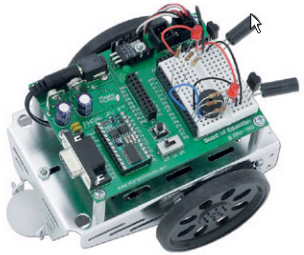
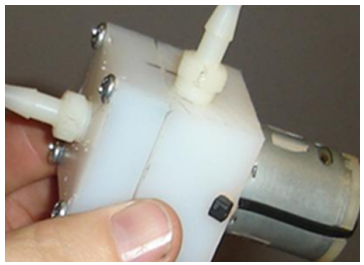
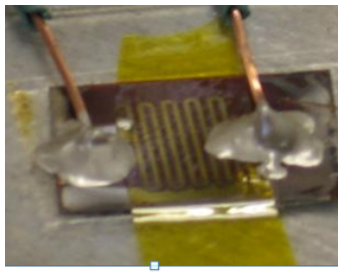
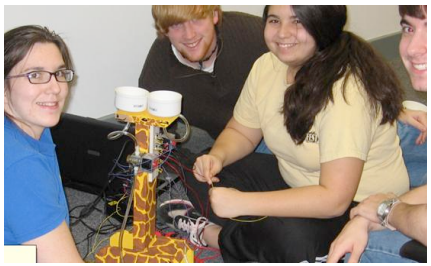
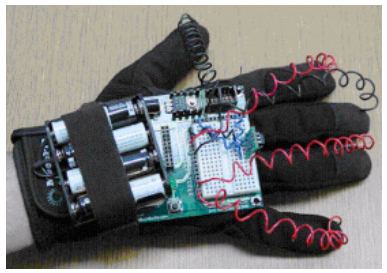
Freshman Engineering

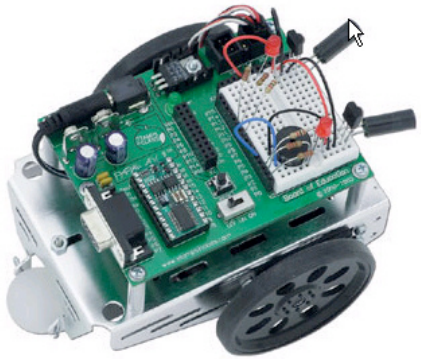


Overview of the
Living WITH the Lab
Course Sequence

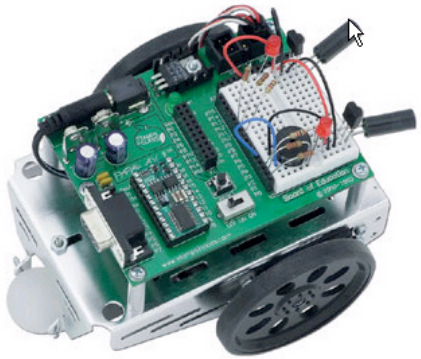
Photos courtesy of Dr. David Hall, Louisiana Tech University

Quarter	New Curriculum	Old Curriculum
Fall	ME 199A: 2 credits	EAS 101: 4 credits
Winter	ME 199B: 2 credits	
Spring	ME 199C: 2 credits	EAS 115: 3 credits
Total	6 credits	7 credits



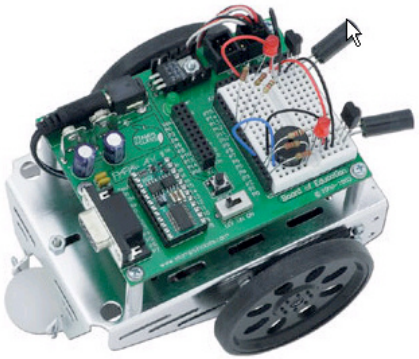
ME 199 Courses meets twice per week for 110 minutes for the entire year.

Quarter	New Curriculum	Old Curriculum
Fall	ME 199A: 2 credits	EAS 101: 4 credits
Winter	ME 199B: 2 credits	
Spring	ME 199C: 2 credits	EAS 115: 3 credits
Total	6 credits	7 credits



ME 199 Courses meets twice per week for 110 minutes for the entire year.

