RASPBERRY PI BASED SMART WALKING STICK FOR VISUALLY IMPAIRED PERSON

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Abstract - *To provide a smart electronic help for blind individuals, a smart system concept has been designed. People who are blind or visually challenged have difficulty finding their way around. The Raspberry Pi-based system is designed to give artificial vision and object identification, as well as real-time support through GPS. In this project, we'll use the Raspberry Pi to create a smart system for blind people that includes a camera module, a switch, and a GPS module. If someone is in distress, the Pi Camera recognizes the location using GPS and sends a message to that person's Whatsapp. The system is made up of a GPS module that receives feedback via audio, and the voice output is controlled by TTS (text to speech). The suggested system identifies an object in their environment and gives feedback in the form of speech, warning messages sent by earphone, and GPS navigation to a specific area. The overall goal of the system is to deliver a low-cost, high-efficiency navigation and text-to-voice aid for the blind that provides a sense of artificial vision by supplying information about the environment's static and dynamic objects.*

***Key Words*: Artifical vision and object identifiaction, TTS(text to speech), GPS, Low-cost, high-efficiency navigation and text-to-voice.**

1. INTRODUCTION

Individuals with visual impairments are those whose good eyes make it impossible to understand even the smallest detail. Many people with 6/60 or the optical range have a longitudinal range of less than or equal to 20 degrees, or have both eyes wide open. These people are known to be deafeningly deafening visually handicapped persons live in a world where they are completely reliant on others. Individuals with sensory disabilities find it impossible to discern even the tiniest information from that of healthy people. Those with a 6/60 or optical range have a lateral scope of less than or equal to 20 degrees, orhave both eyes wide open. They are referred as as blind.

According to the World Health Organization's global data on visual impairment, there are an estimated 285 million visually impaired persons of all ages, with 39 million of them blind. Blindness affects 80% of adults over the age of 50. Uncorrected refractive errors (43 percent) and cataract (33 percent) are the leading causes of visual impairment; cataract is the leading cause of blindness (51 percent). Because humans receive 83 percent of their information from their surroundings through sight, vision is the most crucial element of their physiology. People with those illnesses face a lot of agony in order to live a normal life. They are mentally secluded and allow themselves to be neglected. This dysfunction with them has a significant impact on their ability to make a living. It manifests as a mental illness that causes patients to lose hope in themselves.

As a result, we devised a system for those suffering from those conditions. In recent years, a number of inventors have created devices to assist visually impaired persons. Traditional and oldest accessibility devices for visually handicapped people have their own set of disadvantages. A unique supply or navigator is frequently included with some innovations, allowing the user to carry it in their pocket when travelling al fresco. The consumer is likely to be confused by the profuse patterns. Several attempts to construct blind guard or obstacle-measuring systems utilizing a small number of applications of elements have been made. As a result, it is recommended to design and create a walking stick with all of these functions, such as real-time object identification, voice direction, navigation, and so on, that is affordable to all persons who require assistance.

2. LITERATURE REVIEW

1. A Survey of Voice-Assisted Electronic Sticks for the Visually Impaired. Young Ho and Sung Jae Kang are the authors. Description- We learned about the latest technology in this article, such as the Graphics Positioning System (GPS) and Graphics System Messaging (GSM). Which will aid in the tracking of a person's location and be utilised in the development of

a smart stick module for visually impaired persons, as well as providing information on voice messages sent from an Android phone to a blindperson. [14].

2. Image Processing and Embedded System for Blind Navigation Sacinah Jamaludin and Zul Azizi Hailani are the authors. Description: This paper inspired us to create a navigation system that aids in the mobility of blind people. This study suggests that we capture live video of that individual and seize video feed in front of the blind person, and that this live video may be viewed by theadministrator. [4]

3. Smart Cane: Visually Impaired People's Assistive Cane MohdHelmy Wahab, AmirulATalib, AmirulATalib, AmirulATalib, AmirulATalib, AmirulATalib Description- We got the concept for Voice message & Vibration from this paper. When a person detects an impediment with the use of a smart stick, the blind person becomes aware of it by interpreting the Vibration alert & Voice message that arrives from the smart phone. [3]

