Small-Size Soccer Robots

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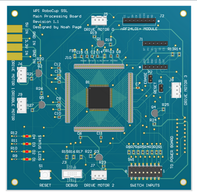
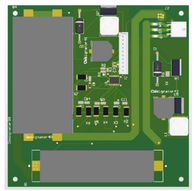
Electrical System

Processor Board



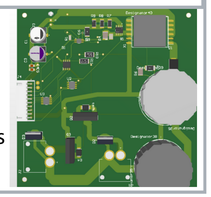
- Wireless communication with custom protocol
- Closed loop motor control
- Operates kicker board and dribbler motor for ball control

Power Board



- Houses 6s1p battery supply and with cells suited for high continuous current
- Monitors battery voltage and current
- Thick outer layers keep the board cool under high-current loads

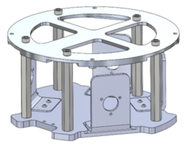
Kicker Board



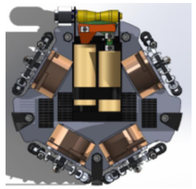
- Isolates solenoids and capacitors from the power supply
- Limits capacitor charging current to prevent burnouts

Mechanical Design

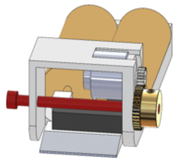
Chassis



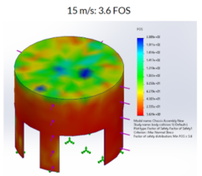
Drive System

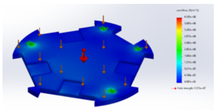


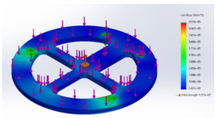
Kicker

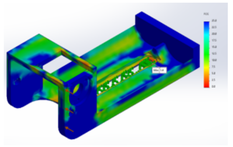


Developement

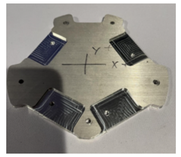


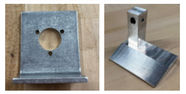






Optimization





Fabrication

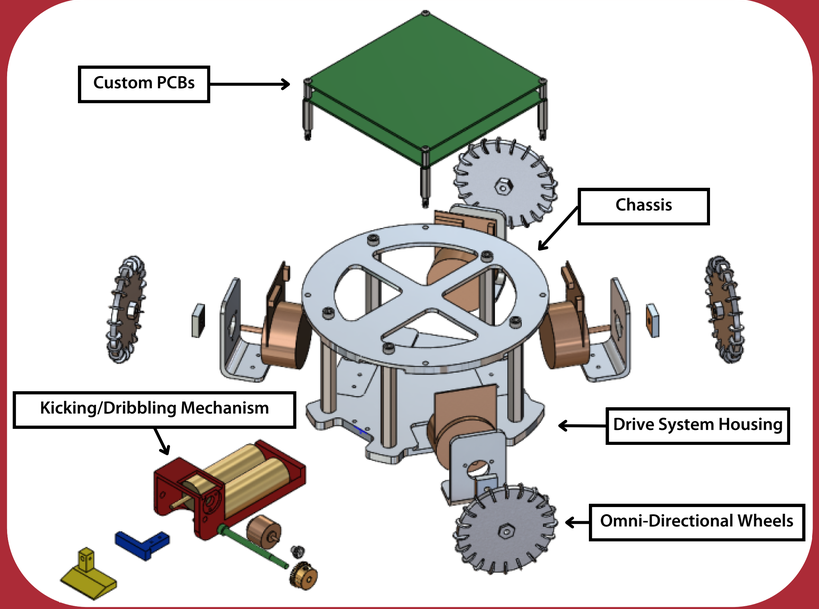
Abstract

The Small-Size Soccer Robots MQP is an interdisciplinary first-year project that aims to design, fabricate, and test a multi-robot system for RoboCup Small-Sized Soccer League.

- Model and fabricate a reproducible robot structure.
- Build a custom electronics system.
- Integrate electomechanical design and develop firmware.
- Design and test software for robot movement and game tactics.

Robot Requirements

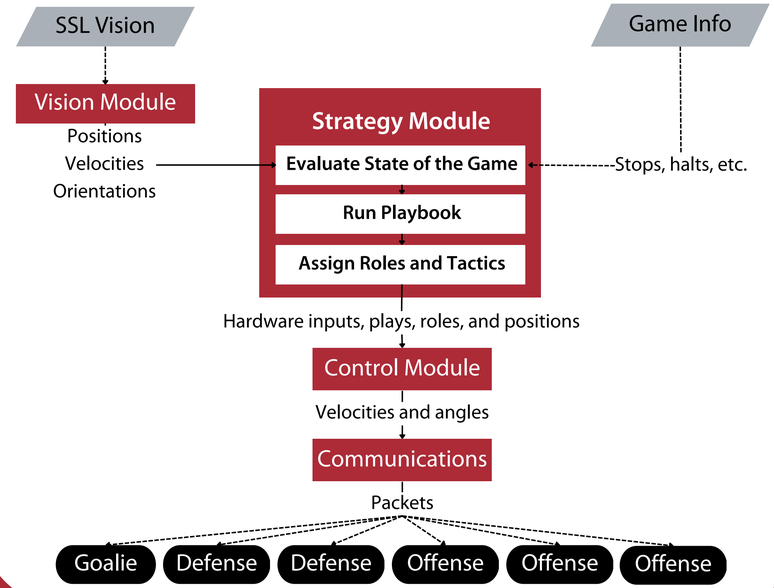
- Reach a velocity of 5 m/s
- Bidirectional communication agents and master
- 32-bit ARM microcontroller at 300 MHz
- Accelerate ball to a velocity of 6.5 m/s in 3D space



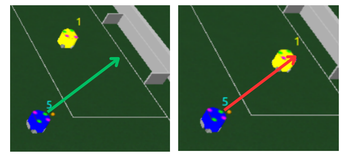
Accomplishments

- Designed and manufactured three robots
- Built and integrated custom electrical system
- Capable of creating paths and avoiding obstacles
- Can make decisions based on game state and complete necessary tactics

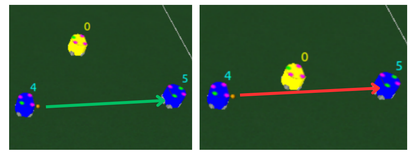
Software Architecture



Probability Identification



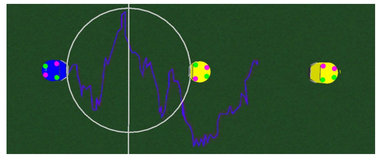
High vs. Low Probability of a Goal



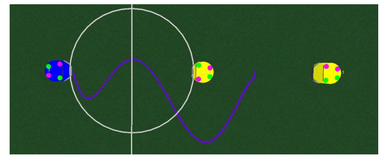
High vs. Low Probability of a Pass

- Probabilities are used to evaluate the viability of specific plays
- Passes are evaluated based on the chance of completion and new ball position
- On defense, robot positions are evaluated by the probability of intercepting each potential pass

Path Planning



Before Curve of Best Fit



After Curve of Best Fit

- Uses Rapidly-exploring Random Tree search (RRT) and A-star (A*) algorithms
- Uses a quintic as the curve of best fit
- Avoids robots and minimizes travel distance