# Chapter 1

# INTRODUCTION

Visually impaired means vision less whether it is totally or partially blindness. Blindness cannot completely solved by eyeglass or contact lenses. Loss of vision is another way of loss of independence.

Visually impaired people are suffering their daily life activities such as walking, reading document, identifying object, recognizing known or unknown person, recognizing medicine, doing shopping independently, even when they go for restaurant, need third person help to read restaurant menu card. According to WHO (World Health Organization) report [1] approximate 285 million people are visually impaired, among them 39 million are blind, 246 million people having less eye side. Now-a-days Digital technology, Artificial Intelligent, Computer Vision and economical image capturing devices are become very popular and powerful. Using this advanced technology and device researchers are making economical and potable system to assist visually impaired people.

The innovation of Optical Character Acknowledgment (OCA) empowers [2] the acknowledgment of writings from picture information. This innovation has been generally utilized as a part of checked or shot records, changing an image into machine understandable code which again convert proper word. Text to speech empowers [3] a content in advanced organization to be incorporated into human voice and provides through a sound framework. This innovation has huge improvement during the most recent decade, with numerous frameworks having the capacity to create an engineered discourse near the regular voice. Investigation in the zone of discourse blend has developed, thus it is expanding significance in numerous new applications. This project depicts the way toward building up a model of a portable application (Android), which can be utilized on any smart phone. It enables visually impaired client to utilize the gadget camera and to get the perusing of the recent composed content in the caught picture. The framework utilizes officially existing OCR and TTS systems to provide best output to visually impaired people.

Reading is essential part in our society. Reading text provides huge knowledge about our enlivenment and helps to navigation. Text can be anything like report, receipt, product package, even restaurant menu card etc. Reading text document is one of the difficult job for visually impaired people. Sometimes document need to maintain privacy like bank document, Tax

invoice, letter etc. which people does not like it to give to others for reading. But because of loss of vision people need to take other help to read those personal documents. The need to read textual and symbolic information become essential in case of blind or visually challenged persons. With this point of view, the system need to detect text from textual and symbolic information and recognize the text character from the captured scene text image and last text or symbolic information convert to the voice message. Some algorithms are used to extract text information from image and text detection. Convert scenic image to text structure is difficult job due to lack of discriminative pixel level, non-text background outliner and different font style and size. So, scene text extraction process having two part such as text detection and text recognition.

Some other daily life activities, identifying medicine is one of the difficult job for visually impaired people. They need every time somebody's help to identify medicine. Taking wrong medicine is dangerous for health. Image capturing based economical device like smart mobile helps visually challenged people to identify the medicine, which is already stored by pharmacist. It also gives voice alert to blind person.

This project also use Eigen value method for recognition of the face of known and unknown person. Family member stores known person images in the database then using face recognition process application detect known person image and provides audio message.

While blind person alone at home and if any stranger arrives at the door then it is very difficult job for a blind to recognize known person or unknown person. A door based camera and mobile based application where known person image are already stored. This system will help blind person to identify known or unknown person through voice command, also this will maintain security.

## 1.1 Objectives of this Project

The main objective of the project is to build an android application for the blind people with the help of which they can read out books, any text any personal document using Optical Character Recognition system and inbuilt camera in smart phone ,it also useful to take medicine get the shop details in the nearby area and many more. The app should be useful for the blind person if any stranger is at door, the app will help the blind person to recognize the person at door. Every time this app provides some audio message to visually impaired people.

# Chapter 2

# LITERATURE SURVEY

In this paper **Akhilesh A et al.,** [4] described navigation system it can be indoor and outdoor using computer vision technology. It able to recognize the printed material, other different front style document. This paper depicts a way to capture some scene image then from this extract text after that it provides audio message. This system is very much useful to visually challenged person.

A handheld PDA-based framework proposed by **J.P Peter et al.** [5] is being produced to help daze individuals in their everyday undertakings. The plan joins in a ceaseless procedure clients' contribution and specialists' exertion. This cooperation is made proficient on account of an expert ready to speak with both sides and to remove valuable information for visually impaired people. The framework must see as a primary circle also added the client taking the preview, content/image discovery, character recognition acknowledgment, criticism to the client, until a helpful yield is come to. Each undertaking is done by calculations coordinating both specialized execution and client prerequisites.

This device proposed by **Chenthamil et al**., [6] a reformative work for building up an assistive guide frame work for visually challenge people. This paper demonstrates a device for identification system and text navigation that will guide partially or fully vision less people. This device involves the sequential operation of colour identification, currency acknowledge. Obstacle detection in inside the house and outside side the house also. This framework incorporates into a single chip that is Raspberry Pi ARM 11(BCM 2836). The content pilot framework is utilized to catches an alphabetic and numeric letter by utilizing a camera module as a picture protest what's more, changeover to content file utilizing OCR (Optical Character Recognition) motor at that point pass on that content file data utilizing the speaker. This identic action framework and content to discourse converter (Content pilot framework) are particularly planned for outwardly disabled individuals, so that they can without much of a stretch utilize the paper without asking for help to others.

A camera based assistive content by **Vasanti .G et al** [7] perusing structure to help dazzle people read content marks and item bundling .It capture surrounding image from that image it able to extract text .This system use one special technology that is ROI.

The proposed framework by **Rajlaskmi P et al.** [8] is a versatile camera based visual help model for tie individuals to recognize money and it can recognize value of the currency

through scanning process .This environment. In Pattern Recognition OCR each character is confined and isolated then the subsequent character picture is sent to use Optical character recognition method to scan this money.

**Krishna K.G et al.** [9] represents a successful method where visually impaired people can get details about a shape of the image through speech signal. In this system image will convert to sound using edge detection.

The proposed framework by **Michael R.T.F et al.,** [10] is a potable mobile phone for visually impaired people. This mobile blind person can use without utilizing keypad, it works through voice command.

The framework by **Adil Farooq et al,** [11] implemented human -computer interface which recognize text, processing speech. This framework uses windows base text to speech conversion and image capturing using OCR) technique to analysis textual information from scanned image. This system use Asprise OCR and Microsoft visual studio using C Sharp.

The proposed system by **Chucai Yi et al.,** [12] provides work to help visually impaired people to read text and package product information using hand held device. To separate the object from other surrounding object in the camera image they use efficient moving type method to ROI in the video by using shaking.

The Framework [13] address facial recognition system for visually impaired people. It is a system to help visually challenged people using this Cane base system. This system incorporates many technology such as GPS, Bluetooth, and face recognition feature. Family member or friends store known person image in the server and this Cane will identify face, send a vibrating signal to the blind person and assist them using audio message.

The Framework [14] designed by **Bhupendra Vishwakarma et al.** camera based glasses for visually impaired people. Using this special glass visually impaired people can recognized face and identify person. Whenever any saved person face comes in fort of camera System start speak using glass base speaker. This framework efficiently event in the complex background like different face position and different light brightness.

In this system **Mr.Ali [15]** explains Matlab programming was utilized to recreate a framework that guides the visually impaired individual to perceive his family and companions facial pictures that are put away in a database, and if a match is found on the database, the framework will declare the name of the individual by means of speakers to the visually impaired individual. Two face acknowledgment calculations will be utilized. The re-enactment considered the acknowledgment of a static facial picture (photograph) and a live facial picture.

The outcomes demonstrated that the PCA calculation performs superior to the HMM. It has a little acknowledgment time and work appropriately under various face introduction.

## 2.1 Existing System

In existing system approach, only colour identification module which identifies the colour object and convert to audio message for the blind person. Other existing systems are text block identification, currency identification, obstacles identification etc. RFID based system which help visually impaired people to find out some object and get details about that object through voice message. Different portable barcode reader designed to help the blind people.

This barcode based portable device identify different product and using its database gives product information through speech or Braille .Pen scanner need to incorporate in these and this system integrates OCR software to provide image capturing and converting image to text and produce audio output. There is a facial recognition tool which identifies face and give audio command to visually impaired people so they can identify unknown and unknown person in front of them. There is a smart cane based system for face recognition. This smart cane recognizes friend and family member using some vibrating signal. Image of love one can store in the SD Card. The visually impaired people get alert through earphone. Camera based glass assist visually challenged people to identify known person and unknown person.

Some existing systems are available for identifying medicine using some hardware device. AccessaMed is a gadget that can be joined to medicines, regardless of whether they're in a container or a crate. It is recorded by the drug specialist through audio message union and an extraordinary program that enables him or her to print the data – precisely as it shows up on the medicine name – to the prescription. Digit-Eyes is an application for iPhone that enables blind user to peruse numerous things, including doctor prescribed solution names, if patient's drug specialist will print a "QR" code that is clear by Digit-Eyes. A QR code is a code fundamentally the same as a standardized tag, just it's not formed like a barcode tag and it installs electronic data. The application enables to utilize telephone's camera to peruse the QR code and after that the data is talked so anyone might hear by the iPhone. The QR code data can be the data that is on the solution name. It can likewise be extra data, for example, notices and precautionary measures to be brought with specific medicines.

The id. mate Quest can be utilized for distinguishing pill bottles – and another item the parent organization [En-Vision America] makes called ScripTalk. This one uses a barcode base

reader and if the medicine does not accompany a standardized barcode tag user can include own scanner tag name [included with the product]. At that point patient can record the data required.

## 2.2 Disadvantages of Existing System

- Most of the existing system need more hardware equipment.
- Carrying all hardware devices is bit of difficult for visually impaired people.
- Some of the cases system will be bulky in size, so it difficult to carry.
- Sometime device cost will be more.
- Barcode base system be difficult to find position of barcode in correct point.
- Scene image are mixed with noise and unwanted thing. To extract text form this type of image is very difficult job.
- Camera based glass system help blind people to identify people but always blind people need to wear bulky glass.
- RFID based system also assist visually impaired people to identify object but most of the place RFID will not available.
- Different language, different front style and front size create more difficult job.
- Third person help is needed to use some of the existing system.
- Wrong doses of medicine can cause dangerous for health for visually challenges person.

## 2.3 Proposed System

The proposed system make easy for daily life activities work for visually impaired people.
i) Using Camera based smart phone and Optical Character Recognition system visually challenge people can read any document and read the text from scene image.

ii) Visually impaired people can identify medicine and get details about through voice command.

iii) Visually challenged person can recognize known and unknown person using camera based smart phone.

iv) They can read shop name while walking and get details about that shop.

v) When visually impaired people visit restaurants without any body help they can read restaurant menu card using their smart phone application. All the feature provides visually

impaired people voice output. This proposed framework not required any additional equipment, just need day by day useable smart phone. Without outsider help dazzle individuals can play out their daily activities.

# Chapter 3

# TECHNOLOGY USED

System essential detail might be a transitionally survey, which outlines those foundation of the outcome change procedure. It proofs those vital of a skeleton and likewise require a representational of its principal high pitch. A SRS might be competent a support seeing on including of a customer or imminent customer skeleton fundamental moreover states amid a particular point of confinement in time for the most part ahead any unmistakable setup on the other hand redesign worth of exertion.

It is a 2-way assurance system that affirmation that both arrangement for instance, customer and the coordinated effort get it elective essential from that perspective amid a particular point of view in time. The setup for altering important lion's share of the information limit change machines, in like manner careful review of the report card may reveal exclusion, wrong desire.

## 3.1 System specification

**Hardware System Configuration**

| | | |
|---|---|---|
| Processor | - | Intel i3 |
| Speed | - | 2.4 GHz |
| RAM | - | 2 GB (min) |
| Hard Disk | - | 80 GB |
| Android Phone | - | Camera based |

**Software System Configuration**

| | | |
|---|---|---|
| Operating System Software | : | Win 7/8 |
| Run time Application Server | : | Tomcat 5.0/6.X |
| Programming Language used | : | HTML, Java, JSP, Java Script |
| Database | : | MySQL |
| Connectivity with database | : | JDBC. |
| Application software | : | Open CV for android application. |

## 3.2 Android Studio

Android is a very popular application development tool for mobile phone, tablet Pc etc. This mainly open source platform. It primarily use Linux environment .The origin of this environment is Google. After many organizations are involved here. This instructional exercise will show fundamental Android programming and will likewise take through some propel ideas identified with Android application improvement. Android writing computer programs depends on Java programming dialect so in the event that you have essential comprehension on Java programming then it will be an amusing to learn Android application improvement. This application very much user friendly ,using this platform developer can easily construct their application .There are many API are available using people can do work fast. This framework can easily understandable.