Quarter	New Curriculum	Old Curriculum
		EAS 101: 4 credits
Winter 2010	ME 199A: 2 credits	
Spring 2010	ME 199B: 2 credits	EAS 115: 3 credits
Total	6 credits	7 credits



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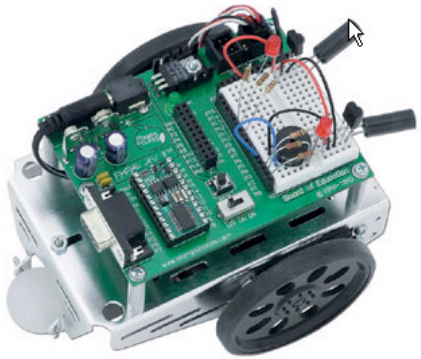
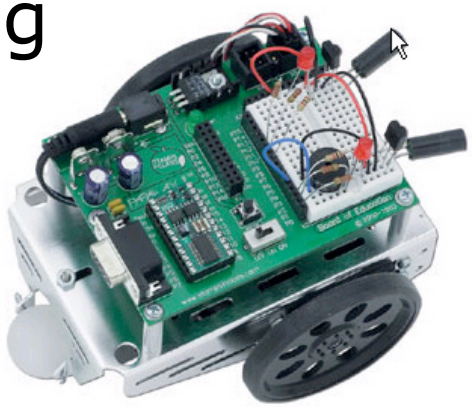


ME 199 Courses meets twice per week for 110 minutes for the entire year.

Living WITH the Lab

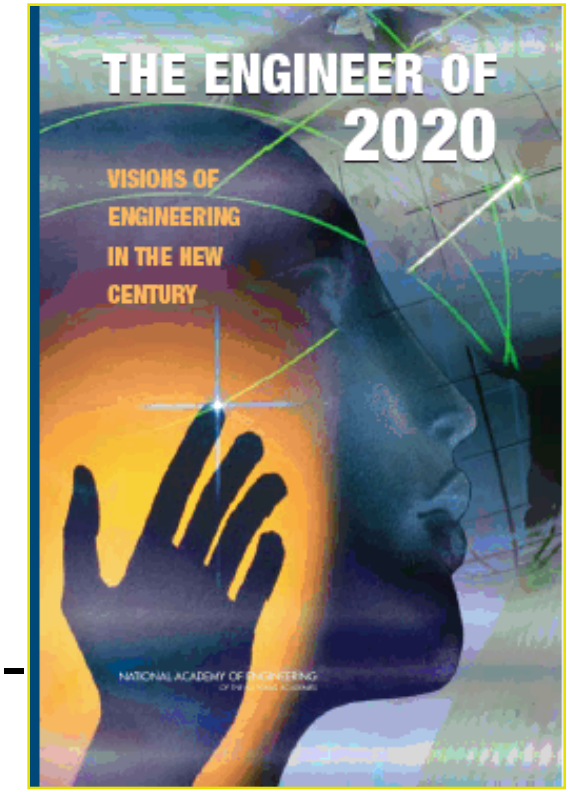
- Students purchase their own personal "lab" for $150 (the BOE-Bot)
- Provides a mechanism to boost hands-on learning beyond what is possible using traditional university laboratories
- Provides for project-based learning

Objective: Developing innovative students with a can-do spirit.



Attributes of the Engineer of 2020

- Strong analytical skills.
- Practical ingenuity, creativity; innovator.
- Good communication skills.
- Business, management skills.
- High ethical standards, professionalism.
- Dynamic/agile/resilient/flexible.
- Lifelong learner.
- Able to put problems in their socio-technical and operational context.
- Adaptive leader.

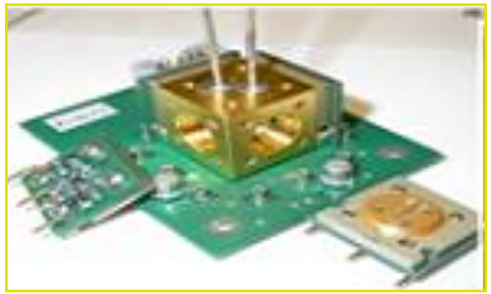


2004 – National Academy of Engineering

Breakthroughs

Nanotechnology

Biotechnology/
nanomedicine



Microelectronics/ telecommunications

Photonics/optics

Manufacturing

Logistics

Challenges

- Fresh water shortages
- Aging infrastructure
- Energy demands
- Global warming
- New diseases
- Security

Seven **"Threads"** define the freshman experience. The outcomes that support these threads are linked to the attributes of the Engineer of 2020.

