A SYSTEM TO MODIFY THE ACCELERATION AND BRAKING SYSTEMS OF A MOTOR VEHICLE TO ACCOMMODATE THE NEEDS OF A PARAPLEGIC INDIVIDUAL

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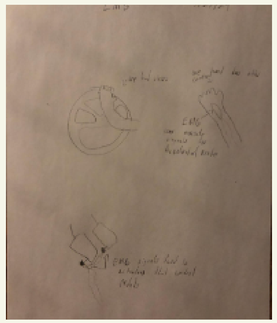
PROBLEM STATEMENT

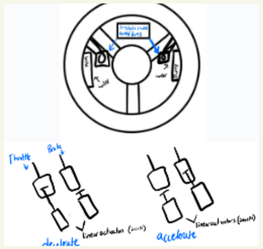
Many people with suffer from paraplegia, which is a partial or total loss of function in the legs. Paraplegic patients can lack the ability to do many tasks such as driving, which can make traveling, and by extension functional life, difficult. Due to the length of many commutes, the inability to drive makes it difficult for patients to live and work comfortably. In the past various driving aids have been developed to allow for a car to function without the use of legs, however, this paper looks at a novel approach that would allow increased functionality and control over the vehicle so that patients can be productive and safe in their day to day lives.

DESIGN #1: STEERING WHEEL HAND GRIP

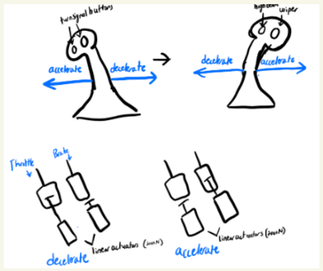
DESIGN CONCEPT #2: EMG CONTROLLER



DESIGN CONCEPT #3: PADDLES/BUTTONS



DESIGN CONCEPT #4: EXTERNAL HAND LEVER



REQUIREMENTS

Type	Requirement	Design #1	Design #2	Design #3	Design #4
Functionality	Does not require use of legs	Y			
Functionality	Can effectively accelerate vehicle	Y			
Functionality	Can effectively decelerate vehicle	Y			
Functionality	Can effectively avoid an obstacle	Y			
Functionality	Shouldn't have to take both hands off the wheel	Y			
Functionality	Safe (but shouldn't be slowest driver on road)	Y			

METHODS

Most of the parts used for our project were 3D printed. All models were designed in Onshape. The electronics include an Arduino and four servo motors. the wires on the handle were soldered for a better connection. We assembled the using screws and tape. The testing setup was assembled using parts provided by Gustavo Rodriguez and Mass Academy.

FUTURE WORK

In the future, we'd like to make the system easier to implement into any vehicle. This would benefit the user as a much quicker installation would increase user satisfaction. We would also like to decrease the latency between the controller and the motors as much as possible, to ensure the utmost safety of consumers with our project.

CONCLUSION

The testing highlights the device's hills and valleys. It is a quality device that can accomplish what is asked of it. It can effectively accelerate and decelerate a vehicle safely and consistently However there are some issues with the system that have to be worked out in the future. The device is sort of unnatural and mildly difficult to use. This may be because our test subjects had little experience with one handed driving and needed some getting used to. We could change this in the future by making a handle that is more a comfortable shape for the hand to make it easier to manipulate the wheel.

DESIGN STUDIES

As the results show, the device is of good quality, but could definitely use some improvements in the future. The relatively low score of 3 for ease of use shows difficulty in the device's steering system. The low physical exertion score however shows that it's not due to the bad leverage of the handle, but it may rather be because of the unnaturalness of the system. The durability tests prove the quality of the system and that nobody should be scared of its reliability on the road. The high scores for the control of the device, acceleration, deceleration, speed maintenance, and learning, show how the device is able to accomplish the basic needs that are required of it. However, the low scores for comfortability and confidence in the system further prove the unnatural nature of the device.

Questions	Average Score
How well were you able to accelerate properly?	4.2
How well were you able to decelerate properly?	4
How well were you able to maintain a consistent speed	4.2
How easy was it to learn how to use the device?	4.2
Was it easy to use the device?	3.4
Did it require significant physical exertion to use the device? (5 is significant exertion, 1 is minimal exertion)	2.6
How comfortable were you while using the device? (5 is maximally comfortable)	2.8
How responsive was the system?	3.8
How confident would you be using this device on the road?	2.8

	Miami Dolphins Design
Brake	Pass
Acceleration	Pass

Questions	Average Score
How easy was it to keep the vehicle driving in a straight line throughout the test?	3
How much physical exertion was required to keep the device in a straight line?	2.8