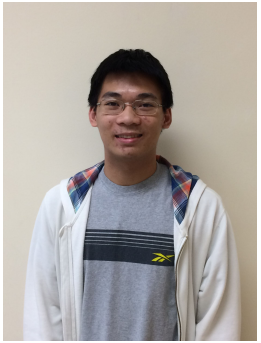
LASERef

Team 18

Comprehensive Design Review

Meet the Team

Advisor:
Professor Tessier



Josh Setow
EE

Tim Freitas
EE

Sam Auwerda
EE

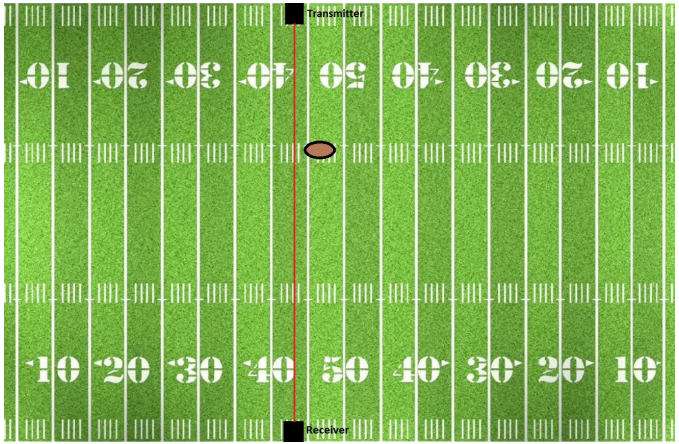
Josh Gallant
EE

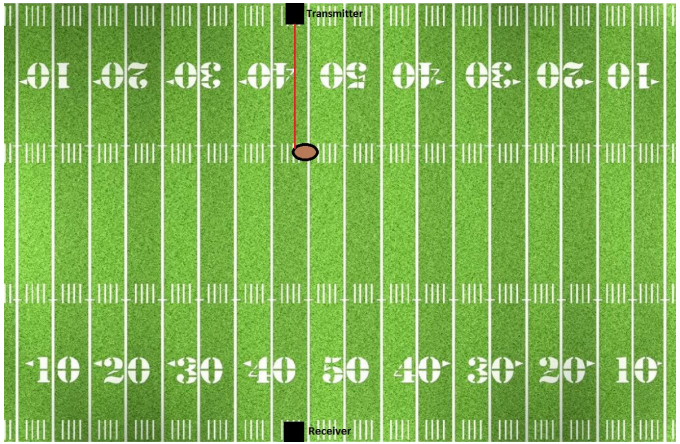
Overview

- The current first down marking system slows down gameplay and is prone to human error.
- The LASERef is a break-beam sensor that:
  - Illuminates a signal LED if beam is broken
  - Sends Tweet and Updates a GUI on current down
  - Uploads Twitter and GUI with a snapshot of the marked ball

