

Wheelchair Warning System

Product Design Specification

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Abstract: A major problem for wheelchair users is their inability to alert others of their presence. This problem is magnified when users are unable to vocally identify themselves. Such is the case for our client's daughter who suffers from cerebral palsy. This impairment not only affects her vocal capabilities, but also restricts the movements in her left hand. Her mother, Sandra Rodriguez, assists her daughter around on a daily basis. Currently there is no system that can be attached to Jessica's wheelchair to alert the public of her presence. Ms. Rodriguez has requested that we develop an audible warning system to inform others of her daughter's presence.

Function: The expected device needs to alert others of the wheelchair's presence to reduce confusion and potentially harmful accidents.

Client Requirements:

- Specific to Jessica's wheelchair but may be tweaked to fit all wheelchairs
- Audible warning system to alert others and Jessica's mother
- Mechanism may not disrupt daily use of wheelchair
- Device can be used by both Jessica and her mother
- Easily activated by Jessica's right hand
- Must not require an 'extensive' amount of force to operate

Design Requirements

1. Physical and Operational Characteristics

- Performance Requirements:* The warning system should be able to be activated by both the person in the wheelchair and the person guiding the wheelchair. The activation system for the person in the wheelchair must be such that only a simple press or slide of a switch is necessary. Once engaged, the device should emit an audio warning and a visual beacon to pedestrians in the immediate vicinity warning them of the wheelchair's presence. A signal should also be sent to the person guiding the wheelchair alerting him or her of the activated warning. The warning system should be attached to the wheelchair, but also should have the ability to be removed and attached to a different wheelchair.
- Safety:* The system should be kept sealed, clean and free of debris. It also should not interfere with the path of the wheels when the system

is mounted. When engaged, the system should not startle the pedestrians, but should just alert them.

- c. *Accuracy and Reliability:* The audio warning should be at a constant tone and at a constant volume every time the system is activated. The system should be able to withstand the vibrations caused by the terrain and not be affected by it. The light on the system should be bright enough such that if the audio warning were ineffective, the light would be able to compensate. If the power source for the audio warning fails, the visual warning should still function on its separate power source.
- d. *Life in service:* The desired device should last as long as possible allowing for wear over time. However, the batteries will run out of power and must be replaced.
- e. *Shelf life:* Should be able to keep for a number of years. Client should be able to change the battery easily.
- f. *Operating Environment:* The product would be used mostly at outdoors which it will be exposed to heavy sunlight or rain. The device should be able to withstand the high temperature and be water proof. This device will also be used in crowded and noisy environments. The light source and alarm should be strong enough to grasp attention
- g. *Ergonomics:* Activating the button should be fairly simple and not require much force. The client should not have a hard time replacing the batteries no matter where they are located. The device should be attached securely to the wheelchair handle and act as part of the wheelchair and not an obstacle.
- h. *Size:* The switch or button should be large enough so that Jessica can use it right away. The compartment for the power source should be small enough so that it does not interfere with use of the wheelchair.
- i. *Weight:* The product must be light enough so that Jessica can place the box in her lap and move it with ease. The final device should not make it any harder for Ms. Rodriguez to advance the wheelchair.
- j. *Materials:* Plastic covering for the power source box and for the switch. Insulated wire will stretch from the power source to the switch box. Small LED lights are to be used that will shine bright enough to attract attention. A piezo-electric speaker will be attached to the circuit.
- k. *Aesthetics, Appearance, and Finish:* No blinding lights or painful noises must emanate from the device. The design should be integrated

and fitted into the wheelchair well so that it does not attract too much attention when not in use.

2. Production Characteristics

- a. *Quantity*: One device that has the ability to be activated in two separate locations.
- b. *Target Product Cost*: No specific target cost was established; however, one can assume lowest cost method to efficiently and effectively provide a solution would be preferred.

3. Miscellaneous

- a. *Standards and Specifications*: None.
- b. *Customer*: Any audible output must be somewhat appealing. Monotone, annoying responses are strongly discouraged.
- c. *Patient-related concerns*: Any design must incorporate right hand activation due to loss of motor skills in left hand. Conceivably, activation methods could be modified in different scenarios.
- d. *Competition*: A patent search provides Patents: 6,163,249; 5,791,761; 6,160,493 as comparable devices. Also, research reveals device employing proximity sensors in order to detect stationary objects producing audible output varying in tone intensity.