H.E.R.O.: A Novel Geographical Data-based Haptic Environment Response Operator for the Visually Impaired

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H.E.R.O. presents a novel approach towards assisting the visually impaired during navigation through the development of an Arduino platform based, multimodal, haptic feedback device that allows the user to navigate along a specific route while being alerted of the distance, size and shape of the nearest obstacles in range. The system interfaces with the user through a stereoscopic sonar system which communicates through vibratory-tactile feedback to indicate immediate obstacle positioning. The system actively combines autonomous collision detection and obstacle recognition algorithms with force-sensory vibration. The use of electroactive polymers for refreshable structural displays allows a human operator to feel the geometrical relationship with the object by creating shapes on the users head. H.E.R.O. combines three lightweight, haptic systems that provide a 3600 range of detection for both static and variable objects. The novelty of the approach lays in coupling such a setup with a voice activated, smart-phone application that utilizes cloud based mapping software and geographic data localization to convey directions to the user through the systematic application of vibrations from a smart-phone device. One vibration to turn right, two to turn left and a long beep to reroute. To give directions, geographic waypoints were determined using an Android-based platform and the Google Directions API, and were interfaced to the Arduino through Bluetooth, allowing turn-by-turn navigation. H.E.R.O. adapts to highly complex environments, and plans a safe route through changing environments by allowing the user to explore object position in an obstacle-cluttered relative environment and navigate via a geographical user interface.

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