

Sound-guided stick with haptics and emergency alert system: Enhance mobility for visually impaired

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Abstract

This study aimed to develop an efficient sound-guided stick with haptics and an emergency Alert System to meet the needs of visually impaired individuals in navigating their environment. The researcher used an applied research design to develop and test the device. The innovative tool incorporated SMS, Vibration, and Sound to enhance users' understanding of their surroundings. The study benefits visually impaired individuals, their families, and caregivers. The product's performance was tested using a validated questionnaire and a survey conducted with five participants at Divine Word College of San Jose and Mabini Extension in San Jose, Occidental Mindoro. The researcher also provided an obstacle to further evaluate the device's functionality in real-world scenarios. The researcher conducted the test with the help of the Excel Analysis ToolPak. They used the regression analysis method and manipulated the statistical data analysis to determine the relationship between the independent and dependent variables. Results showed that the sound-guided stick was effective in enhancing mobility, self-reliance, and safety for visually impaired individuals. The device provided reliable auditory guidance, haptic feedback, and an emergency warning system. When compared to a traditional cane, data revealed that participants performed better with the sound-guided stick. The researcher recommends improving the device by enhancing its features, using a waterproof case to protect its components, adding GPS to the SMS alert system for location tracking, and enabling connectivity to wireless earbuds for clearer alerts.

Keywords: visually impaired, sound-guided stick, haptics, emergency alert system, experimental study

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1. Introduction

Traditional canes and essential assistive devices often fell short in complex uses, where the users needed more than just obstacle detection—being unable to see affected millions of individuals worldwide. Individuals with visual impairments who were curious and unable to look at their environment might have been triggered to be alert all the time. A lack of proper knowledge led to confusion and anxiety, especially when someone was in an overcrowded or unfamiliar place (El-taher et al., 2021). This need led to the development of innovative tools such as the Sound-Guided Stick with Haptics and Emergency Alert, which used vibration to send a message for alert to their family and sound signals to help visually impaired individuals move with excellent safety and confidence.

Blindness made navigating crowded places a big problem, as well as when they were alone in unknown places. Many blind people were anxious and uncertain when going to places they once went to, were unfamiliar with, or had never been to. This anxiety caused them to skip social events, which made them feel lonely and isolated (Kim & Sohn, 2020). Navigating unfamiliar or crowded places without help and known people was one of the significant challenges for visually impaired individuals. However, using white canes allowed visually impaired individuals to navigate and detect nearby obstacles, along with an alert for their safe travel and arrivals. Regardless, their limitations in providing information about distant objects or environmental changes increased anxiety during solo travel, ultimately affecting their overall quality of life (Bhowmick & Hazarika, 2017). The likelihood of getting lost or facing challenges had a significant impact and made life difficult for the visually impaired.

An estimated 1.44 million Filipinos had visual impairments, many of whom lived in urban areas where navigating busy streets was particularly daunting (National Disability Prevalence Survey, 2019). Moreover, visually impaired people sometimes went to unknown places because of their low navigation ability, which was more dangerous. Tools were being made known as assistive technology that played a crucial role in enhancing the overall quality of life for people with disabilities. Devices such as the Sound-Guided Stick with Haptics and Emergency Alert reflected an improved technology utilization trend to create a more inclusive environment. Traditional aids, while helpful, often did not meet the demands of people in modern technology and fast-paced environments. Such advancements highlighted the need for more user-friendly, less expensive, and modern assistive technologies, fostering a more supportive, accessible, and harmless world.

Studies on urban navigation systems highlighted the requirement for accessible, user-friendly tools for those suffering from visual impairments (Saa'id et al., 2016). To help reduce the problems of visually impaired individuals. They utilized modern technology, such as the Sound-Guided Stick with Haptics and Emergency Alert, to navigate a complex environment. For example, smart canes alerted users regarding an obstacle in their path through sounds or vibrations (Khan et al., 2021). The Sound-Guided Stick with Haptics and Emergency Alert was an innovative device designed to assist visually impaired individuals in navigating their surroundings with increased independence. Unlike traditional white canes, this specialized tool integrated auditory feedback and alerts, such as vibration and SMS, offering AI-voice-based spoken instructions on voice navigation about where the user was close to a nearby obstacle and giving alerts by sending a message to the family of visually impaired individuals that they were in an emergency to provide fast assistance. This real-time information enhances users' sense of their environment, allowing for more confident movement in unfamiliar or crowded areas. They helped users be guided to clear any obstacles and provided significant information, including any accidents they might have been in, for faster assistance. This study assessed the effectiveness of a device integrated with vibration for emergency alerts and auditory feedback through a device known as the Sound

