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Virtual Eye for Blind- A Multi Functionality Interactive Aid using Pi

Arathi T R[1], Adarsh J M[2], Aparna V S[3], Sreepriya C K[4], Lija Thomas[5]

[1,2,3,4]*Student, Dept. of Electronics and Communication Engineering, MACE, Kerala, India*
[5]*Assistant Professor, Dept. of Electronics and Communication Engineering, MACE, Kerala, India*

Abstract - *Being able to live independently is everyone's goal but there are many people among us who are incapable to live independently just because they aren't gifted with the senses a normal person have. We propose a design that enables the blind to perceive the world in a way very much similar to a normal person but without the help of eyes, by enhancing the effectiveness of the senses they have, with the aid of technology, to sense the surroundings and to make sudden reflexes. Conventional white canes simply detect obstacles at a certain distance with the help of ultrasonic sensors, but don't give information about the type of situational surrounding they are in or how to counter sudden unexpected obstacles. Our proposal consists of various subsystems including Radar, GPS, vocal system and IR Camera. An interactive vocal assistance integrated with the GPS directs the person through the route with the audio signals. The model is equipped with a microphone and speaker which is connected to the main system – a Raspberry pi. The radar subsystem helps the person to picturize the real time surrounding info. The IR camera identifies ditches along the way even in the dark. The 3 main goals of our system are (1) enable easy and smooth movement of the person between two places, by giving directions to the destination in the shortest possible way (2) alert the blind about ditches or pits (3) inform them about the real time dangers like approaching vehicle and provide a proper response to counter it.*

Key Words: **Doppler Frequency, GPS, RADAR, Raspberry pi, Doppler Frequency, VEB.**

1. INTRODUCTION

The 5 senses (sight, hearing, smell, touch and taste) works in unison to provide the human mind with the real time information of the surroundings and this info is processed to help the body in initiating the necessary action. The 5 fundamental senses are so important that if any one of the system fails to function, smooth and normal functioning is hindered, in short the persons ability to live independently is reduced. And so we have to compliment this with sufficient systems that can balance the function. Many systems have come into being to serve helpful to the visually impaired and the blind from the traditional white canes to some of the modern alternatives like the sound view and the UltraCane.

1.1 Proposed Design

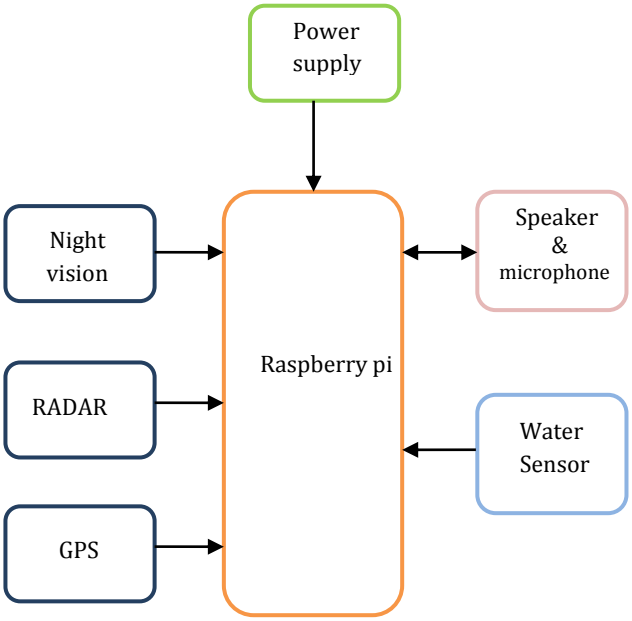


Fig -1: Block Diagram

The proposed system VEB (Virtual Eye for Blind) consists of 3 subsystems and 2 auxiliary systems, which can also be further enhanced with add on systems. The 3 main sub systems are the IR camera for pit detection while walking, GPS system for navigating between the source and the destination[1][2][4]and the RADAR system for moving target identification. The Auxiliary system includes the ultrasound obstacle detection, water sensor for puddle detection. The outputs from all the systems are analyzed and processed by the raspberry pi based on various programs and the results are converted to an appropriate voice signal which is notified to the person through the microphone (warning or a counter action) .The person can input the destination to which he/she has to reach as voice commands itself.

