Technical Survey: Smart Cane

Shawn Popal
February 10th, 2020

[1] Smart Cane

This article is about a group of engineering students at Rutgers University who for their design project, similar to ours, look to improve the capabilities of an ordinary cane by utilizing an Arduino equipped with ultrasonic sensors. They point out some of the limitations of the sensors, mainly with the detecting range, being a maximum of 4 meters as well as the type of surfaces that the sensor interacts with. Surfaces that absorb sound or cause echoing result in inaccurate readings. Similar to our initial ideas, their feedback system is a system of vibration motors in the handle of the cane. Interestingly, they implement it in such a way similar to a heartbeat sensor. When objects are far away, a light slow pulse is noticed by the user and as the distance toward an object is close, the pulsing becomes more and more rapid. With this design, they were able to accurately detect objects up to 2 meters away, however past this distance, the sensor readings started to be very inaccurate. They also describe that the Arduino Uno that they utilized was too large, which made it difficult to house ergonomically in the cane, as well as forced the design to not be modular. This design appears to only accomplish basic object detection and feedback with no modularity.

[2] Blindspot

This smart cane solution takes a similar approach to that of the project developed at Rutgers University but adds some layers of complexity on top of it. First off, the feedback system adds an auditory element, with a special bluetooth device that the user wears which indicates if an object is in their way. The main feature that this cane uses to differentiate itself from other canes is its social aspects. It allows friends of the user to check into certain locations, the user then receives a notification that allows them to either call, find, or ignore the friend. Call and ignore are self explanatory however the find feature is what is really interesting. There is a tactile ball that rolls around the front of the cane that is used to indicate direction. When the user

wants to find their friend, the cane will guide them using the ball, towards their friend. This addresses a problem that blind people face when trying to find someone in an open setting and could potentially be used to help users orient themselves in a room however that specific feature was not mentioned in their demo.

[3] Ultracane

Similar to the other solutions mentioned, the Ultracane takes advantage of Ultrasonic sensors to detect objects from the 2 to 4 meter range. They also advertise that this solution can detect objects at chest/head height up to 1.5 meters. The feedback system is similar to that of the Smart Cane from Rutgers which is a heartbeat system where as objects approach, the vibrating pulses become more and more rapid. This solution is not modular, similar to all the other solutions currently described and does not offer much else than already described. It also lacks any form of social capabilities and appears to be purely an object detection system.

[4] Multisensory virtual environment for supporting blind persons' acquisition of spatial cognitive mapping, orientation, and mobility skills

This article does not describe a smart cane solution but rather a technology developed that is used to map a 3D space in order to aid those who are visually impaired. Users would have someone develop the map of the rooms they are interested in and to test this functionality, the user would be allowed to virtually travel through this environment via joystick, notifying them if they were to run into obstacles. While this technology does not directly translate to our project, ideas can be stemmed off of it to solve the room orientation problem. The system being able to remember an environment or allowing the user to set up key points in a particular building could prove worthwhile in aiding the visually impaired in finding their orientations in large spaces.

[1] - Huang, Whitney, et al. *Smart Cane.* soe.rutgers.edu/sites/default/files/imce/pdfs/gset-2014/Smart Cane Final.pdf.

[2] - Selene chew Company, "Blindspot," http://www.selenechew.com/Blindspot.html, (19 July 2014)

[3] - UltraCane, "About the UltraCane," http://www.ultracane.com/about_the_ultraca ne, (19 July 2014)

[4] - Khan, Izaz et al. "Technology-assisted white cane: evaluation and future directions." *PeerJ* vol. 6 e6058. 10 Dec. 2018, doi:10.7717/peerj.6058