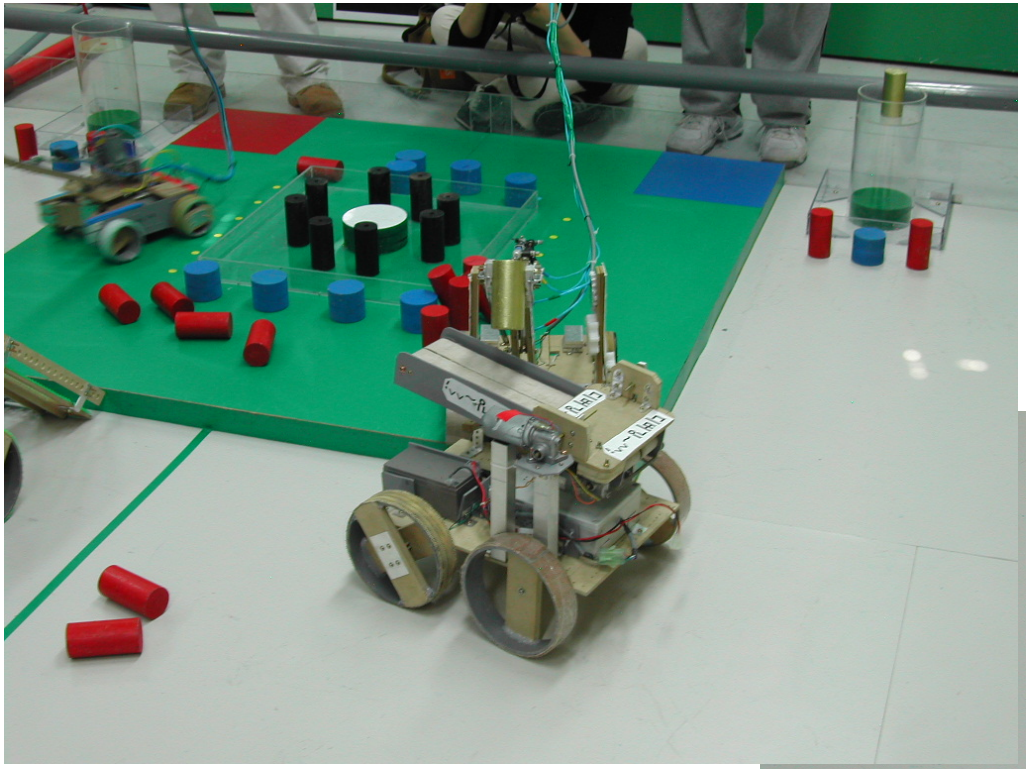


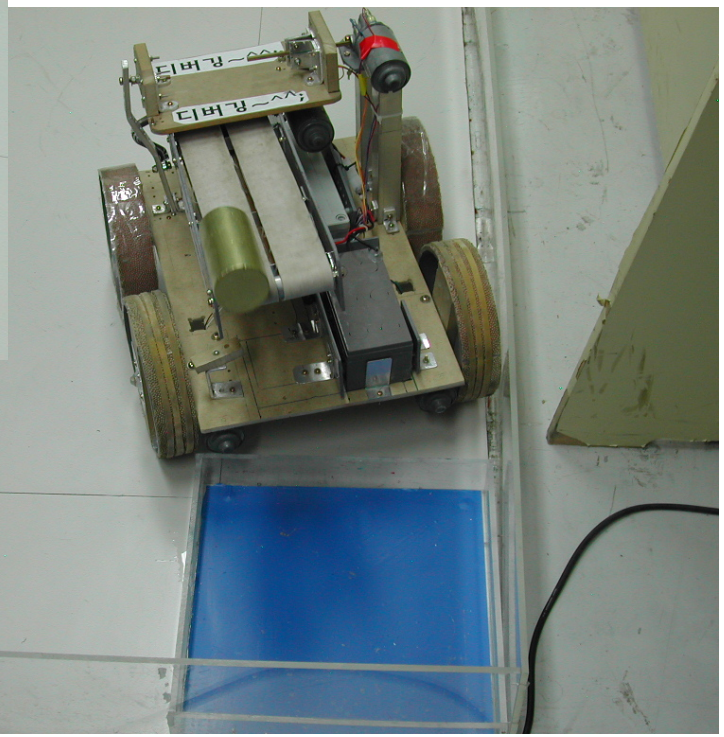
Blocking the Goal



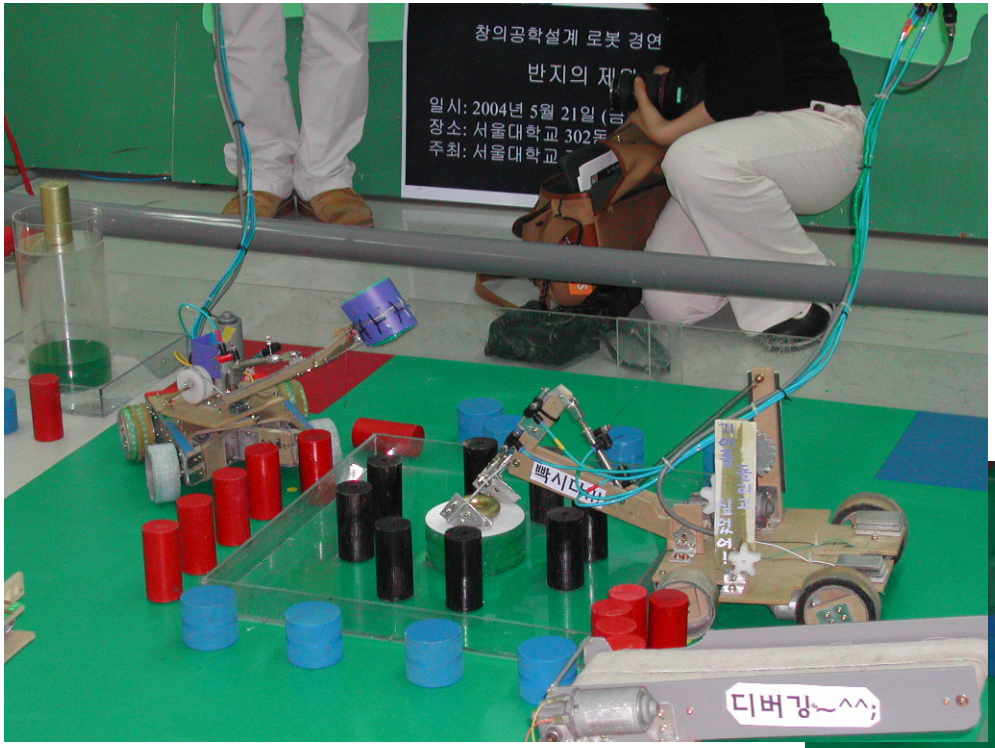


