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Smart Stick

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Abstract: In this generation, advancement in technology is expeditious and thus the products are cost effective and portable. The impact of this in turn has made possible for technology to reach every section of the society. The one such section is the visually impaired people. Our project, aims to provide assistance and support to visually challenged individuals by using today's technology. So that, they can commute without a fear of meeting with any unforeseen circumstances and open new possibilities for themselves. This project is related to providing a safe and economical Smart Stick for the visually challenged individuals to give them freedom and confidence to walk alone in the open and experience the world, without the help of any human help. So, Smart Stick comes as the proposed solution to improve mobility to both blind as well as visually impaired individuals.

I. INTRODUCTION

Around 253 million individuals present with visual incapacity, 37 million are completely visually impaired and 218 million have moderate to extreme visual disability. 82% of people who are sightless are aged 50 years and exceeding (According to WHO estimations). The statistics of visually weakened individual's are estimated to increase in the forthcoming years due to numerous causes. As an effect, there is a requirement for a cost effective arrangement that can be used by visually incapacitated individuals in order to walk easily and comfortably. It is essential that a smart way out is offered to the blind people so that they can use this in their day-to-day living environment. This paper offers the design and development of a Smart Stick in order to help the visually impaired people.

This Smart Stick is an substitute to the old-style walking stick. Here, Raspberry PI, Ultrasonic sensor, Voltage regulator, Buzzer and Vibrator are used. Raspberry PI is a microcontroller which can do all the controls very fast and with great accuracy. One ultrasonic sensor is used to sense the object in the front of the individual by assessing the distance between the object and the stick. Two more ultrasonic sensors are located at an angle for left and right entity recognition.

II. LITERATURE SURVEY

Central Michigan University (2009)-They developed an electronic cane for blind people that would provide contextual information on the environment around the user. They used RFID chips which are embedded into street signs, store fronts, similar locations, and the stick reads those and feeds the data back to the user[1]. The Smart Cane, which has an ultrasonic sensor attached on it, is paired with a messenger style bag that is worn diagonally on the shoulder. A speaker situated on the bag strap speech alerts when an hurdle is identified and also guides the user to move in changed direction.

S.Gangwar (2011)- His team designed the smart stick for blind persons. This tool gives early warnings of obstacles by using Infrared sensors. When it detects the obstacle it informs the person with the help of vibration motor. But this stick focused mainly only on obstacle detection but it does not supports the blind person in all the situation where its use is must. Also the IR sensor has its own disadvantages that it detects obstacles only from smaller distances.

B.MohanSitaramaiah, M.Naganaik [3]-The arrangement comprises of two ultrasonic sensors, voice playback module, and a vibration motor. The ultrasonic sensor observes the entities in front of them. The sensing element set in forward-facing track to the system which notices if any hindrances are existing in front of the sightless individual's lane. Another Sensing element positioned in rear of the system. This will determine the distance from the objects to sightless individual .The voice module will play the matching dialogue for indicating the sightless individual regarding hazards happening. The vibration motor is favorable in case of individual in traffic and if voice output is not audible in hectic areas. In addition there is a GSM module linked to the arrangement, to provide information exchange from sightless individuals.

SriramaDivya, B. Navya, P. Suma manasa, S. Chitra [5]-Proposal of this paper comprises theoretical model and system idea which is an smart electronic tool for blind people. This system aims to provide overall measures that include artificial visualization and object recognization. At the same time this tool is available at lesser cost and offer sense of simulated visualization by providing information about the environmental changes that happens near to him. Here Ultrasonic sensor is used to calculate distance of the

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object near the sightless person and helps him to navigate the path. Here blind person come to know about the obstacles with the help of voice assist that tells to move left or right when object is detected. Aurdino Uno board, Ultrasonic Sensor and speakers are used for this tool.

Ankit Agarwal, Deepak Kumar, Abhishek Bhardwaj [4]-Proposal of this paper includes ultrasonic stick that cost much lesser for blind people in order to improve liberty and freedom from peripheral needs. It develops convenient system that is User friendly and that can also recognize obstacles in the path using ultrasonic sensors and the camera attached to the stick. Here ultrasonic sensor is designed to operate at 180 degrees. Camera is used as a supplementary device in low signal exposure areas .A microcontroller is connected with Buzzer and vibration motor which turns ON when they detect obstacles. GPS system is also connected that helps to identify the exact location of the person. This paper also included SMS feature that allows to send the messages to saved number in case of emergency.

