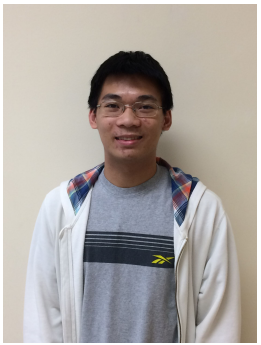
Laser First Down Marker

Team 18

Preliminary Design Review

Meet the Team

Advisor:
Professor Tessier



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What is a First Down?

- A First Down is a checkpoint that the team with possession of the ball has 4 attempts to reach
- A First Down is 10 yards long

Current Methods

- New First Down Mark:
  - Referees “eyeball” where subsequent first down marker is placed

- First Down Determination:
  - On close calls, gameplay is stopped while referees bring first down markers on to the field

The Problem


OUTBACK BOWL
ESPN
10 S. CAROLINA 21
18 MICHIGAN 22
4th | 8:22
IND-BAL
Harbaugh: Only coach in NFL history to win playoff game in each
ESPN

The Problem

- Prone to human error
- Slows down gameplay
- Not very accurate

Goal

- Develop a quicker and more accurate way of determining whether or not the ball crossed the first down marker

- Implement a more accurate way of marking the subsequent first down

Our Method

With the use of lasers…

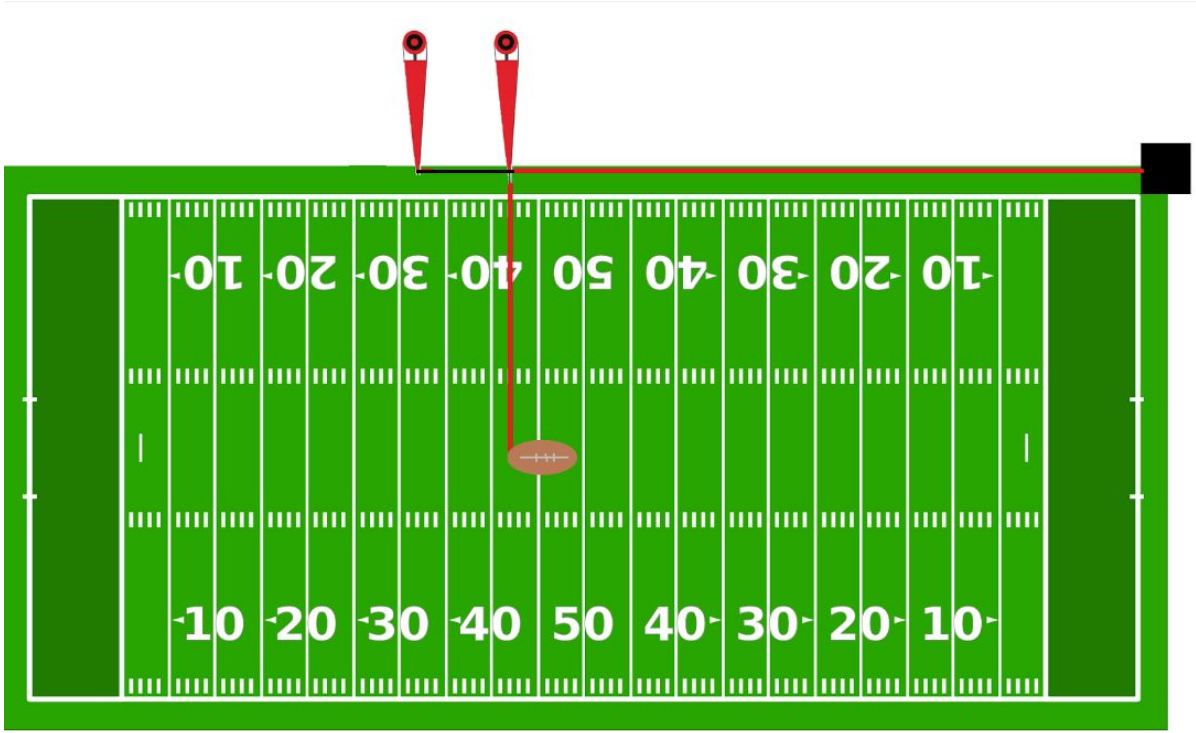
- The marker determines whether or not the ball has crossed the first down plane
  - Instant feedback to referees, stadium, TV crews