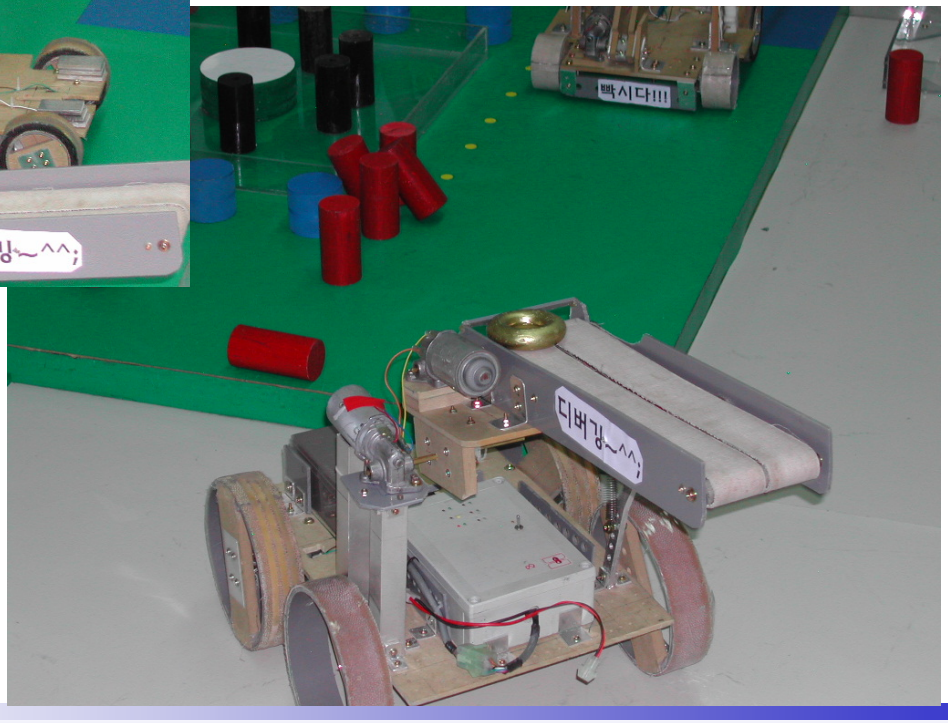
Cooperation





Cooperation





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