ORIENTATION
Project Director

- Professor Vikram Kapila
- Associate Professor
- Room: RH 508
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- URL: mechatronics.poly.edu/vkapila/
Project Instructor

- Name: Nathan (Sang-Hoon) Lee
- Room: RH 514
- Phone: (718)260-3791
- E-mail: sparknate@yahoo.com
Teaching Assistant

• Name: Anshuman Panda
• Room: RH 514
• Phone: (718)260-3791
• E-mail: apanda01@utopia.poly.edu
Laboratory Etiquette

- E-mail checking, chatting, web browsing, listening to music, singing, and running around not permitted in the lab
- Do not touch experiments unrelated to your work
- No Food and drink
- Keep this room as clean as the work allows
  - after experiments, put all components in their original place with the same original condition
- Sign on the attendance sheet
Laboratory Safety Guidelines

- Do not work alone or unsupervised
- Do not operate any equipment with indication of damage
- Do not let wires hang loose
- Do not touch unshielded wires
- Do not subject components to power higher than their ratings
- Do not touch components subjected to excessive power
- In the case of safety hazards or serious injury:
  - Warn others
  - Inform instructor or technician
  - Remove yourself from danger
# Schedule

<table>
<thead>
<tr>
<th>Start Date</th>
<th>July 12, 2004 (Monday)</th>
</tr>
</thead>
<tbody>
<tr>
<td>End Date</td>
<td>August 6, 2004 (Friday)</td>
</tr>
<tr>
<td>Period</td>
<td>4 weeks (Monday–Friday)</td>
</tr>
<tr>
<td>Time</td>
<td>8:30am–5pm</td>
</tr>
<tr>
<td>Lunch Time</td>
<td>12:30pm–1:30pm</td>
</tr>
<tr>
<td>Location</td>
<td>RH514B</td>
</tr>
<tr>
<td></td>
<td>Mon</td>
</tr>
<tr>
<td>-------</td>
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</tr>
<tr>
<td>1st</td>
<td>July 12</td>
</tr>
<tr>
<td></td>
<td>Registration &amp; Opening</td>
</tr>
<tr>
<td></td>
<td>Orientation</td>
</tr>
<tr>
<td>2nd</td>
<td>19</td>
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<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>3rd</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>4th</td>
<td>August 2</td>
</tr>
<tr>
<td></td>
<td>Building the project, report preparation, and presentation slides</td>
</tr>
</tbody>
</table>
## Lecture Schedule

<table>
<thead>
<tr>
<th>Lecture</th>
<th>Topics</th>
<th>Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture 1</td>
<td>Resistor</td>
<td>Lecture 10</td>
</tr>
<tr>
<td>Lecture 2</td>
<td>Mechatronics</td>
<td>Lecture 11</td>
</tr>
<tr>
<td>Lecture 3</td>
<td>LED</td>
<td>Lecture 12</td>
</tr>
<tr>
<td>Lecture 4</td>
<td>Button</td>
<td>Lecture 13</td>
</tr>
<tr>
<td>Lecture 5</td>
<td>Capacitor</td>
<td>Lecture 14</td>
</tr>
<tr>
<td>Lecture 6</td>
<td>Optoelectronics</td>
<td>Lecture 15</td>
</tr>
<tr>
<td>Lecture 7</td>
<td>ADC</td>
<td>Lecture 16</td>
</tr>
<tr>
<td>Lecture 8</td>
<td>Servomotor</td>
<td>Lecture 17</td>
</tr>
<tr>
<td>Lecture 9</td>
<td>555 timer</td>
<td>Lecture 18</td>
</tr>
</tbody>
</table>

- **Lecture 10**: Thermal sensors
- **Lecture 11**: Robotics
- **Lecture 12**: Infrared sensor
- **Lecture 13**: Transistor
- **Lecture 14**: Relay
- **Lecture 15**: H-Bridge
- **Lecture 16**: DC motor
- **Lecture 17**: RC filter
- **Lecture 18**: Op amp
Making Groups

• Make 5 groups of 2 each
• All structured projects and final projects will be done in the same teams
Ice Break

- Name
- School
- Specialty
- Hobby
- Goal for the SMART program
- Others
SMART 2003 Projects
Static Equilibrium

Teachers: Robert Gandolfo & Paul Friedman
The Smart Road

Teachers: Clay Davis & Richard Balsamel
Catch Me If You Can

Teachers: John Luvera & Michael McDonnell

Polytechnic

SMART

Funded by The National Science Foundation
The Physics of Projectile Motion

Teachers: William Leacock & Marlene McGarrity
The Ro-Boe-Clock

Teachers: Michelle Carpenter-Smith & David Deutsch

Polytechnic

SMART

Funded by The National Science Foundation
Reflection Experiment
Refraction Experiment
Static Friction Experiment
Pendulum Experiment
Heat Conduction Experiment
Sample Mechatronics Projects

