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Design and Implementation of Smart Assistance using Image Segmentation and Reorganization

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Abstract: The most valuable present we can give someone is their eyes, which are also very important to our daily existence. For persons who have vision impairment, Long-term independent walking on the road is made possible by the ingenious support hardware design. The goal of this project is to create a prototype of smart assistance that will allow blind people to navigate and move safely. A smart assistance system for the visually impaired is a system for blind persons built using a vibration motor combined with a raspberry pi board. The camera captures live streaming video which will be further processed for segmentation using Region Growing Algorithm(RGA) and object reorganization by support vector machine(SVM), since the device selects the object's name, translates the speech and then produces an audio output in the form of commands when it detects an obstruction. The visually impaired individual receives our assistance, enabling the blind person to reach his destination independently. The proposed system aids in accident prediction for the blind boosts self-assurance in those with visual impairments, and assists in obstacle detection for those with visual impairments while they walk so that the user can easily navigate the impediment.

Keywords: Sensor, Navigation, Segmentation, Recoganization, Classification.SVM, RGA

I. Introduction

One important aspect of the eyes is that they are sometimes referred to as the "window of the soul."Many individuals experience profound vision impairment, such as the person suffering from low vision, vision loss, visual impairment, or blindness is affected drastically and gravely. Simple actions like turning on an addict, changing their daily routine, or taking a walk are unsuited for someone who is completely blind.The primary problem with those who lack eyes is that it undermines their self-esteem and physical integrity. Every time they move into a new place, they have to commit the locations of all necessities and handicaps to memory. These days, it is impossible to separate technology from human existence since they have become a global phenomenon. This technology can assist the blind in overcoming their fears, just as it can assist the visually handicapped in many aspects of their everyday lives. Individuals who are blind are stated to have trouble moving around without assistance from others, have trouble recognizing obstacles in their path, and experience feelings of unease when they are in unfamiliar surroundings. Their aid is not as flexible or supportive as it may be. The long-term solution enabling visually challenged persons to stroll freely in the street is provided by the design of smart assistance. This cutting-edge technology gives users access to real-time information about their surroundings, such as barriers, shifting terrain, and other possible dangers, by combining haptic feedback with a variety of sensors. Based on Internet of Things technology, this smart belt has a built-in camera, voice assistant, and other sensors. By taking a picture of the obstacle, smart help may alert the user and provide voice support when they approach it. This gadget combines a Raspberry Pi with a camera, voice assistant, and vibration sensor.

Haptic feedback is another way that the user is informed via a smart belt for the blind. To communicate information, haptic feedback uses tactile cues like pressure changes or vibrations to give the user experiences. Along with other environmental details that can interfere with their navigation, this can include information about the neighboring points of interest. Encouraging visually

impaired people to feel more independent and confident in their abilities to manage their environment is the main objective of a smart belt for the blind. These advanced technologies could completely change how visually impaired people navigate their surroundings because they make use of innovative gadgets like haptic feedback and image processing.

Three stages comprise the design of the proposed smart assistance.

- **early phase**

It consists of a web camera, a buzzer, and headphones that make this device designed to alert the user about obstructions in their path. A detector is positioned in the middle of the belt to describe the existence of inhibition on the course of the eyeless individual.

- **Phase of Control**

In this instance, a Raspberry Pi, the piezo buzzer, and headphones activate when the web camera detects something that might be in the path of the user and sets itself up as an impediment.

- **Affair's stage**

It uses a headphone and provides vocal assistance to the user. A piezo buzzer is also included, which sounds when the detector detects the presence of a It uses a headphone and provides vocal assistance to the user. A piezo buzzer is also included, which sounds when the detector detects the presence of an impediment.

II. Literature survey

Teja Chava et al., elucidate a system based on the Internet of Things.The blind's smart shoe system makes use of ultrasonic sensors and an Arduino UNO board. To allow physical objects to communicate with people is the aim of the Internet of Things.For those who are blind, independent travel is quite challenging. In the long run, the Smart shoe design provides a self-sufficient means of transportation for visually impaired individuals when walking on roadways. Because of the Internet of Things, numerous sensors, buzzers, and microcontrollers will be installed in the shoe [1].

