A Survey on Indoor Navigation for Blind People

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Abstract - *Indoor navigation deals with navigation within buildings. Because GPS signal is not available inside building environment. There are other technologies are used for positioning such as Wi-Fi or beacons. These technologies are used create "indoor GPS". Today in internet era outdoor navigation is possible due to mobile navigation application and which are very useful for many people. These apps are more useful in unfamiliar city to find desired destination. The GPS positions system works very well for outdoor navigations however GPS satellite signals are not accurately provide navigation details and it is still easy to get lost indoors such as shopping malls ,station etc. For many people having those are not blind , it is difficult for them navigate properly so for visually-impaired and blind people it is more difficult to find their way in unfamiliar indoor environment because the object in front of them sometimes can be transparent. Orientation is most difficult for them even at places where they previously visited. Visually impaired people must orient themselves in a large space. In this paper we have studied and surveyed some already existing indoor navigation systems for visually impaired people and also compared them from different use scenarios.*

Key Words: Indoor navigation, Sensor, Wearable Device, Smart Stick

1. INTRODUCTION

Finding your way or navigating within public building is many times difficult even if we have accurate maps provided. Many of us have been lost is buildings such as hospitals, stations, shopping mall or any other buildings which are crowded. If this normally sighted people struggled in navigation ways so we can imagine how it can be difficult for visually impaired or blind people

According to the World Health Organization, 253 million people worldwide are visually impaired. They are 3 times more likely to be hit by motorcycles, 2 times more likely to have a fall while walking and 3 times more likely to suffer from depression and anxiety disorders. Devising new ways to improve the quality of and security in their everyday lives is therefore vital. It is very critical that some of us are not able to move securely and independently and we need to ensuring that every person may lead to live life comfortably. It is extreme necessity of indoor navigation systems for visually impaired people to live their daily life otherwise it is more difficult which can be stressful. There are variety approaches are already proposed which actually helps in indoor navigation. One such approach is wearable devices. Now a day's variety wearable assistance devices were

introduced for navigation of blind people. An orientation and navigation are the main problems or difficulties, and these are because of missing known landmarks. This can lead to risk overcoming obstacles. Not all the visually impaired people can read Braille tags and the higher cost of the existing indoor navigation systems make it impossible to use by the people with visual disabilities

2. LITERATURE REVIEW

A] Multiple Distance Sensors Based Smart Stick for Visually Impaired People

In this paper the author proposed a smart stick which visually impaired person holds and walk with it, this stick assist person while walking in indoor environment. In this project author choose outdoor context and created a prototype that actually useful for blind people in outdoor environment. This system comprises ultrasonic sensor and Bluetooth module. The ultrasonic sensor detects obstacle of any height in front or slightly sideways of the person. Then it calculates the distance between object and the person. This system notifies to person about obstacles using vibrations and audio alert. [1]

B] Navigational Assistance System For Visually Impaired

In this paper authors created a smart walking stick which having different sensors on it which helps detect obstacles to visually impaired persons. The proposed system basically consists of two main units one is sensor unit and another is GPS unit. The system used a IR sensor for obstacle detection. This system also use water sensor to detect the presence of water in front of the user. The GPS module is used to identify the geographical location of the user. When system detects obstacle, pit or water in front of persons then it sends audio alerts to person such as "Wet Floor" and "Pit Found Better Go Back" [2]

C] The Assistance System using RGB-D Sensor with Range Expansion

In this paper authors proposed a new system which refers Navigation Assistance for Visually Impaired (NAVI) nothing but a system which assists blind persons in navigation using different sound commands. The proposed system is based on visual and range information provided by RGB-D camera. The camera captures scene in front of blind person and provide to system for further processing. This camera provides long-range visual information which is useful in getting depth information. The proposed system detects and classifies the main structural elements of the scene and

provides safe paths to navigate comfortably across any unknown environments. [3]

