Kinect/Arduino hack for indoor navigation (+ video)

18 March, 2011 Isaac Leung 0 comments

THE MICROSOFT Kinect been the subject of many hacks since its introduction as a gaming peripheral for the Xbox 360 system. One of the latest improves indoor navigation for the visually impaired.

The Navigational Aids for the Visually Impaired (NAVI) project using the Kinect was developed by Michael Zöllner and Stephan Huber, Masters students at the University of Konstanz.

The project aims to improve indoor navigation for the visually impaired using the Microsoft Kinect camera, a vibrotactile waistbelt equipped with LilyPad vibration motors and an Arduino board, and markers from the AR-Toolkit.

Key to the project are the depth sensing capabilities of the Kinect, powered by an RGB camera and a PrimeSense infrared projector paired with a monochrome CMOS image sensor. (More regarding the **technicals behind the Kinect here**.)

Commonly used for navigation, the probing cane has drawbacks such as a small detection radius, and the fact that ordinarily, it only detects objects which are on the ground.

Another option for the visually impaired is the seeing-eye dog. However, this must be trained and can get tired.

The last option, GPS, is not available indoors.

As an alternative, the NAVI project aims to communicate to the user the room's layout via vibro-tactile feedback.

The students used three pairs of LilyPad vibration motors located at the left, centre and right of the waist. These motors are attached to the waist belt and also connected to an Arduino 2009 board.

The board is connected via USB to a laptop, which itself is mounted onto a special backpack worn by the user. The Kinect camera was mounted on a socket built with Sugru mouldable silicon and fixed with duct tape to a helmet worn by the subject.

The students put several markers of the AR-Toolkit on the walls and doors of the building to model the route from one room to another.

The camera of the Kinect continuously tracks the markets along the way, and software running on the laptop provides text-to-speech navigation instructions to the user via a Bluetooth headset. The instructions take into account the distance of the person to each marker for exact timed prompts.

As visible from the video embedded below, this is fairly early development, but navigations devices such as these could become more compact by shrinking the Kinect-type camera, using a smart phone instead of a laptop for the software, etc. By improving camera technology such as the resolution of captured images, it may be possible to reduce the size of the markers in the environment to make them unobtrusive and ubiquitous.

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