Pratik Bhongade et al., in their research work, they introduced a smart shoe with a range of sensors, including those for obstacle, pothole, and slippery surface detection, heat sensing, health monitoring, and more, will be integrated into this Smart Shoe and linked to an Arduino module. To help blind individuals in every way possible, Along with position tracking and GPS-GSM navigation, the project also has an emergency SOS line. Piezoelectric plates provide additional power for the system, producing electricity Whenever an individual who is blind moves, in addition to two batteries, which power the complete setup. Data is provided to the microcontroller by sensors that identify an impediment. After that, the microcontroller processes the data and sends it to the Android app for Smart Shoes over Bluetooth [2].

M. Anisha et al., in this research article, they done to help those who are blind or visually impaired identify barriers. When moving from one location to another, they face significant risks. It is quite difficult to discover the roadblocks when they are traveling. As a result of their ignorance of the barriers in front of them, numerous crashes, accidents, and injuries may occur while they are being transported. The main objective of this project is to develop an electronically aided shoe that will facilitate better transportation for those with vision impairments [3].

Jeffrey Chehade et al., this research work included a discussion on When attempting to move about and navigate, people who are blind or visually impaired have many challenges. This technology is intended to detect patient falls, wet floors, and obstructions. If any of the previously listed circumstances materialize, the user will be alerted auditorily by voice alerts. Five people used the system for testing, and the findings indicated that there were few errors good recognition and accuracy percentages, and an accuracy of about 96% [4].

P. Ebby Darney et al., in their research work the population of blind individuals in India is ranked third worldwide. What is going on around them is invisible to them. Accordingly, a unique mechanism is needed to support them both during their travels and in case they lose their way home. A novel solution called IoT-based Smart Shoes for blind persons has been devised by the proposed study to address this. To a great extent, this can

help blind people and solve previously described issues[5].

V Nandalal et al., explain the most crucial sense is vision. A person is considered blind if they are non-perceptive to light (NLP). Guide dogs were also employed to assist blind people in the past as they moved around with the aid of a white cane. In addition to helping blind people, technology has advanced significantly. The suggested approach facilitates blind people's everyday activities and lessens their pain. The use of ultrasonic sensors allows one to measure the separation between an individual and an obstruction. Because the sensors are built into the shoes, they not only assist us in locating obstacles in our path but also in identifying any holes that may be present for the visually impaired [6].

Pradeep Kumar M et al., this article explains people with visual impairments face a variety of obstacles daily; some are novel, while others are recurring. People who are blind are unable to navigate barriers or independently travel to any place. While the phone module has a GPS, the shoe module has sensors and a lightweight controller device. The shoe module's controller is connected to a Bluetooth transmitter via which it syncs with a smartphone app that guides the user and provides navigation information using Google Maps. The route is drawn out once the user chooses the destination; To encourage the user to stick to the desired path rather than straying from it, the direction is updated constantly. The shoe module's controller receives a similar message, and Bluetooth detects the signal given by the phone module. The main goal of this article is to maintain the device's cost-effectiveness and intelligence. The use program is solid and dependable[7].

Varsha Singh et al., explains Blind people's shoes enable visually impaired individuals to go to their destinations. It offers a proposal for a wearable smart gadget that is automated and suitable for blind individuals. Artificial vision and object detection are two of the general answers that the structure is supposed to provide. Blind people can estimate the space between barriers on their path using ultrasonic sensors. The resultgadget assists the user in receiving the greatest audio track available. The hardware includes an audio playback board with speaker and headphones, an IR sensor, an ultrasonic sensor, a GSM modem, and an embedded system based on the Arduino Lilypad. An Audio Processor employing the APR9600 module produces the speech output and can record, store, and replay eight distinct messages. The user has the option to change the language and convenience of these notifications [8].