- Pinpoint accuracy of where the next first down marker should be placed

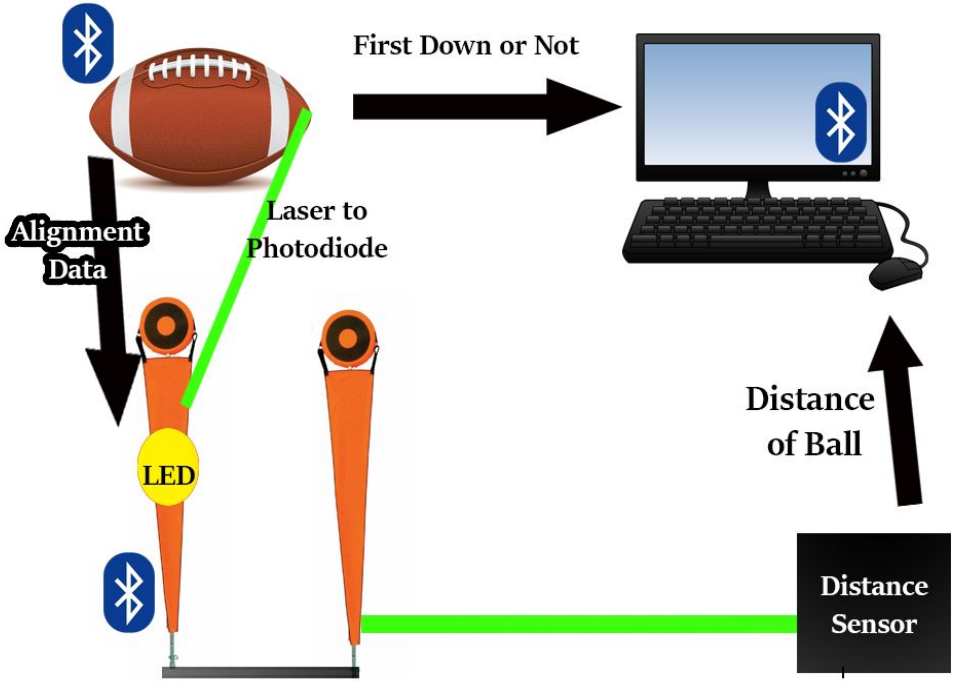
The System

- The Marker
  - Equipped with a laser on the marking stick to shoot across the field to detect the ball
  - Equipped with bluetooth receiver to receive signal from ball
  - When ball is detected green LED will shine on marker
- The Ball
  - Equipped with a photoconductive sensors to sense laser
  - Bluetooth transmitter inside of ball sends signal if sensors are excited
- Distance Tracker
  - Distance measuring laser transmitted from one end of the field to the marker to determine yard line on the field

