The Football Field Generator Program

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Painting the Brookwood High School Football Field

Cost to paint Field

Manual Method

- Total Labor Hours = 20 (4 man)
- Paint Consumption = 25 gallons
- Labor Cost = $330 per field marking (16.50 hr./pay)
- Paint Cost = $250 per field
- Cost Per Season = $4,640
- Contracted Cost = $500/game plus paint

Intelligent One (ION)

Intelligent One (ION)

Intelligent One

- Total Operation Hours = 3
- Paint Consumption = 10 gallons
- Labor Hours Savings = $2,640 annually
- Paint Cost Savings = $1,200 annually

https://turftank.com/intelligentone/

Intelligent One

- Requested changes to program to outline endzone letters
  - Manually, requires a team of 5 over 8 hours to outline the endzones prior to the first game
  - Letters have to be replotted near end of season which requires the same level of effort

- Would require significant cost increase to intelligent one program and would take over a year to program according to turftank

WHY?

Project Overview

- Utilize Python to develop the longitude and latitude points for all lines of a football field
  - Provide a table of start and stop points to avoid having to survey the field each year
  - Provide a table of start and stop points to feed into the “football Roomba” to understand the concepts behind the intelligent One
  - Graphic proof of calculations to demonstrate the calculations and layout

Project Overview

Utilized the formula that gave the longitude and latitude of the second point using the following formula where θ = bearing, A = radius of the earth in feet and d = distance travelled

latitude of second point = la2 = asin(sin la1 * cos Ad + cos la1 * sin Ad * cos θ)

longitude of second point = lo2 = lo1 + atan2(sin θ * sin Ad * cos la1, cos Ad – sin la1 * sin la2)

Project Parameters

- Imported Modules
  - Math for Trig functions and PI
  - Turtle for Drawing

- A = 20902230.971129 feet

- Length of field = 360 feet
- Width of field = 180 feet
- Length of hashmark = 2 feet

Project Steps

- Input the starting parameters of latitude, longitude and bearing and error check
  - Note: formula breaks down at north and south pole. Therefore latitude was limited to +/-75 degrees

- Calculate the Endzone corner points
  - EZ1 = 80 feet from starting point at the bearing + 90 degrees
  - EZ2 = 80 feet from starting point at the bearing – 90 degrees
  - EZ3 = 360 feet from EZ1 at the bearing
  - EZ4 = 360 feet from EZ2 at the bearing

Project Steps (Continued)

- Yardlines are at 30 feet, 45 feet and continue every 15 feet until 330 feet from starting end line
  - Yardline starting point = EZ1 + the distance at the bearing angle
  - Yardline ending point = EZ2 + the distance at the bearing angle

- Hashmarks are every yard between the yardlines but aren't inside the endzone (33 , 36, 39, 42, 48, 51 feet etc)
  - Hashmarks near the sidelines are .5 feet inside the sidelines
  - Starting point for hash marks are
    - Sideline 1 starting point = starting point + 79.5 feet at the bearing angle + 90 degrees
    - Sideline 1 ending point = starting point + 77.5 feet at the bearing angle + 90 degrees

