

Facial Recognition Smart Glasses Integrated with Weather Monitoring System

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Abstract— For the advantage of people who are blind or visually impaired, our research paper highlights the design and development of voice assistance and facial recognition smart glasses integrated with weather monitoring system using Raspberry Pi. Even when their known individual is silent, it aids in recognizing everyone nearby. Additionally, it has some great functions like playing music and web browsing. This concept simplifies their lives and serves as a virtual helper. This gadget has the ability to identify faces of individuals or objects that have already been inserted into our system. It uses our faces as an input and speaks as an output. It uses our visage as an input and produces speech as the output. It also helps user to recognize about the emotion of the people nearby means seeing the face expression of the people the user is able to understand the emotion of that person. Also this paper includes the weather related information that helps the user to know about weather, so if the weather is not good they will be alert. Using the Raspberry PI, an extremely potent system on a chip based on the ARM architecture, we can run our software (SOC). The Raspberry Pi has built-in graphics that it can use to perform graphical computations and run Python and C++ code. In this project, we used ESP32 camera web server, DTH11 tempure and humidity sensor, BMP108 pressure sensor , rain sensor, speaker as buzzer, Google Text-to-Speech, Ultrasonic sensor for object detection, and Raspberry Pi 4 for facial recognition. Our recommended system is superior, incredibly efficient, incredibly cheap, easy to use, and lightweight. Also for facial emmotion of the persong we have used the PCA i.e principle component analysis this is a statical approach used for reducing the no. of variables in face recognition.it helps to extract the most relevant information means feature that contains the image.

Index Terms— Text recognition, Raspberry pi, DTH11 tempure and humidity sensor, BMP108 pressure sensor , rain sensor ,camera , speaker ,ultrasonic sensor, smart devices, G text speech, cable, power supply.

I. INTRODUCTION

A growing number of individuals have visual challenges or impairments over time. The World Health Organization estimates that two hundred eighty five million individuals worldwide are visually impaired or challenged. Therefore, the goal of this research paper is to develop the smart glasses for visually impaired person or the person has tunnel vision i.e shown in figure 1. This research paper shows that the enables people with vision problems to identify obstacles and people with their emotion and also it helps to know about the weather related information so they can be alert , it also helps to know about the distance of the people or obstacles. The face recognition technology and distance detection characteristics will make this endeavor possible. As is well known, there are

many visually impaired individuals who find it challenging to interact with various items and people, particularly those WHO are unfamiliar with them. We are working to create smart glasses that can provide effective and secure guidance to the blind community and people with vision impairments in order to deal with the problem in Figure 1 shows a prototype that we've added in this research paper. It uses a raspberry pi to implement artificial vision using python programming, using an ultrasonic instrument to find objects in front of the user, a camera to recognise faces for the user, a speaker to announce names of people and objects, as well as the distance between people and objects, and a data cable to connect the various components, we have used the dth11 temperature and humidity sensor, pressure sensor and the rain sensor to know about the weather related information. We will use the lane cable as a hotspot for the internet , and we will also using a software for seeing the people on the screen basically it is used as a prototype so that we are able to shown how our project work.