Guided-Stick with Haptics and Emergency Alert, aimed at enhancing outdoor navigation for visually impaired individuals. This aimed to provide the cane's performance to function in ways that visually impaired people needed when entering their environment. An innovative tool utilized SMS, vibration, and sound to deepen users' understanding of their surroundings. Along with working advancements in accessibility technology, mainly through smartphones, the device highlighted the importance of creating universally accessible tools. While traditional aids such as white canes provided some support, they lacked the capacity for detailed environmental awareness and modern assisting abilities. Since the individual was more informed by their surroundings, they could travel more safely and confidently. As the research sought to evaluate whether this device outperformed current technologies in complex urban settings, it promoted safer and more confident navigation. The study's findings informed future advancements in assistive technologies, ultimately supporting the independence and empowerment of visually impaired individuals in navigating public spaces.

Statement of the Problem - This study created and assessed a sound-guided stick with haptics of an emergency alert system to improve the spatial visualization of visually impaired people. Specifically, it aimed to answer the following. (1) What is the level of performance of the Sound Guided Stick with Haptics of emergency alert system in terms of auditory guidance, haptic feedback, and emergency warning system? (2) What is the level of effectiveness of the sound-guided stick with haptics of an emergency alert system in enhancing the spatial visualization of people who were visually impaired in terms of mobility, self-reliance, and safety? (3) Does the sound-guided stick with haptics of an emergency alert system significantly improve the spatial visualization of people who are visually impaired compared to traditional white canes in terms of mobility, self-reliance, and safety? (4) Is the level of performance of the sound-guided stick with haptics and emergency alert significantly affected by mobility, self-reliance, safety, and spatial visualization?

Significance of the Study - The significance of this study lies in its possibilities to improve mobility, safety, and independence for visually impaired individuals. The Sound Guided Stick, integrated with haptics and emergency alert, assisted users in better navigating their environment more effectively, boosting their confidence and decreasing their risk of injury during an emergency. The study's findings and results were valuable to visually impaired individuals. The findings of this study indicated that individuals with impaired vision were the primary recipients of the sound-guided stick integrated with haptics and an emergency alert. By identifying other obstacles in their surroundings and giving alert signals through vibration and SMS, this technology gave people the independence to move through public areas. The purpose of the stick was to improve the mobility and safety of legally blind people by helping them to participate more fully in social and economic activities, increasing their opportunities for education, employment, and leisure. To family members, the findings of this study stated that the families of people with vision impairments would also benefit from the sound-guided stick integrated with haptics and an emergency alert. The device's alert features could reduce concerns about the user's safety in any possible emergency, allowing families to provide better support and care for their loved ones with greater peace of mind. To caregivers, the findings of this study indicated that the Sound Guided Stick, integrated with haptics and an emergency alert, could significantly reduce the stress and anxiety experienced by the caregivers of visually impaired individuals. By lessening the worry about the user's safety while they moved around independently, caregivers could focus on providing more effective support and care, fostering a more positive and supportive environment. The findings of this study informed policymakers and funding agencies about the potential benefits of investing in assistive technologies for visually impaired individuals. This could lead to increased funding for research and development of new technologies and programs that provide access to assistive technologies for those who need them. To future researchers, this research provided valuable insights and data for future researchers exploring advancements in assistive technologies for visually impaired individuals. The findings could serve as a foundation for other investigations and be cited in related literature, contributing to the ongoing development of innovative solutions for enhancing the lives of people with vision impairments. This could lead to the development of even more sophisticated and effective assistive technologies, further improving the lives of visually impaired individuals.

