CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)

Sriram V. Bhimaraju

Project Number

J0802

Project Title

Low-Cost Archery Assistant with an Interface for the Visually Impaired

Abstract

Objectives/Goals

Archery coaches use verbal communication and visual demonstrations to provide feedback to archers. This needs to be available to them in real-time and as an exact science in practice time, so the archer can learn perfectly. The engineering goal of my project is to provide a low-cost archery assistant for sighted and visually impaired users that provides real-time form corrections, draw length adjustments, and bow positioning for optimal launch angle, to ensure accuracy during practice.

Methods/Materials

During bow calibration, readings for optimal form and draw lengths were taken with a spring scale and tape measure and mapped to the readings of the flex sensors on the bow limbs sent by Arduino. Hooke's law graph was drawn, Spring's constant measured, potential energy, kinetic energy and arrow velocity calculated. During game time, the wind speed was obtained using an anemometer, drag on the arrow computed and Euler's rule used to calculate the final travel of the arrow. The App then computed the optimal launch angle to hit the target board, correlated the real-time flex sensor values and phone accelerometer values against values noted during bow calibration, to give audible and visual corrections during shooting by an archer for better aiming at the target.

Results

I evaluated my app with a toy, medium and professional bows. The data generated by flex sensors in real-time is correlated with optimal draw length of the three bows determined during calibration. Based on data from flex sensors, accelerometer & anemometer, my app accurately calculated the desired draw length and angle to hit the target in a consistent way. The voice instructions were clear to aim the shots even when I blind-folded myself. My tool met the objective of incorporating my coach's guidance as scientifically calculated real-time feedback to effectively improve my game.

Conclusions/Discussion

I validated my project with Perkins & Texas schools for the blind, Professor Ting in the Vision Program at SFSU and with archery coaches for its effectiveness as a low-cost scientific tool to incorporate feedback during practice. In future I would like to incorporate target board scoring with image analysis so the game can be recorded, and blind people can know the score easily. As more users use my system, I would like to get more training data, to better my machine learning models for even better predictions in determining the accuracy of a shot.

Summary Statement

Created a low-cost archery assistant App for sighted & visually impaired archers that incorporates data from sensors to scientifically provide real-time, accurate feedback during practice for improved training.

Help Received

I designed and built the archery assistant myself. Learned Physics and Swift programming from my sister. Used BigML website to create models for accurate predictions and to evaluate results. Conducted all testing with arrows/target boards only in archery ranges under the supervision of my dad.