

Real Action Gaming Robots

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Introduction: Importance of Robogaming in Entertainment, Education, and Research

Entertainment and Education

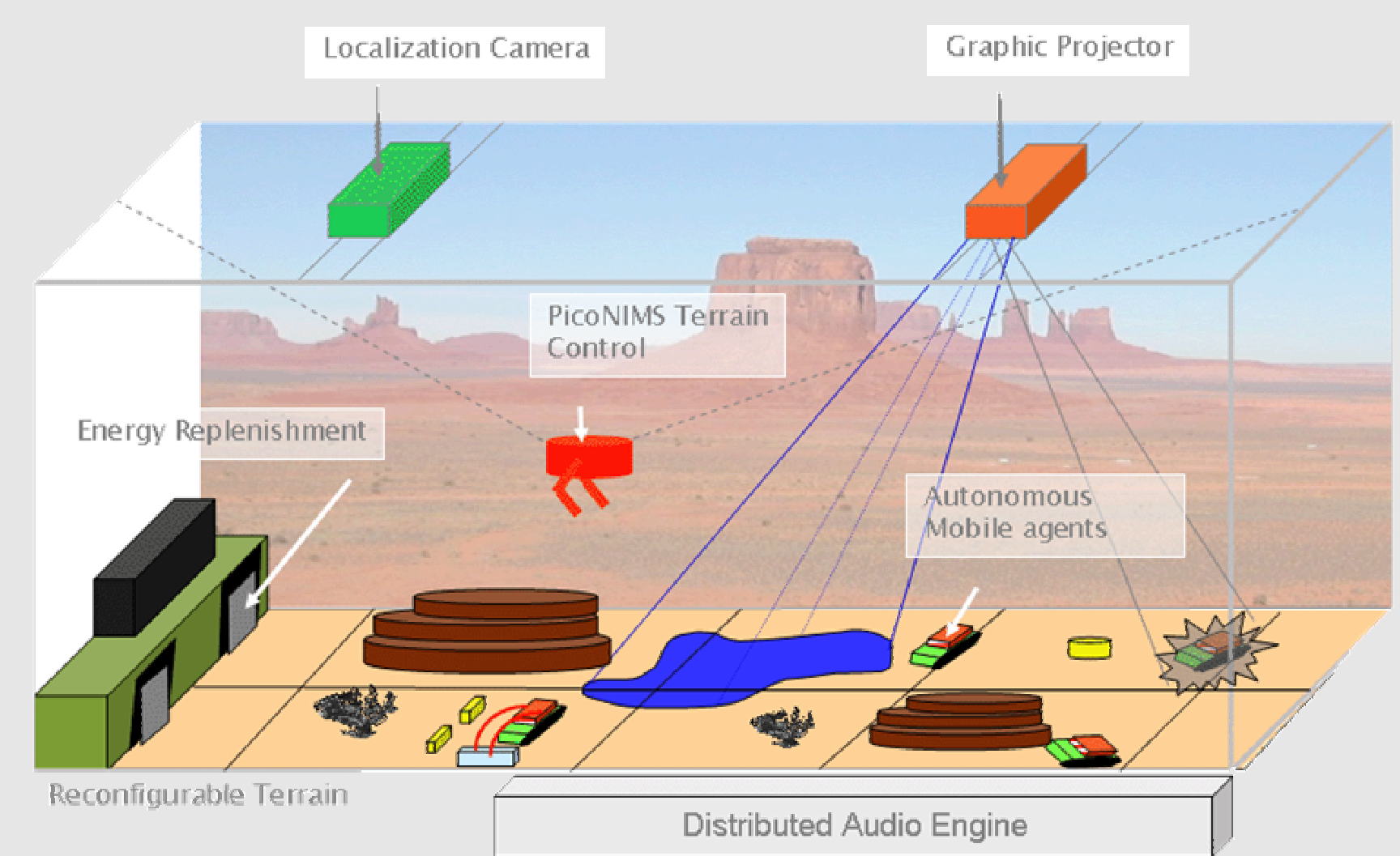
- Provides new interactive gaming environment
 - Creates opportunities for social interaction
- Promotes creativity
- Provides a flexible design platform
- Engages students to learn about robots and embedded mobile sensor networks
- Provides a teaching aid for complex systems

Mobile Sensor Network Research

- Provides reconfigurable mobile platform for embedded research
 - Static sensor nodes may not be sufficient
 - Mobility allows nodes to reconfigure into optimal sensing and communications topologies
- Allows adaptive actuation and coordinated operation

Problem Description: Creation of a Test Platform for Mobile Sensor Network Research

