# DigiEye – An Intelligent Assistive System for Visually Impaired People

**Prof. Vrushali V. Kondhalkar[1], Ayesha R. Shaikh[2], Yogesh A. Chaudhari[3], Omkar R. Bhandar[4], Gaurav B. Katkar[5]**

[1]*Prof. Vrushali V. Kondhalkar, Dept. of Computer Engineering, JSCOE, Pune, Maharashtra, India*
[2]*Ayesha R. Shaikh, Dept. of Computer Engineering, JSCOE, Pune, Maharashtra, India*
[3]*Yogesh A. Chaudhari, Dept. of Computer Engineering, JSCOE, Pune, Maharashtra, India*
[4]*Omkar R. Bhandar, Dept. of Computer Engineering, JSCOE, Pune, Maharashtra, India*
[5]*Gaurav B. Katkar, Dept. of Computer Engineering, JSCOE, Pune, Maharashtra, India*

---

**Abstract –** *According to WHO (World Health Organization) over 280 million people worldwide live with visual impairment which prevents them from basic access to written or visual material. They often need to identify objects around them. How do these people see or recognize objects and read? The only way is by touching and listening. That is the major problem faced by visually impaired people, to detect the object without touching it and in this pandemic situation with COVID like deadly virus around, touching any object directly with bare hands is not safe. In past decades, many efforts have been done in developing several devices or techniques to assist the visually impaired. Many of those are too costly or heavy or doesn't help the visually impaired much. So, the goal of the proposed system is to develop an android application that will help them to recognize and identify various objects and currencies, detect faces in front of them, understand image/ scene text in real-time using object, face, text and currency detection and recognition algorithms and get the current location they are at and assist them hence leading to improve independence and ease of its user.*

***Key Words***: Visually Impaired, Object Detection, Object Recognition, Text Recognition, Currency Recognition, Face Detection

## 1.INTRODUCTION

The term Visual Impairment as experts describe refers to total or partial vision loss which cannot be fixed even with any corrective means such as eyeglasses or contact lenses. Vision Loss is most often accompanied by loss of independence and the person needs some sort of assistance to carry out day to day activities. They often need to identify objects around them, from a pen to clothing items to a person, read from a note to a bill. Hence, the proposed system 'DigiEye' is an android application developed to assist visually impaired people. DigiEye has the following features: 1) Object Detection 2) Currency detection 3) Text detection 4) Face detection 5) Current Location 6) Current Time The proposed system 'DigiEye' assist people with low vision or blindness get things done easily without any human assistance. DigiEye uses the device camera to detect objects, faces, text, currency and get current location and time when requested and then the app audibly describes those objects for people with visual impairment.

## 2. PROPOSED SYSTEM

The proposed system is an android application 'DigiEye'. DigiEye is designed for the blind and low vision community. DigiEye App has a range of visual recognition features that enables blind and visually impaired users to independently access visual information around them. It helps visually impaired people detect and recognize text, objects, faces, currency notes and also get their current location.

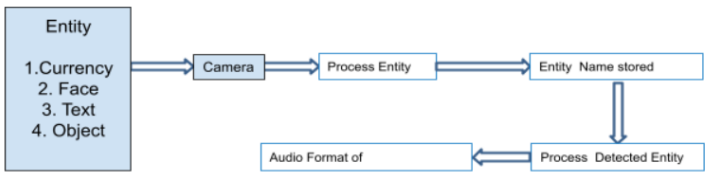
DigiEye enables visually impaired people to detect:

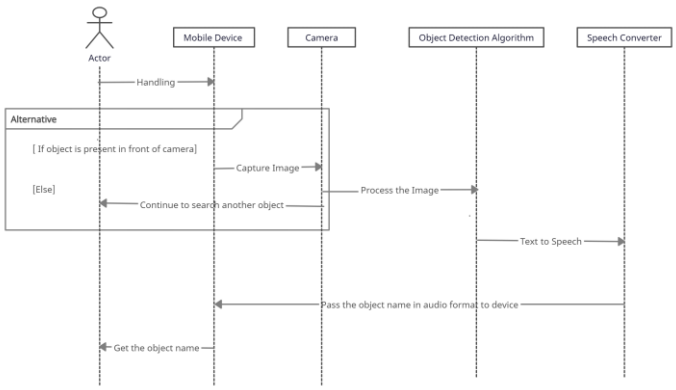
1) Object – quickly detects and identifies the object in front of the device's camera.
2) Currency – Recognizes currency notes in front of the camera.
3) Text – Speaks text detected in the picture clicked
4) Face – Detects faces in the picture clicked

