

# Real time tracking of American football and analysis

Mohammad Shams Arman Rupok, H. Patnaik, Dr. Subramaniam Ganesan  
Electrical and Computer Engineering, Oakland University  
Rochester hills, Michigan, USA  
marupok@oakland.edu

## Introduction

Real time tracking system of ball has been constantly improving throughout the years. American football is prolate spheroid shaped football and players needs-extensive practice for kicking and throwing to achieve the best performance. Several researches have been performed on ball tracking based on camera and vision system. Using camera not only expensive but also it is challenging to track the motion of ball as the ball travels at very high speed. Ball tracking system with embedded sensors allows low cost and easy implementation. The need for this type of technology is to perform various analysis of player's performance and to train players accordingly. The outputs from tracking system of tennis ball are trajectories of motion of the ball and output data obtained from tracking system provides important statistics about the game. For instance, speed and the acceleration at any instant, distance traveled by the ball as well as force acting on ball during throw and kick by players can be obtained from collected data. The statistics of output data can be analyzed and plotted in compelling ways to improve the efficiency of the players and strategy involved in the sport.

## Design

The System consists of 3-axis accelerometer, microSD and microcontroller development board. The tracking system would be mounted inside the ball. The ball tracking system will measure real-time acceleration in 3-axis. Real-time data would be stored into microSD with time stamp and date on a database which can be used to draw the trajectory in Matlab or Excel program for more analysis.

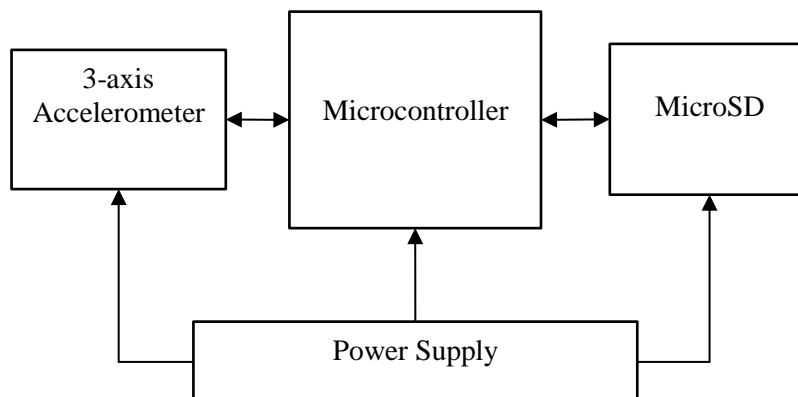


Figure 1: Block Diagram of Ball Tracking System.

## Testing

The testing was performed using Texas instrument LM4F232H5QD evaluation board. The evaluation board consists of Bosch BMA140 3-axis analog accelerometer consists and RTC which are essential for this experiment. To power up the board ARES rescue 7.5mm of thick power supply was used which can supply power up to 2 hours. The ball was placed horizontally and kicked for short distance. The full test takes only 12 seconds. More time is needed to calibrate the football and for in-depth testing.

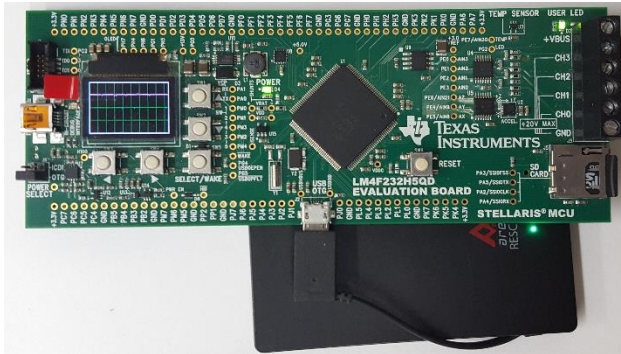


Figure 2: LM4F232H5QD evaluation board.



Figure 3: TI board inside football

## Results

The acceleration is measured in milli-G value (mg) and later velocity is calculated in  $\text{ms}^{-1}$  from computer program. Figure 4 and 5 shows the acceleration and velocity obtained from test.