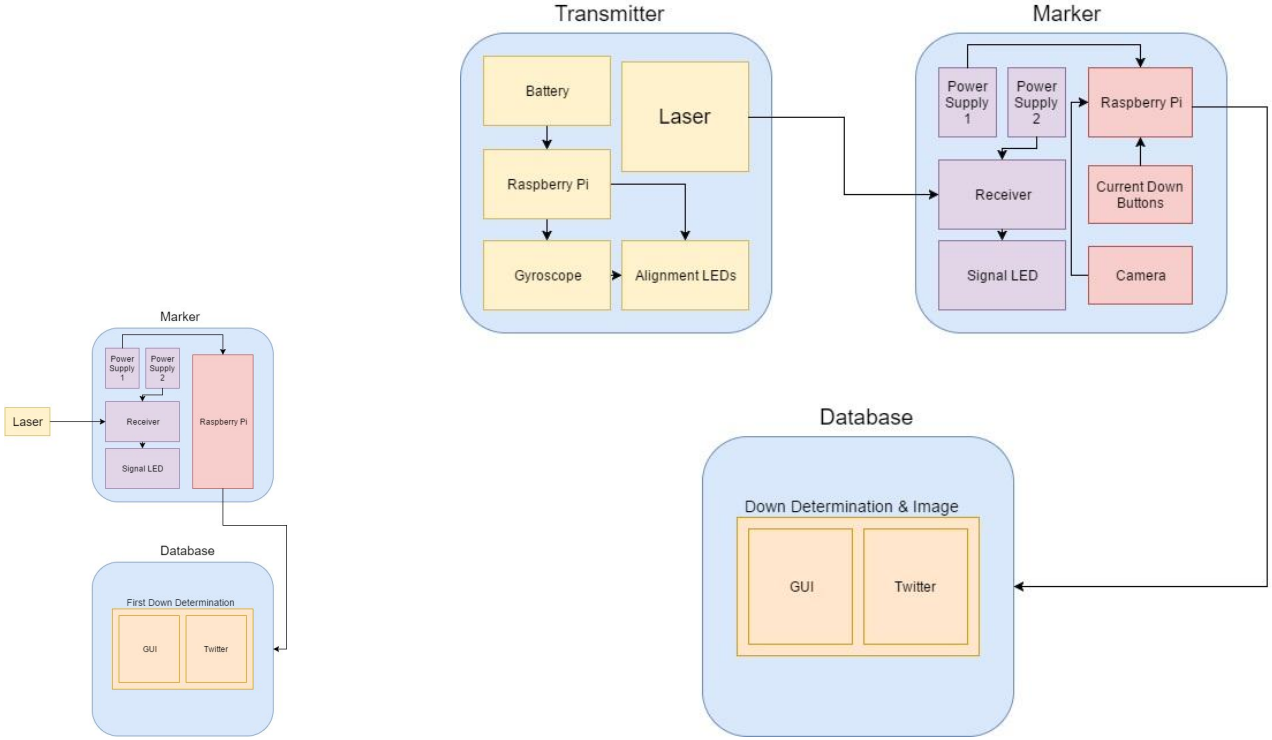
Overview

Ball is detected when beam is broken





Block Diagram

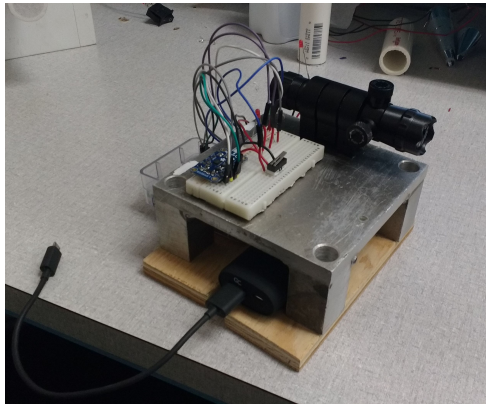


Promised CDR Deliverables

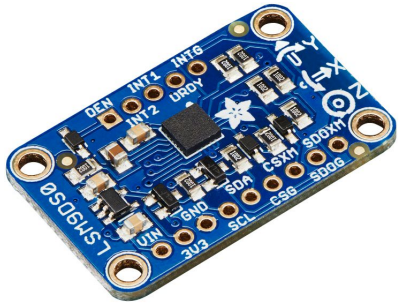
- More information to be relayed to Twitter
  - Current down, game time, etc.
- Design the other marker holding the laser
  - Stabilization and levelling
  - Laser stays still
- Alignment of the markers on the field
  - Laser and photodiode need to be aligned
  - Less time spent manual aligning it