Scope and Delimitation of the Study - This study aimed to build a sound-guided stick with haptics and an

emergency alert system to improve mobility so the visually impaired can navigate more safely and independently in their respective areas. This guided stick detected obstacles and produced voice feedback using ultrasonic sensors. In addition, haptic feedback involving vibrations was included to assist the users in determining the nearness of the obstacles ahead. An emergency alert system was also integrated, with an SMS that could notify authorities or emergency contacts of the respective user. This product was tested with visually impaired people to ensure it worked in real-world situations. This study particularly examined how the device detected obstacles at a distance of 1 to 40 inches. It discussed how an increased noise level, a characteristic of traffic-choked roads and noise-polluted streets, affected the ability of users to hear the audio cues and how the product would be used in locations with weak or no signal. Additionally, the ultrasonic detector is limited to detecting objects within a range of 40 inches. It also cannot detect highly fast-moving objects or extremely low obstacles too close to the ground. Users cannot walk fast while using the device, and it is not suitable for use during rainy conditions, as external factors like water interference may affect its functionality. The device also needs to be held upright for optimal performance. Moreover, the emergency SMS button may not function properly in areas with weak or no signal. The researchers' target population was visually impaired individuals familiar with conventional mobility aids. Thus, the findings could not be generalized to everyone. Finally, the study was conducted in a residential open space and school grounds, which may not reveal potential challenges in rural areas, and the study duration was short, making it difficult to assess long-term impacts on users' confidence and mobility.

2. Methodology

Research Design - This study utilized an applied research design mainly focused on scientific knowledge to develop new technologies. This study aimed to create and produce a sound-guided stick with haptics and an emergency alert system for the visually impaired. This applied research aimed to evaluate the efficiency of the Sound Guided Stick in providing navigation and safety to visually impaired users. This study used quantitative research to acquire objective, precise, and generalized findings.

Participants of the Study - The participants of this study were five visually impaired individuals, and they were purposely selected with a characteristic of having common visual impairments such as glaucoma, cataracts, retinitis pigmentosa, and 300-grade vision. Limiting the sample size to 5 participants allowed for more effective data analysis and ensured that the data gathered remained manageable. Participants first observed how the Sound Guided Stick with Haptics and Emergency Alarm System, including its functions and the process of decoding the auditory, haptic feedback, and SMS alert system for navigation. They were then encouraged to test the device in designated locations at Divine Word College of San Jose and Mabini Extension in San Jose, Occidental Mindoro. After the testing phase, data were collected through structured interviews and questionnaires to gain insight into participants' experiences, improvements in mobility, and ease of use, ultimately assessing the extent to which the device enhanced their safety and confidence.

Data Gathering Procedure - A request letter was sent to the guardians of the chosen participants, asking for their approval for them to participate in testing the device. The researchers prepared six items to evaluate the performance of the device. The researcher-made instrument was validated by the experts in the field of science and technology in the senior high school department. After the guardians' approval, the researchers surveyed to evaluate the product. The researchers selected five (5) participants to assess the effectiveness and improvement of the Sound-Guided Stick with Haptics and Emergency Alert System: Enhanced Mobility for the Visually Impaired. They gathered data through the following steps. First, the researcher prepared all necessary materials, including the product to be evaluated. Furthermore, they asked for the respondents' consent to participate in the study. Then, the respondents used the product in a controlled setting. Following the testing phase, the respondents were asked to complete a questionnaire that addressed key aspects of the product's functionality. The data-gathering process was expected to take approximately 1 day to finish. Once all the data were collected and the results were out, the researcher organized the information given. The primary aim of this procedure was to assess the product's accuracy, efficiency, and potential to enhance the user's confidence and independence.

Research Process: Stage 1 Preparation and Gathering of Materials - This product requires researchers to work on technical materials for its development to grow more effectively in terms of usage. They have chosen materials from authentic sources that meet their affordability needs and are of good quality. The materials needed to create the sound-guided stick with haptics and an emergency alert system were as follows: For the Software: Arduino IDE; Hardware: Arduino Nano, Batteries, Mini Breadboard, Module, AOTOO UART Serial MP3 Music Player - Audio Output, HC-SR04- Ultrasonic Sensor, SMS, Button, Vibrator Motor, DC-DC; For Housing: Tupperware, Cane, zip ties, Electrical tape. The major components used to assemble the product were purchased online, primarily from Lazada Ph. The materials used for the prototype cane were purchased from the store NOVO, and the others were given to the researchers. The total cost of the product is ₱2,867.