### 3.2.1 System Architecture for Android

The following diagram shows architecture of Android Operating system.

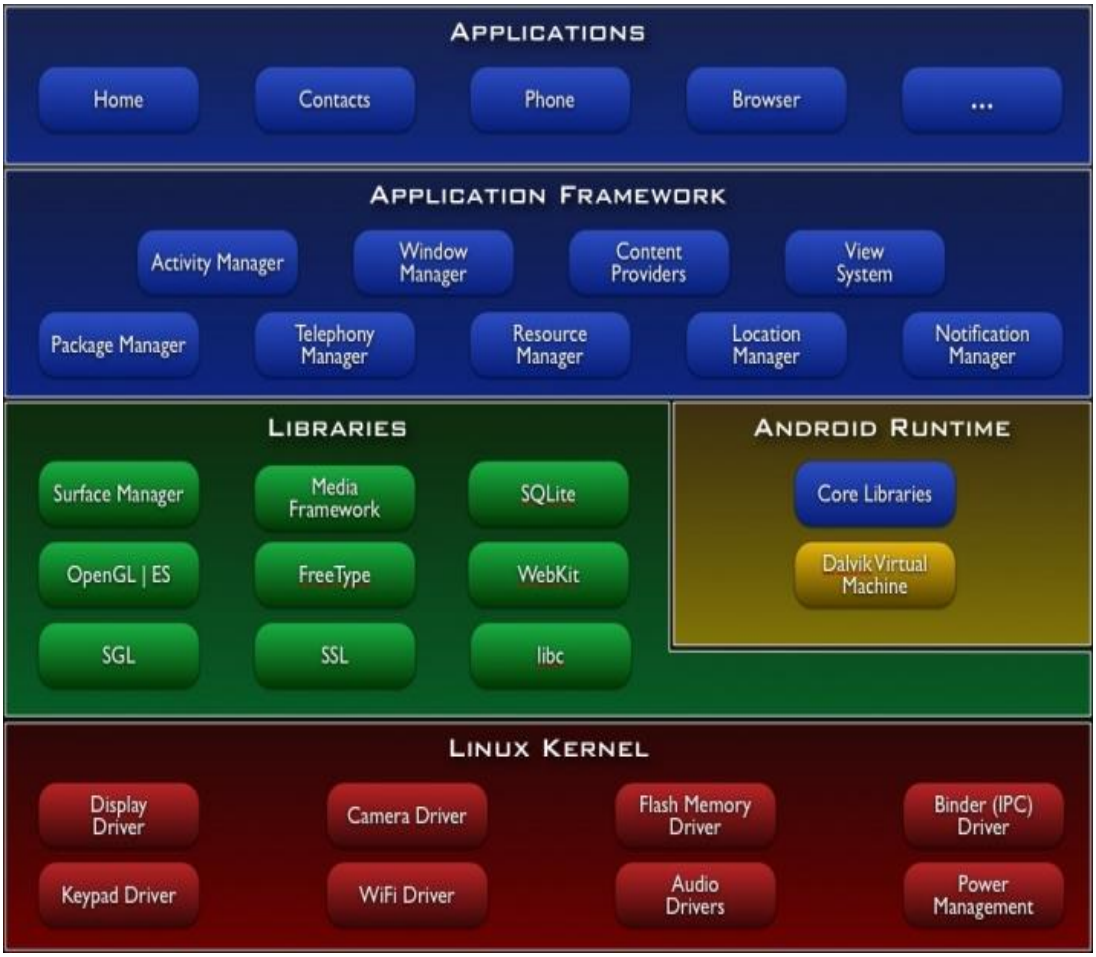


**Fig 3.1: System Architecture for Android**

**The Linux Kernel for Android base Operating system**

The backbone of Android system is Linux. The kernel part maintain all fundamental functionality. Kernel run Android Run time where main function are available such as different thread and administration work are performed. Kernel maintain work such as security, coordinating with different drivers and other module, enable different small hardware etc. Its file system is similar to Linux file system.

**Hardware Abstraction Layer (HAL) for Android system**

Abstraction always hide some design part. Here it cover some interface from Java API. This HAL incorporate different library file which will help to coordinate different segment. Camera, Bluetooth, flashlight etc. are incorporate in this module. In this stage different module call API to activate or integrate with different hardware. This is the main module where hardware communicate with different software application.

**Runtime Environment for Android**

It is an environment where application will run .it mainly used virtual machine concept. It translate the programming language into bytecode machine understandable. Each time it run and dynamically it produce byte code. There is a good feature of application that "ahead of time "which can able to take whole code and compile and produce executable code at the time of installation. So it can able to maintain memory management and garbage collection all the work together.

**Java API Frame work**

Java API develop in java programming language, it provides reusability, module component, modularity of the code and also provide different service. It can able to to provide the service of resource manager where it give access to noncore resource such as localized file, graphic application etc. Notification manager provide alert of different application in status bar. Activity manager maintain lifecycle of the different application. Content manager communicate the one application to another application and along with that it maintain the data flow between different applications. Using View system API developer can see the different working environment such as grid box, UI, list text box etc. To Faster work This API are very useful.

**System API**

System API the service for email, SMS, date management, web application, contact management, hardware resource management. It can accept any kind of application there is no restriction of the feature. Any outsider application can easily run in this environment. Any application can easily turn into client side web application. It easily work with internet base system such as sending email, sending mail etc. Any internet related work developer no need to write separate code directly they can use this service. Especially any SMS application it will work automatically.

### 3.2.2 Feature of the Android

Android feature having user friendly feature. Developer face easy to construct their project in this environment.

- Here source code are open, any person can use it.
- People feel easy to work in this environment.
- Portable application.
- It use Java as core things so it is very powerful environment.
- It maintain security.

### 3.2.3 Application of the android environment

Now a day's Android application is very vast. Its application increased alarming rate. Many of the system transformed into this environment to get easy use. Many user friendly feature are present here. For that reason people choose this platform to develop their project. Integration is very easy here.

There are four component for this application.

Component:

- Activities: They direct the UI and handle the client cooperation to the cell phone screen Administrations
- Service: They handle foundation preparing related with an application
- Broad Cast: Communicate Receivers They handle correspondence between Android OS and applications
- Content provider: Content Providers They handle information and database administration issues.

### 3.2.4 Services provided by Android Platform

Android base framework always run any of segment in the guidance of the administration .It support long running application also. In this system data can flow easily from client to server and vice versa. Data flow not be blocked when one application communicate with other application.

## 3.3 OpenCV

Open source computer vision is a programming platform for computer vision .It is very useful framework in computer vision area. This framework first develop by Intel. It is free and open source platform. It is use in especially artificial neural network, machine learning, Agent construction, automatic robot built, etc. It mainly develop in C++, Python and Ruby. There are lot of API are available as open source. It use many inbuilt which are freely available. But it mainly optimize for Intel processor. In this project mainly used in Optical character Recognition to read image and from that application extract the text. It give us very easy environment to develop project.

- **Core** – This module provides impotent information in structure format. It support multi-dimensional architecture.
- **Imgproc** –Image processing frame work. All geometrical and graphical thing happen here .It can change the shape, create chart, graph etc.
- **Video** - All moving frame processed here .Developer can do lot of work in this environment.
- **Calib3d** – It provides 3D creation al the image .Camera picture it accept and provide 3D reaction.
- **Features2d** – It process on 2D image .Different component locator used here.
- **Object detect** – It works on recognition on object, specially used in robot making to identify object.
- **Highgui** - a simple to-utilize interface to video catching, picture and video codecs, and in addition straightforward UI capacities.
- **Gpu** - GPU-quickened calculations from various modules.

Some other assistant modules, for example, FLANN and Google test wrappers, Python ties, and others. The further parts of the archive portray usefulness of every module. Be that as it

may, initially, make a point to get comfortable with the regular API ideas utilized altogether in the library.

### 3.3.1 Application for Open Source Computer Vision

OpenCV's gives the following facility:

- 2D and 3D image processing.
- Ecological calculation.
- Face identification system
- Environment where human interact with system.
- Moving automatic Agent.
- Motion based framework
- Particle identify
- Image comparing between two camera
- Moving image analysis.
- Moving particle identification.

### 3.3.2 Open CV Functional module

- Graphics and image processing.
- Thing and solid material detection by agent.
- Geometrical function.
- Computational photo processing system
- Computer vision base function

## 3.4 J2EE

It is enterprise version of Java. It mainly used in the web application .There are many protocol available, API, lot of services and functionality .It provides multitier application, support client, server architecture. It is very useful in network environment. It work with servlet, JSP page etc. It able communicate client and server application. It very powerful tool and provides high security.

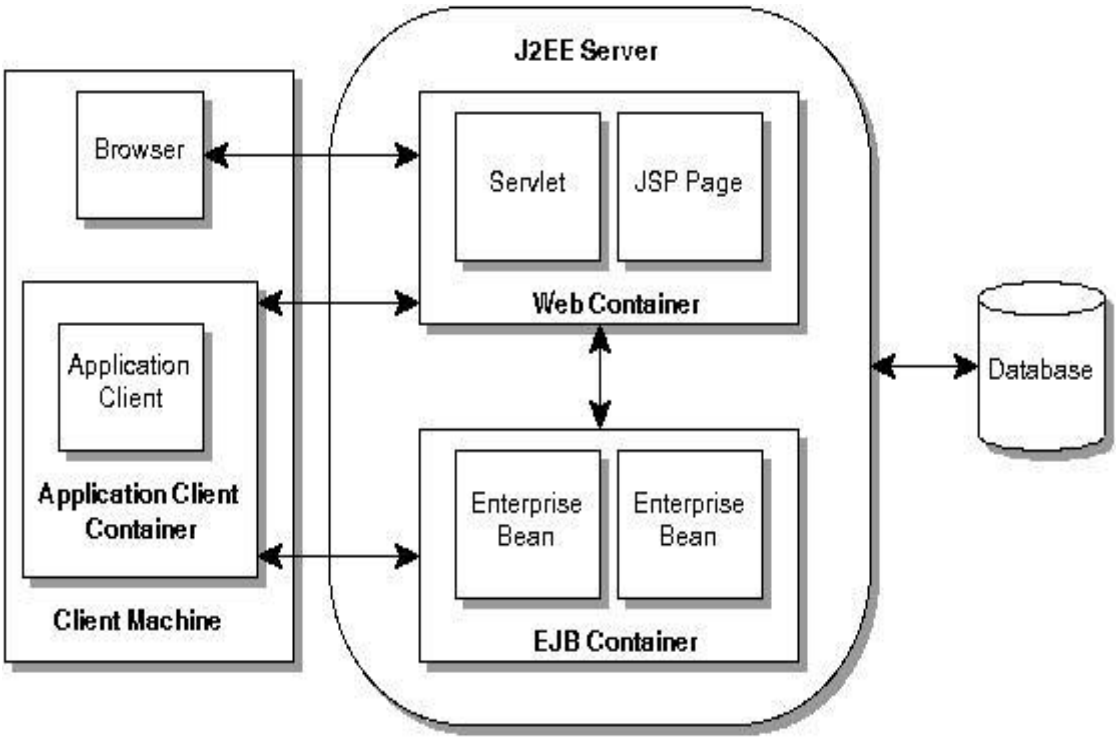


**Fig 3.2: Architecture of J2EE**

## 3.5 The Java Database Connectivity (JDBC)

It is the program for application and it create a situation how client access the database. Mainly used database is Oracle .It use JDBC to ODBC link to connect this enlivenment. There are five steps for this connection.

- First there are some driver class need register and that happen dynamically.
- There is some method get connection which helps to connect database.
- Need to create object statement which helps to extract the queries from database.
- Execute queries is a function which helps to get the response.
- Last step is close the connection.

JDBC provide complete arrangement of database connection. Easy way to access to database. In commercial level ORACLE and JAVA used this environment. This database work both environment two level model and three level structure of database. This connection support SQL and MySQL both of the database.

