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Smart Stick for Blind Person

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ABSTRACT

This project reports an accurate coordination and communication among sensors, controller, modules and other components to build smart sticks for the blind people. Two main objectives of the developed stick were to increase the mobility and also to generate a buzzer as an output after detecting an obstacle has been successfully implemented. A Smart stick system concept is devised to provide a smart electronic aid for blind people. Blind and visually impaired people find difficulties in detecting obstacles during walking in the street. The system is intended to provide artificial vision and object detection by making use of Raspberry Pi. The system consists of ultrasonic sensors, camera, and buzzer. The aim of the overall system is to provide a low cost and obstacle detection aid for blind which gives a sense of artificial vision by providing information about the environmental scenario of static and dynamic object around them, so that they can walk independently.

KEYWORD: Ultrasonic Sensor, Raspberry Pi Controller, Buzzer, Stick, Camera

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I. INTRODUCTION

Electronic Travel Aids are the devices which are used for mobility. The function of ETA is to provide information to the blind people about road and obstacles. Our smart walk stick is also an ETA which helps the blind people to know about the objects opposite to them, color of the objects, and text reading. In this smart walking stick we use Raspberry pi to control the sensors and camera. The feature of object identification helps the blind people to recognize what kind of object is before them and helps them to move around safely. Text reading helps them by reading out the reading out the texts before them and finally color identification helps them to identify the colors before them. These are all done using technique of digital image processing by using compute vision2. This smart walk stick is light weight to carry around and this helps the blind people to move around as a normal people.

Visually impaired people are unable to identify objects with their eyes. Medically, people who have the visual acuity of 6/60 or the horizontal extent of the visual field with both eyes open less than or equal to 20 degrees are considered blind. It has been estimated that 285 million people are visually impaired worldwide. Out of them, 39 million are blind and 246 million have a low vision. It has also reported by World Health Organization (WHO) in [2] that approximately 90% of total visually impaired persons live in developing countries. Further, the approximately one-third population of total visually challenged people live in India only. It is also estimated in that by the year 2020, all blind related numbers will be double. WHO coordinates the international efforts to prevent blindness by developing various policies and strategies for people who live in low-income settings. WHO has also initiated a global action plan for the year 2014-2019 for universal eye health [4]. Apart from this, several country specific eye health organizations are also actively working for their own people. India Health Organization, Sight savers, and many others are dedicated to reducing the number of blind persons in our country also. These organizations have put seamless efforts but still, there is a large population of partial or full visually impaired people lives in our country especially in low-income settings. This category of people is required to have cheap

yet durable and accurate aiding devices to overcome blindness related disabilities.

Sticks have been traditionally and effectively used by persons who suffered from partial or complete visual impairment in their early or later stages of life. Earlier, it was just a wooden stick to assist the person to detect and avoid obstacles and to maintain his/her body frame. As we grow up with technology, sticks have been designed using electronic components to assist the blind people. These assistive devices are usually called smart stick.

OBJECTIVE:

This project reports an accurate coordination and communication among sensors, controller, modules and other components to build a smart stick for the blind people. Two main objectives of the developed stick were to increase the mobility and also to generate a buzzer as an output after detecting an obstacle has been successfully implemented. The stick is able to detect static and dynamic obstacles of any minimum height which are in front of the person.

The main objective of our project is to provide a voice based assistance to blind people. Here we have developed an intelligent system that helps blind person to travel independently and works efficiently. Our project focuses on designing a device for blind people that help them to travel independently and also it must be comfortable to use. The proposed device is used for guiding individuals who are blind or partially sighted. The device is used to help blind people to move with the same ease and confidence as a sighted people.

II. LITERATURE SURVEY

S.Gangwar (2011) designed a smart stick for blind which can give early warning of an obstacle using Infrared (IR) sensors[8]. After identifying the obstacles, the stick alerts the visually impaired people using vibration signals. However the smart stick focused only for obstacle detection but it is assisting for emergency purposes needed by the blind. And also the IR sensors are not really efficient enough because it can detect only the nearest obstacle in short distance.

S.Chew (2012) proposed the smart white cane, called Blindspot that combines GPS technology, social networking and ultrasonic sensors to help visually impaired people to navigate public spaces.The GPS detects the location of the obstacle and alerts the blind to avoid them hitting the obstacle using ultra-sonic sensors. But GPS did not show the efficiency in tracing the location of the obstacles since ultra-sonic tells the distance of the obstacle [9].

