FT Bow: Prototype Device for Archery Form and Technique

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***Abstract*—This paper describes a bow and arrow controller prototype that will utilize a gyroscope and accelerometer to gauge the orientation, steadiness and stability of an archer's stance and release. Form and technique are vital for archery and it is critical that archers have practiced and have established a foundation for utilizing a bow and arrow. This paper aims to provide a solution to give people a way to experience archery on a more accessible, safe, and user friendly level.**

***Index Terms*—Archery, Training, Form, Stability, Accessible, Technique**

I. Introduction

Like with all sports, practice makes perfect. Knowing all the little details about the sport helps the athlete improve their performance and produce quality results. There is always a mental aspect in the game and with archery, it is critical for archers to simultaneously train mental skills as well as technical skills. The mental game of archery consists of having the right mindset to extinguish bad habits and focus mentally on preparing to take the shot. The more archers practice, the more the practice solidifies into a habit and becomes ingrained in a routine. Repetition like this is extremely vital for archers to improve consistency, accuracy and productivity [6].

II. Project Description

To use a bow and arrow, archers must know the proper form and technique to be able to grip, drawback and release the string to accurately shoot an arrow at the intended target. Archers need a way to learn and practice their form and technique with a bow and arrow in an easy and accessible way to ensure accurate shots, proper releases and to reduce injuries from occurring. Performing archery can be quite difficult to practice independently. There are a variety of exercises that an archer can complete to train themselves but without the proper space and equipment, it can be difficult to practice these mechanics. The archer must come up with a solution to allocate time and space to train and make it as accessible as possible.

The FT Bow aims to provide the archer with the necessary means to properly practice the sport of archery. The bow prototype will help teach proper form and technique to both new and old archers alike and will allow them to obtain the necessary experience to feel safe and practice archery whenever and where ever they want.

Some well known archery training devices out there include the TReality TBow Peripheral and the AccuBow Training Device [3]. The TReality TBow Peripheral is designed for gaming but offers a VR experience for exercise. Specifically designed for motion controllers, the bow was created to provide gamers a way to exercise their upper back and shoulder through constant pulling of the bow string [4]. The AccuBow is one of the better known archery training bows. Designed to improve strength, stamina and accuracy, the AccuBow comes with resistance adjustability to help archers get used to different tensions of a bow string. The Accubow Training Device also comes with a built-in laser device that lets the archer see their stability control and accuracy. It also features a non-shootable arrow, eliminating archers from worrying about target panic and where the arrow would impact and instead focusing more on their form and technique. [5].

III. Justification

Being able to safely and properly practice the form and technique for archery is critical for improved performance. If archers do not have enough practice and their form and technique is not sharp and well developed, it could lead to mistakes, injuries and poor performance. Practicing form and technique ensures that archers develop motor skills and muscle memory in order to be successful. When defining an archer's form, it can be thought of as the archer's stance, posture and grip whereas an archer's technique, is defined by how the archer releases the arrow. In most cases, archers train with a coach. A coach helps the archer with their form, and prevents mistakes from occurring. However, a coach will not always be able to give the archer their undivided attention so archers resort to practicing independently. This leaves the archer vulnerable to making mistakes with their form without the proper guidance and practice time. The intention of the FT Bow is to allow an archer to practice on their own while making sure they can still practice and maintain their form with a physical bow. The FT Bow can provide archers with more relaxed training regiments and archers can dial in on what they need to improve on more easily and effectively [1]. In terms of technique, the NTS

method is a widely accepted method on the proper way to shoot an arrow. This method consists of twelve parts: Stance, nocking the arrow, hooking the string, gripping the bow, mindset, set-up, drawing, anchoring, loading/transferring to loading, aiming and expansion, release and follow through, and relaxation. Based on this method of shooting an arrow, there are three types of forms that an archer can perform: Good release, dead release and pluck release. The FT Bow can help identify and train archers to learn how to perform a good release and to eliminate any sort of bad practices that can lead to a bad or a pluck release. A good release follows the NTS method as mentioned above, a dead release refers to when the shooting hand does not move upon release of the string and a pluck release is named after the sound made during the release which is caused by uneven tension on the string, generating said pluck noise and causing the archer's shooting hand to fly upwards, away from the archer [1].

For more novice archers, the importance of practice and feedback from archery training can help them take the next step. Performance feedback offers promising noninvasive, natural interaction methods to train an archer's technique and can potentially promote the development of related motor skills. The FT Bow aims to capture this form of feedback and cater towards any individual wanting to pick up archery as a hobby or a recreational sport. An example of a key setup is explained best through tactile displays [2]. The setup involves finding the best stance for the archer to be in before they start to draw the string. To have a proper stance, the archer needs to have their body and bow be on the same plane orthogonal to the ground. This stance ensures the archer is stable and can maintain it for a full draw. Training like the example above helps improve muscle memory and sensing the proper stance throughout the drawing process. Haptic feedback can also help the training process. Especially for beginners, this form of feedback presents the archer with vibrations which can help with subtle changes on the stance. The archer can rely less on visual cues to know if the drawing process has changed and if they are doing it correctly or not. The feedback is extremely beneficial to help the archer adjust their stance and ensure they are practicing properly and effectively.

IV. System Architecture

For the FT Bow, the goal is to provide an immersive training experience - something an archer can utilize independently, safely and at their own leisure. To practice their form, the bow will have a strong grip on the handle to allow for the archer to maintain their position as they prepare to draw back the string. A tension/force sensor will measure how far back the archer pulls the string and a gyroscope and accelerometer will determine the orientation and position of the aiming hand and bow angle. These sensors will relay the information to an Arduino and send a signal to a vibration motor to provide haptic feedback to the archer. These vibrations are meant to give the archer some immersive feedback for when they provide tension to the bow by pulling the string back. Since the bow is intended to be safe, we do not want to physically shoot an arrow. To indicate if the archer had a good release as a result of proper form, visual feedback will be outputted through an LED light or some sort of pleasant notification sound. All of this will be displayed back to the user to indicate if they are on track and on top of their training.

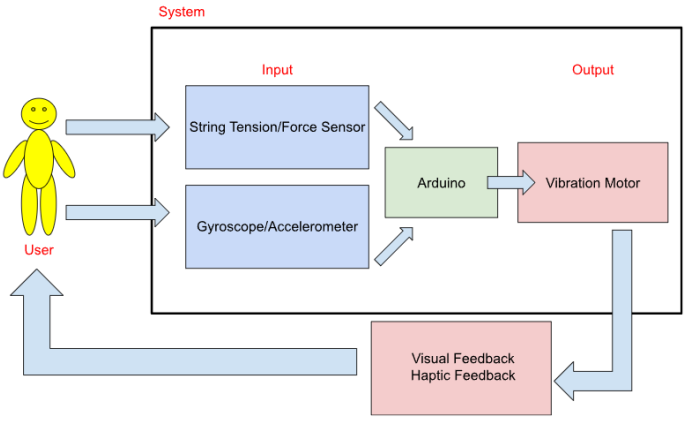

Fig. 1. System Architecture of the FT Bow.

V. Conclusion

The main purpose of an archery training bow is to give opportunities for archers to improve their skills and establish confidence when it comes to shooting a real bow. Accessibility to ranges and space to practice deters archers from getting good training in and the FT Bow hopes to eliminate this barrier and provide a way for archers to train with no consequences. Taking time to learn proper form will help to improve focus, patience and strength and reduce injuries and poor performance. For archers that want to compete at the highest level of competition, the FT Bow will be a great way to get in reps and improve the overall foundations archers have learned and built their skills upon.

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