A1. Strong analytical skills
A2. Practical ingenuity
A3. Creativity
A4. Good communication skills
A5. Lifelong learners
A6. Dynamic, agile, resilient and flexible characteristics
A7. High ethical standards
A8. Leadership skills
A9. Professionalism
A10. Business and management skills

Systems

- Fabricate, test and evaluate the efficiency of an engineering system (A1,A2,A3,A6)
- Fabricate and test an engineering system where two physical parameters are controlled (A1,A2,A3,A6)
- Conceive, design, and fabricate a prototype utilizing a controller, sensors and actuators (A1,A2,A3,A6)

Attributes of the Engineer of 2020:

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Electromechanical

- Utilize a programmable controller that interfaces with selected sensors and actuators (A1,A2)
- Implement functional circuits on a solderless breadboard for sensing and control applications (A1,A2)
- Utilize multimeters to troubleshoot circuits and to determine the power usage of a device (A1,A2)
- Describe the specifications, operating procedures, and underlying physics for the hardware utilized (A1,A2)

Attributes of the Engineer of 2020:

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Fabrication and Acquisition

- Fabricate parts using a wide range of conventional manufacturing processes (A2)
- Locate materials, supplies and components in stores and from online suppliers (A2)
- Specify and purchase materials, supplies or components for projects (A2)

Attributes of the Engineer of 2020:

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Software

- Utilize Excel, Mathcad and SolidWorks to assist in engineering analysis and design (A1,A2)
- Formulate and implement sequential computer programs for sensing and control applications (A1,A2)

Attributes of the Engineer of 2020:

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Fundamentals

- apply concepts of electricity and DC electric circuits (A1)
- apply basic statistics to quantify and model experimental data (A1)
- apply conservation of energy to engineering systems (A1)
- apply basic chemistry and electrochemistry to salt water mixtures (A1)
- apply conservation of mass to engineering systems (A1)

Attributes of the Engineer of 2020:

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Fundamentals (continued)

- apply least squares fitting to calibrate sensors (A1)
- apply concepts of statics to engineering systems (A1)
- apply engineering economics to solve time value of money problems (A1)

Attributes of the Engineer of 2020:

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Communication

- Utilize the specified engineering problem solving approach when completing assignments (A1,A4)
- Properly present technical information in tables and graphs (A4)
- Communicate the results of investigations and projects both orally and in writing (A4)

Attributes of the Engineer of 2020:

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Broadening Activities

- Assess potential impacts of selected global and societal forces on our planet and its inhabitants (A5,A6,A7)
- Regularly attend professional society meetings and other student-led functions (A7,A8,A9)
- Work individually and collaboratively to complete course assignments (A4,A8)
- Apply creative problem solving techniques for product design (A3)
- Manage time and resources during the development of an innovative product (A10)

Attributes of the Engineer of 2020:

