FitNest is a revolutionary, in-home system that provides physical therapy to infants at risk of developing cerebral palsy. Due to insurance limitations, therapy is usually only provided for 30 minutes a week. This system uses a motorized tilting platform and a half exercise ball to replicate “tummy-time ball therapy” which stimulates critical muscle engagement and postural development. FitNest also features a rotating overhead toy mobile and a capacitive touch button box to encourage muscle activation and stimulate interest.

**Background**

- Cerebral palsy (CP) is a muscle impairment disorder that affects motor function, muscle tone, and posture
- Increasing regular exposure to physical therapy has shown promising results in rehabilitation.
- Neuroplasticity, which peaks during infancy, is the brain’s ability to develop and learn. Providing infants with early therapy strengthens this ability.

**Overview**

FitNest Testing

- Therapy Session
  - Test 1
  - Test 2
  - Test 3
  - Reaches for toys
    - 1
    - 4
    - 50
  - Tummy Time (w/out crying)
    - 2:21
    - 6:32
    - 21:04
  - Improved time spent in prone without crying after 3 tests
  - Physical therapists confirmed helpful engagement of key postural muscles during therapy

**Final Design**

**Systems Breakdown**

**Safety Harness Load Testing**

<table>
<thead>
<tr>
<th>Test</th>
<th>Failure Load</th>
<th>Failure Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strap to Strap</td>
<td>424 lbs</td>
<td>Stitching</td>
</tr>
<tr>
<td>Steel Ring</td>
<td>491 lbs</td>
<td>Webbing</td>
</tr>
<tr>
<td>Sewn Buckle</td>
<td>72 lbs</td>
<td>Buckle</td>
</tr>
</tbody>
</table>

**Interactive Button Box**
Custom toy for babies at risk
- Capacitive touch
- Customized sounds, lights, and graphics

**Cylindrical Tilt Platform**
Padded aluminum platform for prone or seated infant
- Clip-on safety harness
- Button box toy inside
- Removable / washable cushions

**Tilt Mechanism**
Two DC linear actuators coupled with u-joints
- Max Speed: 26 deg/sec
- Thrust Capacity: 560 lbs
- Max Tilt Angle: 30 deg

**Overhead Structure**
Designed to rotate a mobile overhead with hanging toys
- Manual or continuous rotation with speed control

**Controls**
Control panel and electronics box allow user to control the tilt with a joystick
- Bluetooth connected app allows user to control device from their phone

**Custom Harness and Chair**
Interchangeable bosu ball and chair for prone and seated positions
- Harness safety factor of 3.6
- Adjustable for 6mo - 2yr olds

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