**Motivation & Purpose:**

Many book readers spend time in awkward positions when reading. Such as; hunching over a book, or reading on their back, and even reading on the bed with a bent back. Positions such as these are damaging to your long term posture. For example, constantly leaning your head forward results in long term neck and back pain. While reading on your back may result in tight shoulder muscles and a stiff neck, due to keeping your hands and neck steady.

Our motivation for this project was to create a sleek and modern electronic system, that utilizes hand gestures to interact with an electronic book reader or pdf file. The reason behind this system was to reduce the physical strain on the body due to poor reading posture over an extended time.

**Alternatives/Challenges:**

We explored an alternative using the Kinect however it required having windows OS, certain video cards, and USB 3.0 support. Since half of us owned a MacBook we decided to instead work primarily through a regular USB webcam. Some of us did try implementing some features using the Kinect, and we were successful. However, we still found more success with the simple webcam.

The initial challenge consisted of figuring how to do image processing on a set of captured frames through the video input. Since our group members lacked any experience in image processing this required a lot of research, and testing through trial and error.

We initially implemented the webcam theory in Matlab, we successfully created commands to turn pages, zoom, and control the mouse. However, the performance was not very good, so we decided to move to OpenCV. After doing so we decided to try to implement voice commands using the inbuilt Mac OS voice recognition software.

**Methods/Theory:**

Input: Hand Gestures -> Webcam -> Receive Video Input To Laptop-> Extract Desired Colours -> Use A Median Filter To Reduce Noise In Image -> Convert Image To Greyscale -> Threshold The Image -> Remove Objects Smaller Than A Given Diameter -> Fill In Holes Within Objects -> Conduct Frame Differencing Calculations To Detect Movement -> Implement Relevant Commands -> E-Book Command Displayed

**Implemented Functions:**

We implemented a variety of functions in MatLab/C++/Swift & OpenCV, ranging from; turning pages left &right, zoom in & out, mouse cursor control with left click functionality, and a voice command to bookmark a given page.

Hands Free

E-Reading Apparatus