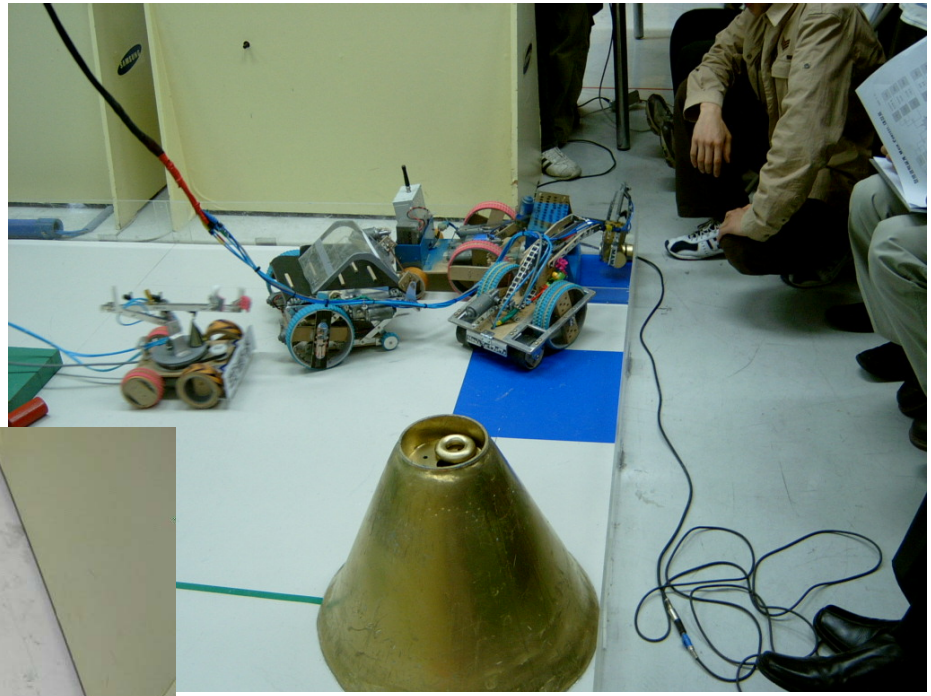
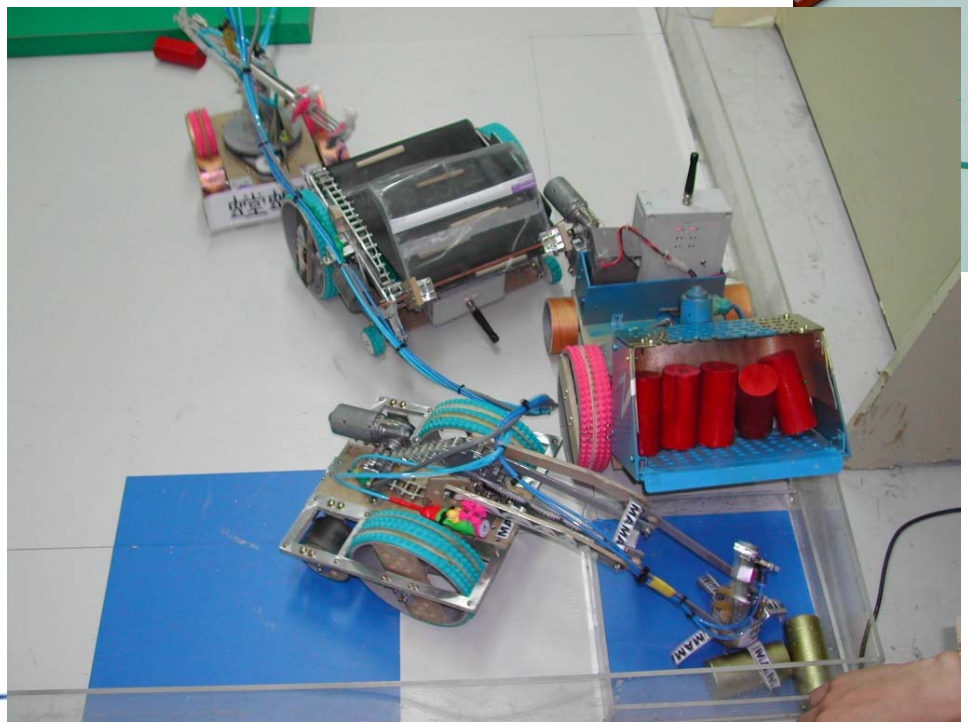
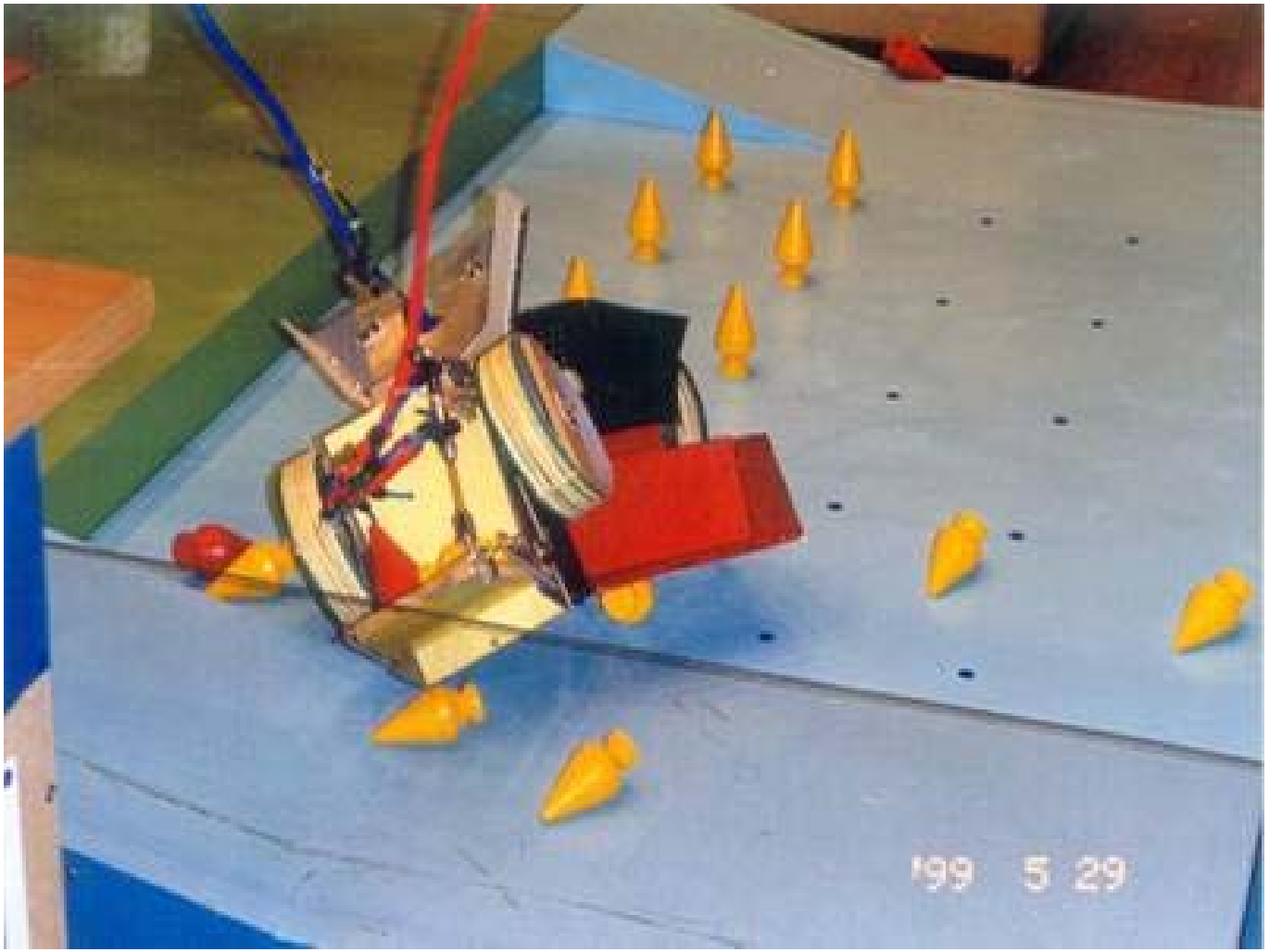
Stealing

