International Journal of Trendy Research in Engineering and Technology (IJTRET)
Volume 2 Issue 2(1) April 2018

EYE RING DEVICE TO ENHANCE SEARCHING OF OBJETS- A Review

VIJAY J RAJ
Final year Student ,Department of Information Technology
SKR Engineering College, Chennai.

ABSTRACT

Finger-worn interfaces are a vastly unexplored space for interaction design. It opens a world of possibilities for solving day-to-day problems, both for visually challenged people and normal people. We show how the Finger-worn interfaced system may serve for numerous applications for visually impaired people such as recognizing currency notes and navigating, as well as helping sighted people to tour an unknown city or intuitively translate signal boards.. Though the ring apparatus is autonomous it is counter parted by a mobile phone or computation device to which it connects wirelessly, along with an earpiece for information retrieval. we also l discuss how finger worn sensors may be extended and applied to other domains.

I .INTRODUTION:

Despite the attention finger-worn interaction devices have received over the years, there is still much room for innovative design. Earlier explorations of finger -worn interaction devices (some examples are shown in Figure 1) may be divided into a few subspaces according to how they are operated Pointing Tapping/Touching Gesturing Pressing/Clicking On-Device.

1.1 EYE RING DEFINITION

Firstly, we wish to make the distinction between pointing gestures with the finger touching the object and pointing in free air. Our system is based on performing Free-air Pointing (FP) gestures, as well as Touch Pointing (TP) gestures. TP gestures utilize the natural touch sense, however the action trigger is not based on touch sensitivity of the surface, rather on an external sensor.

1.2 EYE RING HISTORY

Beyond canes and seeing-eye dogs, there is always room for more technology ideas to help the visually impaired ease up daily tasks that go beyond just walking and navigating sidewalks safely. MIT researchers have come up with a novel way for the visually impaired to independently identify objects and learn more about them. EyeRing is a wearable intuitive interface that allows a person to point at an object tosee or hear more information about it, say the researchers. Their EyeRing is actually a system made up of ring, smartphone, and earpiece.

Pointing devices based on TP gestures, as a reading aid for the blind date back to the Optophone and later the Optacon1. However, the rise of cheap and small photo-sensory equipment, such as cameras, revolutionized the way low-vision people read or interact with visual interfaces. Recently Chi et al presented seeing with Your Hand, a glove apparatus that uses TP gestures. Other assistive devices that are using imaging technology but not TP gestures are Primpo's isonic2 and the i-Cane3 which act both as a white cane and as a visual assistant that can tell the ambient lighting condition and colors of objects. The haptic element of TP gestures is interesting especially in the case of assistive technologies for the visually impaired. This enables them to get additional feedback on the object they want to interact with. FP gestures

on the other hand, are rooted in human behaviour and natural gestural language. This was shown to be true by examining gestural languages of different cultures. Usually FP gestures are used for showing a place or a thing in space a passive action. However, augmenting FP for information retrieval is an interesting extension. Previous academic work in the field of FP gestures, revolved around control and information retrieval. These works and others utilize a specialized sensor, usually an infrared connection, between the pointing finger and the target. This implies the environment to be rigged especially for such interaction.

We choose to use a generalized approach by using a general-purpose camera. This choice breaks the bonds of dimensionality of a single signal source or sensor, as well as the bonds of wavelength as it operates in the wider, visible spectrum. The desire to replace an impaired human visual sense or to augment a healthy one had a strong influence on the design and rationale behind EyeRing. Most of the work around FP and some TP gestures (e.g. the Optical Finger Mouse) are aimed towards sighted people.

At the initial stage of this project, we chose to focus on a more compelling aspect of exploring how visually impaired people may benefit from finger-worn devices. In this paper, we describe the EyeRing prototype, a few applications of EyeRing for visually impaired people and some future possibilities. Finally we discuss our plans of extending this work beyond the assistive interfaces domain.

The user points to an object with a camera-equipped ring worn on the finger. This camera-equipped ring is designed to capture an image and send it to a smart phone for processing. The idea is that the wearer of the ring will simply point the ring at a word or item, snap a photo, and an app on the phone will speak the word or describe the item to them.

In detail the researchers describe the design as a micro camera worn as a ring on the index finger with a button on the side, which can be pushed with the thumb to take a picture or a video that is then sent wirelessly to a mobile phone to be analyzed.