ME3484: Mechatronics, Spring 2003
YES Summer Research Program, 2002
Remote Robot Arm Manipulation
Remote Emergency Notification System
Smart Irrigation System
Smart Cane
Four-Legged Hexapod
Robotic Vacuum Cleaner
Remote Control using the Parallel Port of a PC
Audio Enabled Emergency Hexapod
Automated Distinguisher
<table>
<thead>
<tr>
<th>Name</th>
<th>School</th>
<th>City, State</th>
<th>Amount</th>
<th>Funding Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Richard Balsamal</td>
<td>Science High School</td>
<td>Newark, NJ</td>
<td>$4,000</td>
<td>School district</td>
</tr>
<tr>
<td>David Deutsch</td>
<td>Manhattan Center for Science and Math High School</td>
<td>New York, NY</td>
<td>$3,000</td>
<td>School and through the Children’s Aid Society</td>
</tr>
<tr>
<td>Paul Friedman</td>
<td>Seward Park High School</td>
<td>New York, NY</td>
<td>$1,500</td>
<td>School’s alumni association</td>
</tr>
<tr>
<td>William Leacoc</td>
<td>W. C. Mepham High School</td>
<td>Bellmore, NY</td>
<td>$1,500</td>
<td>School district</td>
</tr>
<tr>
<td>Marlene McGarrity</td>
<td>The Christa McAuliffe School</td>
<td>Brooklyn, NY</td>
<td>$1,500</td>
<td>Online grant agency</td>
</tr>
</tbody>
</table>
Some New York City teachers are hoping to bring all sorts of high-tech concepts into their classrooms next school year to inspire more students to pursue careers in engineering and electronics. As NY1 Tech Beat reporter Adam Balkin explains in the following story, students won't just be hearing about those concepts, they'll be building them too.

Classrooms have certainly come a long way since the abacus and the quill. How far? Polytechnic University in Brooklyn is running a new program this summer, educating area high school teachers on how to bring mechatronics into the classroom. It's a program funded by the National Science Foundation called SMART.

“SMART stands for 'science and mechatronics aided research for teachers,'” says Vikram Kapila of Polytechnic University. “Mechatronics is marriage of mechanical engineering, electrical engineering, electronics, computer science and computer engineering to make smart products.”

These projects aren't just designed to look neat or be like high-tech erector sets - they're built to actually do something eventually in the real world. A hexapod, for example, could be used for disaster recovery. After a building collapse it could be sent in to look for possible survivors.

“These could be robots, smart jet engines, automotive hybrid systems, rockets, missiles, or what have you,” says Kapila.

“This is like a simulator for a jet pilot, and what they'd do before they actually become jet pilots, but most of it has to do with the fact that I'm controlling the helicopter basically by using sensors,” says Clay Davis of Manhattan Comprehensive Day/Night High School.

The teachers all agree, students are more eager to learn when they can use concepts and equations to actually make something they can touch and use.

“It's tangible,” says Paul Friedman of Seward Park High School. “You look at a differential equation and it's a differential equation. It just sits there, and this is real. It's live, and it has applications.”

Michelle Carpenter-Smith of Packer Collegiate Institute says, “I think this is a way for me to bring projects back that will interest females as well as male students so that hopefully more female students will go into engineering, go into math and science professions, and they'll bring their way of viewing engineering from a creative perspective, from an artistic perspective, so that there can be more representation from both genders.”

The program runs for four-weeks. After it's over, each teacher is given supplies to build some of these projects back at their high schools. For more information on the program, including a list of which high schools are participating, visit mechatronics.poly.edu/smart.

- Adam Balkin
2003 SMART Participants

- 10 teachers
- PI
- 3 Poly graduate students
- 2 Poly undergraduates
- 1 undergraduate from CCNY
Matlab-Based Graphical User Interface Development for Basic Stamp 2 Microcontroller Projects

Simulink block diagram used for PC to BS2 serial communication

Unfiltered and Filtered plot of rctime

DB-9 serial cable

Pentium class PC

BS2 installed on BOE development platform

Simulink block diagram used for bi-directional serial communication between BS2 and PC

Plot of rctime vs. angle of light sensor

Yang-Fang Li, Saul Harari, Hong Wong, and Vikram Kapila
Internet-Based Remote Control using a Microcontroller and an Embedded Ethernet Board

Ethernet Enabled BS2P40

DC motor test-bed

Java applet GUI screen capture

Imran Ahmed, Hong Wong, and Vikram Kapila

SMART Funded by The National Science Foundation
Matlab-Based Graphical User Interface Development for PIC Microcontroller Projects

Sang-Hoon Lee, Yang-Fang Li, and Vikram Kapila

Simulink block diagram used for PIC to PC serial communication

Unfiltered and Filtered plot of ADC

Plot of angle of refraction vs. light sensor output

Simulink block diagram used for bi-directional serial communication between PIC and PC
Internet-Based Remote Control of a DC Motor using an Embedded Ethernet Microcontroller

Methods of interaction between remote web-client PC and TINI microcontroller

Java applet GUI screen capture

Hong Wong and Vikram Kapila
MPCRL Demonstration

- Web-enabled Mechatronics/Process Control Remote Laboratory (MPCRL)
- URL: http://mechatronics.poly.edu
- Student in-charge: Mr. Hong Wong