Alejandro R. Garcia Ramirez and Renato Fonseca Livramento da Silvaetal (2012)-They designed an assistive device titled the electronic long cane to aid as a movement assistant for sightless individual [6].The author implements the cane with an ergonomic design and an embedded electronic system, which fits inside the handle of an old-styled long cane. The system was intended to use hap tic sensors to sense hindrances above the midriff. It works in such a method when a hindrance is detected; the cane vibrates or makes a sound.

III. PROPOSED SYSTEM

A sightless individual has trouble to interrelate and sense their environment because; they have slight contact with the neighbouring. Physical movement is a task for a sightless individual, as it can become difficult to discriminate where he is, and how to go from one place to another. To circum navigate unfamiliar spaces he will have to depend on the eyesight of his family member or his friends. In excess of half of the legally sightless people in the world are without a job since they are incapable to get work done without backing.

To solve such issues and make the visually impaired people build their life and make them feel equal to people with eye sight. We have thought about this social cause and trying towards making an economical Smart Stick for the aid of the visually challenged people.

A. To make a Smart Stick that can help a visually challenged person to navigate through obstacles around this person and to avoid accidents.
B. To make it available at affordable cost, without compromising with the functionalities.
C. To make the Smart Stick light weight and easy to carry.
D. Microcontroller can regulate the surroundings by receiving input signals (Digital/Analog) and can affect its surroundings by adjusting lights, relays and other devices linked to the microcontroller.
E. Different sensors with microcontroller interface are used which are connected to buzzer and vibrator.
F. Power Supply gives the system the required power for the processor, alert systems to function.
G. Output of Microcontroller is fed to Alarm unit, which contains the buzzer and vibrator which lets the visually challenged individual to know the surrounding and obstacle is in front of him.

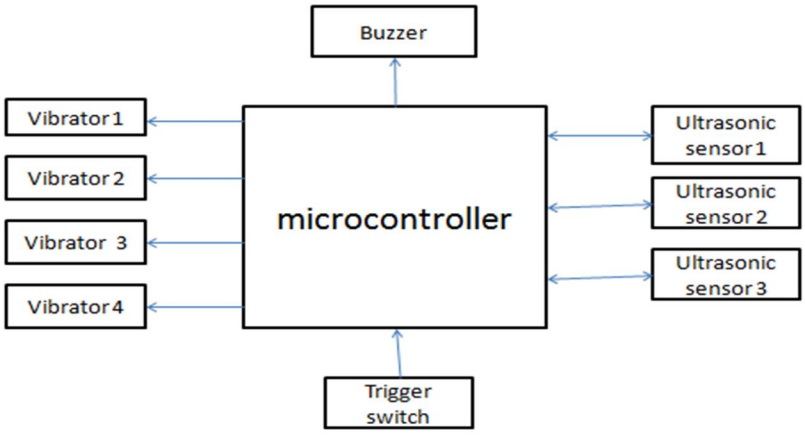


Fig 1. General Block Diagram

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IV. DESIGN AND IMPLEMENTATION

A. Stick

Normally, a visually challenged individual is given a stick with the help of which he/she can walk around. In this paper we did not want to take out the component of the stick as it's a very necessary tool for a visually challenged individual as he/she is used to the stick. This way helps a visually challenged individual to get used to the Smart Stick faster.

B. On/Off Switch

The Smart Stick is a battery powered device which makes the device portable. The device uses a 10000mAh battery, to conserve energy when not in use a On/Off switch is provided which helps to turn on and turn off the system.

C. Ultrasonic Sensors

This sensor calculates the distance with help of ultra sonic waves. This sensor contains Sensing element head that emits ultrasonic wave and that wave hits the object and come back. Now sensing head collects the wave come back from the object. Ultrasonic sensors accounts the distance to the object by computing the time interval between the discharge and reception.

Fig 1.1 illustrates the ultrasonic sensor. It contains of four pins: (1) VCC, (2) Trigger, (3) Echo and (4) Ground. This unit functions at 5 volt with a consumption of 15 mA current. It can measure the distance efficiently starting from 2 cm to 400 cm (4 Meter).

1) *VCC* – It is used to run 5V power to the sensor.
2) *Trigger (Trig)* – Takes in Input Pulse to activate the sensor.
3) *Echo* – It is used to obtain the Output Pulse i.e. the echo from the article sensed.
4) *Ground (GND)* – It links the sensor to the ground.