A computation element embodied as a mobile phone is in turn accompanied by the earpiece for information loopback. The finger-worn device is autonomous and wireless. A single button initiates the interaction. Information transferred to the phone is processed, and the results are transmitted to the headset for the user to hear.Several videos about EyeRing have been made, one of which shows a visually impaired person making his way in a retail clothing environment where he is trying to find his preferred color and size and he is trying to learn the price. He uses his EyeRing finger to point to a shirt to hear that is color grey and he points to the price tag to find out how much the shirt costs.

The researchers note that a user needs to pair the finger-worn device with the mobile phone application only once. Henceforth Bluetooth connection will be established automatically when both are running.

The Android application on the mobile phone analyzes the image using the team's computer vision engine. The type of analysis and response depends on the pre-set mode, for example, color, distance, or currency. Upon analyzing the image data, the Android application uses a Text to speech module to read out the information through a headset, according to the researchers.

The MIT group behind EyeRing are Suranga Nanayakkara, visiting faculty in the Fluid Interfaces group at MIT Media Lab and also a professor at Singapore University of Technology and Design Roy Shilkrot, a first year doctoral student in the group and Patricia Maes, associate professor and founder of the Media Lab's Fluid Interfaces group.

The EyeRing in concept is promising but the team experts the prototype to evolve with more iteration to come. They are now at the stage where they want to prove it is a viable solution yet seek to make it better. The EyeRing creators say that their work is still very much a work in progress. The current implementation uses a TTL Serial JPEG Camera, 16MHz AVR processor, Bluetooth module, 3.7V polymer Lithium-ion battery, 3.3V regulator, and a push button switch. They also look forward to a device that can carry advanced capabilities such as real-time video feed from the camera, higher computational power, and additional sensors like gyroscopes and a microphone. These capabilities are in development for the next prototype of EyeRing.

1.4 BEFORE IMPLEMENTATION OF EYERING

1.4.1 White Cane

Visually challenged persons face great difficulty in independent mobility and use the white cane as a mobility aid to detect close-by obstacles on the ground. However, the cane has two major limitations it can only detect obstacles up to knee-level. Hence, the user cannot detect raised obstacles like elevated bars and frequently collides with them. The cane can only detect obstacles within 1m from the user. Also, obstacles like moving vehicles cannot be detected until dangerously close to the person. Almost 90% of the blind persons live in developing countries, with a majority below poverty line. Current devices available internationally are unaffordable. In this work we present the design and usability features of a low-cost knee-above obstacle detection system and report results from controlled field experiments.

Use of directional ultrasound based ranging to enhance the horizontal and vertical range of the cane. System designed for ease of use at an affordable cost. To assess reduction in collision-risk and improvement in personal safety with the unit, controlled trials with 28 users was performed.

The cane can only detect obstacles less than 1m, giving them little time to take any preventive actions. Additionally, obstacles like moving vehicles cannot be detected until dangerously close to the person.

To ameliorate the problem, researchers have developed Electronic Travel Aids (ETA) to enhance obstacle detection. However, they possess limitations that have restricted there wide-spread acceptance amongst the visually impaired. The K-Sonar gives the output in the form of auditory cues which mask other important environmental sounds e.g. sound of moving vehicles on road and of fellow pedestrians. Mini-Guide is a vibration feedback based obstacle detection system but cannot be attached to the white cane, resulting in occupation of both hands. Laser Cane, apart from being prohibitively expensive also requires consistent movement of the user to comprehend the small cone of obstacle detection. The Ultra Cane transmits the vibration feedback through two buttons, forcing the user to modify their grip. Present day systems available internationally cost more than 450 USD. WHO estimates show that there are 45 million blind people in the world of which 90% live in developing countries where such devices are unaffordable. India has 13 million visually challenged persons (largest for any country in the world), with a vast majority with no access to an affordable and effective mobility aid.

Hence, there is a need for a knee-above obstacle detection and warning system with a user-friendly design, available at an affordable cost to users in low-income countries who presently have very limited access to electronic navigation aids. We developed a novel navigation aid called the Smart Cane that detects hazardous raised obstacles and increases detection range to 3m, thereby improving safety for the blind user. Initial design and implementation details were presented in Next, we summarize the key design and usability features of the device.Distance information is conveyed through patterns of vibration that vary incrementally with changing obstacle distance hence the Smart Cane can also be used by deaf-blind individuals.