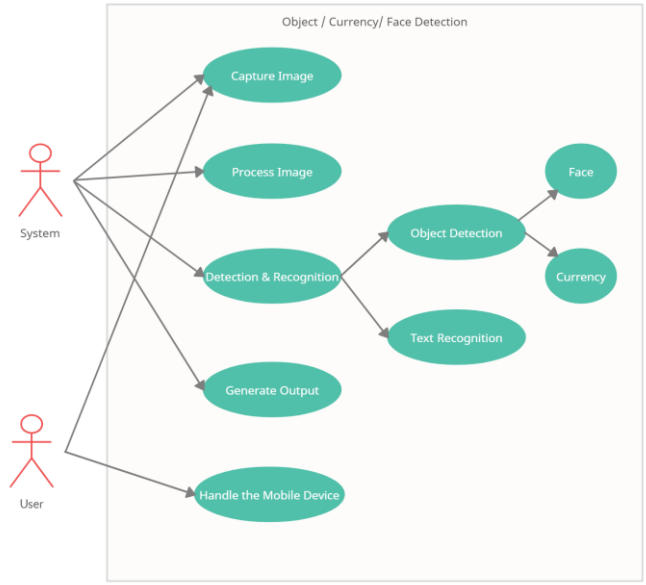
DigiEye enables the visually impaired people to get:

5) Their current location, where they at
6) Current time

## 3. SYSTEM ARCHITECTURE





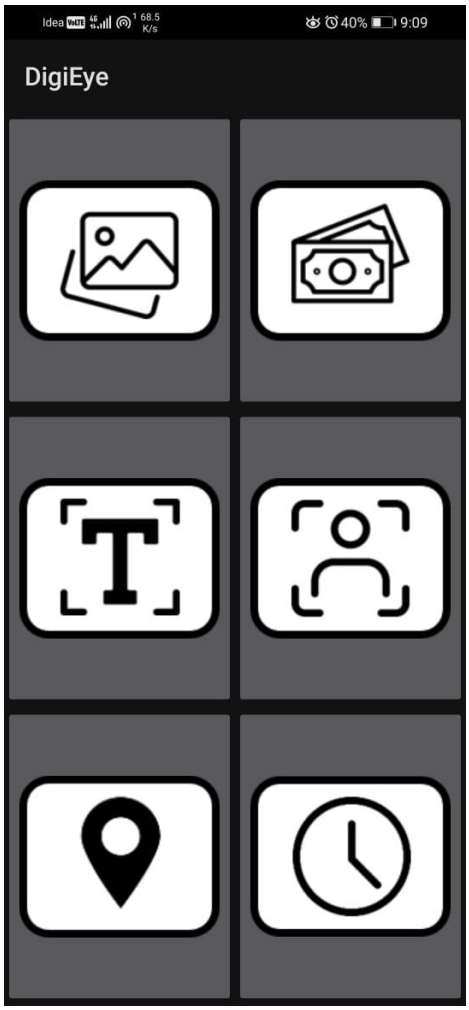




Fig. 1: Application User Interface

## 4. APPLICATION DESIGN

DigiEye is designed keeping blind and visually impaired people in focus. The application is designed by following several best accessibility practices to ensure a good user experience for users who are blind or have a visual impairment.

The peculiarity of User Interface (UI) (Fig. 1) of the DigiEye app –

1. The buttons in the application have large touch targets this makes the buttons easier to distinguish and touch.
2. Adequate colour contrast is used for the UI elements
3. On every button click, voice assistance is provided which help better understand the use of the button

## 5. IMPLEMENTATION

Features of DigiEye application are:

1) Object Detection
2) Currency detection
3) Text detection
4) Face detection
5) Current Location
6) Current Time

### 5.1 Object Detection

For the Object Detection module, we have used Tensorflow lite. Tensorflow is an open-source software library used for machine learning applications such as neural networks, etc. In TensorFlow, we have used the TensorFlow Object Detection API which is an open-source framework built on top of TensorFlow that makes it easy to construct, train and deploy object detection models.

