A Spoke-Wheel Based Wall-climbing Robot

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Purpose of the Gecko

- Vertical Climbing Robot
  - Walls
  - Ceilings
  - Terrain
- Demonstrate Gecko Principle on Robots
- Cheap
Other Wall Climbing Methods

- Suction Cups
- Vacuums
- Magnetism
Advantages of the Gecko

- No power source for adhesion
- Non-Magnetic
- Quiet
- Cheap
- Fast to construct
- Easily adaptable
Downfalls of the Gecko

- Limited weight
- Limited height
- Tape gets dirty
- Leaves sticky residue
What is a Gecko?

- A lizard
- Able to climb vertical and inverted surfaces
- Able to climb in vacuums.
- Special Feet with small hairs
Do not get confused.

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– Susan L.
Bear, DE
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How the robot climbs

- Wheel with legs
- Tape
Ways to Improve

• New adhesion method
• Method to clean tape
• Method to retract tape
Applications

- Space robotics
- Window washers
- Rescue Robots
Components

- 2 x Parallax Servos
- Basic Stamp 2 board
- Gears
- 4 x Gecko wheels
- Lego Roll wheel
- Lego components.
# Parallax Stamp 2 Microcontroller

<table>
<thead>
<tr>
<th>Released Products</th>
<th>BS2e-IC</th>
<th>BS2p24-IC</th>
<th>BS2px-IC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Package</td>
<td>24-pin DIP</td>
<td>24-pin DIP</td>
<td>24-pin DIP</td>
</tr>
<tr>
<td>Package Size (L x W x H)</td>
<td>1.2&quot;x0.6&quot;x0.4&quot;</td>
<td>1.2&quot;x0.6&quot;x0.4&quot;</td>
<td>1.2&quot;x0.60&quot;x0.4&quot;</td>
</tr>
<tr>
<td>Environment</td>
<td>0° - 70°C* (32° - 158° F) **</td>
<td>0° - 70°C* (32° - 158° F) **</td>
<td>0° - 70°C* (32° - 158° F) **</td>
</tr>
<tr>
<td>Processor Speed</td>
<td>20 MHz</td>
<td>20 MHz Turbo</td>
<td>32 MHz Turbo</td>
</tr>
<tr>
<td>Program Execution Speed</td>
<td>~4,000 instructions/sec.</td>
<td>~12,000 instructions/sec.</td>
<td>~19,000 instructions/sec.</td>
</tr>
<tr>
<td>RAM Size</td>
<td>32 Bytes (6 I/O, 26 Variable)</td>
<td>38 Bytes (12 I/O, 26 Variable)</td>
<td>38 Bytes (12 I/O, 26 Variable)</td>
</tr>
<tr>
<td>Scratch Pad RAM</td>
<td>64 Bytes</td>
<td>128 Bytes</td>
<td>128 Bytes</td>
</tr>
<tr>
<td>EEPROM (Program) Size</td>
<td>8x2K Bytes, ~4,000 inst.</td>
<td>8x2K Bytes, ~4,000 inst.</td>
<td>8 x 2k Bytes, ~4000 inst.</td>
</tr>
<tr>
<td>Number of I/O pins</td>
<td>16 +2 Dedicated Serial</td>
<td>16 +2 Dedicated Serial</td>
<td>16+2 Dedicated Serial</td>
</tr>
<tr>
<td>Voltage Requirements</td>
<td>5 - 12 vdc</td>
<td>5 - 12 vdc</td>
<td>5 - 12 vdc</td>
</tr>
<tr>
<td>Current Draw @ 5V</td>
<td>25 mA Run / 200 µA Sleep</td>
<td>40 mA Run / 350 µA Sleep</td>
<td>55 mA Run / 450 µA Sleep</td>
</tr>
<tr>
<td>Source / Sink Current per I/O</td>
<td>30 mA / 30 mA</td>
<td>30 mA / 30 mA</td>
<td>30 mA / 30 mA</td>
</tr>
<tr>
<td>Source / Sink Current per unit</td>
<td>60 mA / 60 mA per 8 I/O pins</td>
<td>60 mA / 60 mA per 8 I/O pins</td>
<td>60 mA / 60 mA per 8 I/O pins</td>
</tr>
<tr>
<td>PBASIC Commands</td>
<td>45</td>
<td>61</td>
<td>63</td>
</tr>
<tr>
<td>PC Programming Interface</td>
<td>Serial Port (9600 baud)</td>
<td>Serial Port (9600 baud)</td>
<td>Serial Port (19200 baud)</td>
</tr>
<tr>
<td>Windows Text Editor</td>
<td>Stampw.exe (v1.096 and up)</td>
<td>Stampw.exe (v1.1 and up)</td>
<td>Stampw.exe (v2.2 and up)</td>
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</tbody>
</table>
Compared to the QSK62P

<table>
<thead>
<tr>
<th>Released Products</th>
<th>BS2px-IC</th>
<th>QSK62P (M16C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processor Speed</td>
<td>32 MHz Turbo</td>
<td>24 MHz</td>
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<tr>
<td>Total Memory</td>
<td>8 x 2k Bytes+38 Bytes + 128 Bytes</td>
<td>384 Kbytes</td>
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<tr>
<td>Voltage Requirements</td>
<td>5 - 12 Vdc</td>
<td>5 Vdc</td>
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<tr>
<td>Current Draw @ 5V</td>
<td>55 mA Run / 450 μA Sleep</td>
<td>14 mA Run / 1.8 μA Wait Mode</td>
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<tr>
<td>A/D Converters</td>
<td>0</td>
<td>8</td>
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<td>D/A Converters</td>
<td>0</td>
<td>2</td>
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<tr>
<td>LCD</td>
<td>No</td>
<td>Yes</td>
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<td>Price</td>
<td>$79</td>
<td>$55</td>
</tr>
</tbody>
</table>
Uses of a Stamp 2

• Digital Input and Output from pins.
  • A/D
  • D/A
  • Communication
  • Motors

• Perform Calculations
See a Stamp Board
Performance of the Gecko

Success

• Wall Movement
  • Vertical
  • Horizontal
  • Rotation
• Ceiling Suspension
• Transition between floor and wall

Failure

• Fall after use
Conclusion
References