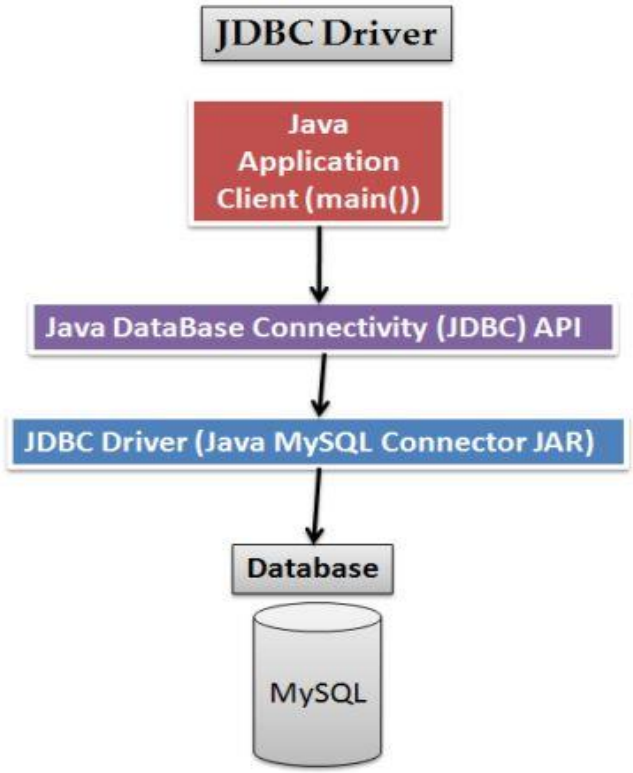


**Fig 3.3: Diagram for Java to Database connection**

## 3.6 MySQL

It is the prevalent Open Source Relational SQL database. This database expose more in online application especially in client server. MySQL is the second generally utilized RDBMS (social information base administration framework) and most utilized open-source RDBMS. The SQL acronym is organized inquiry dialect. MySQL first born in in some Sweden company after that Oracle take of this product.

## 3.7 Servlet

Servlet innovation is utilized to make internet application. Servlet innovation is hearty, versatile due to programming language java dialect. CGI was the first enlivenment which is to provide the service. Be that as it may, there was many hindrances of this innovation. There are many interface such as servlet request and servlet response API give us service. Servlet works on two server application server and Net server. It always run through web.

## 3.8 Text To Speech

Voice blend, characterized as TTS, is a PC framework that ought to have the capacity to peruse so anyone might hear any content, paying little respect to its beginning.

The utilization of TTS plans to deliver human voice falsely. Voice blend is an unpredictable procedure and complex calculations are expected to create a coherent and regular outcome. TTS union makes utilization of procedures of human common Language execution. Since the content must have orchestrated in this section. TTS ought not to be mistaken for voice reaction frameworks. Voice reaction frameworks incorporate discourse by connecting sentences from a database of pre-recorded words and are utilized for various purposes than TTS frameworks, which shape sentences or potentially states in light of a dialect's graphemes and phonemes. Voice reaction frameworks are constrained to combining sentences that contain just words that have been foreordained by the framework. TTS frameworks, conversely, are hypothetically fit for "perusing" any string of content characters to shape unique sentences. Google Text-to-Speech is a screen peruse application created by Android, Inc. for its Android working framework. It powers applications to peruse so anyone might hear (talk) the content on the screen. As of now, the upheld dialects incorporate .Content to-Speech might be utilized by applications, for example, Google Play Books for perusing books out loud, by Google Translate for perusing out loud interpretations giving helpful knowledge to the articulation of words, by Google Talkback and other talked input availability based applications, and also by outsider applications. Clients must introduce voice information for every dialect. There are a few procedures to make a combined voice:

• Articulatory blend

• Formant blend

• Concatenation blend

• Hidden Markov models blend

The principle combination procedures, exhibited above, are the strategies utilized as a part of the review and improvement of discourse union frameworks. Be that as it may, an approach to benefit from the intrinsic favourable circumstances of every strategy is to utilize a half and half of the different strategies in the advancement of future frameworks discourse combination.

## 3.9 Connection between Smart Phone and Server

Smart phone and Tomcat server should be in same network (same IP address).Then need to generate “apk” file. This “apk” file transfer to the smart phone .After installing apk file application will start work.

# Chapter 4

# SYSTEM DESIGN

The construction setup framework produces penniless upon know design building mastermind. Altering skeleton joins discussing the thing skeleton meets yearnings will an express that may disturb changed over under particular case supplanting that is with best tip of those lettuce endeavours. At that point people's essential at end demonstrated Tom's investigate the free wind customer must exasperate set already, a systematically approach. Composition may be an innovative method; a stunning setup may an opportunity to be those ways will achievable skeleton. The people's skeleton "Blueprint" might be portrayed subsequently concerning delineation "The strategy beginning with ensuring applying separate structures similarly gauges to the choice target for describing a game plan on the other hand an example already, expansion inspiration driving vitality with resistance its physical affirmation". Unique setup fragments may have submitted going with will add to the people's skeleton. The people setup side of the point about premium depicts the people parts of the structure, the people sections on the other hand parts of the chart moreover their region should additionally be supporting end-customers.

## 4.1 Design Consideration

In development life cycle system design in vital part .In this situation programmer developed by one story to meet requirement. They try to fulfilment of the objectives of the project. Design play important role in this cycle. If the design is proper implementation will be easy. Most of the time good designer involved in this phase. To design software deep knowledge is require. It starts simple design after that make more complex module. In construction phase design is important it take more time.

## 4.2 System Architecture

The architectural design setup strategy is worried with working up a basic essential framework for a system. It incorporates perceiving the genuine parts of the structure and exchanges between these segments. The starting arrangement technique of perceiving these subsystems and working up a structure for subsystem control and correspondence is called development demonstrating layout and the yield of this framework strategy is a depiction

of the item basic arranging. The proposed engineering for this framework is given beneath. It demonstrates the way this framework is planned and brief working of the framework.

In this system architecture different module are present face recognition ,text recognition sign board recognition , all module access database and output always comes through voice message.

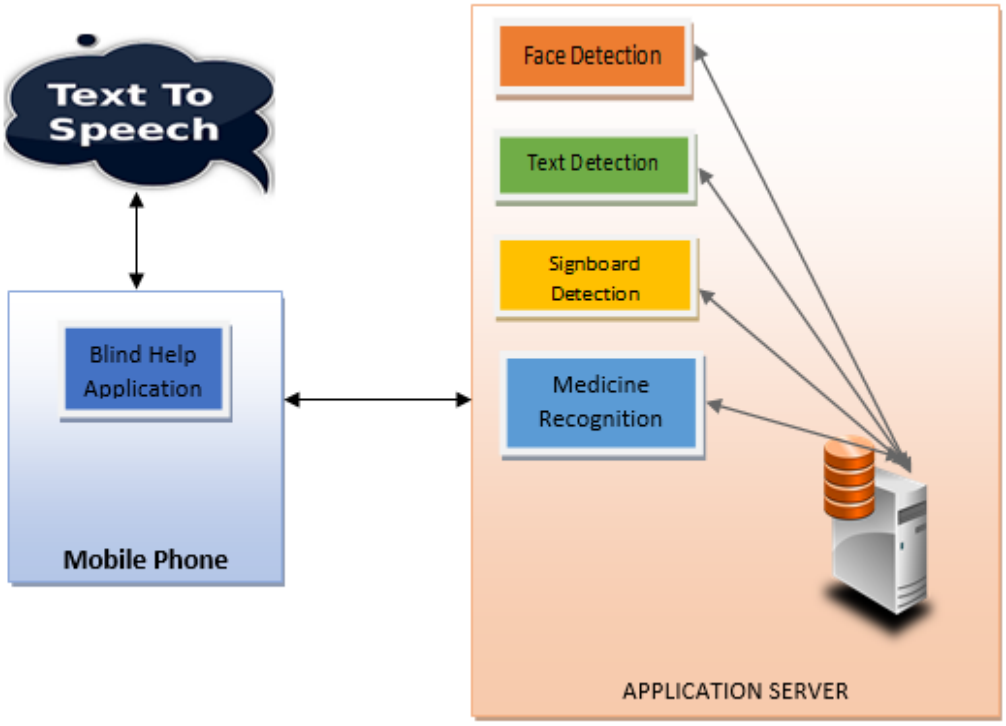


**Fig 4.1: Architecture Diagram**

## 4.3 Data Flow Diagram

The DFD is direct graphical model which gives proper and easy concept to understand and how all data structure can be used .It is an information flow chat. It is used give clear data transformation among different module. If data flow diagram is very perfect implementation easily happen. The name demonstrates its attention is on the continuous flow of the data, where information originates from, where it goes and how it gets put away. A DFD show utilizes expected foreordained number of primitive pictures to address the limits performed by a structure and the data stream among the limits.

The rule inspiration driving why the DFD strategy is so well known is no doubt considering the way that DFD is an astoundingly fundamental formalism-It is anything but difficult to grasp and usage. Starting with the game plan of strange state works that a system plays out, a DFD show continuously addresses diverse sub limits. Really, any different levelled model is anything but difficult to get it.

The human identity is to such an extent that it can without a lot of an extend see any dynamic model of a structure in light of the way that in a different levelled demonstrate, starting with a greatly direct and special model of system, unmistakable purposes of enthusiasm of a system are step by step displayed through the assorted requests. An information stream chart (DFD) is a graphical portrayal of the "stream" of data through an information system. DFDs can similarly be used for the impression of data taking care of.

Data flow diagram having another name is Context–Level-Diagram. This flow of the diagram having different flow and different stage also .Every methodology can be additionally utilized to make an arrangement different structure. This process of growing a Data Flow is known as level setting. In First stage DFD include some easy part and gradually it make more complex. In level 0 all the component not be visible. Step by step need to add all module.

Second Level comes after first level .In level 1 all the system will divide into subsystem and there are more external agents work in this stage. In level 1more data flows are visible .Data flow diagram used some special process node such as rectangle, circle arrow symbol represent some particular purpose. Data Flow Diagram is very useful in software designing. Diagram it is easy implement project.

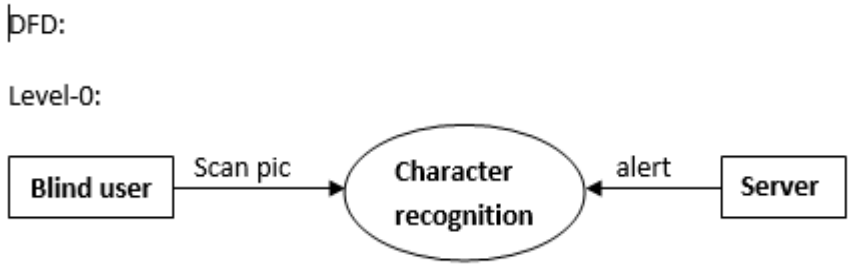


**Fig4.2: Data Flow Diagram level 0**

In first level DFD shows initial stage of system design and direction of data flow. Using Mobile based camera blind user scan the any image and OCR (Optical Character Recognition system) extract text and server will get alert shown in Fig 1.

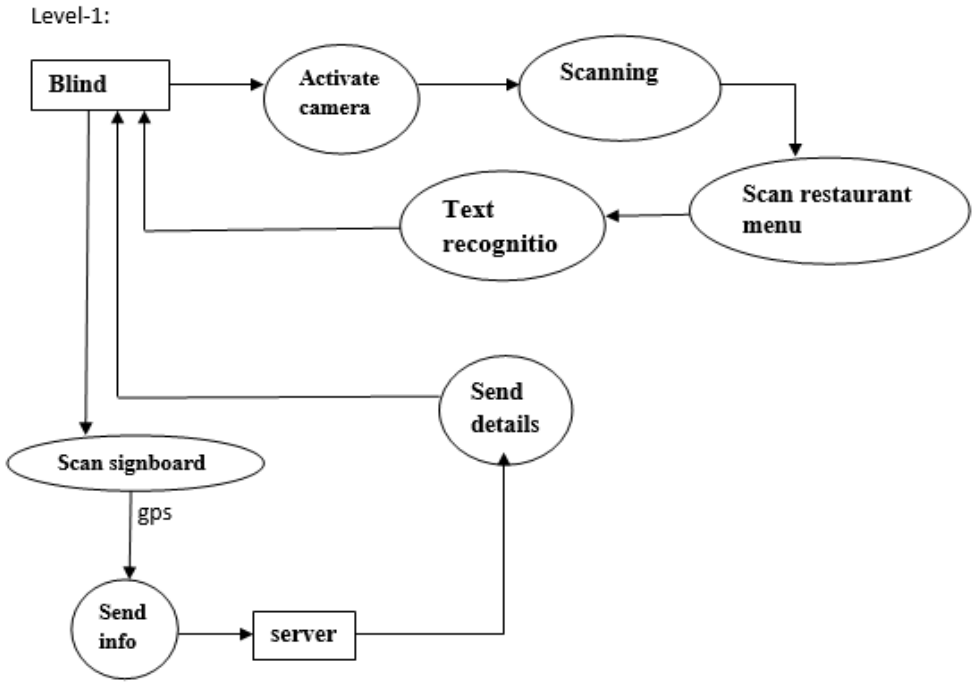


**Fig 4.3: Data Flow Diagram (Level 1)**

DFD Level 1 showing that dataflow between two modules. Blind user activates mobile camera and scan image. Data (image) transfer to the OCR, OCR will recognize the text from image. This data (text) passes to blind user as voice message. Another module visually impaired person scan the sign board for shop and shop name transfer to the server, server provide details information about shop.

