Abstract

Many spinal cord injury (SCI) patients are confined to using a wheelchair for mobility. Propelling wheelchairs manually is a difficult task in rainy circumstances due to several factors. A protective, retractable canopy was proposed to attach to manual wheelchairs in order to provide protection from the rain and allow users to propel their chair during rain.

Introduction

Spinal cord injury (SCI) occurs as a result of damage to the spinal cord region. Patients are generally left with limited mobility depending on the region of the spine injured and may require the use of a mobility assistive device. Up to 31% of SCI patients may require the use of a manual wheelchair [1-4]. Due to a regular umbrella being unsuitable for these patients, users are forced to wait out the rain or travel in the rain. In the case of the former, quality of life is reduced. In the latter, moisture buildup combined with friction from sitting for an extended period could contribute to the development of comorbidities that SCI patients are already at increased risk for such as pressure sores.

Design Specifications

Design specifications were created considering comments from participants at the Miami Project; foremost that the design be portable, easily assembled at a moment’s notice, lightweight and not impair their ability to propel the chair.

Method I Design I Analysis

Retractable canopy design was developed by integrating and modifying a pre-existing canopy on an extended, hinging frame to provide the ability to fold into a smaller size.

- Paddle clips connect the product to the wheelchair seat frame.
- Opening in the side of the fabric with protruding plastic sleeves provide ability to use arms to move wheelchair.

Results

Results were simulated for several tests including user protection and assembly time.

User Protection

<table>
<thead>
<tr>
<th>Rain Type</th>
<th>Average % Wet with Device Without Prior Knowledge (s)</th>
<th>Average % Wet with Device With Prior Knowledge (s)</th>
<th>% Change in Wetness Due to Device Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light</td>
<td>77</td>
<td>69</td>
<td>10.4</td>
</tr>
<tr>
<td>Moderate</td>
<td>70</td>
<td>61</td>
<td>13.6</td>
</tr>
<tr>
<td>Heavy</td>
<td>70</td>
<td>62</td>
<td>11.2</td>
</tr>
</tbody>
</table>

Assembly Time

<table>
<thead>
<tr>
<th>Assembly Time Without Prior Knowledge (s)</th>
<th>Assembly Time With Prior Knowledge (s)</th>
<th>Average Assembly Time Without Prior Knowledge (s)</th>
<th>Average Assembly Time With Prior Knowledge (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>204.24</td>
<td>158.84</td>
<td>174.79</td>
<td>160.3</td>
</tr>
</tbody>
</table>

Conclusion

There is a large gap in the market for a device in this need area, and the quality of life of manual wheelchair users could be significantly improved. Physical construction and testing were not able to be completed, but the device is expected to function successfully.

Acknowledgments

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References


