RoboCup Simulator

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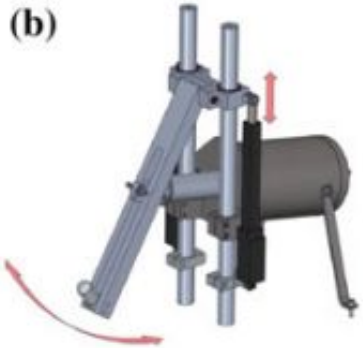
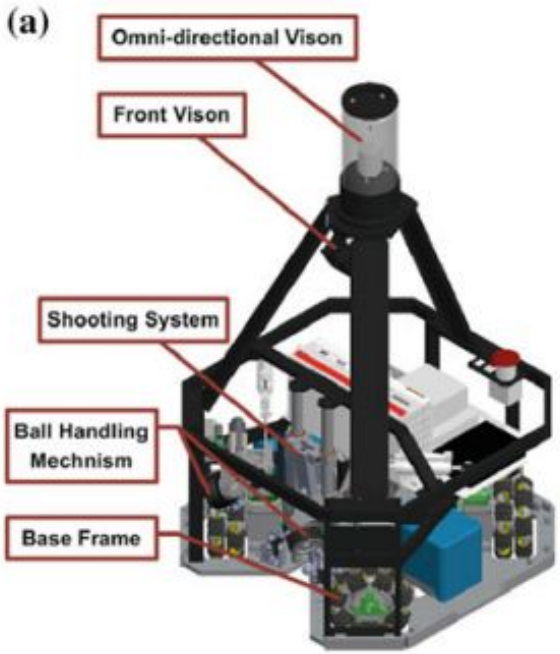
Overview

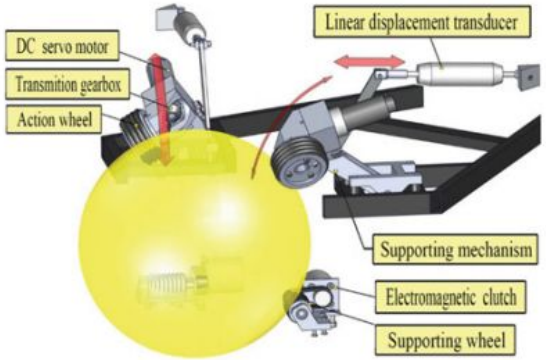
Goals and Approach

- Goals
  - Main Goal: 2 vs. 2 soccer match
  - Subgoals
    - 1 vs. 0 Basic path planning
    - 1 vs. 1 Path planning with obstacles
    - 2 vs. 2 Goalie dynamic passing
  - Stretch goals
    - 3 vs. 3 Dynamic role reassignment
- Approach
  - Design algorithms in Jupyter Notebook, then transfer to sim

Implementation: The Robot

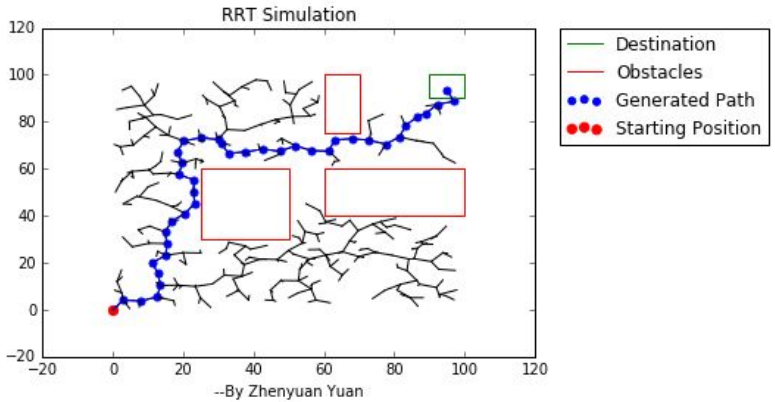






Implementation: Path Planning

- RRT, RRT*
- Dynamic Window
- A*
- **Real-Time Modified A***



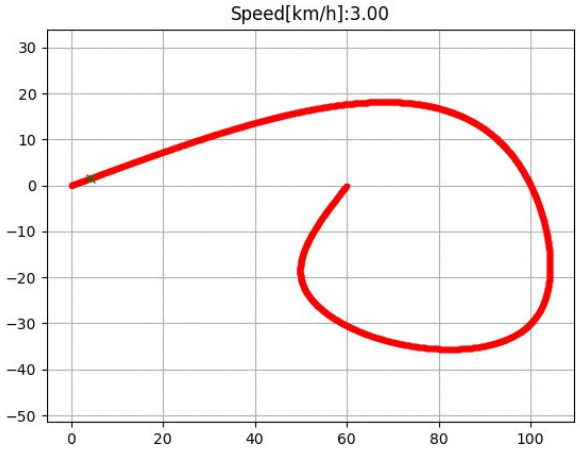
Implementation: Control

- Low-level
  - Inputs Desired linear/angular velocity
  - Outputs Motor torques
- High-level
  - Inputs Position error from reference
  - Outputs Desired linear/angular velocity
  - Design Proportional + Feedforward

$$\dot{x}(t) = v_x(t)$$
$$\dot{e}_x(t) = v_x(t) - \dot{x}_{des}$$

$$v_{x,cmd}(t) = -\frac{1}{\tau_x} e_x(t) + \dot{x}_{des}(t)$$

- Implementation: Open loop control



Implementation: Strategy

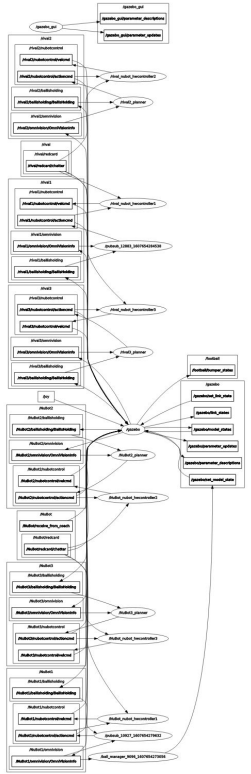
- Centralized
- Decentralized
- Both

Challenges

- Less-than-desired documentation for the sim
- Multiple language barriers

```
#endif
    /// 订阅自身全向视觉节点topic
    omin_vision_sub_     =  nh->subscribe("omnivision/OmniVisionInfo",1,&nubot::World_Model::updateOminivision, this);
    /// 订阅自身kinect节点topic
    kinect_vision_sub_   =  nh->subscribe("/ball_obstacle_position",1,&nubot::World_Model::updateKinectBall, this);
    /// 订阅自身nubot_control节点topic
    strategy_info_sub_   =  nh->subscribe(strategy_topic, 10 , &nubot::World_Model::updateStrategyinfo, this);
    /// 发布经过RTDB更新后的世界模型信息，包括来自队友的信息，COACH信息*/
    worldmodelinfo_pub_ =  nh->advertise<nubot_common::WorldModelInfo>("worldmodel/worldmodelinfo",10);
    /// 30ms触发一次的定时器
    worldmodel_update_timer_ = nh->createTimer(ros::Duration(0.015),&World_Model::update,this);

    /// 开辟内存空间,用于存放RTDB中的队友信息
    teammatesinfo_.resize(OUR_TEAM);
```



Improvements

- Continue to create new states for each robot. i.e more precise inter-team passing, varying shooting power, etc
- A more robust path planning algorithm
- 4v4 and 5v5

Thank You!