The RO-BOE-CLOCK
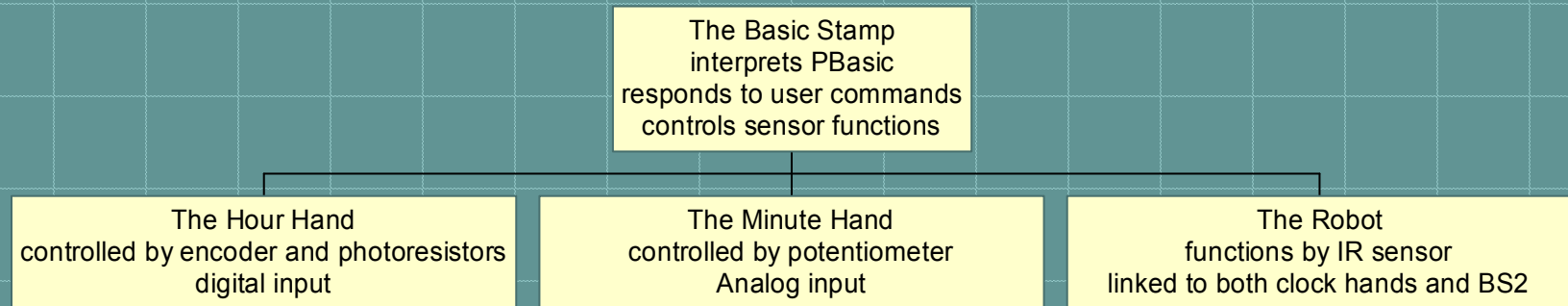
(fusing educational play with

cutting edge technology
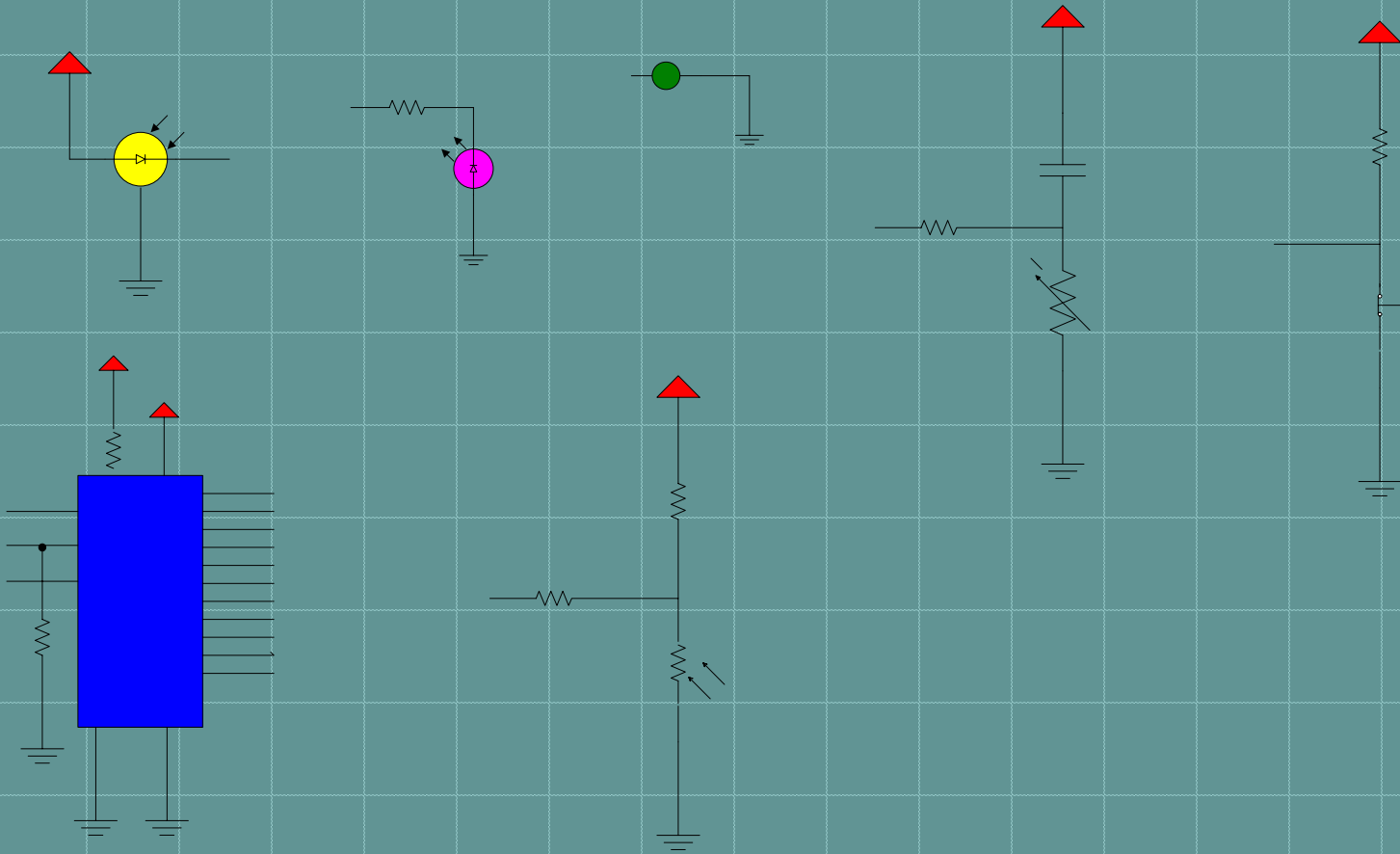
The RO-BOE-CLOCK OBJECTIVE:

- To teach children ages 4-7 how to tell time
- To demonstrate the differences between analog and digital data input
- To seamlessly integrate several sensory devices
- To create a product that introduces the microcontroller to a currently untapped market (children's educational toys)
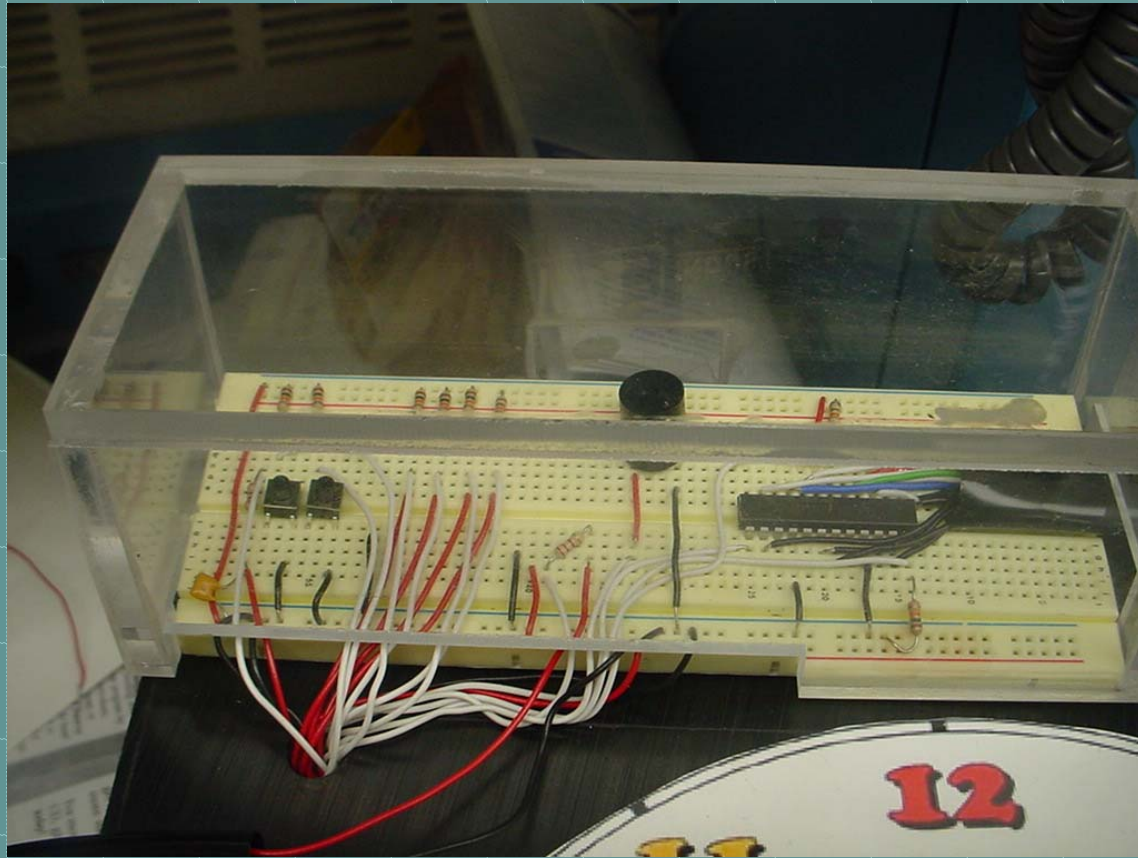
The Elements of the RO-BOE-CLOCK Design