Mritha Ramalingam et al., This research presents a smart shoe-tracking individual that is enabled by IoT. Through the use of smartphone applications, this Internet of Things-based innovation helps the VI community navigate and track their location. Rechargeable batteries are used to store the electrical energy produced by piezoelectric sensors, which also transform applied pressure into DC by filtering AC content. The suggested smart sneaker tracks a user's location, detects obstacles, navigates, and gathers energy from walking. The concept put out by the authors in this research describes how the energy produced by a walking VI person is captured and applied to the suggested design. The electricity created from the captured energy is used to recharge the battery pack inside the smart shoeand the phones that are attached to it[9].

Qianli Xu et al., explain that People with vision impairments can receive directional information from a wearable technology. It is made up of haptic shoes and a cell phone. Directional instructions are produced by the former, which also functions as the perceptual and control unit. Sixty individuals participate in a usability test of the prototype system. By contrasting several configurations, it is demonstrated that the system performs differently depending on the type of walking environment and that the suggested design outperforms the benchmarking setup[10].

Iii. Proposed Methodology

The proposed project intends to create a real-time item recognition approach shown in figure 1, to assist the blind and people with visual impairments. The system was constructed with a Raspberry Pi controller, an electronics platform that is open-source and has foundational

hardware and software that are easy to use and serve as the foundation for the smart assistant software. The controller will assist the system in functioning as a little computer that is connected to various sensors in the system, as well as a built-in camera slot. Using the Raspberry Pi 3, the camera module functions as a portable camera. The MIPI serial interface protocol is used by the camera module and Raspberry Pi to communicate. The camera receives information from the surrounding environment in real-time, it will record live video, which the system will then analyze to recognize objects. It is perfect for real-time video applications since it identifies objects based on an SVM algorithm that learns from RGA's segmented image and directly optimizes detection performance. When an obstruction is identified, the device generates audio output in the form of commands by selecting the object's name, translating the voice, and producing an audio output. Enhancing the vibration sensor is another upgrade. When the camera detects obstacles in the user's path, the vibration motor vibrates to alert them.

In this instance, the smart assistance is additionally furnished with a WEBCAM for object detection and facial recognition, as well as an earbud and vibration sensor that combine to provide warnings. The Raspberry Pi Thonny Ide, a freely available electronics platform with easily navigable hardware and software, is the programming language used to create the smart assistance software. The vibration sensor, earphone port, and camera module are all managed by the code.

The purpose of this study is to create intelligent support that will increase the safety and independence of blind individuals navigating their environment. Our device has an advantage over others since it caters to visually impaired people and allows them to stroll in a pattern even when there aren't others around.