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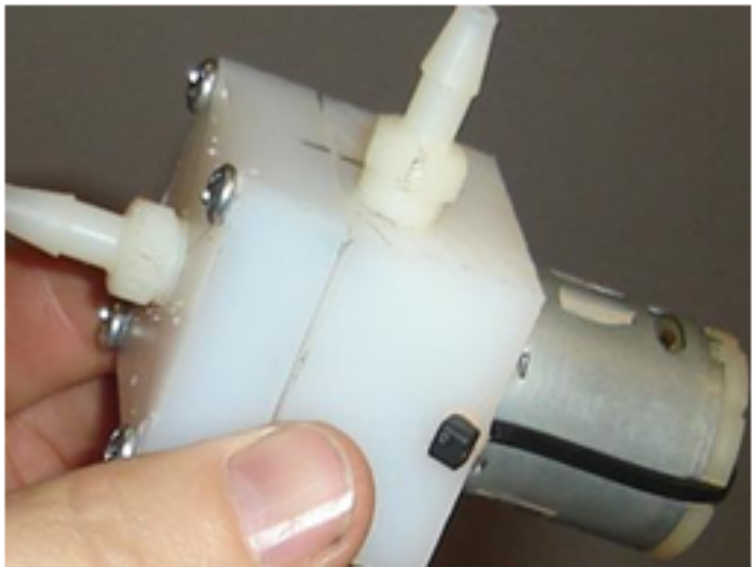
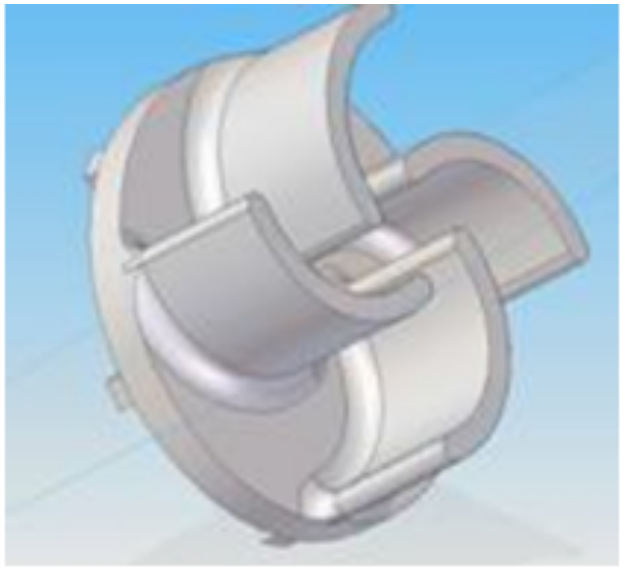
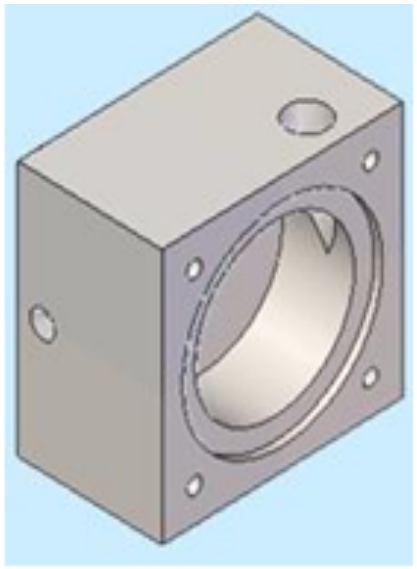
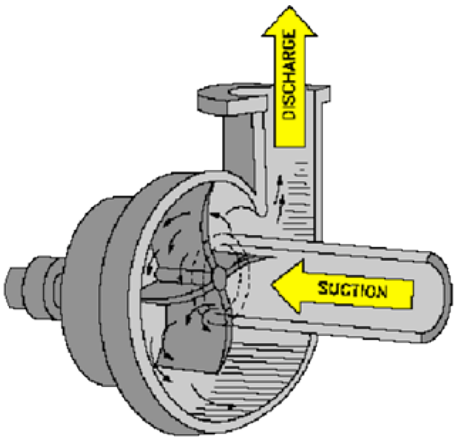
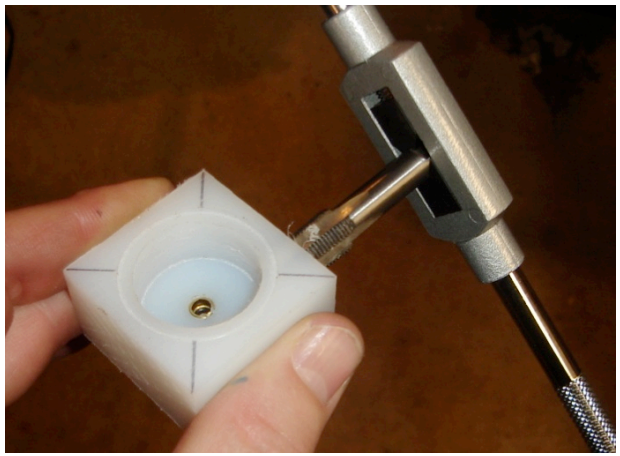
ME 199A Project: Fabrication of a Centrifugal Pump