The Basic Stamp
interprets PBasic
responds to user commands
controls sensor functions

The Hour Hand
controlled by encoder and photoresistors
digital input

The Minute Hand
controlled by potentiometer
Analog input

The Robot
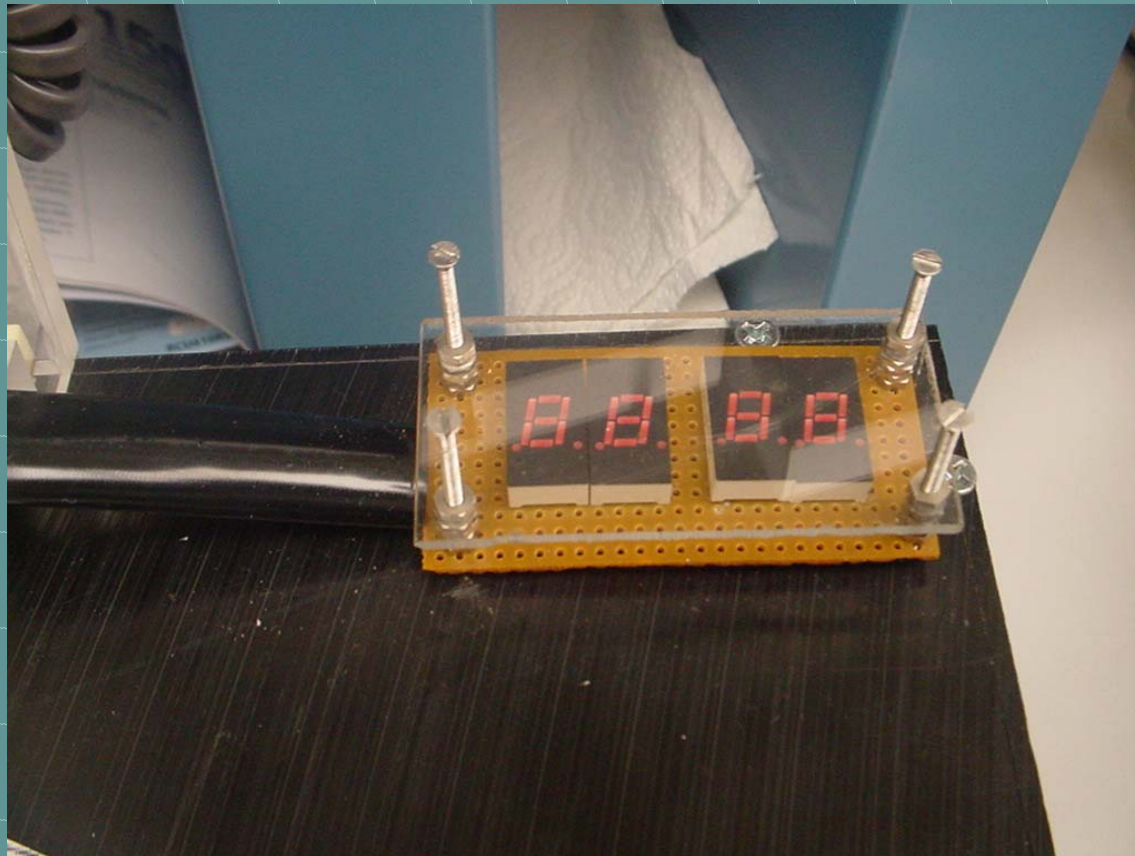functions by IR sensor
linked to both clock hands and BS2

