Smart Guidance System Of Sightless Challengers

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Abstract

Eyes are one of the most essential sensory organs to human life. Blind's everyday-life issues are hectic. In the new scheme the blind are directed by an ultrasonic sensor and a camera mounted within the walking stick to overcome obstacles. It makes use of the raspberry pi interfacing module. The weather sensor serves to carry blind climate. The weather sensor helps hold the climate blind. But blind may be uncertain of his current position just in case the individual is left behind and there can be no support. The proposed system overcomes the drawback of an interfaced ultrasonic sensor to detect obstacles, and includes the USB camera to capture live images and connect the devices to the Raspberry Pi. The obstacle detected is transmitted to the speech process through one earphone using text, and the live images taken by the camera are also stored in a drive folder. The trusted person should have an application where he can get the contact with the drive, where the live photo is provided to monitor the blind. Just in case the blind is lost, they will have an access button that will be used to call the trusted individual and it will be available as an android application connected via Bluetooth to the Raspberry Pi module. The applications for android include linking with the trusted person and guiding the blind user. Blind can travel by themselves, because they are connected to the internet. Locating the local place easily via live photos can be done just in case of immediate emergency response.

Keywords*: Air embolism, Drip chamber, Infusion process, Doctor unit, Patient unit, Load cell, Bluetooth transceiver, BO Motor, Raspberry PI.*

1. INTRODUCTION

Blindness is the state of sightlessness, or lack of vision. Generally speaking, everybody firmly suspects that the life of visually disabled people is not as easy as regulars. Technology contributes a great deal to bridge this void between visually disabled individuals and society. Day by day scientific advancements incorporate new innovations to make life simple and convenient for the good of ordinary and disabled people.

The network Internet of Things (IoT) consists of web-active smart devices that use embedded systems such as processors, sensors, etc. to capture, transmit and act on data from installed environments. IoT devices exchange sensor data that they obtain by connecting to an IoT gateway or other edge node where data is either sent to the cloud for analysis or can be analyzed separately. While the idea of IoT has breathed for an prolonged period of time, this has been made possible by a gaggle of recent developments in large numbers of different technologies. This paper focuses on designing a guidance system that uses the visually impaired IoTand keeps them in contact with the trusted person when they are abandoned by android applications.

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II. RELATED WORKS

For several years, developments are being suggested in the IoT domain for the needs of visually impaired individuals, with various ideas. The ideas from previously developed programs for the visually impaired people are being reviewed. Mohamed Manoufaliet.al[1] enabled the mobility of the blind person by warning if there were any obstacles in the vicinity which would support him / her in daily activities. The advice for both indoor and outdoor environments is provided in the form of audio instructions via the headset and is focused on real-time situation. The ultrasonic sensors are used both inside and outside to detect obstacles. Afterwards, Hamza A. Alabriet.al[2]developed a program to help blind students move to and from classrooms. To design such a device, the design team had to use many design measures which were popularly used in engineering design process. Phases include analysis of the literature, essential design, solution brainstorming, system functional decay, software modeling, prototype execution, and testing. Built-in interface consists of two fully integrated mobile application modules and a smart button.

Additionally, NamitaAgarwalet.al[3] has built a stick that allows the individual to approach the barrier to decide where they are. The author has proposed the design and creation of a new Smart Electronic Guiding Stick (EGS) system for visually impaired people .In addition, Syed TehzeebAlamet.al[4] has introduced a visually impaired mobile assistive system. Blind people face autonomous transportation and mobility limitations. Normal activities are hampered by their incapacity to adapt to their environment. The system was used to guide the blind person and to protect them from unwanted collisions with the obstacles via pre-recorded voice commands, thereby providing a positive feedback. GivaAndrianaMutiaraet.al[5] identified a method by which they introduced a cane mechanism which could decide the hitch, barrier, holes and direction of the wind position. This research has created a prototype called Smart Guide Extension which can use Arduino to detect obstacles, holes and provide information on eight wind directions.

In addition, Jahedul Islam et.al[6] explained this mechanism by offering two main facilities – a short-range system for spotting obstacles and a shortest route guidance system for source to destination. They engaged an instrument that mounted three sensors in the body of the user. One is in the users' hand back, another is in the front and the third is on shin just under the knee. Detection of obstacles, distress calling, global location monitoring, voice control apps and shortest route guidance are elements of the app in real time. KabalanChaccour et.al[7] continued by explaining a new navigation device strategy that would help the visually impaired walk easily indoors (house, workplace, etc.) without anybody's aid. The program has a simple design that allows the subject to be fully independent at home or at work. They can direct freely inside their house or office without any further assistance. Nadia Nowshinet.al[8] proceeded by demonstrating a smart walking stick for visually impaired people. This device uses an ultrasonic sensor to sense the barrier and intimate it to the visually impaired person by use.