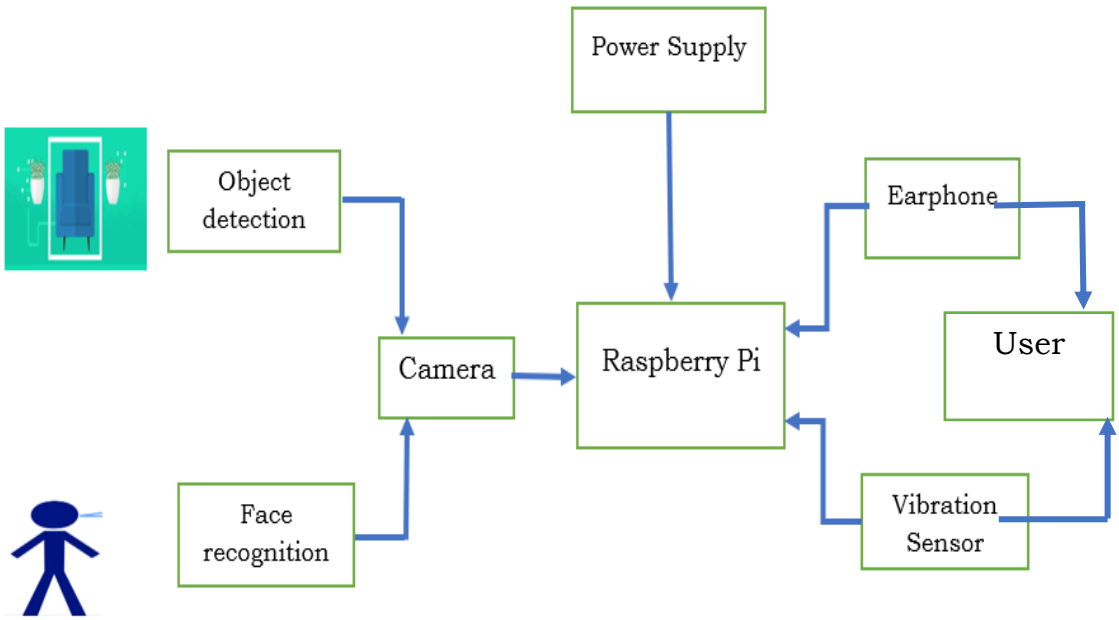

Figure 1: Block diagram of Smart Assistance

Iv. Results And Discussion

We utilized the Raspberry Pi Thonny Ide program to put the commands in this experiment into practice.

Implementation of Smart Assistance Using Raspberry Pi

Set the Raspberry Pi and primary server to their initial settings. The primary server and Raspberry Pi are connected. A session is created when the main server receives the input in the form of a real-time video. This system detects real-time items via a camera video stream input, identifies the object type by segmenting the image and recognizing the specific object based on its trained attributes set, and alerts the visually impaired individual via commands such as audio through

earbuds and vibration. Irrespective of the region on the picture where the object was identified shown in figure 2, the user receives audio feedback that is appropriate for the motion. The blind can avoid obstacles by using the system's specification of them.