Transmitter: Overview

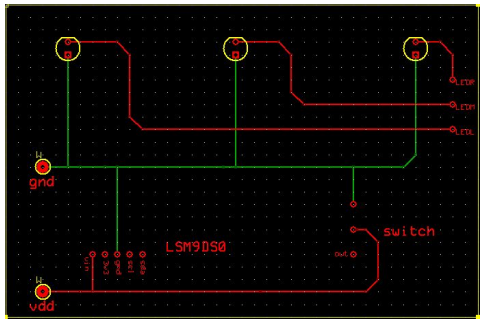
- Transmitter will be placed on first down marking mat in front of marker
  - Too many uncontrollable variables to account for it it was attached directly to held marker
- Transmitter is fitted with angle detector for assisted alignment
  - Uses gyroscope to recognize angles
  - LEDs used to signal current state



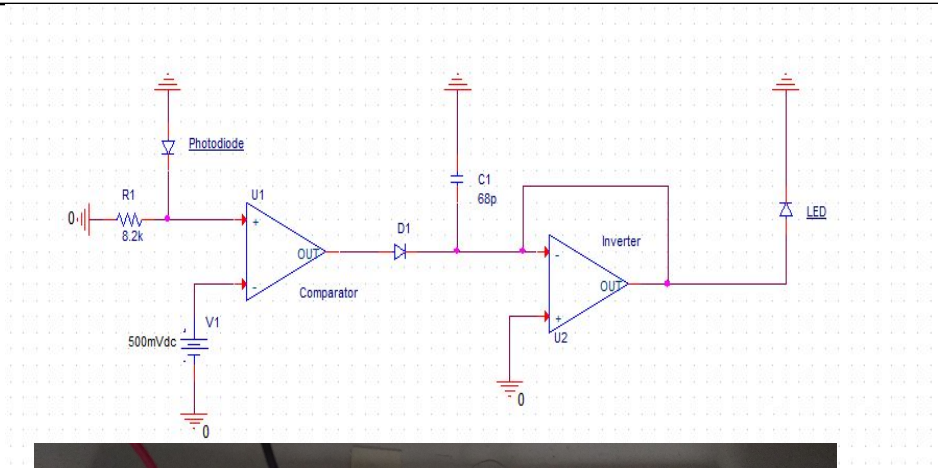
Transmitter: Angle Detector

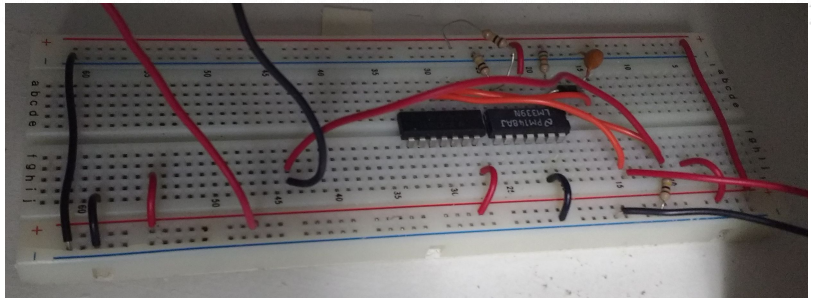


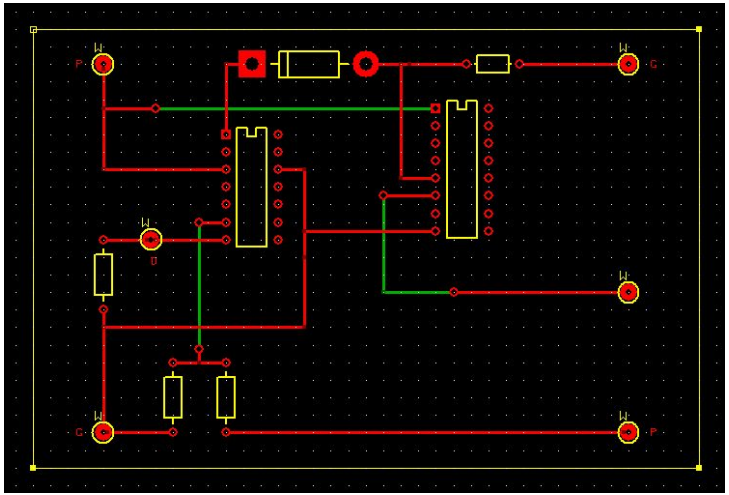
- Made with…
  - Raspberry Pi 3
  - LSM9DS0 accel, gyro, mag breakout
  - Signal LEDs
- Designed to assist in the alignment process
  - LEDs indicate when angle is out of tolerance of calibrated set angle
- Accurate to 2°
  - Worst case inaccuracy - 1.75 yards