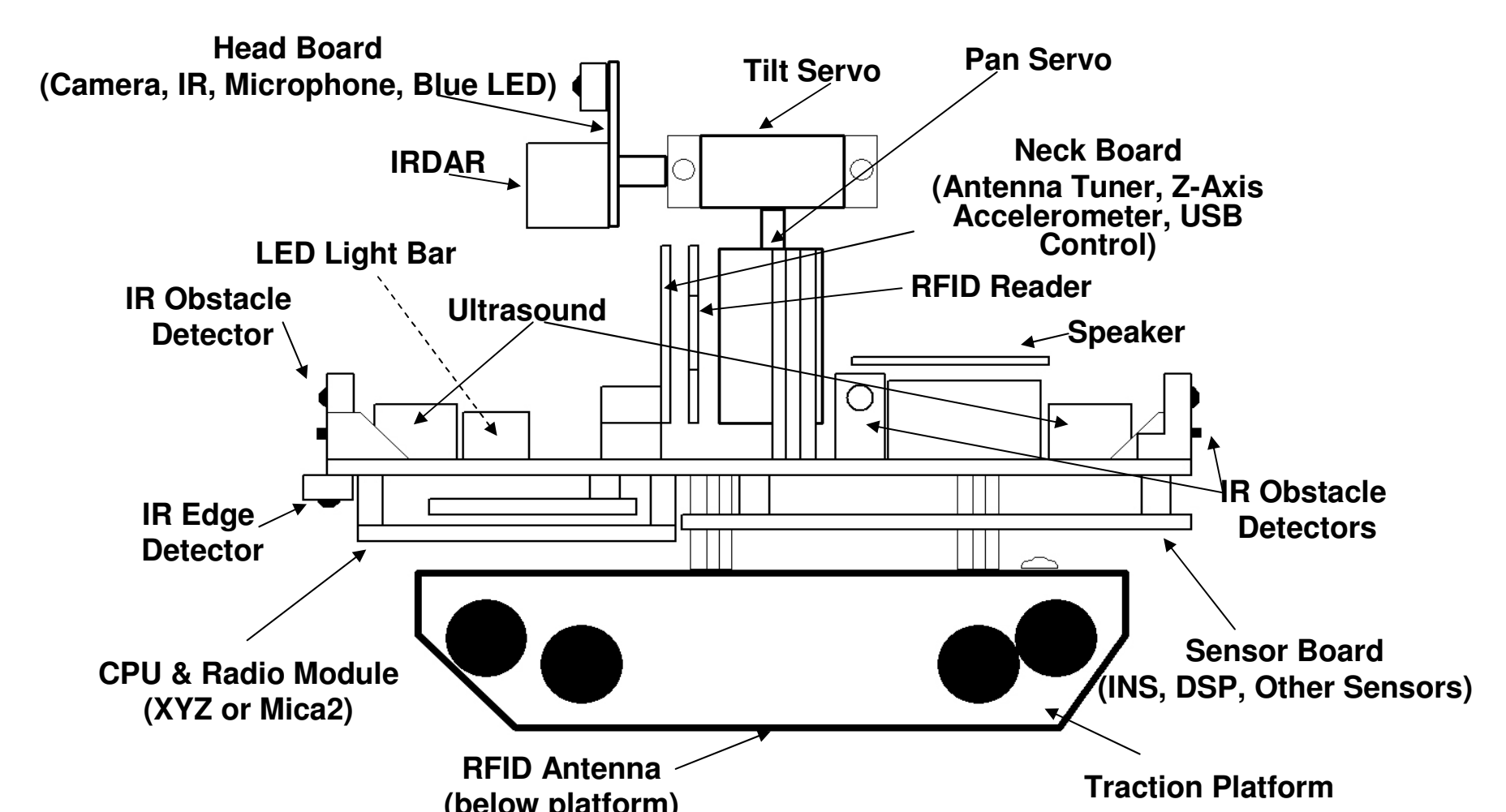
- A fully capable, reconfigurable mobile platform to interface with sensor nodes
- Customizable sensor suite on mobile robots
- Simple programming interface for expert and non-expert users
- Real-time response to environmental stimuli
- Flexible, reconfigurable, interactive terrain