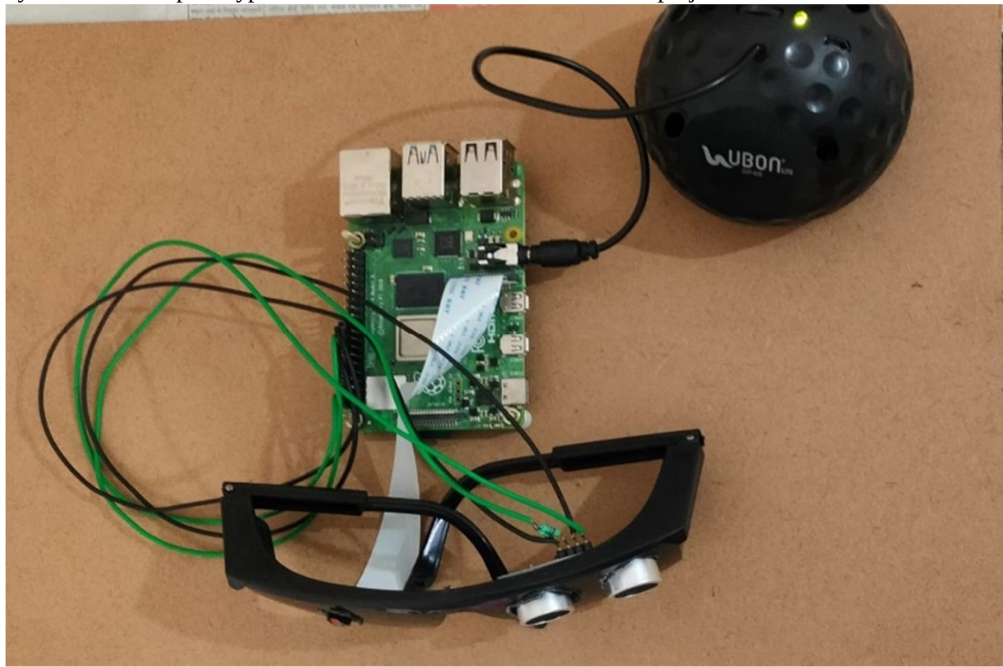


Figure 1. Hardware

II. LITERATURE SURVEY

Constantino A.C et all. [1]., proposed a Key elements in numerous camera-based gadgets and apps are face detection and recognition. Smart spectacles are a type of transparent head-mounted display that feature hands-free displays, first-person cameras, and instant access to computing power that can analyze first-person images in real time while being operated hands-free. In order to do this, we created a prototype application that runs separately on the device and recognizes faces right away. At the system level, we explain the embedded implementation and put a focus on the trade-offs and difficulties that come with creating applications for wearable electronics. The solution has a parallel pipeline that lowers the application's latencies.

Cho et al [3] a single visible-light camera and a convolutional neural network to concentrate on the recognition of faces at night. (R-CNN), achieving a 90% accuracy in dim illumination. As thermal cameras or near-infrared (NIR) light cameras, which can withstand changes in environmental illumination and low illumination, are the primary imaging technologies used in conventional nighttime face recognition studies. The extra NIR illuminator's intensity and angle can be changed for the NIR camera, but it is challenging to do so in relation to an object's distance. In terms of cost, using a thermal camera as a security video is expensive. We suggest a deep learning-based technique for nighttime face detection that only requires a single visible-light camera in view of these factors. Due to image noise and blur, it can be challenging to identify faces in a long-distance night photograph. Therefore, based on the image that has been preprocessed using histogram equalization, We propose a region-based convolutional neural network with two faster steps. (R-CNN). (HE). By running the body and face area detectors in sequence, our method finds the face inside a constrained body region.

Ma et al.[4] By contrasting the effectiveness of the suggested algorithm with other cascade classifiers trained with various characteristics, it is possible to show how competitive the model is. For face recognition, they employ a thermal camera and the local features technique. They also suggest extending Multi-Block LBP.

Daniel et al.[5] suggested an article, According to a study, more than 10 million people worldwide suffer from visual impairment. Many initiatives are made to support and mentor visually impaired and blind people as they go about their everyday lives. Everybody uses language to communicate with one another, but the blind and visually effected person use a special language called Braille. As a result, most schools now teach Braille, enabling those who are blind or visually effected to read and write on their own. Visually impaired people can communicate more effectively by using audible sound to comprehend what is going on around them.

G Kumar, Se Nayak, et al. [6], proposed a paper in that smart eyewear could help a person with vision impairment recognise the individual in front of them and become aware of risks. This is made feasible by the capability of measuring distance and recognizing faces. This prototype's components include an ultrasonic sensor, a 5 volt power supply, a Raspberry Pi 2 microprocessor, a Raspberry Pi 4 with camera, and a set of eyeglasses. The prototype is performing as anticipated, according to the results of their experiments.