Benjamin etal (2011) had developed a smart stick using laser sensors to detect the obstacles and down curbs [10]. Obstacle detection was signalized by a high pitch “BEEP” using a microphone. The design of the laser cane is very simple and intuitive. The stick can only detects obstacle, but can not provide cognitive and psychological support. There exists only beep sound that triggers any obstacle and there is no any assistance to direct them.

Central Michigan University (2009) developed an electronic cane for blind people that would provide contextual information on the environment around the user. They used RFID chips which are implanted into street signs, store fronts, similar locations, and the cane reads those and feeds the information back to the user [11]. The device also features an ultrasound sensor to help to detect objects ahead of the cane tip.The Smart Cane, which has an ultrasonic sensor mounted on it, is paired with a messengerstyle bag that is worn across the shoulder.A speaker located on the bag strap voice alerts when an obstacle is detected and also directs the user to move in different direction.

Mohd Helmyabd Wahab and Amirul A. Talibetal (2011) developed a cane could communicate with users through voice alert and vibration signal) [12]. Ultrasonic sensors are used to detect obstacle in front, since ultrasonic sensors are good in detecting obstacle in few meters range and this information will be sent in the form of voice signal. This voice signal is send via speaker to the user. Here blind people might find it difficult in travelling without any emergency alert rather than having only ultrasonic sensors.

Alejandro R. Garcia Ramirez and Renato Fonseca Livramento da Silvaetal (2012) designed an assistive technology device called the electronic long cane to serve as a mobility aid for blind and visually impaired people [13].The author implements the cane with an ergonomic design and an embedded electronic system, which fits inside the handle of a traditional long cane. The system was designed using haptic sensors to detect obstacles above the waistline. It works in such a way when an obstacle is detected; the cane vibrates or makes a sound. However this system only detects obstacle above the waistline.

III. BLOCK DIAGRAM

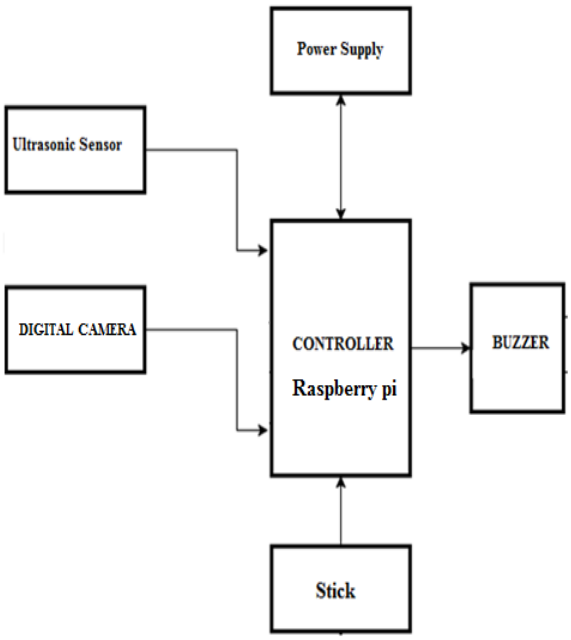

Fig 1. Block Diagram

This system describes ultrasonic blind walking stick with the use of raspberry pi. According to WHO, 30 million

peoples are permanently blind and 285 billion peoples with vision impairment. If u notice them, you can very well know about it they can't walk without the help of other. One has to ask guidance to reach their destination. They have to face more struggles in their life daily life. Using this blind stick , a person can walk more confidently. This stick detects the object in front of the person and give response to the user either by vibrating or through command. So, the person can walk without any fear. This device will be best solution to overcome their difficulties.

IV. METHODOLOGY

Our algorithm implemented in Python programming language is deployed on Raspberry Pi. This algorithm is used to calculate the distance between the obstacle and the person, by recording the time interval between the pulse sent and pulse received.

