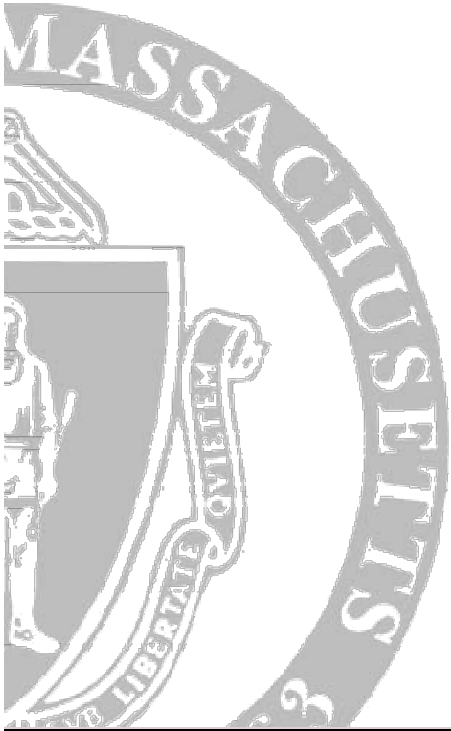


Final Project Review

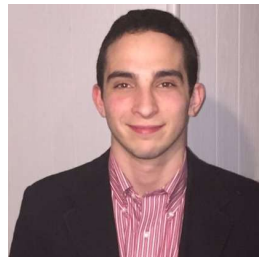
Team 1 (AutoUmp)
April 11th, 2017



The Team



Timothy Adams
CSE



Jason Camiel
EE



Justin Marple
CSE



Matt Barnes
EE

The Setting

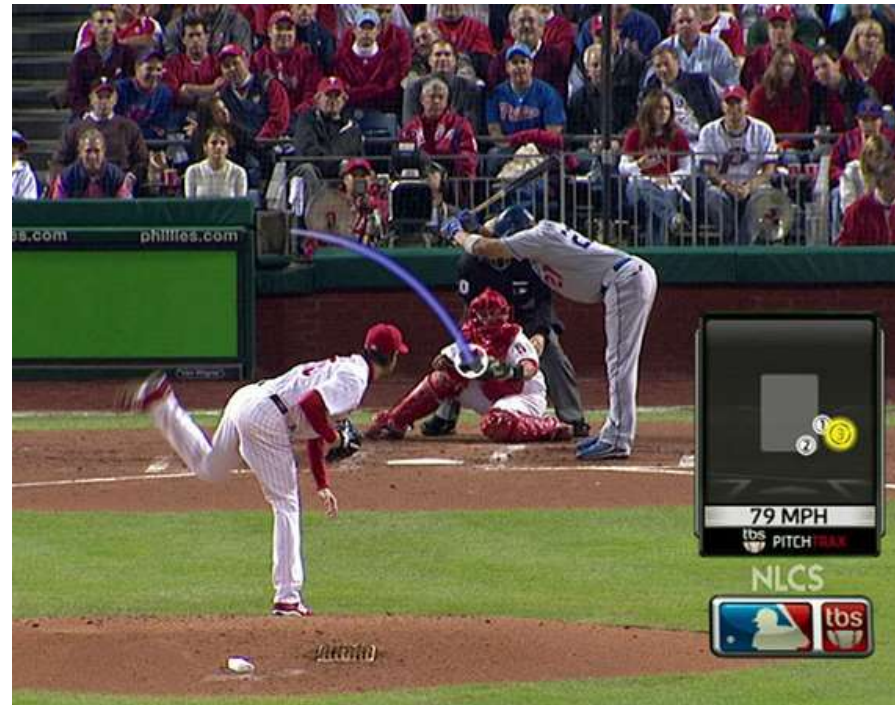


Current Solutions



- Inaccurate
- Biased

- Prohibitively expensive
- Extensive set-up required



Our Solution

- A self-contained, autonomous home plate that detects balls and strikes
- Cheaper than traditional technology
- Not subject to human error

