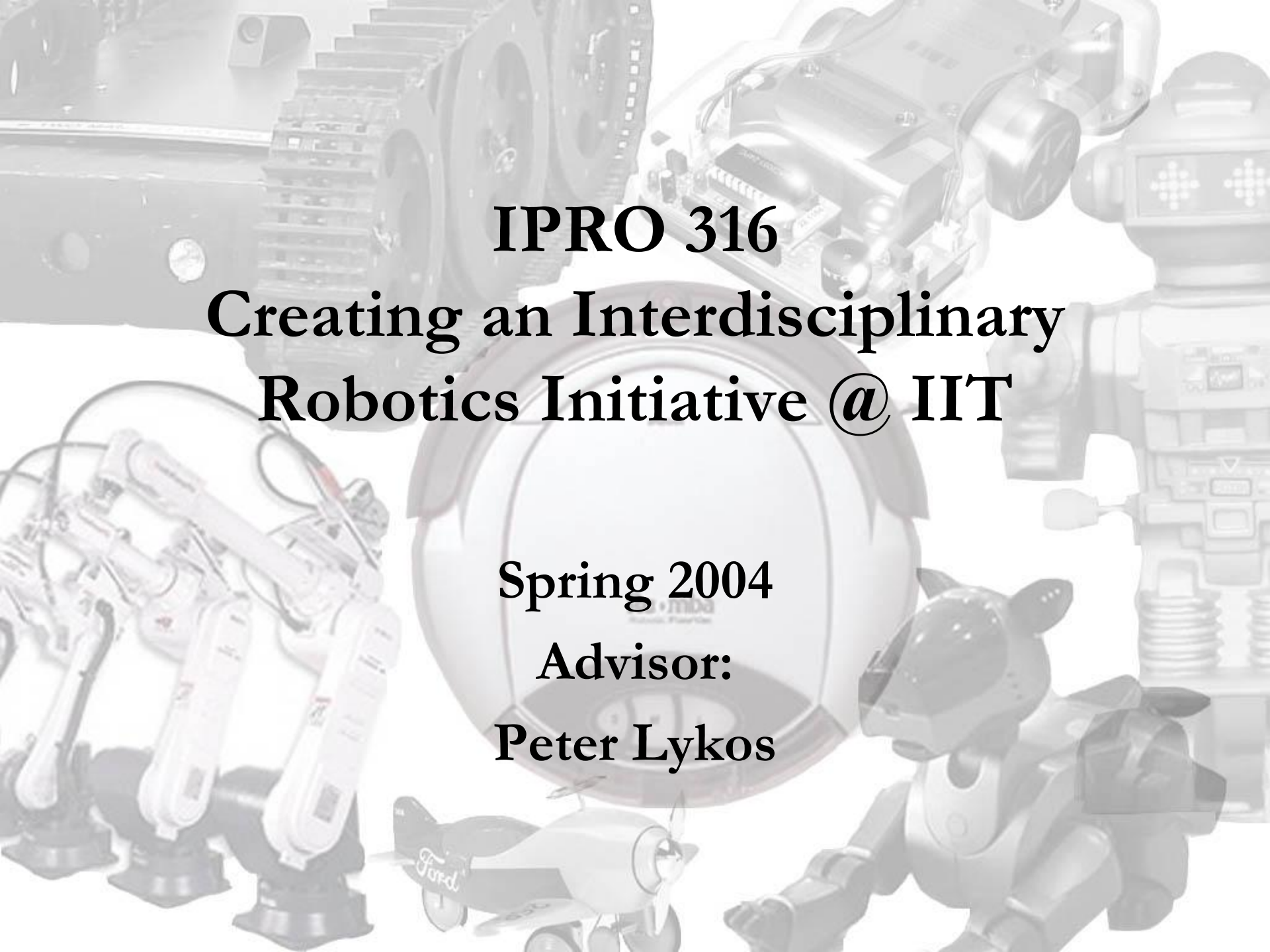


IPRO 316
Creating an Interdisciplinary Robotics Initiative @ IIT

Spring 2004

Advisor:

Peter Lykos

IPRO Members

Name	Dept.	Level	Role in IPRO
Christopher Jones	EE	Freshman	• IPRO Leader • Peppy Robot – Design • Competition Initiative
Shirali Patel	EE	Junior	• Competition Initiative • Posters and Presentations
Eugenia De Marco	MMAE	Sophomore	• Peppy Robot – Mechanical
Jonathan Hovde	MMAE	Junior	• Peppy Robot – Sonar
Daniel Krol	CPE	Junior	• Peppy Robot – Programming • Website developer
Paul Stachowicz	ECE	Junior	• Peppy Robot – Power
Gabriela Monis	EE	Senior	• Mobile Platform – Design, documentation
Henry Oyuela	CPE	Senior	• Mobile Platform – Design, programming • Website developer
Nicholas Burica	EE	Junior	• Rhino Arm Bartender

