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Smart Third Eye with Optimum and Safe Path Detection Based On Neural Networks for Blind Persons Using Raspberry-Pi

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Abstract: Blindness is the condition of lacking the visual sight due to physiological or neurological factors and partial blindness is due to lack of integration in the growth of the optic nerve or visual centre of the eye. In this proposed work, a simple, cheap, friendly user, virtual eye will be designed and implemented to improve the mobility of both blind and visually impaired people in a specific area. The proposed work includes a set of ultrasonic sensors for detection, raspberry-pi tool kit for programming and implementation,earphone for speech signal, hand stick(with sensors) using neural network. The main section of this project ultrasonic sensors which are used to scan a predetermined area around blind by emitting the waves.The rejected signals received from the barriers objects are used as inputs to raspberry-pi.Raspberry-pi carry out the issued commands and then communicate the status of a given appliances or device back to the earphone using raspberry-pi as speech. Also, this concept is cheap, fast and easy to use and an innovative a ordable solution to blind and visually impaired people.

Keywords: *Ultrasonic sensors, Raspberry-pi, Earphone, Speech Synthesiser, neural networks.*

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I. INTRODUCTON

The Vision is a brilliant gift to human beings by the GOD.Vision allows people to feel and understand the surrounding world. However,a World Health Organisation survey made in 2010 estimated that 285.389 million people with the visual impairment are across the globe. These visually impaired people face the problems of orientation and mobility in the environment. Many hardships have been made to improve their mobility by use of technology . Total blindness is the complete lack of form and visual light perception and is clinically recorded as NLP, an abbreviation for “no light perception”. Blindness is mainly used to describe the visual impairment with residual vision. Those described as having only light perception have no more sight than the ability to tell light from dark and the general direction of a light source. Many people suffer from serious visual impairments preventing them from travelling independently. Accordingly, they are forced to use a wide range of tools and techniques to help them in their exploration. One of these techniques is the orientation and mobility exclusive tool who helps the visually impaired and blind people and trains them to move on their own independently and safely depending on their other remaining senses. Second method is the trained guide dogs which are there specially to help the blind people on their movement by navigating around the obstacles to alert the person to change their way. However, this method has some complecations such as hardship to understand the complex direction by these dogs, and they are only suitable for several years. The cost of these trained dogs is very high, also it is diffcult for many of blind and visually impaired persons to provide the necessary care for another living being.There is an international symbol tool of blind and visually impaired people just like the white cane with a red tip which is used to enhance the blind movement. The walking cane is a very simple and purely mechanical device made to detect static obstacles on the ground, uneven surfaces, holes and steps via simple tactile-force feedback. This device is light, portable, but range limited to its own size and it is not usable for dynamic obstacles detection neither.Recently, many techniques has been developed to enhance the mobility of blind person that depend on signal processing and sensor technology. These are called electronic travel aid (ETA) devices.These help the blind to move freely in an environment irrespective of its dynamic changes. According to the literature, ETAs are mainly classified into two major aspects:the sonar input (laser signal, infrared signals, or ultrasonic signals) and camera input systems (consists mainly of a mini CCD camera).The way these devices operate just like the radar system which uses the ultrasonic fascicle or laser to identify the height, the direction, and speed of the fixed or moving ob-jects. The distance between the person and the obstacles is obtain by the travelling wave time.

However, all the existing systems inform the blind person of the presence of an object at a specific distance in front of or near to the person. These details allow the user to change the path.Information about the object characteristics can create additional knowledge to enhance space manifestation and memory of the blind. To overcome the above mentioned limitations, this effort is a simple and gettable way for the blind. The originality of the proposed system is that it utilizes an embedded vision system of four simple ultrasonic sensors and brings together all output signals in order to detect an

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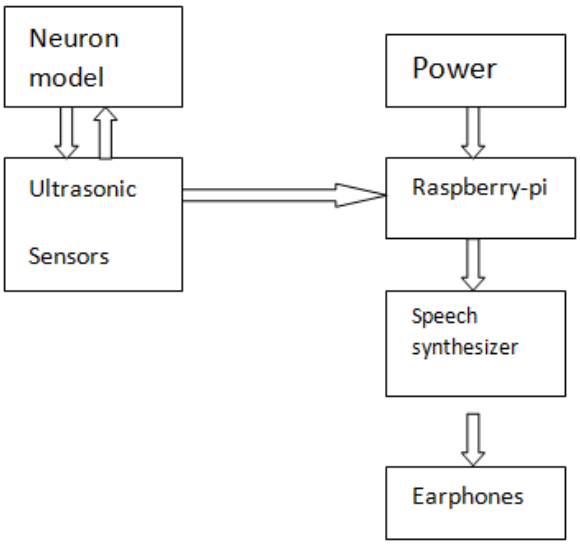
obstacle through the raspberry-pi. Furthermore, the user of the system does not need to carry a cane or any other marked tool. He/she can just wear a hat, a hand stick and foot shoes or sleepers.It is very suitable for real-time applications.

