CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
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Project Number
38515

Project Title
How High Can You Jump?

Abstract

Objectives/Goals
The objective of this study is to measure vertical jump using the accelerometer of a mobile device. I am a volleyball player and work hard at improving my vertical jump and wanted to be able to document my progress.

Methods/Materials
I used the accelerometer inside my phone, Physics toolbox suite (accelerometer application), App inventor 2, a camera taking a slow motion video of the jump, spring, PCS pipes and planks for the jumping simulator. Following steps are followed:
1) Measure free-fall time using Physics toolbox suite. 2) Write an app using App Inventor 2 that calculates the height of my jumps by measuring hang-time. 3) Take a slow motion video of me jumping in front of a measuring tape while, at the same time, measuring my jump height with the app I wrote. 4) Verify accuracy of the app by comparing the data captured on video to the data from my application. 5) Build a jumping simulator out of wood to replicates my jump to make more measurements in a shorter period of time.

Results
By determining the time I was in the air and knowing that the acceleration of my jump was going to be 9.8 m/s (gravitational pull), I could solve, Distance = ½ * acceleration * time ^ 2. Since half of hang-time is used for jump-distance, Jump-height = ½ * acceleration * (time/2)^2
My application could measure 80% of the time within 3% of my actual jump height, after correcting for heel to toe offset. The application could measure the jumping simulator jump height (rebound) more accurately.

Conclusions/Discussion
For jumps over 10 inches statistically significant deviations were noted, indicating hand movement (reflex to jump higher) may be a factor and that measurements should be independent of hand movement. Another factor is the heel to toe offset making it very unpredictable to measure the actual jump height using the slow-motion camera.

Summary Statement
Estimating height of a jump using an accelerometer

Help Received
I designed the project and programmed the app myself after an internet search on techniques and laws of physics related to vertical jumping. My dad reviewed my results. While building the jumping simulator, my dad set-up power tools, and helped me use them safely.