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Blind Navigator

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Abstract: In this hi-tech world the main problem that visually impaired people facing is social restrictiveness. They suffer a lot in unknown surroundings without any aid. Visual information is most basic information for some of the tasks, in this area visually impaired people experiencing some difficulties that necessary information is not available for them. With the advanced technology it is possible to give a support for visually impaired people and make the daily tasks easier than before. This project is using Artificial Intelligence, Machine Learning, Image and Text Recognition. The idea is implemented through mobile app that focuses on voice assistant, face recognition, obstacle avoidance for path planning. Here we propose a voice operated IPA which can process direct commands to perform menial tasks for the users. By using artificial intelligent and image processing, this smart device is able to detect faces and obstacles. The detection process is manifested by notifying the visually impaired person through a voice notification. Text recognition help those people to read environmental messages, words, letters, daily newspapers, and so on to cope up with the social life. Images will be processed in a wearable smart device, it means, in a light and small processing device. It will be an efficient way to utilize the new facilities and technologies to help visually impaired people to interact with the environment without any external aid.

Keywords: Text Recognition, Image Processing, Face Recognition, IPA, Obstacle Avoidance.

I. INTRODUCTION

Blind and visually impaired people have difficulty for moving and carrying out daily task's unknown environment, mainly due to the lake of useful information of the environment. It reduces job and educational opportunities, it reduces the quality of life, and also increase the dependence from the others. The optical character recognition (OCR) helps in recognizing the text from the image. Image from the environment is captured and text recognition is done through OCR. Face recognition helps visually impaired people to recognize people present in their surroundings. The user is able to detect the face from the database and add to the database. The IPA interacting with users only through voice, without the use of screens or physical interaction. It have its own IPA (Intelligent Personal Assistant). we will implement through an app and providing the navigation guidance through the IPA to make the user feel easy interactive experience with the user. In first phase blind navigator application will be get activated using the command "**open app**" then the camera starts tracking the images from the surroundings. The captured image will used for the second phase that are face detection, object detection and text reading. These processes are complete by the help of IPA (intelligent personal assistant). If a familiar face (face already stored in data base) captured on the camera the app will identify the person and tell to the user by voice assistant. The captured image is used for the object detection. After that the pose estimation of the target take place. Next is the 2D construction of grid using this the path planning is proceeded. IPA will be guiding the user with correct navigation path. OpenCV is a library functions are using for object detection. In third phase if the user gives voice command as "add face" the face detection process take place. Here from the captured image proper portion of the face will be cropped and resized. The image will be searched in the database. If the image is matched with the data the output will be given as "The face is already added" if there is no matching face in the database IPA will ask to give a name for detected face. Face recognition part are implementing by the help of Amazon Rekognition. In the fourth phase if the user gives voice command as "read text" with the help of OCR the text captured in the camera are identified and with the help of TTS (text to speech) conversion of text to speech takes place. The converted speech will be given output through voice assistant.

II. THEORY

A. Android Smart Phone

Smartphone should have at least 8 Megapixel camera it should be convenient specification for picture quality. Talk about processor the smartphone at least should have Snapdragon 435 processor the system need perform image

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processing so this processor is minimum specification for this project. The performance of this project is purely based on the speed so the smartphone should have 2GB RAM at least.

B. Smart Phone Holder

In this project we are using mobile smartphone for whole process so the smartphone is always working ,so we need to take care of it that's why we are using phone holder. For the efficient performance we need to place the mobile smartphone in very good angle that why it can collect maximum and accurate data. It should be very compactible and cheap

C. OpenCV

OpenCV (Open Source Computer Vision Library) is a library of programming functions mainly aimed at real-time computer vision. OpenCV can read and write images from scratch, code base image drawing, capture and save videos, perform feature detection, process images, analyse the image from video and detect object from it, and determine the direction and the motion of an object. It is a huge open-source library for the computer vision, image processing, and machine learning. By using OpenCV, it can process images and videos to identify objects, faces, or even handwriting of a human. Basically in this system OpenCV is using for object detection.

D. AWS Rekoginition

Amazon Rekognition is a deep learning technique that helps to analyse the videos and images to applications. It is highly scalable and also that requires no machine learning expertise to use. With Amazon Rekognition we can identify objects, people, text, scenes and activities in videos and images. In here we use AWS Recognition for face recognition, the successive rate is quite high in AWS recognition in terms of face recognition.