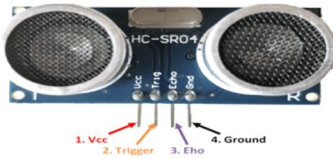


Fig. 2. Ultrasonic Sensor

Ultrasonic ranging unit HC–SR04 offers 2cm–400cm non-contact measurement task, the ranging accuracy can spread up to 3mm. The component contains ultrasonic transmitters, receiver and control circuit. The basic principle of work:

a) Using I/O trigger for at least 10us high level signal.
b) The unit automatically directs eight 40 kHz and detect whether there is a pulse signal returned.
c) If the signal returned, through high level, period of high output I/O duration is the period from transmitting ultrasonic signal to receiving signal.

Test distance = (high level time × velocity of sound (340M/S) / 2

i) *Step 1:* Make a "Trigger" pin of the sensor high for "10 micro second". This designates a device cycle.
ii) *Step 2:* 8*40KHz pulse will be sent from the transducers of the sensor, after which the "Echo" pin of the sensor will go from low to high.
iii) *Step 3:* The 40 KHz sound will rebound off the adjacent object and return to the sensor.
iv) *Step 4:* When the sensor notice the returned sound wave, the echo pin will go low.
v) *Step 5:* The space between the sensor and the sensed object can be deliberated based on the distance of the Echo pin is high.
vi) *Step 6:* If no entity is sensed, the Echo pin will stay high for 38ms and then go low.

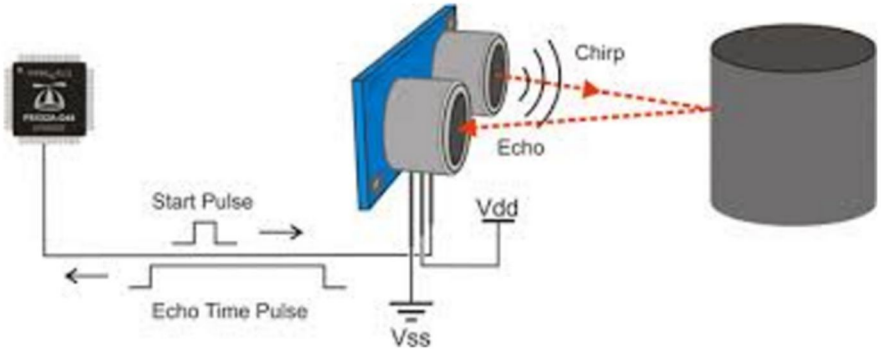


Fig. 3 Working of Ultrasonic Sensor

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Like stated previously the functioning voltage of the module is 5V. The input pin on the Raspberry Pi GPIO is only 3.3V tolerant. Directing a 5V signal into 3.3V input port could damage the GPIO pins. So we use the voltage divider to bring the voltage below the 3.3V as shown in Fig 4.

Here are four pins on the ultrasound module that are connected to the Raspberry:

VCC to Pin 2 (VCC), GND to Pin 6 (GND), TRIG to Pin 12 (GPIO18), link the 330Ω resistor to ECHO. On its end you link it to Pin 18 (GPIO24) and over a 470Ω resistor you connect it also to Pin6 (GND).

We do this because the GPIO pins only tolerate utmost 3.3V. The connection to GND is to have an evident signal on GPIO24. If no pulse is directed, the signal is 0 (through the link with GND), else it is 1. If there would be no association to GND, the input would be indeterminate if no signal is sent (randomly 0 or 1) abstruse.

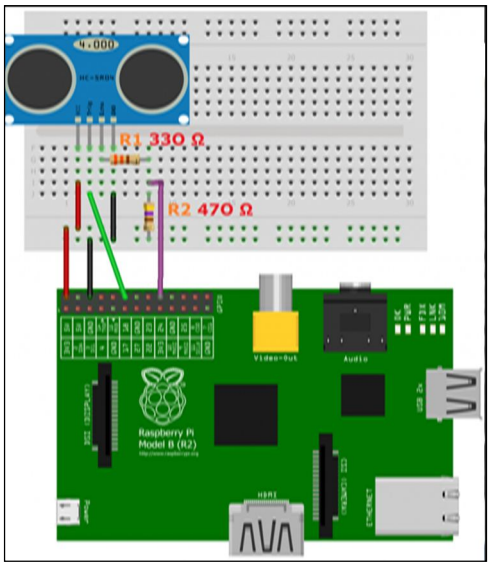


Fig.4.Interfacing between Raspberry PI and Ultrasonic Sensor

D. Buzzer

A buzzer is also known as beeper and it is an audio signaling device which may be mechanical, electro mechanical, or piezoelectric Buzzers are executed across numerous uses, frequently to act as a cautionary signal.