Level-2:

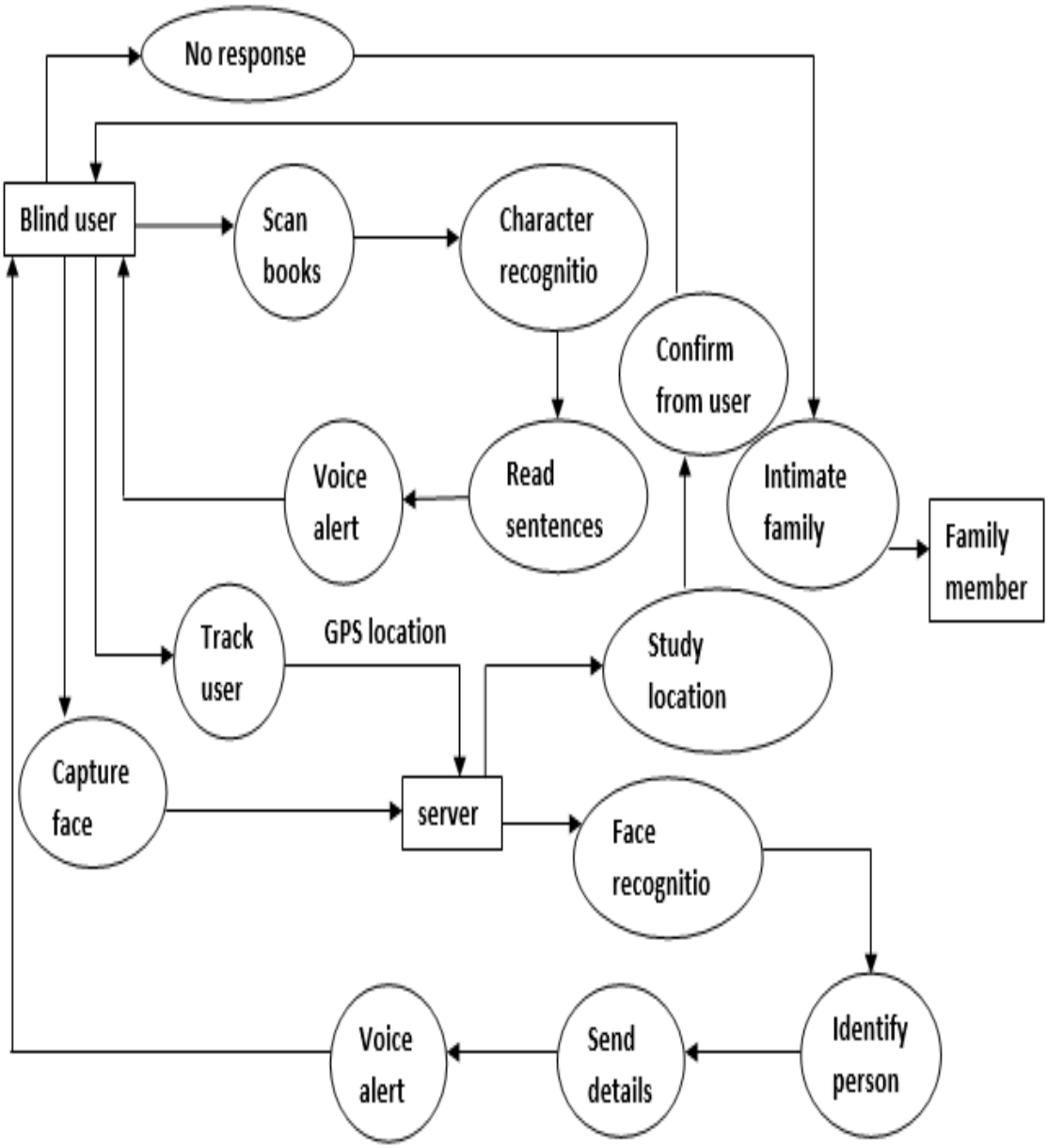


**Fig 4.4: Data Flow Diagram (Level 2)**

In the above diagram demonstrates full work and their concept in depth. The collaboration between structure head and end customer is revealed concerning the proposed estimation's pictorial portrayal.

## 4.4 Sequence Diagram

A sequence diagram is an incorporated Modelling Language is a kind of correspondence outline that shows systems work with each other. A sequence diagram is generally called occasion follows diagrams, event circumstances, and timing chart. In this diagram it incorporate three module blind user, application, and server .Some of family member need to add details about medicine, shop nearby, known person image in the server, application scan the text and fetch the word and send the details to server ,server check the match word if it is available it send again to the server and provide audio message.

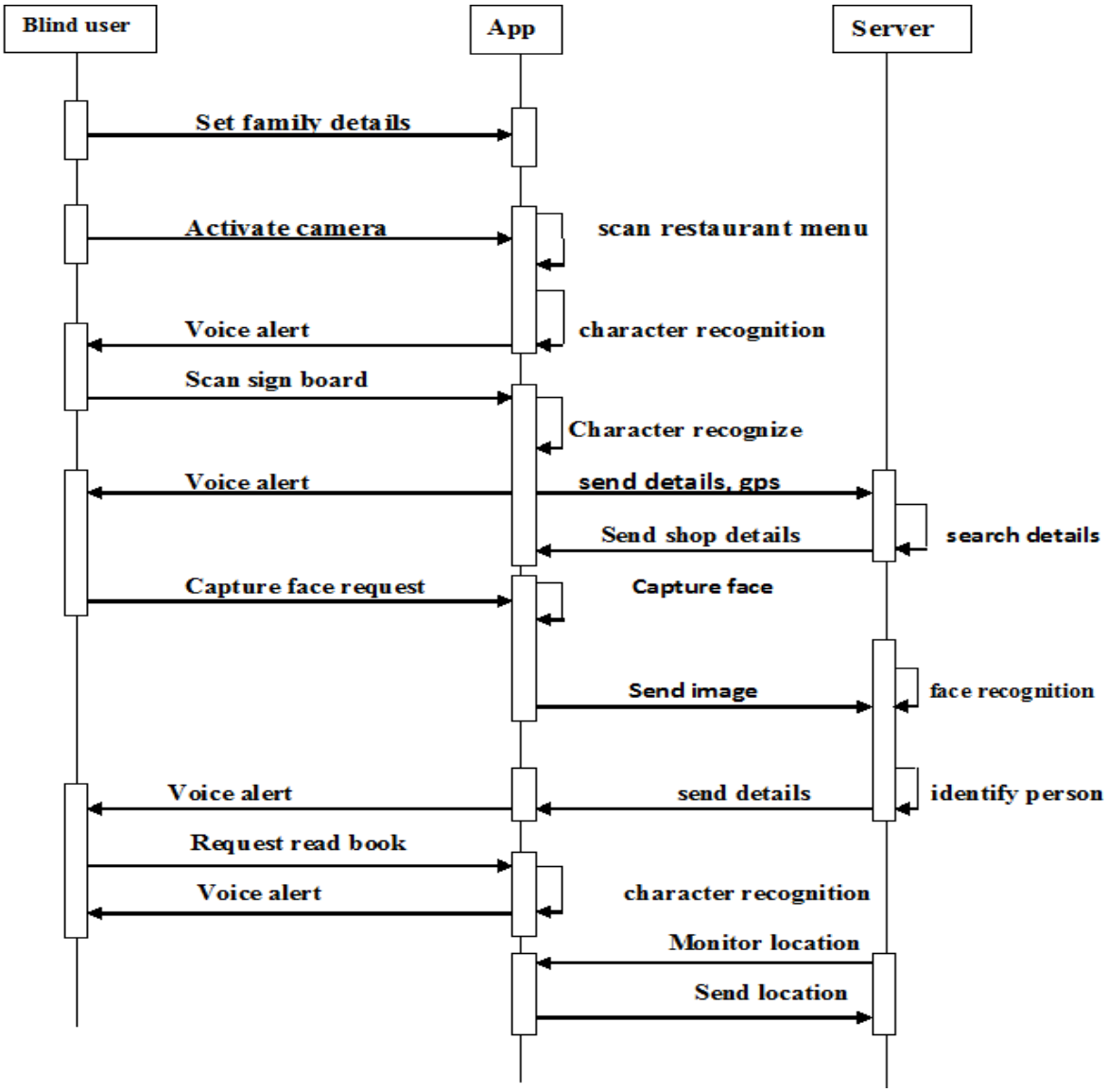


**Fig 4.5: Sequence Diagram**

## 4.5 Use Case Diagram

A Use Case Diagrams is a diagram where programmer can use different use case. Its protest is to display a graphical outline of the handiness gave by a system with respect to entertainers, their destinations (addressed as use cases), and any conditions between those use cases. Utilize case graph gives us the information about how that customers and usage cases are associated with the structure. Utilize cases are utilized in the midst of important part need to be delete and result part helps to make valuable system.

A performing craftsman depicts any component that works together with the framework. The entertainers are outside the point of confinement of the system, while the utilization cases are inside the farthest point of the structure. In this project different use case are there, one side blind user and other side server. Application fetch data from server but some of the part it not fetch the data from servers such as activate the camera, scan the text those are the time server access are not required. To find the shop details, to recognize face to identify the person, sending alert server based database needed.