III. RELATED WORKS

Here we introduce each papers based on the technologies used in the Blind Navigator and this are arranged in technologies bases.

The aim of this paper[1] is to assist the visually impaired people using voice assistance to perform their day to day tasks. The main intention is to help those people to read the environmental messages, newspapers, letters and so on to link with the social life. Old times they required Braille type of objects, but its not available for all useful environmental messages. The main aim of this proposed system is to overcome the above problem. RASPBERRY PI and OCR [Optical Character Recognition] sensor are used for automatic recognition of the environmental messages, these messages are converted to speech or audio by utilization of TTS [Text To Speech] which helps to easy interaction with the society. The messages to be read is captured by the digital camera which is fixed with Raspberry pi. The user can edit electronic copies which are converted from documents using OCR. Human voice is artificially produced by TTS and also used for natural language techniques. This paper helps the Blind people to read the environmental message and it makes easy for them to cope up with the society very easily.

The aim of this paper [2] is to build a real-time system that can help visually impaired to recognize people present in their surroundings and external environment. There are many problems faced by the visually impaired people in daily activity, especially to identify the people. The concept of a mobile personal assistant that runs in android smart phone is applied in the proposed system. The input data is a real-time video. The video is taken using 16-mega pixel smart phone camera with a resolution of 1280*720. Gamma correction and difference of Gaussian methods are used to improve the accuracy of the local binary pattern histogram (LBPH) algorithm. It gives the highest accuracy of 87.2% out of 10 trials.

The aim of this paper [3] build a real time vision base system that helps blind and virtually impaired people. An Intelligent Personal Assistants like Alexa, Siri, Google assistant are created to assist there with user. This IPA is build with application call Sphinx-4 and it support 2 languages English and Bengali to perform tasks for the user, Here the system using modified finite state automaton to perform language processing. The IPA using subject/action structure of commands to reduce the size of the word domain. Automatic Speech Recognition helps to understand the voice command from user, NLP (Natural Language Processing) are playing an essential part understand what is being

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complimented in the sentence. This approach have some limitations the size of corpus is smaller it can further improved.

In this paper[4], the main intension is to investigate the reliability of online recognition platforms, Amazon Rekognition and Microsoft Azure, with respect to the changing background, acquisition device, and object orientation. The main focus is on platforms that are commonly used by the public to better understand their real-world performances. Main requirements in this work are three smart phones, one DSLR and one webcam to capture side views and overhead views of objects. Dataset will be provided in which the objects are classified into different categories. The ratio of correct classifications for each object in which ground truth labels will be calculated. This paper introduces a framework to estimate the recognition performance with respect to backgrounds and orientations. Here using deep neural networks, utilize both handcrafted features based on colour, texture, and shape characteristics and data-driven features. This paper analyses the robustness of recognition platforms. After analysing the paper, reported that object background can affect recognition performance as much as orientation whereas acquisition devices have minor influence on recognition.

The main aim of this paper[5] is to develop a navigation system to aid the visually impaired using SONAR. SONAR [Sound Navigation And Ranging] system plays an important role in under water scenarios. This above application is used in detection of obstacle in real-time. The main intension is to create a portable, cost-effective, light weight, unobtrusive, unprecedented system for the blind to enable their movement without assistance of others. The drawback of existing satellite navigation based on GPS is not accurate. The obstacle avoidance strategy is based on the SONAR sensors used. HC-SR04 ultra sonic sensors are used. The samples will be sending by the transmitter section of the sensor and the distance will be measured by the time difference in receiving the waves. The device detects all the obstacles in the visually impaired person's path which requires coverage of 180 degree.

In this paper [6] the methodology is to build a vision-based wearable system that assists blind people in navigation in unknown environments. The system detects walkable space, obstacles and objects of interest and plans a path that allows the user to reach the objectives in a safe way. There are six modules in the system: for floor segmentation, building an occupancy grid, obstacle avoidance, detecting objects of interest, path planning and haptic feedback to the user. The sensor is the stereo camera. Stereo camera has an inertial sensor, an embedded localization system and provides high frame rates. It captures the information from the environment and the processing device Jetson TX2 process the image. The output is given to the user through the haptic feedback belt.

