Designing a LiDAR Topographic Navigation System: A Novel Approach To Aid the Visually Impaired

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The WHO reports 2.2 billion people internationally have a form of visual impairment, with Perkins School of Blind adding that 4 to 8 percent (8.8 - 17.6 million people) solely rely on a white cane for navigation. In an interview by Stephen Yin for NPR, visually impaired interviewees claimed that a white cane was ineffective as it failed to detect moving obstacles (ex. bikes), aerial obstacles (ex. falling objects), and it became physically demanding after a prolonged period. This problem can be solved with a headset that integrates lidar technology and haptic feedback to provide a real-time assessment of their environment. Theoretically, the device will determine how far an object is from the user and place it into one of three conditionals based on distance (0-290mm, 310-500mm, 510-1200mm). As the user gets closer to the object, the haptic will vibrate more frequently. The device has 11 lidar sensors, beetle processors, and ERM motors so that when the lidar detects an object, the device will send a haptic signal in that area. It not only identifies the existence of an object but it tells the user its relative position with a latency period of approximately 2 milliseconds. When testing the device, a simulated walking environment was made. Ten obstacles were included: five below the waist (72”, 28”, 35” and 8.5” tall sticks) and five above the waist (paper suspended 6”, 10”, 48” and 28” from the ceiling). The white cane detected 4.1 obstacles, whereas the device detected 7.3 on average. The LiDAR navigation system is 178% more effective at detecting objects comparatively. Visually impaired individuals no longer have to rely on the white cane; rather, using this device, they can detect small, moving, and aerial objects at a much faster, and more accurate speed.

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