Autonomous Soccer Robot

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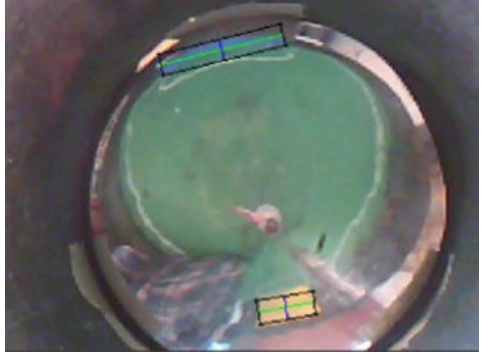
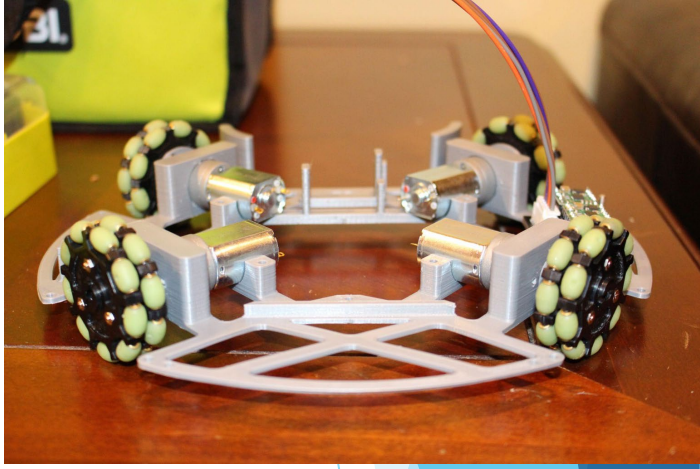
Purpose

- Create a Soccer Robot that can autonomously Play Soccer
- Compete In the Robocup Junior Competition and have the potential to Win
- Act as a platform for beginner students to learn robotic concepts
- Allow students to use robot as a learning platform to build additional features
- Allow students to use customize robot to compete in the competition themselves

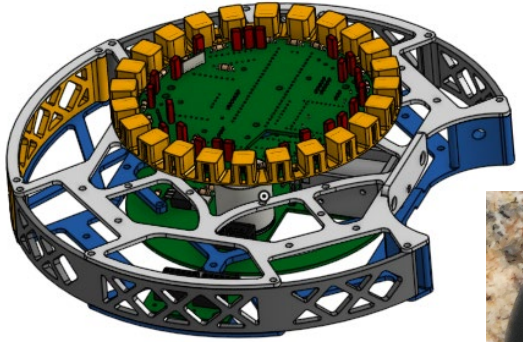
Materials



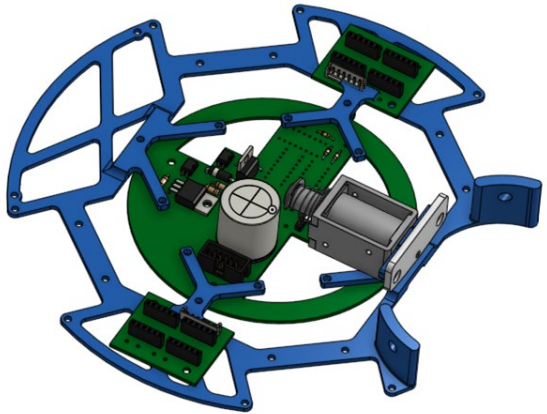


- Chassis
  - Acts as the foundational structure of robot
  - Holds all the parts together neatly
  - Created using Computer Aided Design softwares to produce accurate and custom parts
  - 3D printed using PLA and NylonX to create quick and cost efficient parts
- Brushed DC motors that allow intuitive control and very few external electronics
  - Maxon DCX19 + GPX16 gearbox
- Omni Wheels - Allow robot to move in all directions while facing the same orientation
  - Custom Made plates to support custom mount for motors
- Printed Circuit Boards
  - Designed Using KiCad
  - Saves space and allows for use of smaller electronic components
- Mirror - Omnidirectional
  - Allows camera to see 360° view of the field