In this paper[7],the main intention is to help the visually impaired people to recognize the text data's and to identify the face of the people around them by using Face Recognition in RASPBERRY PI. The text present on the captured image by the camera assistive text reading helps the blind people to read the text information in the environment, and also it can identify the face of the person when a person enters into the frame by the mode control. In this paper Tesseract Optical Character Recognition [OCR] is use for extraction the text data's from environment, and E-Speak tool is used for TTS[Text To Speech].The main intention is to extract the image data and conversion it into speech for better understanding them to the real world. This proposed system is portable because of Raspberry pi and also it is achieved by using a battery backup, so device can be carry out anywhere easily. Previously stored faces can be identified and inform it to the user by checking the face image in the database. The MATLAB is replaced with Open CV so it results in the fast processing. This technology will be helpful for millions of people who experience a significant loss of their vision.

This paper [8] introduces a wearable system to provide situational awareness for blind and visually impaired people in their navigation purpose. The system includes a camera, embedded computer and haptic device which provide the feedback to the user through vibrations. The techniques used are from computer vision and motion planning to identify walkable space, plan step-by-step a safe motion trajectory in the space and recognize certain types of objects. The camera tracks and captures the images then the images are processed. The feedback is given to the user only through the vibrations. Depth information is used to provide the free walkable space. This is the real time walkable space.

The purpose of this paper [9] is to build a navigation system that helps to guide visually impaired people safely and ease, in an indoor and outdoor environment. This goal can be achieved by the use of an ultrasonic sensor, it determine the position or range of the obstacle. The project proposes a navigation system with a white cane cable of detecting obstacles and provide feedback. The system alert the user with vibration and voice feedback. The user can easily walk with the white cane and continuously get details about the obstacle. ATMEGA16 microcontroller was used to develop the obstacle detection system. The system is user friendly and cost effective, the voice alert and vibration which alert the user until the user moved away from the obstacle.

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In this paper [10], work is mainly based on a novel face recognition algorithm based on the point signature- a representation for free-form surfaces. The face recognition problem is treated as a non-rigid object recognition problem. After registering the range data sets of faces having different facial expressions the rigid parts of the face of one person are extracted. For efficient indexing a model library is created using the rigid parts. Models are indexed from the library for test face. Most appropriate models are ranked according to similarity with the test face. Verification is done according to the ranking. The correct model face can be identified quickly and efficiently.

In this paper [11], the main work is based on a novel face recognition technique for two dimensional subspace learning which is able to exploit the symmetry nature of human faces. The most common method for face recognition is subspace learning techniques. The two dimensional clustering based discriminate analysis by incorporating symmetry regularize into its objective function to determine symmetric projection vectors. The proposed technique is applied to the face recognition problem. Results show better classification performance in comparison to the standard one.

The paper [12] mainly describes the challenges problem, data corpus, and presents baseline performance and preliminary result on natural statistics of facial imagery. By coming years face recognition researches have been developed new technologies. These developments will bring advances in computer vision techniques, computer design, sensor design, and interest in fielding face recognition systems. Such advances reduce the error rate in face recognition systems. It includes 3D scans and high resolution under both controlled and uncontrolled conditions.

This paper [13] is an advantage to better accuracy improvement as compared to the previous system on combining the features face, ear and iris to a single modal to multimodal. This discusses a new research area to introduce ear as the feature for multimodal biometric. This system implements a multimodal. A multi algorithmic biometric system combining ear, iris and face recognition. A secured facial features-based authentication system multimodal biometric system is the major areas of study and it has large applications in recognition system. Single modal biometric system has many challenges with variety of problems. Some of these can be solved with multi modal biometric systems. This system provides better and advanced accuracy. In this work overall accuracy of ear-face facial biometric authentication system will be tested under various facial images.

The purpose of this paper [14] to build a Face Recognition System by holistic approach, Face recognition are basically sub-divided into two-part first part is image processing part and the second is recognition technique. The image processing part is analysing the image and then it detects the face from the image. The second part recognition will identify the face that detected before then give analyse report to the system. The feature-based approach first processes the image and extract the facial features such as mouth, eye, nose etc. As well as other fiducial marks thus reducing the input to a geometrical feature. The face recognition performance is affected by lightning, orientation and scale. Otherwise it have good successive rate.