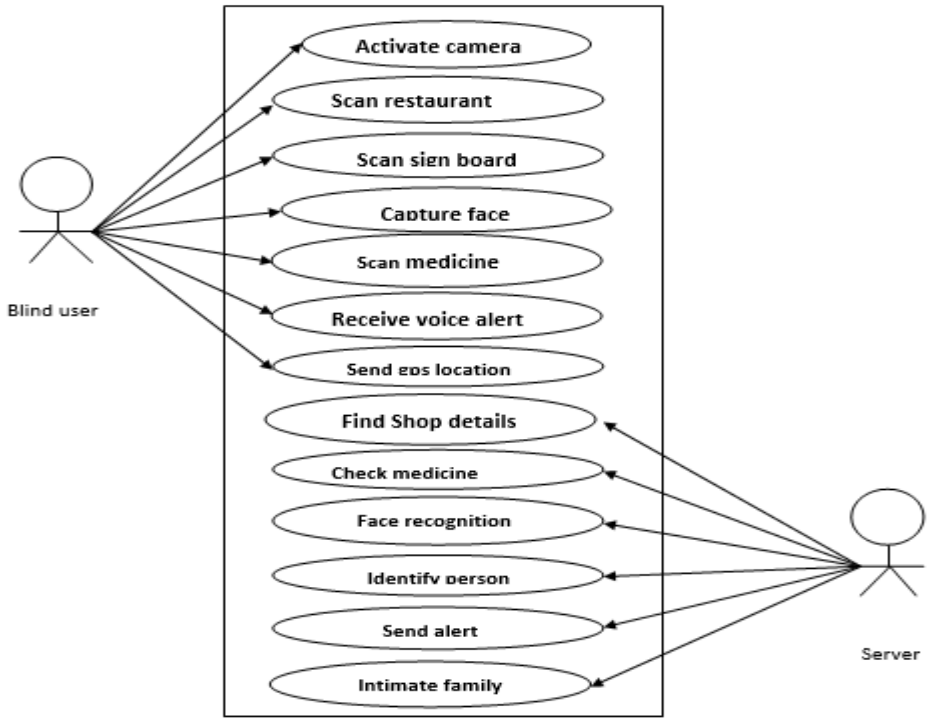


**Fig 4.6: Use Case Diagram**

## 4.6 Activity Diagram

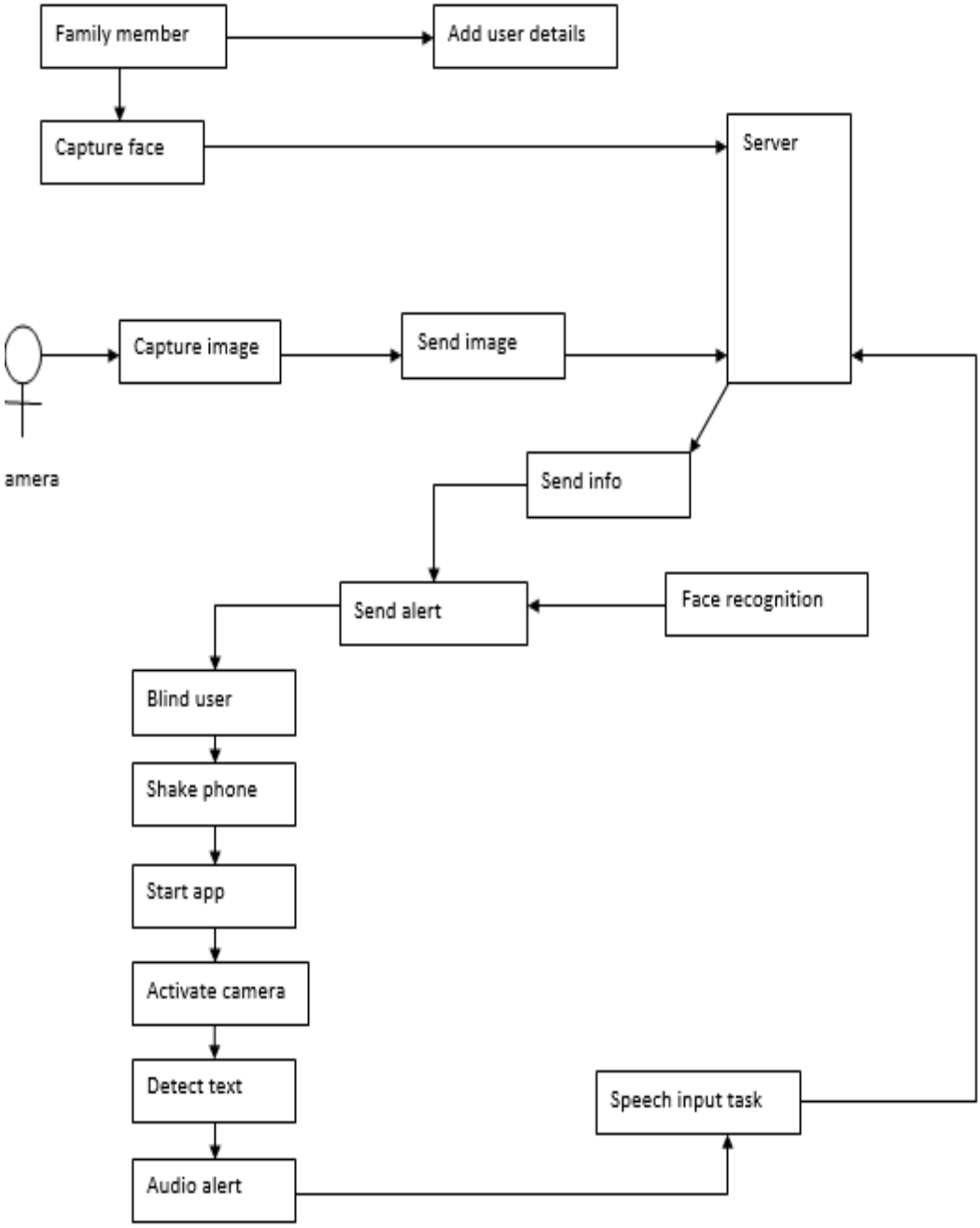


**Fig 4.7: Activity Diagram**

# Chapter 5

# IMPLEMENTATION

Implementation is a phase where documented requirement transfer to coding phase. After implementing all feature it produce a new product. Product should satisfy the customer need make them happy. In this stage programmer decide to see which are the platform or programming they need to choose. In this way it can be thought to be the most separating stage in achieving a productive new system and in giving the customer, conviction that the new structure will work and be feasible. This stage provide an efficient devolving framework. It must check limitation of the execution and implementation .Among whole phase it takes more time.

The phase represent theoretical concept to executable code. This stage is full of challenge. Lot of difficulties happen in this stage. Sometime design not to be clear to developer, they need to redesign, as a result implementation takes more time. In this stage some important thing is need to plan before, need to maintain some schedule, communication between different people within a team is very important. Usage is a basic stage in the change of the assignment where the item arrangement is recognized as an arranged of framework units. The things that are perceived in the layout stage are completed and limits, which control these articles, are made sense of it. Ensuing to performing system examination took after by laying out and coding, execution is done to check whether the consequence of the wander is obviously.

The execution has numerous:

• Methodical arranging.

• Examination of limitations in framework.

• Assessment of strategies and changes in the framework.

• Platform choice.

During implementation programmer must be careful about naming concept, so that in future other person can easily debug the code. At last it is very important that implementation documentation. So absence of the any developer other can do work easily. In this stage

there is important factor is challenge such as –version management, developer should reuse the code in future.

• Choosing of programming dialect.

• Guidelines for coding.

# 5.1 Module Description

This project consists of five module such as-Text Recognition, Signboard Recognition, Face Recognition, Medicine Recognition, Restaurant menu recognition.

## 5.1.1 Text Recognition

Text Recognition is the way toward identifying content in pictures and video streams and recognize text which contained in that. Once distinguished, the recognizer then decides the real content in each block and sections it into lines and words. OCR (Optical Recognition System) has been used to implement mobile based Text Recognition system. As this Google controlled OCR API contains highlights like various language acknowledgment where dialects resemble: English, French, German, Spanish or some other Latin based content. Additionally the content can be parsed from a flood of stream i.e. a video. Be that as it may, because of the extent of this Android OCR Library case can keep things basic and scan the content from a picture only.

## Optical Character Recognition

OCR system use two method to detect text such as-Pre-Processing and Post –Processing

**Pre-Processing of the Optical Character Recognition**

Pre-processing is the primary stage in recognizing the text. Using this stage quality of the image has been increased. To do this work there are many stage.

•**De-skew** – If the report was not adjusted legitimately when examined, it might should be tilted a couple of degrees clockwise or counter clockwise.. There are several technique:

• **Despeckle –** remove the extra unwanted dark pot and need to do smoothing of the edge.

• **Binarisation** – Trans formed the image from grey scale to bright image. The undertaking of binarisation is executed as a straightforward method for isolating the content (or some other craved picture segment) from the foundation. The assignment of binarisation itself is

essential since most business acknowledgment calculations work just on double pictures since it turns out to be more straightforward to do as such. Along with that in this process any image covert into binary image means any colour image which having multi-colour ,it change to only two colour black and white normally IT use foreground image into black and back ground image into white. Since the nature of the binarisation strategy utilized to get the paired outcome relies on upon the kind of the information picture (filtered record, scene content picture, chronicled debased archive and so on.).

• **Line evacuation** – it make setup for line.

• **Layout investigation –** find out segments, passages, inscriptions, and so on as particular pieces. Particularly critical in multi-section formats and tables.

• **Discovery of word and Line-**Provide gauge for design of document, isolates words if vital.

• **Document acknowledgment** – In different language it will change and thus, recognizable proof of the script is fundamental.

• **Text disengagement or "division"** – For every letter OCR, various letter that are associated because of picture antiquities should isolated;

• **Normalise angle proportion and scale**

Division of settled pitch textual styles is refined generally basically by adjusting the picture to a uniform network in light of where vertical matrix lines will slightest frequently meet dark zones. For corresponding textual styles, more advanced strategies are required in light of the fact that whitespace between letters can now and then be more noteworthy and Vertical and horizontal line need to be consider.

### Character Recognition

The OCR can able to change any text related image to machine encrypted text .Developer normally use matrix matching to store every pixel for image. This depends on the info. This technology is very useful because it can able to connect through inter very easily. Strategy works best with message which people get from typing and may not function admirably that time new textual styles are visible.

Some are contrasted and a conceptual vector-like portrayal of a character, which may lessen to at least one glyph models. General methods of highlight identification in PC vision are relevant to this sort of OCR, which is ordinarily observed in "wise" penmanship acknowledgment and without a doubt most present day OCR programming.

**Post-Processing**

Pre-processing is the method where input image accuracy can be increased .It also provide some other service that is which are the word are not available in the database then it nay change some pattern and try to find out matching. This method should be dangerous if the archive word not present in the database, as formal people, places or things. Tesseract utilizes its lexicon to impact the character division venture, for enhanced exactness. "Close neighbour examination" can make utilization of co-event frequencies to right mistakes, by taking note of that specific words are frequently observed together. For instance, In case of some special word especially noun it face difficulties to detect such as “Washington D.C” it make it DOC, but database support in this matter only. The Levenshtein Distance calculation has additionally been utilized as a part of OCR post-preparing to additionally advance outcomes from an OCR API.

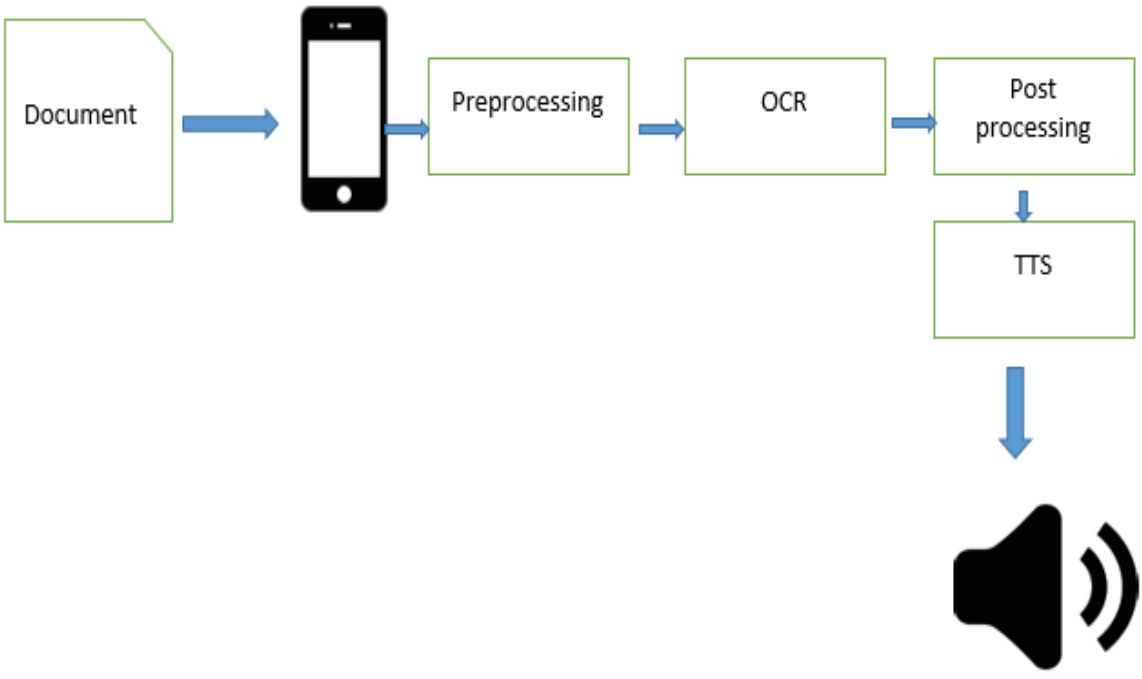


**Fig 5.1: Optical Character cognition**

### 5.1.2 Medicine Recognition

In Medicine Identification Android studio is used to develop mobile application and data can be store in the server. Doctor will give only medicine prescription to the visually impaired people. Pharmacist will store the name medicine details, time and doses in the server from prescription. The details will store in the TOM CAT server and server will store the data into the MYSQL database. Blind person at home shake the phone and mobile application will start automatically and camera of the phone start scanning, when the mobile is placed above the medicine, scanning will start and text detector detect the me medicine name and send it to the server. Server check whether the medicines are matching or not and check user should take at that time. If the medicine need to take at that time, server send the notification to the user, the mobile application once receives the information from the then convert the text information to speech and plays the audio. This module develop in two part one is server side which maintained by family member or physician to maintain medicine database and other side is android application for visually impaired people.

**Registration**

A registration phase is developed using Java .In this phase either physician or any family member can register using their mobile number. Resister person only can have access to the database.

**Medicine Details**

Register family member or physician get access to enter medicine details in the server. Medicine name, doses of that particular medicine, time to take medicine store in the server database. Application provide alert to blind person if take wrong medicine.