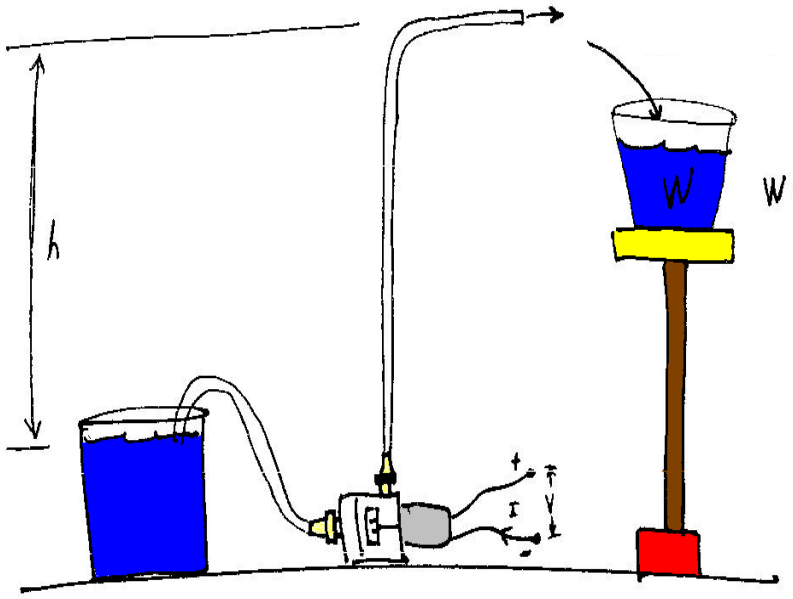


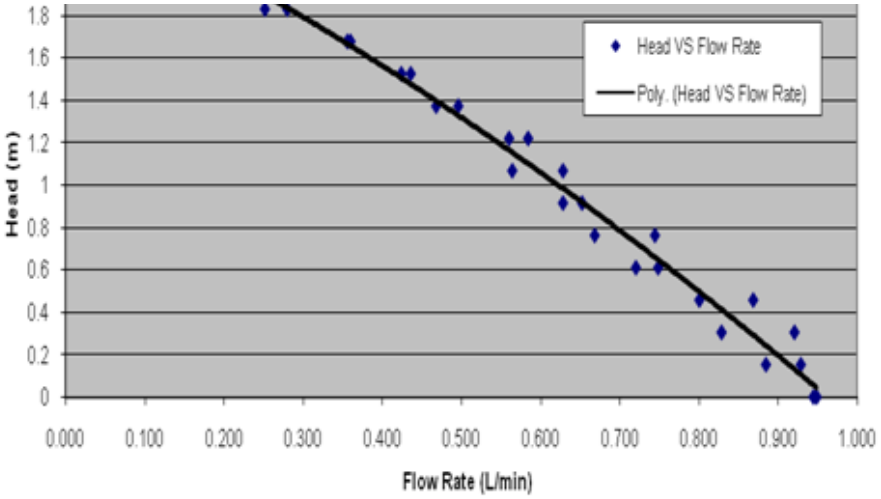




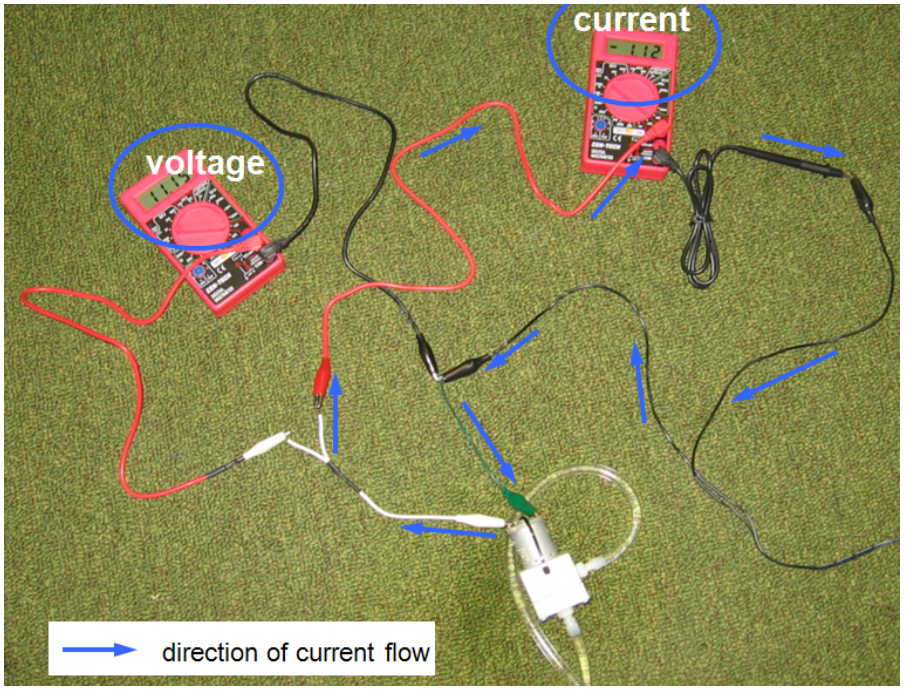
Living with the Lab – Freshman Engineering
Mechanical Engineering Program