Receiver Circuit - PCB Schematic





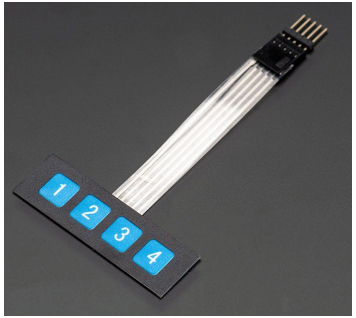


Light Shield

- New light shield constructed from PVC pipe
- Light filter fabric added to restrict the amount of sunlight hitting the photodiode

Information Relay to Twitter + GUI

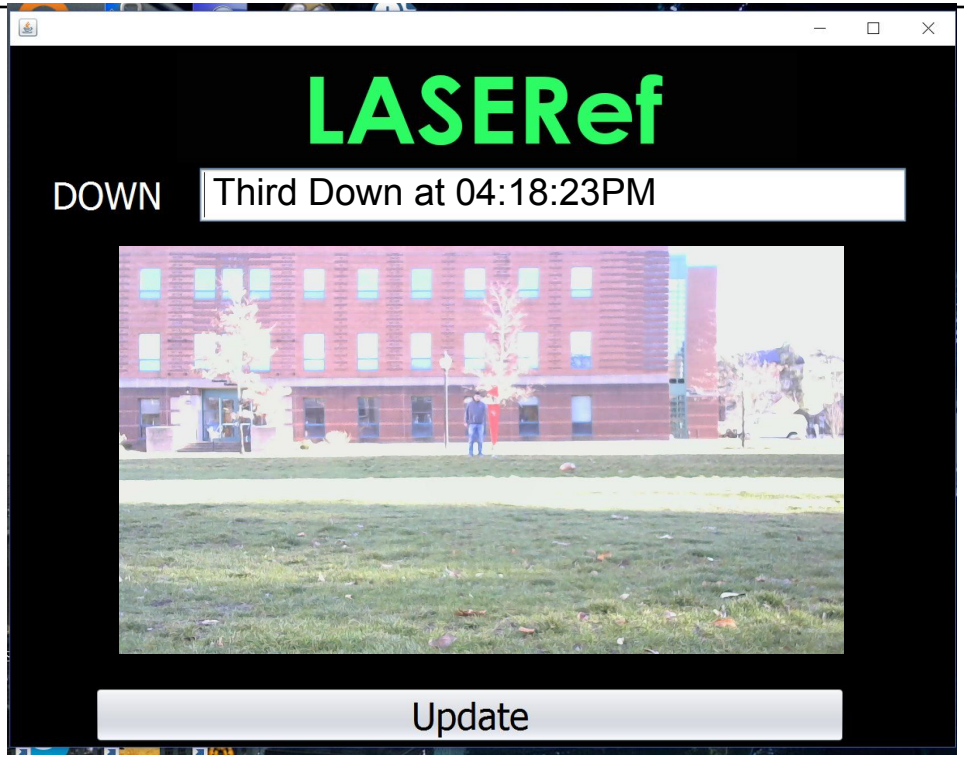
- Using both Twitter and GUI now
- The current down (First, Second, Third, Fourth) is now sent through a push button
- After button is pressed, webcam takes image of football
- Image and current down are tweeted along with the current time
- GUI extracts this information from Twitter and displays it