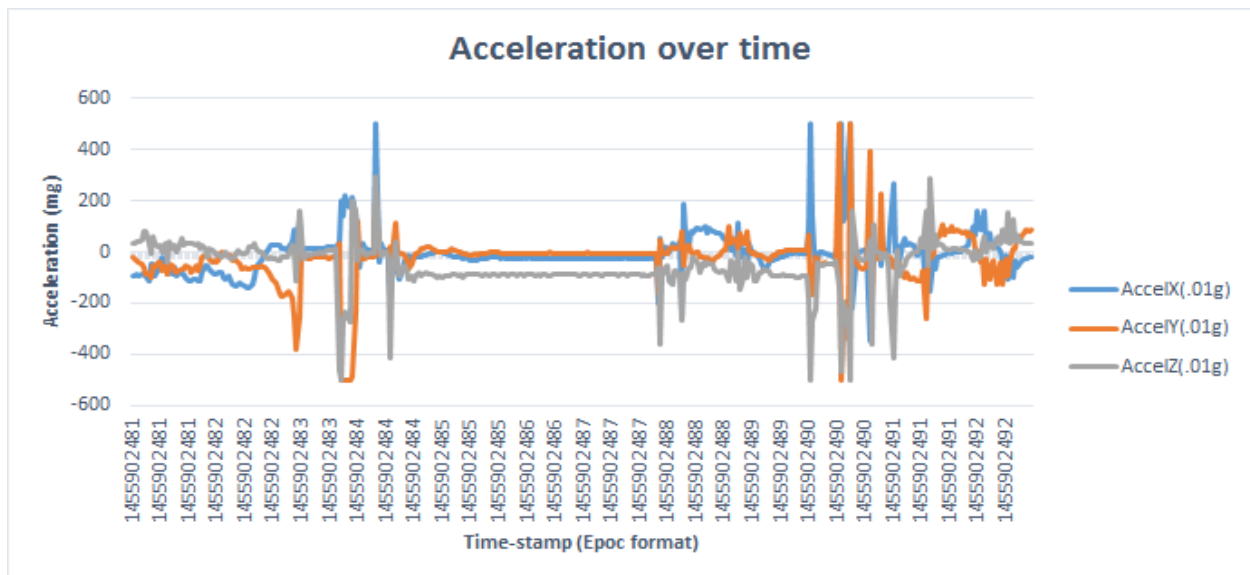


Figure 4: Acceleration in 3-axis from football

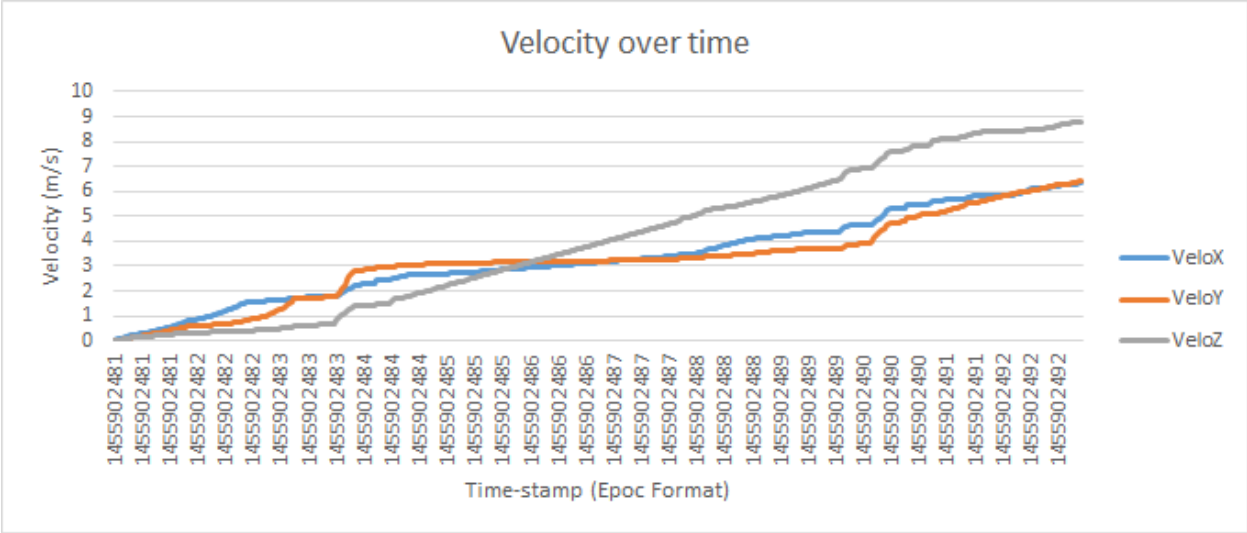


Figure 5: Velocity in 3-axis from football

**Conclusion**

Use of Accelerometer in sports is increasing rapidly to train the players to become more skilled. Embedded sensors in real-time ball tracking system offers inexpensive and easy way of implementation and acquired data from tracking systems allows to analyze skills and techniques of players. Due to its low cost and easy to interface, many low cost applications are being developed using embedded sensors includes: health monitoring systems, finding lost keys and so on.