Swing On: The App to Perfect Your Golf Swing

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Abstract—The goal of this project is to create a golf swing improver focusing on concentration, balance, and consistency. A cross-platform mobile APP will be built to track the motions of the golfer in real-time. Motion sensors may be used to detect the golfer's actions. Multiple factors of the golfer will be focused on, including body motion detection and head rotation. Data of the golfer's motion will be recorded, stored and analyzed to monitor the golfer's consistency of swings as well as to keep a record of their improvement over time. MATLAB will be used for video processing and React Native for developing the front-end of the APP.

Index Terms—video analysis, machine learning, body and object detection, sensors

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1 Need For This Project

There are a variety of different sports, and a plentiful of different reasons why people practice sports. Some do it for exercise and maintaining health, some may do it for the enjoyment and ecstasy they receive from playing, while others do it for the competitive nature or even for monetary reasons. These are the majority of reasons people decide to involve themselves in sports, such as basketball, soccer, and football. Golf, however, is very different to these sports. It is not a high intensity sport, which attracts people from different ages and backgrounds. Many people play golf as a way to relax or distract themselves from the "real world." Another reason is that it is a nice way to catch up with friends or colleagues, as it does not require as much intense activity, making it much easier to talk. However, there are many limitations as to why golf is not as popular as other sports, and why it seems to attract an older crowd. Golf is a much more expensive and hard to access sport than most other highly popular sports. This discourages many people, especially the youth who may not have the money or resources to play. To play many other sports, all one needs is a ball and a field or court, which can almost always be found at the nearest school or park. However with golf, one needs equipment—a golf ball and a club—and access to a golf course to play. As a result, this makes it much harder for the game to attract newcomers. In addition, golf is a challenging sport to begin to learn, and many must resort to hiring a coach, which can be expensive and time constraining. Additionally, golf has been losing more players than what it is gaining, especially in the 18-34 age range [1]. This project will help to solve this problem because it will give easier access to all people who are planning to play golf. This project will help beginners to learn the sport in a more economical way. Since most products on the market focus on the golf ball flight trajectory instead of the position of the golfer, advanced players can also learn different aspects of their golf swing from this project. More importantly, golfers can gain confidence in themselves by improving their golf swing, therefore they are encouraged to keep playing golf.

2 Problem Statement and Deliverables

2.1 Problem Statement

Golf is an expensive sport to play since it requires costly equipment, golf course fees, and coaching fees if the player wants to become a competitive golfer. Besides the initial costs, golf is also difficult to learn as it requires plenty of time to learn the correct swing technique, have practice sessions and put effort in to notice improvements. Therefore, most beginner golfers often get discouraged, especially junior golfers and young adults. This proposed solution, SwingOn, aims to boost a golfer's training, either as a complement of their coaching sessions or as a stand alone tool during individual practice, all with the goal of maximizing the player's potential.

SwingOn will consist of a cross-platform mobile app that analyzes the player's motions and golf swing based on three main focus points: concentration, balance, and consistency. The app will not focus on static elements of the golf swing such as the grip and basic golf stance, because the objective of the app is to aid golfers improve their swing because the body position during the swing is critical for having a good swing.

2.2 Solution

The most challenging aspect about golfing is to learn the correct technique, which requires enough practice to notice results. Therefore, this project proposes a solution to help beginners learn the sport in a more economical way to ultimately enable them to gain confidence and improve their golf swing.

Advanced players will also benefit by being able to improve different aspects of their golf swing. MATLAB will be used for video analysis, to be more specific, the detection and movement of the head. The app will also use MATLAB to calculate the centroid of the user to analyze whether or not they are balanced throughout the swing. Then, the app will give feedback in real-time during and after the swing based on these analyses. The user can review their videos and the feedback in the future to continue to improve and not repeat old mistakes. Consistency, Balance, and Concentration are the backbone of developing a great swing, and the app focuses exactly on that.

2.3 Deliverables

SwingOn is a mobile app to track the motions and swings of the golfer. Using phone cameras, the user will take photos and videos and upload them to the app. Then using facial extraction to detect face orientation, the project will be able to tell whether the golfer's head rotates before impact of the golf club with the ball. The centroid of the golfer's body will be calculated to see whether they are balanced or not during the swing. At a later stage of the development of the product, motion sensors detect the golfer's actions. These sensors will be able to track motions (with 9 degrees of freedom) and the impacts on the ball. These calculations will be uploaded to the app and analyzed for consistency.

3 VISUALIZATION

The app will have a login screen in which the user can either sign in or sign up. Then they can choose to either record a video, upload a video from their photos library, or view the statistics for their previous swings.

