The First Portable Sonos Speaker

Sonos speakers allow users to stream audio from a home WiFi network to a home speaker system. Our product, the Sonos MOVE, is a modified version of the Sonos Play:1 that can be used outside, without external power or connection to a home WiFi network. It features a handle with a power button and a bottom-mounted removable Electronics Pack which houses batteries, a heatsink, power electronics, an LED strip, and WiFi and 4G LTE modules with antennas. The Electronics Pack mounts to the speaker with an innovative, omnidirectional twist lock interface.

Operating Procedure

1. Charge the Electronics Pack
2. Attach the Electronics Pack to the Play:1
3. Hold the power button for 5 seconds
4. Control the speaker with the Sonos app
5. Tap the power button to see the level of remaining battery level
6. Enjoy your uninterrupted music for hours

<table>
<thead>
<tr>
<th>Original Criteria</th>
<th>Accomplished?</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 Hour Battery Life</td>
<td>✔️</td>
</tr>
<tr>
<td>50 ft. WiFi Range</td>
<td>✔️</td>
</tr>
<tr>
<td>IPx4 Rating for Electronics Pack</td>
<td>✔️</td>
</tr>
<tr>
<td>Less than 4 hours for 90% battery recharge</td>
<td>✔️</td>
</tr>
<tr>
<td>Internal Electronics Operating Temperatures within 5-70°C</td>
<td>✔️</td>
</tr>
<tr>
<td>External Operating Temperature below 44°C</td>
<td>✔️</td>
</tr>
<tr>
<td>Total product weight under 5 lbs.</td>
<td>✔️</td>
</tr>
</tbody>
</table>

Capstone Team

Electrical Engineering: Saam Maroofi, Sean McCotter, Paige Sullivan, Bradley Hall, Nathan Wu
Mechanical Engineering: Thomas Mannell, Brayden Levy, Sam Fagrey, James Harrison, Patrick Mossman
UCSB: Ilan Ben-Yaacov, Tyler Susko, Steve Laguette, Ted Bennett, Trevor Marks, Yoganda Isukapalli, Ekta Prashnani, Madeline Dippel, Andy Weinberg, Roger Green
Sonos: Nathan Pike, Camille Zaba, Jennie Block, Gregorio Tellez, Arvin Faruque, Farhad Mirbod, Vicki Chen
Laritech: Bill Larrick, Veronica Ellias, Lillian Ware, Kristen Bradley, Jon Young
SONOS MOVE

Design Overview

1. Handle/Top Cap
   - Created to emphasize the portability of the Sonos MOVE
   - Buzz-free, comfortable, and attractive
   - Original play/pause and volume buttons
   - Power/battery life indicator button

2. Latching Mechanism
   - Connects the Electronics Pack to the speaker with a 45° twist
   - Tabs provide tactile feedback to confirm connection
   - Omnidirectional connection

3. Contact Assembly
   - Electrically connects the bottom enclosure to the speaker with gold-plated pogo pins
   - The pins carry power, ground, and a power button signal in four locations
   - DC Power Jack for charging batteries
   - Gaskets for water resistance

4. Battery Assembly
   - 4 lithium-ion batteries
   - Battery management system for safe operation
   - Balance board ensures proper charging

5. Enclosure
   - Mounts the battery pack, heat sink, power board, WiFi/LTE modules, antennas and LEDs
   - Protects from dust/water

6. Heat Sink
   - Aluminum heat sink coupled to power board via thermal pads

7. Power Board
   - Highly efficient switch mode power supply
   - Digitally controlled load switches
   - Integrated battery charging circuit
   - Voltage quantizer for battery monitoring

8. WiFi/LTE Modules and Antennas
   - LTE module
   - On board WiFi hotspot
   - Music streaming capability

9. Charge Indicator
   - Omnidirectional LED ring
   - Displays color ring of green, yellow, or red light, representing high, medium, and low battery life, respectively

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Acknowledgments
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