2. DEVELOPEMENT

VEB comprises of a versatile hardware section controlled by the raspberry pi on which the standard Raspbian operating system runs.

2.1 Raspberry Pi

The pi model that is used is the Raspberry pi 3Bplus. It is a single board computer with 1.4 GHz 64-bit quad-core processor, 1GB RAM, integrated 802.11n wireless LAN, and Bluetooth 4.1, 40 pin populated GPIO header, HDMI, 3.5mm analogue audio-video jack, 4× USB 2.0, Ethernet, Camera Serial Interface (CSI) and Display Serial Interface (DSI).The OS image of the latest Raspbian Stretch OS is written on to a class 10 microSD card (minimum of 8 GB,16 GB preferred) .

Connect the Pi board with a display and a keyboard to to use it as a mini computer. The Raspbian Stretch is loaded which provide with us platforms to code. Raspbian is a free operating system based on Debian optimized for the Raspberry Pi hardware. Raspbian provides more than a pure OS: it comes with over 35,000 packages, pre-compiled software bundled in a nice format for easy installation on your Raspberry Pi. Raspbian comes preloaded with Python, the official programming language of the Raspberry Pi and IDLE 3, a Python Integrated Development Environment. So we use python for programming.

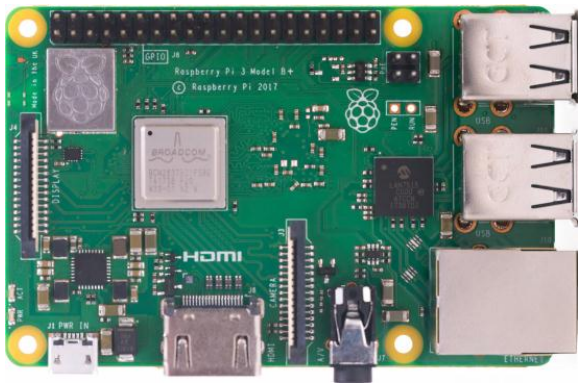


Fig 2. Raspberry pi 3 B plus

2.2 Pi Camera 5MP

We provide sight to the blind with the help of the Raspberrypi PiCamera connected to the board through the CSI port. The main purpose of which is to identify ditches, stairs, pits, road boundaries. The 5 MP camera analyses the depth information to compare it with a similar attribute .xml file in the program to identify the structures. For 24x7 usage the camera can be operated in night vision mode with a camera view angle of 160 degrees, tilted slightly towards the ground, camera can lock on to these structures pretty easy. Once stairs are locked, the audio/speaker unit (Bluetooth headphones) connected to the pi gives out appropriate voice output to counter what is at hand. In case of pit detection, the surrounding areas are also analyzed with a simple heuristic approach, and directions/navigations to counter the pit is given (like move right and left).Alert message for stairs and border lines for roads can also be given in the similar way.

Fig 3. Night Vision Pi camera

2.3 GPS Module

Another one of the feature of VEB is a simple navigation system that aids the person in moving freely between places. The routes can be mapped and used offline. Maps provided by Openstreetmap can be used to map the route.(Anyone can add places or modify the map) A GPS module is used to get the coordinates of the present location which is loaded on the map. The destination to which the person has to reach, can be input into the map by audio signal, which is also locked on the map. According to the preset routes the directions are given as in the case of the camera. The GPS Module used for fulfilling this functionality is UBLOX NEO 6M-0-001, interfaced via RS232 TTL and has a baud rate of 9600bps. The NEO-6M GPS module is a well-performing complete GPS receiver with a built-in 25 x 25 x 4mm ceramic antenna, which provides a strong satellite search capability.

