Autonomous Electronic Guiding Stick Using IoT For The Blind

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ABSTRACT

Visually challenged people have the inability of visual perception due to various genetic, biological and neurological factors. Navigating from one place to other is one of the fundamental actions performed in man's life. Visually challenged people face so many problems in navigation and they are often dependent on traditional walking sticks, guide dogs or guides.With increasing human machine interaction, there are lots of devices which help in navigation of the visually challenged in indoor and outdoor environments. The most preferred guiding solution by the blind is the walking cane..Guides and guide dogs can turn out to be an expensive option. Therefore, we aim to design and implement a low cost, real time navigation system which is the guiding electronic stick that assists these visually challenged people in their navigation by audio instructions and can autonomously move which resembles the traditional walking cane.

Keywords— *Visually challenged, Navigation, Walking stick*

I. INTRODUCTION

One of the main aims of Engineering is to improve the quality of lives of humans. There are lots of technological inventions and innovations which help in the wellbeing of physically and mentally challenged people in their day to day activities. Visually challenged people have the inability of visual perception due to various genetic, biological and neurological factors .Navigating from one place to other is one of the fundamental actions performed in man's life. Visually challenged people face so many problems in navigation and they are often dependent on traditional walking sticks, guide dogs or guides. It is a challenge for these people to independently navigate on a daily basis. Situations are even worse in unfamiliar environments. Blind people do not know the surrounding information data regarding obstacles, potholes or other dangers and have very little knowledge regarding landmarks in a particular region .With increasing human machine interaction, there are lots of devices which help in navigation of the visually challenged in indoor and outdoor environments. The most preferred guiding solution by the blind is the walking cane. Guides and guide dogs can turn out to be an expensive option. Therefore, we aim to design and implement a low cost,real time navigation system which is the guiding electronic stick that assists these visually challengedpeoplein their navigation by audio instructions and can autonomously move whichresembles a traditional walking cane.

II. PROPOSED SYSTEM

To create a low cost autonomous guiding system controlled by Raspberry Pi.To interface sensors that collect environmental information to Raspberry pi.To alert the user regarding forthcoming vehicles or obstacles in outdoor navigation.

III. EXISTING SYSTEM

The past work done in this domain is based on echolocation and image processing and the demerit in that one is ,it's operation is entirely dependent on smart phone's reliability and the dynamic image processing is used which requires complex programming and there is also an another work done for indoor navigation.

IV. HARDWARE DESCRIPTION

- **Raspberry Pi 3 b+**

Raspberry pi is a pocket personal computer with Linux operating system on it. This is great cheap to encourage young people for learning, programming, experimenting and for making innovation. Resembling like motherboard, raspberry pi has all the components to connect inputs, outputs and storage. The model A has all of the same features of the model B minus one of the USB plugs, the Ethernet port, and half of the RAM. An SD card inserted into the slot on the board acts as the hard drive for the Raspberry Pi.

It is powered by USB and the video output can be hooked up to a traditional RCA TV set, a more modern monitor, or even a TV using the HDMI port. This gives you all of the basic abilities of a normal computer. It also has an extremely low power consumption of about 3 watts. To put this power consumption in perspective, you could run over 30 Raspberry Pi"s in place of a standard light bulb.

