WiiCane Demo

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ABSTRACT

We will demonstrate WiiCane, a new commercial product that helps blind pedestrian walk straighter without veering, and provides practice in several other aspects of cane technique in safe, indoor environments. *WiiCane* combines precision motion tracking with real-time audio and vibratory feedback to produce a tool for training blind pedestrians to be move about with greater confidence and control as they navigate. The technology being developed also shows promise for creating immersive gaming environments where one or more players moves along a linear path of any length.

Author Keywords

Blind, Wii, Mobililty, Cane, Sensors, Education,Training.

ACM Classification Keywords

H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.
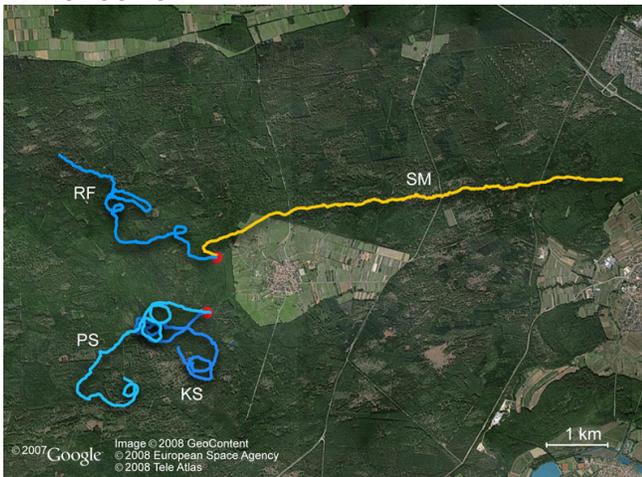
INTRODUCTION

Figure 1. Path of test subjects attempting to walk straight. Yellow = sunny day, Blue = cloudy day. (Souman, 2009)

Deprived of visual and auditory cues about their immediate environment, humans tend to be unable to walk in a straight line for any significant distance. This phenomenon is familiar to anyone lost in the woods on a cloudy day: inevitably, the lost individual trying to maintain a straight-line path will veer in one direction or the other, and this tendency often leads hapless hikers to walk in circles,

getting really lost in the process. This is illustrated in figure 1, where the yellow line shows the path of a hiker asked to walk straight through a featureless landscape on a sunny day, and blue lines show the convolutions of other (confused) subjects attempting to go straight on a cloudy day (Souman, et al, 2009).

For blind pedestrians, it is of the utmost importance to be able to walk in a consistent direction, often for long distances, in situations where audible or tactile reference data is not available (Blasch and LaGrow, 1996). The most obvious case is in street crossings, where a curb or building line is not present to trail with the cane, and veering is common. Orientation and Mobility trainers work with students to overcome their tendency to veer. According to David Guth, whose research in this area is of particular interest to the *WiiCane* developers, repeated spoken corrections delivered during attempted straight-walking exercises can help people veer less, even for months after the training has ended (Guth, 2009). *WiiCane* virtually walks behind the person, tapping them on the shoulder when their veering causes then to step outside a predefined threshold for perpendicular displacement from the line connecting the start and end points. *WiiCane* attempts to teach a user what it "feels like to walk straight" over a prolonged distance in the absence of any auditory or visual clues about the physical environment.
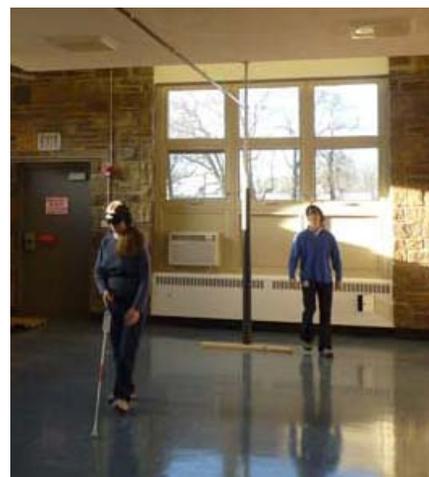