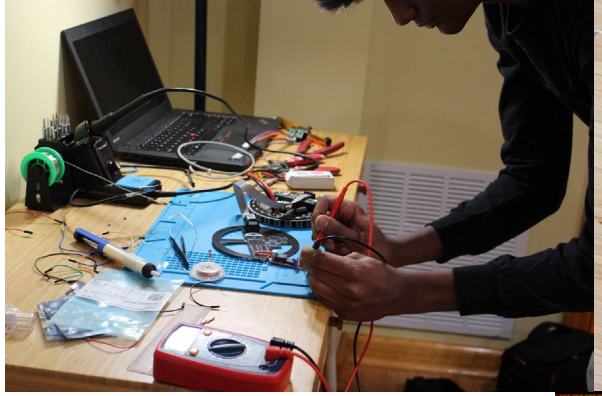
Hardware Design

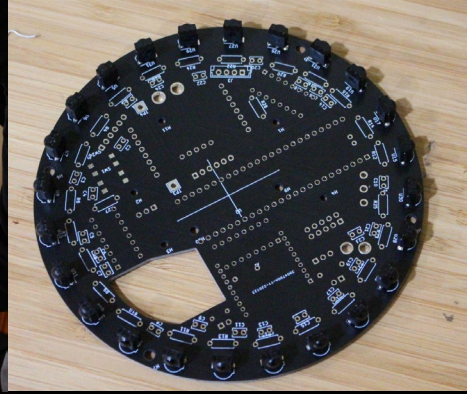


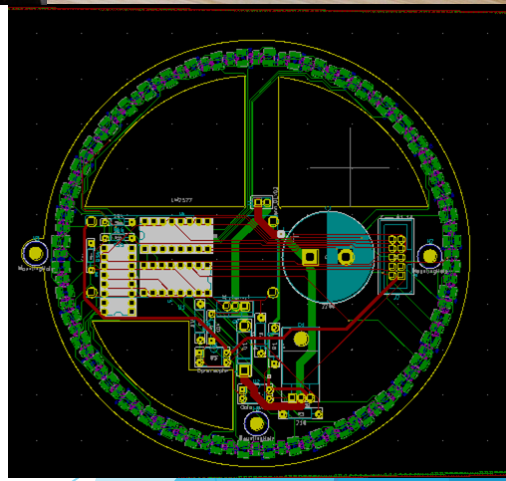
- Omni Wheels
  - Dual Layered
  - Embedded Mounting
- Chassis
  - X Drive
  - Lightweight
  - NylonX vs PLA
  - Compatible With PCB’s
    - Raised into the robot to increase ground clearance
  - Ball Sensor Shield