FIGURE.1. BLOCK DIAGRAM

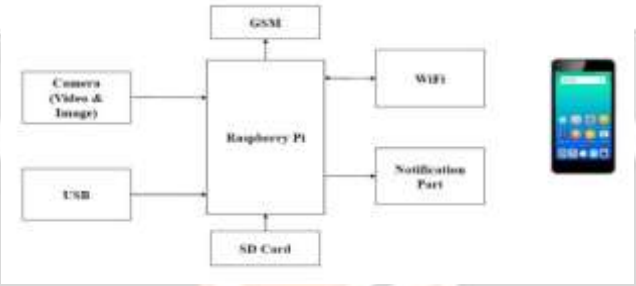
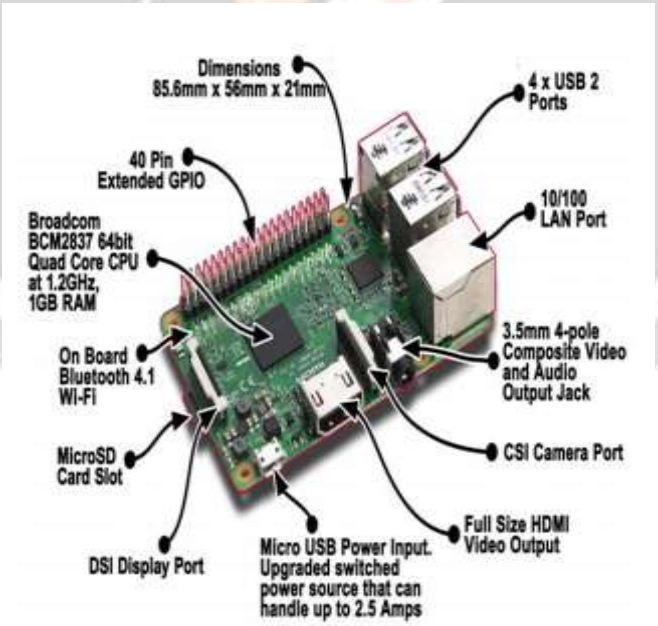


FIGURE.2. RASPBERRY PI



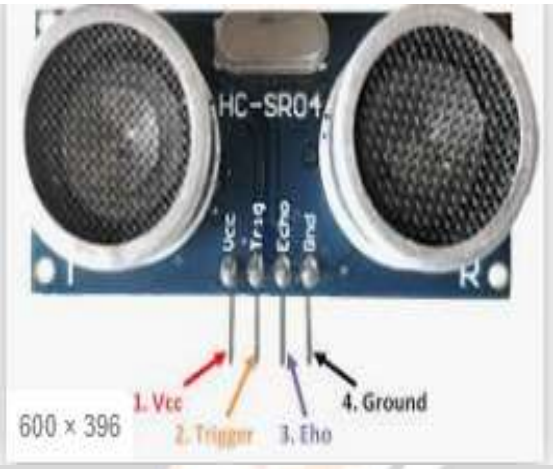
- **DC Gear Motors**

A geared DC Motor has a gear assembly attached to the motor. The speed of motor is counted in terms of rotations of the shaft per minute and is termed as RPM. The gear assembly helps in increasing the torque and reducing the speed. Here, the speed is 200 RPM.

- **Ultrasonic Sensors**

An ultrasonic sensor is an instrument that measures the distance to an object using ultrasonic sound waves. At every 50ms sensor transmits an ultrasonic burst and send out ascii value of distance that corresponds to the time required for the burst echo to return to the sensor. They can be used for precise detection of objects. They generate high frequency sound waves and evaluate the echo which is received back by the sensor.

FIGURE.4. ULTRASONIC SENSOR



- **Image Sensors**

An image sensor is an electronic device that converts an optical image into an electronic signal. It is used in digital cameras and imaging devices to convert the light received on the camera or imaging device lens into a digital image.

- **Webcam**

Webcams typically come with software that allows the user to record video or stream the video on the Web. If the user has a website that supports streaming video, other users can watch the video stream from their Web browsers.Since streaming video over the Internet requires a lot of bandwidth, the video stream is typically compressed. The resolution of a webcam is also lower than most handheld video cameras.Webcams can also record short video messages. Similar to taking still images, videos are captured by clicking on a designated button on the computer screen.
Unlike still images, videos require the act of starting and then stopping the camera. The start and stop button are usually the same, and have a red blinking circle when the camera is recording. A video is saved to the computer's hard drive.

FIGURE.3. WEBCAM

V. SOFTWARE DESCRIPTION

RASPBIAN OS:

The Raspberry Pi lines of micro-computers are impressive machines with endless possibilities. As a result. The Linux community has created dozens upon dozens of special Linux operating systems for it. Everything from Linux powered server operating systems, to media centres, console emulation kits andmore; there's just so much to choose from. Raspbian is a Debian-based computer operating system for Raspberry Pi. There are several versions of Raspbian including Raspbian Stretch and Raspbian Jessie. It has been officially provided by the Raspberry Pi Foundation as the primary operating system for the family of Raspberry Pi single-board computers. Raspbian was created by Mike Thompson and Peter Greenasan Independent project. Raspbian is highly optimized for the Raspberry Pi line's low performance ARM CPUs. Raspbian uses PIXEL, Pi Improved X windows Environment, Light weight as its main desktop environment as of the latest update. The scripts and files created are run on the Raaspbian OS.