There are already trained models for detecting objects in that framework.

It includes a collection of pre-trained models trained on various datasets such as the

1. COCO (Common Objects in Context) dataset
2. KITTI dataset
3. Open Images Dataset.

Input: An image that consists of one or more objects.

Output: One or more bounding boxes (e.g. defined by a point, width, and height), and a class label for each bounding box. Again as our end-user is visually impaired we are providing an audio output of the detected object

### 5.2 Currency Detection

Just like the Object Detection Module we have used TensorFlow to detect currencies

We have trained a separate TensorFlow model to detect various currencies.

Input: An image of currency.

Output: Our end-user is visually impaired we are providing an audio output of the detected currency

### 5.3 Text Detection

Text detection and recognition is a task of extracting text data in a machine-readable format from still images, video frames, live video stream and scenes.

In this application text detection module uses Google's ML Kit. With ML Kit's text recognition APIs we can recognize text in any Latin-based character set. We can recognize text in images, such as text in street signs, price tag, social media post etc.

ML Kit's Text Recognition provides both on-device and cloud-based APIs. Here we are using free on device API.

Input: Image with Text

Output: Extracted text from image

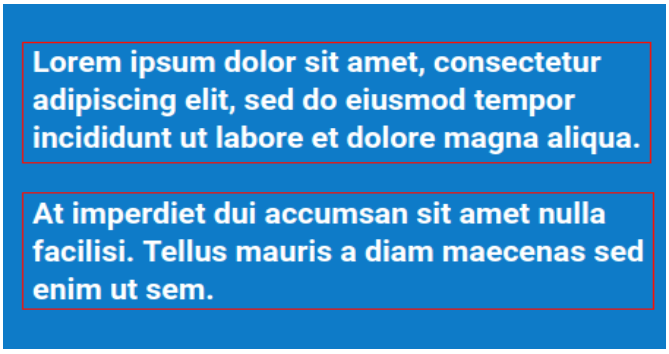



Fig. 2: Text detection

### 5.4 Face Detection

This module uses Google's ML Kit to detect faces. With ML Kit's face detection API, we can detect multiple faces in an image and identify key facial features. We also get the contours of detected faces.

Key Concepts

1) Landmark :
   Landmarks are the intersection points within a detected face. Some Examples of landmarks are the left eye, right eye, and base of the nose. Google's ML Kit provides the ability to find landmarks on a detected face
2) Classification :
   Classification determines whether a certain facial characteristic is present. For example, a face can be classified by whether its eyes are open or closed, or if the face is smiling or not.
3) 3.Contour:
   A counter is a set of points that follow the shape of a facial feature. ML Kit provides the ability to find the contours of a face.

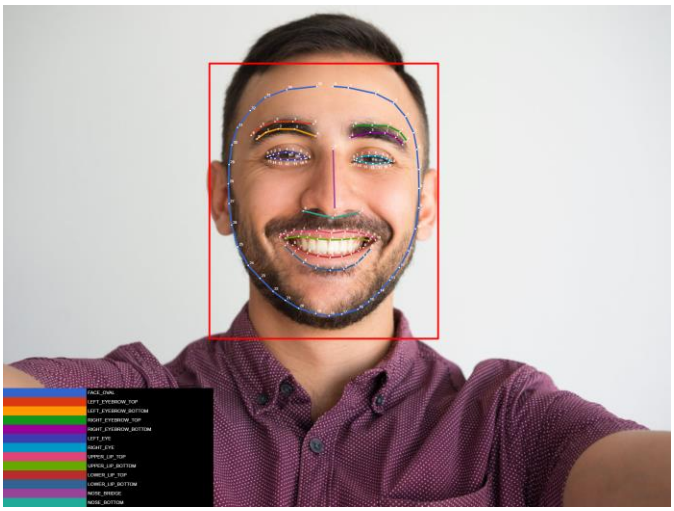


Fig. 3: Face Detection

### 5.5 Location

The application uses Google Location Services API to get current location of the user. These services allow applications to get periodic updates of the device's geographical location.

