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Design Of Smart Goggles for Visually Impaired With Audio Features

Mrs. Samatha R Swamy[1], Sujay C V[2], Suhas G R[3], V K Sunidi[4], Varuni V[5],

[2345]Student, Department of Information Science and Engineering, DSATM, Bangalore-88, Karnataka

[1]Faculty, Department of Information Science and Engineering, DSATM, Bangalore-88, Karnataka

Abstract- Researchers have created a variety of technologies that can help the disabled execute their daily chores as a result of the growing population of individuals with disabilities, including the roughly 2.2 billion people who are blind or have vision impairment globally. For persons with low vision or impaired sight, visual improvement through augmented reality (AR) techniques and smart glasses that display traversable directions might be helpful. Individuals frequently employ aural cues based on the direction they should walk. These innovations, including smart glasses with head-tracking displays, can improve a wearer's perception and vision no matter where they look. The main contribution of the proposed work is to design an artificial intelligent fully automated assistive technique for visually impaired people to perceive the objects in the surrounding and provide obstacle-aware navigation, where auditory inputs are given to users in real time. The goggles use ultrasonic sensors and raspberry pi camera to detect objects in the user's path and provide haptic feedback to the user to help them avoid obstacles and monitors the data and plot the graph using ThingSpeak. The device is designed to be lightweight, comfortable, and easy to use.

Keywords- Augmented Reality, smart glasses, ultrasonic sensors, raspberry pi camera, haptic feedback, ThingSpeak.

I. INTRODUCTION:

Visual impairment is a significant challenge that affects millions of people worldwide. It limits their mobility, independence, and ability to navigate their surroundings. According to WHO figures, there are around 285 million visually impaired people in the world, of which 39 million are blind and 246 have limited vision. Around 90% of the world's visually impaired persons reside in low-income areas, and 82% of those who are blind are 50 years of age or older. Technological advancements have led to the development of various devices that aim to enhance the independence and mobility of visually impaired individuals. One such innovation is Smart Goggles with ultrasonic sensors.

All the before solutions have helped (VIPs) overcome their obstacles and increase their mobility, they have not entirely addressed safety considerations when VIPs travel alone. There are also many more systems out there, but none of them enable people with disabilities stay in touch with their family and friends and are frequently challenging and expensive. Handling indoor and outdoor situations, which contain a range of obstructions and the knowledge of the person in front of them, are the main challenges that blind people experience. Recognizing things or people only based on perception and hearing is difficult.

Our proposed device uses Deep learning neural networks are used to train images of objects that are very important to the lives of

people who are blind.

The dataset is enhanced and manually annotated to make the system robust and free of overfitting. Sensors and computer vision-based approaches are combined to offer visually impaired persons a practical travel aid that allows them to sense various things, identify barriers, and prevent collisions.

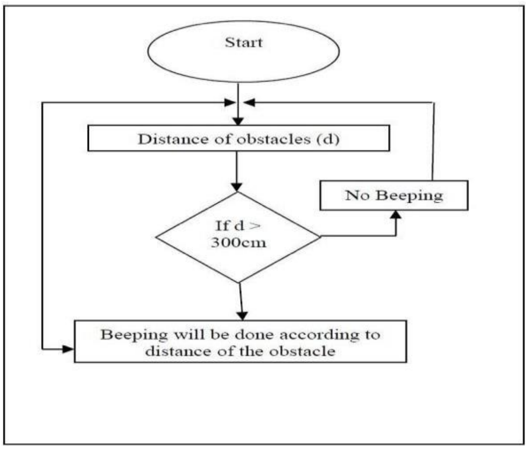
This device consists of a pair of glasses with an obstacle detection module installed in the centre, a processing unit, an output device (a beeping component), and a power source. The processing unit is linked to the obstacle detecting module and the output device. The power supply provides power to the central processor unit. The obstacle detection module comprises primarily of an ultrasonic sensor, the processing unit of a control module, and the output unit of a buzzer. The control unit activates the ultrasonic sensors, which collect information about the barrier in front of the man and process it before sending it to the buzzer. These Ultrasonic Smart Glasses for Blind people is a portable device, easy to use, light weight, user friendly and cheap in price. These glasses could easily guide the blind people and help them avoid obstacles.

