Quantum Leap

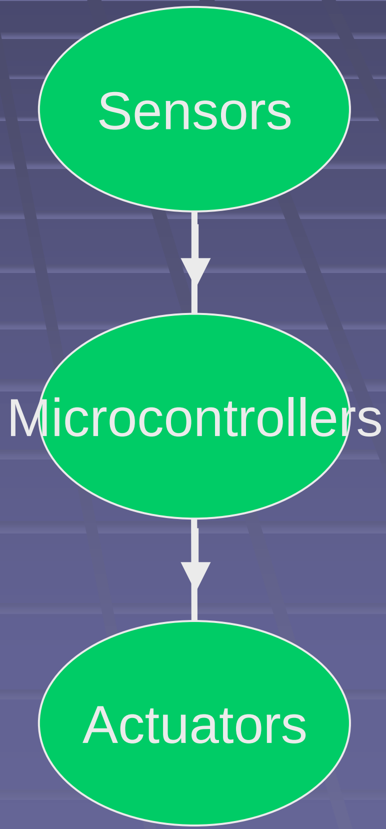
BY: Amanda Gunning and Ram Avni
North Rockland High School
Middle College High School

This work was supported by the National Science Foundation under a RET Site Grant 0227479.

SMART **S**cience and **M**echatronics **A**ided **R**esearch for **T**eachers **2003—2005**

What is Mechatronics?

- Combines various fields of engineering to build “smart” machines



Need for New Instructional Tools

- Modern Physics is abstract
- A plethora of demonstrations for other physics topics
- Hands-on activities engage students

Project Goals

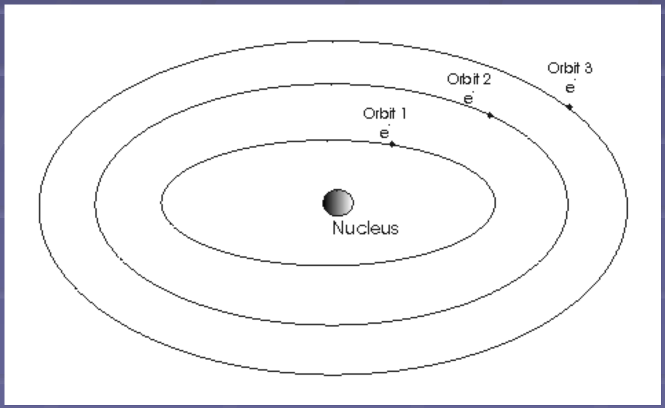
- To address three skills that students learn
- To make the topic interesting and engaging
- To actively involve students

New York Standards

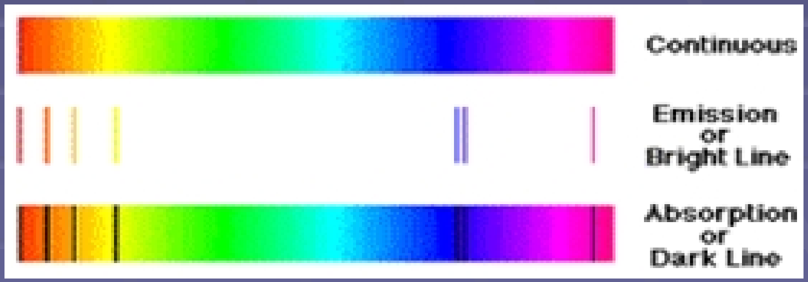
- STANDARD **1—Analysis, Inquiry, and Design.** Mathematical **Analysis**
- STANDARD **4—The Physical Setting**
- STANDARD **6—Interconnectedness:** Common **Themes**
- STANDARD **7—Interdisciplinary Problem** Solving

