

## A Measurement and Motor Control System for Free Throw Shots in Basketball Using Gyroscope Sensor

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**Abstract :** This research aims at finding a tool to provide basketball players with real-time audio feedback on their shooting form in free throw shots. Free throws played a pivotal role in taking the lead in fierce competitions. The major problem in performing an accurate free throw seems to be improper training. Since the arm movement during the free throw shot is complex, the coach or the athlete might miss the movement details during practice. Hence, there is a necessity to create a system that measures arm movements' critical characteristics and control for improper kinematics. The proposed setup in this study quantifies arm kinematics and provides real-time feedback as an audio signal consisting of a gyroscope sensor. Spatial shoulder angle data are transmitted in a mobile application in real-time and can be saved and processed for statistical and analysis purposes. The proposed system is easy to use, inexpensive, portable, and real-time applicable. Objectives: This research aims to modify and control the free throw using audio feedback and determine if and to what extent the new setup reduces errors in arm formations during throws and finally assesses the successful throw rate. Methods: One group of elite basketball athletes and two novice athletes (control and study group) participated in this study. Each group contains 5 participants being studied in three separate sessions over a week. Results: Empirical results showed enhancements in the free throw shooting style, shot pocket (SP), and locked position (LP). The mean values of shoulder angle were controlled on 25° and 45° for SP and LP, respectively, recommended by valid FIBA references. Conclusion: Throughout the experiments, the system helped correct and control the shoulder angles toward the targeted pattern of shot pocket (SP) and locked position (LP). According to the desired results for arm motion, adding another sensor to measure and control the elbow angle is recommended.

**Keywords :** audio-feedback, basketball, free-throw, locked-position, motor-control, shot-pocket

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