The buzzer contains of an external case with two pins to attribute it to power and ground. Inside is a piezoelectric element, which contains of a central ceramic disc, enclosed by a metal (often bronze) vibration disc. When current is given to the buzzer it makes the ceramic disk to contract or expand. As we know that the buzzer contains only two pins in which one must be provided with the Vcc, where Vcc is given to the buzzer by connecting to the GPIO of the raspberry pi board and another pin should be connect to the ground .we commonly use the piezoelectric buzzer because it provides higher sound pressure level.

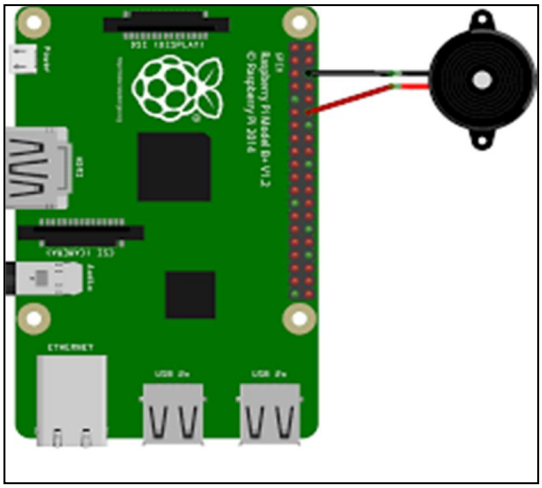


Fig.5 Interfacing Buzzer with Raspberry PI

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E. A linear Resonant Actuator (LRA) or Coin-type Vibration Motor

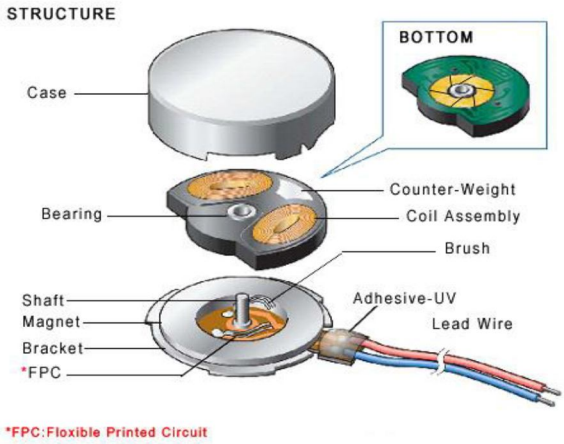


Fig.6. Coin type Vibration Motor

Similar to the bar-type vibration motor, coin-type vibration motor is consist of a weight, a ring magnet, rotor with commutation points attached in the anterior and coils assembled on the back, and power provided brushes attached to the ring magnet.

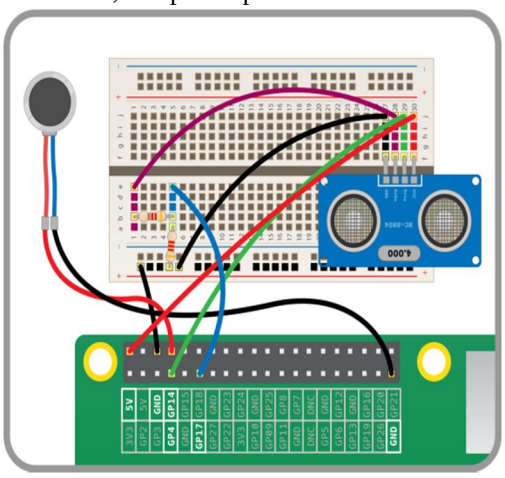


Fig.7.Interfacing with raspberry pi

We can connect the vibrators to the pi board by connecting one end to the GPIO of the pi board and another end to the ground in the processor. Three to five vibration motors have been connected to the hand rest of the device to offer tactile response to the sightless individual when a hindrance is sensed by the ultrasonic sensors.

When a hindrance is sensed by any one of the sensors, the vibration motor is activated. Thus, the device not only shows the existence of obstacles, but also the relative location, i.e. to the left, in front, or to the right of the user. When hindrances are existing at numerous locations, the corresponding motors vibrate concurrently.