1) LocationManager.GPS_PROVIDER: It determines location using satellites.
2) LocationManager.NETWORK_PROVIDER: It determines location based on availability of nearby cell towers
3) Android Geocoder class is used for Geocoding and Reverse Geocoding. Geocoding is the process of transforming any address into latitude and

longitude. Reverse Geocoding is transforming latitude and longitude into its corresponding address.

4) Address class helps in fetching the street address, locality, sub-locality, city, country, landmark etc. features of the location.
5) In this application first the latitude and longitude are fetched from the current location of the user, and then by using reverse geocoding the coordinates are converted into the place's address. And then the current address of the user is given as an output in audio format.

### 5.6 Time

To get the Current time we have used the Calendar class from Java.
Calendar class in Java is an abstract class that provides methods for converting date between a specific instant in time and a set of calendar fields such as MONTH, YEAR, HOUR, etc.
To get the exact time we are using the getTime() method this passes that values to the text to speech converter so that the user can listen to the current time.

## 6. RESULT

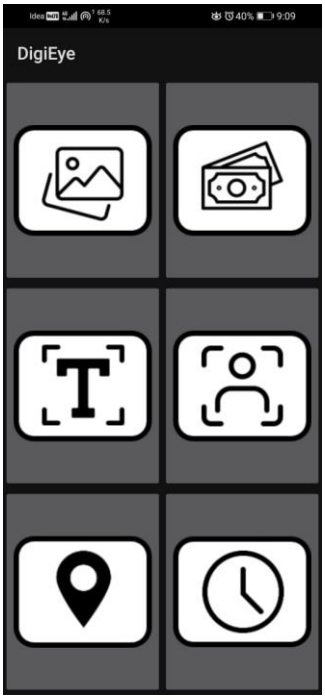



Fig. 4: Application UI


Fig. 5: Object Detection


Fig. 6: Text Detection


Fig. 7: Location Finder

## Actual and Expected Output

**Table -1:** Actual and Expected Output (Object Detection)

| Sr. No. | Expected Output | Actual Output |
|---|---|---|
| 1 | Laptop | Laptop |
| 2 | Bottle | Bottle |
| 3 | Mouse | Mouse |
| 4 | Book | Book |
| 5 | Chair | Chair |
| 6 | Photo Frame | TV |
| 7 | Person | Person |
| 8 | Bowl | Bowl |
| 9 | Refrigerator | Refrigerator |
| 10 | Container / Box | Book |

**Table -2:** Actual and Expected Output (Currency Detection)

| Sr. No. | Expected Output | Actual Output |
|---|---|---|
| 1 | 500 | 500 |
| 2 | 2000 | 2000 |
| 3 | 100 | 100 |
| 4 | 500 | 500 |
| 5 | 50 | 50 |
| 6 | 20 | 200 |
| 7 | 2000 | 200 |
| 8 | 20 | 20 |
| 9 | 100 | 100 |
| 10 | 50 | 50 |

**Table -3:** Actual and Expected Output (Text Detection)

| Sr. No. | Expected Output | Actual Output |
|---|---|---|
| 1 | Hello World | Hello World |
| 2 | Silence is better than unnecessary drama. | Silence is better than unnecessary drama. |
| 3 | Complete multiple tasks with one app | Complete multiple tasks with one app |
| 4 | English Slogans | Englis Slogans |
| 5 | Camlin Notebook | Camlin Notebook |
| 6 | Medical House General Stores | Medical House Oeneral Store |
| 7 | Quality is our top priority | Quality is our top priority |
| 8 | Senorita | Senorita |
| 9 | Om Medico | Om Medico |
| 10 | Raj Stationary | Raj Stationary |

**Table -4:** Actual and Expected Output (Face Detection)

| Sr. No. | Expected Output | Actual Output |
|---|---|---|
| 1 | 2 | 2 |
| 2 | 3 | 3 |
| 3 | 0 | 0 |
| 4 | 1 | 1 |
| 5 | 3 | 2 |

