

# **Stereo Camera Based Navigation Assistant For Blind People**

## **A brief description about the problem**

People with visual impairments face a lot of challenges when it comes to navigation, including:

1. **Obstacles while navigating:** Blind people may have difficulty detecting obstacles in their path while navigating. They also may have difficulty determining the height or location of an obstacle. Also when there's a staircase, it can be dangerous for them as they can fall and get injured.
2. **Orientation and mobility:** Without the ability to see, blind people may have difficulty orienting themselves in unfamiliar environments and maintaining their sense of direction. They may also have difficulty navigating through crowded or busy areas.
3. **No information about their surroundings:** Blind people may have difficulty accessing information about their environment.
4. **Identifying the person and their expression:** Blind people might have difficulty in knowing about the expression of a person while talking to them.

## **How our solution works.**

- The device will have an onboard stereo camera, Raspberry Pi, Lithium Polymer battery and speaker or aux output to connect to headphones.
- For the very first time the device will construct the 3d map of the house using a stereo camera, and through SLAM technique .
- Now the user can wear the device on their head and give instructions to the device and in response to that, the device will guide the visually impaired person to the desired area and also describe their surroundings.
- As the user moves in the house, the device will also occasionally update the Map and also store the position of each and every object identified in the database so that the device can help the user to find it later on when asked for it.

## **Technology Stack**

1. Ubuntu, ROS(Robot Operating System),
2. Rviz,
3. Gazebo,
4. 3d printing
5. Stereo camera - Arducam 2mp stereo camera
6. Microprocessor - Raspberry pi 4 8gb

## **Literature survey**

- One study, published in the International Journal of Human-Computer Interaction in 2017, examined the use of a smartphone app with auditory and haptic feedback to assist blind individuals in outdoor navigation. The study found that the app was effective in providing accurate and timely navigation instructions and that users were satisfied with its performance.
- A more recent study, published in the Journal of Medical Internet Research in 2020, evaluated a navigation system for the blind that utilizes a combination of GPS, a compass, and a tactile

map. The study found that the system was able to provide accurate and reliable navigation instructions and that users were able to navigate unfamiliar outdoor environments with greater independence.

## Real World Implementation

### a) Application

1. The device can be used to provide valuable information to the blind person with the help of a stereo camera such as the distance and location of obstacles, and descriptions of the environment and guide them to the desired place in the house using SLAM and audio instruction.
2. Identifies the object in the surrounding and stores the location of it in the database.
3. Integrating a natural language processing model can provide more detailed and accurate navigation instructions and allow for hands-free control of the device.
4. Additionally, the device's ability to detect facial expression can be used to provide more context to the user, such as recognizing if the person is facing them or not.
5. In future the user will be able to download pre existing 3d maps of famous areas and airports to the device so that the device can help them navigate through these areas too without any difficulty.
6. People with both visual and hearing impairment will be guided by two wireless haptic feedback bands placed on both hands.

### b) Uniqueness in our solution

Some of the unique features in our device are :-

1. Integrated Natural Language Processing based assistant for hands-free control of the device and giving navigation instruction.
2. Wireless haptic feedback based bands for assisting people with both visual and hearing impairment
3. Ability to download 3d maps of famous areas and airports from a database to the device so that the device can help them navigate through these areas too without any difficulty.

### c) Cost breakdown

S. No	Component Name	Price
1	Raspberry Pi 4 8gb	10,000
2	Stereo Camera	15,000
3	LiPo Battery	1,500
4	Miscellaneous (3d printing, pcb, etc.)	5,000
	Total	31,500