N.TIV, S. Kumari[7] and others presented a concept for "Smart Glasses" that are intended to aid the blind and partially sighted. With the aid of a headset that is connected, People who are blind or have other visual impairments can use smart glasses to recognize and recognize objects around them. They want to develop an intelligent system that can recognise objects and transfer knowledge to the brain for blind people. To do this, we use a programme called "NODE MCU," which mimics how the human brain works by analysing images and identifying adjacent objects. A audio message delivered to the blind user in-ear headphones to help them locate specific things quickly and autonomously also secure time & effort. This is a small device that aids in mental scene and image visualisation by using sensors to identify objects.

G. K .Madhan et al. [8] presented a concept for creating a tool for people who are vision impaired. They suggested smart glasses, which work by allowing the person who has some blind or visually impaired issue in which they faces the issue to see through a tiny camera mounted on the glasses to locate and recognise the office furniture nearby. This method helps a blind person locate various items quickly and autonomously by sending an audio message to a headset that is worn on the person's head. It is especially helpful for office jobs. We also save time and effort this way. They created an intelligent system that mimics how the human eye transmits different situations and images to the brain in their paper. The brain then assesses the scenes or images, recognising the surrounding objects using previously stored information. For their suggested concept, they use a little gadget called the "Raspberry Pi," which uses the camera to analyse pictures and scenes in a way similar to how the human brain does it. A sensor that is already a part of this project emits ultrasonic waves that survey a maximum of 5 to 6 metres away at an angle of 30 degrees in the operator's direction. Finally, the visually impaired and the blind were sent a message asking them to speak about the person in front of them depends on each person's behaviour as recorded in the database.

Ali Ag. et. al.[9] completed the assignment for the person with visual impairment face a different level of challenges in their everyday lives, and contemporary assistive technology frequently falls woefully short of consumer standards in terms of price and scope of support. They recommended a different style of smart eyewear that could assist blind children or teenagers. The main objective is to assist with numerous active everyday tasks by utilising wearable smart glass design advantages. Word recognition software that can help with reading from physical documents is the only example application they provide as a proof of concept. The Raspberry Pi 4 single-chip computer serves as the project's computing hub while our Raspberry Pi 4 camera takes pictures at a lower cost. Additionally, the results of their tests indicate that the sample is operating according to schedule.

Fianna et al. [10] In 2014 has created Headlock, a portable device that aids the blind in navigating large spaces. Using Google spectacles and the OpenCV blob identification technique, the device directed to the user to entryway in the quickest and least distracting manner possible.

Hendrik P. B et. all.,[11] describes For blind and visually impaired people (VIPs), a variety of daily tasks, such as locating items and people in an unfamiliar environment and recognising faces and facial expressions, pose serious challenges. Face-to-face contact is one of these activities: During conversations between two sighted persons (SPs), a lot of information is conveyed nonverbally through body language, gestures, proximity to one another, and facial expressions. For instance, it is thought that a person's emotions are closely related to their facial expressions, which also reveal the message they are attempting to communicate. VIPs who lost their vision as children may struggle with social development and, eventually, social inclusion as adults because of their limited ability to access nonverbal information. There are, to our knowledge, very few assistive technologies that

make an effort to help VIPs access nonverbal communication in real time during social encounters, despite the demand from the VIP community.

III. COMPARATIVE STUDIES

Author Name	Year	About paper
Constantino A.C	2015	Proposed a Key elements in numerous camera-based gadgets and apps are face detection and recognition. Smart glasses are a form of optical head mounted display that incorporate first-person cameras and hands-free displays with instant access to processing capacity capable of analysing first-person images in real time with hands-free operation.
S. Cho, Na Rae Baek	2018	Focus on the detection of faces at night using a single visible-light camera and a convolutional neural network (R-CNN), achieving a 90% accuracy in dim illumination

Author Name	Year	About paper
Hendrik P. B	2018	They describes For blind and visually impaired people (VIPs), a variety of daily tasks, such as locating items and people in an unfamiliar environment and recognising faces and facial expressions, pose serious challenges.
G.k madhan	2020	This paper presents a concept for creating a tool for people who are vision impaired. They suggested smart glasses, which work by allowing people who are blind or visually impaired to see through a tiny camera mounted on the glasses to detect and identify the office equipment around them.
Seema Nayak,	2021	This paper proposed a paper in that smart eyewear could help a person with vision impairment recognise the individual in front of them and become aware of risks.

