**Project goals**

The goals for this project we planned are applying the laser pointer on the PowerPoint slide for the convenience of presenters and instructor.

* Tracking the laser path on a whiteboard
  + We planned to use MATLAB as the design developer to detect the laser dot from the video input of a normal webcam.
  + The basic test background would be a white board to avoid all kinds of interference.
* Support color-change
  + After we can successfully track the laser point, and plot out in real time at an output window, we planned to implement the color-change of the output laser trace in output plot to improve the usefulness.
* Users can erase what they write
  + To offer more applications, the erase function should be applied, and there were multiple ideas for this function at the original brainstorm.
    - Pushing a special button from the output window to make all the writing invisible.
    - Detecting another “thing” to make all the writing invisible.
    - To erase specific part of the writing, detecting and applying the trace of “eraser”.
* The laser marker can work on PowerPoint slides
  + Using the MATLAB to access the PowerPoint directly, and applying the drawing function with laser pointer.

**Planned approach**

There were multiple attempts, different outputs and some implements to complete the project and approach the goals we made before.

* Show the laser path in MATLAB figure
  + The first attempt is using the image acquisition toolbox of MATLAB directly find the laser point, but there are few weakness. Firstly, because this attempt uses findlaser() function directly, the surround light requires being dark, in another word, black background is needed. Secondly, we apply a calibration screen to determine the plot of laser point, and then show the output on the MATLAB figure, the process is too complicated, every time running the code, it requires do the calibration at beginning, and the output cannot be displayed in real time, also the algorithm we used take too much running time, the output is not smooth.
* Tracking the red and green color on all backgrounds
  + The second attempt we implement the color detecting instead of detecting the laser point, we trade each frame as a image and doing the processing, we use background subtraction to get the color difference, because the webcam is recording the real time video, a median filter is applied for noise deduction, and then convert the frame to binary under a threshold to get the specific color pixels we need.
* The output displays in the GUI in real time with some functions
  + Our original goal is applying our project in PowerPoint slide, but the access the PowerPoint, there is vision limitation, thus, we build a GUI to plot the output, and we can insert any background in the GUI, just like a real PowerPoint slide. In the GUI, the color-change, shape-change, and size change is performed in the menu set.
* Erasing all the writing since green is detected
  + As the writing part, the red color is detected and prints out the trace, for erase function, that will erase the writing as the trace of the green color.