Fig.no. 1.2 Smart Cane

The device operates in two user-selectable modes Short Range Mode (<1m) Useful while navigating within a room and Long Range Mode (<3m) Used outdoors e.g. roads, parks etc. Detection and warning of fast-approaching obstacles, like vehicles, within 3m allowing time for a reflex action instead of being hit unwarned. The system is powered by rechargeable Li-ion battery which can be charged like a cell phone. This eliminates the inconvenience of opening the battery pack to replace batteries and dependence on others to procure batteries from a store. Once fully charged, the batteries last at least 4 days of device usage after which a recharge is indicated through a beep pattern. The system is designed as a detachable unit that a user can mount on his/her white cane. It complements and enhances the functionality of the traditional cane. The device is user-detachable, light-weight and possesses Braille markings. An ergonomic design allows the user to hold the Smart Cane with a variety of personalized grips. A crucial design objective was cost. The device employs innovative use of low-cost and mass produced electronic components manufactured in a durable yet inexpensive plastic material. The projected cost of the device is under 35 USD making it affordable for users in developing countries. Figure 2 Detection of knee-above obstacles and increase in detection range with the Smart Cane. The red and green lines compare the typical range of normal cane and Smart Cane, respectively. The dotted lines illustrate the detection cone of the ultrasonic transducer. Top view of detection cone showing the horizontal and angular coverage. Figure Smart Cane utility detection of the raised side of a truck and finding a clear path without colliding with randomly positioned observers.

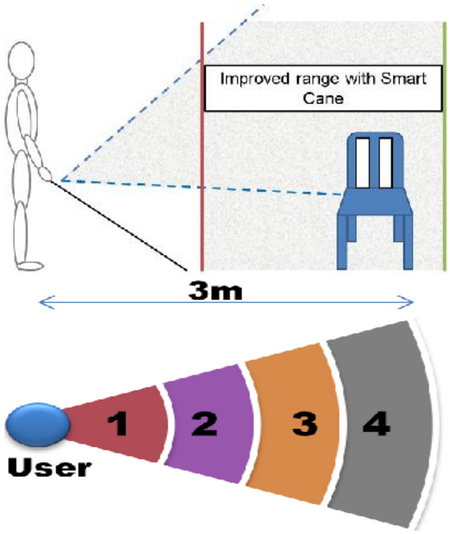

Fig.no. 1.3 Detection of Smart Cane

To quantitatively assess reduction in collision-risk and improvement in personal safety with the Smart Cane, a controlled trial was conducted with 28 users on 4 artificial obstacle courses to test reliable detection of commonly encountered obstacles. Users were enrolled from varied backgrounds (age, gender, experience in cane usage etc.) and were given standardized training in Smart Cane usage.

Experiments were conducted in a corridor (17m x 4m) with 14 laid out obstacles commonly encountered obstacles in indoor and outdoor environments. Seven obstacles were perceptible with the traditional cane (e.g. flower pots, chairs, ladder, card-board boxes) and the remaining were knee-above obstacles (e.g. railing, horizontal bars, table edge, inclined ladder, elevated bar) that are difficult to detect using the traditional cane. Four different courses were created by randomizing the obstacle positions. This eliminates the effect of spatial map learning by the users during the trial. The obstacle course area was regularly tiled. This allowed determination of obstacle detection distance and accurate positioning of obstacles during multiple runs for different users.Twenty eight visually challenged cane users were enrolled in the trials from 5 blind schools and associations in New Delhi. There were 20 male and 8 female cane-users from an age group of 10-35 years with experience in white-cane usage varying between 1-25 years. All the volunteers consented to participate in the trials. Figure 4 illustrates the composition of users according to age and number of years of cane usage. Please note that an ideal trial necessitates stratified random sampling with equal number of users within each age and gender group. However, this was not possible due to practical issues. We found that male volunteers aged between 20-25 years were most willing to visit the controlled trial site and participate in the experiment.

Operate the rotor

Rotate two fingers on the iPad screen to turn the dial and choose items on the rotor. Flick up and down to use the selected item. The effect of the rotor depends on what you’re doing. For example, if you were reading text in an email, you can use the rotor to switch between hearing text spoken word-by-word, character-by-character, or line-by-line when you flick up or down. When you browse a webpage, use the rotor to choose whether you hear text word-by-word or character-by-character, hear just the headers, hear just the links (all of them, visited links, or links not yet visited), hear form elements, or hear descriptions of images. You can use the rotor setting to hear all of the text, or to jump from one element of a certain type (such as headers or links) to another.

