Interbots Initiative: An Extensible Platform for Interactive Social Experiences With an Animatronic Character

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Figure 1: A highly expressive robotic character, a robust behavior control system, and a host of content-authoring tools combine to generate interactive social experiences with an animatronic character.

1 Art and Sciences

At Carnegie Mellon's Entertainment Technology Center, artists and technologists work together on projects that emphasize user experience. The Interbots Initiative specifically focuses on creating complete, interactive, believable experiences with animatronic characters. The most important factor in the success of these experiences is personality. However, the fields of human-robot interaction and entertainment robotics have thus far been largely limited to technical specialists: animators, writers, and other artists who design characters with interactive content. This project opens robotics to non-technologists through an easily extensible platform for rapid development of social interactions between humans and animatronic characters.

The extensible Interbots platform's greatest strength is that it provides an interface between artistic vision and technological implementation. Maya, a 3D modeling program, allows 3D artists to directly export animations to the animatronic robot's hardware. The platform leverages the power of Macromedia Flash and Macromedia Director, two multimedia applications most artists are very familiar with. Finally, a custom behavior-authoring tool allows people with no programming experience to design personalities and behaviors for the robot.

2 Goals

The primary goal was to create a platform capable of delivering a solid and engaging experience. Users should forget that they're interacting with an autonomous hunk of wires, metal, and plastic. They should see the character in front of them, not the robot.

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Other goals include maximizing extensibility of the platform and giving non-technologists the ability to rapidly author content for interactive, entertaining, animatronic experiences.

3 Innovations

1. Developing a plug-in for Maya that allows animations created on a virtual model of the animatronic robot to be exported directly to the robot's hardware. The performance robot (Quasi) was designed with expression of personality and emotion in mind. Development began with character sketches and storyboards, which were expanded as a 3D model in Maya. The model was exported to SolidWorks, in which Quasi's internal structure was designed. The parts were then fabricated by hand out of aluminum, steel, and plastic, and assembled.
2. Controlling costs by combining largely off-the-shelf hardware with custom software. While Quasi is a custom piece created by students on the team, most of his system consists of off-the-shelf components: LED lighting by Colorkinetics for his eyes and antennae, servos by Hitec and Multiplex, Sharp IR rangefinders, industrial power supplies from Jameco, control hardware from Gilderfluke, raw materials and hardware from McMaster Carr, a standard USB webcam for vision, and a number of components from Radio Shack.
3. The Interbots Platform. This modular collection of software allows non-technologists to program interactive animatronic experiences, utilizing familiar tools like Maya, Flash, and Director along with a simple yet powerful GUI for programming states and behaviors. The system is also highly extensible, so components can be mixed and matched with minimal hassle to achieve desired results.

4 Vision

In the immediate future, the Interbots Initiative seeks to refine and expand the set of tools for authoring content, allowing even deeper interactions to be created. On the control side, the Interbots Initiative is currently implementing a guided performance interface that will allow for simple wireless control of the platform and a virtual robot control system using the open-source 3D engine Panda3D, which will allow developers to see the full effect of their content (complete with animation, sound, and interactivity) before ever connecting it to the physical system.

As robotics move into everyday use, their sophistication continues to advance. Systems for controlling these robots will need to adapt to allow consumers the level of control that this new technology promises. Just as Macromedia Flash opened up the world of web programming to non-programmers, the right tools can do the same for entertainment robotics. As the barrier between idea and implementation is lowered, the possibilities only increase.