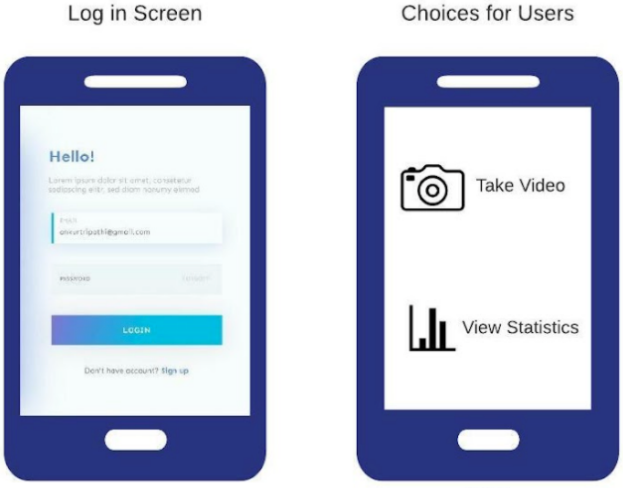

Fig. 1. Visualization of the sign-in screen and the two choices they have when they sign in

If the user clicks on the 'Take Video' option, then on the next screen they can take a video of themselves by setting their phone on a stable location such as a tripod. The user needs to be in a specific location within the video frame in which their head and the golf ball needs to be present to satisfy the requirements for video analysis. Detailed step-by-step instructions will be provided in the app so it will be easy for users to follow. By choosing the 'View Statistics Button', the golfer will be able to track their performance of consistency as well as their focus over multiple swings.

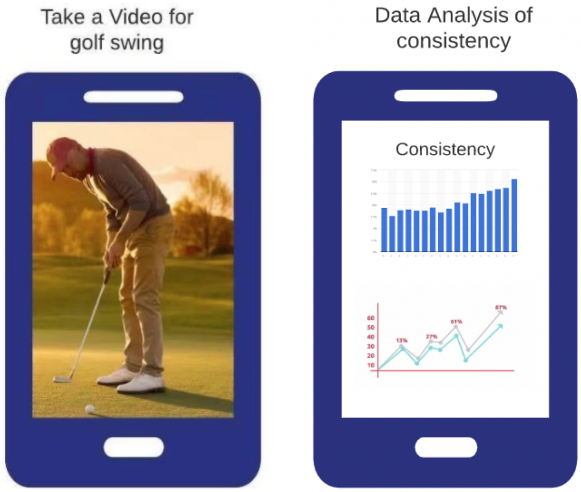

Fig. 2. Visualization of the screens for video recording and overview of the data analysis of user's golf swings

4 COMPETING TECHNOLOGIES

There are existing products in the market that offer products for improving golf swings. The following sections describe several competing technologies that have similar functions and goals as the project:

4.1 Trackman

Trackman is a software subscription for golfers. Users of Trackman can share their reports, videos and screencasts of them playing golf [2]. Users can get access to Trackman's Tour Swing Library, Indoor Simulator Courses and suite of communication tools with the software subscription. It also allows users to upload and share all their data directly from their iPad or PC. The data and video is synchronized across all devices. The cost of this product starts at $1000.

4.2 K-motion

The product is a learning system for golfers, and it includes bluetooth sensors and a software subscription [3]. The software subscription includes annual K-PLAYER software upgrades, unlimited access to K-CAMPUS educational website, remote based customer service and live coaching from customer success representatives. The cost for access to all features starts at $2,495.

4.3 4D Motion Sports

4D Motion includes hardware and a 1-year license for the modules it offers for $390 [4]. Hardware includes a sensor, XL body strap, Hydrogel Body Tape, KTape, Sensi-Wrap and Club Mount. The sensor has 4 modules which includes Golf Club, Golf Chest, Golf Hip and Golf Sway. Each of the modules provides auditory and visual feedback for golfers to make immediate adjustment. There's also a player version

which allows users to have a single player profile.

4.4 CaddieView

CaddieView is the closest competing technology to SwingOn available in the market in terms of portability and ease of use. The product consists of a mobile application for Android and iOS to analyze the golf swing with video, a patented aluminum phone mount, and a Bluetooth control to start and stop video recording [5]. This integrated ecosystem costs $70 plus a monthly subscription fee of $4 to use the app, the least expensive alternative in the market.

4.5 SwingOn Differentiation

Some of the competing technologies discussed in the previous sections, consist only of software while others have both software and hardware components. The primary focus of the project will be on software development, and will include the same functions such as sharing videos and storing data. The project will incorporate features such as giving feedback and analysis of the golfer to the design. The main differentiator is focusing on the golfer and their golf swing technique, unlike most products on the market that focus only on the trajectory of the golf ball. The goal is to build the project in a way that best suits the target customers at an affordable price. The app will be available in a freemium model for users to download for free and access advanced features—storing older swings and data—for a low subscription fee.

5 Engineering Requirements

The requirements for the implementation of SwingOn are specified in the following sections:

5.1 Software

1. The product will be a cross-platform application. The App will be built on Matlab first and then converted to an mobile App. The reason for choosing Matlab is that it has a great library for analyzing images and videos [6].
2. Head detection and body centroid will be analyzed.
3. Timely feedback and analysis will be provided after the user swings the golf club.
4. Trend analysis will be provided to calculate the improvement and consistency of the user overtime.
5. Users' information along with their video footage will be securely stored in a cloud database.
6. Users will be able to sign up and login to the app using Google single sign on.
7. User-friendly UI and step-by-step instructions for video setup.

5.2 Hardware

1. Smartphone camera to take videos in 720p HD format at 60 fps. It will be better to use iPhone cameras since the video size will be smaller if they are taken by iPhones.
2. Tripod to stabilize the smartphone when recording videos.
3. Motion sensors to accurately measure the motions of the player.

6 References

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