Title: WaCane: A Phone Free Navigation Cane for the Visually Impaired.

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Introduction and Background: I've always wondered how people with visual disabilities navigate the world around us. Even as a kid I closed my eyes and tried to navigate through my own house, and couldn't even do that. Approximately 43 million people worldwide are blind, and I can't even fathom how they would traverse the streets if they got lost. Established smart canes use a bluetooth connection for navigation, which defeats the purpose since the user can use the phone for navigation. They also rely on audio cues, which can be a problem in loud spaces. That's why I created the WaCane, a walking stick for the visually impaired with nearby obstacle detection and navigation that is phone free and uses vibrating modules.

Procedure: WaCane uses an ESP32 microcontroller with an ultrasonic sensor, GPS module, and a BNO055 compass. Four vibration motors sit in the handle, one per quadrant, vibrating in distinct combinations to signal obstacles, forward, backward, left, and right. A paired LED blinks continuously, faster as objects get closer, alerting others at night. Three buttons let the user save their GPS location with a five second hold, then navigate back with a press, comparing GPS bearing to compass heading to choose which motors vibrate.

Results: The ultrasonic sensor performs as intended, from a slight buzzing at 50cm distance to intensely vibrating at 15cm. GPS captured an outdoor location matching a verified position, and the compass calibrated fully and tracked heading accurately. Button save/navigate logic and full four-motor integration are complete in firmware and in final on cane testing.

Conclusion: WaCane shows that a fully phonefree, low cost navigational walking stick is achievable using simple, affordable hardware. The next steps to improving WaCane are attaching a rechargeable battery, a finished and smaller enclosure, and expanding to broader route guidance.

References:

Bourne, R., Steinmetz, J. D., et al. (2021). Trends in prevalence of blindness and distance and near vision impairment over 30 years: an analysis for the Global Burden of Disease Study. The Lancet Global Health, 9(2), e130–e143. https://www.thelancet.com/journals/langlo/article/PIIS2214-109X(20)30425-3/fulltext

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