Smart Orthopaedic Walker

redeem
ACCELERATING PRODUCT SUCCESS

Our Client

A leading orthopaedic hospital chain in India

Why they needed us

As a part of orthopaedic rehabilitation, at a particular stage the patients are advised to practice climbing stairs. They wanted us to design and manufacture a walker, which would enable their patients to practice climbing stairs in their home.

What we did

Working Principle:

We chose a mechanism which would enable the patients to use our walker on stairs of varying heights. As can be seen from the model, the walker works like a normal walker while walking on flat surface but it changes its configuration based on the scenario when the need arises. There are 4 different possible scenarios. The following is an explanation on how the walker would configure itself to work in these 4 scenarios.

Scenario 1: Flat Surface to up the stairs
When the patient reaches the stairs, he/she places the front legs of the walker on the first stair. On doing this the walker detects that the patient needs to climb up the stair and lowers the rear legs of the walker until they touch the floor and then they stop. Now the walker is configured to be used for walking up the stairs.

Scenario 2: Up the stairs to flat surface
On reaching the land after climbing the top most stair, the walker detects that now the patient needs to walk on flat surface and lowers the front legs of the walker until they touch the floor and stop. Now the walker is configured to walk on the floor.

Scenario 3: Flat surface to down the stairs
On reaching the stairs (to climb down) the walker detects that the patient needs climb down and lowers the front legs of the walker until they touch the stair and then stop. Now the walker is configured to climb down the stairs.

Scenario 4: Down the stairs to flat surface.
After climbing down the bottom most stair the walker detects that the patient needs to walk on flat surface and lowers the rear legs until they touch the ground and stop. Now the walker is configured to be used on flat surfaces.

Detecting the different scenarios:

We used 2 piezoelectric sensors, one on one of the front legs and the other on one of the rear legs.
These sensors were used to detect which legs are supporting the load, based on which the decision is made as to lower either the front or rear legs, appropriately, for the 4 scenarios above defined.

Helpful Feedback:

The walker gives a visual and audible feedback when the configuration is being changed and when the configuration is changed and the walker is ready to be used.
We also used piezoelectric sensors at different positions on the holding bar to detect if the patient is exerting an uneven force (which could either hinder the rehabilitation and recovery process or otherwise cause harm) and notify him/her about the same and how to correctly use the walker.

Design and Analysis:

We designed 2 versions one with Aluminium and the other with Carbon Fiber, both of these materials were chosen due to their superior strength to weight ratio. This enabled the walker to be strong while being easy to be carried around.
We made the CAD models using SolidWorks and ran simulations using Ansys.
We did Static, dynamic, buckling, fatigue analysis, while maintaining a factor of safety of 4.
We ran simulations for impact loading conditions for falling down the stairs, again maintaining a factor of safety of 4.
We built prototypes using 3D printing to get feedback about ease of use etc.
We utilised our state of the art in-house manufacturing capabilities to 3D print the parts and assembled them.
We conducted various tests such as buckling, bending, etc on the individual components as well as the assembled product.
We also prepared the user manual for the walker.

How they benefited

The injury rates while using the walker came down which in turn helped in the recovery and rehabilitation of the patients.