**Table -5:** Actual and Expected Output (Location)

| Sr. No. | Expected Output | Actual Output |
|---|---|---|
| 1 | IDBI Bank, Patil Plaza Near Jashree Talkies, Chinchwad | IDBI Bank, Survey No. 4628, Patil Plaza Near Jashree Talkies, Pimpri Chinchwad, Maharashtra 411019, India |
| 2 | Medical Store Kothrud, Kothrud, Maharashtra 411038 | Medical Store Kothrud, PMT depo, dhankude corner, opposite to Kothrud, Kothrud, Maharashtra 411038, India |
| 3 | Army Public School Dighi, Alandi Road, VSNL Old Colony, Kalas, Pune, Maharashtra 411015, India | Army Public School Dighi, Alandi Road, VSNL Old Colony, Kalas, Pune, Maharashtra 411015, India |

## 7. Future Scope

In future we hope this application helps many visually impaired in easing their life by assisting them with their day-to-day activities.

This work can be extended by adding additional functionality such as:

1) Multilingual Support: As of now the proposed application only supports English language and audio-visual outputs given to the end user are in English. This functionality can be updated and application can be made available in multiple languages so that worldwide users can get output in their native language and can benefit from the DigiEye application.

2) Face recognition: The application will detect and recognize and save faces in the image taken. So that the user can get to know who is in front of him/ her.

3) Accuracy: As of now the application has accuracy of 60-70% for modules like object detection, text detection and currency detection. In future accuracy can be increased by implementing advanced future researches.

## 8. CONCLUSIONS

In this paper, we have proposed an intelligent, portable assistance system to assist visually impaired people. A robust application which is integration of techniques like object, text, and currency detection and recognition. The application is mobile based because today almost everyone uses smart phones. It is easy to carry and user friendly unlike other assistive systems and devices. There are many standalone assistive systems and devices which work on an individual challenge faced by the blind people. But maintaining and carrying all those heavy and costly devices together is very hard, here the user gets overwhelmed and confused. Hence, the main focus is to incorporate all the techniques and technologies under one roof which promotes ease of use, independence and usability resulting in improved quality of life.

## REFERENCES

[1] Prof. Vrushali V. Kondhalkar, Ayesha R. Shaikh, Yogesh A. Chaudhari, Omkar R. Bhandar, Gaurav B. Katkar, An Intelligent Assistive System for Visually Impaired people 2020-2021 International Reasearch Journal of Engineering and Technology (IRJET, April 2021)

[2] Reagan Galvez, Argel Bandala, Elmer Dadios, Ryan Rhay Vicerra, Jose Martin Maningo, Object Detection Using Convolutional Neural Networks, Proceedings of TENCON 2018 - 2018 IEEE Region 10 Conference (Jeju, Korea, 28-31 October 2018)

[3] N. K. Srivastava and Satyam Satyam Singh, NETRA: Smart Hand Gloves Comprises Obstacle Detection, Object Identification & OCR text to speech converter for blinds, 2018 5th IEEE Uttar Pradesh Section International Conference on Electrical, Electronics and Computer Engineering (UPCON)

[4] Kanimozhi S., Gayathri G., Mala T., Multiple Real-time object identification using Single shot Multi-Box detection, Second International Conference on Computational Intelligence in Data Science (ICCIDS-2019)

[5] Siddharth Sagar Nijhawan, Shubham Bhardwaj, Aditi Kumar, Geeta Nijhawan, Real-time Object Detection for Visually Impaired with Optimal Combination of Scores, 2019 6th International Conference on Computing for Sustainable Global Development (INDIACom)

[6] Akhilesh Panchal, Shrugal Varde, Dr. M. S. Panse, Automatic Scene Text Detection and Recognition System for Visually Impaired People, International Journal for Research in Emerging Science and Technology, Volume-3, issue-6, jun-2016

[7] Rakesh Chandra Joshi, Saumya Yadav, Malay Kishore Dutta, YOLO-v3 Based Currency Detection and Recognition System for Visually Impaired Persons, 2020 International Conference on Contemporary Computing and Applications (IC3A) Dr. A.P.J. Abdul Kalam Technical University, Lucknow. Feb 05-07, 2020