Concept Designs – Scope

**Team Mobitronic (13): Project:** Portable Lifting Device

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# **Airbag Solution Concept Design**

* Air-Bag Lifting mechanism will be connected to the client’s wheelchair from the back using connecting rods. The lifting device will contain a circular airbag that will be meshed between two platforms as shown below.
* The Air-Bag lifting capacity is more than sufficient to carry the patient. The Air-Bag will be inflated whilst the patient is seated using an Electric Pump that will be actuated by the patient using a toggle switch to pump and another to deflate.
* Transfer from surface to surface will be facilitated by the inclusion of hand-rails on either side of the top platform as depicted.
* Example air bag:

http://12.188.149.117/categories/lifting\_air\_bags/lowmedliftbags.aspx

|  |  |
| --- | --- |
| Advantages | Disadvantages |
| Robust to hold weight of patient | Weight (Heavy) – Due to Electric Pump and Air Bag (Weight:Lifting Capacity Ratio) |
| Transported using wheelchair (Has wheels) | Not Hand-Portable – Will weigh more than 13kg |
| Electrically Operated (Electric Pump and Switches) – Easy to use and operate | Requires minor modification to wheelchair (Latch to connect lifting device) |
| Gradual raising of patient (not jolty) |  |

# **Alternative Hydraulic/Mechanical Concept Design (Hydraulic Jack)**

* Hydraulic Jack used between two platforms to raise and lower the client to the specified heights of a wheelchair (500mm) and a kayak (350mm).
* Hydraulic Jack will be manually operated to raise and lower the platform by the patient. This doesn’t necessarily require much effort.
* The lifting device can in this case be smaller in dimensions, this will reduce the weight due to negating the electric pump and batteries from the design above.
* The topology of the design will be the similar to the air-bag lifting device in that it will be dragged behind the wheelchair and attached using a latch.

|  |  |
| --- | --- |
| Advantages | Disadvantages |
| Lightweight Design | Hand-Operated (Manual Operation) |
| No external accessories such as a pump or heavy materials | Requires minor modification to wheelchair (Latch to connect lifting device) |
| Cheap and easy to operate, Height easily controlled |  |
| Transported using wheelchair |  |

**Airbag Proof of Concept – Testing**

* We will be purchasing an inflatable mattress/airbag to simulate the effects and dynamics of raising and lowering the patient from deflation (once the patient is seated) to inflation.
* We will find a suitable pump to use within this experiment to provide enough pressure to lift the patient based on the specifications provided and to the required heights.
* This is just an experiment to determine the pressure required lift the patient.

**Concept Designs – Specifications/Needs**

The following specifications and functional requirements below are based on approximate values and are here to provide an indication and to accentuate the above advantages and disadvantages of each concept design.

|  |  |  |
| --- | --- | --- |
|  | Airbag Concept Design | Hydraulic Concept Design |
| Weight (kg) | Gross Weight: ~15kg  AirBag: 7kg  Electric Pump: 3.9kg  Batteries: 2kg  Extras: 3kg | Total Weight: >5kg |
| Costs ($) | $2,500 | $300 |
| Size (mm) | 800 x 600 x 250 | 600 x 600 x 200 |
| Ease-of-use | Moderate | Easy |

**Questions to be clarified with stakeholder**

1. Why is the lifting device needed?
2. What are the uses cases:
   1. Helps user to transfer to kayak
   2. 2nd scenario? To help user transfer to wheelchair in event of fall
3. Need to get a storyboard of user’s daily activity, to help understand motivation, use case and how the design can best suit user needs
4. How portable should the device be? Pump, power may take a lot of weight
   1. Will the device be carried independently by user for set up with other assistance?
5. Is a platform needed for the airbag to reside on top?