4. Electronic Path Guidance for People with Visual Impairment Iwan Ulrich and Johann Borenstein are the authors. Description- From this paper, we learned about the range required for identifying an obstacle or object from the location of a smart stick. We need to define a threshold value, and if the obstacle falls within that range, it may be detected successfully; otherwise, it cannot. [4]

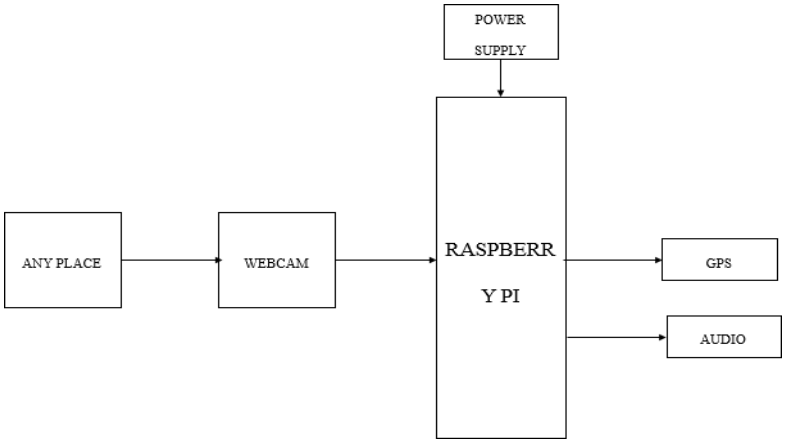
5. Development of an Electronic Travel Aid Using Ultrasonic Sensors Alex Harold and Chris Gearhart are the authors. Description- From this article, we learned that in order to capture video images, some processing is required. Using some algorithms and methods, we perform some procedures on the image in order to capture it, and we can also view live monitoring of that person on the admin side. All processing data is saved in a serialised manner on the server. [5]

6. Automated Mobility and Orientation System for People Who Are Blind or Partially Blind Abdel Ilah Nour Alshbatat is the author. Description- We learned about GSM, GPS, and sensors such as integrated ultrasonic sensors and accelerometers from this study. [14]

7. A Guide to Navigation for the Blind - For the sight impaired, taking each step without encountering any impediments is a significant struggle in today's fast-paced world. The visually impaired can use a smart assistant like 3S (Sensory Supervision Spectacles) to read images, avoid obstacles, and track routes. As a result, this study proposes the creation of a clever framework that can assist visually impaired people in their daily lives. Some of the most significant difficulties include difficulty moving without assistance, difficulty reading text or visuals, detecting impediments, and so on. Text recognition using Optical Character Recognition (OCR), speech synthesis using Text-To-Speech (TTS), and obstacle detection using ultrasonic sensors (HC-SR04) and a GPS tracker are all possible with the proposed 3S (Sensory Supervision Spectacles). The device is a voice-activated framework that would assist visually impaired peoplein their daily tasks.

3.PROPOSED WORK

It also offers a camera-based assisted reading system to assist blind people in reading text labels and product packaging from everyday things. The text that the user needs to read is collected as an image and sent to the image processing platform using a small camera. OCR tesseract is used to recognise the text on the acquired image.CThe e- speak algorithm converts the detected text into vocal output. The system is lightweight and portable, thanks to a built-in battery backup. It will provide them with a safer atmosphere as well as a sense of independence, allowing them to enjoy a more regular life. The Raspberry Pi 3b, GPS module, voice command module, moisture sensor unit, and ultrasonic sensor unit are all used in this smart navigation system stick. The voice command module is the highlight since it gives customers with dependable voice commandsupport. The GPS module is also important since it offers users with safe and precise navigation.