SCHEMATIC DIAGRAMS

+5V

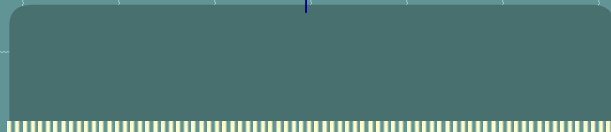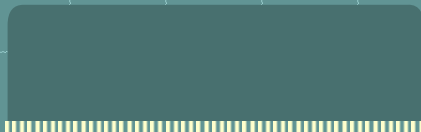Infrared Sensor
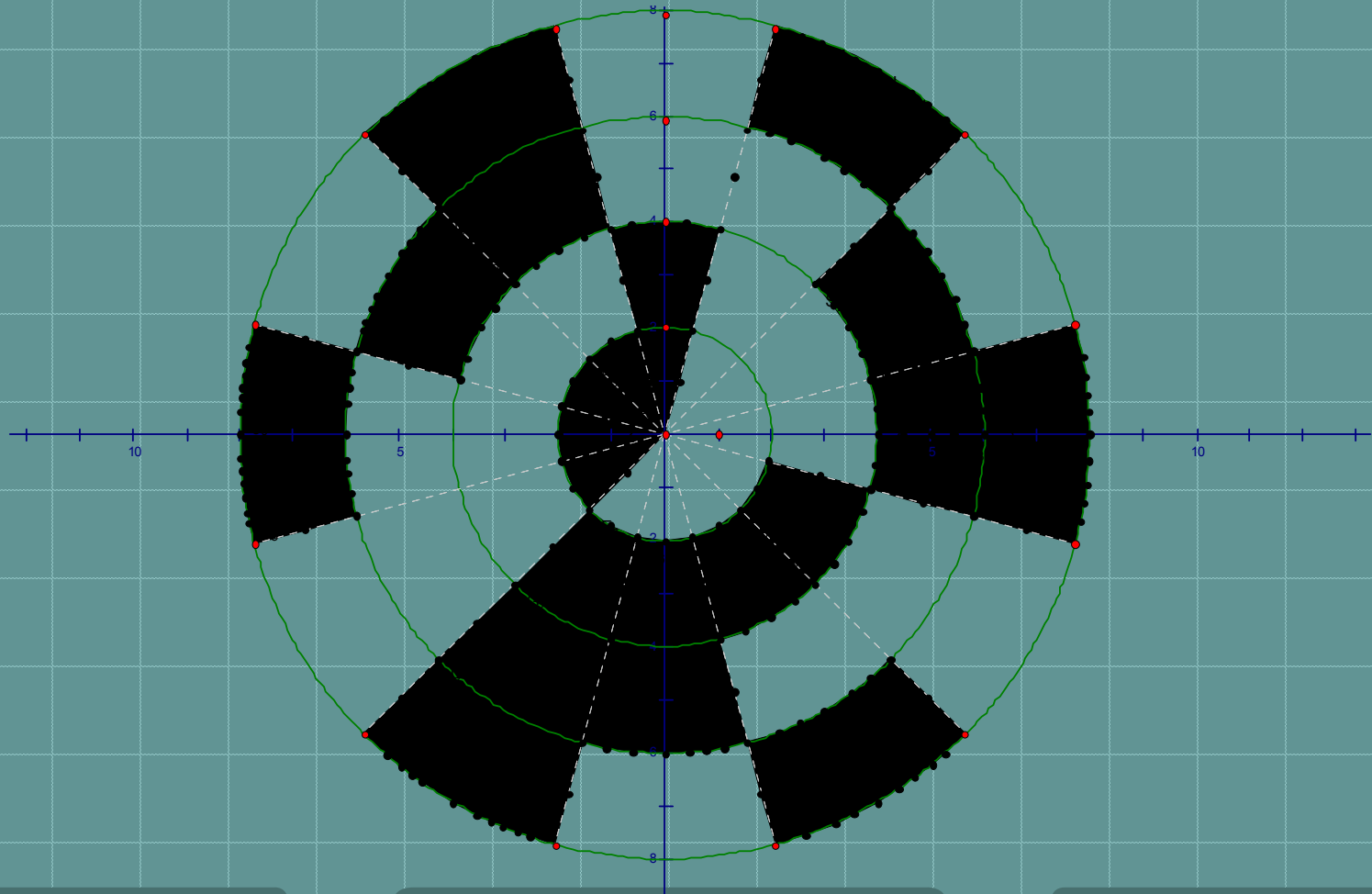on Robot

