

Automatic-Cane - An Intelligent Tool for Blind with AI Techniques

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Abstract—Independence and confidence are building methodologies in achieving your dreams and goals in life. Visually impaired persons find themselves challenging to go out independently. There are about 12 million visually impaired or blind people in this world who are always in need of helping hands. For many years the white cane has been the most commonly used travel aid by the blind. The biggest disadvantage is that the user has to be trained a lot and the user is forced to scan manually the vicinity for obstacles. "Success comes in cans, failure comes in can'ts". Gulping this energy capsule we came up with a dream device for the blind I-cane.... the only cane in this world with intelligence. I-cane, which we have created, answers all the problems that the blind face very intelligently. This paper starts with very brief introduction about the description of the I-cane. This paper also deals with the next version of Automatic-cane with a single wheel design. The main idea behind this paper is to contribute our service to the blind society and helping them with the little knowledge that we have. We feel that it is the duty of those blessed with the power of vision and knowledge to contribute and help the blind and other deprived people in their lives. This paper also deals with the next version of I-Cane with a single wheel design, the ultra cane. The drawbacks of the I-cane lead to invent the Automatic cane. With little technology and flexibility to the users, there came ultra cane. Detailed explanation of the individual parts and Do's and Don'ts of it is discussed. The main idea behind this paper is to contribute our service to the blind society and helping them with the little knowledge that we have. We feel that it is the duty of those blessed with the power of vision and knowledge to contribute and help the blind and other deprived people in their lives.

Keywords- Automatic-cane, I-cane, blind I-cane, AI Technique

I. INTRODUCTION

The growth of information technology plays a vital role in the recent development almost in all the fields. We also want to explore the developments for the benefit of the visually impaired persons. Visually impaired persons find themselves challenging to go out independently. The population of the visually impaired is growing day by day. The problems faced by them also increased without finding any solution. They require a help to come out from their problems. For many years the white cane has been the most commonly used travel aids by the blinds. The blind people get trained a lot to move out in the streets with the white cane and they have to take each step after scanning the area ahead of him/her. The white cane is also not suited for detecting potentially dangerous obstacles at head level. Guide dogs are another methods using which the blinds navigate. Guide dogs are very capable guides for the blind, but they require extensive training. Fully trained guide dogs cost between Rs.15, 000 and Rs.20, 000, and they are only useful for about five years. Furthermore, many blind and visually impaired people are aged and find it difficult to care appropriately for another living being. As a result, only 3% of the estimated twelve million visually impaired people in the world have guide dogs. The proposed model of I-cane is one such intelligent device that allows the blind to navigate. "Success comes in can's, failure comes in cant's". Gulping this energy capsule we came up with a dream device for the blind the I-cane ... the only cane in this world with intelligence. I-cane. I-Cane is a novel device designed with Artificial Intelligence (A.I) techniques, to help blind or visually impaired users navigate safely and quickly among obstacles and other hazards faced while walking in the road.

II.A BRIEF DESCRIPTION OF THE "I-CANE"

The I-Cane project will investigate, apply, and assemble state-of-the-art sensor, processing, and man-machine interface technology to design and build an intelligent tool for the blind. I-cane is a user-friendly device, which is definitely an indispensable travel aid for the blinds. It has two parts. One is the base (made of wood) and the other is the handle. The base bears the electronic circuits, the embedded chip along with three powerful infrared sensors. These infrared sensors detect obstacles ahead up to considerable distance. The base is also fitted with four rubber wheels, which helps the user to move with the device easily. The important part of the I-cane is the handle that is fitted on to the base. The handle is very cleverly designed in such a manner that the user could increase or decrease its height by means of an easily adjustable screw. This ensures the easiness and comfort while operating the device. The device is also portable and could be easily dismantled and assembled without any external help. I-cane device provides its user a joystick at its handle to switch over different controls like START, STOP and HORN. In addition to these, there is also a brake