Fig 4. UBLOX NEO 6M-0-001 GPS Module

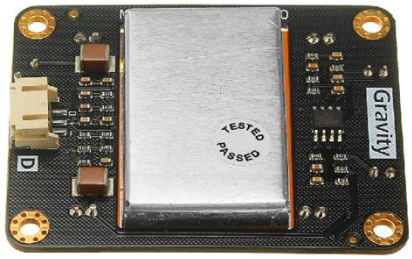
2.4 RADAR module

High speed moving targets like vehicles are always a challenge even for people with full health and eye sight. So

the threat posed by them at large for the blind and insecurity while walking down the road and crossing doors are of concern. Moving targets can be identified by the Doppler shift radars that can understand the rate of approach of a vehicle in a more efficient way, by analyzing the shift in the frequency. The fields around the person is subdivided to various critical zone to notify the person of the approaching vehicle in a efficient way. The HB100 microwave modules can be used. The range can be adjusted by connecting an appropriate amount of resistance. SEN0192 is a digital microwave sensor with HB100 at its core which is much more user friendly can also be used.

Ultrasonic sensors can be used to detect obstacles, with which the zone division strategy is easier[6]. But for speed and directional information much more analysis is needed.

(a)



(b)

Fig 5.*(a)* HB100 microwave modules,
(b) SEN0192

The modules mentioned are connected to the Raspberrypi through various ports. These modules mainly as a input devices which gives the perception of the real world .we aid the blind in their decision making in various scenarios via a Bluetooth headphone or even a wired one (as pi board is provided with an audio jack. But for more comfortable usage a wireless Bluetooth headphone cum microphone is preferred. Prerecorded voice notes are fetched by the program in accordance to the outputs from each of the modules. The program calls the respective voice notes give it to the audio section which is coupled by the Bluetooth technology. The module can also take in voice inputs to map it to a co ordinate loaded into the make for destinations to reach.

The pi is powered by a rechargeable power supply, which then drives the whole system. The radar consumes more power so it is controlled by a manual switch, which can be switched on at the time of need (like during crossing roads).

Further modifications like including water sensors for puddle detection, alerting surrounding community with LED strips, Remote access to the stick ,security locks.

3. CHALLENGES

This paper is a preliminary stage that has wider scopes for development at the same time being the initial stage, it is also tied together with some challenges. one being the accuracy and accessibility of the GPS[7]. The correct co ordinates of the place can only be accessed under a clear sky, preferably with area with less number of tall buildings, which is not always guaranteed. Second is that only pits or poth holes of considerable depths can be accurately detected by the camera.

Another improvement needed is in the excessive power consumed by the radar. A technology that can harness enough energy for the combined working of the system with the element of renewability would quench an extent of limitations.

4. CONCLUSION

We proposed a design that enables the blind to perceive the world in a way very much similar to a normal person. Technology has forever done its part in improving human lives and this is just a simple example. The scope of this system is not limited to what is presented in this paper. Similar technologies have developed during these past years which can bring this the next level.

REFERENCES

[1] Akhila S, Disha M Rani, Divyashree,Varshini S S ," Smart Stick for Blind using Raspberry pi ",ICACT 2016conference proceedings .

[2] Nilima Sahoo, Hung-Wei Lin , Yeong Hwa Chang "Design and Implementation of a Walking Stick Aid for Visually Challenged People" , IEEE International Conference on Applied System Invention (ICASI),2018.

[3] Qian Lu, "Feasibility Study of a Smart Aid for the Visually Impaired and Blinds Independent Mobility in Outdoor Environments" (Book style) 2018 June.

[4] M Vanitha, A Rajeev, K Elangovan, S Vinoth Kumar, "A Smart Walking Stick for Visually Impaired using Raspberrypi" International Journal of pure and applied mathematics, Vol 119, 2018.

[5] P Pydi Sai Charan, Ambati Nikhil, Itla Sneha Mounika, V Shyam Sandeep, Ganta Haswanth Kumar, Mahboob Baig, "Vehicle Speed Detection and Collision Avoider Radar(VSDCAR)," IJRET,vol 05 issue 02,Feb 2018.

[6] Ayush Wattal, Ashutosh Ojha, Manoj Kumar, " Obstacle Detection for Visually Impaired using Raspberrypi and Ultrasonic Sensors," National Conference on Product Design, July 2016.

[7] Amany El Gouhary, Richard Wells, Anthony Thather,"GPS Tracking System", April 2006.