A NAVIGATION KIT FOR THE VISUALLY IMPAIRED

GPS and GIS for the Blind

To date the visually impaired have received navigational aid from a wide range of technologies such as tactile maps, tactile graphic displays, acoustic devices, distance measurement by ultrasound or laser, and, last but not least, GPS and GIS. To make GPS and GIS feasible for the visually impaired a navigation kit is required which can represent spatial data in tactile graphics and attribute data using the Braille system.<P>

Everybody needs to orient themselves in the environment, to find their way to workplace, home, school, shops and so on. The sighted person does not usually and necessarily need any navigational aid. For the visually impaired things are often very different; he or she has difficulty moving around in unfamiliar places, assessing distances and possible obstacles, and identifying points of interest. The development of a navigation kit, possibly based on a Personal Digital Assistant (PDA) and using Micro Electro Mechanical Systems (MEMS), could make possible the representation of spatial data in tactile graphics and attribute data in Braille.

Maps for the Blind

Maps not only enable perception of space but also provide a wealth of lower-level information, such as routes and locations. Maps must be presented in an understandable format and give information that relates to a person's physical and/or sensory needs; maps therefore aim to provide a balance between objects, words and images. The visually impaired lack the skills to appreciate the aerial perspective displayed on a tactile map, or to apply the scale transformation necessary to relate map to real world. The most common problems experienced are rotation, inversion and mirroring, and might depend on age and environmental bravery. Maps presented by tactile graphics may lack convention and violate cartographic design principles but, in essence, they still attempt to convey a message to the user. Moreover, a map is an aid to communication and should not be subject to fashion or constrained by aesthetics; appeal is simply secondary to function.

Navigational Kit

The navigation kit should be equipped with:
-a wide range of input/output options, such as tactile graphics display, word recognition, voice output and refreshable Braille
-ultrasound/laser distance measurement for identifying obstacles
-GPS and GIS to provide current position and address priority needs in an easily understandable format.
The interface should be based on touch, and the kit should create tactile maps and provide object information by voice output. Tactile point, line and area symbols must be larger than their visual equivalents, and there also needs to be more space between them. The role of Braille here differs from text on visual displays in terms of orientation, point size and visual clutter. Inputting numerical and text data should be possible, along with editing, deletion and capacity to relate such data to spatial data. Image resolution should be changeable and information should be provided to the user at any resolution (zoom). The system should automatically extract graphical features. Orientation and course directional information to enable the user to get to an object should also be provided. The device should identify location in a static image and examine its finer details. GPS and GIS are able to provide this type of information.

GPS and GIS

GIS in combination with instantaneous GPS positioning enables identification and location of objects, including buildings and people, in the immediate vicinity. It also determines the topology of objects, for example, the primary school is north-east of Winston Churchill Park. Distances between the position of the visually impaired and an object can be calculated from GPS and GIS data, as can direction. The best route may also be extrapolated and the level of detail at which route information is presented can be selected. Updates of spatial data can be downloaded from the internet or other information sources en route. The interface can be customised based on user interest and skill level. GIS allows a user to select level of detail related to travel route and transportation mode. To date, the weaknesses of GIS and GPS are as follows: GPS does not work well indoors, performance is degraded in bad weather and signals can be blocked by mountains, buildings and trees. GIS databases are infrequently updated and are often specialised. But the foremost impediment is that GIS data is focused on the information needs of sighted people; much information needed by the visually impaired is lacking. To get there, specialised geo-databases have to be built: a costly and time-consuming process.

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