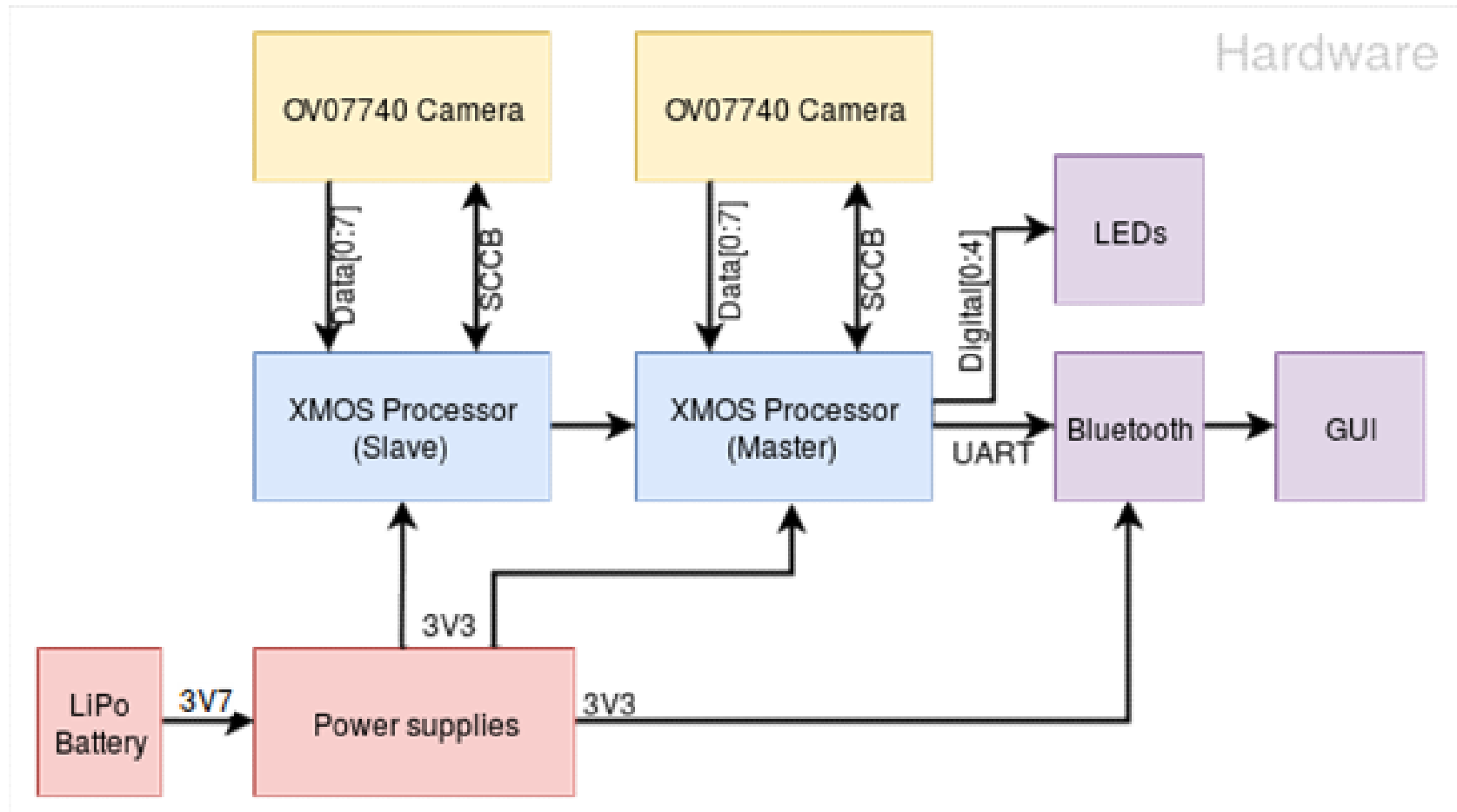
Requirements

- Detect balls/strikes accurately (\geq human ump)
- Detect fastball of average little league player
- Real-time use
- Self-standing
- Battery life lasts duration of game
- Robust against physical impacts, changing weather
- Allow for different height batters