**Medicine Scanning**

Optical Character Recognition are used to scan to medicine name and medicine name send to the server .Server match medicine name with the database send the details of the medicine to the application . Application accept the details of the medicine and transfer to voice message using Text to Speech.

### 5.1.3 Face Recognition by Visually impaired people

Camera at the door clicks the picture when anyone comes, sends the image to the server. Server recognizes the face using Eigen face recognition and sends an audio alert to the blind people’s

phone saying the known person name or as unknown person.

**Face Recognition**

The motive of the face recognition identifying people using store database. When system accept input image then it mixed with many noise and very poor signal strength and also very much irregular data. After accepting image, it need to transfer into Eigen face, so for that need to calculate matrix .To covert this image to matrix first it check dark spot in the face. After that in the image it capture all black spot and white spot .Then make all black more black and white more grey. Then it need to find out distance between broader lines to every dark spot. According to the distance it may calculate matrix value. After that it start matching operation using Eigen value method. After extracting data from image need to store those data .This whole process where face is convert into Eigen face is called PCA. It can be used to reconstruct main image by combining Eigen faces in the right proportion.

To reconstruct the original image from Eigen face, weighted sum of all Eigen face is needed Each Eigen face must have a weight. On the off chance that one uses all the Eigen faces separated from unique pictures, one can reproduce the first pictures from the Eigen faces precisely. In any case, one can likewise utilize just a piece of the Eigen faces. At that point the recreated picture is an estimate of the first picture. Be that as it may, one can guarantee that misfortunes because of precluding a portion of the Eigen faces can be limited. This occurs by picking just the most vital components (Eigen faces). Oversight of Eigen faces is essential because of shortage of computational assets. Utilizing this weights one can decide two imperative things:

- Decide, the available picture being referred a face by any stretch of the imagination. For the situation the weights of the picture contrast excessively from the database of the weights of face pictures, the picture most likely is not a face.

- Comparable confronts (pictures) have comparative components (Eigen faces) to comparative degrees (weights). In the event that one concentrates weights from every one of the pictures accessible, the pictures could be assembled to bunch. That is, all pictures having comparative weights are probably going to be comparative appearances.

**Eigen Vectors and Eigen values**

An eigenvector of a matrix is a vector to such an extent that, if multiplied with the matrix, the outcome is dependably an integer number which corresponding eigenvalue of the eigenvector. This relationship can be depicted by the condition $M \times u = c \times u$, where u is an eigenvector of the framework M and c is the comparing eigenvalue.

Eigenvectors have taking after properties:

- They can be resolved just for square lattices
- There are n eigenvectors (and relating eigenvalues) in a $n \times n$ network.
- All eigenvectors are opposite, i.e. at right point with each other.

## Flow chart of the Face recognition using Eigen Value

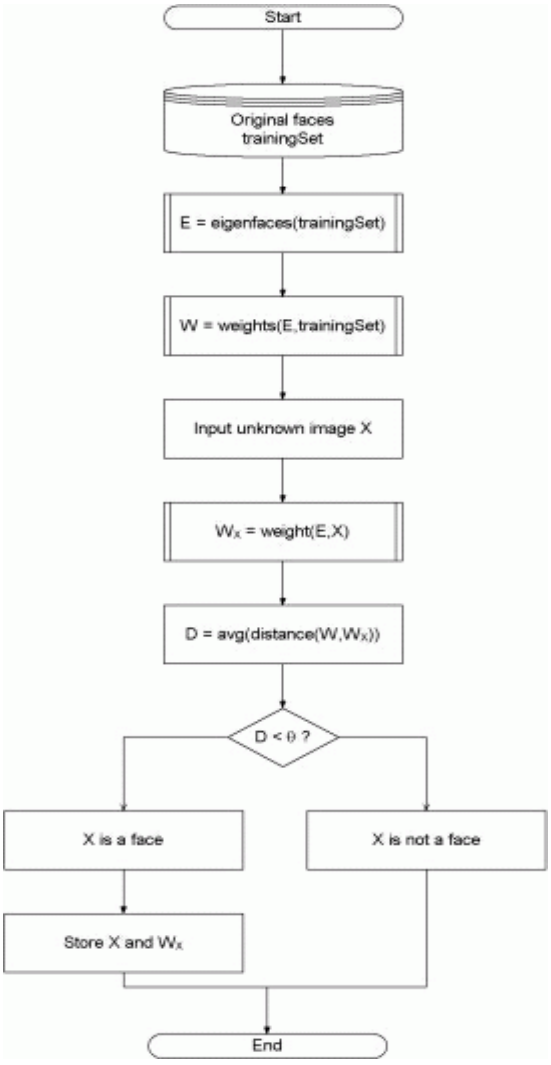


**Fig 5.2: The face recognition algorithm using Eigen values**

**Determination of the Eigen Face using PCA**

Step 1: Prepare the information

In this progression, the face constituting the preparation set (Gi) is used for processing.

Step 2: Subtract the mean

The average matrix Y must be computed, then subtracted from the first data set of face (Gi) and the outcome put away in the variable Pi:

Step 3: Calculate the covariance matrix.

In the following step the covariance matrix C is figured by - 1-Sum M T C = M PnP n-1

Step 4: Find out the eigenvectors and eigenvalues of the covariance matrix.

In this progression, the eigenvectors (Eigen faces) ui and the relating eigenvalues ci ought to be figured. The eigenvectors (Eigen faces) must be standardized so they are unit vectors, i.e. of length 1. The portrayal of the correct calculation for assurance of eigenvectors and eigenvalues is precluded here, as it has a place with the standard armoury of most math programming libraries.

Step 5: Select the principal factors

From M eigenvectors (Eigen faces) ui, just M' ought to be picked, which have the greater eigenvalues. The greater the eigenvalue, the more trademark elements of a face does the specific eigenvector portray. Eigen faces with low eigenvalues can be overlooked, as they clarify just a little piece of trademark components of characteristic feature of faces. After M' Eigen faces ui are resolved, the "preparation" period of the calculation is done.

### 5.1.4 Sign Board Recognition by Visually impaired people

When a visually impaired person is walking on the footpath, by using his smart phone .It capture the signboard image. Using open CV OCR in android it recognize the characters in the signboard and tells about the shop name and what type of products are available in the shop through audio alert to the user.

## 5.2 System Integration

Text recognition ,Medicine Identification, Face recognition ,Sign Board recognition all module develop separately .While integration all module merge in single package then change starting activities in android manifest file. When all module provide output it call Text To Speech.

## Chapter 6

# TESTING

Testing is a primary steps in developing software. This is very important stage in software life cycle. Assuming any. In this way testing plays out to a great degree segregating part for quality confirmation and ensuring the steadfastness of the item.

In the midst of the testing, the framework to be attempted was executed with an arranged of trials and the yield of the venture for the investigation was surveyed to make sense of if the venture was executing obviously .Bugs are visible in this stage There are different commercial testing tool are available .In development stage tester use this tool to test program code .This testing result helps current scenario as well as future reference also.

Testing phase happen before the project will deliver to the real customer, for their use. This process is very much valuable in software development. This testing phase also provide accuracy, perfection, customer satisfaction, easy to use and error free. Testing stage also evaluate programmer work is how much perfect. Tester should very much careful when they do testing that customer should not get any error. This stage evaluate not only program code error it also check the project requirement fulfilment. All the feature are implemented or not .It also check happy path scenario and all those critical condition should satisfy. Good testing provides good quality of software. Testing is incorporate the quality related issues. If all module test properly then software productivity automatically increased. No developer cannot give guarantee that they produced error free code. Some bugs will be there, it will corrected by testing phase. Most of the software development life cycle testing phase run simultaneous with development.

In software development many testing phase can incorporated. Testing is very much primary thing for deployment life cycle .It happen step by step. Though a substantial bit of the insightful methodology of testing are practically unclear to that of review or repetitive checking, testing is a process where tester passes many test case and check the result and accuracy. Testing provides quality assurance along with that it gives the limitation of the feature, where week point present, how much the product is user friendly ,how much accurate ,how much product satisfy the requirement of the feature. If the test is not happen properly, the product create less value. Software productivity decreased if testing phase not happen properly. Testing phase determine programmer efficiency of the writing code.

## 6.1 Different kind of Testing

Testing can be categorised in the basis of different type of functionality. Different type of testing happen in different stage. Testing process need to perform different activities and analysing work. Some testing are low quality, some are good, which type of testing need to used that depends on the type of software and also depends on accuracy of the software .It depends on the cost of the software. Different life cycle use different testing.

## 6.2 Testing for every Module

Unit testing is famous testing process where each and every module can be tested .This is popular because each unit (small part) are tested by separately. It accepts one or many input but produce one output. In case of procedural language unit means one program. In case of object oriented unit means class, it can be abstract class or it can be derived class. In this project after integrating all part unit test is happened.

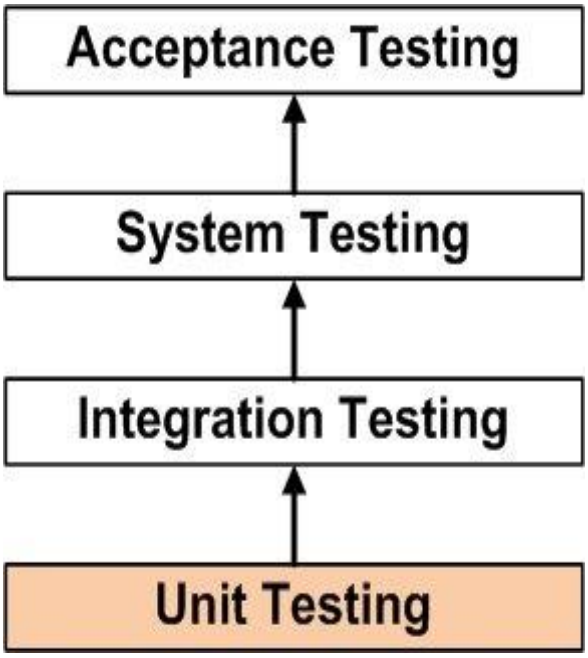


**Fig 6.1: Unit Testing**

In this project unit testing work nicely. Each and every module tested separately .Face Recognition, Medicine identification, and sign board identification all the module design separately and tested also unit wise. Different test case result given in the table.

## 6.3 Whole System Testing

This is a one type test where tester test whole software and integrate module .This test is important because it check whether the system is meet the requirement or not. This test get success when system meet customer requirement properly. Normally software development happen unit wise ,after merging all unit how it works that will check by this system testing. Whole integrated module tested by this system testing. When a car manufacture unit assemble car, that time each and every parts such as tire, body etc are developed separately but after integrating all module together how it works that can be done by system testing.

## 6.4 Testing for Integration of the different module

Integration testing is a testing which execute between unit testing and system testing .The difference between the integration testing and system testing is ,this testing check when all the module combine together in that integration works properly or not but system testing check after integration whole system works properly or not. This testing only check integration part of the software is working or not. After unit checking this particular testing works start. Test driver and stubs are used in this testing. It will happen before system checking .It only check defect of the integration part .For example a pen manufacture unit make different part separately such as cap of the pen, body, ink etc. But when the assemble every unit they check whether the cap of the pen is fitting in the pen perfectly or not. This is this testing need to check. When are happen in the android and server that time this test used to check the proper apk file generated or not.

## 6.5 Testing for Performance

Performance Testing is address performance of the system .It check how the system able to take load , reliability of the system ,response time of the system, accuracy of the system, scalability of the product everything it check. This testing gives the productivity of the software.

## 6.6 Validation Testing

It is very important part in testing .In this testing tester check whether the product meet the requirement specification or not .What are the story product should have that are present or not.

## 6.7 Black Box Testing


**Fig: 6.2 Block diagram of Black Box Testing**

This testing is very famous in development lifecycle. This testing can be apply each and every test part. This method check every functionality of the software module. All feature works properly or not.

## 6.8 White Box Testing

This testing is specially code base testing. It required code knowledge to do test. Tester passes some input to the system and check whether it works properly or not. Sometime it is called “open box” testing. To do testing it accept some data as input. Especially it check feature working behaviour is working or not. In this case tester should have programming knowledge Of the particular system.

## 6.9 Acceptance Testing

This testing check whether the system meet business requirement or not .It check business value of the product. It also verify the product is ready for delivery .This testing also incorporate user need ,user acceptance ,user satisfaction .It also check whether the product is able meet customer requirement or not. Customer is ready to accept this product or not .In this testing phase most of the time business people involvement is required. They need to check it satisfy the business need and also check how much it bring return in future. If customers are happily accept product then automatically it increased the business.