Reading text

Select and hear text character-by-character-
Select and hear text word-by-word-
Select and hear text line-by-line-

Browsing a webpage

Select and hear text character-by-character-
Select and hear text word-by-word-
Select and hear text line-by-line-
Select and hear headers-
Select and hear links-
Select and hear form controls-
Select and hear visited links-
Select and hear links not visited-
Select and hear images-
Select and hear static text-
Zoom in or out-

Entering text

Move the insertion point and hear text, character-by-character-

Move the insertion point and hear text

Move the insertion point and hear text, line-by-line-
Text editing functions-
Auto-text-

Using a control

Select and hear the value, character-by-character-
Select and hear the value, word-by-word-
Select and hear the value, line-by-line-

Using Voiceover

Unlock iPad Select the Unlock button, then double-tap the screen.

Select items on the screen Drag your finger across the screen. Voiceover identifies each element as you touch it. You can also move systematically from one element to the next by flicking left or right with one finger. Elements are selected from left to right, top to bottom. Flick right to go to the next element, or flick left to go to the previous element.

Tap a selected item when Voiceover is turned on Double-tap anywhere on the screen.

Speak the text of an element, character-by-character, word-by-word, or line-by-line with the element selected, flick up or down with one finger. Flick down to read the next character, or flick up to read the previous character. Twist the rotor control to read word-by-word or line-by-line.

Adjust a slider With one finger, flick up to increase the setting or down to decrease the setting. Voiceover speaks the setting as you adjust it.

Scroll a list or area of the screen Flick up or down with three fingers. Flick down to page down, or flick up to page up. When paging through a list, Voiceover speaks the range of items displayed (for example, “showing rows 5 through 10”).

Scroll continuously through a list Double-tap and hold. When you hear a series of tones, you can move your finger up or down to scroll the list. Continuous scrolling stops when you lift your finger.

Use an index Some lists have an alphabetical index along the right side. The index can’t be selected by flicking between elements; you must tap the index to select it. With the index selected, flick up or down to move along the index. You can also double-tap, then slide your finger up or down.**Stop speaking an item** Tap once with two fingers. Tap again with two fingers to resume speaking. Speaking automatically resumes when you select another item.

Turn off the display while you use Voiceover Triple-tap with three fingers. Repeat to turn the display on again.

Speak the entire screen from the top Flick up with two fingers.

Speak from the current item to the bottom of screen Flick down with two fingers.

A computation element embodied as a mobile phone is in turn accompanied by the earpiece for information loopback. The finger-worn device is autonomous and wireless. A single button initiates the interaction. Information transferred to the phone is processed, and the results are transmitted to the headset for the user to hear.

Smart Cane usage increased obstacle awareness by 57%, decreased obstacle collision-rate by 91% and increased the mean distance of detection by 2.6 folds and hence improved safe mobility for the blind users. Two users using the device for three months reported successful detection of railings, raised bars, raised sides of trucks and presence of a gate, people, trees etc.

The researchers note that a user needs to pair the finger-worn device with the mobile phone application only once. Henceforth Bluetooth connection will be established automatically when both are running.

The Android application on the mobile phone analyzes the image using the team's computer vision engine. The type of analysis and response depends on the pre-set mode, for example, color, distance, or currency. upon analyzing the image data, the Android application uses a Text to speech module to read out the information through a headset, according to the researchers.

REFERENCES

[1] Merrill, D. and Maes, P. Augmenting looking, pointing and reaching gestures to enhance the searching and browsing of physical objects. In Proc. Pervasive'07, (2007) 1–18.

[2] Tsukada, K. and Yasumura, M. Ubi-finger: Gesture input device for mobile use. *In* Proc. APCHI'02, 1 (2002), 388-400.

[3] Lee, J., Lim, S. H., Yoo, J. W., Park, K. W., Choi, H. J. and Park, K. H. A ubiquitous fashionable computer with an i-Throw device on a location based service environment. In Proc. AINAW'07, 2 (2007), 59-65.

[4] Fukumoto, M. and Suenaga, Y. 'FingeRing' a fulltime wearable interface. In Proc. CHI'94, ACM Press (1994), 81-82.

[5] Fukumoto M.A finger-ring shaped wearable handset based on bone conduction. In Proc. ISWC '05,(2005), 10-13.

[6] http://www.researchgate.net>publication

[7] http://www.eyesmart.com.au>anews>features

[8] http://en.m.wikipdia.org> wiki> Bag -of vision-

[9] http://www.seminarsonly.com>eyering-seminar