*Shiva Nathan (svnathan)*

*15-112 G*

*Term Project Design*

This outlines the general design for a Rock-Paper-Scissors game that uses OpenCV to determine the move made by a human, compare it to the move made by the computer, determine the winner, and play multiple rounds.

The game of Rock-Paper-Scissors is very simple; in keeping with this theme, and due to the limitations of OpenCV, the GUI is simple as well. There are only three options in the entire game: help, easy mode, or impossible mode. The help screen contains the most text in the entire game. The game screen consists of the cyan game field, and red text such as the round counter, the move list, and the players’ scores. Cyan and red show up against most backgrounds while being relatively easy on the eyes (attempts at white text was washed out by lighting or light backgrounds).

The **Competitive Analysis** document shows various rock-paper-scissors robots and algorithms that were explored for inspiration during the early part of the project.

The main influence on the design of the program was MVC functionality and emphasis on modularity. All view functions, such as for the GUI, displaying score, instructions, winners, rounds, etc. are separate from each other and do not manipulate any variables in the program itself. All functions for manipulating the bionic hand are separate; though they combine serial communication with variable manipulation, the serial communication can be considered an extension of variable manipulation since it is simply sending the resulting variable to the bionic hand. Due to the limitations of OpenCV, the code for hand detection could not be made as modular; it had to be stored in the run function in order to keep running properly.

The functions for the Python program are described below.

***FUNCTIONS BY SHIVA NATHAN***

**init(data):** initialize all variables to default state for fresh game

**startScreen:** display prompt to start game or show help screen

**endScreen:** display final score and prompt to return to start screen

**helpScreen:** display text for how to play

**pauseScreen:** display text to prompt continuing game

**controlHand:** randomly pick move for bionic hand, send move to arduino over serial, return move

**fakeBionic:** test function that simulates controlHand without arduino

**cheatBionic:** pick move for bionic hand that will defeat player move, send move to arduino over serial, return move

**cheatFakeBionic:** test function that simulates cheatBionic without arduino

**fakePlayer:** test function that simulates human player without webcam

**determineWinner:** determine winner of round

**displayCountdown:** show rock-paper-scissors-shoot countdown on screen

**playRound:**  determine player move, make bionic move based on difficulty, determine and increment score of winner, end game once a player has won best of how many ever

**displayWinner:** show text for round winner

**displayGameData:** display round number, moves made by players, and round winner

***FUNCTIONS BY ZANE LEE***

**removeBG:** strip frame from captured image for detecting hand

**calculateFingers:** locate hand in frame, count number of defects in shape (i.e. spaces between fingers), and return value

***FUNCTIONS BY SHIVA NATHAN AND ZANE LEE***

**run:** play game using all functions described above. Open webcam, allow player to choose mode, determine move made by player, move bionic hand, determine winner, increment score, finish game, allow player to restart.