D] Smart Phone Application to Assist Visually Impaired People

In this paper, the authors Laviniu Tepelea, Loan Gavrilut & Alexandru Gacsadi proposed a system comprises smart phone application to assist visually impaired people. Now a day's smart phone is household item and use of this to assist blind people will be easy. The mobile application developed by authors is having special interface which is very efficient for blind people to do daily phone related tasks such as making phone calls, reading articles and also work as travel guide. All information is provided to blind person by audio commands. This system also has sensors which transmits collect useful information from environment and commutates to phone application via Bluetooth and Wi-Fi. The information collected by sensors such as obstacle in front of blind person and warns user. In case, blind person fall down this can be detected by accelerator meter and automatic phone call will be made to favourite number saved by person. The authors claimed that proposed system is portable, low-cost, small-scale and efficient solution for visually impaired people.[4]

E] Novel Indoor Navigation System

In this paper ,the authors Kabalan Chaccour & Georges Badr proposed system for indooe navigation for visually impaired people. A smart phone application is used to assist blind people. This system comprises two modules one is mobile application and second is remote processing system. The mobile application work as interactive interface to blind person. The blind person can send voice commands. The mobile application consists of two basic functionalities: the speech to text and the text to speech function. When person send voice commands then the speech to text function convert this audio in text. This converted text transmitted to processing system with the help of Wi-Fi connection. The indoor environment has cameras installed which take photos and sends to image analytics algorithms. These photos are scaled and processed to compute the orientation of the visually impaired and guide him to his destination safely. So user sends voice commands i.e. destination where user wishes to go and system responds with audio commands that is useful to safely navigate. The text to speech function is used to convert processed navigation text commands to audio or voice commands. [5]

F] Smart Guiding Glasses

In this paper the authors proposed a indoor navigation system for visually impaired system which consists of pair of display glasses and sensors. This system helps blind people to move safely and efficiently in indoor environment. This system uses depth image and the multi-sensor fusion based algorithms to tackle the problems of identifying obstacles. They had tested three auditory cues for different scenarios. For obstacle detection a ultrasonic sensor is mounted on

guiding glasses. The depth cameras are mounted on glasses to take depth image of environment. In depth-based way-finding an algorithm uses depth image to find different traversing directions. In some scenarios the obstacle can be transparent, in such scenarios only depth image based algorithm wont works for that they also used ultrasonic sensor along with depth cameras, this functionality called as multi-sensor fusion based obstacle avoiding. Not all the time people uses such systems supposed to be totally blinded, some people may have weak sight, for those people AR based technique is proposed. The proposed smart guiding glasses can enhance the traveling experience of the blind people. The sensors used in this system are low-cost sensors which possibly makes it widely adaptive.[6]

3. COMPARISON OF THE REVIEWED SYSTEMS

Table -1: Comparison Table

System	Collision Avoidance & Object Detection (Yes/No)	Guiding Feedback Method & Device & Sensors Used	Feature
1. Multiple Distance Sensors Based Smart Stick for Visually Impaired People	1.Yes 2.Yes	1.Audio 2.Microcontroller, Ultra Sonic sensor, Bluetooth module, Vibration motor	[1] Accurate coordination and communication among sensors, motor, controller, Bluetooth modules and other components to build a smart stick for the blind people.
2.Navigational Assistance System For Visually Impaired	1.Yes 2.Yes	1.Audio 2.IR Sensor(30cm), Water Sensor, Pit Sensor, GPS,	[2] It focuses on barrier recognition, pit detection, water recognition and finding a location to weaken navigational difficulties for visually impaired people.
3.The assistance system using RGB-D	1.Yes 2.Yes	1.Audio 2.Wearable Device, RGB-D Sensor	[3]Floor Segmentation with 99% accuracy

Sensor with range expansion			
4.Smart Phone Application to Assist Visually Impaired People	1.Yes 2.Yes	1. Audio 2. Camera, Light Sensor, GPS Sensor, GSM Module, Arduino, Raspberry Pi.	[4] Small in size, Low weight, Easy to use
5.Novel indoor navigation system	1.Yes 2.Yes	1. Audio 2. PIC Controller, Beep Vibrating Motor, Ultrasonic Sensor	[5] More efficient to collision detection
6.Smart Guiding Glasses	1.Yes 2.Yes	1.Audio 2.Wearable Device, ultrasonic sensors, RGB-D camera	[6]Small and Transparent collision detection

4. CONCLUSION

In this study, we have reviewed and examined different approaches used to assist visually impaired people for safe navigation in indoor environments. This study suggested that sensors play vital role to achieve goal. The survey focuses on the study of various techniques used for indoor navigation and also discussed their advantages and disadvantages.

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