Sprinter Optimization

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Outline

- Introduction/motivation
- Project scope/customer needs and requirements
- Concept generation
- Concept selection
- Summary

Introduction

- What is the most effective way to learn?
- Data vs. Image
- The power of simplicity

Project Scope

- Create a system that analyzes the form and technique of sprinters, focusing on 100m event, and provide a clear display of the sprinter while giving feedback on their form.

Customer Needs/Requirements

Needs:

- Improve sprinter performance
- Immediate feedback
- Quantitative data
- No effect on sprinter

Requirements :

- Detect technique
- Live video output
- Display collected data
- Cost effective
- Lightweight and durable
- Fast and accessible

Concept Generation

- Brainstorming, forced analogy, biomimicry, and random ideas

- Generate list of possible ideas
  - Cameras?
  - Software?
  - Hardware?
  - App features?
  - Measurements?

- High fidelity concepts

Design #1: Camera and sensors

Hardware	● Camera ● Ankle sensor covered with nylon taffeta and attached by fluoroelastomer ● Tripod
Software	● Swift ● User inputs on app
Outcomes	● Frame by frame analysis ● Playback ● Speed, stride length, and stride frequency

Design #2: Camera only

Hardware	● Camera ● Tripod
Software	● Opencv and python ● User inputs on app
Outcomes	● Frame by frame analysis ● Playback ● Speed, stride length, and stride frequency

Design #3: Sensors only

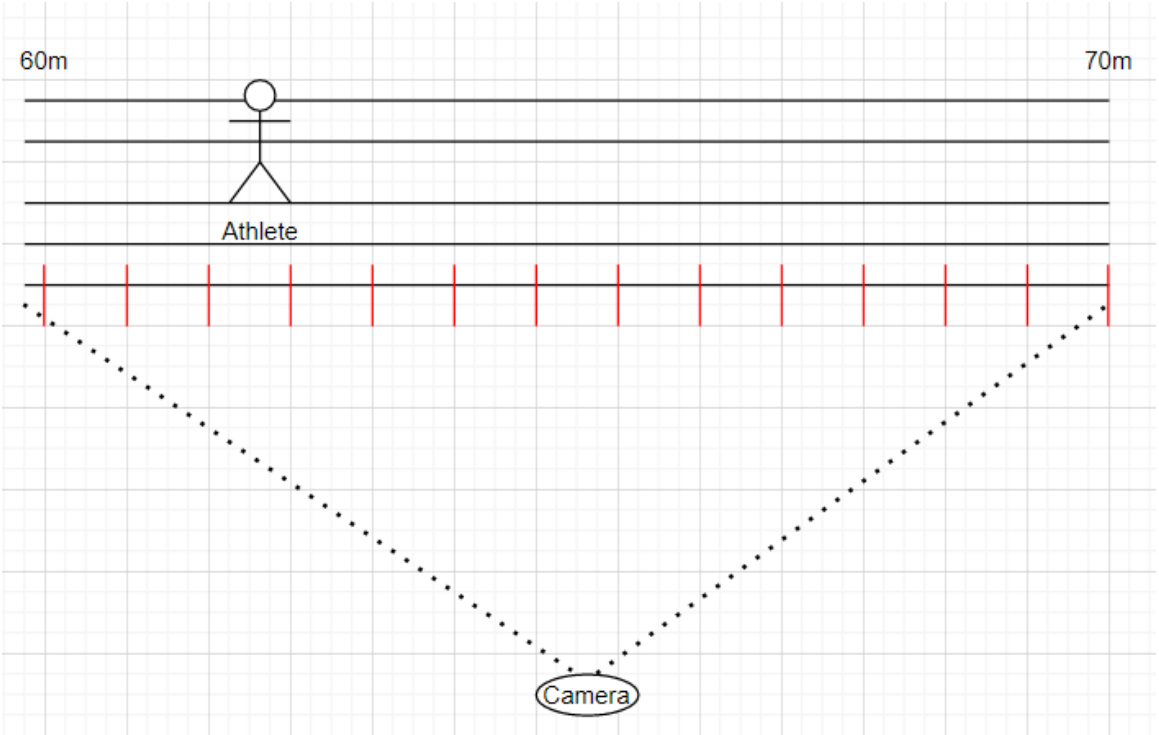
Hardware	● Ankle sensor covered with plastic ● Velcro attachment
Software	● Flutter ● Video feedback ● User inputs
Outcomes	● Speed, stride length, and

Concept Selection

- House of Quality
- Pugh Matrix
- Analytical Hierarchy Process (AHP)

