International Journal of Advanced Technology in Engineering and Science
Volume No.05, Issue No. 09, September 2017
www.ijates.com
ijates
ISSN 2348 - 7550

Stick for Vision Impaired and Elderly People: An Intelligent Walking Stick

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ABSTRACT*:*

The goal of technological advancement has always been to make daily living easier. With ever-evolving technology, everyone today is reaping the benefits of technology, with the exception of some segments of society. The visually challenged are one of them, as they must rely on others for transportation and other activities. This research provides a theoretical model for providing efficient and intelligent electronic assistance to the blind that combines the newest technology. For hurdle detection, we employed IR sensors in conjunction with UV sensors. A moisture sensor detects the presence of water, whereas a fire sensor detects the presence of flames in the route. Visual processing is used to help blind people read by translating image text into speech. In crisis circumstances, an application software is utilised to send an SMS alert along with his current position to registered cellphone numbers, proving to be an effective gadget and a great help to blind individuals.

Keywords- IR sensor, UV sensor, Image Processing.

I. INTRODUCTION

The ability to see is one of the most important aspects of human physiology. Our senses of sight and hearing are crucial to our understanding of our environment. According to a research issued by the World Health Organization, over 285 million individuals worldwide are considered to be visually impaired, with 39 million of them blind (WHO). Blind adults aged 50 and over account for 82 percent of the population. Furthermore, 90 percent of the visually handicapped live in underdeveloped nations. A walking stick was the first sort of navigation equipment for the blind[1-2]. However, the lack of requisite skills, cost, and training length are all disadvantages of employing it. With technical advancements, it is now feasible to build and develop electronic solutions that can assist a visually impaired person in freely navigating. Various studies have been conducted in order to produce such a smart blind stick. This chapter includes a review of the following blind sticks: Ultrasonic rangers were used to identify obstacles or obstructing objects in the development of a sound and touch-based smart cane. It directs the person in the direction of the hazard. It is powered by an ARM CPU, which has greater memory and a faster processing speed.

However, due to the lack of GPS detection, this device cannot be utilised inside. This system is unusual because it includes a novel wet detecting circuit and a fire sensor. An earpiece has been fitted to provide voice warnings when obstructions are detected. The technology is reasonably priced and tiny enough to be carried on a walking stick.

II. LITERATURE SURVEY

Blind Aid Stick has been a popular project with constant enhancements and modifications. Currently the commercially available of the blind stick is not that popular due to the high cost and lack of accuracy. Previous projects on the same idea-Shruit and Prof. A. Sakhare (2011) [1] method proposed for using a smart stick for blind visionless: obstacles estimation, artificial vision and real-time assistance via GPS. This system works with GPS, an artificial vision system, obstacle detection, and audio circuit.The guide stickis used to assist the blind person both indoors and outdoors. It has an obstacle detection system along with a GPS navigation system. The GPS navigation system is pre programmed to help the user navigate to their desired location. A raspberry pi is used to store the obstacle detection programs and GPS navigation programs. For navigation and obstacle detection, the user receives auditory input. This project includes a camera mounted on the person's head that uses an algorithm to identify obstructions. Ultrasonic sensors are also included in the model to identify impediments. The GPS system aids in reaching the desired location. When we face an impediment or arrive at our goal, the voice circuit will activate, producing a certain style of voice. A microcontroller connects the subsystems and executes and organises the actions. The system is inexpensive. The accuracy is high. But, the design complexity is high [2]. A similar study for unsighted uses pulses echoes technique for provides a warning sound when detecting the obstacles.

III. SYSTEM DESIGN

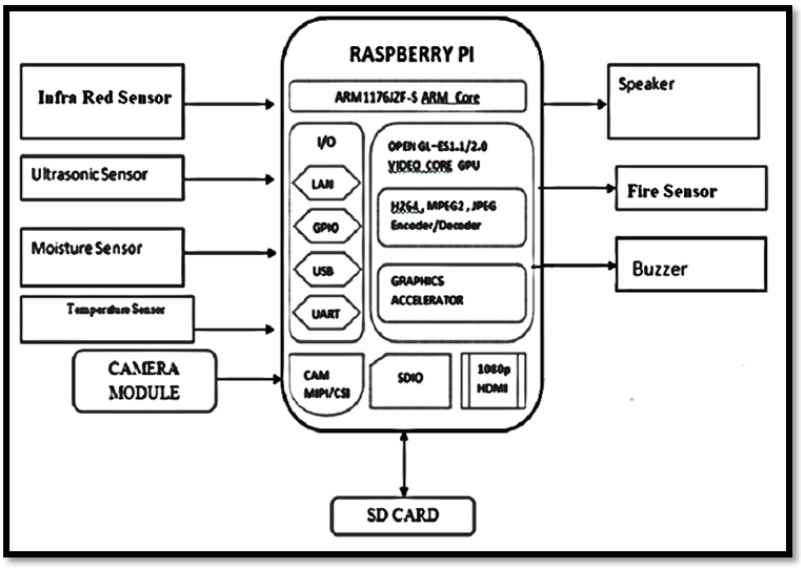

Fig.1. Block diagram of blind stick

A. This smart stick is a four-ultrasonic sensor electronic walking guide. Obstacle detection is handled by three of the four sensors, which are located on the side of the stick.

B. The other sensor, which is located beneath the smart stick, is in charge of detecting potholes. The range of these ultrasonic sensors is 2-250cm. For object recognition and text recognition, a camera is employed. A toggle switch is preserved, which is used by the user to enable the smart stick's many functionalities. Finally, the stick's output is delivered through an earphone.