Block Diagram of Proposed system

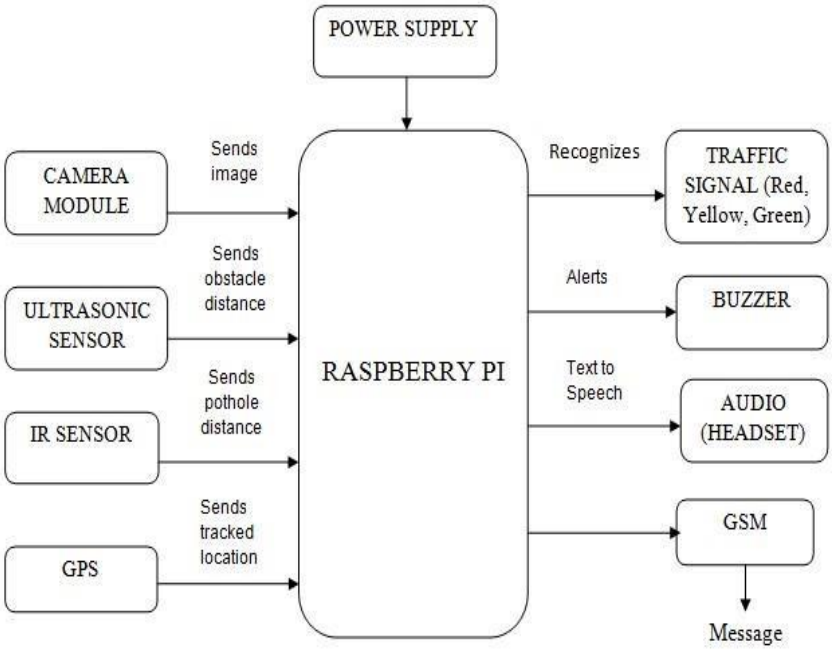
3.1. ADVANTAGES:

It is efficient. It is inexpensive. By receiving communications, we can keep track of the blind people's whereabouts. Character recognition that is done automatically. A prototype system for assisting blind people by reading printed text on hand-held devices. Weproposed a motion-based method for detecting the object for a few seconds to detect it.

3.2. PROBLEM IDENTIFICATION:

Understanding the precise context of deaf and dumb people's symbolic expressions is a difficult task in real life unless it is adequately described. Webcams can occasionally struggle to determine the desired skin colour due to light and contrast. Because the tracking environment background colour and skin colour are so similar, the SLR receives unexpected pixels.

4.ARCHITECTURE DIAGRAM



METHODOLOGY

Image to text - Tesaract algorithm and text to audio - Espeak algorithm connecting ultrasonic sensor for detecting the obstacle and updated to blind person through headset. Camera will take the pic and detects the location of the area.

5.1 TESSERACT ALGORITHM:

Tesseract Algorithm is an optical character recognition engine with open source code. This is the most popular and qualitative OCR library. Tesseract is finding templates in pixels ,letters, words and sentences. This algorithm is able to accurately decypher and extract text from a variety of sources As per it's namesake it uses an updated version of the tesseract open source OCR tool. We also automatically binarize and preprocess.

Images using the binarization, so tesseract has an easier time decyphering images. And qualitative OCR library. Tesseract is finding templates in pixels , letters, words and sentences.

5.2 E-SPEAK ALGORITHM:

eSpeak is an open source text-to-speech synthesizer that can be invoked from the Linux command line. This is a compact speech synthesizer that provides support to English and many other languages. It can be used with the existing layout analysis to recognize text within a large document, or it can be used in conjunction with an external text detector to recognize text from an image of a single text line. The eSpeak package provides a few good variations to the default voice used to speak outthe text.

5. HARDWARE AND SOFTWARE COMPONENTS

Hardware Requirements: We are using the Raspberry Pi,WebCamera,Speaker etc.,

Software Requirements: Raspian OS,Python andOpen CV.

Raspberry pi board

A. A. It's a lot of fun to bond with Arduino and you can do a lot with it. The Raspberry Pi is available in two models: model A and model B. These two are quite similar, with Model B having a few more advanced features than Model

A. Model B features 512 MB of RAM and two USB ports, while Model A only has 256 MB of RAM and one USB port. Furthermore, the Model B features an Ethernet interface,whereas the Model A does not.

B. SD Card Slot : Raspberry Pi doesn't have the real harddrive as in laptop and computer, SD card is taken as solid state drive (SSD) which is used to install operating system and all others software and store everything. This card is needed to insert into the slot for using the Raspberry Pi. SD card may be 2GB, 4GB or 16GB

C. Micro USB Power : The power port is a 5V micro-USB input and supply should be exactly 5v as it doesn't have onboard power regulator. So, power supply shouldn't exceed than 5V.