Key Challenges

- Detect and track ball with cameras
- Embedded hardware
 - Image processing on an embedded system with power/size constraints
- Design of robust, self-enclosed system that still allows for user notification and feedback
 - Enclosure
 - App, 2-way communication

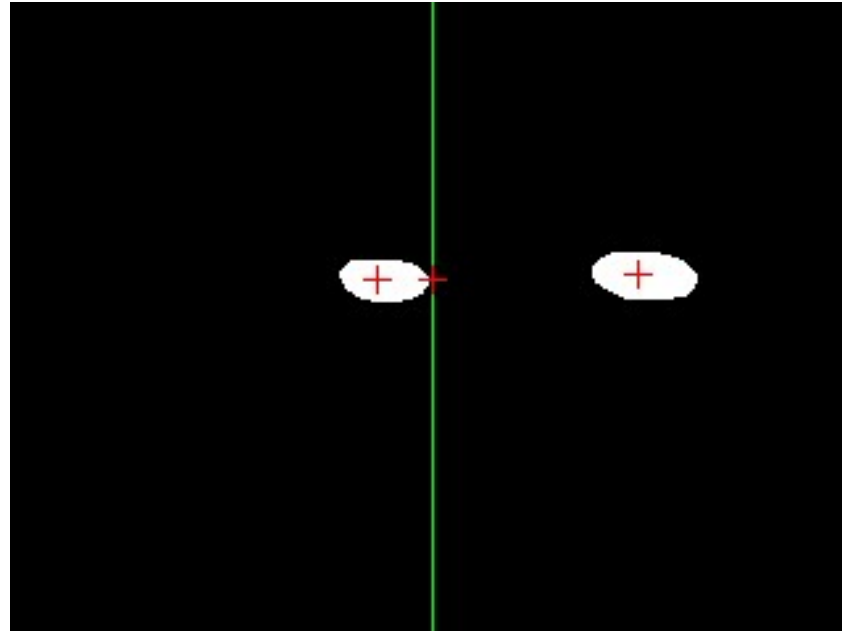
Block Diagram - Hardware



Specifications

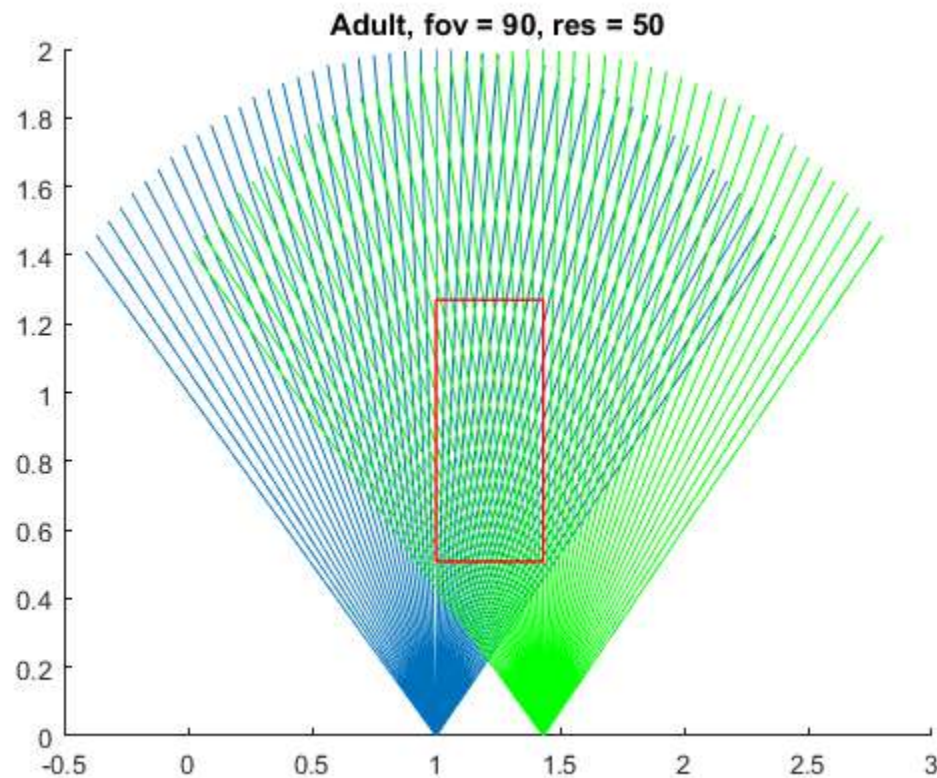
- 16.7ms throughput for image processing tasks
- 60fps with 110 degree field of view in flight direction
- Maximum 1 second delay
- Self-standing
- Can withstand physical conditions at baseball field
- Battery life > 3 hours
- Adjustable height of strike zone from app