Stage 2: Building of Development of the Product - The researcher's primary purpose in conducting this study was to develop a sound-guided stick with haptics and an emergency alert system that enhanced the mobility of the visually impaired. The researchers aimed to provide a reliable device that navigated and guided using sound. It helped the users to navigate successfully and independently. This project included a sound module for auditory navigation, an SMS alert system, and haptic feedback assistance for emergencies. These technologies worked together to enable the device to efficiently guide users by giving them a warning of potential obstructions in their way. The researchers used an Arduino Nano to put the components together. The SMS alert system and haptic feedback were in charge of assistance for emergency purposes, and they used an ultrasonic sensor to detect potential obstacles. The visually impaired could move around more quickly because of the audio signals that told them of their distance and any obstacles in their path. The researchers used breadboard jumper wires to connect the components of the device. It helped to ensure the accuracy of transferring the data. It produced accurate guidance using sound, the SMS alert system, and haptic feedback through coding and programming. It took 59 days for the researchers to build the whole product. After the product was constructed, the Sound Guided Stick, which has haptics and an emergency alert system, was tested in different environments to assess its functionality and accuracy. The researchers acknowledged the potential for further refinements and enhancements in the future.



Figure 1. Actual Product of Sound Guided-Stick with Haptics and Emergency Alert System

Stage 3: Experimental stage, Observation and Data Recording - The researcher experimented and observed whether the cane responded and matched the navigation that was programmed on entering the area and when it was going to or passing through an obstacle. They experimented to determine if there was a significant difference between the traditional cane and the sound-guided stick that was integrated with the emergency alert in terms of the navigational accuracy of the visually impaired. The researchers measured the navigational accuracy using a cane without the feedback of the stick on the visually impaired individuals. They tested the current yield of the cane for the visually impaired individuals with the feedback of the stick. The mobility of the following individuals was also monitored to see if it lessened and compared to the mobility of an individual with a cane without the following feedback attached to the tool. Then, they let the visually impaired individuals use the cane for 30 minutes to 1 hour to see if the adaptation and accuracy were observed. Finally, they tested the strength and durability of both products, whether the product was beneficial to have, and how long the cane lasted. The researcher observed the efficiency and accuracy of the product. The participants tested the product, and the researcher observed whether the product's function was accurate to its performance. The researchers gathered the data as the primary data; it was the first-hand information that the researchers collected. The researchers measured the distance the visually impaired could walk independently while walking with the sound-guided stick. They

measured whether the tool helped to reduce the functionality of the cane. The researchers observed the development of the cane to see whether it was suitable, safe, and credible to use. The researchers took notes on the speed and the distance that they needed to improve for the further development of the product. Purposefully, the researchers did the whole gathering procedure with an unbiased, accurate, and honest approach.

Statistical Treatment of the Data - The researcher described the status of the Sound Guided Stick with haptics and emergency alert system with Arduino nano microcontroller and the level of effectiveness of the systems by computing the frequency and percentage, and the data was presented graphically for easy understanding of the results. The researcher conducted the test with the help of the Excel Analysis ToolPak. They used the regression analysis method and manipulated the statistical data analysis to determine the relationship between the independent variable, such as the sound-guided stick with haptics and emergency alert system of the product when in use, and the dependent variables, such as environment navigation, mobility efficiency, confidence and independence, and spatial awareness and navigational accuracy, that were produced. This method was highly suitable for this study since it determined the effect of the environmental terrain on producing several factors on mobility enhancement, as well as the duration of the product and its accuracy.

3. Results and Discussion

Table 1

Mean Level of Performance of the Sound-Guided Stick with Haptics and Emergency Alert

Indicators	4 (Very Good)	3 (Good)	2 (Fair)	1 (Poor)	Weighted Mean	Descriptive Indicator
The S.G.S. cane provides the user with effective auditory guidance.	1	3	0	0	3.2	Good
The S.G.S. cane provides the user with responsible haptic feedback.	3	2	0	0	3.6	Very Good
The S.G.S. cane provides the user with a reliable emergency warning system.	3	2	0	0	3.6	Very Good
Overall Mean					3.5	Very Good