IV. METHODOLOGY

For people who are visually impaired, we suggested a project involving facial recognition smart glasses that are integrated with weather monitoring systems. In our initiative, we are attempting to assist those who are unable to see clearly, who are blind, or who have lost their vision as a result of an accident, but who still desire to work and lead normal lives. In order to help them recognise items, people, and distances, we are working to create a project. We have also included a weather monitoring system that enables blind people to learn about the weather. Thus, the weather monitoring system that is integrated into their glasses will warn them in advance if the weather is not favorable. We used a Raspberry Pi to create this project, which facilitates the implementation of artificial vision using a programming language and PCA, or principal component analysis. This static method is used to cut down on the number of variables in face identification. The feature that includes the image is used to extract the most relevant data. In our activity, Python is being used. The next thing we used is a camera, which is used to take pictures of objects and people and send them to software, making it easier for blind and visually impaired people to identify objects and people when they are in front of them. The third component that we use to measure distance and identify objects is a device that senses objects and anything else that hasn't been uploaded to our system. It only alerts the wearers of the glasses when it detects something and only works when there is something. The power source, which is the fourth component, helps in providing our project with power. The speaker or headphones is the fifth component are used to speak or notify when there is something. Lane cable as a hotspots were used for internet access. And as a prototype and to understand the family if blind people , we used a VNC viewer software to see how our smart eyewear took pictures of us, how it analyzed our faces and objects, and how it informed us through the speaker and headphones. The weather monitoring system, which includes temperature and humidity sensors as well as pressure and rain sensors that alert before rain so that the user i.e blind person gets an alert , it is the sixth component of the system. In basic terms, this system provides the user with information about the weather.

We have also included a methodology diagram in figure 2, which illustrates how easy it is to use this methodology to create prototypes and indicates which sensors are connected to the Raspberry Pi 4 in that figure. The block diagram of our project is shown in figures 3 and 4, and it outlines the actions that would be taken to complete it. Block diagrams provide detailed information about our project, including how input is received, how it is processed, and how it produces the desired results. Figure 4 illustrates how it functions in more detail.