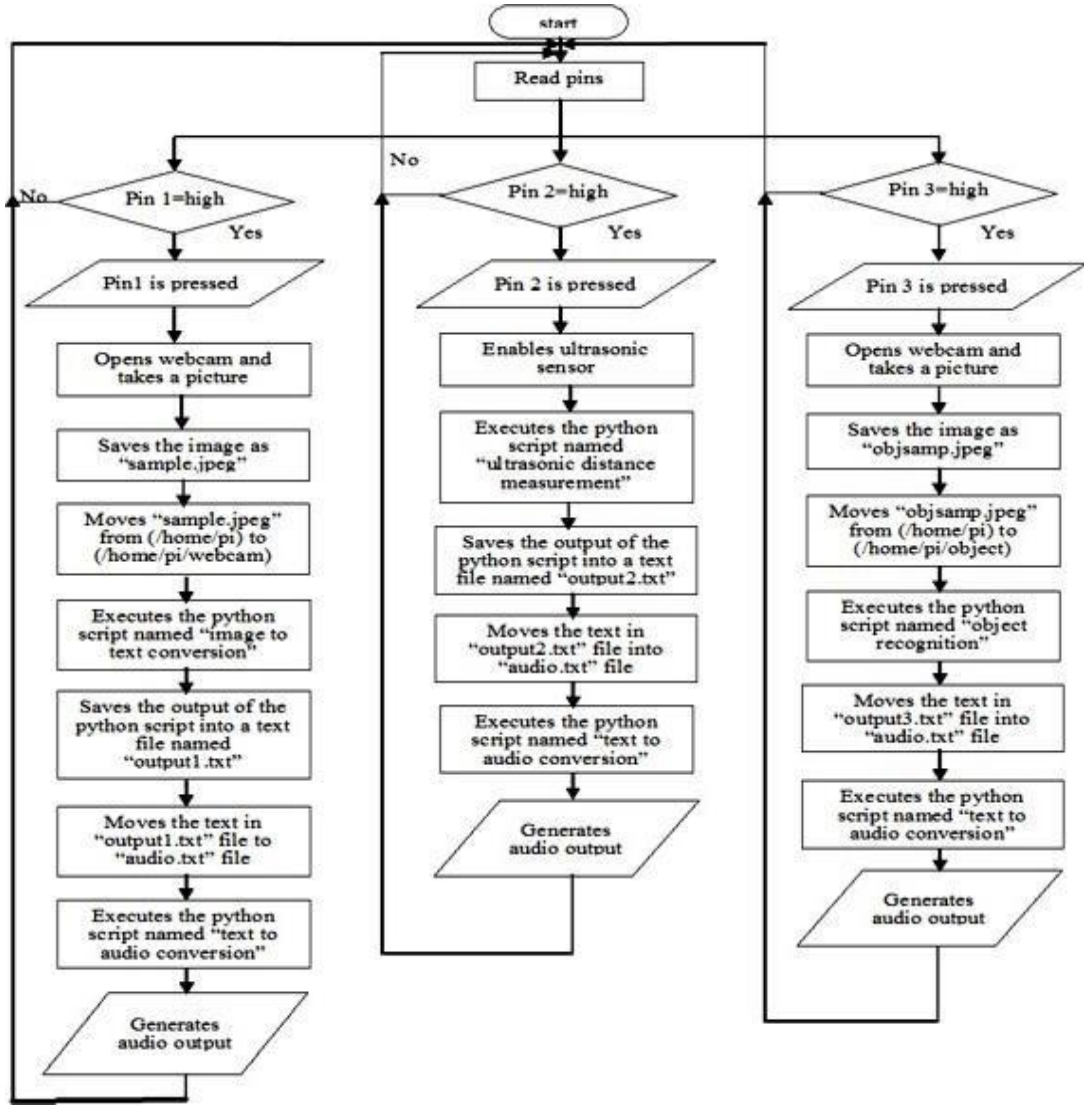
D. HDMI Out: To connect the Raspberry Pi to a monitor via HDMI, use this output port (High Definition Multimedia Interface). As a result, any screen or TV with an HDMI connector can be attached to it.