Ball Detection



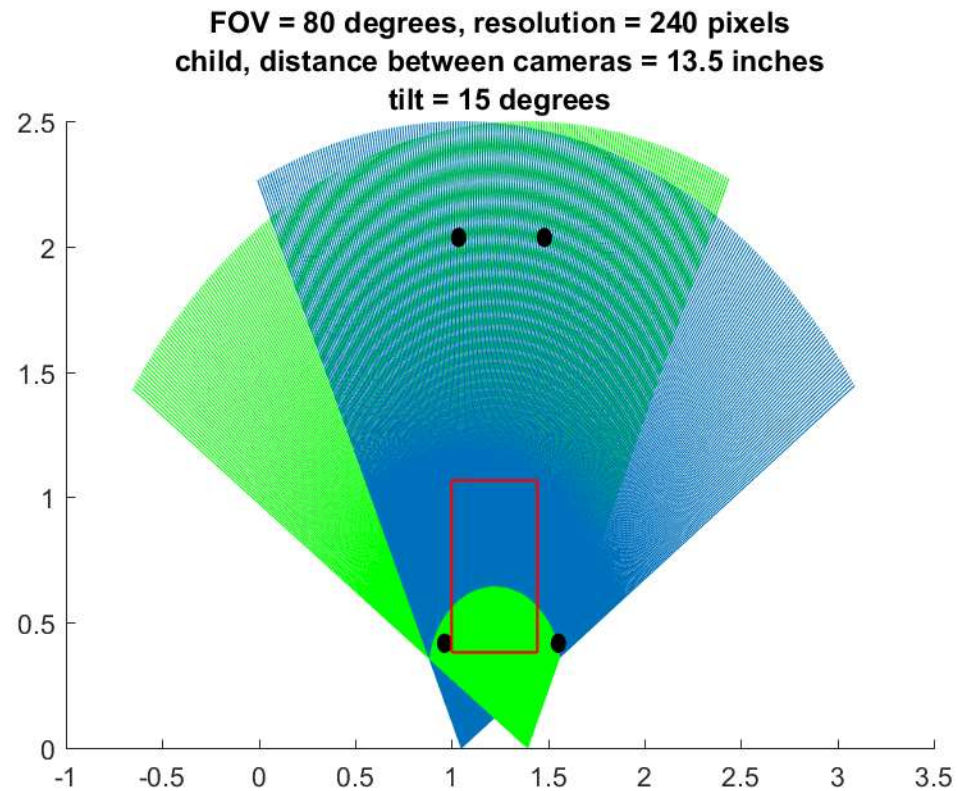
- Interpolate path of ball using a ball on either side of the strike zone
- Calculate pixel location of strike zone intersection