As we know about the vibration motors we are going to use the ERM type vibration motor for the application because They are also the most versatile ,encapsulated, use a variety of power connections, and even be based on brushless motors and gives better performance than the LRA or coin type vibration motors

V. RESULTS AND DISCUSSION

The outcome of this project is

A. Making a visually challenged individual to be self-reliant.
B. To help the visually challenged individual to be able to avoid accidents.
C. To produce an affordable system so that it is available for people from all backgrounds.
D. It can be improved by adding GPS and GSM system which will further make the system even more helpful for a visually challenged individual.

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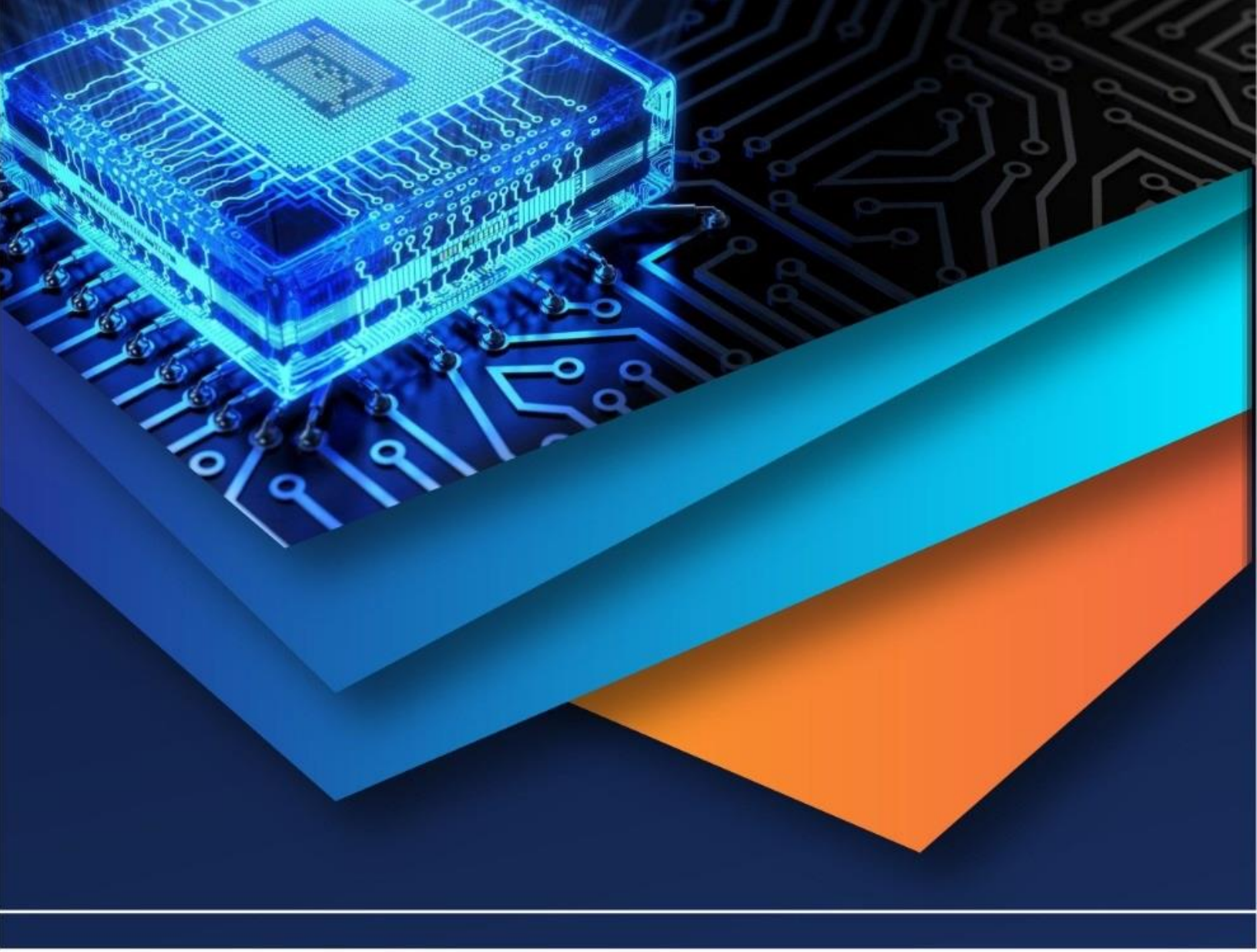
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