CHAPTER 15
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LOWER EXTREMITY ASSISTANCE PROJECT

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INTRODUCTION

The Lower Extremity Assistance Project (LEAP) was designed for a client with decreased quadriceps strength and control. Helps the client to move independently from a seated position on the side of a bed into a resting position on a bed. The LEAP design uses a pneumatic lifting mechanism to move the client's legs from a hanging vertical position to a horizontal position.

SUMMARY OF IMPACT

LEAP allows the client to move to a resting position and eliminates the client's need for assistance.

TECHNICAL DESCRIPTION

The leg lift was designed to be similar to a recliner leg lift using an air bladder.

The dimensions of the device were determined based on stability, force, and shear requirements. The device was designed to adjust using a pin mechanism for varying heights of beds and couches.

Pneumatic lift analysis was performed to specify the pressure needed to lift the client's legs . The electrical and computing components were developed to control the pneumatic pump speed and display the current operating range. Speed is controlled using a large radial switch and is shown with a seven segment display.

The cost of the parts and materials was about $775.

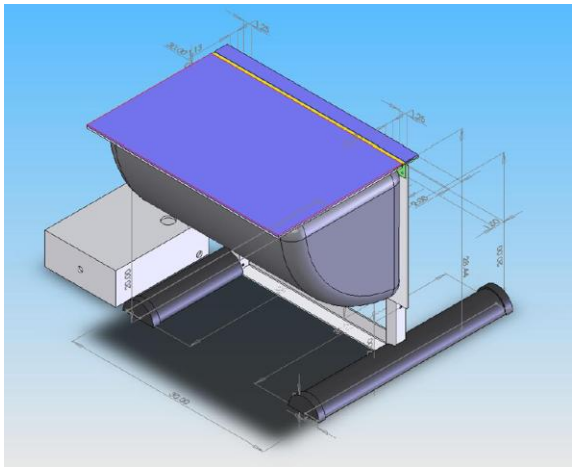

Fig. 15.1. CAD drawing of LEAP.

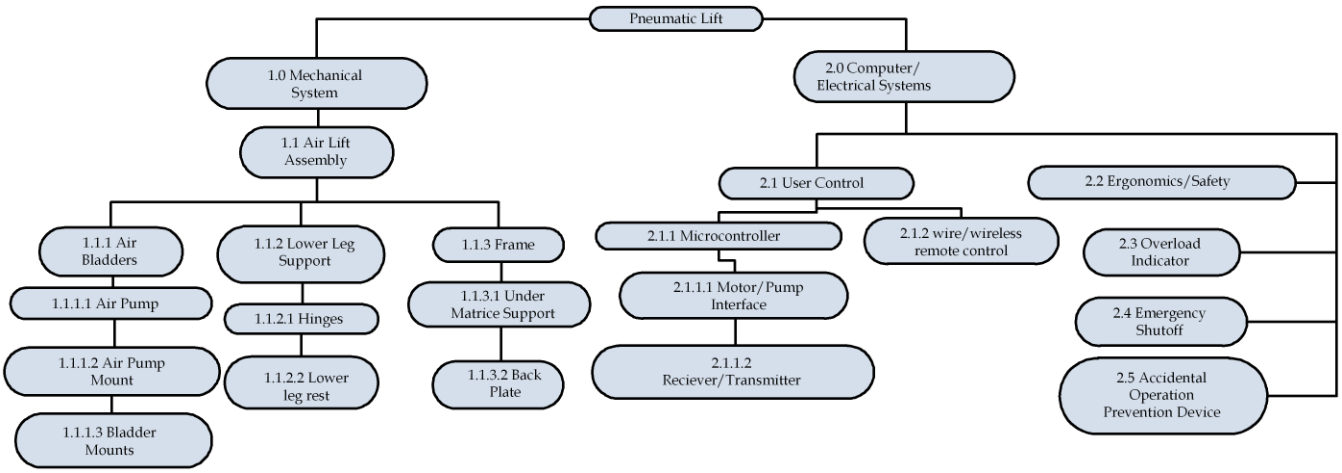

Fig. 15.2. System Block Diagram of LEAP.

RECUMBENT EXERCISE MACHINE

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INTRODUCTION

The recumbent exercise system was designed to provide a cardiovascular workout for an individual who is unable to use existing exercise products. A design was used to ensure balance. Workout information is displayed for: 1) heart rate; 2) speed; and 3) duration of exercise. Resistance is manually adjustable, and the device is self-powered with low momentum. The seat is designed for comfort and it turns, enabling the user to easily access the device.

SUMMARY OF IMPACT

The device allows the client to perform cardiovascular exercise without risk of falling or injury (see Fig. 15.3). The exercise system allows for recumbent exercise with low momentum in case the client needs to stop. The device provides balance and stability for the client, and it is self-powered. The device also provides comfort and easy access.

