My Claim

While there are many different types of controllers for rhythm games, most of these are inaccessible to people with motor control function issues or people missing a hand or arm. The standard controller for many other video games is either a console controller or a mouse and keyboard, both of which are not accessible controllers for this demographic. Rhythm games have a wide variety of controllers that make the interactions and resulting gameplay completely different. Some examples are the full-size guitar shaped controllers for Guitar Hero and Rock Band, the dancing mats for Dance Dance Revolution, and the Oculus Touch controllers for Beat Saber. These controllers are all very different from each other and are part of the appeal of their respective games, proving that controllers are an important part of the rhythm game experience. Therefore, there needs to be a way to bring this experience of rhythm games with interactive and fun controllers to people that cannot use other controllers for accessibility reasons. Furthermore, video games can be very inaccessible due to the cost of the equipment and game itself. For people with disabilities, there is the added cost of having to get custom controllers just to be able to play. And getting custom controllers can be even more difficult because not all custom controller makers are able to ship everywhere. For example, the PS4 controllers from Ben Heck can only be shipped within the US and are multiple times more expensive than buying the standard controllers. So, ability, cost, and geographic location can all be limiting factors for enjoying rhythm games for people with disabilities.

What I did

To solve these problems of accessibility on multiple axes, I created a browser game that utilizes head and arm movements to control the game. The game is created in p5 and only requires a laptop with a webcam. So, the affordability is much better than most consoles and custom controllers. Also, it is not region locked, meaning that anyone anywhere can play this game, unlike how some accessible controllers cannot be sent to some regions. The controller was made using ml5 and Posenet. Posenet is a machine learning model in tensorflow, a javascript library. What posenet does is estimate where certain points are on the body, including the eyes, nose, shoulders, elbows, wrists, etc using a picture or video of a human. This is called pose estimation. Using these points, I was able to create the different controllers. There are two different controllers I made for this project, a wrist controller and a nose controller. The wrist controller was pretty straightforward, I used the points on the wrists found through posenet and added circles to where the wrists were detected. The aim of the game is to hit the boxes that float across the screen, which plays a series of notes that makes a song. So, to make this controller dependent only on wrists, I made it so when the circle on the wrists hit a box, it played the note. The nose controller was much more complicated because I wanted it to require as little movement as possible. To achieve this, I made it so that the only motion that the player needed to be able to do was turn their head side to side. To start, I used the point on the nose and added a circle to it. Then, I added a vector with another circle on the end to that. The vector increased in size as the head was turned to the side, so that when the head is turned 90 degrees, the circle is furthest away from the player. To find out when the head is turned to the side, I used the eyes as reference. When the face is turned, from a straight on view, the eye

points are closer together than they are when facing forward. So, I created a formula that used the distance between the user's eyes in the beginning and the distance between their eyes at any given moment using the nose controller to decide how long the vector would be. The circle on the end of the vector is used the same way the circle on the wrists are being used; if they collide with a rectangle, it will play the note. To make the actual game, I based the gameplay off of the game Rock Band. To do this, I created rectangles that started from the bottom of the canvas and slowly floated vertically until they were either hit or disappeared at the top of the canvas. Different notes start from different positions at the bottom. But, if it is the same sound played, it will start from the same position. To make sure that the player is able to hit all the notes in the right order, the notes are slightly staggered. Not everyone has played Rock Band before, or even a rhythm game in general. To account for this, I added an instructional video and written instructions to make sure the game was understandable. Both of these were added to the top of the page, above the canvas so that people were inclined to read the instructions before trying to play the game.

How I tested it

I tested this by sending it out to family, friends, and fellow students to try it out. With that, I created and sent out a form with a few questions about usability of the controller, how clear the instructions were, and if the gameplay made sense. With the information I got from this, I edited my project to account for the feedback. After I made changes, I sent out the project again asking the same questions. This iteration was done so that I could get the most amount of feedback possible. The goal of this was to make sure that nothing big was missing for usability, especially in terms of the accessibility. I also made sure to talk to people well versed in accessibility to make sure that I was following proper accessibility guidelines for web pages. That was also helpful in taking more of the controller mechanics into account.