Objectives & Team Organizations

The IPRO members were organized into different teams to work on each of the following objectives:

- **Work towards developing an Institute for Robotics Education at IIT**
- **IIT Grand Challenge Robotics' Competition**
- **The Peppy Robot**
- **Mobile Platform (Roomba)**
- **Rhino Robotic Arm**

Robotics Education at IIT

- **Develop an Interdepartmental Institute for Robotics Education at IIT**
- **Perk corporate interest in IIT**
- **Attract enthusiastic and intelligent new undergraduate students**

Robotics' Competition

Robotics' Competition

Objectives:

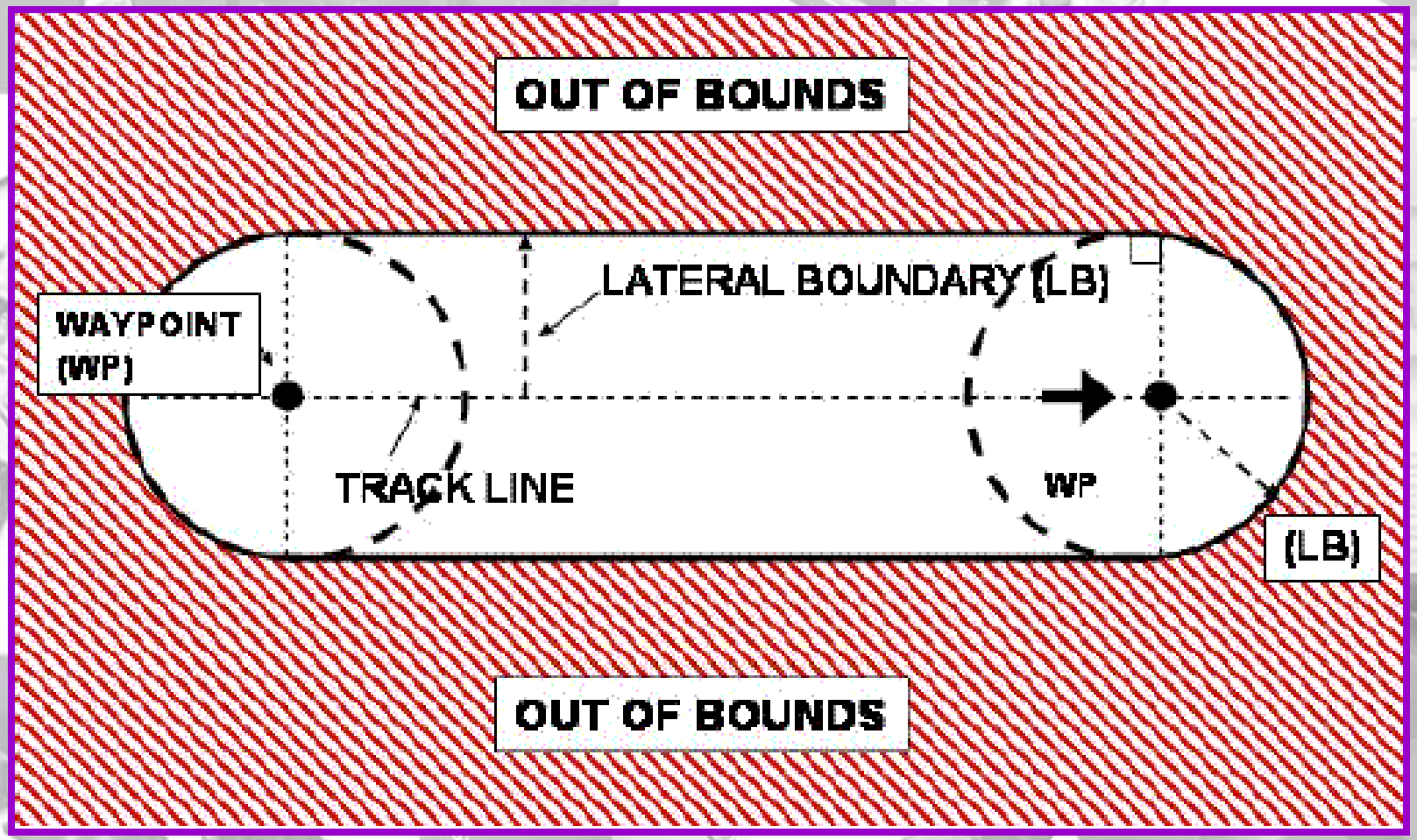
- Raise the interest of IIT students and faculty in robotics.
- Provide a high level of competition and exposure to practical problems.
- Promoting innovative thought and application of modern technology.