II. OVERVIEW OF DEEP LEARNING

Deep learning is a subset of machine learning that uses artificial neural networks with multiple layers to learn and extract features from data. The term "deep" refers to the number of layers in the neural network, which allows for more complex and abstract representations of data to be learned.

Deep learning has gained significant attention and popularity in recent years due to its ability to achieve state-of-the-art results in various applications, such as image recognition, natural language processing, speech recognition, and robotics.

A.Data preparation: Collecting and pre-processing data to prepare it for training.



B. Model architecture: Designing the neural network architecture, including the number of layers, types of layers, and activation functions.

C. Training: Feeding the data into the network to learn and optimize the parameters through backpropagation.

D.Evaluation: Testing the model on a separate set of data to evaluate its performance.

E.Deployment: Using the trained model to make predictions on new data.

III.DETECTION OF OBJECTS AND OBSCTACLES

There are smart ultrasonic glasses available for those who are blind. consists of a pair of wearing glasses, ultrasonic sensors, a buzzer to signal the user's direction of an obstacle, and an Raspberry pi serving as the brains of the system. When the obstacle is close enough, the Raspberry pi gets data from the sensor, analyses it in line with the coding, and generates the buzzer-based signal. When the central device is powered, information is transmitted to the wearing glasses and buzzer. The sensor is attached to the optical glasses between the top bar and bridge. A single-strand USB cable is used to connect each component to the main unit. As the blind man approaches the impediment, the sent distance of the sensors to the central unit will shorten. As a result, the buzzer will beep more often and for shorter periods of time. But when the man moves away, the beeping will become less frequent. This technique use a sensor to find distant objects. The sensor will sound a warning to the user if the object is within 300 meters. Additionally, the sound effect gets louder as it gets closer.

Figure 1: Flow of process

The **Figure 2** shows a obstacle which is been detected by the ultrasonic sensors and the buzzer will beep as soon as the object is found.

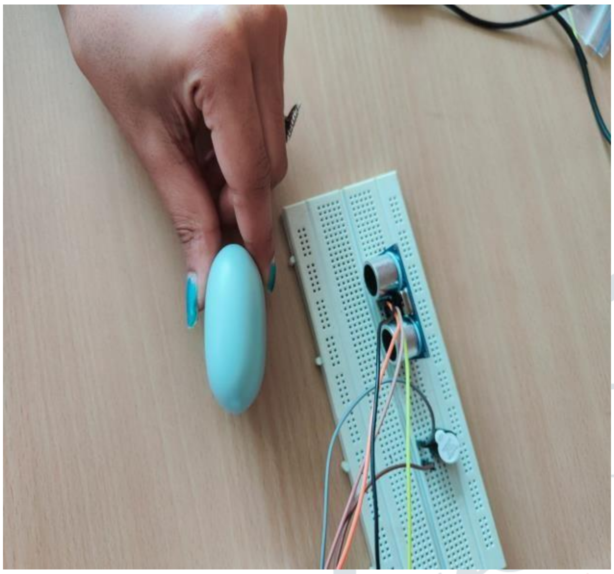


Figure 2: Detection of obstacle

IV. LITERATURE SURVEY

Low-Cost Ultrasonic Smart Glasses For Blind [1]

In this paper's gadgets, a pair of glasses with an obstacle detecting module fitted in the middle, a processing unit, an output device, a buzzer component, and a power supply are employed. The output device and the obstacle detecting module are linked to the processing unit. The power source powers the central processor unit. The ultrasonic sensor, control module, and buzzer that comprise the processing and output units of the obstacle detection module are critical components. The control unit activates the ultrasonic sensors, collects data about the barrier in front of the user, analyses the information, and then produces the appropriate output via the buzzer. These Ultrasonic Smart Glasses for the Blind are lightweight, portable, and reasonably priced.The blind could effortlessly navigate and avoid hazards with the aid of these spectacles.

A Unique Smart Eye Glass for Visually Impaired People [2]

In this study, we look at the presence of a particular smart glass developed to enable blind people navigate more effortlessly. It can precisely identify the obstruction and estimate the distance using an ultrasonic sensor and a microcontroller.

Information gathered from the environment is transmitted to the blind individual via a headset. The GSM/GPRS SIM900A module collects information from the internet. When visually impaired people are in danger, a system-connected switch sends an SMS to the subject's guardian with the subject's location, time, and temperature. Wearing smart glasses allows visually impaired people to traverse both indoor and outdoor situations.