Ball Detection



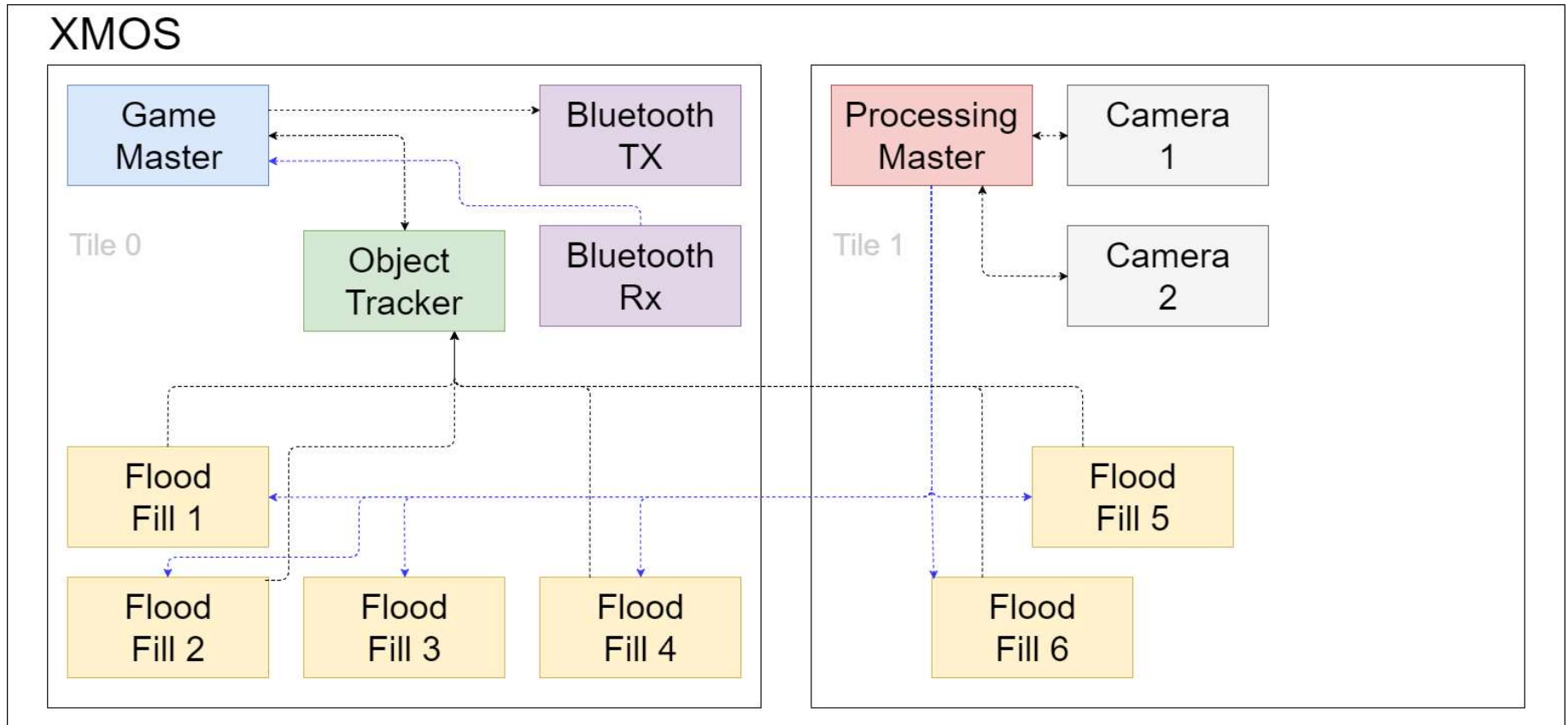
- Use pixel location from each camera to calculate (x,y) position of baseball in strike zone plane

Ball Detection



- Tilt cameras in order to see entire strike zone

Dealing with Bottlenecks



Camera Protection

- Baseball fields made up of dirt
- Polycarbonate: (Mohs)
- Glass: 5.5 (Mohs)
- Quartz: 7 (Mohs)
- Sapphire: 9 (Mohs)



Requirements

- Detect balls/strikes accurately Often
- Detect fastball of little league player ~35mph
- Real-time use Yes, no perceptible delay
- Self-standing Yes
- Battery life lasts duration of game Yes
- Robust against physical impacts, changing weather Yes
- Allow for different height batters Yes, via app

Costs

- Initial Prototype Development: \$380.26
- Final Prototype Development: \$677.25
 - PCBs: \$478.28
 - Enclosure: \$198.97
- Miscellaneous: \$185.69

- Development Cost: \$1242.94

- Final Prototype Actual Cost: ~\$200.00