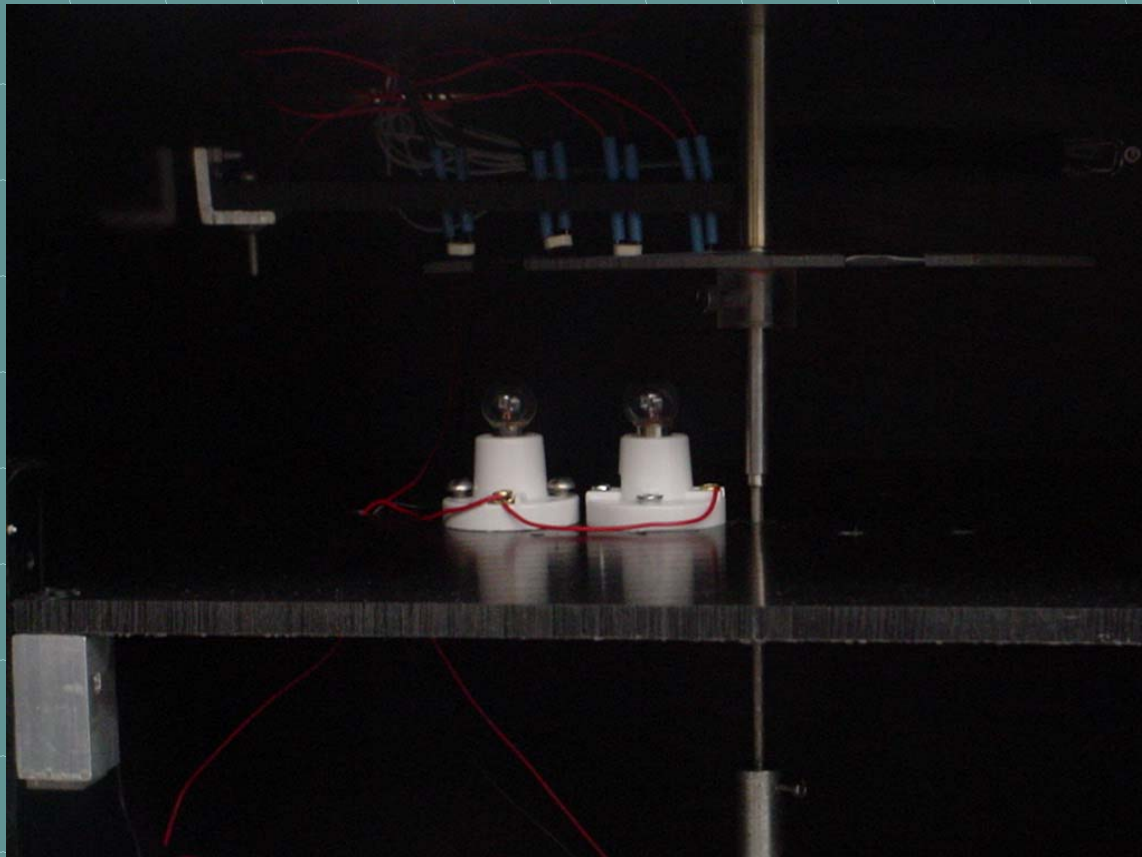# THE WIRED BREADBOARD

THE LED DISPLAY

The Encoder

- ◆ Corresponds to the Hour hand

- ◆ Binary layout

- ◆ Photoresistors are aligned with segments

- ◆ When user moves Hour hand, binary signal is read into BS2 then converted to "time" in hours

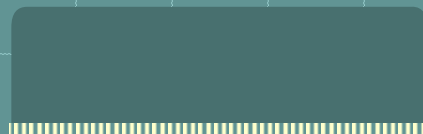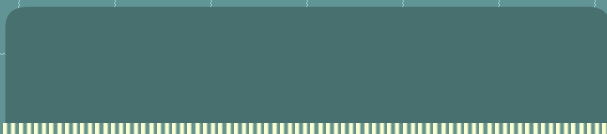The Encoder
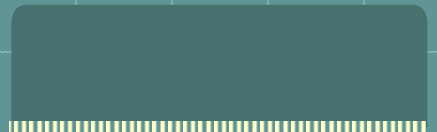
A POOR VIEW OF THE PHOTORESISTORS & BULBS