Portland State UNIVERSITY





$$\eta = \frac{Wh + \frac{1}{2}mv^2}{VIt} * 100\%$$

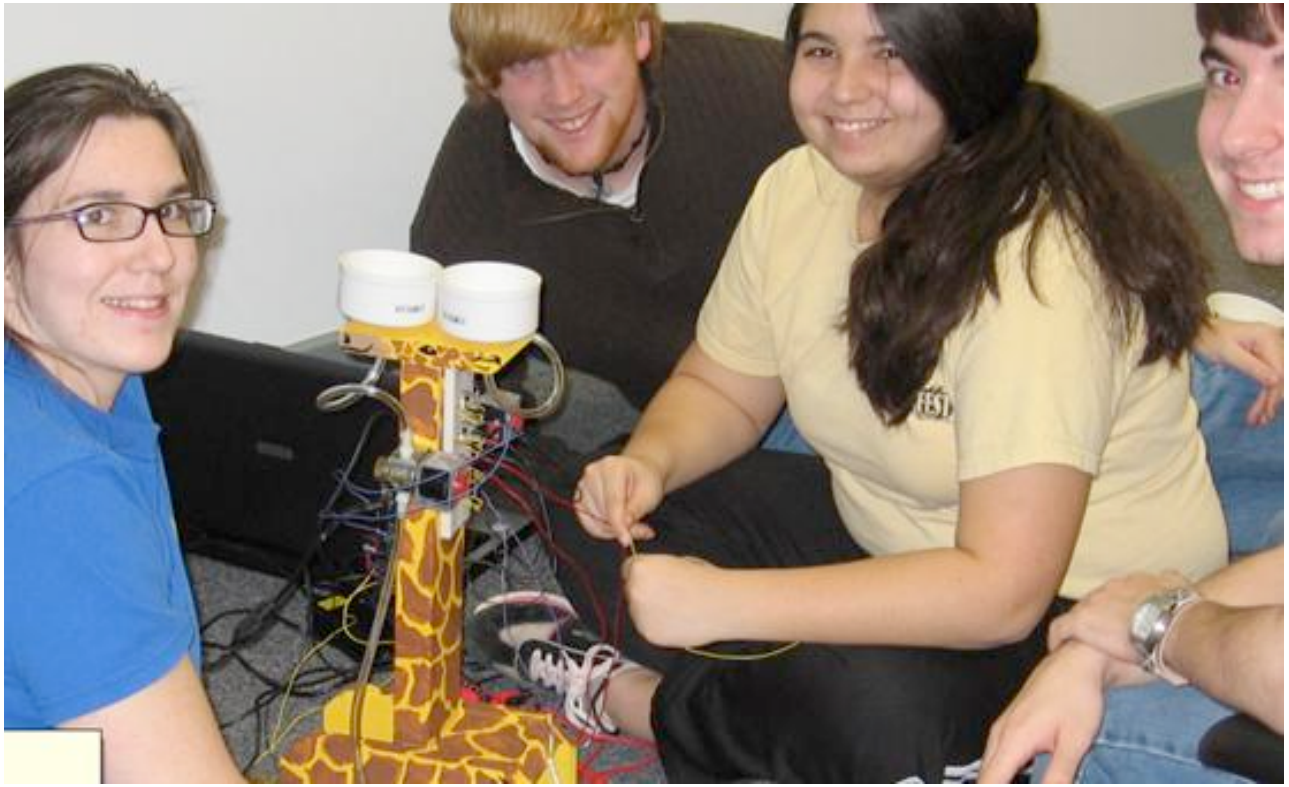


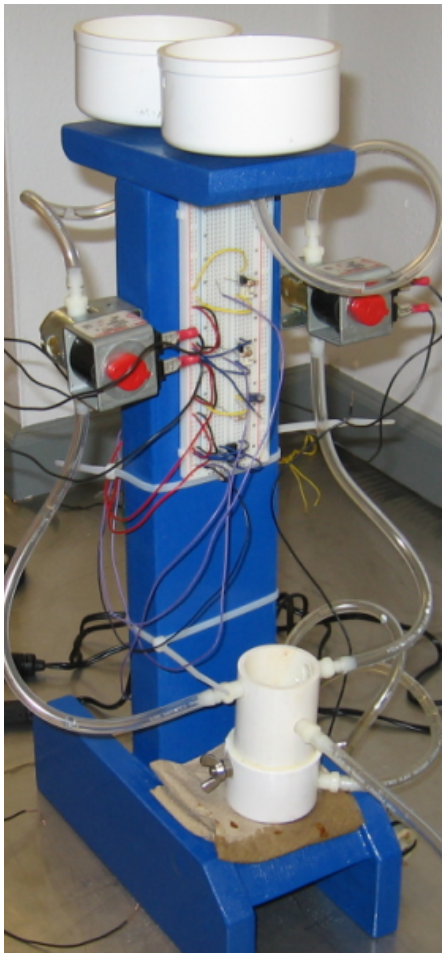
Approximate cost per pump = $3 USD

Two students can fabricate the pump in about 2 hours

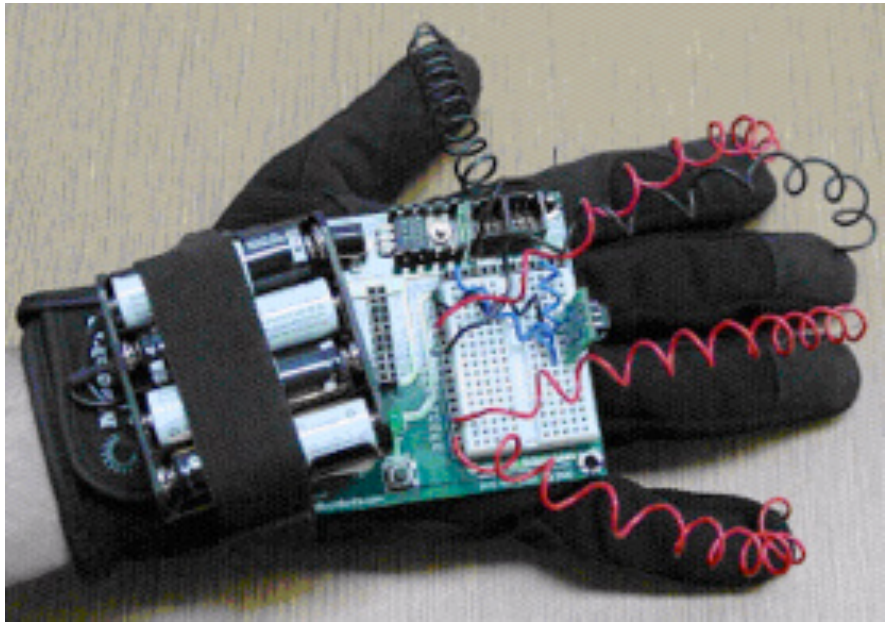
ME 199B Project – The Fishtank

- Closed loop control of temperature and salinity in a small tank
- Teams of 2 initially later turning into teams of 4

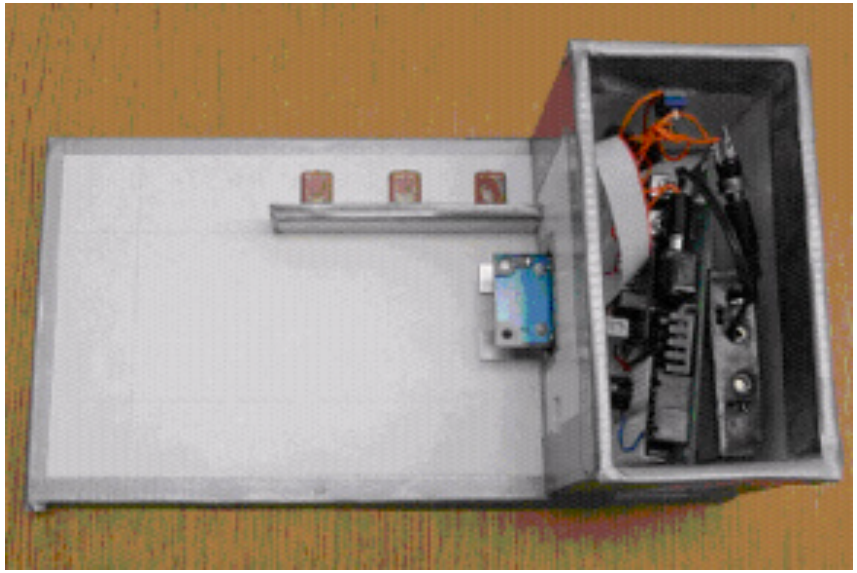




ME 199C – Open Ended Product Design



•Infrared glove remote control



•Currency identification device

ME 199C– Example Design Projects

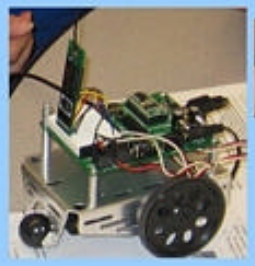
- Musical relaxation fountain