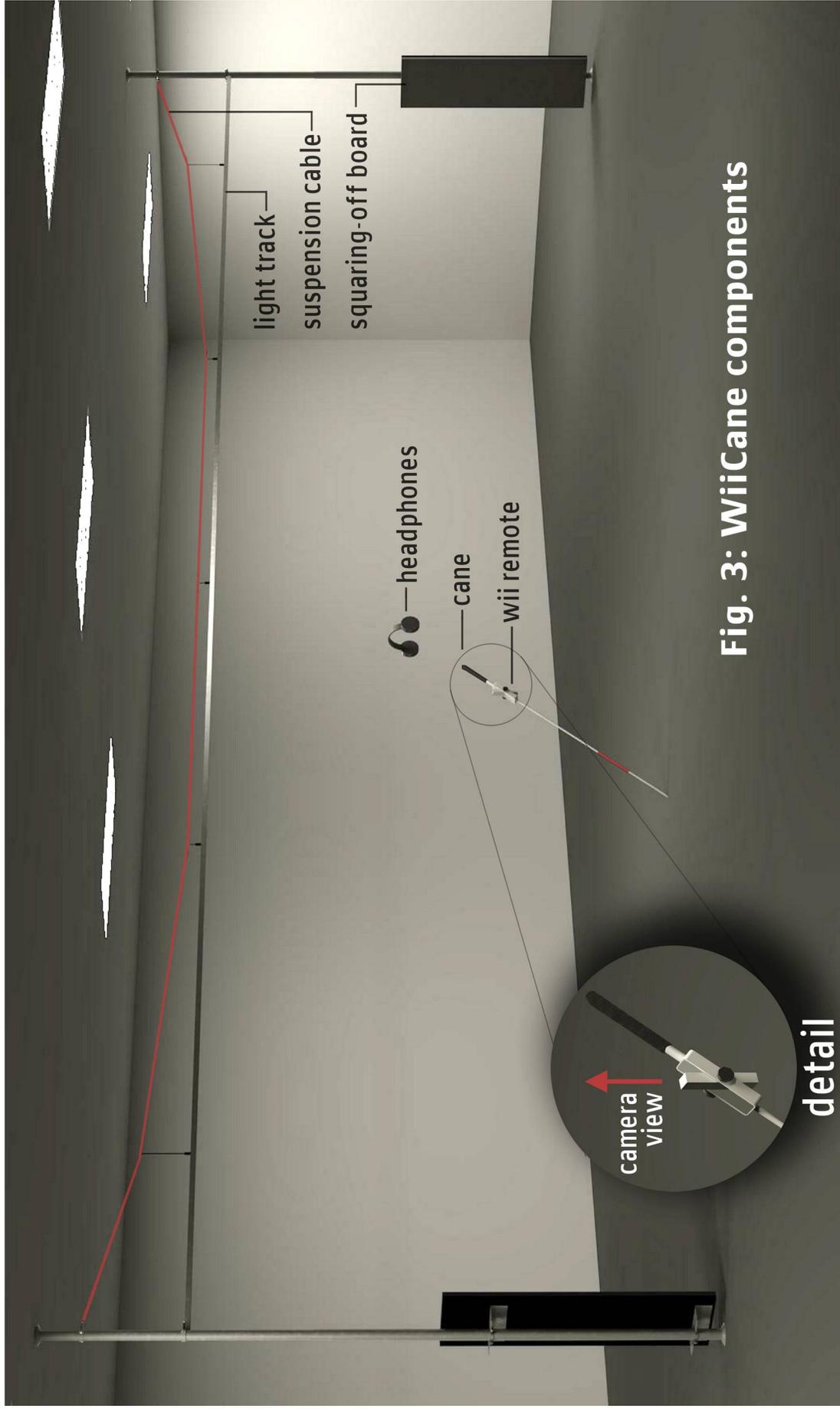**Figure 2: A trainee walking the course as her instructor looks on.**

light track
suspension cable
squaring-off board

headphones
cane
wii remote

Fig. 3: WiiCane components

detail

camera view

TECHNOLOGY

WiiCane consists of the following components

- An overhead track with individually controlled IR LEDs at 6" spacing. The light track is modular, and can be any length. It is either suspended on a cable structure or mounted to the ceiling like track lighting (see figure 3 on previous page).

