ULTRASONIC NAVIGATION ENABLED WALKING STICK FOR THE VISUALLY IMPAIRED

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Abstract - *Basically it is difficult for blind people pass their day to day life with their disabilities. Blindness is a condition of lacking the visual perception due to physiological or neurological factors partially or fully. Blindness hinders the ability of a person to walk on his own as it can be very dangerous. Mobility aids like walking sticks and guide dogs are used by blinds depending on their affordability. In this system we interfaced some smart functions with their stick. The obstacle along their way is detected through ultrasonic sensor placed on the stick; Camera gets triggered to capture the object which is on the way. The captured image is sent to cloud to identify the type of the object and then it is converted to text and is intimated as voice command through speaker or via earphones connected with Raspberry pi. So that blind can be able to identify the object in-front of them. Additionally, by interfacing GPS with the system, with the help of Google maps, the system will automatically detect the live location in terms of latitude and longitude and the location can be shared to the caretaker via email. Also through camera, the writings on the board can be captured, read and converted to text through Tesseract and the text is vocally received to the person with the help of connected earphones. . RF ID is used to find the stick using tags. The buzzer goes ON to identify the location of the stick. When the distance is less than the threshold value (15cm), the buzzer goes ON.*

*Key Words***:** *Blindness, Walking stick, Obstacle, Camera, GPS, image to text, text to speech, Tesseract.*

1. INTRODUCTION

Blindness is a lack of vision. It may also refer to a loss of vision that cannot be corrected with glasses or contact lenses. Partial blindness means you have very limited vision. Complete blindness means you cannot see anything and DO NOT see light. (Most people who use the term "blindness" mean complete blindness.) People with vision that is worse than 20/200 with glasses or contact lenses are considered legally blind in most states in the United States. Vision loss refers to the partial or complete loss of vision. This vision loss may happen suddenly or over a period of time. Some types of vision loss never lead to complete blindness.

Vision loss has many causes. In the United States, the leading causes are Accidents or injuries to the surface of the eye (chemical burns or sports injuries), Diabetes, Glaucoma, Macular degeneration.

Blindness refers to loss of useful sight. Blindness can be temporary or permanent. Damage to any portion of the eye, the optic nerve or the area of the brain responsible for vision can lead to blindness. There are numerous (actually, innumerable) causes of blindness. The current politically correct terms for blindness include visually handicapped and visually challenged.

Blind people do lead a normal life with their own style of doing things. But, they definitely face troubles due to inaccessible infrastructure and social challenges. Let us have an empathetic look at some of the daily life problems faced by the blind people.

The most valuable thing for a disabled person is gaining independence. A blind person can lead an independent life with some specifically designed adaptive things for them. There are lots of adaptive equipment that can enable a blind person to live their life independently but they are not easily available in the local shops or markets. A blind person needs to hunt and put much effort to get each equipment that can take them one step closer towards independence.

2. Software and Components used:

• 	Raspbian Jessie

• 	Programming Language: Python

Raspberry Pi, Ultrasonic sensor, GPS module, Camera module, RF ID Tags, Walking stick, Earphones, Buzzer.
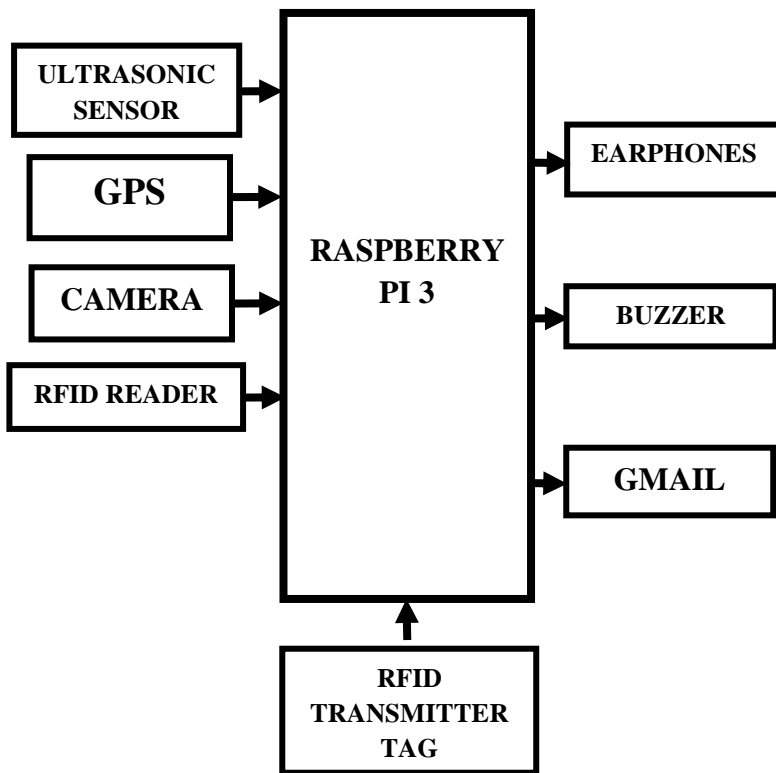
3. Block Diagram:

