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Market Analysis of Sport Tracking Equipment

Introduction

With golf being a \$70 billion industry [1] and over ten million people actively playing baseball [2], there are numerous opportunities to capitalize on training equipment products. Companies have developed systems and devices to help casual players and professional athletes train for sports that require swinging motions such as golf, baseball, and tennis. Unlike trackers the player wears, external tracking equipment takes two forms: devices attached to equipment and camera tracking systems. Each form is coupled with software to provide feedback for the end user. This paper is a review of external sport tracking equipment.

Commercial Applications of Sport Tracking Equipment

Baseball

To maximize swing power and efficiency athletes use tracking devices to improve their swing. Hittinguru produces a camera system starting at \$55 [3]. By leveraging the Xbox Kinect hardware and custom software to analyze images, the system is relatively low cost. Diamond Kinetics sells a baseball bat sensor attachment for \$150 [4]. Even though the attachment is more expensive than the camera system, it is more portable and interfaces with a smartphone mobile application.

Golf

Tracking camera systems such as Gears Golf, which uses multiple cameras, specialized clothing, and club attachments, can be as large as an entire room and cost \$39,500 [5]. With a more complex system such as Gears, multiple metrics on the body and club can be analyzed in 3D [6]. For almost a tenth of the price, Smartgolf Smart Club is a custom driver with built in sensors to analyze golf swings [7].

Tennis

PlaySight is a tennis court monitoring system for recording matches and swings [8]. It does not provide individual metrics, but allows the player to retroactively view their performance. Zepp produces a racket mounted sensor for \$150 that provides swing feedback and metrics [9]. Sport tracker development is not limited to small companies; Sony's Smart Tennis tracker, costing \$200, is another sensor attachment with built-in smartphone connectivity [10].

Technology of Sport Tracking Equipment

Camera Systems

There are two major components to a camera based tracking system: the camera and image processing. Due to the resolution and dimension required in some systems, multiple specialized cameras and tracking points may be needed, as described in the NaturalPoint patent that powers the Gears Golf system [11]. Specialized software is required to capture the images and perform signal processing to analyze the swing. In the case of Hittinguru's Kinect based system, the hardware is readily available, but the software had to be developed to take advantage of it.

Sensor Systems

The cornerstones of the sensor systems are accelerometers and gyroscopes. While some measure motion and vibration, such as the Sony Smart Tennis [12], others such as Diamond Kinetics implement tracking through an Inertial Measurement Unit (IMU) which is typically a combination of accelerometers and gyroscopes [13]. With a microcontroller to collect sensor data, signal processing is used to produce useful information for the end user.

Implementing Sport Tracking Equipment

Both camera and sensor systems need software to produce useful results for the player. In addition to software, a combination of communications, micro processing, and power management is also required. Due to the complexity of the data collected, camera based systems are typically installed on a desktop computer, reducing power and communication restraints. Embedded sensor attachments need to balance the requirements of efficient data collection and transfer while maintaining a low power overhead. Embedded devices mostly use Bluetooth Low Energy (BLE) to save power and communicate with a smartphone [14]. Depending on the use case and user goals, one platform may be a better option over the other.

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