TECHNICAL DESCRIPTION

The recumbent cycling system provides sensor information for the client's heart rate and cycling speed to monitor workout performance. The information is displayed during the workout using a microcontroller and a custom display unit. Resistance is generated using electrical current and is manually adjusted.

Static load analysis was performed to ensure the structure would support individuals weighing up to 500 lbs. The seat rotates 90 degrees for sitting and then locks in the operating position. The space between the seat and the foot peddles adjusts to accommodate heights from 5'5" to 6'5".

The cost of the parts and materials was about $1500.

Fig. 15.3. Exercise Machine Demonstration.

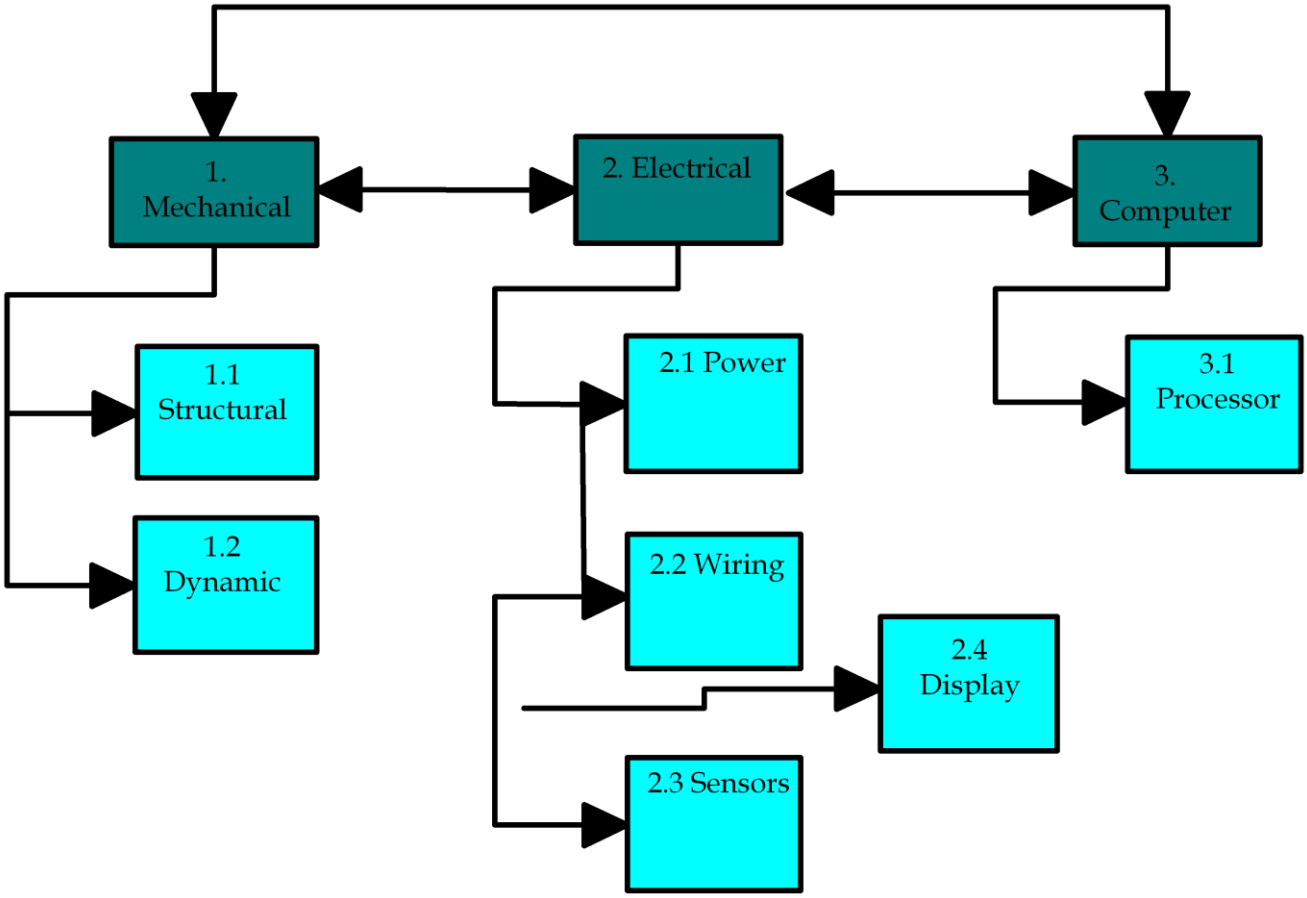

Fig. 15.4. System Level Block Diagram.