There are many different types of Linux distributions for the Raspberry Pi, but the best one to use by far is Raspbian. It is an ARMHF port of the popular open source operating system with one key difference: Raspbian builds differently than Debian, to support hardware floating point.

PYTHON:

Python is a flexible and dynamic language that you can use in different ways. You can use it interactively when you simply want to test a code or a statement on a line-by-line basis or when you‟re exploring its features. You can use it in script mode when you want to interpret an entire file of statements or application program. To use Python interactively, you can use either the Command Line window or the IDLE Development Environment.

IOT:

- The term Internet of Things generally refers to scenarios where network connectivity and computing capability extends to objects, sensors and everyday items not normally considered computers, allowing these devices to generate, exchange and consume data with minimal human intervention. There is, however, no single, universal definition.
- Enabling Technologies: The concept of combining computers, sensors, and networks to monitor and control devices has existed for decades. The recent confluence of several technology market trends, however, is bringing the Internet of Things closer to widespread reality. These include Ubiquitous Connectivity, Widespread Adoption of IP-based Networking, Computing Economics, Miniaturization, Advances in Data
- Connectivity Models: IoT implementations use different technical communications models, each with its own characteristics. Four common communications models described by the Internet Architecture Board include: Device-to-Device, Device-to-Cloud, Device-to-Gateway, and Back-End Data-Sharing. These models highlight the flexibility in the ways that IoT devices can connect and provide value to the user.

OCR:

An OCR (Optical Character Recognition) system which is a branch of computer vision and in turn a sub-class of Artificial Intelligence. Optical character recognition is the translation of optically scanned bitmaps of printed or hand written text into audio output by using of Raspberry Pi. OCRs developed for many world languages are already under efficient use. This method extracts moving object region by a mixture-of-Gaussians-based background subtraction method. A text localization and recognition are conducted to acquire text information. To automatically localize the text regions from the object, a text localization and Tesseract algorithm by learning gradient features of stroke orientations and distributions of edge pixels in an Ada boost model. Text characters in the localized text regions are then binaries and recognized by off-the-shelf optical character recognition software. The recognized text codes are output to blind users in speech. Performance of the proposed text localization algorithm. As the recognition process is completed, the character codes in the text file are processed using Raspberry pi device on which recognize character using Tesseract algorithm and python programming, the audio output is listened.

The main purpose of **Optical Character Recognition (OCR)** system based on a grid infrastructure is to perform Document Image Analysis, document processing of electronic document formats converted from paper

formats more effectively and efficiently. This improves the accuracy of recognizing the characters during document processing compared to various existing available character recognition methods. Here OCR technique derives the meaning of the characters, their font properties from their bit-mapped images.

- The primary objective is to speed up the process of character recognition in document processing. As a result the system can process huge number of documents with-in less time and hence saves the time.
- Since our character recognition is based on a grid infrastructure, it aims to recognize multiple heterogeneous characters that belong to different universal languages with different font properties and alignments.

VI. WORKING METHODOLOGY

1. The user holds on to the electronic stick in the same way as the traditional white walking cane using a strap.

2. The system initially gets the input destination from the user via speech through Arduino Bluetooth controller App.

3. This speech information is converted into relevant text.

4. The destination address is located and the navigation is started.

5. As per the route, the user is directed to go left or right or to keep walking straight through audio instructions which is reflected on the headphones.