Robotics' Competition

Course:

- Closed course around IIT, disclosed just before the competition.
- Length of course not more than 1.5 miles.
- Include obstacles of any compositions like dirt, grass, gravel, pavement, etc.
- Range along the course will be decided by waypoint paths as shown in the diagram on next slide.

Course Range - Waypoints



Robotics' Competition

Robots:

- Completely autonomous, switched on at starting line, and then on their own, by following GPS waypoints along the paths.
- Should weigh less that 200 lbs., dimensions not exceeding 36 x 48 inches .
- Should be capable of traversing pavement, dirt, grass, gravel, and maneuver around Chicago curbs..

Robot examples

Pioneer P3-DX

Pioneer PTRV

Pioneer P3-AT

Robotics' Competition

Future Plans:

- We laid the ground work for this challenge.
- IPRO 316 Fall 2004 can pursue on and gather more information to successfully go through with this competition.

The Peppy Project

Peppy Project

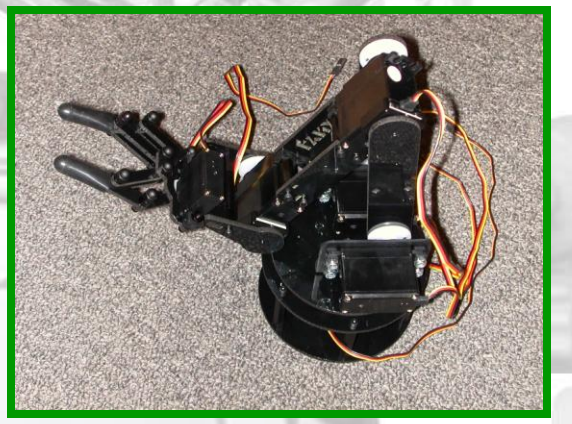
Objectives:

- Develop an expandable robot platform
- Install speech recognition and commands
- Develop sonar object identification
- Leave a detailed record for future semesters

Peppy Project

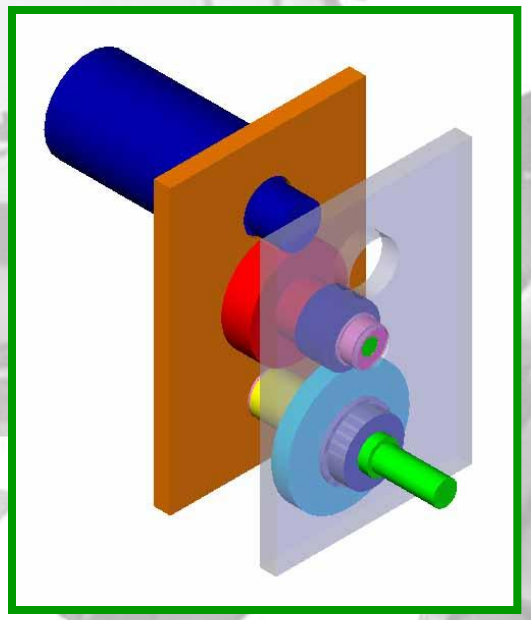
Chassis:

- Mount to Scorpion frame
- Using Lynx robotic arm



Transmission:

- Developed using Fisher-Price motors and other components donated by the ThunderChickens



Peppy Project

Speech Recognition:

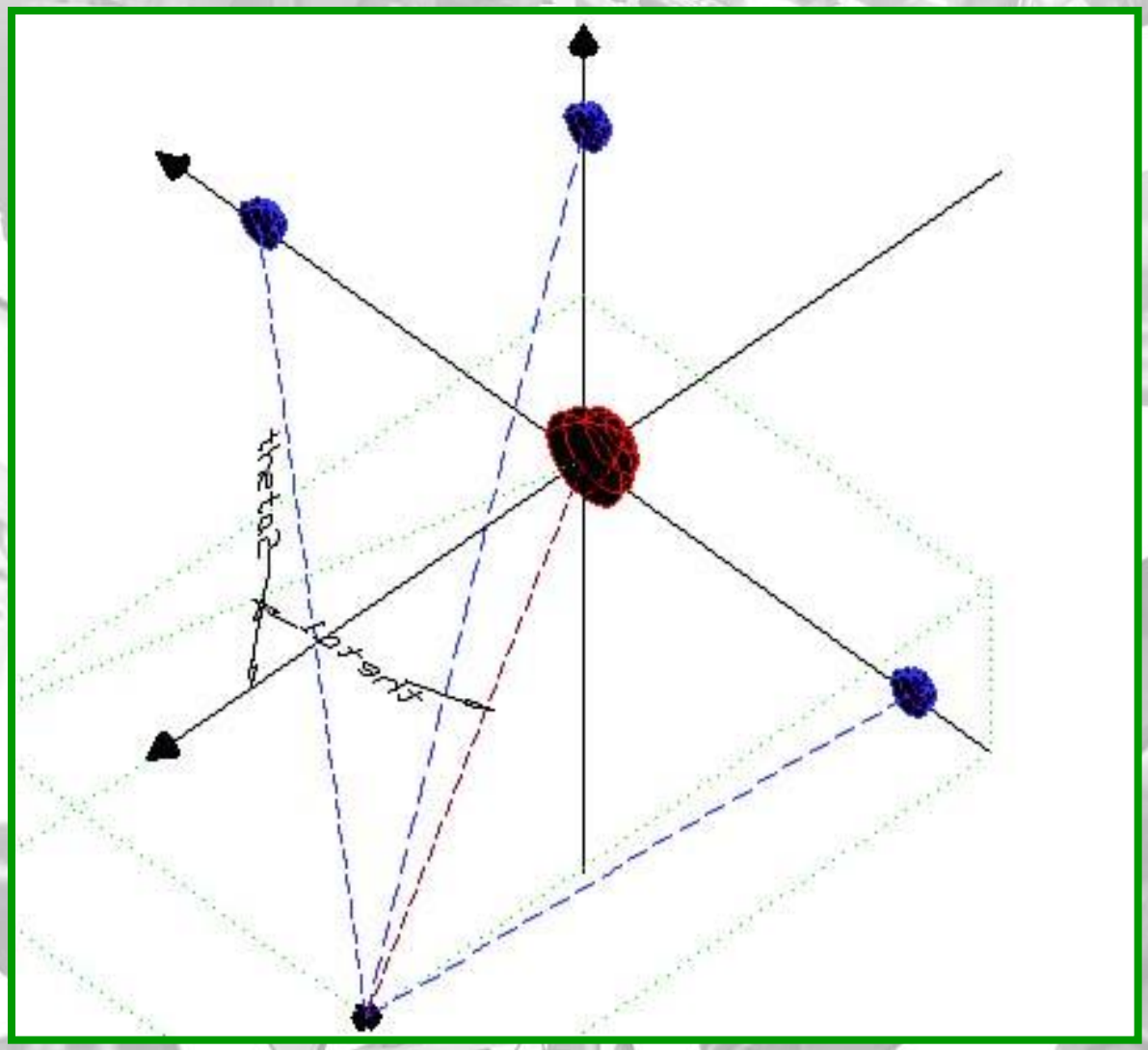
- Unique interface
- Programmable commands
- Talk-back option
- Relay information to FRC

Peppy Project

Sonar:

- The robot is to be able to identify the range and shape of objects
- Create a sonar array that will communicate target object data to the controller.

Sonar Array



Peppy Project

Future Goals:

- Advanced features
  - Invention to product
  - Video pattern recognition
  - Robot location via GPS
- MMAE or EE research for advanced features.
- Build Sonar analysis software and integrate into controller programming.
- ENPRO to follow up and long-term business goals.

Mobile Platform

Mobile Platform

Introduction:

- Roomba
  - Robotic floor sweeper created by iRobot Corporation.
  - Patent covers only the Microcontroller
    - Platform for robotic experiments.

Mobile Platform

Objectives:

- New Microcontroller
  - Functionalities of a Mobile Platform
  - Ability to integrate additional functions
- Integrate Microcontroller onto Roomba

Mobile Platform

Method:

- Reverse engineer the Roomba
- Familiarization with the Parallax Javelin Stamp
- Test and program each individual object
- Design algorithm to run the entire system

Mobile Platform

Roomba Components:

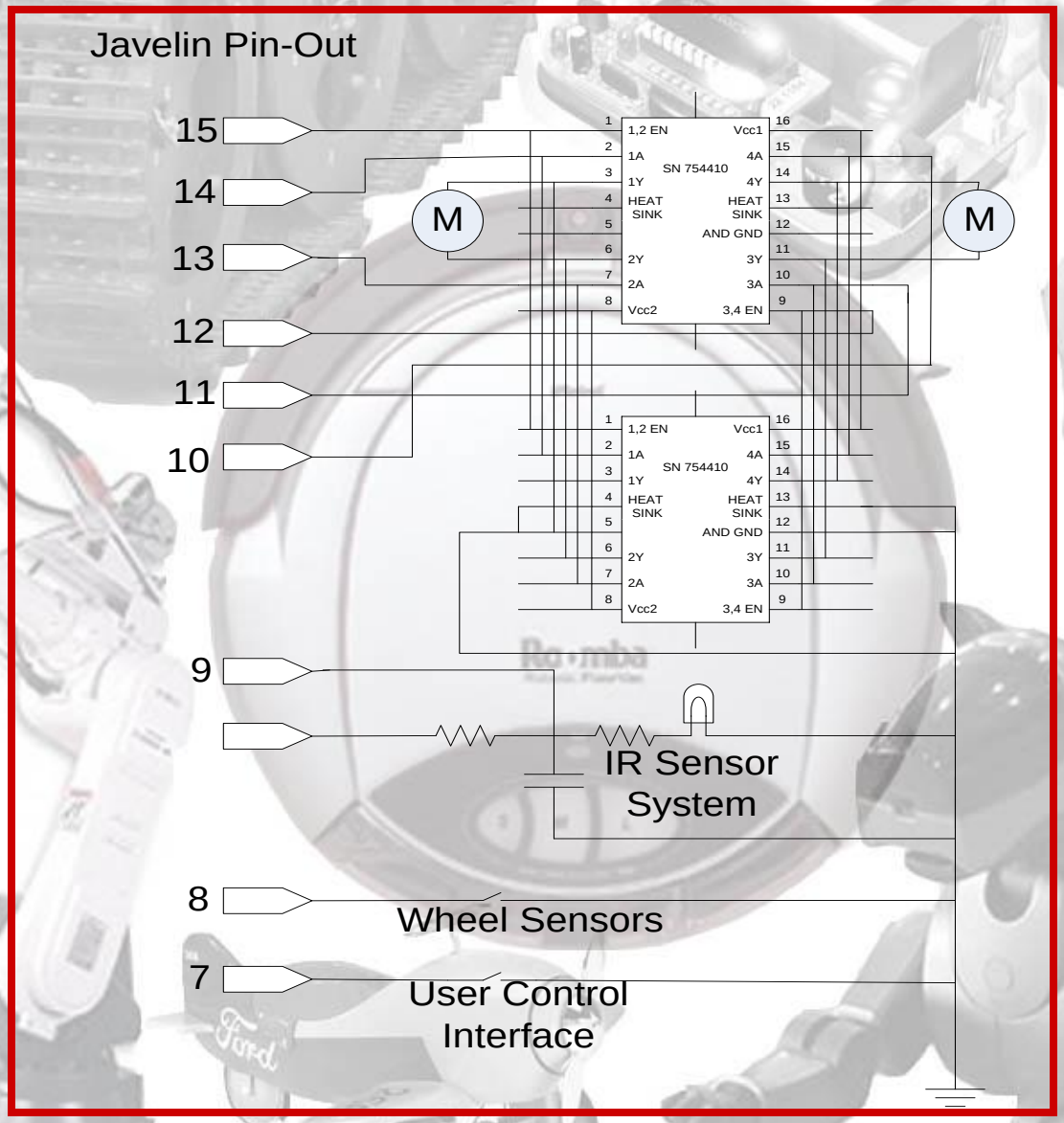
- User Control Interface
- Wheel Sensors
- Front Bumper Sensors
- Wheel Motors
- Roomba Battery

Mobile Platform

Additional Circuitry:

- Texas Instruments Quadruple Half H-Drivers
- Analog to Digital
- Push Button Circuitry