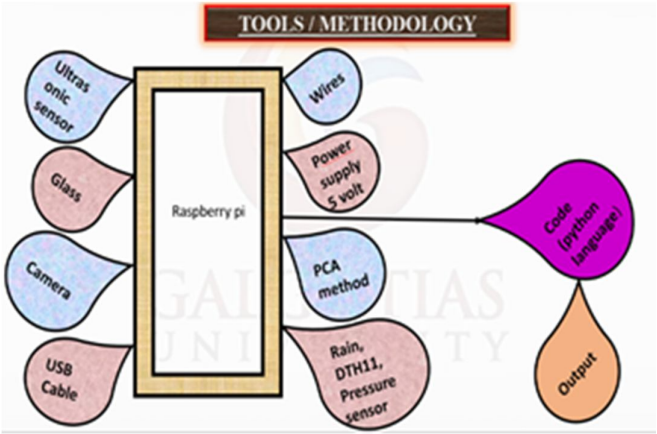


Figure 2. methodology

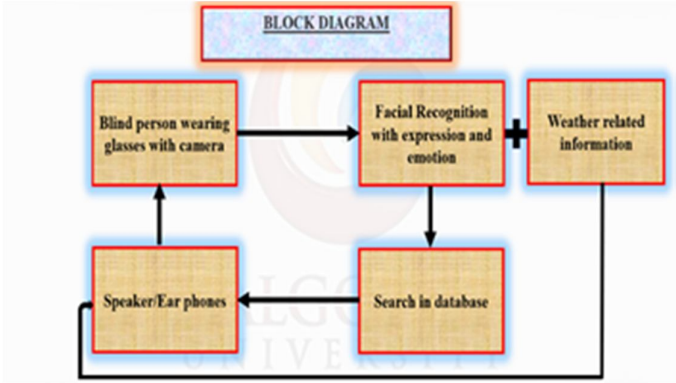


Figure 3. block diagram

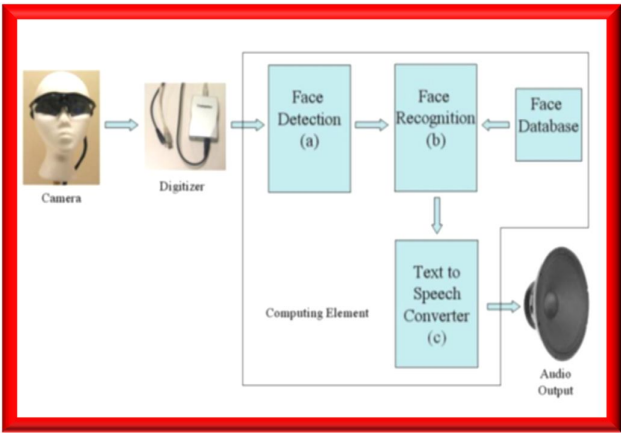


Figure 4. a virtual block diagram

V. COMPONENT REQUIRED

A. Raspberry pi 4 with camera:

The Broadcom Company and the Raspberry Pi Foundation worked together to develop the Raspberry Pi 4 series of small single-board computers (SBCs). The original goal of the Raspberry Pi initiative was to promote the research of basic technology science in educational settings and in developing countries. As a result of being used more broadly than anticipated, the initial model was sold outside of its intended market for uses like robotics. As shown in figure 5, it is frequently used in a variety of areas due to its low cost, flexibility, and open design. Computer and electronics aficionados frequently use it because it supports the HDMI and USB standards. Additionally, the camera aids in object and face detection, uploading and saving the picture in the system for later recognition. The camera also helps with object and facial recognition, uploading and storing the image in the system for later identification.



Figure 5. Raspberry pi 4

B. Ultrasonic sensor:

An ultrasonic sensor is a piece of technology that converts the sound that is reflected back into an electrical signal after using ultrasonic sound waves to measure the distance to a designated object. Perceivable sound travels at a faster rate than ultrasonic vibrations do. (ie. the sound that humans can hear). The transmitter and receiver are the two essential components of an ultrasonic sensor, which produces sound using piezoelectric crystals.



Figure.6 Ultrasonic sensor

C. Speaker/headphone

We are using speaker or headphones to speak names into them. If it can identify the individual, it will say their name; if not, it will say they are unknown. It will also speak the distance between obstacles and people. The picture is displayed in figure 7.

D. Lane cable:

As shown in picture 8. When connecting to the internet using dongles or laptops, we use a port on the Raspberry Pi 4 to attach one side of the lane cable through and one side of the lane cable to the laptop. This lane cable helps us connect to the internet, which makes our project function smoothly as a result.



Figure7.Speaker

headphone



Figure.8 Lane cable

VI. RESULT

Whenever we put the spectacles on a person who is visually impaired and the people who is blind , it's similar to how we discuss the project's outcome. The ultrasonic sensor, raspberry pi with camera, dth11 sensor, rain sensor for weather monitoring, and earphone for receiving the information are then placed on that glass. So if a person or object is in the way of the people and they need to know the weather information, they can be alerted by earphone, headphone, or speaker by saying their names. If a person's photo has been uploaded to the system, the glass can identify them by name and can also tell how far away they are from the people. If a photo has not been uploaded to the system, however, the glass shows the distance but reports the outcome as unknown. The VNC viewer is used to add a new picture, and to view how the camera scans a person or object, we use the same viewer. To do this, we have used code, and after excuting it, our camera opened and began to display the operation as shown in Figures 9 and 10. If a person is known, the name is written on the screen and spoken if the system scans the people and searches our database for that individual. It specifies the name of the person and the name of the thing we need to specify in the code. In order for the code to execute correctly and provide the result, which details the identity of the individuals and the object's location, we must upload an image when we add a new person.