Jinqiang Bai et.al[9] further identified a novel Electronic Travel Aids (ETA)-smart guidance device. It consists of a pair of eyeglasses to provide direction for these people in an efficient and healthy manner. Unlike current works, a new multi-sensor fusion-based obstacle is proposed that avoids the algorithm that uses the depth sensor and the ultrasonic sensor to solve the problems of detecting small obstacles and transparent barriers, such as the French door.MadhuraGharatet.al[10] clarified that a model has a functional system that allows the blind to walk around freely. Knowledge of location in indoor area is not understood. Radio Frequency Identification (RFID) tags are an efficient way of transmitting user information, as well as their location. They install an RFID-based navigation system in a house for visual impaired persons. Translation of speech to text is achieved using the voice recognition software modules.

In addition, KunjaBihari Swain et.al[11] described a stick guide model that uses the method of vibration to communicate information to the visually impaired. They used ultrasonic and infrared sensor linked Arduino system. In this model, they used the Global Positioning System (GPS) sensor and the Global Mobile Communication System (GSM) to relay information of the location to the relatives by communicating latitude and longitude with that particular number. Reshma Vijay Jawaleet.al[12] proceeded by explaining the device works in two ways, being hurdle detection and fixed mode. For the hurdle detection mode they used Arduino, ultrasonic sensor, and water sensor to avoid barriers. In this

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model, voice message via Bluetooth, the system senses solid and liquid obstacles giving the blind person the correct instructions Kasturi R et.al[13] expanded to clarify that this model is to guide blind people to use an Android Phone to use smart apps. The program is an groundbreaking and effective Visually Impaired People's Guidance System (VIP), which they called. The tremendous difficulty for the blind is living outside. Language is the key way to use your language to track your picture
Additionally, M. Maiti*et.al* [14] described this system by presenting a unique intelligent electronic eye that provides road guidance to blind people while they are walking. Surrounding visual data is collected by image and obstacle sensors mounted on a helmet which the user has to put in. A group of objects distance sensors are installed at the front, back, right and left side of the helmet. These are used to detect obstruction with distance of any type (moving and static obstruction). A charged coupled camera installed on to the helmet is rotated using a stepper motor to provide 360-degree surrounding the view. Furthermore, Mukesh Prasad Agarwal*et.al* [15] described a smart stick using microcontroller. This system uses the obstacle detection process with the ultrasonic sensor. Here Radio Frequency (RF) module is employed. They used Arduino *system* connected with ultrasonic and infrared sensor. In this model, they used Global Positioning System (GPS) sensor and Global System for Mobile Communication (GSM) Module to convey the location details by sharing the latitude and longitude to that specific number.

In continuation, Nishajith.A*et.al* [16]described this system is to develop a navigation aid for the blind and the visually impaired people. In this system, they design and implement a smart cap which helps the blind and the visually impaired people to navigate freely by experiencing their surroundings. The scene around the person will be captured by using a NOIR camera and the objects in the scene will be detected. The earphones will give a voice output describing the detected objects. Runze Chen*et.al* [17]presented a prototype of a voice assistant specially designed for them. The model mainly consists of fundamental services. They are falling detection, safety care, accessibility of mobile phone, daily information broadcasting and view description to create life easier for them. Natural language understanding, voice recognition and synthesis have been combined to enable users to operate majority of mobile phones functions.

Furthermore, Rami Saade*et.al* [18] proposed a guidance system that interacts with a voice controlled smartphone interface to address this issue. The proposed system aims to present the student with a way to navigate from one location to another, in addition to an emergency system that is triggered when the alarm system goes off in any building or manually by the user. In addition, S.Munirathnam*et.al* [19] proposed assistive voice alert based smart stick. This system detects the obstacles using ultrasonic sensor. This system consists of NodeMCU. If obstacle is detected, the information is conveyed as playback voice. This system consists of LDR sensor which gives the information about the lighting of the environment.