**Table 6.1: Test Case for connection setup**

| | |
|---|---|
| Serial Number of Test Case | TC 01 |
| Module Under Test | Registration |
| Description | User can register from android app and the details are saved in the server |
| Output | User registered successfully and saved in server |
| Remarks | Successfully Executed |

**Table 6.2: Test Case for Login connection**

| | |
|---|---|
| Serial Number of Test Case | TC 02 |
| Module Under Test | Login |
| Description | User can loin from android app |
| Output | User login using android app successfully |
| Remarks | Successfully Executed |

**Table 6.3: Test case for Text to Speech**

| | |
|---|---|
| Serial Number of Test Case | TC 03 |
| Module Under Test | Text to speech |
| Description | The text information is converted to speech using Google API |
| Output | Google API converts text information to speech successfully |
| Remarks | Successfully Executed |

**Table 6.4: Test case for Database Connection**

| | |
|---|---|
| Serial Number of Test Case | TC 04 |
| Module Under Test | DATABASE Connection |
| Description | When the application program is executed, it tries to connect to DATABASE (MySQL) using the data source. |
| Output | If the connection details are correct, the DATABASE is connected. If the connection details are incorrect, an exception is thrown. |
| Remarks | Test Successful. |

**Table 6.5: Test case for Shake the Phone**

| | |
|---|---|
| Serial Number of Test Case | TC 05 |
| Module Under Test | Shake the phone |
| Description | When the user shake phone app should start. |
| Input | Phone shake |
| Output | Phone get start |
| Remarks | Test Successful. |

**Table 6.6: Test case for User login**

| | |
|---|---|
| Serial Number of Test Case | TC 06 |
| Module Under Test | User Login |
| Description | When the user shake the phone server should verify user id password sent by the app internally. |
| Input | Phone shaking ,User Id and Password |
| Output | Server verify user id and password. |
| Remarks | Proper result came |

**Table 6.7: Test case for connection Registration**

| | |
|---|---|
| Serial Number of Test Case | TC 07 |
| Module Under Test | Register family members |
| Expected outcome | Family member capture their face and face image is saved in the server |
| Actual outcome | Images are getting saved in the server |
| Remarks | Correct Result |

**Table 6.8: Test case for verifying person in the Door**

| | |
|---|---|
| Serial Number of Test Case | TC 08 |
| Module Under Test | Verify person in the door |
| Expected outcome | Camera at the door capture the face and the image is verified and identifies the person at the door and sends audio alert to the blind person phone |
| Actual outcome | Face identified and blind user receive the audio alert. |

**Table 6.9: Test case for Character Recognition**

| | |
|---|---|
| Serial Number of Test Case | TC 09 |
| Module Under Test | Character recognition |
| Expected outcome | Camera should get automatically on and recognise the character. |
| Actual outcome | Camera can recognise the character |
| Remarks | Expected result |

**Table 6.10: Test case for Medicine Recognition**

| | |
|---|---|
| Serial Number of Test Case | TC 10 |
| Module Under Test | Medicine recognition |
| Expected outcome | App should recognise the speech as medicine and should send detected text to server. |
| Actual outcome | App can recognise the speech as medicine and can send text to the server. |
| Remarks | Execution success. |

# Chapter 7

# RESULT ANALYSIS

Through OCR system tested 40 image of document and from this input we got different type response some are perfect and some are little distortion .There is a problem of different hand written document and different style letter. Though OCR able to read most of the document. To read some document OCR need bright light, smart phone are supported that. Visually impaired people can able to read restaurant menu and get voice message. This OCR can able to scan at some particular distance ,so first time wen blind people start use this application they face some problem but after few time use it can be recover. If signboard placed in more distance then it takes little bit more time to scan. Compare to aureate result it provides faster result. Text read happen here block wise.

The outcomes for face discovery appear discovery precision of up to 93% in sufficiently bright conditions as appeared. Better location exactness was accomplished when the individual is taking a directly and close at the camera with an impartial facial expression. Bring down exactness is acquired at the point when appearances are recognized at slight edges and diverse facial expressions are utilized. A perfect precision can be gotten when the individual is strolling straightforwardly around the camera. This happens when no false discoveries are made because of a basic foundation with no different items. The result however is just conceivable when the client is stationary what's more, perfect conditions are available. Calculation times for each outline, regardless of whether a face was available or not, were under 400 ms. The outcomes for face acknowledgment which were acquired by bolstering the aftereffects of confront location into the acknowledgment program. Be that as it may, as it were genuine discoveries (where a real face was recognized) were considered. Comes about for face acknowledgment indicate generally high acknowledgment precision. This is potentially because of the individual looking straightforwardly at the camera with a natural face. Confront acknowledgment exactness for Persons are lower subsequently of perceiving countenances at points with diverse outward appearances. A central point in low acknowledgment exactness is the utilization of just frontal face pictures for enlisting an individual into the face database. These outcomes demonstrate that further changes to the face acknowledgment program are required.

**Table 7.1: Result Analysis for Face Detection**

| User | Photo | Detection | Not Detection | AvgTime |
|---|---|---|---|---|
| Snigdha |  | 16/20 | 4/20 | 32ms |
| Madan |  | 18/20 | 2/20 | 37ms |
| Sumit |  | 12/20 | 8/20 | 36ms |
| Piyali |  | 2/20 | 18/20 | 38ms |

**Table 7.2: Result Analysis for Medicine Detection**

| Medicine Name | Correct Detection | Not detection |
|---|---|---|
| Zerodol | 13/15 | 2/15 |
| Wokadine | 14/15 | 1/15 |
| Flutibact | 14/15 | 1/15 |
| Tenovate | 12/15 | 3/15 |

There is a camera based text detection system [2] for blind help provide text detection but accuracy is less compare to android based OpenCv based OCR and response time camera based OCR is more compare to this system. In case of Face recognition when single person image give average 80% accuracy of detection. When multiple people face visible in the image it produced 20 % detection .Most of the existing system not produce this much accuracy. Eigen face algorithm provide more accurate result.

## Chapter 8

# CONCLUSION AND FUTURE WORK

Today's reality is moving towards digitalization .as of late, computerized cameras and camcorders an increasingly well-known and they have demonstrated potential as other imaging device. The scientists working in report investigation and acknowledgment have changed their introduction and as opposed to working with ordinary scanner caught archive pictures, they are focusing on examination of pictures taken from smart phone base camera.

In this developed system used to provide the facility to visually impaired people to detect the text from any document such as personal document, bank document, also able to read restaurant menu, so they can maintain privacy in their life. It can recognize any signboard, recognize medicine, and recognize known and unknown person. This way they can maintain security of the life. These people can solve their some of daily life problem without taking any third person help. After integrating all module it provides best result. This system is not provide much more accuracy but because of android smart phone application it gives faster response to blind people. This system consuming less hardware but produce better result. Application is very user friendly. It start working using only" shaking" the mobile phone. It's all feature start working using voice command and visually impaired user accept all output through voice instruction.

In future, instead of smart phone application smart glass will be used to detect known and unknown person, recognize the text and GPS location also. Face detection algorithm need to improve, so it can detect face in any position and light. Some artificial algorithm can be incorporate to recognize facial expression and mood of people. In case of text detection system need to support different language and it need to recognized data from long distance and different front size. Security framework need to utilize using some voice command or finger print scanner.

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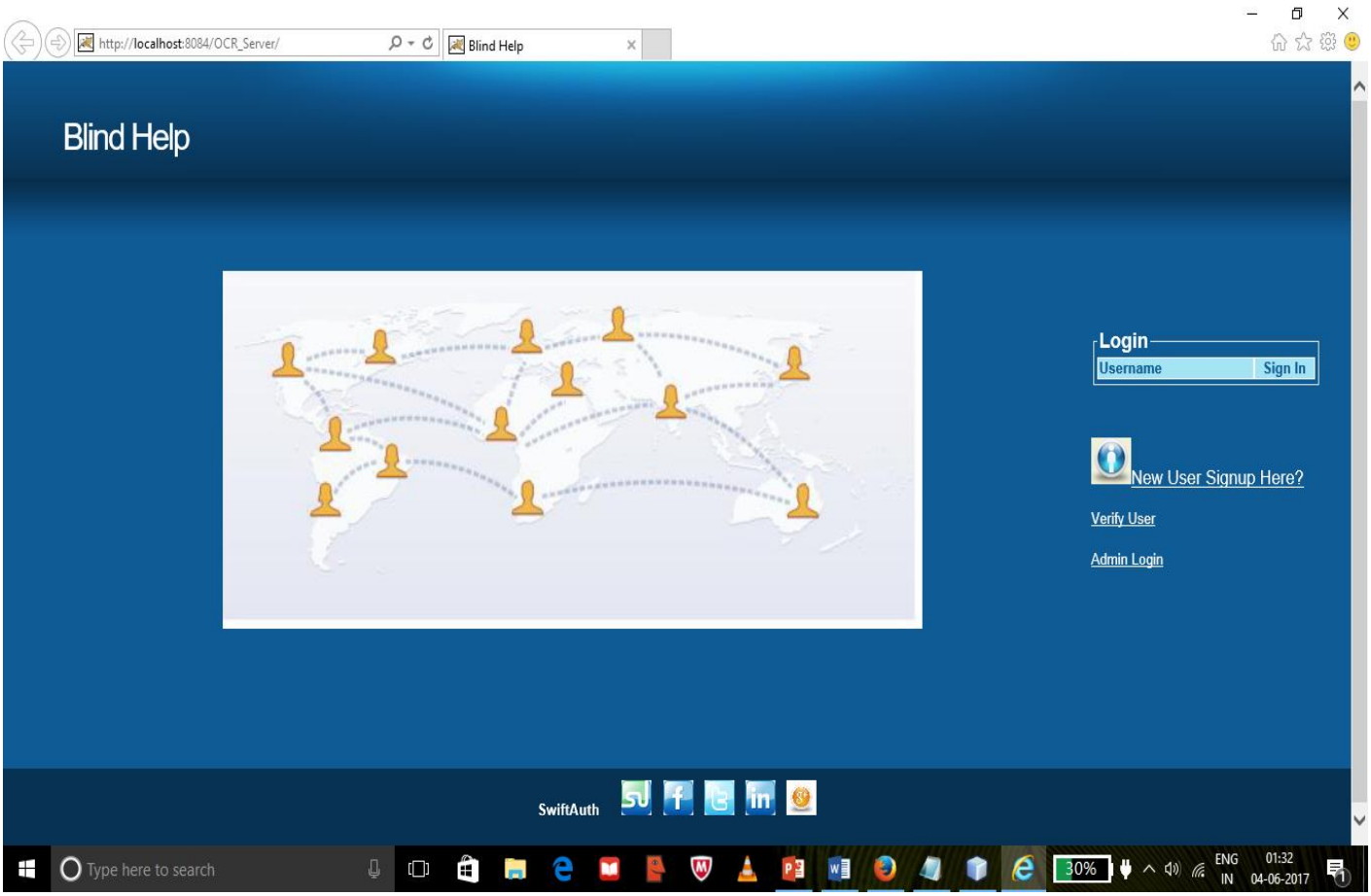
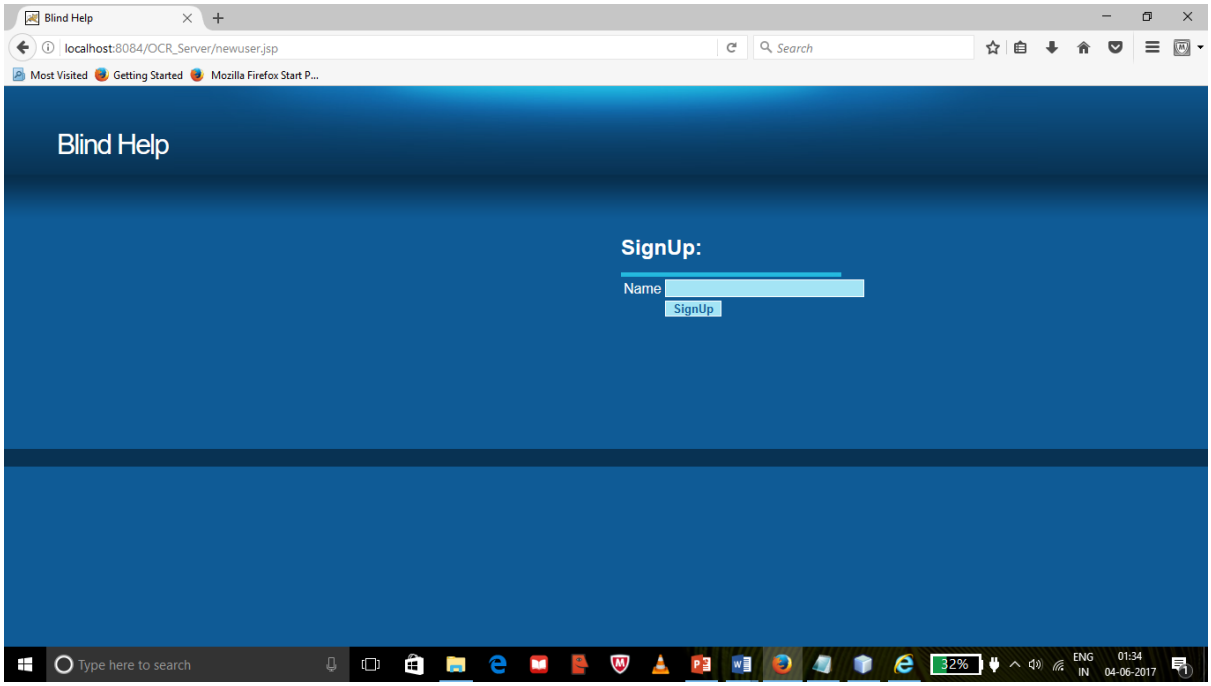
# APPENDIX

