Alternative Design Report:  
Stair-Lift

By
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Team 2
1. *Standard Commercial Full Chair Lift System:*

Commercial systems such as this are made and installed to produce the safest of results. With a large comfortable chair, this design would be ideal for a large house, and a broad stairway. With the single track, lining the bottom of the staircase, the load of the chair is placed on the ground instead of on the wall. With a built in motor, the user would be able to turn the chair on and off even in mid-decent/climb.

Even though safety is such a huge factor in this design #1, the price and size outweighs the benefits of this design. With a large permanent chair, and a wide rail placed on the ground, our skinny 35-inch wide staircase is much too small for this design. In the price range of up to $3000.00, this device is also 3 times what we would like to spend on our design for the Almeidas.
2. *Quadruple Pulley, Double Rail Stair-Lift System:*

As a self designed model, safety and special constriction were a main concern in this design. With a collapsible chair, and a double track guide along the wall as seen in the appendix, this design will sit snuggly against the wall, and the chair can be raised up and collapsed for passage through the narrow stairway. Using a series of pulleys and hinges this design is perfect for going up a single flight of stairs. And the hook above the pulleys is a backup safety net if a problem were to occur with any of the four pulleys. Also equip with a seatbelt, this design covers every basis of safety requirement.

The cost would be severely reduced from design #1, and should only be between $1000 to $1500 for parts and labor costs. This is less than half of the price of design #1, and is also half as bulky as well.

However, with the double hinge, quadruple pulley system, a few problems seem to arise. When placed onto the tracks, the top pulleys would be the sole bearer of the weight of the user, and there is nothing to divert any of the force in the x-direction from the moment of the user sitting in the seat. This would place too much weight on the back of the design, and would cause a certain malfunction.

Another problem arising from this design would be the sharp turn at the top of the first flight of stairs. This 180-degree transition would not be handled properly by the quadruple pulley system. They are much too wide for a pivot of this angle.
3: *Double-Pulley System, Two Rail Stair- Lift:*

As seen in the appendix, this design is optimal, for safety, price and compact design with the unique double pulley system, the weight of the patient, and the moment of the force in the x-direction will be compensated by the *Two-Pulley-System.* And with the base-pivoting design, the patient will remain in an upright position going up stairs, and turning corners at a flat platform midway between the two stairs. The compact hinge design of the chair will allow for a slim design for family members to easily and safely move past up and down the stairs. Not shown in the design, will be a cable winch system moving the user up and down the stairs, by handheld remote. This is a commercial part that must be purchased for this design. And even though these customized parts will be costly, they will be necessary, and will be much less in price than that of design #1.

This design will also use a two-track system as in design #2, and unlike #2 this design will be capable of making tight turns around the winding staircase in the Almeida home.

Designed in SolidWorks, this device will be easily created in the machine shop on the lathes and with the plasma torches. All parts are 3-D capable and measured out precisely to necessary specification for fitting in the 35 inch staircase.
Appendix:

Figure 1 Staircase Flight 1 to level Platform Turn-Around

Figure 2 Collapsible Chair