Legend: 3.5-4.00 Very Good; 2.8-3.4 Good; 1.8-2.7 Fair; 1.7-1.0 Poor

Table 1 presents the data collected through the validated questionnaire and the corresponding weighted mean and descriptive indicators. This reveals that the device is rated as offering highly effective auditory guidance, with a response anchor of “very good.” Additionally, the device is rated highly for providing responsible haptic feedback and reliability of its emergency warning system, both receiving the highest positive response anchor, “very good.” The mean score for the effectiveness of the auditory guidance is 3.2, which is the lowest among the three indicators. Meanwhile, the means for responsible haptic feedback and the reliability of the emergency warning system are both 3.6, the highest of the three. The overall mean score is 3.5, placing it within the “very good” category. This indicates that the performance of the Sound Guided Stick with Haptics and Emergency Alert System is excellent in terms of auditory effectiveness, responsible haptic feedback, and the reliability of the emergency warning system. These results align with the findings of Tan et al. (2024), who emphasize that integrating advanced technologies such as obstacle detection and navigation assistance in the Smart Guide Cane enhances the quality of life for individuals with disabilities, promoting greater autonomy and dignity. This allows users to navigate unfamiliar environments more safely and independently. Building on this literature, our analysis of user feedback further emphasizes how the device's auditory guidance, responsible haptic feedback, and reliable emergency warning system directly contribute to its usability and user satisfaction.

Table 2*Mean Level of Effectiveness of the Sound-Guided Stick with Haptics and Emergency Alert*

Indicators	4 (Very Good)	3 (Good)	2 (Fair)	1 (Poor)	Weighted Mean	Descriptive Indicator
The S.G.S. cane is effective for the user in aiding their mobility.	3	2	0	0	3.6	Very Effective
The S.G.S. cane is effective for the user in aiding their self-reliance.	1	4	0	0	3.2	Effective
The S.G.S. cane is effective for the user in aiding their safety.	1	4	0	0	3.2	Effective
Overall Mean					3.3	Effective

Legend: 3.5-4.0 Very Effective; 2.8-3.4 Effective; 1.8-2.7 Slightly Effective; 1.0-1.7 Not Effective

Table 2 presents the level of effectiveness of the sound-guided stick with haptics and the emergency alert system. The table evaluates the level of effectiveness based on three key indicators: mobility, self-reliance, and safety. Each of the indicators has a corresponding weighted mean and descriptive rating. The sound-guided stick with haptics and an emergency alert system enhances the user's mobility. The cane helps the visually impaired to become independent, and it is effective in keeping the users safe. The overall mean is 3.3, which is classified as "effective." The Sound Guided Stick is generally useful in enhancing mobility, or self-reliance, and safety. The Sound-Guided Stick with Haptics and Emergency Alert System is effective in assisting and guiding visually impaired users. Thus, the key function of the product shows a significant effect on the way of living of the user, falling on the "effective" indicator that clearly states that the sound-guided stick cane has a significant improvement for the user in aiding its mobility, self-reliance, and safety. These results resonate with the idea of Tan et al. (2024), which suggests the effectiveness of the smart cane. They highlight that the Sound Guided Stick improves the quality of life for those with disabilities, promoting autonomy and dignity in their daily lives. The SMS module in this product effectively sends messages when the visually impaired person is in an emergency.

Table 3*Difference and Comparison between Sound-Guided Stick and Traditional Cane*

Indicators	T-value	P-value	Interpretation
Mobility	0.894	0.023	Significant
Self-reliance	0.447	0.033	Significant
Safety	0.447	0.033	Significant

Legend: $p \leq 0.05$ Significant

The sound-guided stick and the traditional cane were compared using a t-test that considered the three features. As revealed in Table 3, significant differences are found considering self-reliance and safety. This has been proven by the results of t-values: 0.894 and 0.447. The t-values are acceptable if they are less than +2. The t-values indicate that a difference exists between the sound-guided stick and the traditional cane. The significance is given by the p-value of 0.023 in Mobility. Moreover, it was found that the sound-guided stick and the traditional cane are also significant in terms of self-reliance and safety of the users since the p-values of

mobility are 0.033. This indicates comparability of the two systems considering mobility, self-reliance, and safety. With the result given, it can be said that the sound-guided stick with haptics and an emergency alert system differs from the traditional cane in terms of users' mobility, self-reliance, and safety. Many users, however, prefer to walk with others because their white cane has trouble identifying things far away. Based on the study of Williams et al. (2014), it concluded that the traditional white cane should be supported by the new technology. The Sound Guided Stick differs from the traditional white cane in terms of mobility, self-reliance, and safety. Visually impaired users also differentiate between the two canes. Using the Sound Guided Stick with Haptics and Emergency Alert System, the users become more independent and confident, exploring things and making it easier to enjoy their daily lives and discover the world around them.