Electrical Design



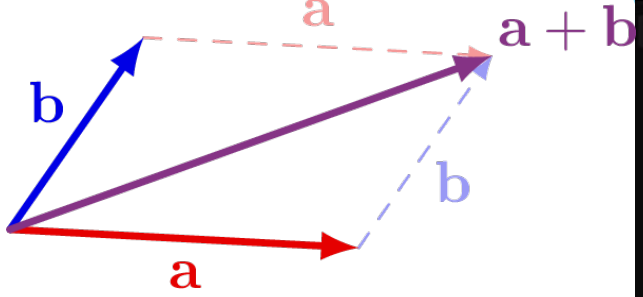


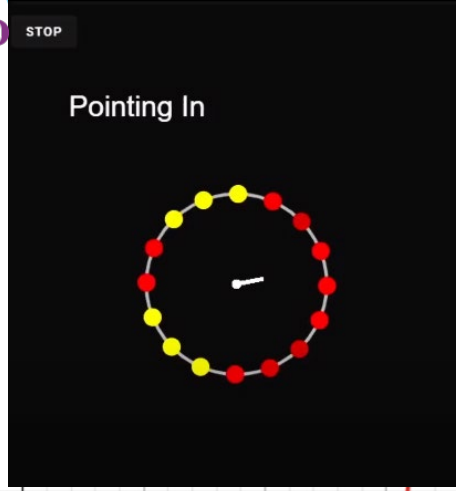


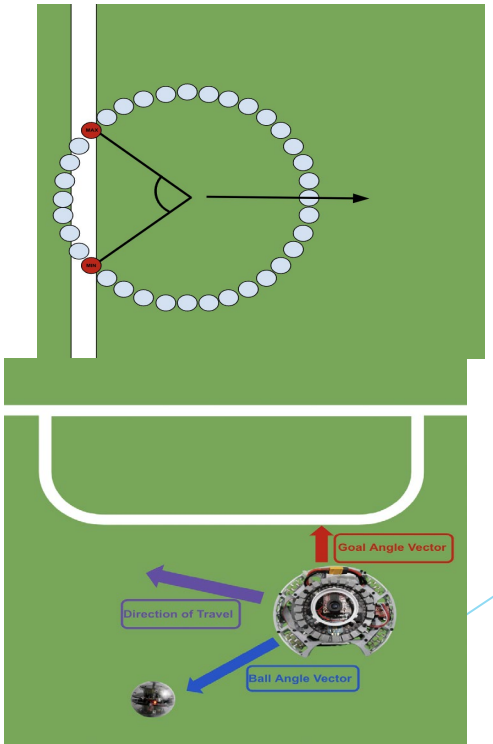
- Main PCB
  - Ball Sensors
  - OpenMV
  - Xbee
- Analog to Digital Convertors
  - SPI
- Circular Pattern
  - Custom Placement Algorithm
- Kicker
  - Boost Convertor
  - MOSFET Control Logic

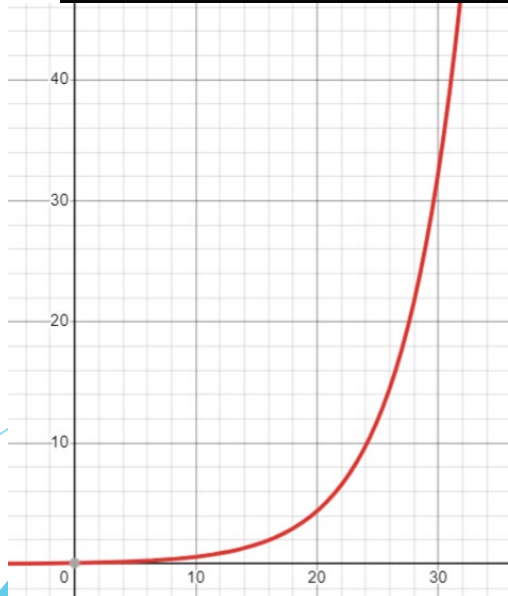
Software

- Ball Sensing
  - Vector Addition
  - atan2()
- Orbit Function
  - Dampen Function
  - Video
- Line Avoidance
  - Vectors
  - Angle difference
  - Dot Product
- Rotation Correction