III. GENERAL DESCRIPTION

We have come up with a new and a novel design with just one wheel to help the blind to navigate easily and also in a very safe manner. The new design makes the I-cane a very compact, less weight and a portable one, unlike the previous model. We employ a new design with a single wheel (Fig4-3D view) connected to the motor for driving the system and another motor connected to a circular disc for changing the direction of wheel. Initially two wheels will be attached to the device to provide static stability, in addition to the main wheel which steers the system. These two wheels are intended be detached from the device after testing. It is to be noted that these wheels don't have any electronic significance and they are merely included to ensure static stability. The three infrared sensors are eliminated and instead we intend to use two IR proximity sensors of bigger diameter to provide more precise detection. The sensors will be placed over the rotating disc. So that when the disc rotates when an obstacle is sensed the sensor also rotates along with it to check for the presence of obstacles in all directions. The other sensor will detect potentially dangerous obstacles at head level or hanging obstacles. The other sensor is placed on the stick itself. This intended feature is absent in the prototype model. The serious drawback of the prototype model is that it cannot detect holes. This problem is overcome in the new version by placing a high precision ultra-sonic sensor at the wheels so as to detect holes. The main aim of our work is not only make the blind to navigate in a fluid and graceful manner but also ensure his safety at all possible levels. The circuit board bearing all the electronic components, which was earlier, integrated in the base part of the device, and is to be integrated on the stick itself is connected to the handle that allows the user to control the motion of the device. The brake system in the previous design is completely eliminated in the new design.

IV. AUTOMATIC CANE OVERVIEW

The Automatic Cane is a new electronic mobility aid, designed to help you get around more easily and safely. It increases the amount of information available to you about obstacles in your path and at head height. This means you can make decisions more quickly. In other words, it gives you more confidence and allows you to walk faster than with a traditional white cane.

The Automatic Cane is an electronic primary aid, modelled on the traditional long white cane, but with some important differences. It uses Ultrasonic echoes to find objects in front of and at shoulder or head height of the person using it. It gives tactile feedback to the hand via two vibrating buttons. Each button indicates a different direction where an object may be, and the intensity or speed of vibration lets you know how far away the object is. In essence, the purpose of the Automatic Cane is to locate landmarks, obstacles, hazards, and environmental features. This additional information leads to safer travel which in turn increases confidence in travelling alone, assisting in the development

GETTING STARTED

Hold the cane up vertically with the handle at the top and the cane tip at the bottom. Placing your hands on the very top of the cane handle, you will be able to feel an elastic quick release wrist strap and below that the rubberised flip open door to the battery compartment. As you feel down the cane handle you will feel two raised oval shaped buttons.

These buttons are placed in the rubberised grip area on the top of the handle and are there to provide the tactile feedback.

As you move down the handle you will feel the larger rounded area at the end of the handle itself, which houses two Ultrasound sensors; one which looks in front, in the direction of travel, and one which looks upwards. Please do not press the sensors. Underneath the handle at the end which houses the sensors, is the on/off switch. This switch also enables the range of the forward sensor to be selected. Beyond the sensors is the cane shaft which folds when each section is pulled apart.

Mobility Experts recommend taking familiar routes to start with, as you learn to use the Automatic Cane. This will help you get used to the new information in a place that you know, so you can start to build up confidence in your new independence.

AUTOMATIC-CANE

Hundreds of vision impaired testers helped develop the Automatic Cane and told us what they wanted -a user friendly product based on the familiar white cane but with remarkable differences: Automatic Cane uses ultrasonic echoes to detect objects in the path of the user. This includes objects at head height, like wing mirrors on parked Lorries.

It gives tactile feedback, not audible which could interfere with other hazard information. Different buttons on the ergonomically designed handle of the cane indicate the direction of the object. The intensity of the vibration lets you know how far away the object is. This type of feedback accesses the mapping area of your brain, enabling you to form an immediate mental map of the layout of your surroundings.

