

**Project proposal for  
DST & Texas Instruments Inc.  
India Innovation Challenge Design Contest  
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Anchored by IIM Bangalore**

**SMART NAVIGATION SYSTEM FOR THE VISUALLY  
IMPAIRED**

**SSN COLLEGE OF ENGINEERING**

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**Project Abstract**

Visually challenged people all over the world face difficulties in navigation, particularly in an unknown environment. Most of them use normal cane to navigate for their regular activities. They face challenge only when they want to navigate in a new environment, where they need help from others. Hence there is a need for a system to guide them in such cases. This project aims to develop a smart navigation system using the current communication technology for visually impaired people to navigate independently. The proposed system will have a smart hand held device with Wi-Fi transceiver and Wi-Fi access points. When the visual impaired people nears the Wi-Fi

access point, the hand held device with Wi-Fi transceiver get paired and the MAC address of the Wi-Fi access point representing that location is sent to the server and the corresponding audio file will be played to guide them to navigate. The proposed system will also have a cane with ultrasonic sensors for obstacle detection and intimate them via an audio message and in turn makes the system as a smart navigation unit for visually impaired people.

**Keywords:** Wi-Fi, Transceiver, Wi-Fi Access point, MAC Address, Smart Cane, Ultrasonic sensor

### Team Members – Roles & Responsibilities

Serial No	Student Member Name	Role (Choose one of the following – Marketing, Technical, Operations & Other Roles as applicable)	Justification
1	NAVEEN NARAYANAN	TECHNICAL	In charge of designing the handheld device with microcontroller
2	SOMASUNDAR	TECHNICAL	Responsible for designing the smart cane
3	VIMALRAJ	OPERATIONS, TECHNICAL	Sets up the server with different audio files
4	SIVASANKAR	MARKETING, TECHNICAL	Compares prices of similar products available in the market
5	PRAKASH	MARKETING, OPERATIONS	Sets up Wi-Fi system in the building

### Market Analysis

#### A. Customer Need Identification

Most visually impaired people use only white canes or dog which guides to navigate in an unknown environment. This system provide guidance to avoid obstacles and also help the visually impaired people to navigate in an unknown environment through audio message.

## B. Serviceable Addressable Market (SAM) Identification & Justification -

There has been a raising demand to have an alternate smart system that will aid visually impaired people to navigate and avoid obstacles in indoor environment. This project is to develop a marketable product to bridge this impairment in communication between normal person and visually impaired people.

## C. Product Differentiation w.r.t. Competition & Justification

In today's scenario, not much focus has been given on the indoor navigation for visually impaired, which is equally important as external navigation. This smart self-assistive navigation system will provide voice based guidance as an alternate to current conventional cane.

## D. Understanding of your customer & user

The primary customers are the visually impaired people. Their basic difficulties are overcome obstacle and independent movement in an unknown environment. So the system caters to remove these problems by providing a smart cane and a hand held device for the direction guidance.

## E. Distribution Channel Identification

The proposed system can be implemented in large buildings such as malls, banks, hospitals, schools, offices and in other areas with inbuilt Wi-Fi system.