III. PROPOSED SYSTEM

The main aim of this proposed program is to allow the visually impaired journey alone, where technology helps their travel safely and in case of any emergency technology allows them to tackle the situation without fear by getting them in touch with the trusted individual in their time of panic. Block Diagram of Sightless Challengers Smart Guidance (SGSC) scheme is shown in Fig. 1

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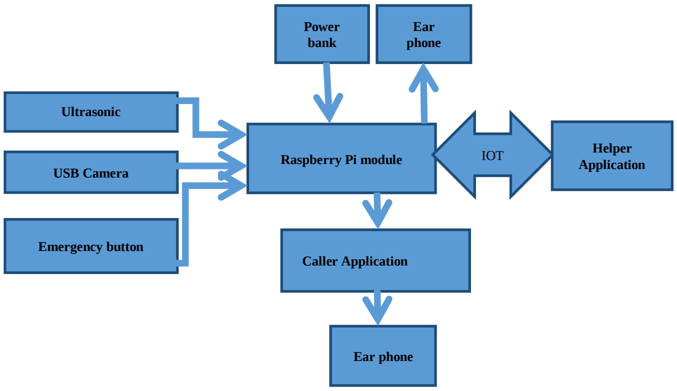

Fig.1 Smart Guidance for Sightless Challengers system

The primary SGSC block is known as the Raspberry Pi system. Ultrasonic sensor, USB camera and Emergency button are attached to the Raspberry Pi. Initially, the Raspberry pi is supplied with power by connecting it to a power bank, because access to the SGSC device is portable. The system consists of two modules.

- Visually challenging ending
- Ending the person you trust

SGSC system contains two systems, namely the Caller App and the Helper App. Accessing the emergency button involves the caller app in making a call to the trusted person. The Helper App helps to display live photos recorded by the USB screen. Thus the person being challenged visually is connected to the trusted person via the IoT. SGSC device flowchart as shown in Fig. 2. The SGSC system starts running once the Raspberry Pi gets ON. If the Raspberry Pi runs, the ultrasonic sensor, Wi-Fi, and Bluetooth is enabled. The flow is as follows.

- Thus, when an ultrasonic sensor detects an obstacle, the analog result obtained is converted to digital and given via text to Raspberry Pi 's speech feature as output in the earphone
- Since of Wi-Fi access the USB camera begins taking live images. The image is initially saved as a JPEG file and sent over internet to a drive. You can use this link to display live photos in the Helper App
- Upon activation of Bluetooth, we can access the emergency button for automatic calling operation. Once the button is pressed a call is made from the Caller app to the trusted person's mobile phone.

A. Hardware Modules

Hardware is the most visible part of any information system. It defines the performance and power consumption of the designed application. The major hardware components used in the proposed work are,

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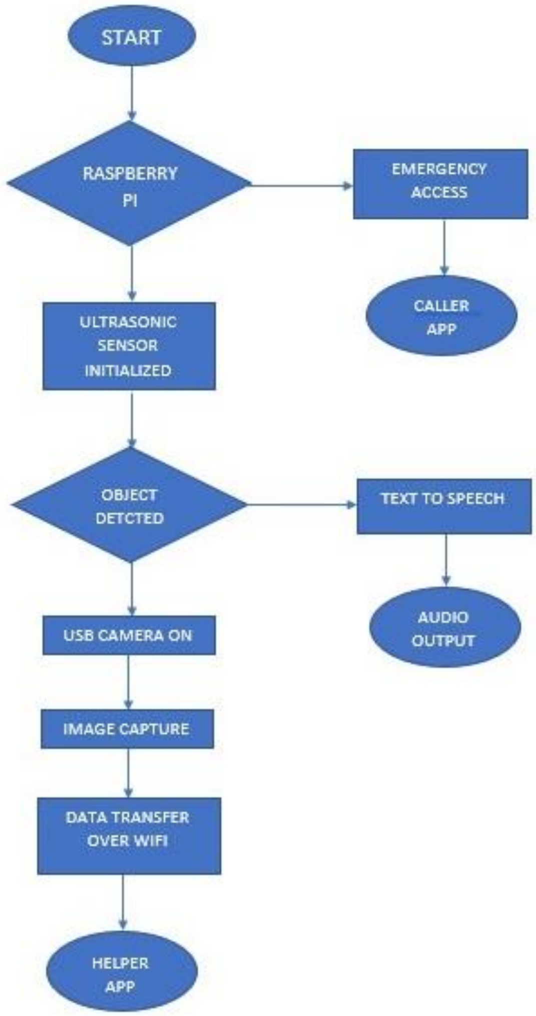