Table 4 shows the correlation analysis of the sound-guided stick's effectiveness level and its significance level. The independent variables are mobility, self-reliance, safety, and spatial visualization, while the dependent variables are auditory guidance, haptic feedback, and emergency warning systems. Since the p-value is less than the alpha level of 0.05, it rejects the null hypothesis and accepts the alternative. The dependent variables for haptic feedback and the emergency warning system have a p-value of 0.033, auditory guidance of 0.000, and auditory guidance with haptic feedback of 0.002. Therefore, the p-values that fall on $p \leq 0.05$ are significant, and those $p \leq 0.01$ are highly significant. As a result, the Sound-Guided Stick with Haptics and Emergency Alert is significant regarding the mobility, self-reliance, safety, and spatial visualization of the visually impaired.

Furthermore, the findings stated that the device made by the researchers is highly significant, especially in mobility with the auditory guidance and haptic feedback, and spatial visualization relies on the auditory guidance. These results highlight the study of Jafari et al. (2016), which stated that haptics have an interface on the touch feedback as it makes a difference for the user's mobility, as it also indicated enhanced task performance, object perception, and manipulation tasks for an individual. The smart cane captures obstacle information and allows users to establish destinations using voice commands. That highlights the aid of the cane with a signaling effect and the capacity to have direct engagement as stated in the three IVs that integrated and correlated with the DV in terms of the significant value of correlation analysis.

Table 4

Correlation Analysis on the Level of Effectiveness of Sound-Guided Stick with Haptics and Emergency Alert

Independent Variables	Dependent Variables	R-value	R-value ²	T-value	P-value	Interpretation
Mobility	Auditory Guidance with Haptic Feedback	-0.218	0.048	-0.387	0.002	Highly Significant
Self-reliance	Haptic Feedback	-0.612	0.375	-1.340	0.033	Significant
Safety	Emergency warning system	-0.612	0.375	-1.340	0.033	Significant
Spatial Visualization	Auditory Guidance	-0.245	0.060	-0.438	0.000	Highly Significant

Legend: $p \leq 0.01$ Highly Significant; $p \leq 0.05$ Significant

4. Conclusions

Based on the summary of findings, the following conclusions were drawn in response to the stated research problems: The level of performance of the Sound Guided-Stick with Haptics of an Emergency Alert System is

enhanced in terms of auditory guidance, haptic feedback, and emergency warning system. The level of effectiveness of the sound-guided stick with the haptics of an emergency alert system improves the spatial visualization of visually impaired people in terms of mobility, self-reliance, and safety. The sound-guided stick with haptics of the emergency alert system significantly improves the spatial visualization of visually impaired people compared to traditional white canes in terms of mobility, self-reliance, and safety. The level of performance of the Sound Guided Stick with Haptics and Emergency Alert is significantly affected by mobility, self-reliance, safety, and spatial visualization.

Recommendation - This research study shows the usefulness and effectiveness of the “Sound-Guided Stick with Haptics and Emergency Alert: Enhanced Mobility for Visually Impaired” (product). Thus, the following recommendations are offered based on the work accomplished during this research and on the conclusion given previously: The researchers recommend that the Local Government Unit (LGU) consider providing funding to enhance the device by integrating GPS features. This addition would improve navigation capabilities for visually impaired users, allowing for real-time location tracking, route guidance, and emergency assistance, ultimately increasing their mobility, safety, and independence. The researchers recommend that engineers develop a durable, waterproof casing designed specifically for housing Arduino-based projects, ensuring the protection of electronic components from environmental factors such as water, dust, and impact while maintaining accessibility for modifications and upgrades. The researchers recommend that signal providers enhance network coverage to reach remote and underserved areas, ensuring reliable connectivity for features that rely on mobile signals, such as emergency alerts and GPS tracking, to improve accessibility and safety for users. For the user, this product is also recommended for use in urban areas, as it is more suitable and easier to receive messages because of the strong signal. Moreover, for future researchers, it is recommended to integrate multiple ultrasonic sensors to enhance obstacle detection accuracy and effectiveness, along with a wired or wireless earbud connection to improve user audio feedback.

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