Smart Glasses using Deep Learning and Stereo Camera [3]

For safe walking, blind people typically use a cane or highly trained guide dogs. The existing blind cane has the problem of being unable to adapt quickly to changing situations. The cost of managing guide dogs is not free. To address these shortcomings, we offer smart glasses that use deep learning and a stereo camera. The vibration motor and sound of a stereo camera evaluate the distance between the user and the obstacle and then alert the user of the unsafe level. Furthermore, the user's location is communicated through LED to prevent mishaps at night. One of the deep learning algorithms, YOLO v3 (You Only Look Once version 3), is used to inform the type of obstacle to the user. The experimental results indicate that the proposed smart glasses overcome the existing blind guidance system disadvantages and may be helpful when the user recognize and avoid obstacles.

V. METHODOLOGY

Some of the tools and techniques used in the implementation is here:

A.Build Model: It includes the documents needed to create, test, and evaluate the deep learning model.

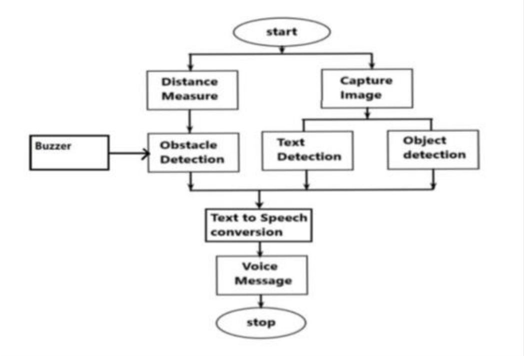


Figure 3: Proposed flow diagram

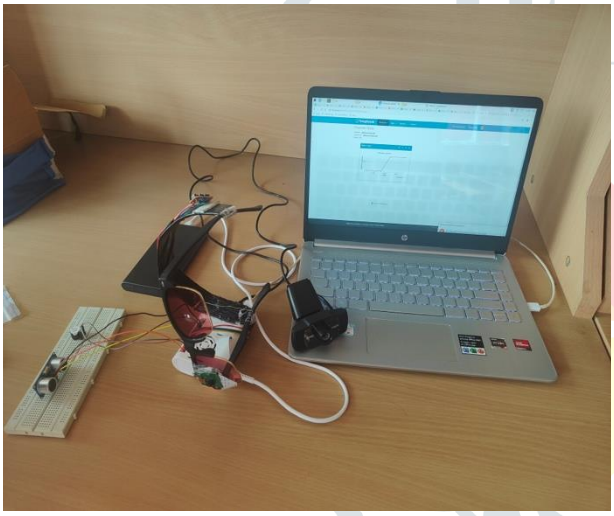


Figure 4: Proposed model

B. Caption Generator: It contains the code to utilize the constructed model to create captions for the pictures in the sample pictures. Using deep learning and computer vision, an image caption generator can identify the context of a picture and annotate it with pertinent captions. Using datasets supplied during model training, it involves labelling a picture with English keywords. The CNN model Xception is trained using data from the Imagenet dataset. The **Figure 5** shows a Image caption generator model

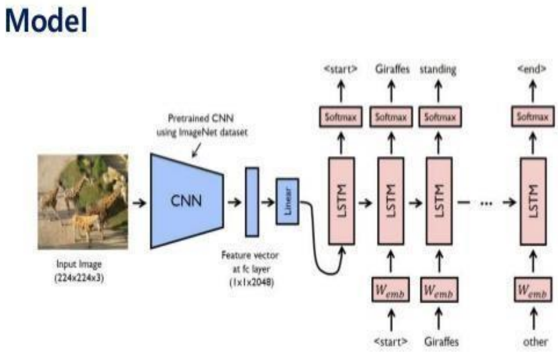
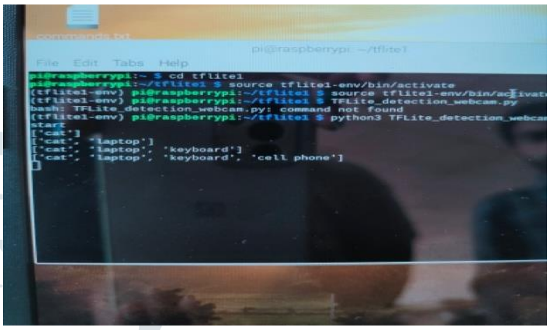
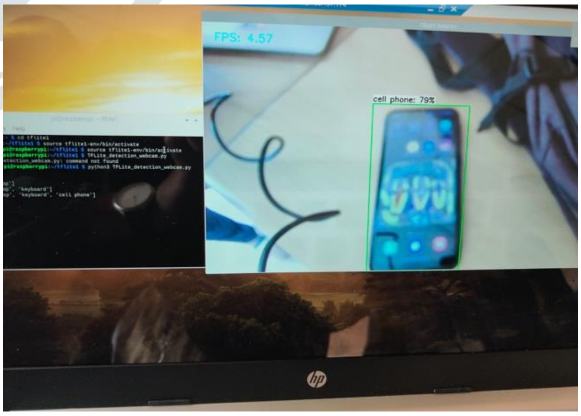


