Soccer Robot

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Design

Our soccer robot design incorporates several key hardware components and utilizes behavior-based control to navigate and interact with its environment effectively. The hardware includes an ultrasonic sensor, a gyroscope sensor, and an infrared sensor strategically placed on the robot.

Ultrasonic Sensor (Front):
The ultrasonic sensor is positioned at the front of the robot to detect obstacles, specifically walls. This allows the robot to navigate within the soccer environment, avoiding collisions and adjusting its movement based on the proximity of walls.

Gyroscope Sensor:
The gyroscope sensor is crucial for determining the robot's orientation. This information is vital for making informed decisions about the robot's heading, ensuring it can move in the desired direction and adjust its behavior based on its orientation.

Infrared Sensor (Front):
The infrared sensor located at the front is dedicated to detecting IR signals, particularly those emitted by IR sensors associated with the soccer ball. This enables the robot to locate and track the ball, forming the foundation for behaviors related to ball detection and possession.

Movement Equation

The robot's translational movement was determined by the angle of rotation of the tires. To convert from a desired distance to the angle of rotation of the tires, we used known equations. Taking in a desired distance, we calculated the tire angle and multiplied this by the error factor to get a more accurate angle.

$$\theta = \left(\frac{X}{C}\right)360,$$

$$\theta = \theta\gamma$$

$$\theta = angle\ of\ tire\ rotation\ [deg], \gamma = error\ factor, C = tire\ circumference$$

Turning Equation

The robot's translation movement was determined by the angle of rotation of the tires. To convert from a desired steering angle to a rotation of the tires, we used known equations. First find the arc length of the turning circle of the robot, then divide by the tire circumference, multiply buy the error factor. And then you receive the left and right rotation of the tires

$$s = 2\pi r(\frac{\theta_i}{360})$$

$$\theta_f = \left(\frac{s}{C}\right)360$$

$$\theta_f = \theta_f\gamma$$

$$\theta_R = \theta_f, \theta_L = -\theta_f$$

$$\theta_L = rotation\ of\ left\ tire\ in\ degrees, \theta_R = rotation\ of\ right\ tire\ in\ degrees,$$

$$\theta = angle\ of\ tire\ rotation\ [deg], C = tire\ circumference, \gamma = error\ factor$$

Behavior-Based Implementation

Approach: Our robot employs a priority queue and behavior-based control, a paradigm that organizes the robot's actions into distinct behaviors, each designed to address a specific task or scenario. In your implementation, the two primary behaviors are `HasBall` and `FindBall`.

`HasBall` Behavior

- **Objective:** This behavior focuses on the scenario where the robot has possession of the ball.
- **Control Logic:**
  - Utilizes the gyroscope sensor to determine the robot's orientation.
  - Incorporates an ultrasonic sensor to detect the proximity of walls.
  - Uses an infrared sensor to sense the presence of the ball.
  - Implements conditional statements to guide the robot's actions, such as turning and recalibrating position based on the robot's orientation and the ball's location.

`FindBall` Behavior

- **Objective:** This behavior is activated when the robot is searching for the ball.
- **Control Logic:**
  - Initiates a loop to continuously search for the ball using the gyroscope and IR sensors.
  - Implements a timeout mechanism to handle scenarios where the ball is not found within a specified time.
  - Includes conditional statements to react to various situations, such as detecting a high IR signal (indicating proximity to the ball) or being close to a wall.

References

None