Theory

- Bohr model
- Absorption and emission spectra

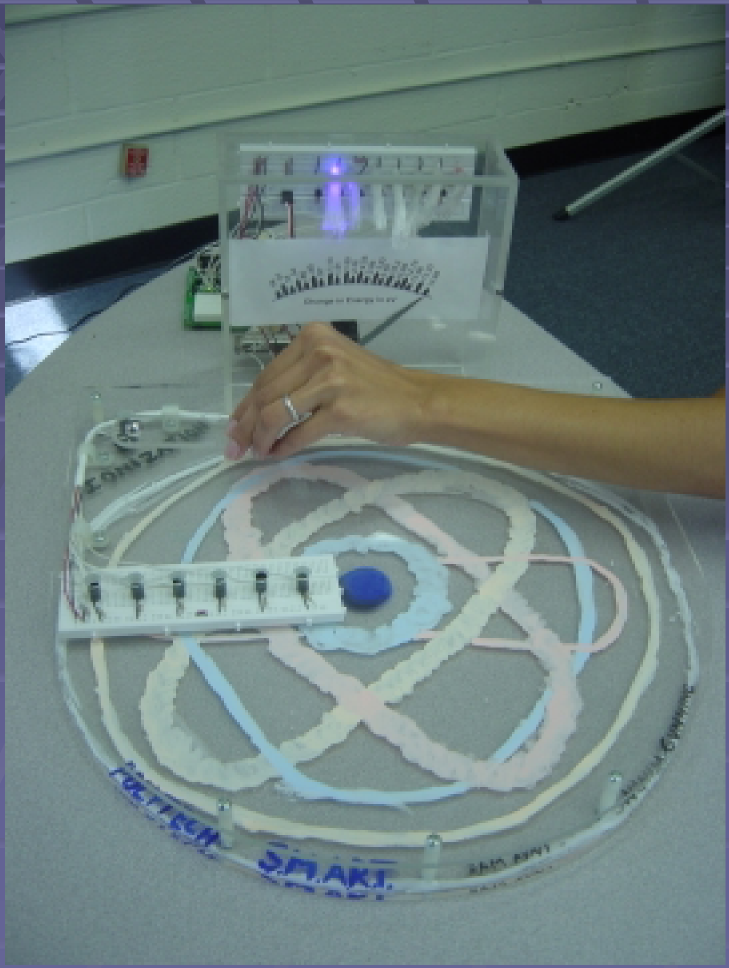


Examples of energy levels proposed by Neils Bohr



Examples of emission and absorption spectra

Quantum Leap



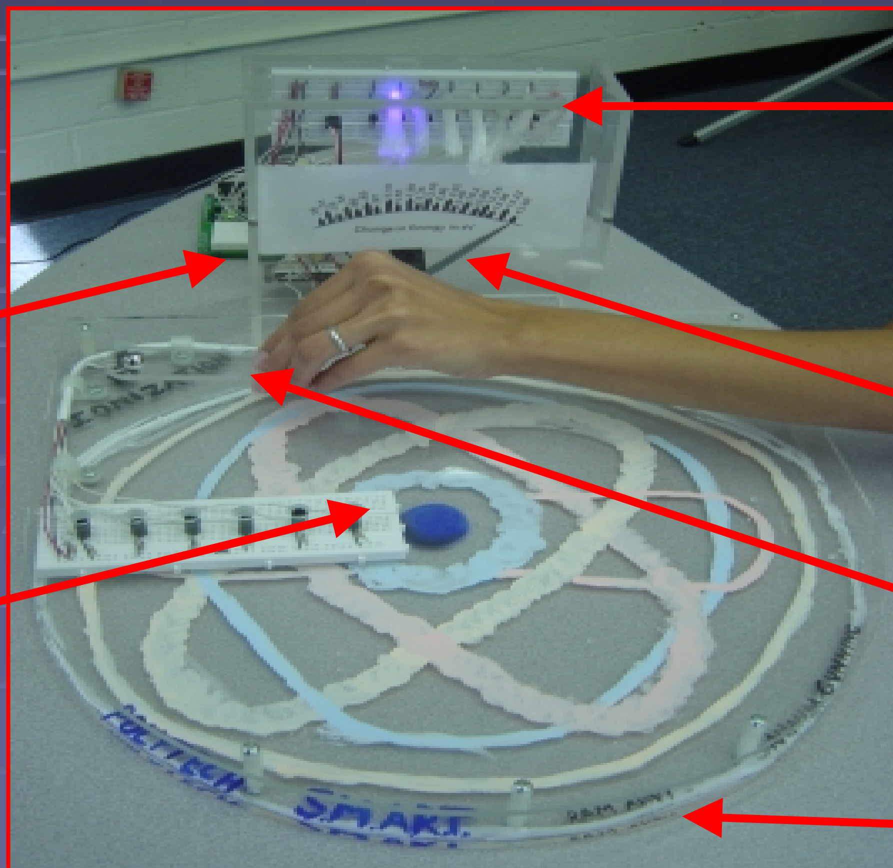
Allows Students to:

- Move the “electron”
- Determine the energy emitted or absorbed
- Determine the related frequency of light
- See the emission or absorption “spectra”

Project Design

- Sensors: photoresistors detect electron location
- Microcontroller: Interpret sensors' output and determines spectra and energy value
- Actuators: LEDs and servo motor receive information from BS2 and display output

