Project Statement
Motorized Wheelchair Lift

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STATEMENT OF NEED

Wheelchair users need access to health care professionals and diagnostic equipment. Unfortunately, many times these people have difficulty reaching the necessary equipment for the procedure due to obstacles such as stairs or changes in floor level. For these reasons, treatments like mammograms or magnetic resonance imaging (MRI) tests can be problematic for persons in wheelchairs.

A platform device is desired for this project to facilitate a wheelchair bound person access their healthcare procedures. A major requirement for the device is for it to have two-degrees of freedom. This means it has the ability to rotate 360 degrees and has vertical translation from three to nine inches above the floor. A small ramp is desired so the wheelchair client is able to wheel onto the device. In addition, the device will be motorized and have adjustments the user can maneuver while securely held onto the device. It has an easy to use control interface that will accommodate people with disabilities. The device is also transportable by means of carrying or rolling and has safety features for transportation and use.

BASIC PRELIMINARY REQUIREMENTS

Wheelchairs are designed for paraplegics, the elderly, people with a loss of limbs, and others that need to be transported by a wheelchair due to health issues. The reason for creating this device is that many health care procedures are not accessible to the handicapped. For example, portable MRI units may not have the proper lift device to place the patient in the machine or may not have an accessible entrance to where the unit is stationed. Overall, this device is beneficial in any location that is not handicap accessible. A wheelchair ramp requires a specific slope, and a facility may not have the room or financial means to build one. A portable lift device is a much more practical solution.

For this device safety is a major requirement. The wheelchair must be secure enough so the chair does not fall off the lift while it is in motion. The base must be stable enough to prevent tipping if the maximum load is distributed at any location. The device must be motorized with controls that are accessible and easily manipulated by the user no matter what his/her disability. The speed that the motor(s) raises and rotates the platform must be within appropriate limits as to not injure the user. There must be emergency stop functions and safety interlocks to prevent motion if the wheelchair is not secure. A manual function should be incorporated in the event of an electrical failure while the platform is in an elevated position, as well.

A constraint of the platform is that there are many styles and sizes of wheelchairs, so the device must be compatible with many different varieties. The device must be congruent with as many types of wheelchairs as possible for it to be useful. It must be adaptable to multiple wheel sizes, and motorized and non-motorized wheelchairs. All parts of the wheelchair must be contained within the diameter of the lift for it to rotate safely. The device is also constrained by the maximum amount of weight it can lift and rotate.

There are similar products on the market to the Motorized Wheelchair Lift. The company RAM Manufacturing has created a wheelchair lift built for both residential and commercial uses. This device can lift 330 lbs vertically at a speed of 8 feet per min from 52 to 72 inches to climb a flight of stairs. Max Ability Products has a hoist called the
Guldmann DH400 which is ideal for hospital use. It consists of two straps which can vertically raise 660 lbs. UQM has created a gearless wheelchair motor that rotates the wheelchair in any direction.

BASIC LIMITATIONS
The device is limited by the maximum weight capacity it can safely support. It will also only have two-degrees of freedom, rotation and vertical translation. The platform will only be able to lift three to nine inches above the initial base level. The device will only allow transfer of a wheelchair to a higher platform proximal to its base. The power will be supplied by a battery or alternate power source and thus will be constrained by the product’s limitations. The device, although desired to be as lightweight as possible, will require a significant weight itself to accommodate an appropriate weight limit. Also, the base will be as compact as possible while still being able to accommodate a variety of wheelchair sizes.

OTHER DATA
There have been many prototypes of wheelchair lifts created by universities around the country. The University of Delaware has designed a wheelchair raiser that can lift the person fifteen inches but is not necessarily made for health care procedures. Worchester Polytechnic Institute has designed a chair that can raise a maximum of eighteen inches. The University of Toledo has created a tilting platform that allows wheelchair access to dental surgery. This platform tilts the chair backwards, which makes it easy to perform dental surgery. However, this is not useful for MRIs or cat scans. Pennsylvania State University has invented a swivel platform which can only rotate 360 degrees and has no motor. It cannot lift or tilt the chair because it does not have a motor.

UNRESOLVED QUESTIONS
Limitations that are unknown at this time include battery size and capacity, and the strength and number of the motors. The materials needed to create the base and lift are to be determined, as well as the mechanical linkage between the base and the platform. Also, the range of dimensions of wheelchairs on the market and the average chair weights need to be researched.