Fig 2 Flow diagram of SGSC system

- *Raspberry Pi*is also known as Minicomputer which is widely used in many industrial as well as automation system. The Raspberry pi model B+ has high processing speed and it comes with an advanced wireless capability. The dual-band Wireless Fidelity (WiFi) 802.11ac operates at 2.4 GHz and 5GHz frequency and gives an efficient range in wireless environments and Bluetooth 4.2 is available with Bluetooth Low Energy (BLE) support. The upper side is fixed with metal shielding, which acts as a heat sink.
- *Ultrasonic Sensor* (HC-SR04) used for detecting the gap to an object using sonar. The transmitters emit a high frequency ultrasonic sound, which bounce off any nearby solid objects, and also the receiver listens for any return echo.
- *USB camera* are imaging cameras that use USB 2.0 technology to transfer image data. USB Cameras are designed to simply interface with dedicated computer systems by using the identical USB technology that's found on most computers.
- *Emergency Button* is an emergency stop buttons are nothing quite a Normally Closed (NC) pushbutton that has mechanical plastic or metal tabs and grooves internally specified after you push it (interrupting the circuit), it's held therein position until you twist it.
- *Earphones* are tiny speakers that can be worn in or around ears. Basically earphones have two ear cups attached by a band that is placed over your head. They are electro-acoustic transducers, which convert an electrical signal to a corresponding sound.

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B. Software Module

Application software is defined as a program or program group intended for end-users. Such systems are divided into two classes: software framework, and software application. Though system software consists of low-level programs that communicate low-level with computers, application software resides above system software and includes applications such as databases, word processors and spreadsheets. Application software can simply be referred to as an application. In this proposed system, two applications are involved.

- *Helper App for RPI:* It is involved in viewing the live pictures which is captured by the USB camera which is made available in the trusted person mobile. Here live pictures are shared which occurs as one picture at a time and it gets deleted automatically such that storage problems are solved. This application works in the presence of internet. Thus it is one of the IoT integration app involved in this proposed system.
- *Caller App for RPI:* It is involved in calling the trusted person in case of emergency. It is connected to raspberry pi kit via Bluetooth. Turning on the Bluetooth in mobile, the emergency button gets connected with this application and thus in the case of any emergency, when the panic button or the emergency button is pressed, automatically the call is placed to the trusted person. This is done by initially saving their mobile number within the application.

C. Interfacing of the System

The software applications namely the caller app and the helper app are interfaced separately. The helper app is made available in the trusted person mobile and this application gets started by connecting with the internet. The caller app is installed in the visually challenged mobile and it is started by connecting it with the Bluetooth. The helper application is linked with the USB camera and so the live picture can be seen in the application. The caller application is linked in with the emergency button such that the on accessing the button, call is placed in terms of emergency by saving the mobile number in the application to contact for the visually challenged.

The hardware interfacing is done as such

i. The emergency button is connected to the mobile application through Bluetooth. On accessing the button, the call is placed to the trusted person. Since there are four USB cable ports available in Raspberry pi kit, the USB camera is connected to any one of the port.
ii. Since there are four USB cable ports available in Raspberry pi kit, the USB camera is connected to any one of the ports. Once internet is connected to Raspberry pi, then the photo capturing process takes place automatically. Coding is done with Python Language.
iii. For connecting the ultrasonic sensor with Raspberry Pi, pin 2 and 6 are connected to the Vcc and Gnd. The pins 16 and 18 are connected to the trigger and echo of ultrasonic sensor.

D. Preliminary Steps for Smart Guiding Systems

The followings steps are to be done before the start of travel of the visually challenged.

- The system setup is given to carry along with them
- Connect the Raspberry Pi with internet and Bluetooth
- Make sure to switch on the Wi-Fi and Bluetooth of the Visually challenged android phone
- Connect Power bank with the Raspberry Pi to turn ON
- Check for live pictures in the Helper App

IV. RESULTS AND DISCUSSION

The proposed smart guidance system for sightless challengers comprises of three outputs with each considered as special functions

i. Obstacle detection using ultrasonic sensor
ii. Live pictures transmission
iii. Automatic emergency call

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A. Obstacle Detection

The obstacle is detected using the ultrasonic sensor.

Range	50 cm
Pulse Duration (PD)	Pulse End Time (PET) – Pulse Start Time (PST)
Distance	PD×17150

The distance is actually the output which is intimated to the visually challenged person through earphone. It is done by using text to speech feature of Raspberry Pi. Once the obstacle is detected, the analog output which is obtained as PD is used to calculate the distance. Using Python code, this output is directed to text to speech process of Raspberry Pi and thus any obstacle detected is intimated to the visually challenged using earphone. Fig 3 describes the obstacle detection result.

