**User Needs**

When approached by our client, the main problem was falling and not being able to get back up or call for help. Based on research and the interview this was a fear among many elderly patients. This issue will be solved first by gathering information about the average senior citizen as well as statistics about how many people fall.

**Needs Served:**
- Alerts emergency services or contacts automatically when client falls
- Option to cancel alert in case of false alarm
- Comfortable enough to wear on a daily basis
- Weight
- Ability to use in shower
- Long lasting power source
- Affordable
- Device should last 2 years
- Easy to use
- Detects fall

**Goals and Constraints**

- Rechargeable Weekly for 4-6 hours
- Easy to use
- User interface with the device
- Attaching the device to the patient
- Canceling false alarm
- Easily wearable
- Affordable - $100
- Lightweight <100g
- Water resistant to at least 5 feet for 1 hr
- Uses a system fail safe
- Radius of radio signal - 600 ft to the landline
- A component that can detect instantaneous changes in movement

**Design Development**

- **Accelerometer & Gyroscope**
  - Detects rapid acceleration
  - Detects Magnitude of Motion
- **Heart Rate Monitor**
  - Present Before
  - No input from Heart Rate Monitor
  - No input from Button
  - Fall Detection
  - Make Call
  - Check Heart Rate Monitor Again

**Design Output**

- Top and side view of casing
  - Top View of Bands

**Design Verification**

<table>
<thead>
<tr>
<th>Component</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arduino Uno [1]</td>
<td>$24.95</td>
</tr>
<tr>
<td>Breadboard[2]</td>
<td>$4.97</td>
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<tr>
<td>Pulse Sensor[3]</td>
<td>$3.97</td>
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<tr>
<td>Berry IMU Accelerometer/Gyroscope/Altimeter * [4]</td>
<td>$25</td>
</tr>
<tr>
<td>IO pins [5]</td>
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</tr>
<tr>
<td>IO pin header [5]</td>
<td>$5</td>
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<tr>
<td>Solder [6]</td>
<td>$15</td>
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<tr>
<td>4.7 kΩ Resistors [8]</td>
<td>$5.77</td>
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<tr>
<td><strong>Total</strong></td>
<td>$96.65*</td>
</tr>
</tbody>
</table>

*Since custom-boarding after creating the prototype will be pricey due to the size, it is estimated that the total price when creating the actual device will be 2 to 3 times this price.

**Design Review**

A list of specific changes or additions to the device were put together based on all of the feedback given. The list is as follows:

- **Heartbeat Sensor**
  - Specifically, when the device doesn’t detect a heartbeat, whether it is due to the device being dropped or the user not having a heartbeat
- **Accelerometer**
  - Specifically, what will constitute as a “fall” and what doesn’t constitute as a “fall”
- **Raspberry Pi Chip**
  - Integration of all the systems to work together with the operating system

**References**