AUTOMATIC-CANE FEATURES

Buttons and Grip

The Automatic Cane is suitable for both left and right handed people, and is best used with good cane technique with the cane hand centred with the wrist as the primary pivot point. The sensors will then face correctly upwards and forwards. It may be held as you would a regular long white cane with the forefinger down the side of the handle and there is a small groove on each side of the handle to assist this grip, which mobility specialists recommend. It may be, however, that you prefer to hold the handle with the forefinger around and underneath the handle and this grip is acceptable. It's what works for you.

In either case, it is important to place the thumb across the top of the handle taking care to cover both of the buttons at the same time. The buttons are oval and measure about 5 x 7 mm or 1/4 x just over 1/4 inch in diameter. The buttons are lined up so that when holding the handle, as if for use, the furthest away button will feed back information about the direction of travel in front. The remaining button, which is closest to the body, will provide feedback on obstacles at shoulder or head height.

Please note these buttons do not require pressure.

The button which warns of objects at head height acts as an alert, giving strong vibrations that cut quickly into your awareness, causing you to take action in time to avoid bumping your head. The other button gives more detailed information. It will start to pulse when it detects an object ahead of you. This pulse or vibration will become faster as you move closer to the object. The two buttons work independently, but can operate at the same time if they both have information to give you. This way they give you a full understanding of what's in front of you. For instance, if you detect a tall object, such as a wall up ahead, both will vibrate, indicating both the distance and the height.

SENSOR POD

The curved part at the cane end of the handle. The sensor pod contains the two sensors which send and receive the Ultrasound signals for each direction. Information about obstacles in your path is interpreted in the handle and fed back via the vibrating buttons as described earlier. These sensors should not be covered or pushed. The forward sensor covers two ranges, short and long, which may be selected whilst the cane is in use. For details please refer to the On/Off/Range switch section. The short range of 2 metres or 6 ½ feet from the tip of the cane is thought to be useful for unfamiliar routes, or for use in busy environments. The long range of 4 metres or 13 feet, from the tip of the cane, is helpful on routes well known to the person using the Ultra Cane, or if they walk fast, perhaps being a Guide Dog owner. The overhead sensor detects objects approximately 1.5 metres or 5 feet from the handle of the cane, and is angled in front of the person, again in the direction of travel.

FOLDING CANE SHAFT

The Automatic Cane has a reflective, carbon graphite cane shaft which folds into 4 or 5 pieces depending on the overall cane length. The quick release wrist strap may be used to wrap around the cane when folded, conveniently holding it all together.

Your tip is either a push on or a hook on tip. For push on tips, simply line up the cane end with the open part of the tip and push on. The tip fits snugly over the cane shaft. To remove a push on tip, immerse the tip in warm water and then it tip will slide off. The hook on tips hooks securely over the elastic bungee cord loop which is at the end of the cane shaft.

One of the great things about the Automatic Cane is that you don't need to understand how it works for it to help you get around.

However, if you are interested in technical things, and what makes the Automatic Cane so easy to master, read on. At the centre of our survival lies part of the brain shaped like a couple of hillocks, called the Superior Colliculii. Without it, we would not have evolved. Primitive as it is, it enabled us to do the hunter-gathering we needed to do, and to evade predators. It works at a subconscious level and accepts information from the three main senses - sight, hearing and touch. It processes this information and sets in motion a response to the stimulus, within a fraction of a second. So, a primitive human, walking in the woods with a club, would react to a twig snapping in an instant, knowing exactly where to turn to face the predator or to catch the prey. Likewise, sighted people walking along a Crowded pavement or sidewalk has the ability to avoid a person coming out of a shop doorway and they don't have to think about it at all.