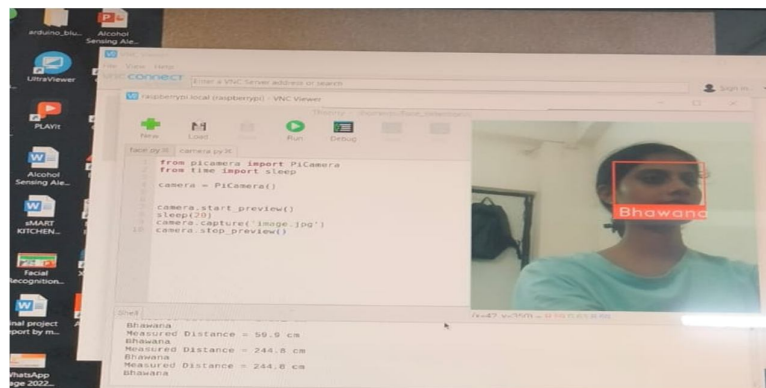


Figure 9. Face recognition using test audio

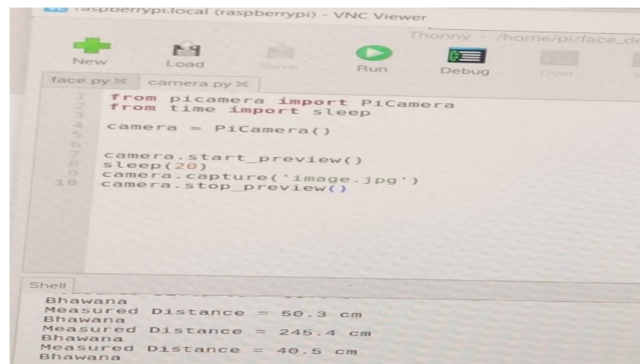


Figure 10. text voice that includes a name and dist.



Figure 11. A gif of project

The situation is depicted in figure 11 in an image where the computer simply observes a human face before searching the database in an effort to identify it. Following acknowledgment, they will be able to identify any staff members or managers who have been permanently added to their database. The earphones that were linked to the project and were used by the blind or visually impaired person helped them to understand this.

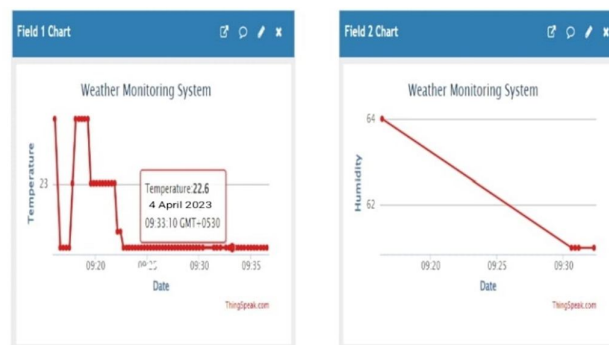


Figure.12. Graph

In figure 12 we have added a graph with the help of things speak that gives about the weather related information and according to the weather its speaks about the weather information so blind people get to know about the weather and they can alert before.

VII. CONCLUSION

Our project uses the low-cost Raspberry Pi 4 microprocessor and its camera to offer a novel idea for smart glasses with facial recognition for blind and visually impaired people. These intelligent glasses were created to conduct text detection as a demonstration. Although the Raspberry Pi SD cards' storage capacity is a limitation,

the device's ability to handle a variety of tasks can be readily increased by integrating additional models into the main code. Each variation represents a distinct purpose or strategy. The clints have the choice to carry out the designated task separately from the others. The system's design, operation, and guiding principles were discussed along with different experiment results. This initiative is assisting a large number of people who have lost their visual faculties, are visually impaired, or were born blind. Additionally, this initiative benefits the students who continue to attend school despite having financial difficulties.

The area for improvement in future work is the ability to immediately execute our assignment without utilising internet. Additionally, we'll endeavour to make it make sense that the system will attempt to identify the things based on some data and info. that has already been provided to it, even without changing the object's name.

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