Diagram



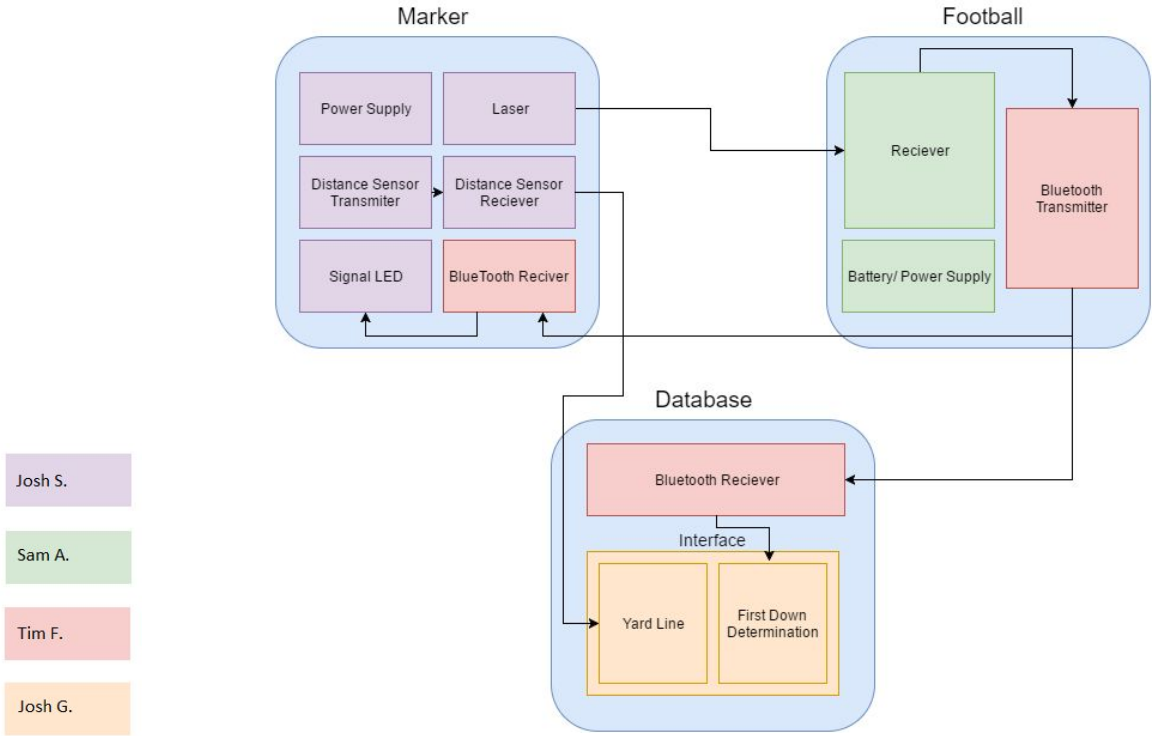
System Overview



System Requirements

- Detect football at long distances
  - Up to 25 yards across the field
- Fast
  - Be able to move quickly up and down the field to ball's position
- Accurate
  - Track ball's position down to the inch
- No effect to durability and performance of the ball
  - Ball can withstand the normal wear and tear during a game
- Quick relay of yard line information to referees, announcers, and viewers

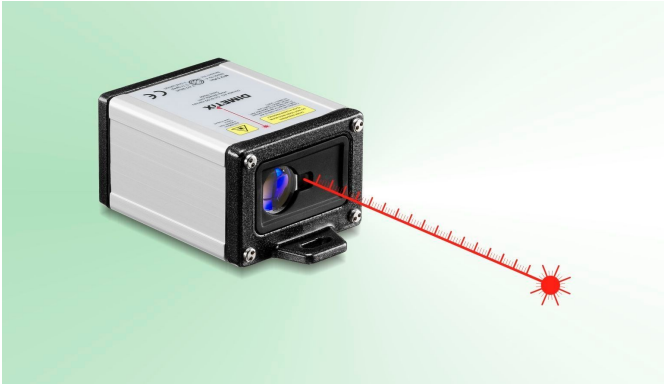
Block Diagram



System Overview

Displacement laser

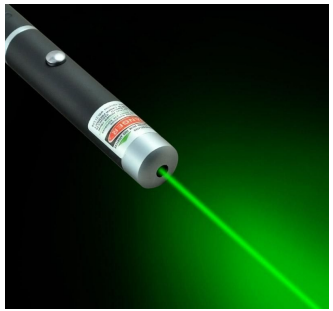
- Function:
  - Find marker's position on field
  - Relay information to database
- Location:
  - Transmitter at endzone
  - Receiver at marker

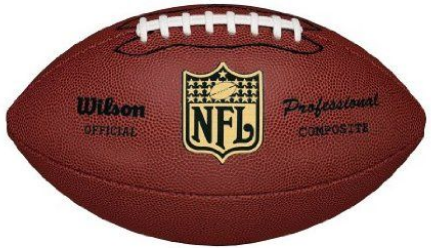


System Overview

Ball Detection

- Function:
  - Laser from marker excites photodiode in football
- Location:
  - Photodiode located on tip of football
  - Use of conductive surfaces on nose to direct light to sensors





System Overview

Bluetooth Transmitter/Receiver

- Function:
  - Transmit a signal if photodiode is excited by laser
  - When the signal is received an LED will shine to let chain crew know that the ball is aligned with laser
- Location:
  - Transmitter located in Football
  - Receiver located on Marker

System Overview

Database

- Gathers data from marker, football, and distance sensor
- Interface to computer to easily show whether a first down is achieved
  - Also be able to show marker's position on the field

Challenges

- Placing the photodiode into the football so that it can be detected by the laser from the marker
- Determining correct first down location from distance laser
- Making sure that the laser will shoot perfectly perpendicular to the field
- Assembling all of the components so that they work together properly

MDR Deliverables

- Demonstration that marker can detect the nose of the football up to 25 yards
- Distance sensor can detect how far down the field the marker is placed
- Bluetooth modules in football and marker to relay information to central software system

Thank You

Questions