C. Ultrasonic Sensor

An ultrasonic sensor is a type of sensor that uses sound waves to detect an item. It works on the same concept as radar or sonar, which creates and receives high-frequency sound waves. Sensors detect the distance of an object by measuring the time it takes for the echo signal to be received after transmitting the signals and getting the echo signals back.

D. IR Sensor

This sensor is analogous to human's visionary senses, when the device turns on, detects the object's direction whether on RIGHT or LEFT and intimates the person via earphones.

E. Camera

A camera is used in this smart blind stick for capturing images which are used for object identification and text reading. The image captured in the camera is processed using the technology of digital image processing.

F. Moisture Sensor

A moisture sensor is a device used in the detection of the water level.When the device turns on, the sensor will automatically detect the presence of water and intimates to a blind person through the speaker. This intimation prevents him from tripping down as well as drenching.

G. Temperature Sensor

Temperature sensing can be done through direct contact with the body when he holds the handle of the blind stick.When the device turns on, the sensor will automatically detect the body temperature and if it exceeds the normal body temperature, it intimates the guardian with his current position to the registered phone number.

H. Fire Sensor

Fire sensor is actuated when they receive electromagnetic radiation on sensing a flame and intimates the person through earphones or speakers.

I. Earphones

Earphones are used as an output device which gives the audio output of all the features of smart stick such as object identification, text identification, and pothole detection.

J. Buzzer

When a power supply is applied this device will produce noise and the cycle continues until the power is removed.When the blind person is in an emergency and requires external help from people he can actuate the buzzer simply by toggling the switch.

K. Raspberry Pi

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ijates
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A low-cost high-performance computer which can be plugged in TV and monitor and can be used as a computer which is very small as a credit card.

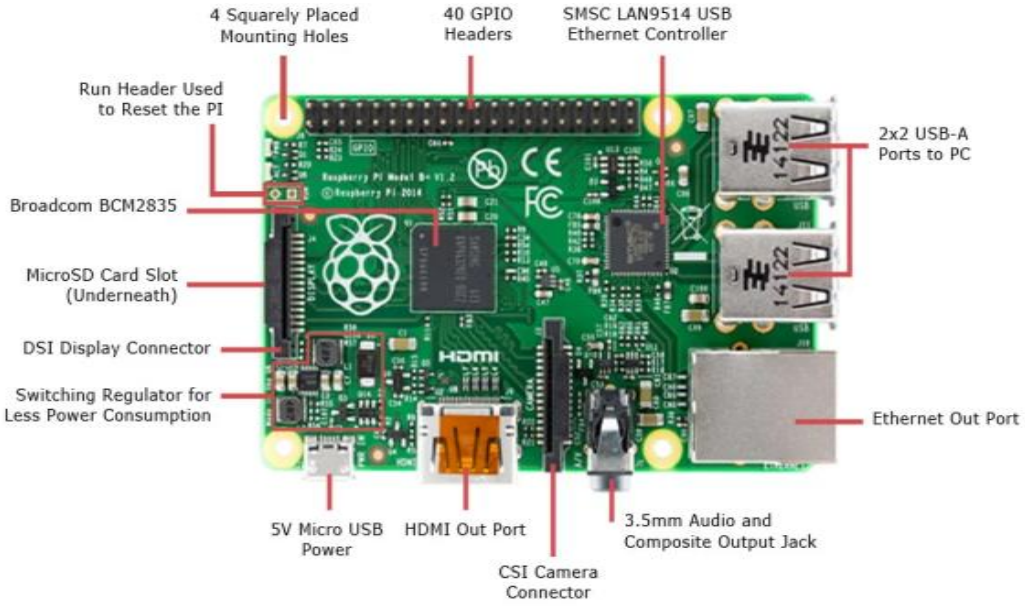

Fig .2. Raspberry Pi board

Its CPU is 700Mhz single core ARM1176JZ F-S

- It has 4 USB ports
- It has dual-core video core iv multimedia coprocessor
- Size of its RAM is 512mb
- It has a micro SDHC slot for storage
- The power rating of raspberry pi is 600mA i.e, 3.0W
- It has 17 GPIO plus the same specific functions.
- This raspberry pi works as the computer of the smart walking stick.

IV. IMPLEMENTATION SYSTEM

There are 17 GPIO pins on the Raspberry Pi board. These GPIO pins allow you to connect to electrical devices directly. Sensors, buttons, and other low-level protocols SPI and serial UART connections will be used as inputs to communicate with circuits or modules. Logic levels of 3.3V are used. Although there are no analogue inputs or outputs on these GPIO pins, we may connect to the analogue world via external chords.

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 a picture and saves the image as "sample.jpeg" and moves it to home/pi/webcam

STEP 5: Executes image to text conversion using python and saves the output as “output1.txt”

STEP 6: Moves “output1.txt” to “audio.txt” file and executes text to audio conversion

STEP 7: generates audio output moves to step 2

STEP 8: executes ultrasonic distance measurement using python and Saves the output as “output2.txt”

STEP 9: Moves the text in “output2.txt” to “audio.txt” and executes text to audio conversion

STEP 10: Generates audio output and moves to step 2

V. CONCLUSION

The concept of a smart blind stick based on an ultrasonic sensor is presented and effectively executed in this study. It may be used by blind people as an excellent navigation tool. The smart blind stick sounds a buzzer to provide an alarm when it detects an obstruction in the way of the concerned person. Within the defined range, the constructed system can identify any obstruction. It also includes an embedded GPS function that provides information to the guardian for extra assistance.

VI. FUTURE SCOPE

Our future research will concentrate on improving the object recognition system's ability to detect and identify things in difficult environments. The picture object database may be upgraded to better item identification. We'll also increase the device's charging capacity. For the gadget to navigate utilising dynamic picture recognition, better algorithms might be developed.

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