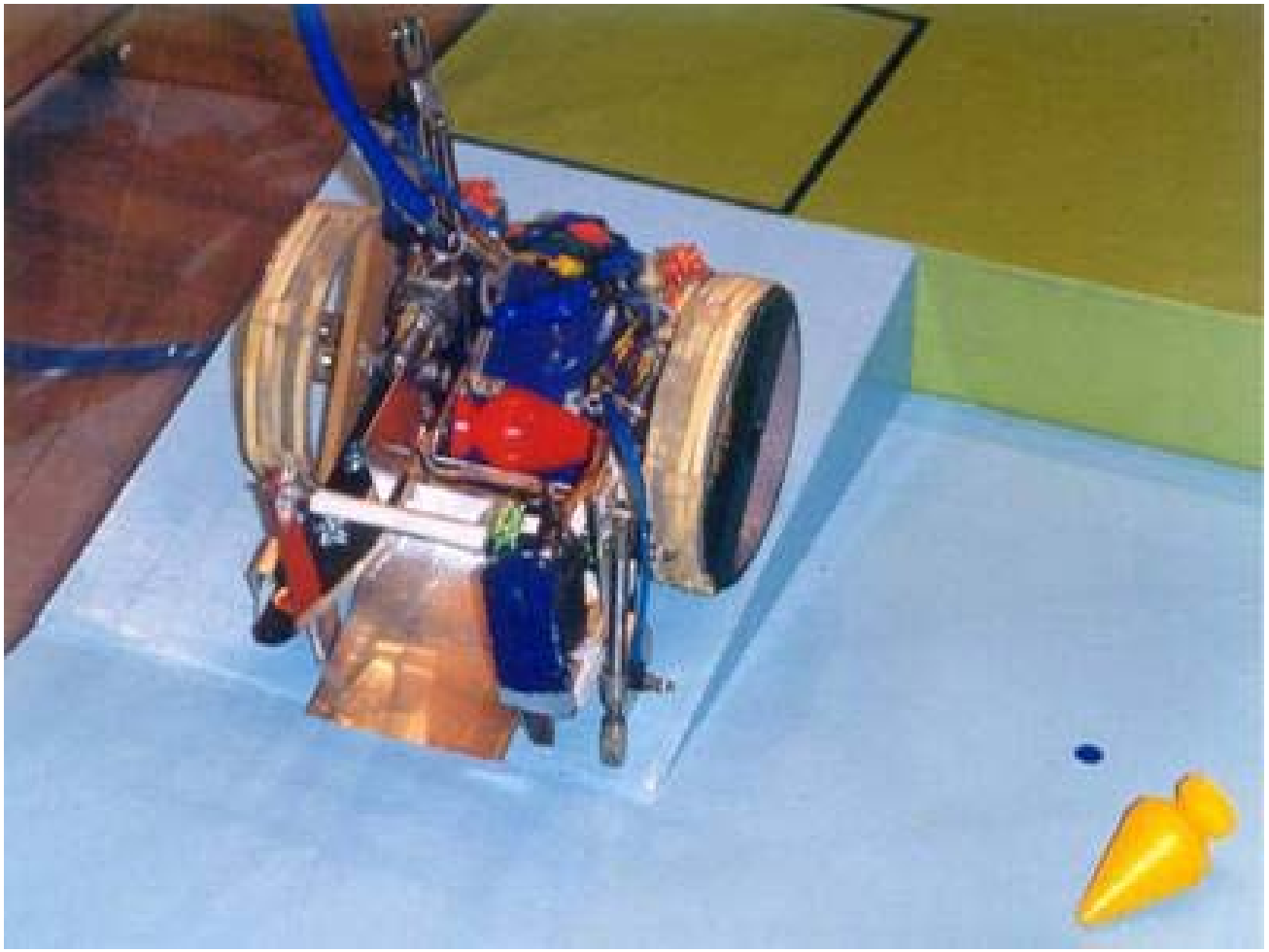




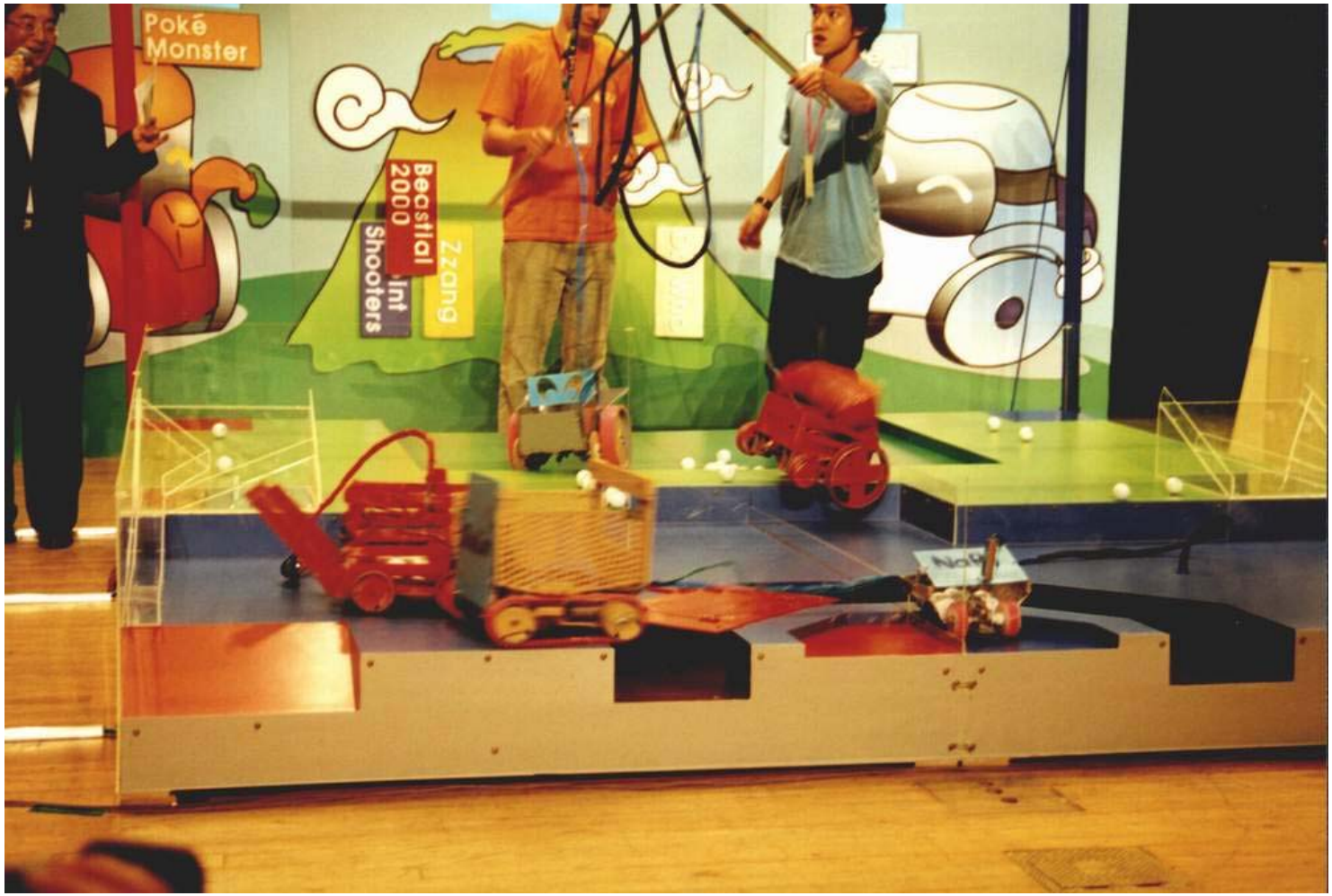
Driving Skill is Important



Climbing up



Action

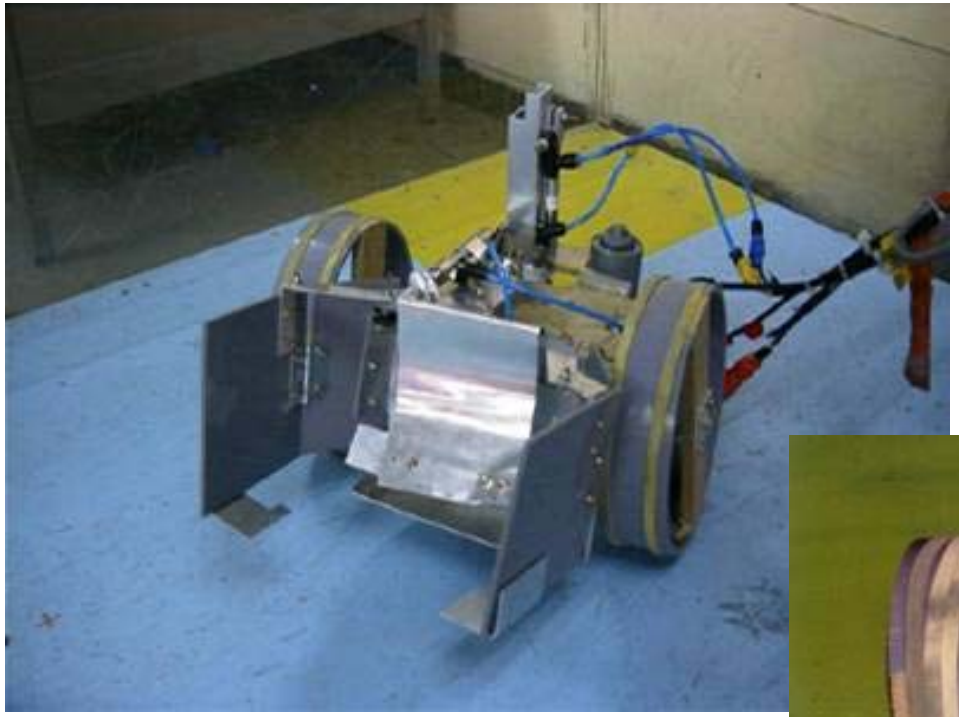


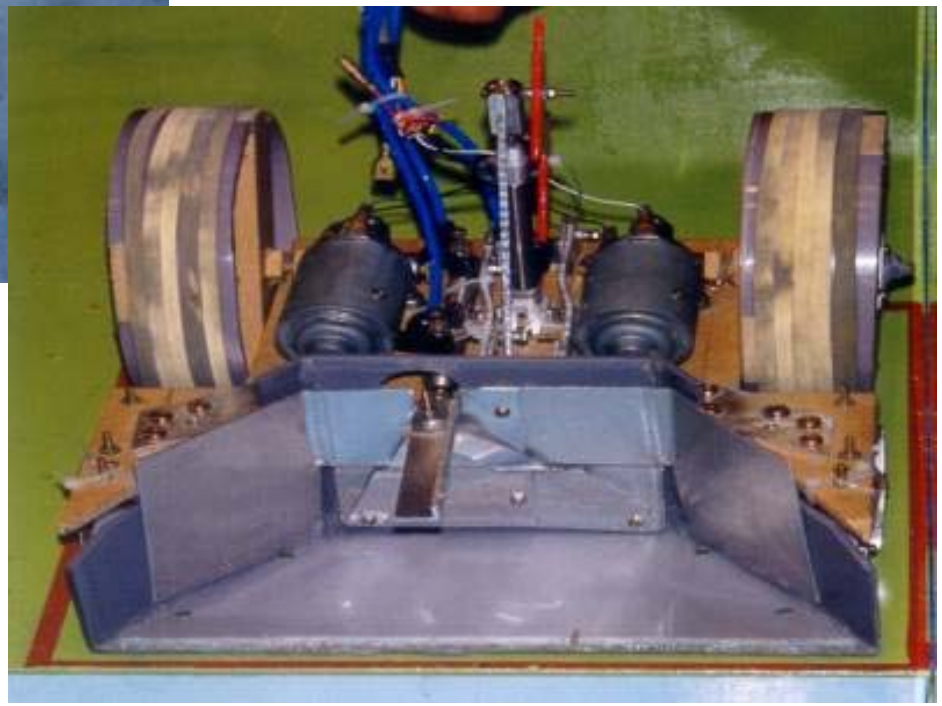
Blowing Tube and Beach Ball

Stealing

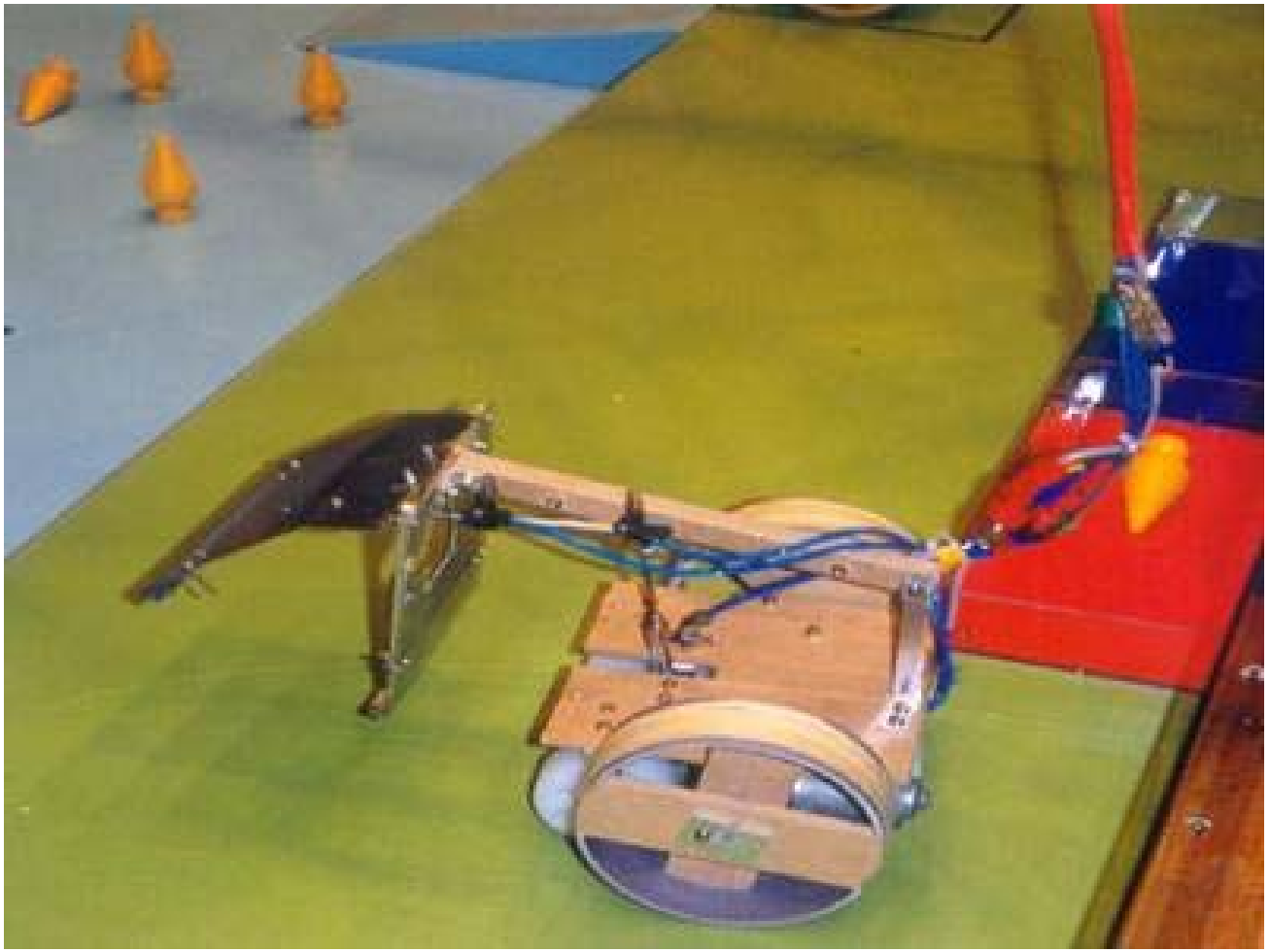
Pushing the Opponent

Scoop and Grabber