- Smart cane for the visually impaired (compass ultrasonic distance detection)
- RF coasters (transmit signal to waiter when glasses low)
- Automatic flag device
- Light activated window blinds
- Smart duck decoy
- Remote controlled dog
- Pants with built-in infrared sensors
- The friendly flusher – a smart toilet

I hear and I forget.
I see and I remember.
I do and I understand.
Confucius, ~500 BC

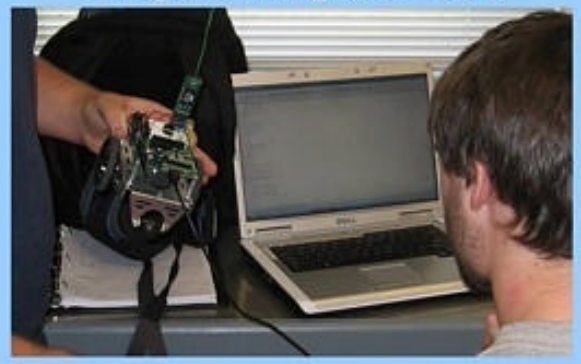
ME 199C – Making RC BOE-Bots

RC Robot Contest

Living WITH the Lab



Programming the Robot



Overview

- Each student group mounted a RF receiver to their Boe-Bot
- The RF receiver was controlled by a keychain remote
- Student groups competed to see who could get through a maze the quickest
- Candy was given to the winner

