# The Intelligent Mobile Projector (IMP)

Anis Zaman, Curtis Carmony, and Keith J. O'Hara
Computer Science Program
Bard College
Annandale-on-Hudson, NY 12504
`kohara@bard.edu`

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**The IMP (Intelligent Mobile Projector) combines recent advances in mobile robot and projector-camera system research resulting in novel methods of mixed-reality interaction and low-cost range-sensing.** We will provide a poster presentation and a live demonstration[1] of the IMP. The platform is composed of an iRobot Create mobile robot, a Dell Mini 9 netbook (with a 1.3 megapixel webcam), and a 3M MPRO120 Pocket Projector. The software is written using the Processing programming environment. The project began during the 2010 Spring semester.

Mixed Reality (MR) and Augmented Reality (AR) are technologies that blend the normally quite distinct physical and virtual worlds. An augmented reality application might overlay virtual information (e.g. a plane blueprint) onto our physical world (e.g. a plane being serviced by a mechanic). Once in the realm of science fiction, recent advances in smart phones (e.g. LCD, GPS, and CMOS camera technology) have led to a surge of AR interest and applications.

Rather than viewing the AR-world through a small smart-phone display, another option is to use a projector to overlay information onto the physical world. Projector-camera systems have found uses in range scanning and human-computer interfaces. Image processing becomes easier when a known, controlled image is projected into the environment. Leveraging this insight, researchers have developed methods for recovering 3D scene geometry from camera-projector systems[1]. Moreover, interacting with a large projected image by "touch" (using computer vision to track fingers) has created novel human-computer interfaces.

The projector-camera approach to AR and range scanning has limitations. Past projectors have been bulky and power hungry, and thus relatively immobile. Although still a nascent technology, mobile LED-powered projectors are small, energy efficient and effective in low-light envi-

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[1]If possible, we request a dark room for our demonstration. The pocket projector works best in dark environments.
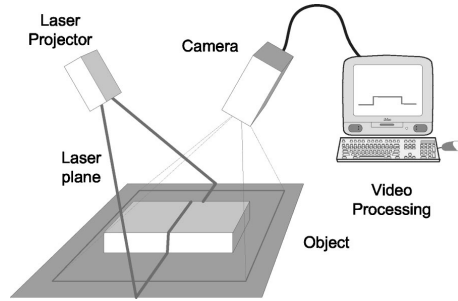
An Illustration of Structured-Light Range Scanning[1] and MIT's SixthSense System[2]

ronments. *Mobile projector-camera systems* have only recently been explored; most notably, MIT's SixthSense[2] wearable computer system.

Despite recent work on wearable mobile projector-camera systems, there has been very little research on using mobile projector-camera systems on mobile robots. 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 realistic 3D maps. Second, a mobile robot can reorient the projector to follow a moving person or find suitable projection surfaces. Third, an intelligent mobile projector-camera system can provide a new way to interact with a robot. Finally, a mobile project-camera system might create an entirely new medium for mixed reality by creating an expansive surface of augmented reality.

# References

[1] F. Blais. "Review of 20 Years of Range Sensor Development." Journal of Electronic Imaging 13(1). 2004.

[2] P. Mistry and P. Maes. "SixthSense - A Wearable Gestural Interface."SIGGRAPH Asia 2009, Emerging Technologies. Yokohama, Japan. 2009.