Fig -1: Block diagram of ULTRASONIC NAVIGATION ENABLED WALKING STICK

4. Specification of Components:

4.1 Raspberry Pi 3:

Fig-2: Raspberry pi 3

A computer which is credit card sized is the Raspberry Pi, in which any HDMI input gadget is able to plug as well as for an operation, a keyboard is required for a procedure. Raspberry Pi is also said as Minicomputer. It has 40 pin extended GPIO, 2 USB Port, CSI camera port, Micro SD port, DSI display port, Micro USB power source.

The Raspberry Pi 3 Model B features a quad-core 64-bit ARM Cortex A53 clocked at 1.2 GHz. This puts the Pi 3 roughly 50% faster than the Pi 2. Compared to the Pi 2, the RAM remains the same – 1GB of LPDDR2-900 SDRAM, and the graphics capabilities, provided by the VideoCore IV GPU, are the same as they ever were. As the leaked FCC docs will tell you, the Pi 3 now includes on-board 802.11n WiFi and Bluetooth-4.0. WiFi, wireless keyboards, and wireless mice now work out of the box.
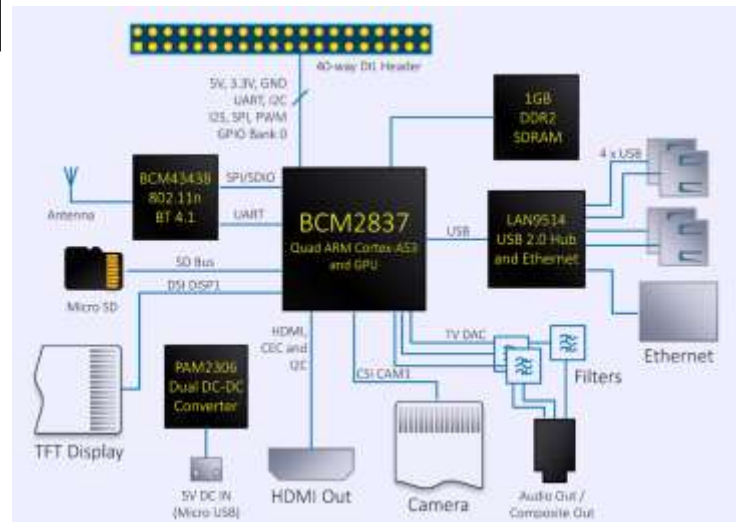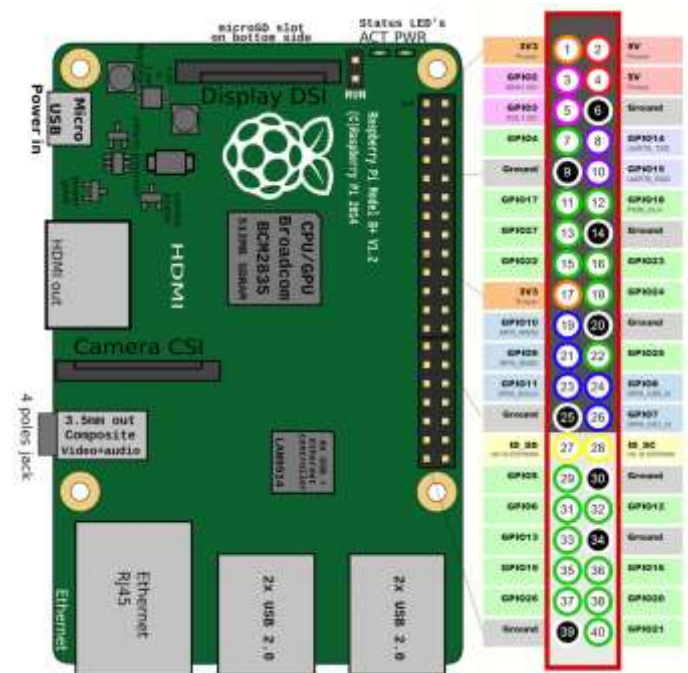