- A telescoping mobility cane with roller tip and aluminum fixture for holding a standard Wii remote so that its light sensor is pointing at the overhead track. (see figure 4).
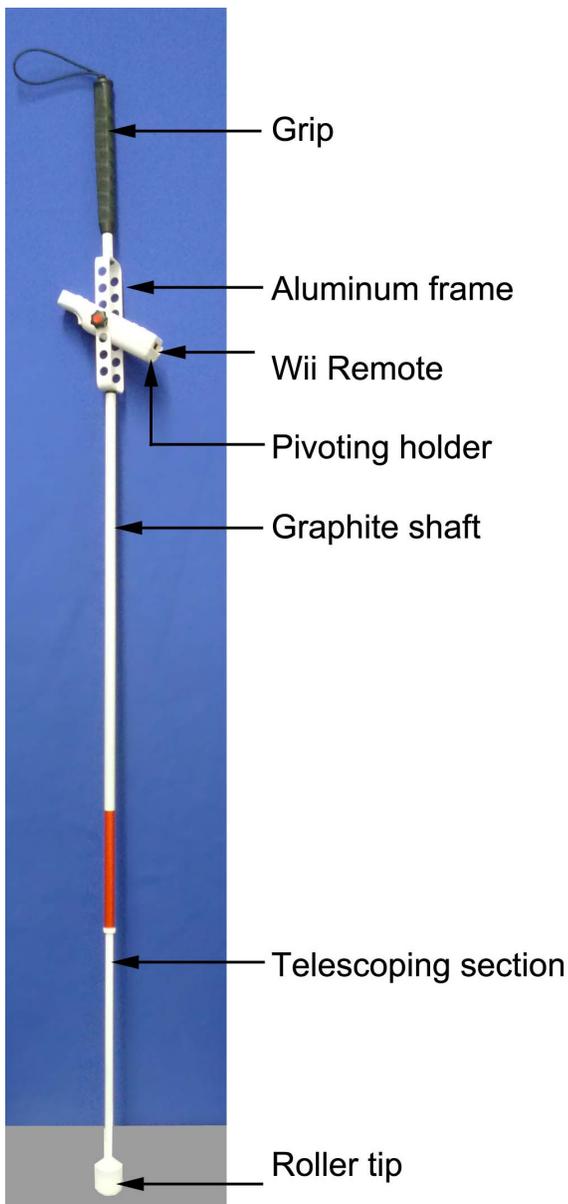

Grip

Aluminum frame

Wii Remote

Pivoting holder

Graphite shaft

Telescoping section

Roller tip

Figure 4: A standard telescoping mobility cane with Wii remote mounted in a pivoting fixture.

- A PC with Bluetooth radio mounted somewhere within 30 feet of the walking course.

- Wireless headphones for occluding the hearing of the trainee while providing real-time audio feedback.

- A Java program to manage the Bluetooth radio connection with the Wii device, control the LED's on the light track, send feedback to the trainee on several aspects of their cane technique via headphones and the rumble motor on the Wii remote, and capture find-grain data on movement and performance to see if performance improves over time.

In its current configuration, *WiiCane* observes movement and provides corrective audio and vibratory feedback on:

- *Veering.* Users hear a single tone every few seconds when their veering does not exceed a threshold. When veering is detected, they hear "go right" or "go left" spoken in their right or left ear.

- *Wrist roll.* The cane's grip vibrates when users fail to hold the cane straight. If they do not correct this behavior, they hear "Correct wrist roll", and all other feedback stops.

- *Arc width.* The system speaks "too wide" or "too narrow" if the angle of the cane's swing is inadequate to ensure complete coverage of the body during travel.

- *Rotation.* Users are asked to turn in precise 90 and 180 degree increments. When the system detects that they have stopped rotating, they receive feedback as to their accuracy in rotating.

NEXT STEPS

While the *WiiCane* project is intended for the specific purpose of training visually impaired independent travelers to use their long canes in a safe and efficient manner, the developers are considering a number of other possible uses for this apparatus. The main difference between *WiiCane* and other movement-based activities intended for the Wii platform is that the 12" long sensor bar that sits on the user's television in typical Wii set up is replaced by a variable length overhead light track in *WiiCane*. This means that the user is not constrained to remaining within 15 feet of the television, but can move anywhere along the track's length (within about 7 feet from either side of the light track depending on height of the lights above the Wii remote's IR sensor). Some possible activities include: pole vaulting, fencing, throwing and catching a virtual ball between two players, and many other competitive or individual games that include movement along a path. These will be investigated and demonstrated in future phases of this project.

WiiCane is currently in development, and is undergoing user testing at multiple sites in the United States. The company plans to introduce the product commercially in January of 2011.

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