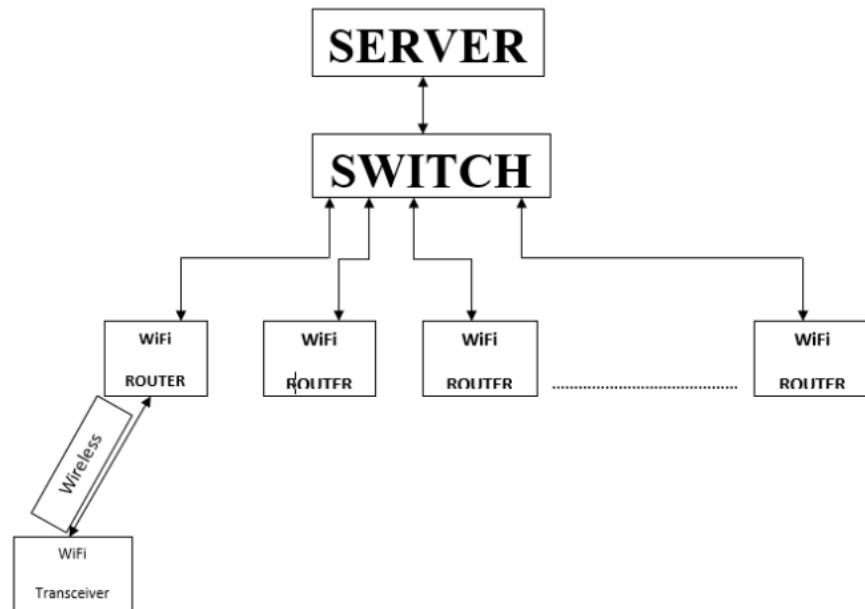
## Proposed Design

This project is intended to develop a self-assistive in-door navigation system such as hospitals, schools etc... for visually impaired people through Wi-Fi. The system makes use of wireless routers, placed at different locations in the building as shown in figure 1, and all these routers will be connected to a common server through a switch. The user will be provided with a wireless transceiver and whenever the user is near a Wi-Fi router, the device will get paired up and the corresponding MAC address of the router is sent to the server. Thereby, the server can identify the connected router and the corresponding audio file, with the required direction information, is sent back to the intended device. The received audio file could be played using a headphone connected to the transceiver through the audio jack. When the user moves away from the Wi-Fi router, the transceiver will now get paired to the next Wi-Fi router and once again the required audio file will be provided by the server.

The ultrasonic sensors will be placed on the cane to detect the obstacles. When the sensor senses an obstacle, an audio file is sent to the person, thereby helping them to move about safely.

**Objectives:**

- A. Setup a database server that stores the different audio files with direction guidelines to different places.
- B. Place WI-Fi routers at different points and connect them to the server through a common switch.
- C. Preconfigure the server with the MAC addresses of the router
- D. Place the ultrasonic sensors along with the microcontroller on a cane to detect obstacles.



**Figure1:**Block diagram of the proposed system.

## Component Used -

TI Part Number (link all the parts to their respective product page on the TI website)	How is it being used in the proposed solution? Explain its role/functionality
Part 1 TDC1000	Ultrasonic sensor-Used to detect nearby obstacles
Part2 CC3100 MOD <a href="http://www.ti.com/product/cc3100MOD/description">www.ti.com/product/cc3100MOD/description</a>	Microcontroller

Non - TI Parts	How is it being used in the proposed solution? Explain its role/functionality
Part 1 PC	Used to setup the server
Part 2 Wi-Fi Router D-Link	Used to find the important locations in the indoor environment

## Innovativeness of the Proposed Solution

Currently, the visually impaired people make use of walking cane for navigation. However, these canes are inefficient since they don't provide smart solutions like directions to be followed in a new environment. The proposed system eradicates this flaw by a handheld device which helps in navigation by audio files by making best use of Wi-Fi based positioning. The system also consists of a cane with ultrasonic sensors for obstacle detection and by an audio message, the information about the obstacle is conveyed to the visually impaired person.

## Impact of the proposed solution

The proposed solution will provide better safety measures for the visually impaired in navigation as shown in figure 2. This will reduce their dependency on others also increase their confidence while navigating in unknown locations.



**Figure2:** Navigation devices for the visually impaired people

## Feasibility

**Figure3:** Population statistics of blind people in India

Ages (in years)	Population (millions)	Blind (millions)	Low Vision (millions)	Visually Impaired (millions)
0-14	1,848.50	1.421	17.518	18.939
15-49	3548.2	5.784	74.463	80.248
50 and older	1,340.80	32.16	154.043	186.203
all ages	6,737.50	39.365 (0.58)	246.024 (3.65)	285.389 (4.24)

India has the world's largest population of visually impaired. Figure 3 shows the population statistics of blind people in India. The government along with NGOs and non-profit organizations are striving for the betterment of the visually challenged community. This project will be highly productive in India due to these reasons. Moreover, most of the large buildings have inbuilt Wi-Fi systems, hence this proposed system can easily be implemented at low cost.