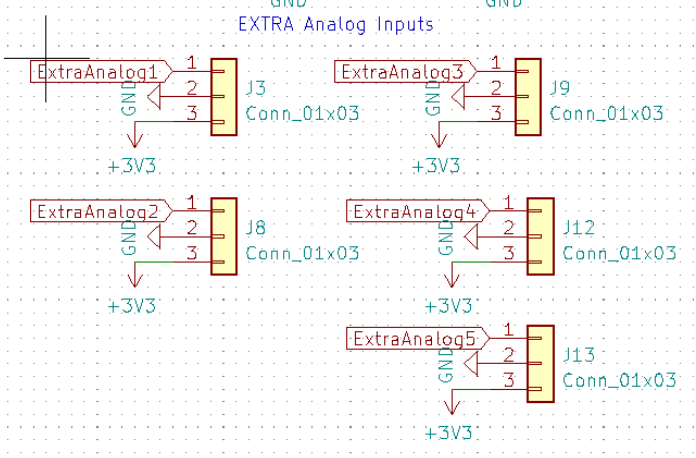




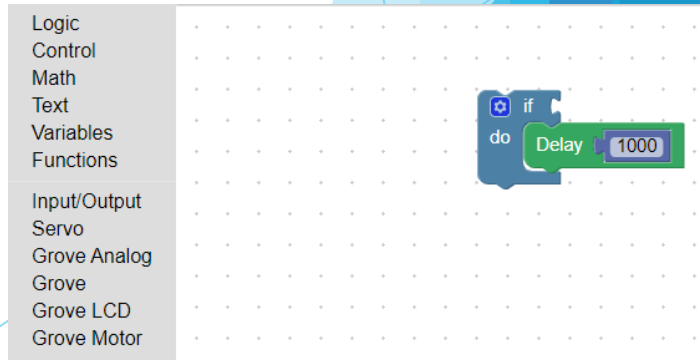




Educational Tool



- Expansion Ports - customizable
  - Extra analog and digital ports
  - Support for SPI,I2C and UART devices
- Uses parts that are easily controllable using popular libraries
- Limited off the shelf parts - increases affordability
- Supports a wide range of age groups



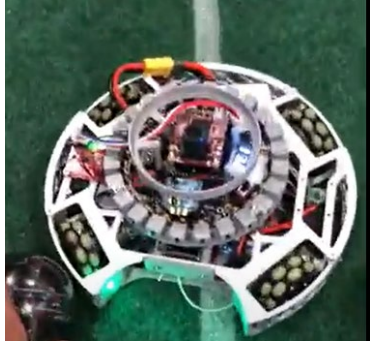
Final Product

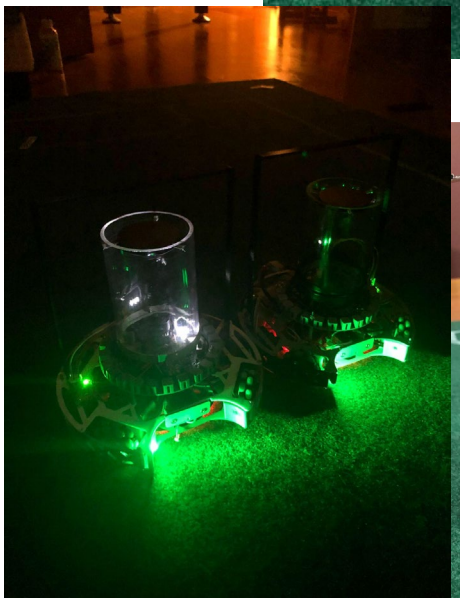
Videos:

Video 1

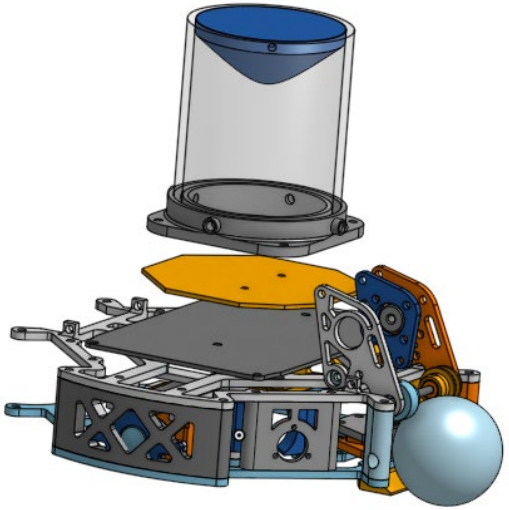
Video 2

Video 3





Future Work



- Adding a Dribbler
- Implementing Artificial Intelligence
  - Oak D Camera
  - RasPi Cam
- Spin-Move
- Ball Hiding
- Adding additional mounting methods so students can create custom parts to add functionality to the robot