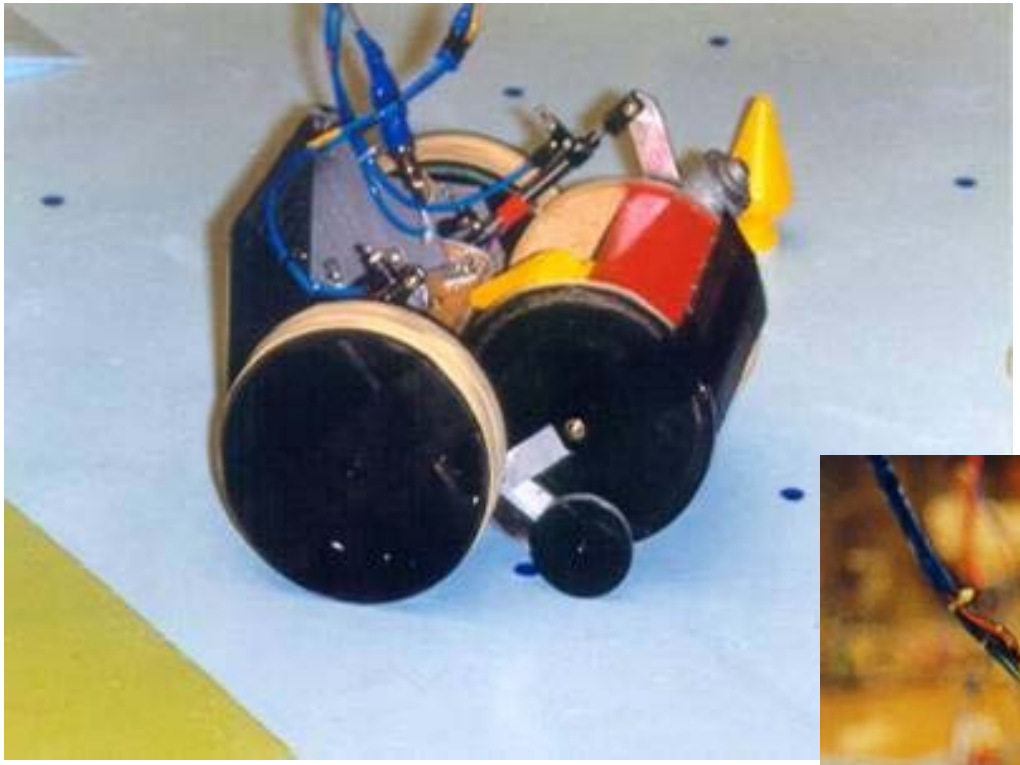


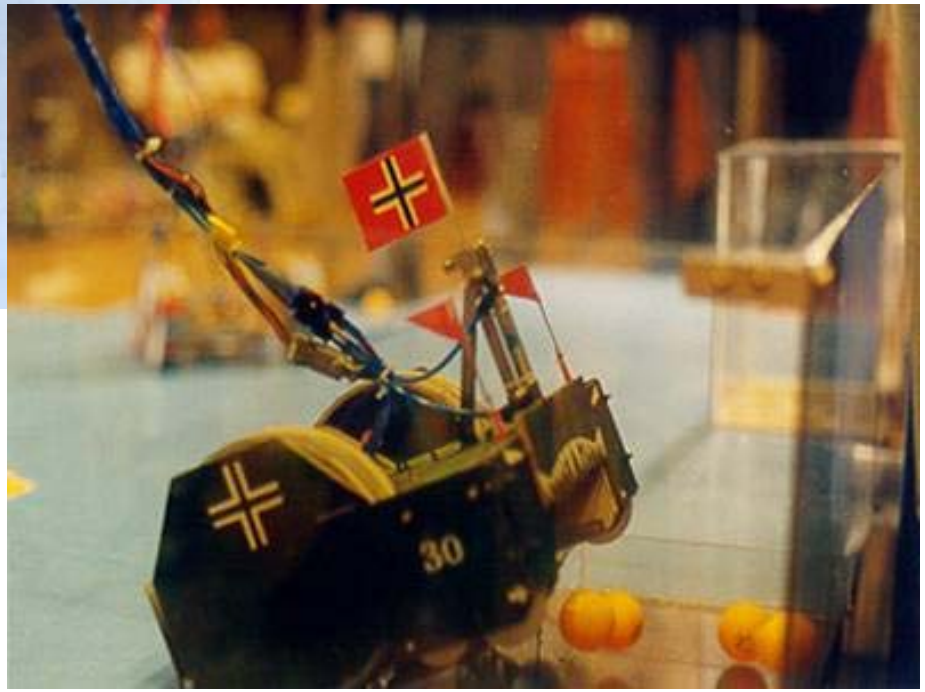


Crane

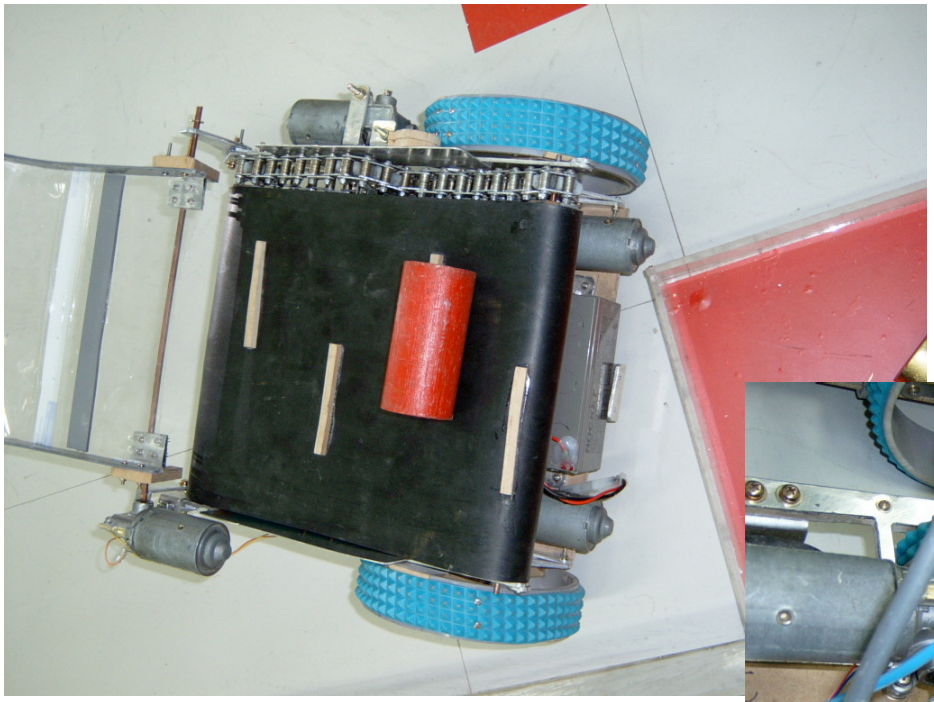


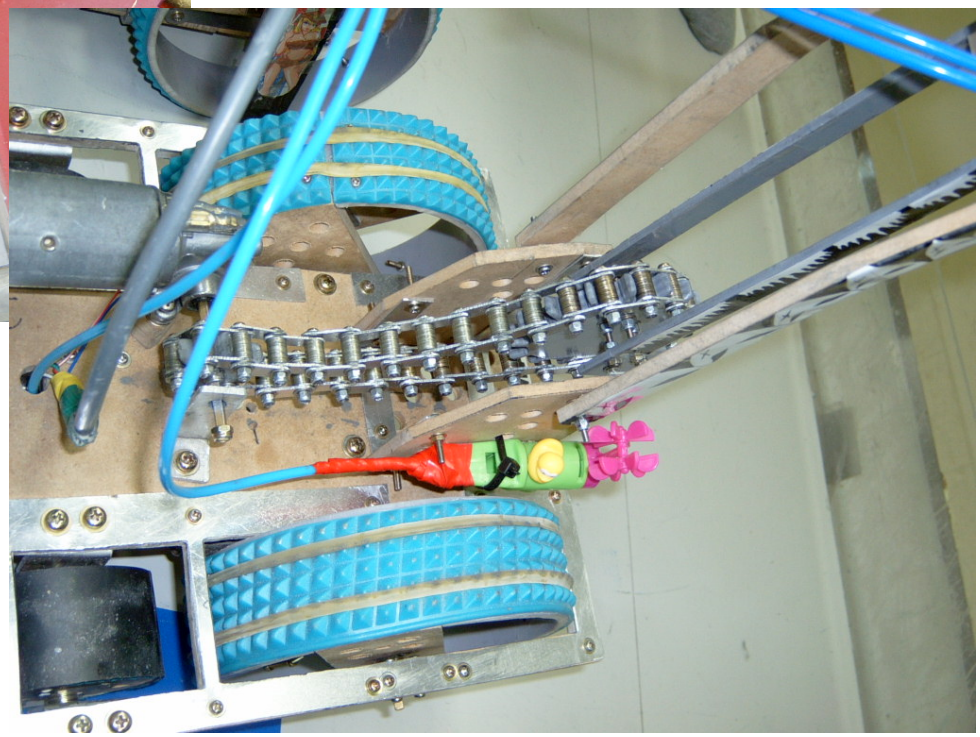
Rotating Blade





Belt and Chain





Satellite

Decorating the Robot

International Robocon

NHK sponsored event

For 2 weeks in July

Participating Universities

- MIT
- Tokyo Institute of Technology
- Cambridge University
- Technical university of Darmstadt
- Seoul national University
- University of Sao Paulo

2000 RoBoCoN

International Design Contest

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International Robocon

ROBOCON KOREA 2001

Organized by Korea Broadcasting System and broadcasted on a national channel

17 teams from 11 universities, 3 students per team

Design and manufacture wired and wireless remotely controlled robots for 2 months

The winner team participated in the 1st Asia-Pacific Robot Contest sponsored by NHK

Stadium of ROBOCON KOREA 2001

Robots and Action

Conclusion

Expensive to run the course
- Material, equipment
- Teaching assistants
- Professor

Great motivation for freshmen students

Teamwork Skill

Students are clever.
- Their creativity is beyond our imagination.

Creative robot does not necessarily win the game.
- Diligent students usually win.
- 1/3 design and manufacturing, 1/3 debugging, 1/3 practice
- Students learn the value of trial-and-error.