This paper [15] mainly brings overview of different partial face recognition approaches proposed. Face recognition technology gained attention due to its broad applications. By the scope of image analysis, computer vision and pattern recognition it is a potential research area. The traditional applications of face recognition such as access control, authentication, and surveillance, requires maximum information to attain exceptional performance in recognition. There are numerous methods have been devised for unconstrained face recognition. The partial face recognition has application in broad spectrum.

This work [16] proposes an effective wearable system. This is an IOT enabled navigation system for the blind. It uses a raspberry pi to process a raspberry pi camera and ultrasonic sensors to provide information about obstacles in the vicinity, with the help of audio assistance, for the mobility of blind and visually impaired people. Ultrasound sensor is used to measure the distance of an object to the user. This image is processed. The output is given in the form of the audio signal. It also makes use of a NEO-6M GPS module to provide real time position status. This help the user for easy location analysis in time of distress and project pathways to a particular destination using audio signals and maps. Inbuilt GSM module is used in Raspberry pi to send a distress signal to the authorities concerned by the user.

In this paper[17],the main aim is using spin image for Efficient Object Recognition in Cluttered 3D Scenes. This paper introduces simultaneous of multiple objects in scenes containing clutter and occlusion by using 3D Shape-based object recognition system. The spin image representation recognized on the basis of matching surfaces by matching points and it is a data level shape descriptor which is used to match the surface meshes. In this paper it represents the compression scheme for spin image which results in the efficient multiple object recognition, in which the results showing simultaneous recognition of multiple object from library of 20 models.so this system demonstrate

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the robust performance of recognition in the presence of occlusion and clutter through analysis of recognition trials on 100 scenes.

In this paper[18],the main intention is to utilize the technology for text recognition by using image processing. Image processing and OCR [Optical Character Recognition] is a non-negligible part of technologies of our everyday life because it increases the power of computing and the ubiquity of scanning devices. It is easy to convert the printed document in to digitize document by using OCR, this will very helpful when there will be a large volume of printed materials to be taken in a span of time. In this paper for increasing the recognition accuracy and to improve the efficiency of extracting text from image it demonstrates how the image processing technologies can be link with Optical Character Recognition [OCR]. The proposed system can accurately recognize the text in image which is captured by checking the results of experiments which are demonstrated. This proposed system is very helpful on the basis of time consuming, easy to use, and easy to understand the corruption of text data's.

The main aim of this work [19] is to help the blind to move from one place to another by wearing the navigation device. Microcontroller with speech output is the basis of the system. Urban walking routes information is also given by the system. Ultra sonic sensor helps the blind to avoid the obstacles. They can easily identify the objects in their surroundings camera capture the image and is send to the raspberry pi board which is coded with python programming language. Then by using OCR. It is converted to speech or voice signal. It help the blind to go to out-door environment. This can also use for indoor navigation. Power supply is given through battery. This system has more features than existing system.

This paper [20] mainly aims at helping blind people of all categories to achieve their daily tasks easily by the use of a smart device. Device is able to detect faces, colour and different objects by using artificial intelligence and image processing. Sound alert or vibration is used for notifying the visually impaired person about their detection process. This study gives palpable survey that entails visually impaired people from the local community. OpenCV and python programming and implementation of the project. The algorithms which are used for detecting the objects are investigated by the exertion of this project prototype demonstration also done to show how this smart device could detects certain physical object and how it could send a warning signal when obstacle is identified. This will be a positive addition in the world of health care sector.

IV. CONCLUSION

This Project will help the blind and visually impaired people to easily interact with the unknown environment. The project proposed the design and architecture of a new concept of AI assistant Guiding for blind and visually impaired people. The advantage of the system lies in the fact that it is very low-cost solution to millions of visually impaired people worldwide. By utilizing all new technologies, we can make a brighter future for virtually impaired people and blind people. This will also bring more educational and job opportunities to them. It aims to solve the problems faced by the visually impaired and blind people in their daily life. The system also takes measures to ensure their safety of the user.

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