It also maps stimuli all around very accurately, enabling the person to form an awareness of the surroundings without having to look around and memorize everything consciously. For someone with vision impairment, the superior colliculus has two sources of information available to it: hearing and touch. When you are moving around, touch is a pretty impractical sense to rely on. You can't go around feeling everything, not if you want to get on. So you rely heavily on your hearing.

With the Automatic Cane, you have the opportunity to benefit from information from both senses in a meaningful way. Its reliance on touch, rather than beeps, as a source of information for you means that you are free to listen to all the other sounds in the area. In addition, touch is also processed in the Superior Colliculus, so you will find yourself building up a spatial map, and becoming aware of your surroundings and any dangers there, at a subconscious level. In other words, with no effort at all.

After a short period of teaching your brain will recognize what the new stimuli mean. You'll be able to switch on the Automatic Cane and use it, just as you would an ordinary long white cane, providing a greater source of information about your surroundings.

Because Automatic Cane is intuitive to use, vision impaired users of all ages usually feel confident with it within a few days. We believe that Automatic Cane should compliment and add to the skills that you have already, not force you to learn new ones.

This means that the features of the Automatic Cane are designed entirely with the user in mind. carbon graphite collapsible cane is reflective and lightweight intuitive to use, just switch is ergonomic, reducing the risk of RSI is rugged, hard wearing and easy to maintain works on two rechargeable AA batteries, so its running costs are low Switchable between "near" or "far" settings, so the Automatic Cane can detect objects 2m or 4m away to suit the environment you are in. It may be that from time to time you wish to give the cane a wipe, perhaps to remove any collected debris from the tip. Please do not immerse your Automatic Cane in water. It may be unable to do their job if the path of the sonic beam is blocked. This might happen if sufficient rain droplets fill the mesh cover at the front of either sensor. The solution is to simply blot the mesh gently with a clean cloth removing any excess water then leave to dry for a short while

Conclusion

Very few people are aware of this cane and the real pride comes when every blind person is benefited from this. The main idea behind this paper is to contribute our service to the blind society and helping them with the little knowledge that we have this is the revolutionary thing for the blind people.

REFERENCES

- [1] Lions Club International, "White Cane," Sep 2010, <http://www.lionsclubs.org/EN/common/pdfs/iad413.pdf> (19 July 2014) .
- [2] Philip Strong, "The History of the White Cane," January 11, 2009, http://www.acb.org/tennessee/white_cane_history.html (19 July 2014) K. Elissa, "Title of paper if known," unpublished.
- [3] World Health Organization, "Visual Impairment and Blindness," October 2013, <http://www.who.int/mediacentre/factsheets/fs282/en/>, (19 July 2014). R. Nicole, "Title of paper with only first word capitalized," J. Name Stand. Abbrev., in press.
- [4] American Foundation for the Blind, "Key Definitions of Statistical Terms," September 2008, <http://www.afb.org/info/blindnessstatistics/key-definitions-of-statisticalterms/25> (19 July 2014)
- [5] Canadian National Institute for the Blind, "The White Cane," <http://www.cnib.ca/en/living/safetravel/white-cane/Pages/default.aspx>, (19 July 2014)
- [6] Wisconsin Department of Health Services, "Why Would Someone Need a White Cane?" <http://www.dhs.wisconsin.gov/blind/whitecane/whitecane.htm>, (19 July 2014) J. Clerk Maxwell, A Treatise on Electricity and Magnetism, 3rd ed., vol. 2. Oxford: Clarendon, 1892, pp.68–73 S. Jacobs and C. P. Bean, "Fine particles, thin films and exchange anisotropy," in Magnetism, vol. III, G. T. Rado and H. Suhl, Eds. New York: Academic, 1963, pp. 271–350.
- [7] Smart Cane by Whitney Huang, Hunter McNamara, Diana Molodan, Amol Pasarkar & Rachel Rizzo, <http://soe.rutgers.edu/sites/default/files/imce/pdfs/gset-2014/Smart%2BCane%2BFinal.pdf>

