AAAI-2012 AI AND ROBOTICS MULTIMEDIA FAIR — ROBOT DEMONSTRATION

The Intelligent Mobile Projector (IMP)

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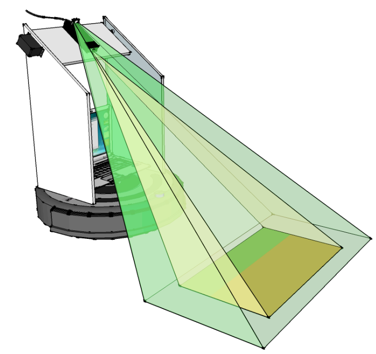
Overview



We will present the continued development of the intelligent mobile projector (IMP) system which combines recent advances in mobile robot and projector-camera system research. Our central research question is whether mobility can be used to create expansive mixed-reality interfaces. We continue to explore techniques for mixed-reality interaction by integrating new sensors and explore new applications. We first presented this work at AAAI 2010.[7].

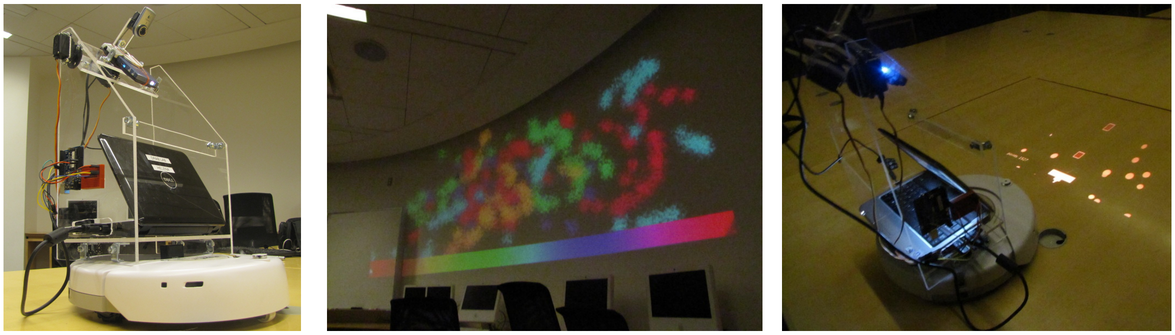
Motivation

Using a projector as a means for robots to communicate with users has recently been investigated [5, 3] as well as using projector-camera systems for human-robot interaction [4, 6]. Placing a projector-camera system on a mobile robot has a variety of uses. First, the robot can use the projector-camera system as an inexpensive range scanner to detect obstacles or build 3D maps. Second, the projector-camera system can provide new ways of interacting with a robot. Third, a mobile robot can actively reorient the projector to follow a moving person or find suitable projection surfaces. Finally, by exploiting the autonomy, a new type of mixed reality lets the robot control not only what is projected, but also where the scene is projected.

Approach

The IMP is a low-cost platform for exploring mixed-reality interaction, structured-light range sensing, and human-robot interaction. The platform is composed of an iRobot Create mobile robot, two pan-tilt servo motors, a Dell Mini 9 netbook, a Logitech webcam, and a Microvision laser pico projector. The software is open source and written using the Processing programming environment. The entire platform can be created for around $1,000 making it accessible to a large audience. The IMP is able to project onto flat surfaces almost anywhere using its pan-tilt-move interface.

We follow the approach of [8] for computing the homography relating the points in the camera frame to points in the projected image. Two types of calibration procedures are used, one in which the users selects the four corners of the projected image with known locations, and another that automatically finds the projector boundary using image processing. Once we can relate points in the camera to points in the projected image, the user can meaningfully interact with projected image. Currently, users interact with the system using laser pointers. Relying on laser pointers as the primary form of interaction has multiple benefits [2, 1] including making the image processing (detection and tracking) easier and allowing interaction from a distance. Interaction from a distance is particularly important in our system because close interaction with the projected image often results in shadowing. The laser pointers are tracked and offered as Processing primitives similar to those of the computer mouse. We are currently integrating the Kinect sensor into the IMP to provide a method of detecting projection surfaces and human input.



(a) (b) (c)

Figure 1: (a) The IMP (b) An expansive multi-user drawing application (c) A mixed-reality vacuuming game.

Demonstration Requirements

- ○ Electrical outlet for recharging the robot
- ○ Small working area ($6m^2$)
- ○ Surface to project onto (e.g. wall, floor)
- ○ The darker the demonstration area, the better
- ○ Table
- ○ Three chairs
- ○ Poster easel

References

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