6. The raspberry pi receives information from the Smartphone wirelesslyvia bluetooth from the mobile.

7. As per the navigation route, the wheels in the underlying chassis of the stick move in the respective direction.

8. These wheels are powered by motors that rotate according to the control signal received from Raspberry Pi.

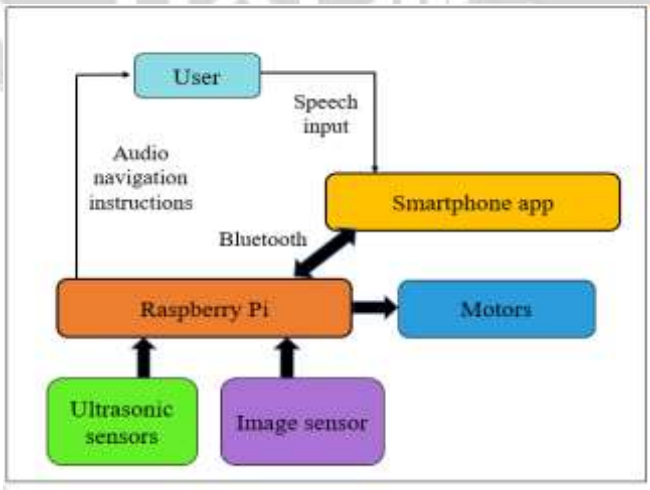
9. Thee are ultrasonic sensors in the chassis (front, both sides and downwards) to indicate nearby obstacles and the sensor in the bottom is used to indicate potholes.

10. An mage sensor is mounted on top of the stick which capturethe environment at equal intervals of time and sends to the smartphone app as navigation history.

11. An obstacles or heavy vehicles or unknown location captured by the image sensor alerts the user by suitable voice commands.

12. Thus, autonomous function of the electronic guiding stick is achieved.

FIGURE.5. BLOCK DIAGRAM



VII. NAVIGATION PROCEDURE

- First the location is received and the time required to reach the destination is predefined.We use the .time() function for

- Based on the specified time, the robot traverses in forward direction.
- As per the route, the robot takes either left or right and the user is indicated via headphones.
- The audio instruction is given using the Espeak command.
- The navigation database is acquired for our college and specific indoor environments.

FIGURE.6. HARDWARE CONNECTION

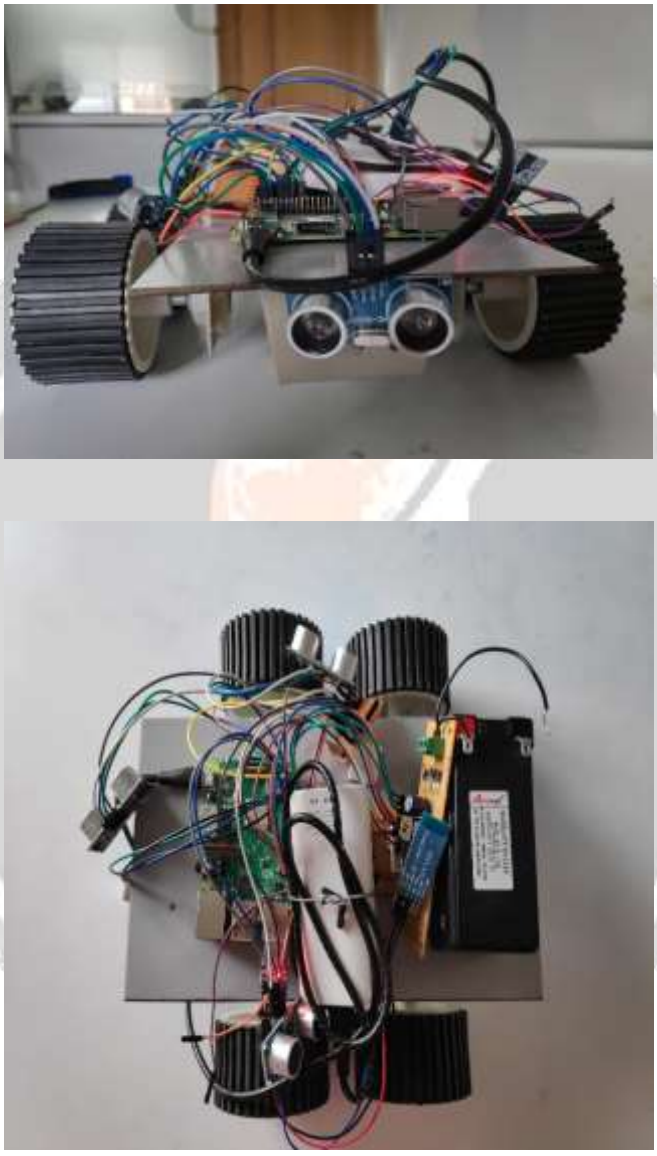


FIGURE.6.1

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