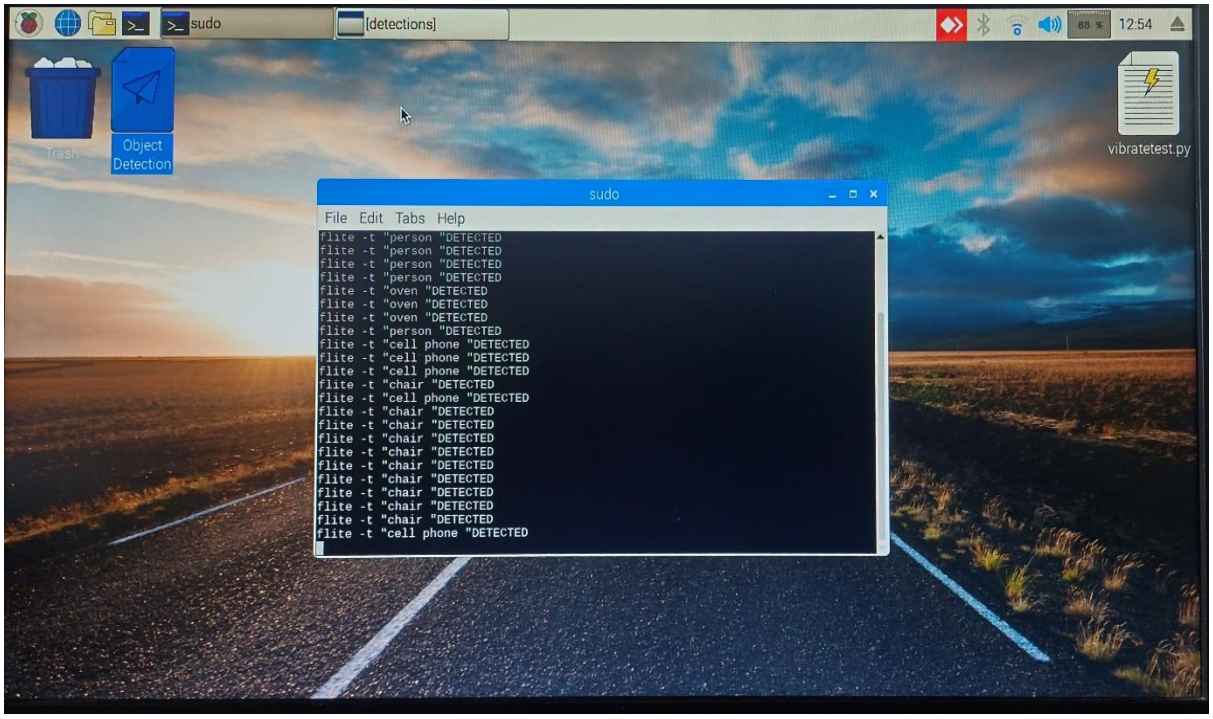

Figure 2: Object Detection Commands

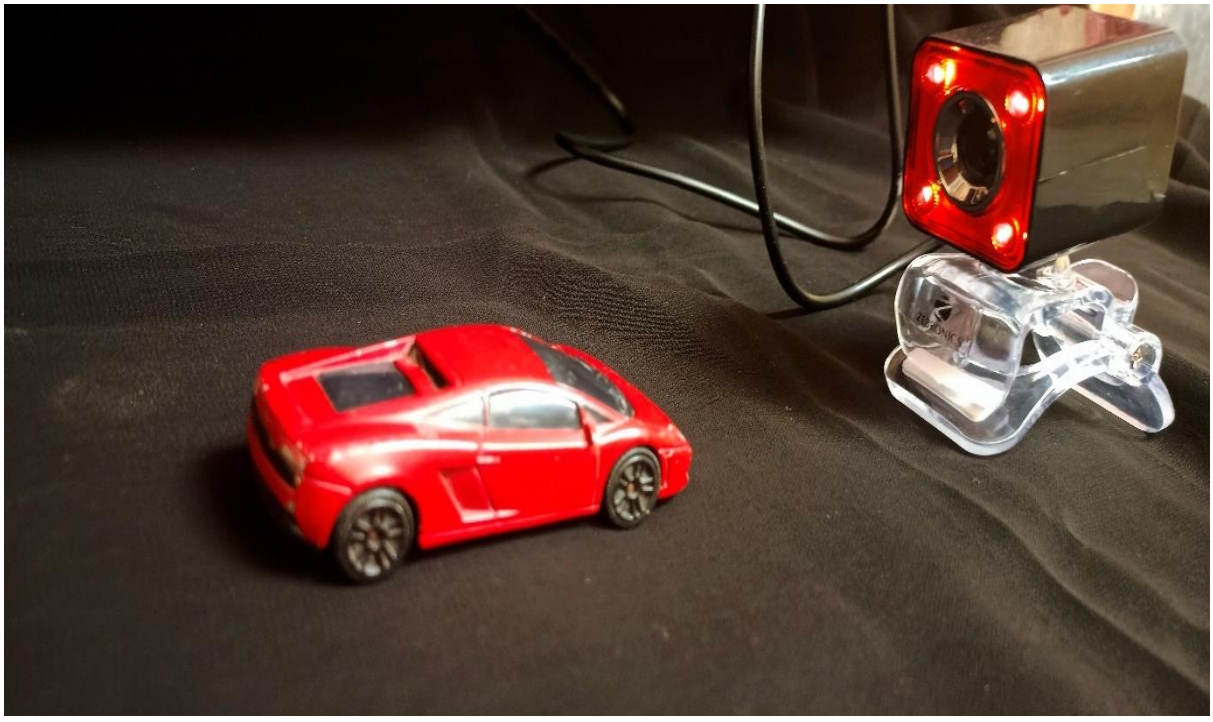

Figure 3: Prototype of Object Detection

Figure 4: Prototype of Smart Assistance

The systems employed in this project are summarized in this section. These outcomes came about after the coding was successfully installed and tested. Connected to the raspberry pi are the

Vibrator motor, camera, and earphones. Figure 3 and figure 4 shows system configuration and a prototype for the proposed work.

.V. Conclusion And Future Scope

On an embedded system, the suggested system is built. The developed navigation aid system will be created where both software and hardware are merged. Voice guiding and camera integration have been used to create the smart help. Research has demonstrated that a well-designed assistance system can accurately detect obstacles and provide those with impaired vision with the necessary information to navigate their journey, avoiding any roadblocks that may stand in their way. Because of their ambition to succeed in everything on their own, blind people are going to be capable of exploring on their own.

In the future, we plan to integrate the GPS within the system we use to assist visually impaired users in locating the quickest and most efficient path, complete with precise position and real-time coordinates, source and destination route information, and more. Similarly, incorporating the use of machine learning algorithms may someday allow the device to identify as well as adapt to the particular requirements and tastes of eachuser.

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