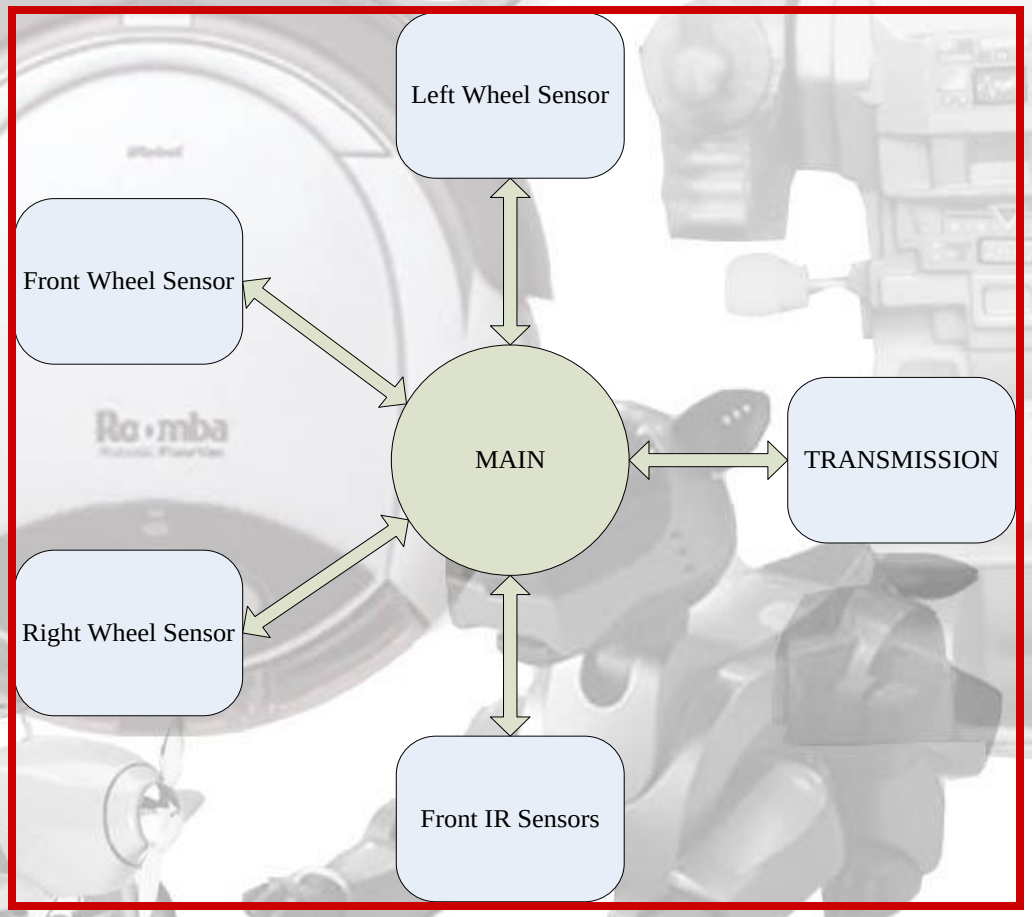
Main Circuit Design



Mobile Platform Group

Programming the Javelin:

- **Quick Facts:**
  - 32k RAM
  - Java Based
  - 16 I/O Pins
- **Operating System**
  - Background Virtual Peripherals



Mobile Platform Group

Where We Are Going:

- Educational Manual
- Roomba B
- Room for More

Rhino Robotic Arm Group

Rhino Robotic Arm Group

Objectives:

- Learn the range of use of the Rhino Robotic Arm
- Automate the arm to work a general everyday function
- Function taken at hand: Bartending
- Program the Arm to mix and serve multiple drinks
- Make a mini-manual for upcoming IPRO

Rhino Robotic Arm Group

Key Points:

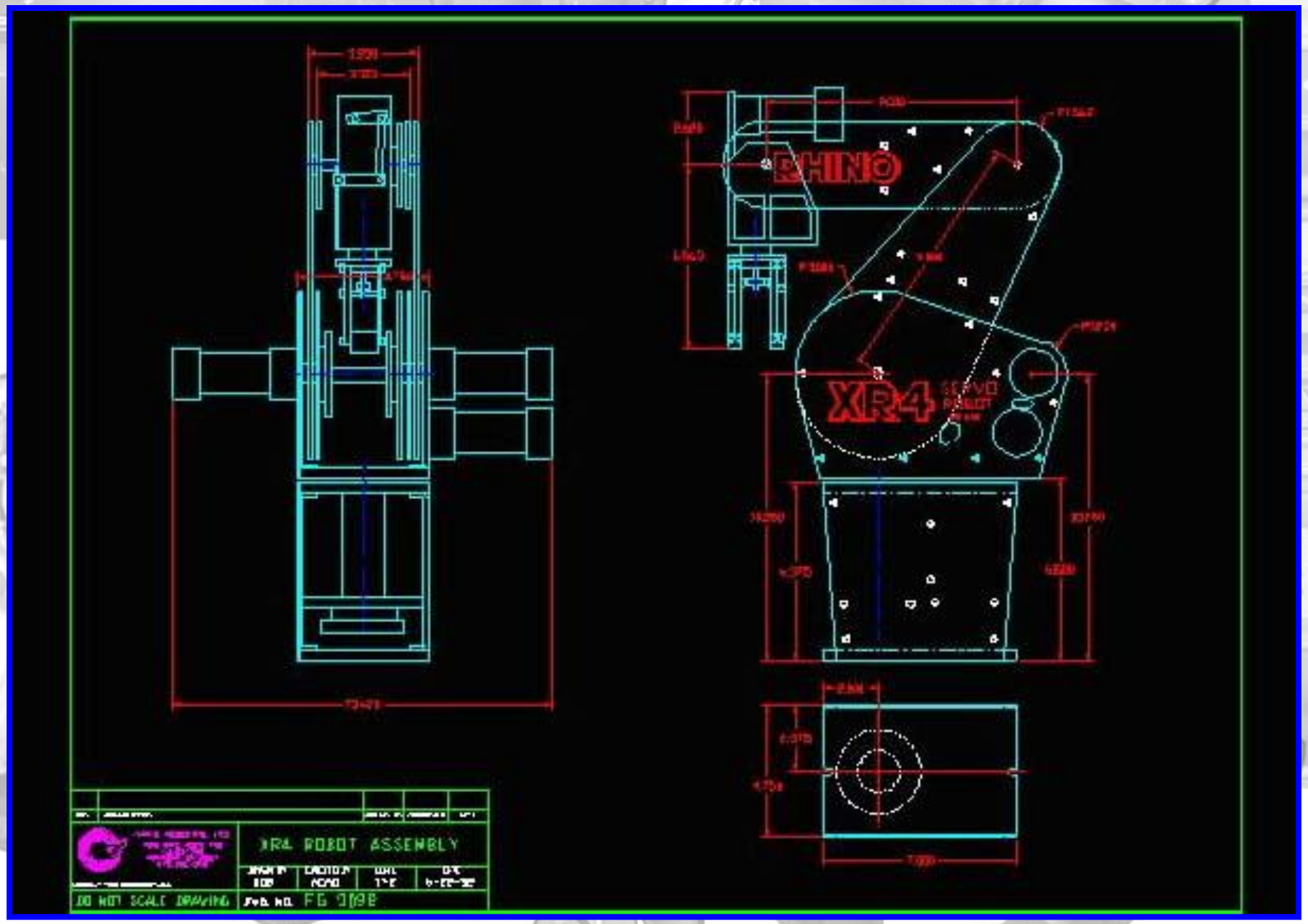
- Located in MMAE Showcase Lab in E1
- Costs around $15,000
- Monitored by Graduate Student Nikhil Sherman