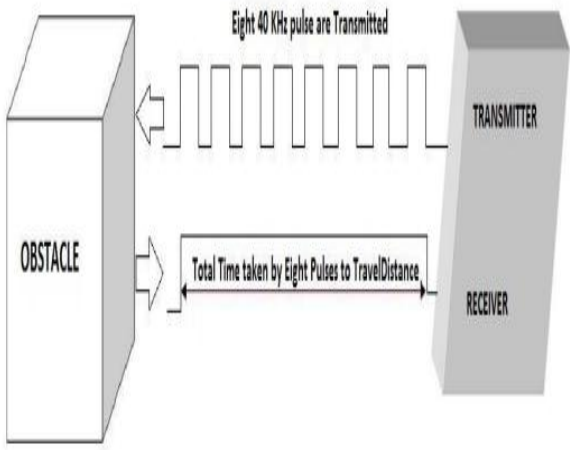

Fig 2. Working of an Ultrasonic sensor

A. Distance Calculation

*Distance=speed*time

The command condition is as follows:
[1] If the distance between the objects and the person is 30 inch, it will send the command as the obstacle is nearer to the person.

[2] If the object is about 60-90 inch, it will send the command as the obstacle is just closer and reaching the person.

[3] If the object is about 90-120 inch, it will send the command as the object is far away from the person.

B. Algorithm

STEP 1: Start

STEP 2: Read the GPIO pins

STEP 3: If pin 1 is high go to step 4, if pin 2 is high go to step 7,if pin 3 is high go to step 10 else go to step 2

STEP 4: opens webcam, takes picture and saves the image as "sample.jpeg" and moves it to home/pi/webcam

STEP 4: Executes image to identify the object using python and saves the output as "output1.txt"

STEP 5: Moves to the notification pin active for buzzer on

STEP 6: generates sound (buzzer) output moves to step 2

STEP 7: executes ultrasonic distance measurement using python and Saves the output as "output2.txt"

STEP 8: Moves the text in "output2.txt" to detecting object

STEP 9: Generates sound(buzzer) output and moves to step 2

STEP 10: STOP

C. Flow Diagram

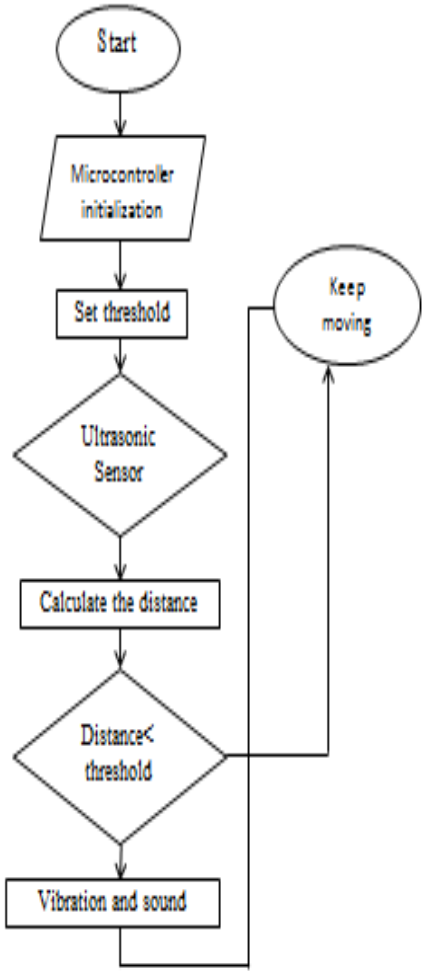

Fig 3. Flow diagram

V. RESULT

The raspberry pi board has 17 ins in it. These GPIO pins provide ability to connect direct to electronics devices. The Input like will be sensors, buttons or with other communication with chips or modules using low level protocols SPI and serial UART connections it uses 3.3v logic levels. No analog input or output is available in this GPIO pins but we can use external chords for this analog connection.

VI. CONCLUSION

The project "Smart Stick for Blind Using Raspberry Pi" is designed to create a system using Ultrasonic sensors, camera and buzzer to the blind people. It would help a visually impaired person navigate through a public place independently. The proposed system tries to eliminate the faults in the previous system. It aims to solve the problems faced by the blind people in their daily life. The system also takes measures to ensure their safety. The design Smart Stick for Blind using ultrasonic sensors and camera of great benefit to blind people when it comes to independent mobility. The advantage of the system lies in the fact that it can prove to be very low cost solution to millions of blind person worldwide. The proposed combination of Ultrasonic Sensor and camera makes a real-time system that monitors position of the user and provides feedback making navigation more safe and secure. The prototype of Smart Stick for Blind is able to detect obstacles in front of the user. And, it is therefore capable of guiding a visually impaired person for navigating his environment.

VII.FUTURE SCOPE

In future we enhance robot using the navigate from room to another. It can be built for altering environment and bigger fire as in the case of forest fire. It can be extended for swarm robotics.

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