E. GPIO Headers (Pins): A GPIO pin is a general-purpose input-output pin. These pins are used to connect the Raspberry Pi to a variety of physical expansions. Pre installed libraries on the Raspberry Pi allow us to access the pins using programming languages such as C, C++, orPython.

F. Ultrasonic Sensor: A form of sensor that detects an item using sound waves is known as an ultrasonic sensor. It works on the same principle as radar or sonar, which generates 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 receiving the echo signals back.

6. SMART FLOW CHART

The above flowchart shows the process details that takes place in the smart walking stick. And much easier algorithm of the smart stick is given below



7. FUNCTIONAL DESCRIPTION

An ultrasonic sensor is a device that detectsthe presence of ultrasonic waves

The ultrasonic sensor is used to calculate the object's distance or to detect potholes. Elastic waves of a frequency more than 20,000 Hz are produced by these,which can be found in solids, liquids, and gases.

The ultrasonic sensor, which sends ultrasounds and estimates distance, is inserted in three sides of the walking stick for object detection.

The sensor is put beneath the smart walking stick to identify potholes. The distance is chosen to be more than the average distance. As a result, when a pothole arises,its distance will be greater than normal, and we will bealerted.

The pulse reflection method, which counts the number of reflection pulses reflected back, is used to calculate distance in the block diagram[5].

A. Raspberry pi

The Raspberry Pi board's brain is the Central Processing Unit, which is in charge of carrying out the computer's instructions through logical and mathematical operations. The Raspberry Pi's Ethernet connection serves as the primary interface for communicating with other devices. The Ethernet port of the Raspberry Pi is used to connect your home network to the internet [9].

B.ARM 11 processor

The raspberry pi uses ARM11 series processor ARM11 is a group of older 32-bit RISC ARM processor

Its operating frequency is 335Mhz. power consumption is0.4mV/Mhz

ARM Trust-Zone Technology for on chip security low power consumption and High performance integer processor the GPU is a specialized chip in the raspberry pi board and that is designed to speed up the operation of image calculations.

C. Object identification

Using digital image processing technology and software called computer vision 2, the process of item identification is carried out. We feed the fundamental structures of items such as stones, vehicles, and persons into this process, and if any variation is detected by ultrasonic sensors, the camera turns on to take the image, which it compares to the pre-fed photographs to discover the object [11].

D. Optical character recognition

Tesseract, a supporting software for the Raspberry Pi, is used to do OCR (optical character recognition). The image acquired with the camera is first converted to black and white, and then the edge detection procedure is used to discover the edges in the image in order to find the distinct letters in the image. Against determine the right character of the image, these letters are compared to pre-fetched characters from other languages [7].

E. Switch

To enable the ultrasonic sensor for obstacle detection, pothole detection, or text reading, a toggle switch is needed. To get the smart walking stick'srequired output, the user must operate the switch.

8.CONCLUSION AND DISCUSSION:

In this analysis, we got described an epitome system to scan written communication and hand-held objects for serving to the blind people. To extract text regions from advanced backgrounds, we have got projected a totally distinctive text localization formula supported models of stroke orientation, and edge distributions. The corresponding feature maps estimate the worldwide structural feature of text at every element. Block patterns project the projected feature maps of an image patch into a feature vector. A adjacent character grouping is performed to calculate candidates of text patches prepared for text classification. Associate Ada boost learning model is used to localize text in camera-based footage. OCR is utilized to perform word recognition on the localized text regions and work into audio output for blind users. Throughout this analysis, the camera acts as input for the paper. As a result of the Raspberry Pi board is high-powered the camera starts streaming. The streaming data square measure attending to be displayed on the screen victimization interface application. Once the item for text reading is placed earlier than the camera then the capture button is clicked to supply image to the board. Mistreatment Tesseract library the image square measure attending to be converted into data, and conjointly the data detected from the image square measure attending to be shown on the standing bar. The obtained data square measure attending to be pronounced through.

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