One of the most vital issues to be regarded in smart third eye is the planning of path to be used which can be done in or on line from a start cell to a goal cell without the collision with the obstacle. In this framework we have used pre path planning. i.e. the path planning can be done before the person starts to move. A plethora of works is available in the literature based on path planning using variety of techniques such as classical approaches probabilistic approaches and many more which include Genetic Algorithm, Fuzzy Logic, Ant Colony Optimisation,Neuro Fuzzy Logic and Neural Networks.In this framework we have prepared a parallel distributed model of neural network for secure path planning of the blind person.

II. PROPOSED DESIGN:

In order to abide the difficulties in the existing method and to provide the cheap and user friendly system for blind navigation, the following design is presented. Figure shows that this project mainly consist of four main parts namely Ultrasonic sensors, Raspberry pi, Headphone, Power supply.



2.1 Ultrasonic Sensors

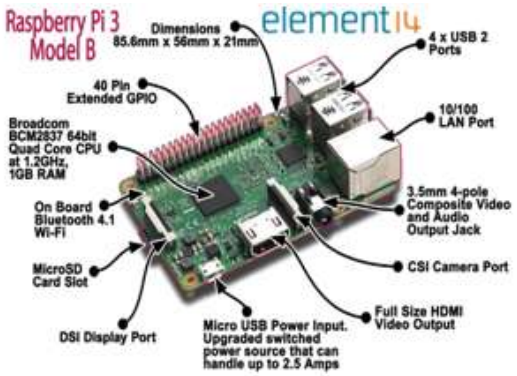
In order to abide the obstacle,the Ultrasonic sensora are used. Ultrasonic ranging provides 2cm to 400cm non-contact measurement function, the ranging accuracy can reach to 3mm.It includes the ultrasonic transmitters, receiver and control circuit. The Ultrasonic use input/output trigger for at least 10us high level signals. Sensor automatically sends eight 40 KHz and detect whether there is a pulse signal back. IF the signal returns back through high level, time of high output I/O duration is the time from sending the ultrasonic for returning.

2.2 Raspberry pi :

The Raspberry Pi is a computer, very like the computers with which youre already familiar. It uses a di erent kind of processor, so you cant install Microsoft Windows on it. But you can install several versions of the Linux operating system that look and feel very much like Windows. If you want to, you can use the Raspberry Pi to surf the internet, send an email or write a letter using a word processor. But you can also do so much more. Easy to use but powerful, a ordable and (as long as youre careful) di cult to break, the Raspberry Pi is the perfect tool for aspiring computer scientists. What do we mean by computer science? We mean learning how computers work so youcan make them do what you want them to do, not what someone else thinks you should do with them. And who do we mean by computer scientists? We mean you. You may nish this manual and decide you want to be next Tim Berners Lee, but even if you dont, we hope you have fun, learn some-thing new and get a feel for how computers work. Because no matter what you do in life, computers are bound to be part of it.

Raspberry pi provides us various feature :

1. Dual step-down (buck) power supply for 3.3V and 5V supply has polarity protection, 2A fuse and hot-swap protection
2. New USB/Ethernet controller chip
3. 4 USB ports
4. 40 GPIO pins instead of 26. The top rst 26 pins