Fig-2a: Raspberry pi 3 Blocks

Fig-2b: Raspberry pi 3 Pin Diagram

4.2 Ultrasonic Sensor:

Fig-3: Ultrasonic Sensor

Ultrasonic sensor is a 4 pin module, whose pin names are Vcc, Trigger, Echo and Ground respectively. This sensor is a very popular sensor used in many applications where measuring distance or sensing objects are required. The module has two eyes like projects in the front which forms the Ultrasonic transmitter and Receiver.

4.3 GPS Module:

Fig-4: GPS Module

It has 44 channel GPS receivers and Quectel chipset solution to track up to 20 satellites at a time while providing fast time-to-first-fix and 1Hz navigation updates. This hardware capability combined with software intelligence makes the board easy to be integrated and used in all kinds of navigation applications or products. The module communicates with application system via RS232 or UART level with NMEA0183 protocol.

4.4 Camera Module:

The images are actually stored as a several pixel, for every pixel in the sensor, the brightness data, represented by a number from 0 to 4095 for a 12-bit A/D converter, along with the coordinates of the location of the pixel, are stored in a file. Although the camera can record 12 bits or 4096 steps of brightness information, almost all output devices can only display 8 bits or 256 steps per color channel.

Fig-5: Camera

The original 12-bit (212 = 4096) input data must be converted to 8-bits (28 = 256) for output. the indicated pixel has a brightness level of 252 in the red channel, 231 in the green channel, and 217 in the blue channel. Each color's brightness can range from 0 to 255, for 256 total steps in each color channel when it is displayed on a computer monitor, or output to a desktop printer. Zero indicates pure black, and 255 indicates pure white. 256 colors each of red, green and blue may not seem like a lot, but actually it is a huge number because 256 x 256 x 256 = more then 16 million individual colors.

4.5 RFID Tag:

Fig-6: RFID Tag

RFID (Radio Frequency Identification) uses electromagnetic fields to read, monitor and transfer data from tags attached to different objects. EM-18 RFID reader module is one of the commonly used readers and can read any 125 KHz tags. It features low cost, low power consumption, small form factor and easy to use. It can be directly interfaced with microcontrollers using UART and with PC using an RS232 converter.

5. Working:

The system includes ultrasonic sensor to detect the distance (in cms) of the obstacle and when it is detected at a particular distance it alerts the disabled by a voice command by using espeak module. The GPS is used to track the live location of the user and it can also be sent to the care taker through email. It also consists of a RFID tag and a RFID reader module; When the stick is somewhere away from the user, with the help of the RFID tag (if the tag is within the

respected range of distance) buzzer goes on, so that with the help of the buzzer sound, the user would be able to find the location of the stick. The camera is used to identify the obstacle ahead and it also captures the writings on the board (eg.name of the shop) and using the software TESSERACT, that image is converted to text and using espeak module text is converted to speech.

6. Conclusions:

This system helps the blind people to lead their life independently with confidence. The camera acts as an artificial eye to the visually impaired. The obstacles along the way is detected by the ultrasonic sensor. Camera identifies the object along the way.

This system also uses GPS which detects the live location of the blind and it is sent to the caretaker via email. Thus the caretaker can be available to help the blind person during emergency situations. In future, the GPS can also be interfaced with G-Maps and navigation to specific location can be achieved.

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