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

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♦ Hong Wong
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♦ The National Science Foundation
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