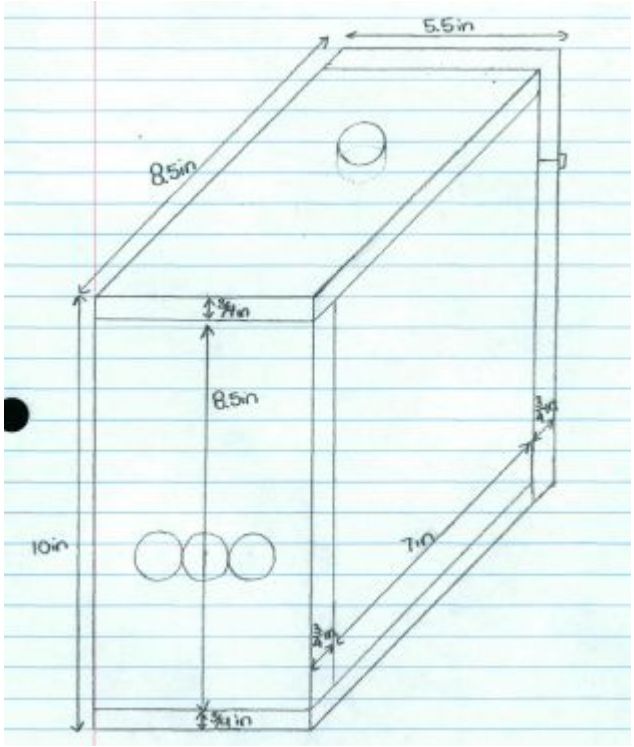
GUI

- GUI (Graphical User Interface) is the software system which shows the current data (Current Down and Image)
- Program developed using Java in Netbeans IDE
- Works by pressing the ‘Update’ button

GUI

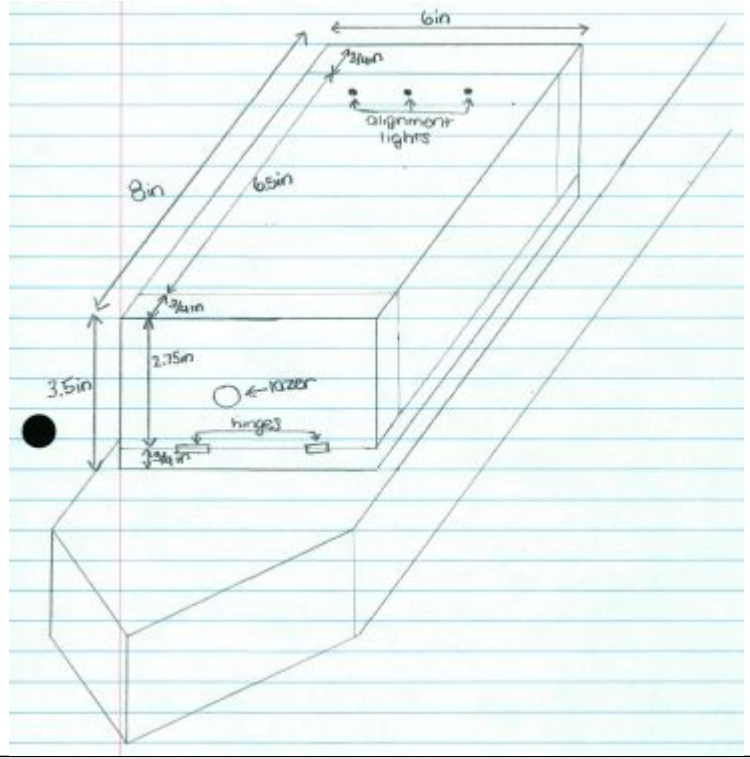


Design of New Receiving Unit

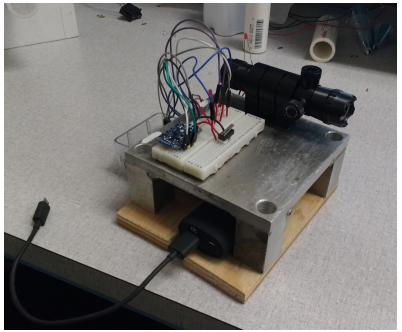


- Original unit dimensions:
  6.5″ x 6.5″ x 14.5″
- New dimensions:
  5.5″ x 8.5″ x 10″
- Longer box length allows the photodiode receiver cone to be inside the box