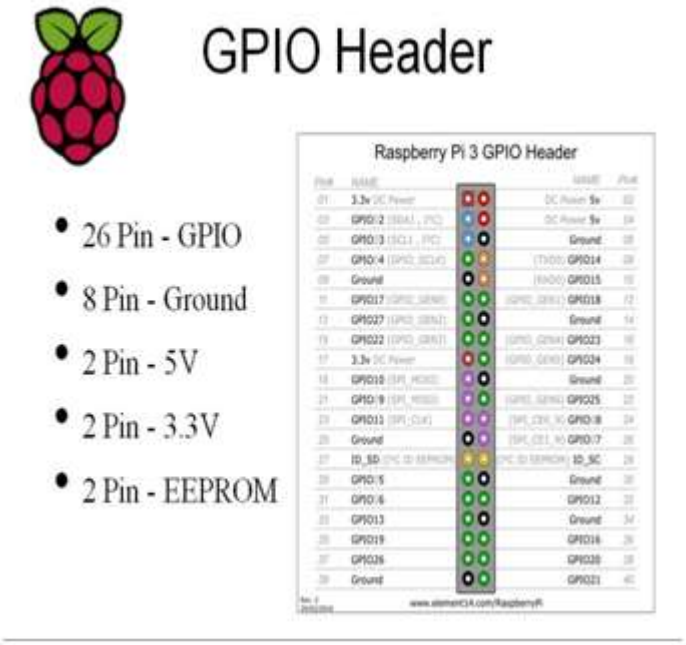


match the original layout, 9 additional GPIO and 2 EEPROM Plate identi cation pins

6. Composite (NTSC/PAL) video now integrated into 4-pole 3.5mm'headphone' jack
7. MicroSD card socket instead of full size SD
8. Four mounting holes in rectangular layout
9. Many connectors moved around
10. Basic size, 85mm x 56mm
11. Processor, Broadcom SoC running at 700MHz (can be overclocked)
12. RAM, 1 GB , soldered on top of the Broadcom chip
13. power connector, microUSB
14. software - identical operating systems will work ne, just make sure you have version
15. First 26-pins of GPIO are the input output pins
16. HDMI port
17. Audio part of the A/V jack
18. Camera and DSI Display connector

2.3 Raspbian Linux operating system:

The commonly operating system to run on the Raspberry Pi is "Raspbian Linux". This is a distribution specifically created for the Raspberry Pi based upon Debian Linux. It can be purchased and preinstalled on a SD card from the main suppliers (look for recent version of NOOBs SD cards), or can be downloaded from the Raspberry Pi website for install onto an SD card Linux is a free open source operating system. It is free for anyone to use and its source code is available on internet. Much of the software within the distribution is provided under the GPL (GNU General Public License) which means that if you modify and share the code then you need to make your modifications available under the same conditions. If you are familiar with other operating systems such as Windows, then you will understand the Linux graphical desktop (sometimes referred to as a GUI Graphical User Interface). It has a look and feel more reminiscent of older versions, which is due to the low specification processor needing a leaner operating system.The Modern Linux distributions running on a powerful computer provide a more feature rich machine. One thing that isnot same to some other operating systems is that you can run the full operating system without needing to have a graphical environment loaded and you can run the commands on the computer remotely using the command line. This may be a little strange for those used to clicking on icons, but provides a lot of control and is very easy and powerful. It is particularly useful in projects such as this robot where we can control and program the robot without needing to connect it to a monitor or TV. It may be useful to spend some time getting familiar with Linux before working on the rest of this project. To get more about the Linux operating system see or one of the many guides on Linux or the Raspberry Pi.



2.4 Raspberry pi Speech Synthesizer

The text generated by distance measurement module is stored in a folder. The speech maker spells the text from this folder and give the output of a voiced signal. Blind person can hear this output through microphone. A system used for this purpose is known as Raspberrypi speech synthesizer and it can be implemented in software and hardware both. The quality of speech synthesizer is judged by its similarity with human voice and its clarity to be understood. Festival text-to-speech software installed in Rpi allows people with visual impairments or reading disability to listen to written works. Festival is a software which is multilingual speech synthesis workbench that runs on multiple platforms covering a full text to speech system with various APIs, as well as an environment for the development and research of speech synthesis techniques. It is written in C++ with a Schemelike command interpreter for general customization and extension.

2.5 Headphone

The headphone is used in this project for guiding the visually impaired persons to navigate independently with the help of audio interfacing according to the situation.

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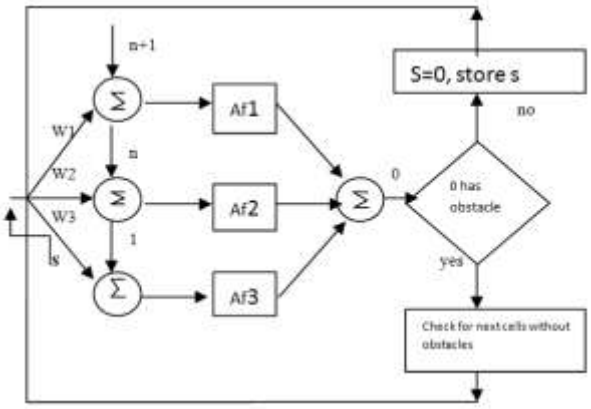
2.6 Power supply

Since all the electronic circuit work only with low dc voltage only. So we need a power supply unit to provide the appropriate voltage supply. This unit consists of battery, rectifier and regulation.

