



Laser Backpack Prototype Maps Inside Buildings

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About the Author

Within a year or two, the U.S. military could field a portable, laser backpack device that will provide a three-dimensional (3-D) map of buildings. The reconnoitering pack could be used by reconnaissance scouts to form a 3-D, interactive image of buildings that other troops might have to access at a later time.

A team at the University of California, Berkeley, recently unveiled a **prototype** of the device developed for the U.S. Air Force Office of Scientific Research and the Army Research Office. The device is the first in a series of similar systems specifically designed to be carried by an individual soldier rather than on a cart or vehicle. Although sending in a robot would be safer—and technologically easier—the system would also be largely restricted to buildings without stairs, since robots would have a difficult time carrying the load upstairs, explains Avidesh Zakhor, professor of electrical engineering and computer sciences at the university. Zakhor is the lead researcher on the project.

The system uses a combination of cameras, laser range finders and inertial measurement units to generate a textured, realistic 3-D image that does not require Global Positioning System input. The prototype records the data on a laptop, and then with the push of a button, specially designed algorithms create the 3-D image. Previous systems for indoor mapping required they be placed inside a room, which could be mapped in about 20 minutes and then moved from one room to the next in a stop-and-go fashion, Zakhor explains.

"We have designed the sensors and the algorithms for a backpack human-operated system whereby a person wearing the backpack walks inside a building, and once this is done, we can come up with a 3-D photorealistic model of a building, which you can then interact with using a browser. There are times that you want to make a 3-D model of the building once in order to have, for example, an inventory of what's in it, so that later on you can either send in robots, or when soldiers go in, they know exactly what the layout of the building is. Having a complete model of the building helps soldiers be better prepared and to accomplish their mission in a better way."

Zakhor says her team also developed the **outdoor** mapping technology that became the Defense Advanced Research Projects Agency's UrbanScape technology, which was adopted by Google for its 3-D Google Maps.

Zakhor points out that the laser pack still faces some technological challenges before a working system is fielded. Challenges include calibration, sensor registration and localization, which is the ability to compute the system's orientation and location at all times. Without the localization capability, it is not possible to line up the laser scanners needed to build the 3-D point cloud, which is the first step in the modeling process. The unique ways humans move as they walk present particular challenges that vehicle-mounted systems do not, Zakhor explains.

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She envisions a future system mounted on a Segway--a middle ground between backpack and vehicle-mounted technologies.

Although the backpack is not quite ready for combat, it is being put to use on the Berkeley campus to map the electrical engineering building, including the stairway.

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