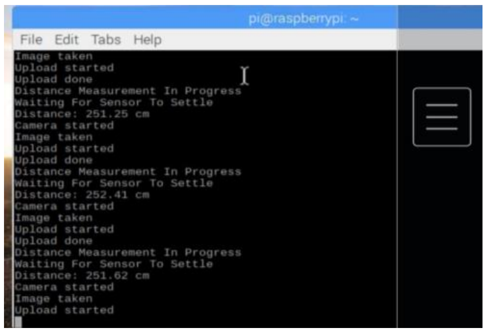

Fig. 3 Obstacle Detection

B Live Pictures Transmission:

The USB camera is involved in taking the live pictures. The main purpose of this live picture is to inform about the activities of the visually challenged to their trusted person. It depicts the travel of the visually challenged. Live pictures are taken in order to overcome the storage problem which is faced while live video is transmitted. Through live pictures, the movement of the visually challenged is under surveillance of the trusted person. So, in case of any problem if they see through the live pictures, they could contact the visually challenged and direct them. The rate of capturing is about one picture per second. This live picture gets deleted automatically to overcome the storage problem automatically for each transmission after one sec. The obtained result is shown in Fig 4.

- Image width = 320
- Image height = 240

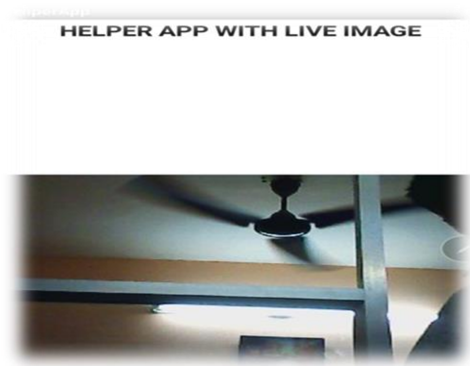

Fig 4 Live picture

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When the Raspberry Pi is ON, automatically the live picture capturing starts and thus similar live pictures are captured from the USB camera. Initially it is saved as JPEG image and then it is send to a drive folder through internet provided by Wi-Fi. The link of the drive can be viewed in the trusted person's mobile. In case of emergency, since the visually challenged are traveling locally, they can be guided by the trusted person using this application. It also ignores the necessity to always travel with the visually challenged to help them.

C Automatic Emergency Call:

This feature is proposed in SGSC system to handle emergency situations. Emergency situation may be defined as situations where the visually challenged might feel uncomfortable. If they face any obstacles they can't resolve, they can use this emergency feature to get in contact with their trusted person to solve their discomforts in that situation. This feature is activated by connecting the emergency button to the caller app present in the mobile of the visually impaired person. This is achieved via Bluetooth communication. In the event of an emergency, if the visually challenged person feels some discomfort when they click the button, the call is placed automatically to the trusted person whose mobile number is already saved in the app.

Fig 5 Trusted person's number Saved in Blind person's mobile app

Figure 5 lists the application's initial interface. This knowledge is initially available in the document. When the emergency button is clicked, the trusted person is automatically called. Bounce time is 1000ms, where bounce time here refers to the time after which the call can be placed again.

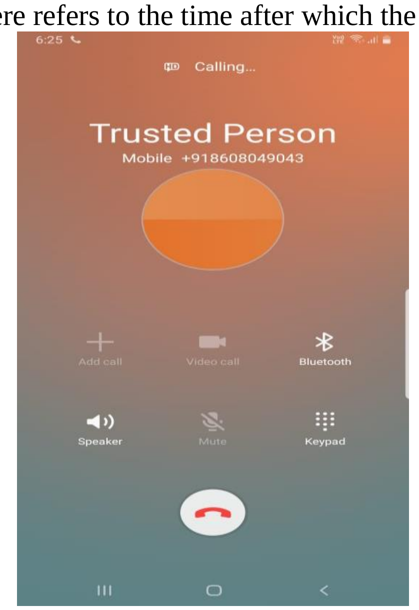

Fig 6 emergency call

Fig 6 denotes the call placed to the trusted person. Thus automatic call is placed at the time of emergency.

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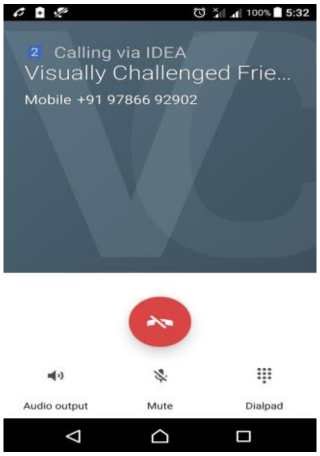

Fig 7. Call received by trusted person

The call received at the trusted mobile person is shown in Fig 7. This emergency call is helpful in addressing the emergency situation and in providing appropriate guidelines to overcome the emergency.

V. CONCLUSION

This suggested system is designed for the visually impaired traveling locally and the Wi-Fi and Bluetooth are turned ON in their smartphone and then the automated process begins collecting and transmitting live images, intimating them if any barriers are detected and calling for them to be in touch with the trusted individual in the case of an emergency.

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