2.7 Neural network

Let s be the start position, g be the destination position and n be the number of cells in row or column.presently location = 0 Store the start position in first location of memory path.

Let there is 1 input , going further at 3 summer with 3 weights w1 , w2 , w3 . at 1 summer n+1 is added at 2 summer n is added and at 3 summer 1 is added . they are multiplied with respectively AF1 , AF2 , AF3 . then add at one common point. There is a condition in this if this value is 0 then it is considered as an obstackle . then store s is 0 otherwise check for next cells without obstacle and assign to s ,stores.

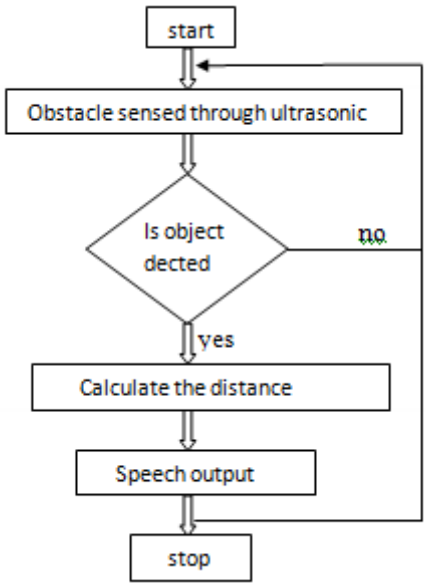


III. ALGORITHM

1. While(s not equal to g)
2. f
3. Location=location+1
4. If((absolute value(s-g))mod(n+1)=0) then
5. f
6. If(location s+n+1 contain obstacle)then
7. f
8. Checkup more cell i.e. s+n left move cell s+1
9. If(both cell does not contain obstacle or left move cell contain obstacle) then
10. f
11. s=s+n
12. g
13. If(up move cell only contain obstacle) then
14. f
15. s=s+1
16. g
17. g
18. else
19. f
20. s=s+n+1
21. g
22. g
23. elseif((absolue value(s-g)) mode n=0) then
24. f
25. If (location=s+n contain obstacle) then
26. f
27. Check diagonal move cell i.e. s+n+1 and left move cell s+1
28. If(both cell does not contain obstacle) then
29. f
30. s=s+n+1
31. g
32. If(diagonal move cell only contain obstacle)then
33. f
34. s=s+1
35. g
36. g
37. else
38. f
39. s=s+n
40. g
41. else
42. f
43. If(location s+1 contain obstacle) then
44. f
45. Check up move cell i.e. s+n and diagonal s+n+1
46. If(both cell does not contain obstacle or up move cell contain obstacle) then
47. f
48. s=s+n+1
49. g
50. If(diagonal move cell only contain obstacle) then
51. f
52. s=s+n
53. g
54. g
55. else
56. f
57. s=s+1

58. g
59. g

IV. WORKING OPERATION



Our project is an innovative idea of intelligent system which has basically Obstacle detection feature and will provide safety and support to visually impaired Persons. The ultrasonic sensors in the system will sense surround-ing and will detect the obstacles and give feedback to raspberry pi speech synthesizer change the path way.

1) The power supply activates the circuit.

2) The sensor transmitter transmits the frequency, which re ects from the obstacle. Sensor receiver receives the re ected frequency and gives it to raspberry pi.

3) Raspberry pi processes it and gives signal to Raspberry pi speech synthesizer.

4) Raspberry pi speech synthesizer gives sound and start to inform the person that the obstacle is detected through headphone.

V. CONCLUSION

This project proposed design and architecture of a new concept Concept of Microcontroller based Virtual Eye for the blind people. A simple, cheap, , easy to handle electronic nevigation And Guidance system is presented to provide the constructive assistant and support for blind and visually impaired persons The system will be efficient and unique in its capability in the Specification of the source and the distance of objects that may across the blind. It is able to scan areas left , right and in front of the blind person regardless of its height. With the proposed architecture,if constructed with at most accuracy for blind from one place to another without others help.

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