Figure 5: Image caption generator model



C. Convolution Neural Network: Convolutional neural networks (CNNs) are a form of artificial neural networks that are most frequently used in deep learning to analyse visual data. Convolutional neural networks (CNNs) replace generic matrix multiplication in at least one of its layers. to take features out of the picture. This is done using a pre-trained model called Xception.



D. Long-short term memory: An artificial neural network called LongShort-Term.

Memory (LSTM)[1] is used in deep learning and artificial intelligence. LSTM features feedback connections as opposed to typical feedforward neural networks. Such a recurrent neural network(RNN) can analyses whole data sequences, such as audio or video, in addition to single data points like pictures.

E. TensorFlow Lite: On the Raspberry Pi, TensorFlow Lite (TFLite) models execute substantially more quickly than standard TensorFlow models.

TensorFlow Lite is considerably simpler to set up on the Raspberry Pi than standard TensorFlow is.

Figure 6: Image detection using tensorflow

F. OpenCV: The vast open-source library known as OpenCV is used for computer vision, machine learning, and image processing. It currently plays a significant part in real-time operation, which is crucial in modern systems. Using it, one may analyse pictures and movies to find people, objects, and even human handwriting**.**

G. TTS (Text to speech): Text-to-speech(TTS) is a type of assistive technology that reads digital text allowed.It takes the words from computers and convert them to audio.

Figure 7:The objects detected displayed in command prompt

H. ThingSpeak: With the help of the IoT analytics tool ThingSpeak, you can gather, visualize, and examine real-time data streams online. Data sent by your devices to ThingSpeak is instantly visualized by ThingSpeak. You can perform online analysis and analyze data as it comes in with the option to run MATLAB code in ThingSpeak.

ThingSpeak is frequently used for prototyping and proof-of-concepts system.

The **Figure 8** shows ThingSpeak showing real time data from ultrasonic sensors

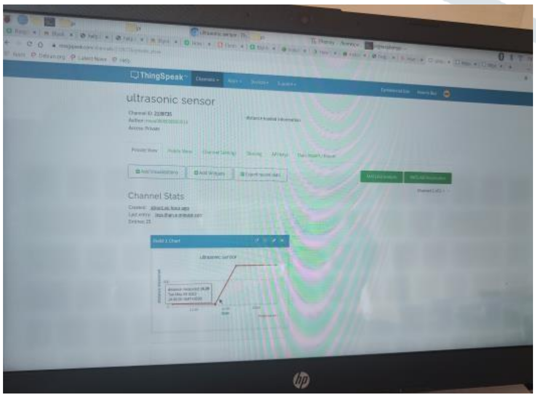


Figure 8: ThingSpeak

VI. CONCLUSION:

Our Smart Goggles are designed to alert a blind individual who is unable to see anything about an accident. Applications in the future might include systems for image recognition that notify the user when an object is present. This work creates an application system that enables people with visual impairments to change their environment while donning smart goggles with the aid of TTS and deep learning. The trial findings show an overall recognition rate of 96.3% and a typical delay of 3.788 seconds between the smart eyewear and speech output. The application system is designed to make it easier for persons with visual impairments to interact with more live objects and comprehend a foreign environment.

VII. FUTURE WORK:

While team members were working on the implementation, we thought of many ideas and improvement for our glasses. Smart goggles can be improved in the future for blind people and people with vision difficulties by adding new technologies. For example, direction and warning messages to prevent accidents on the road,

messaging system to tell user about the battery life, provide live GPS tracking facility reduce the weight of the goggles.

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