The Potentiometer

- Continuous variable resistor

- Corresponds to the Minute hand

- Independent of the Hour hand

- BS2 converts analog signal to digital

The Potentiometer on its Shaft
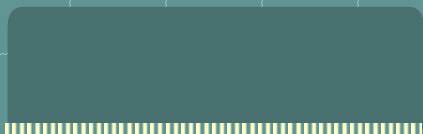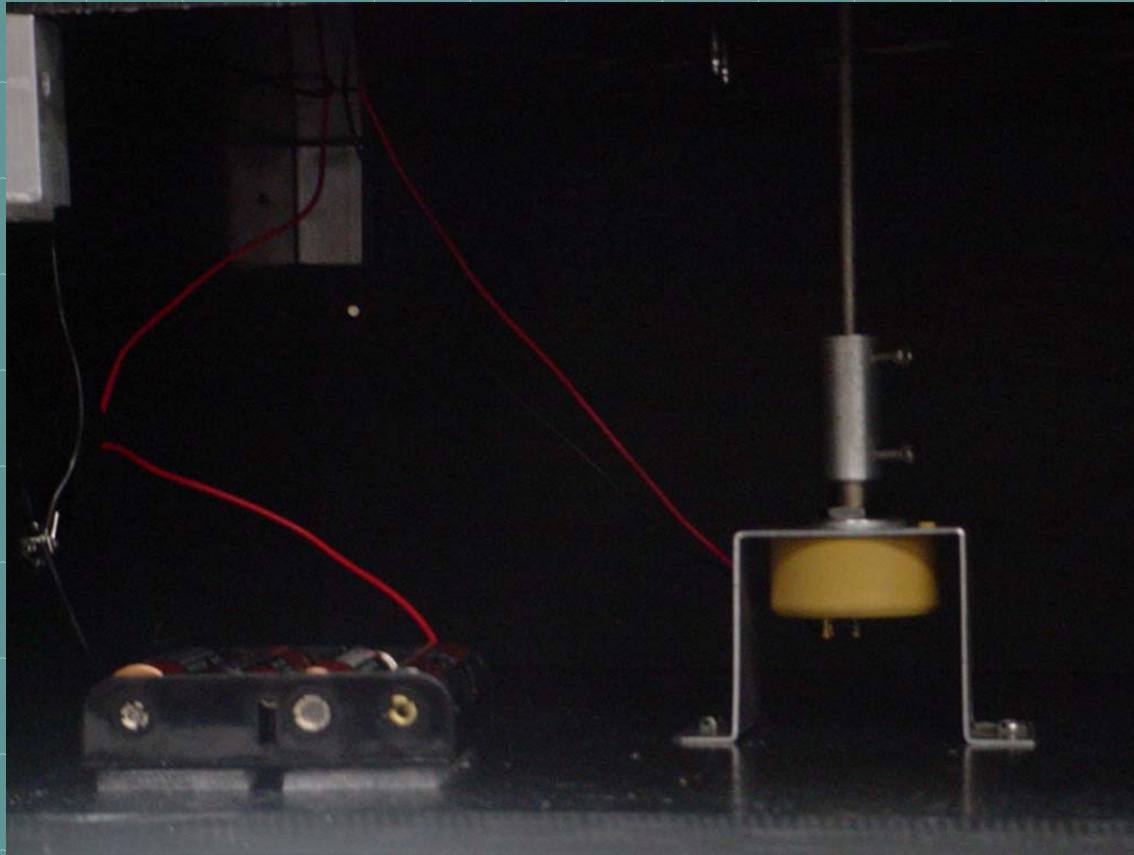
How the RO-BOE-CLOCK game is played:

- ◆ MODE 1:
  - ◇ SET THE HANDS
  - ◇ PRESS THE BUTTON
  - ◇ READ THE LED DISPLAY
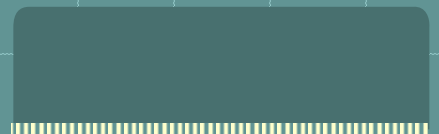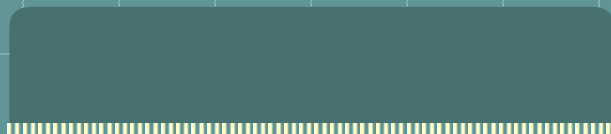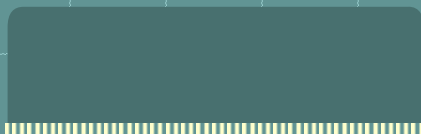
How the RO-BOE-CLOCK game is played:

- ◆ MODE 2:
  - ◆ PRESS THE BUTTON
  - ◆ READ THE LED DISPLAY
  - ◆ SET THE HANDS
  - ◆ PRESS THE BUTTON
  - ◆ "HAPPY" OR "SAD" BUZZER SOUND
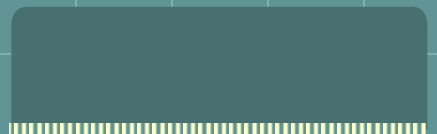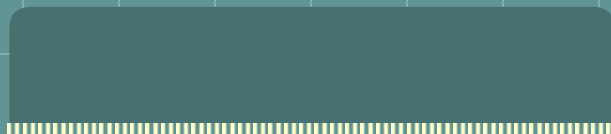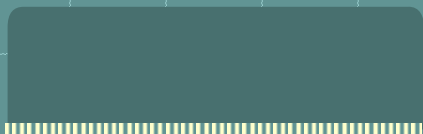
How the RO-BOE-CLOCK game is played:

- ◆ MODE 3:
  - ◇ PRESS THE BUTTON
  - ◇ READ THE LED DISPLAY
  - ◇ SET THE HANDS
  - ◇ PRESS THE BUTTON
  - ◇ BOE-BOT MOVES FORWARD OR BACKWARD

Design Considerations

♦ "Gray" area on encoder

♦ Photoresistor armature composition

♦ Limited IR sensitivity

♦ Encasement size

Product Merits

◆Interactive teaching tool

◆Multi-faceted instruction

◆Exposure to high-tech applications

◆Eliminates computer screen

◆Developmentally appropriate for children

◆Can be inexpensively mass produced

Marketing Plan

- ◆ Partnership with Polytechnic University, Parallax, Inc. and the designers to patent

- ◆ Target market: "yuppie parents", elementary school teachers

- ◆ Multiple modes of use: interchangeable boards, "loadable" programming

- ◆ Sample sales venues: The Sharper Image, FAO Schwartz, Parallax online

EQUIPMENT LIST

COMPONENT	WHY WE USED IT
Board of Education (BOE) with Basic Stamp 2	microcontroller & circuit board from Parallax, Inc.
Binary encoder (twelve regions, four levels)	for the photoresistors to "read" light into binary code
4 photoresistors	respond to the presence or absence of light
1 continuous potentiometer	to adjust position of the minute hand
1 multiplexer	to reduce the # of I/O pins needed to run the LED display
1 IR LED	for two-way communication between the clock and the program
1 LED display	to show the time in hours and minutes
1 on-off switch	to control the light bulbs which power the photoresistors
push buttons	to switch from one game-playing mode to another
several 10K ohm resistors	to limit the current flowing from the power source to individual components
1 microfarad capacitor	part of the R-C circuit that controls the calibration of the potentiometer
2 miniature light bulbs with holders	to provide more direct light so photoresistors will be more sensitive
4 AA batteries with holder	power source for the light bulbs
standard parts for the parallax ro-bot	these include 2 servo-motors, another BS2, IR sensors/emitters, etc
wires of various lengths	for making complete circuits between components
1 15-pin data port	to transfer the P-basic program from the computer to the microcontroller
1 speaker	to make a programmed "win" or "lose" sound
1 IR emitter	for two-way communication between the clock and the program

ACKNOWLEDGEMENTS

- Dr. Vikram Kapila and Polytechnic University
- Sang-Hoon (Nathan) Lee
- Yan Fang (Yvonne) Li
- Hong Wong
- Alex Betti (our unsung hero!)
- All of the Mechatronics graduate students
- Parallax, Inc.
- The National Science Foundation
- Each other and the rest of the inaugural SMART class!!