Parts and Components



BOE with BS2

Photoresistors

LEDs

Transistors

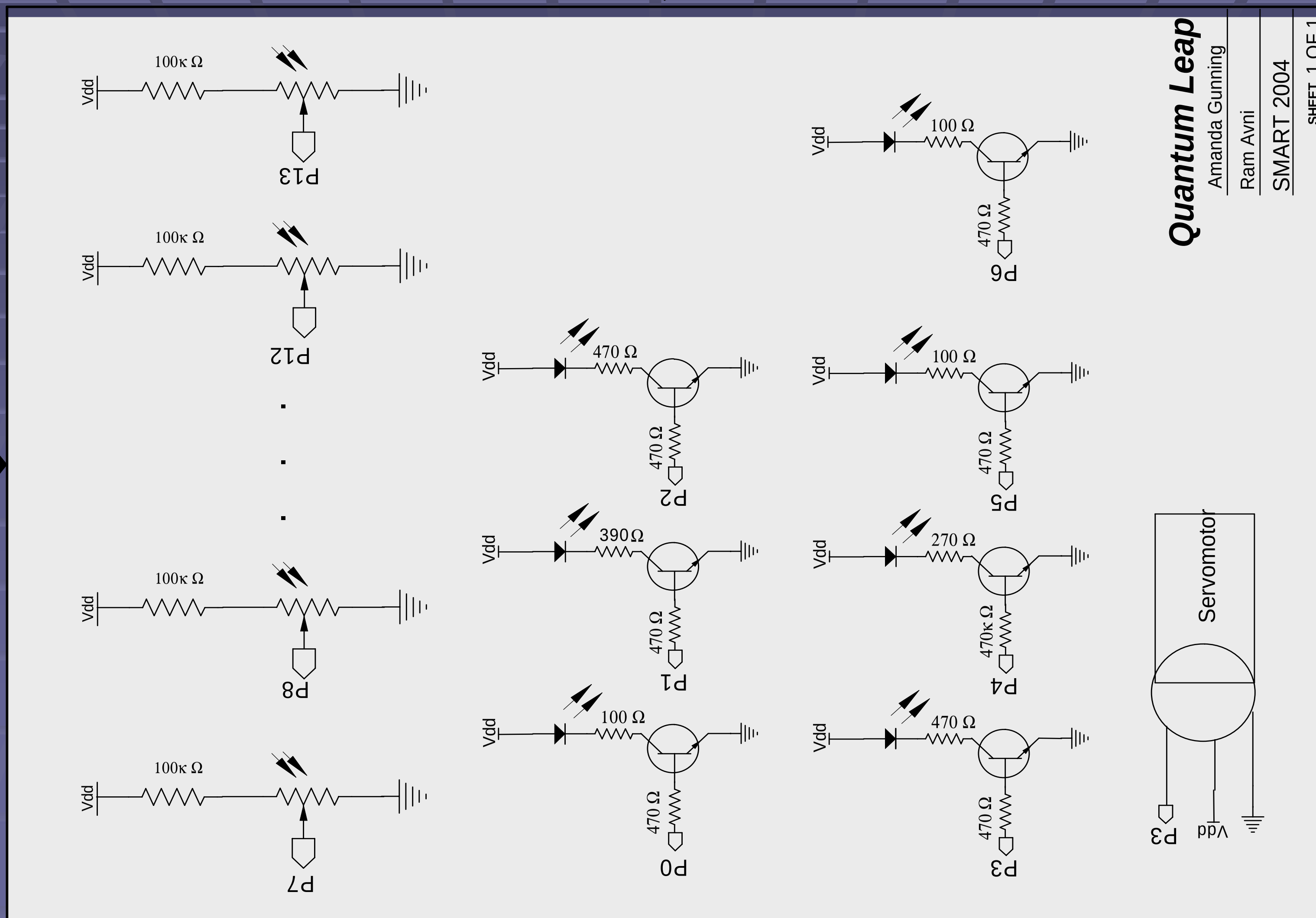
Fiber Optics

Servo Motor

Electron Wand

2 Layers of Plexiglass

Circuit Design



Program Logic

A. Electron Location Detection

B. Calculating Spectra Lines

C. Energy Level Detection

Lesson Plans/Class Activities

- The most stable condition of an electron is called the ________ state.
- Predict whether you would see absorption or emission spectra when an electron moves from n = 2 to n = 4.

Conclusions and Next Steps

- SMART project – extraordinary training tool
- Empowering science teachers and students
- Grants to expand/develop/implement more programs
- Continuous feedback starting October 2004

Acknowledgments

- Polytechnic University
- National Science Foundation
- Professor Kapila
- Sang-Hoon Lee (Nathan)
- Anshuman Panda
- Arthur Nisonov