Proposed Solution: Ragobot and its Gaming Terrain

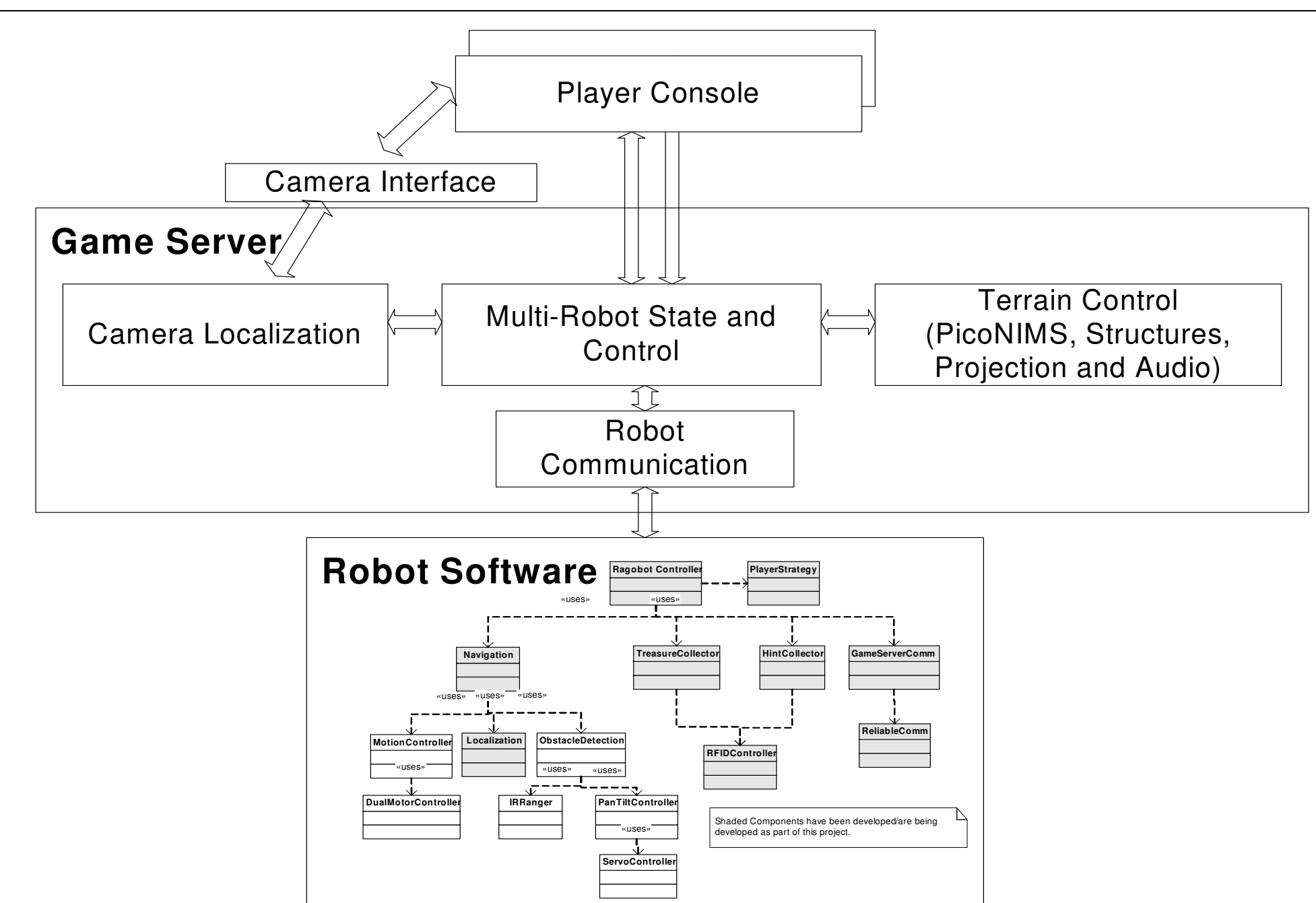
• Ragobot Hardware

- Hierarchy of modularity: robot divided into 5 PCBs:
 - DSP sensor “Nerve” board,
 - Processor “Brain” board,
 - Motile sensor “Head” board,
 - Vertical sensor mount “Neck” board, and
 - Main interface “Body” board
- Large sensor array: 1) ultrasound, 2) RFID, 3) IR obstacle detection, 4) inertial navigation system, 5) microphone, and 6) camera
- Custom power supply to reduce noise on mixed signal board



• Ragobot Software

- Game Server: 1) provides global services such as localization, 2) maintains state and provides robot control, 3) controls terrain configuration
 - Platform independent GUI for player console (Java)
 - Components communicate using TCP/IP sockets (modularity)
- Robot Software (in TinyOS) 1) controls actuators and sensors, 2) communicates with game server and other Ragobots, 3) performs local tasks such as navigation, obstacle avoidance and treasure collection
 - Different levels of abstractions to isolate hardware changes from upper layers
 - Modular software design allows selection of different sets of functionalities



• Ragobot Terrain

- Electronically-controlled actuated structures using Ni-Ti shape memory alloys
- Modular terrain pieces with natural obstacles created from Insulfoam
- Reconfigurable to create new terrain environments
- Global localization system using camera (CMVision) or ultrasound