Rhino Robotic Arm Group

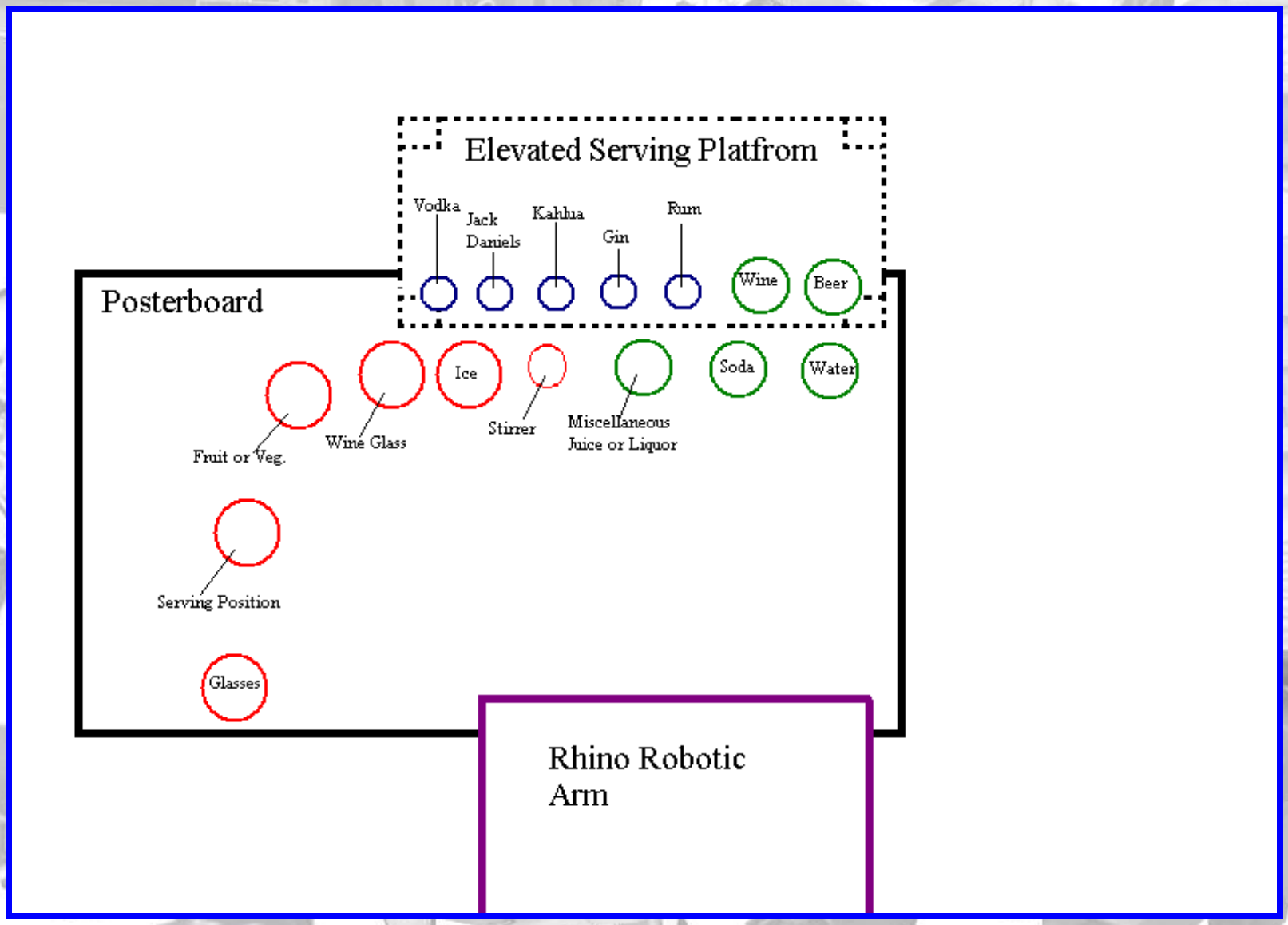
Method:

- Plotted various points on a board and platform to assemble into a computer code
- Then ran and tested the written code
- Demonstrate my progress and program via TV/VCR on IPRO day

Rhino Robotic Arm XR-4



Board Diagram



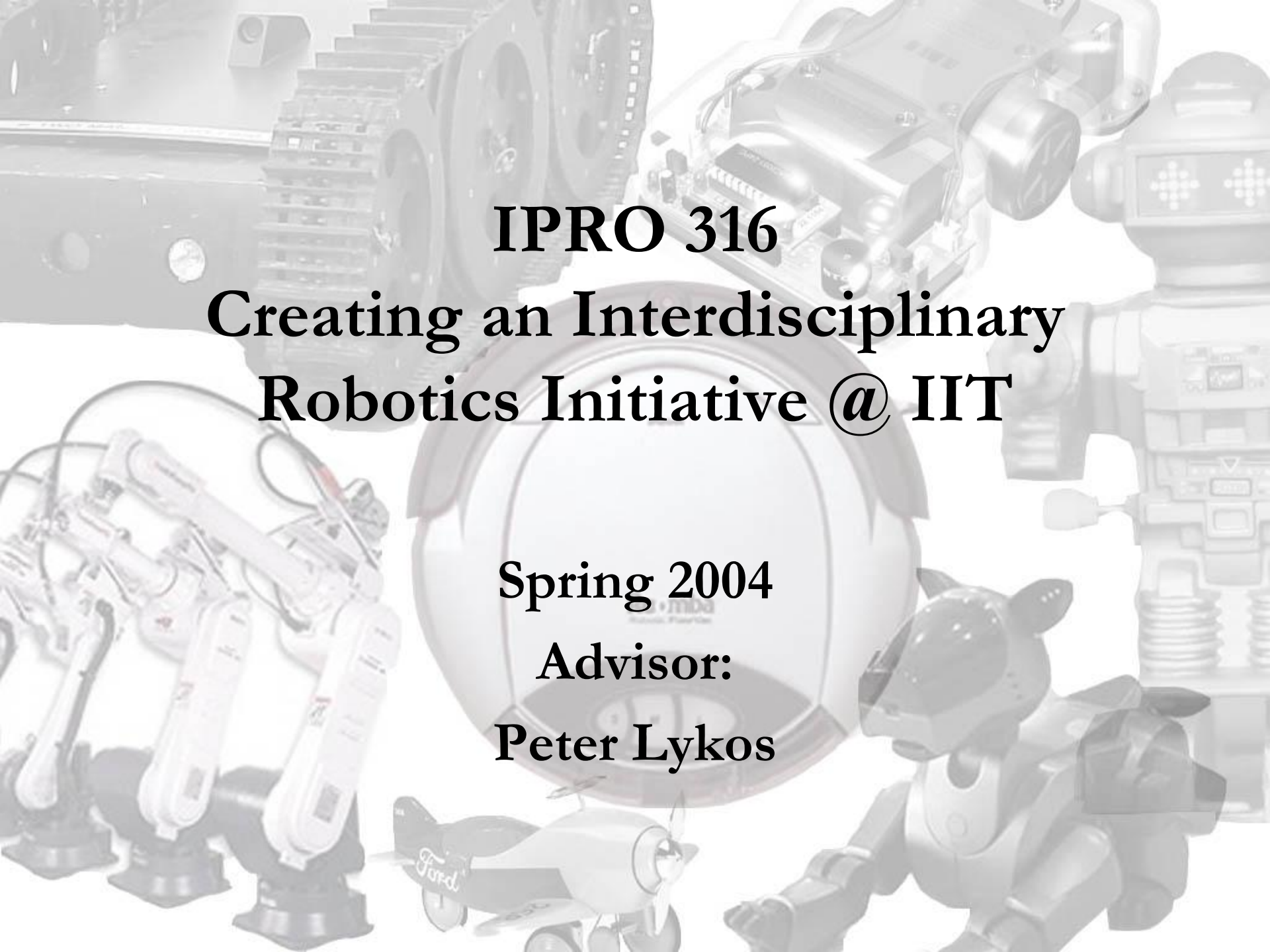
Rhino Robotic Arm Group

Pictures:

Rhino Robotic Arm Group

Conclusion:

- Evaluating the capabilities of this Arm was a great asset.
- This project could be used in a classroom setting as a guideline to learn more about the various uses and about automation.
- The manual, that will be left behind, will serve as a integral tool for students.



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