Design of Transmitter Unit



- Dimensions:
  6” x 8” x 3.5”
- Placed on top of foam first down arrow



Demo

- Transmitter
- Receiver
- Information relay

CDR Deliverables

- More information to be relayed to Twitter ✓
  - Current down, game time, etc.
- Design the other marker holding the laser ✓
  - Stabilization and levelling
  - Laser stays still
- Alignment of the markers on the field ✓
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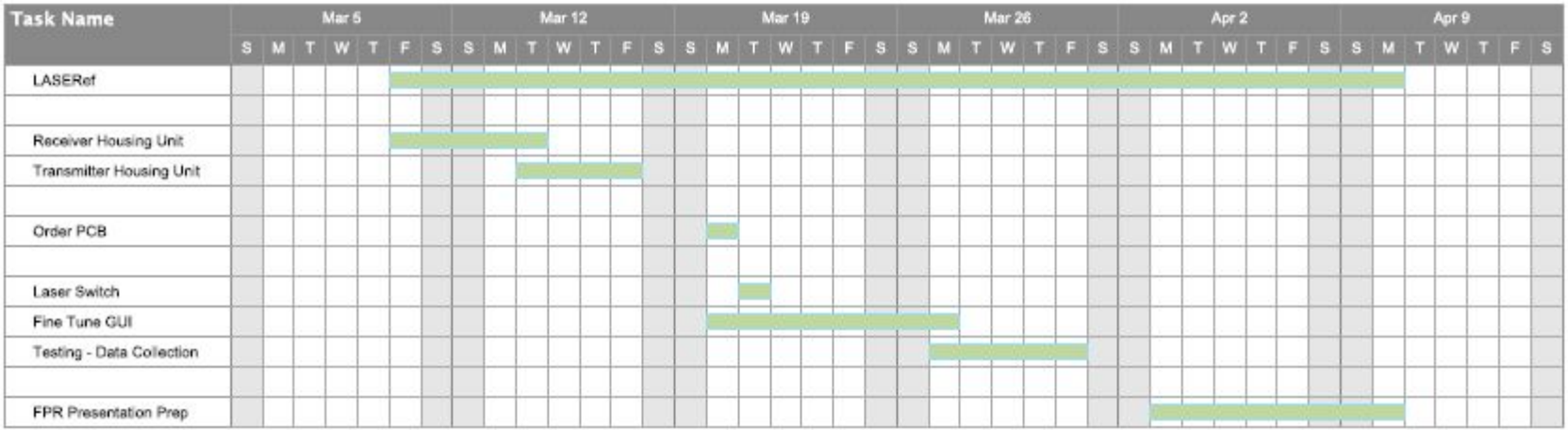
FPR Deliverables

- New Housing Units for Transmitter and Receiver
  - Padded, Durable, Visually Appealing
- Improved Materials for Light Shield
  - Matte color to avoid unwanted reflection
  - Filter in-front that will allow laser but restrict ambient light
- Improved accuracy on angle detector
- Testing and Data Collection

Team Contributions

- Josh G
  - Implemented the webcam and button strip
  - Designed the GUI
- Josh S
  - Updated the light shield
  - Designed new transmitter and reciever units
- Sam
  - Designed transmitter and angle detector
- Tim
  - Receiver PCB
  - Building Housing Units over Spring Break

Gantt Chart


Task Name
Mar 5
Mar 12
Mar 19
Mar 26
Apr 2
Apr 9
S M T W T F S S M T W T F S S M T W T F S S M T W T F S S M T W T F S S M T W T F S
LASERef
Receiver Housing Unit
Transmitter Housing Unit
Order PCB
Laser Switch
Fine Tune GUI
Testing - Data Collection
FPR Presentation Prep

Thank You

Questions