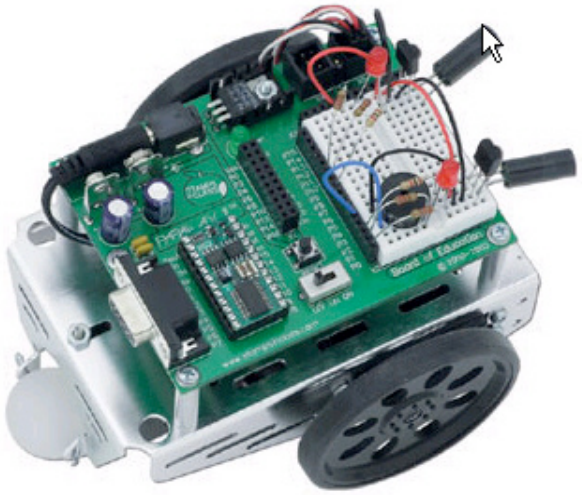
Competing

Living with the Lab – Freshman Engineering Mechanical Engineering Program

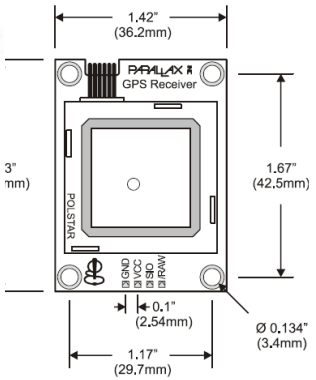
Portland State UNIVERSITY

All students implement these sensors.

- Whisker
- Photoresistors
- IR pairs
- Temperature Sensor
- Conductivity Sensor
- Hall Effect Sensor
- RF Keychain Transmitter and Receiver
- LEDs
- Buzzers
- Switchable Actuators: Pumps, motors, lights, etc.
- Continuous Rotation Servos



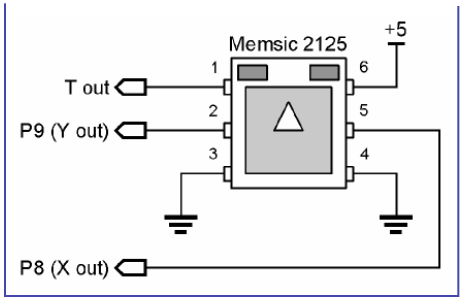
GPS sensor



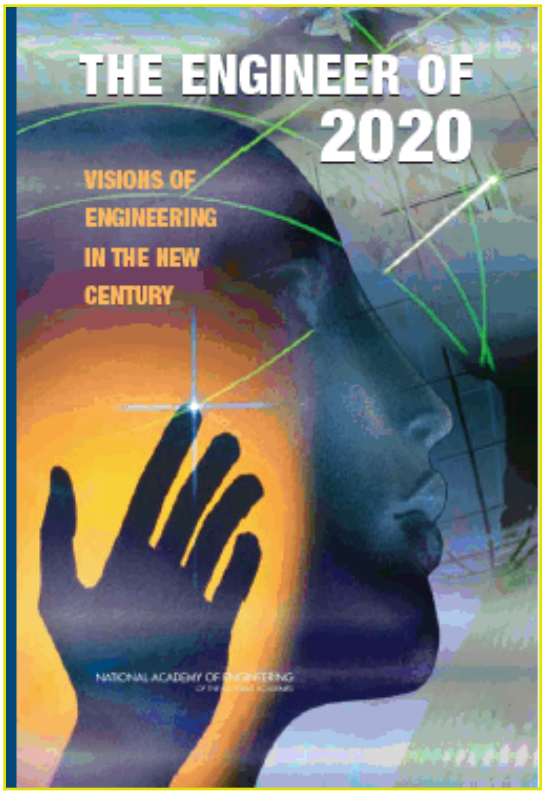
Some students implement these sensors, depending on their chosen project.

- Ultrasonic Range Finder
- Accelerometer
- RF ID Tags and Reader
- GPS Receiver
- Compass
- Force Sensor
- Temperature and Humidity Sensor
- RF Communication Modules (Boe-Bot to Boe-Bot communication)
- Embedded Blue Transceiver Appmod (add Bluetooth capabilities to the Boe-Bot)
- Color Sensor (senses RGB colors at a point)
- CMUcam Vision System
- Limited Rotation Servos
- LCD Display Output

Memsic 2125 Accelerometer



AIM: Implement a fast-paced, threaded curriculum that boosts experiential learning and creates dynamic learners with a can-do attitude.



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