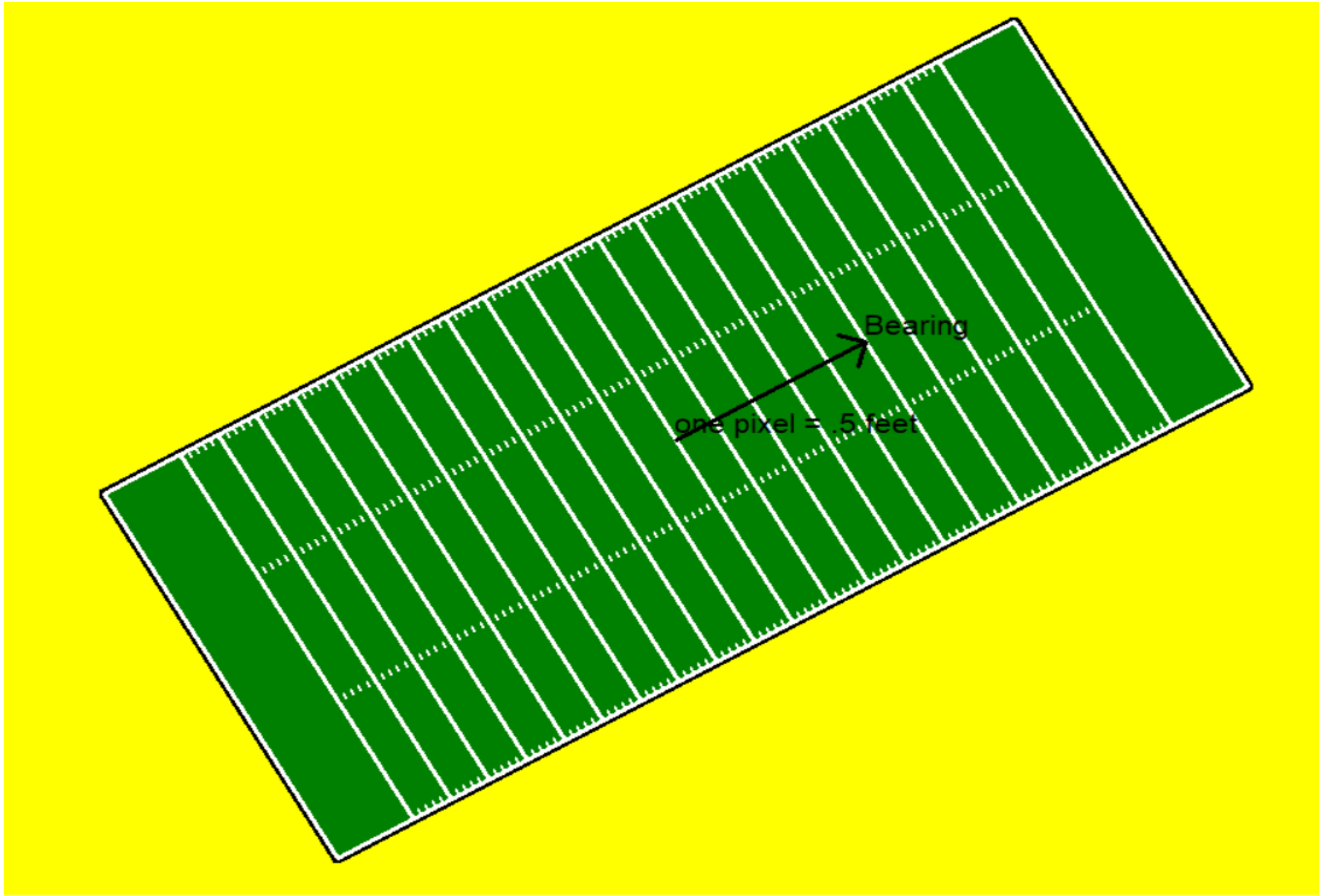
Proof of Concept Plotting

- Used turtle and converted longitude and latitude to x,y coordinates for plotting
  - Set midpoint of field to be (0,0) on turtle screen
  - Calculated change in latitude and longitude between two points to determine change in feet / change in degree to convert to x,y
  - Used two equation two unknown algebraic logic to solve for x,y coordinates
  - Each pixel represents .5 feet in turtle

- Two equation logic failed at bearings 0, 45, 90, 135, 180, 235, 270, 315, 360
  - Used separate logic to address those conditions

Drawing Steps

- Changed background to yellow
- Added title to drawing window
- Drew a Black border around field
- Changed field color to green
- Drew white sidelines on top of black border
- Drew yardmarkers
- Drew hashmarks
- Added bearing arrow
- Added name
- Added pause to wait on user click


Bearing
one pixel = .5 feet