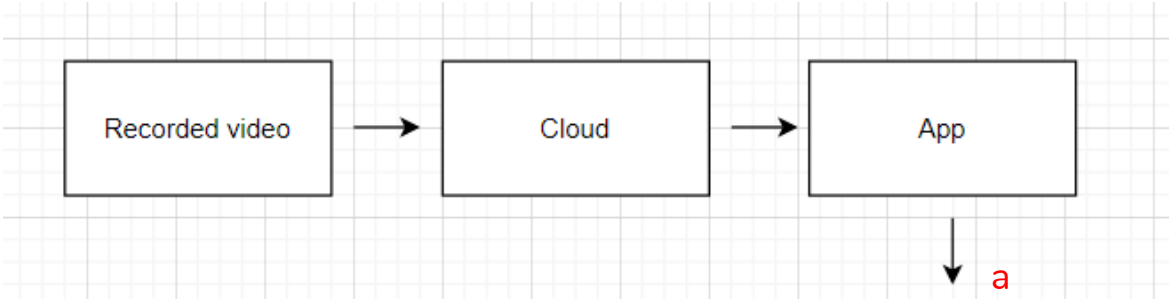
Selected Design- Set Up

- GoPro Hero 8 and tripod
- Recording at 2.7k at 120fps



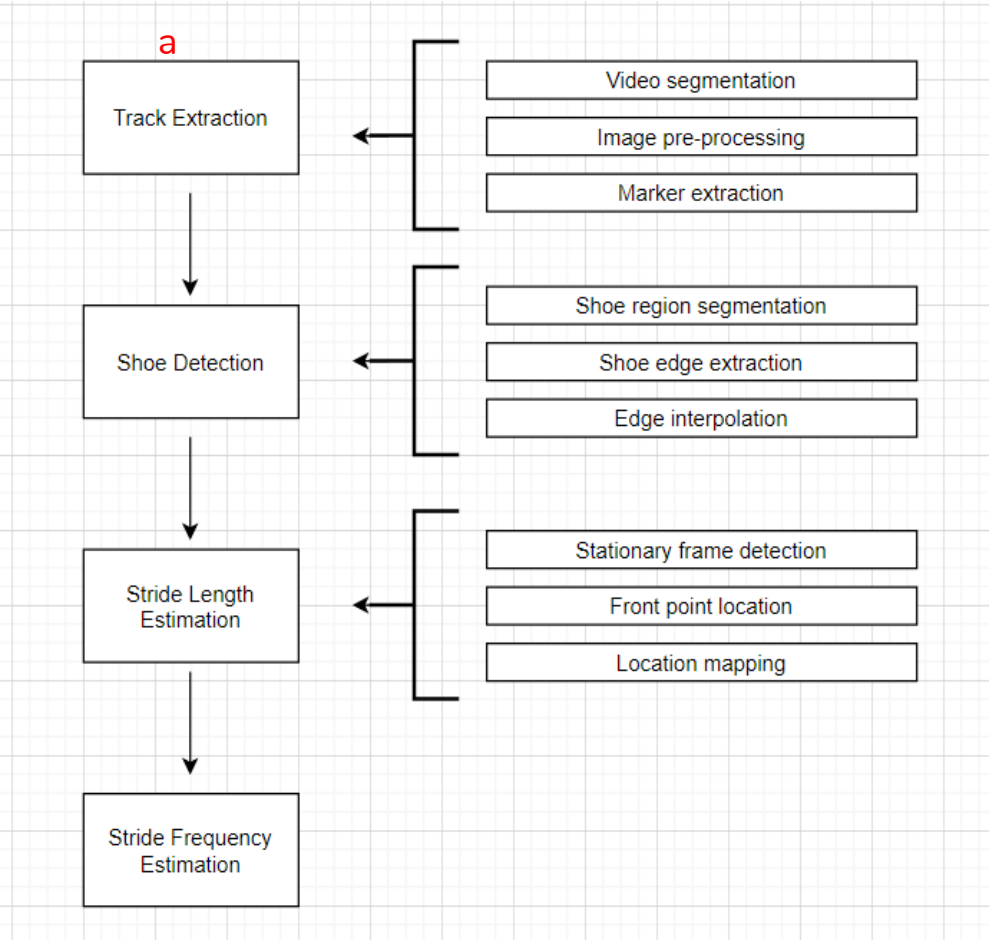
Selected Design- Video Transfer

- Potentially use SD card to transfer the video to the app/software if the wifi transfer is slow



Selected Design- Video processing

- All components of stride frequency estimation come from earlier stages
- Stride frequency = (distance* fps)/(number of frames * stride length)



Summary

- Our goal is to create a system that allows a sprinter to document review their progress. And track key statistics, such as stride frequency and length.
- System requirements
  - Durable, and cost efficient.
  - High quality camera to record the sprinter.
  - Network connectivity for easy video transfer and review.
  - Mobile app for quick and convenient feedback.

Thank you!

- Dr. Boyd Anderson
- Dr. Hooker
- Dr. Chuy
- Dr. Devine

Questions?