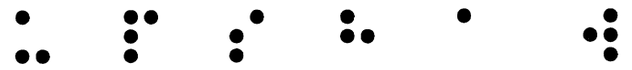
UPSHAW



INSTITUTE FOR THE BLIND

Formerly Greater Detroit Society for the Blind

August 11, 1995

To Whom It May Concern:

As the Executive Director of the Upshaw Institute for the Blind, I have known Dr. Johann Borenstein from the University of Michigan since 1989. In that year Dr. Borenstein showed me his original plans for the NavBelt, a portable obstacle avoidance and detection device for blind pedestrians. The obstacle avoidance capability of the NavBelt was implemented by means of very advanced ultrasonic sensor-based techniques originally developed for mobile robots. At this time, I provided Dr. Borenstein with our opinion and recommendations concerning the NavBelt and identified some of its shortcomings.

I have long been a user of and an advocate for the use of technology to overcome the problems associated with blindness. Of the two major categories of problems, communications and mobility, we have seen major advances only in communications. Voice synthesizers, optical character recognition, braille translation software all have provided blind persons access to information for education and employment opportunities only dreamed of a few years ago. The problem of mobility, on the other hand, has not seen anywhere near the same research and development efforts. So when Dr. Borenstein showed me his original plans for the NavBelt, I was extremely enthusiastic.

It has become clear that there are still great technical challenges associated with the NavBelt concept. For example,

. the use of audible guidance signals interferes with and masks important environmental acoustic cues useful to the blind traveler;

. the length and difficulty of training necessary to develop safe travel skills could drive training costs too high for widespread use; and

. the lack of the ability to sense for down-steps and other drop-offs.

Again, on 7/12/95 Dr. Borenstein visited my office at the Upshaw Institute for the Blind. This time he showed me his recent invention of the GuideCane. Dr. Borenstein explained the basic functioning of the GuideCane and then demonstrated his proof-of-concept prototype to me. The prototype consisted of a pair of steerable wheels at the distal end of an aluminum cane. A radio control (RC) steering device allowed Dr. Borenstein to steer the wheels left and right by means of a hand-held RC joy stick. The initial experiment was designed to show the feasibility of guiding a visually impaired person. At walking speed, I held the handle of the GuideCane and followed its motion as it was remotely steered.

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In the initial experiment, I tested the device inside the building of the Upshaw Institute for the Blind. Steering the GuideCane with the RC joy stick, Dr. Borenstein guided me safely and at a normal walking speed through narrow corridors, open doorways, and among office-type obstacles, such as, desks and chairs. At the end of this one-minute "test-run," I was amazed at the completely intuitive way in which I was able to follow the GuideCane's path without any training.

In a second experiment, we tested the GuideCane for some 15 minutes in a real-life, outdoor environment. In this test I walked with the GuideCane along different suburban sidewalks, turned in and out of driveways, and crossed streets including stepping down and up the curb. Among the real-life hazards that we encountered during this excursion were raised, cracked, and otherwise poorly fitted concrete sidewalk slabs. In one case, a concrete slab was raised by about 1.5 inches relative to the neighboring slab--a serious hazard for visually impaired persons using other travel aids. With the GuideCane, however, the wheels bumped into the obstacle and gave me ample warning of the hazard. Throughout the whole experiment there was absolutely no need to verbally warn me of a hazard that the GuideCane might have missed. Also, throughout the whole experiment, I walked at a fast pace while relying solely on the GuideCane.

In view of these very promising experiments, I wish to express my enthusiastic support for the further development of the GuideCane. Not only does this device overcome all the shortcomings of the earlier NavBelt design, but it also elegantly adds important functionality not found in the NavBelt or any other existing travel aid. Among these unique functions is the GuideCane's ability to

. use its two wheels for audiometric dead-reckoning, (i.e., computing the device's relative motion and position by monitoring the wheel revolutions),

. the tactile feedback, (i.e., surface-specific vibrations), transmitted by the wheels as they roll over different surfaces, and

. the GuideCane's fail-safe detection of down-steps and up-steps, even if they are small (on the order of one inch).

In addition to the superior obstacle avoidance functions of the GuideCane that I am intrigued by, is another function of the GuideCane, which makes it unique among other Electronic Travel Aids. This function is the (proposed) ability of the device to guide the user to a predefined goal--whether that goal is next-door or halfway across town. Additional and highly desirable functions include voice input/output, accurate outdoor navigation (by means of the Global Positioning Systems (GPS), and a readily available compass that is functional indoors and outdoors.

Dr. Borenstein explained that even the first experimental prototype of the GuideCane would weigh no more than eight pounds (and a commercially manufactured future version of the device would even be lighter). This weight is approximately equal to that of a modern notebook-type computer. In my opinion, this is not an unreasonable weight, for those times when the device is off the floor, to carry it up or down stairs. While the GuideCane is, of course, temporarily inoperative when lifted off the floor, the user is being guided by the handrail and does not need another guidance device.

Dr. Borenstein further explained that with today's technology, the GuideCane could be built from mostly off-the-shelf parts, and that a commercially manufactured GuideCane could cost the end-user approximately $3,000 to $6,000, depending on the desired options, i.e., speech input/output, GPS, etc. At this cost, the GuideCane will likely be commercially successful provided the device functions as well as its inventor predicts. There are about two million visually impaired or blind persons in the

United States, of which perhaps 30 percent could directly benefit from the GuideCane. For low-income potential users, it is quite likely that the acquisition cost of the device could be shouldered by foundations and other human service programs. By contrast we have 14 guide dog schools currently operating with an average per dog training cost between $12,000 to $20,000. As a result, there are approximately 7,800 guide dog users in the U.S. today.

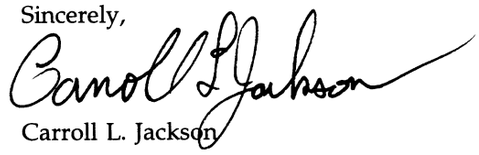
As the cost of technology continues to decline and its power continues to rise, it is not hard to project a decline in the cost of the GuideCane. The cost of training would also be greatly reduced by this device because of its intuitive nature of use. The training in the use of sub-functions like compass and GPS could be built into the voice-output sub-system, giving the user direct access to the use of the GuideCane. It is not inconceivable that the on-board computer could be used for other functions when not in use for travel. For example, the voice-synthesizer could be used to provide speech for the office computer or the owner's personal data file could be accessed and maintained using the voice recognition sub-system or keyboard.

Clearly, the GuideCane holds great potential for overcoming many of the mobility problems by blind persons. We are at a point where the level of readily available technology can be integrated into a device capable of significantly improving the lives of blind people. I sincerely hope that the GuideCane project will replace the NavBelt as the research and development focus for Dr. Borenstein's efforts. Its potential is far superior.

As president of the National Council of Private Agency's for the Blind and Visually Impaired, I have described my observations to other directors and have received an enthusiastic response. The blindness service system is in desperate need of the GuideCane.

I have offered the services of the Upshaw Institute for the Blind for ongoing consultation and evaluation of prototypes. In addition, we are able to provide liaison to the leadership of the blindness service system when it is time to transition the GuideCane from the lab to the real world of the blind.

Sincerely,



Carroll L. Jackson