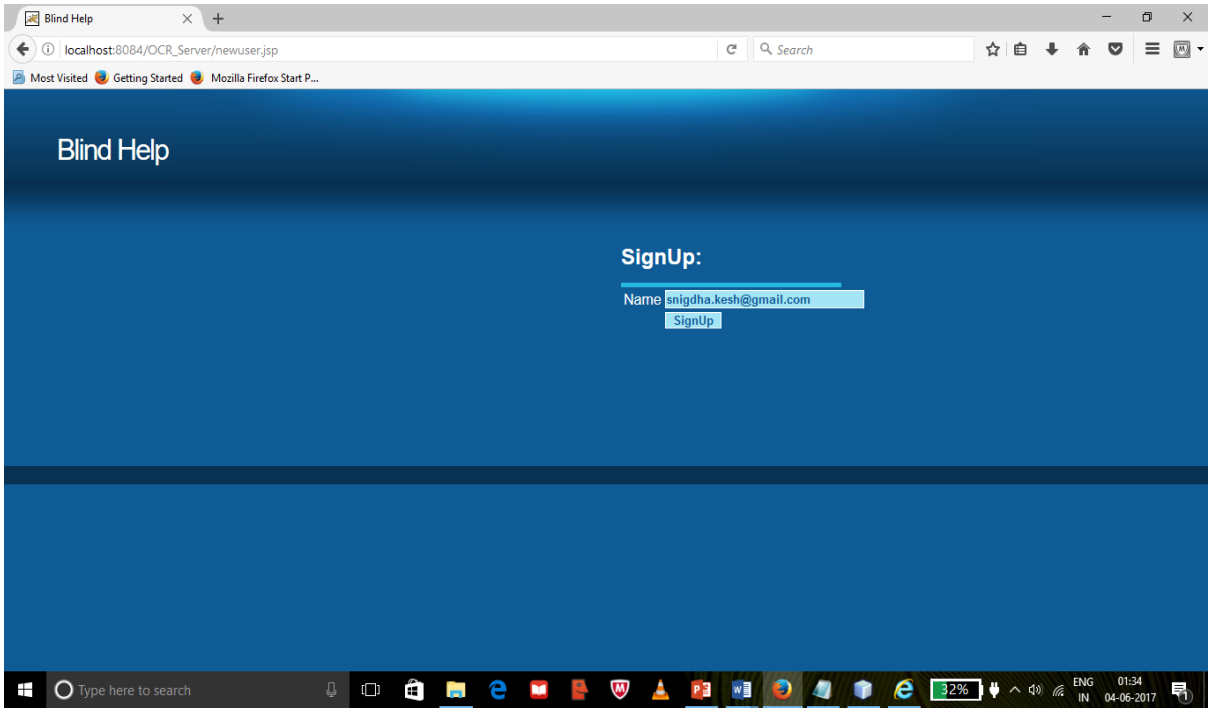
# SCREENSHOTS



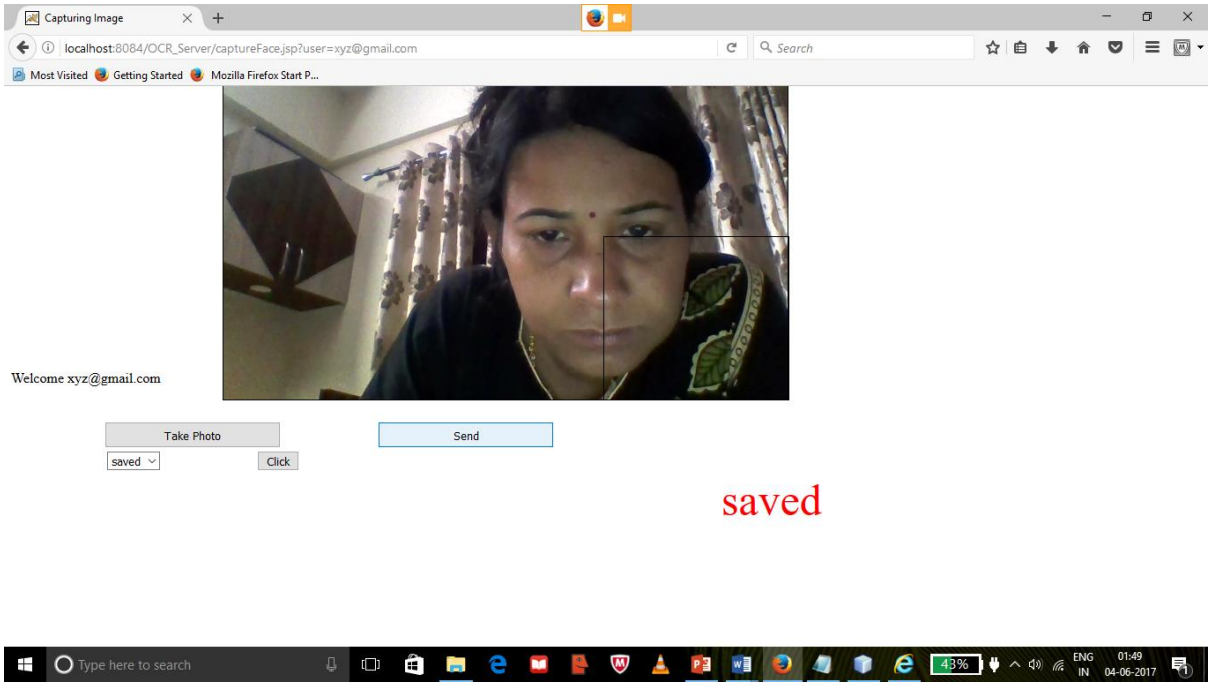

**AP 1: Home Page**



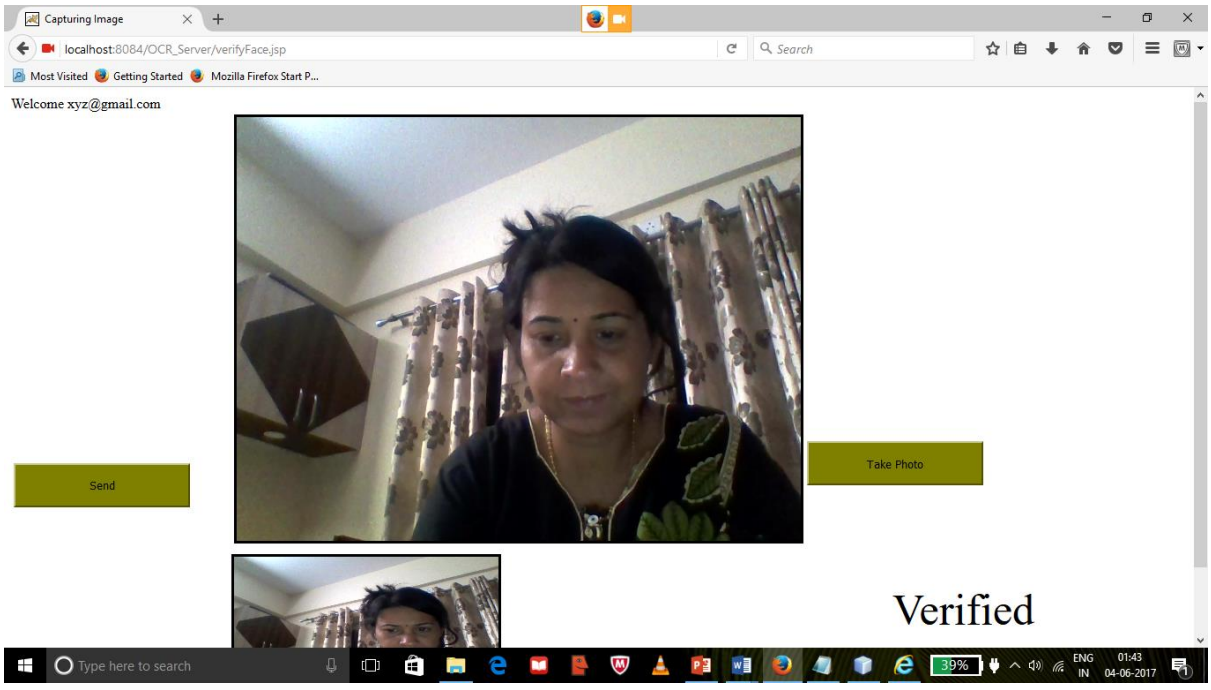

**AP 2: Registration Page**



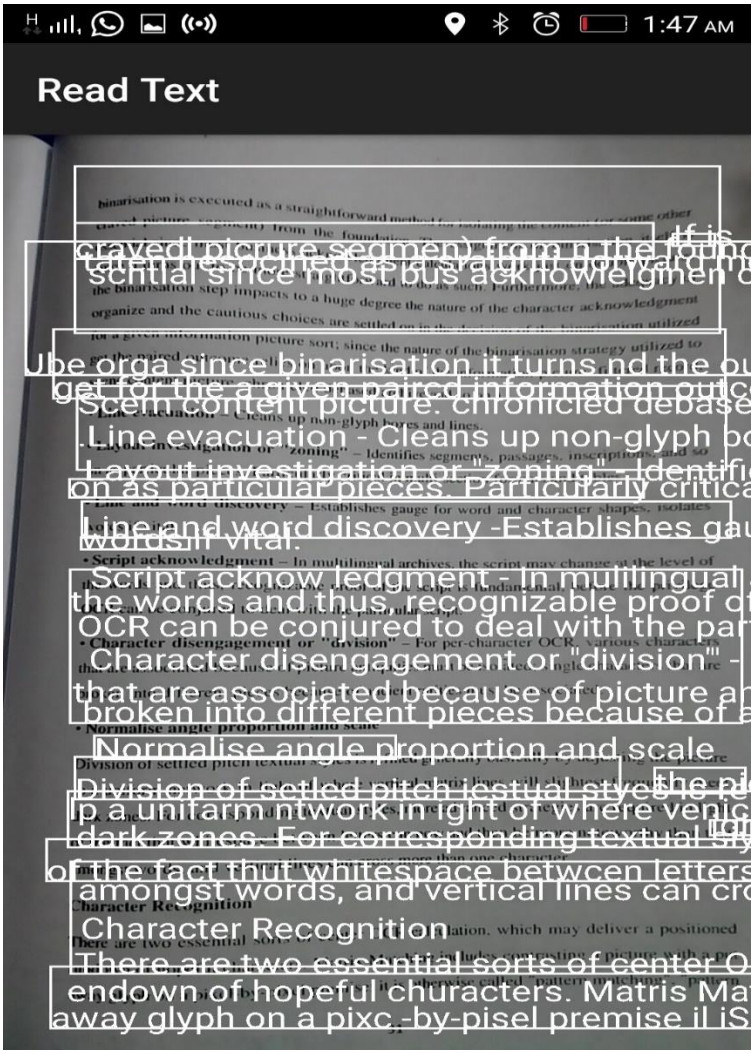

**AP 3: Sign Up Page**



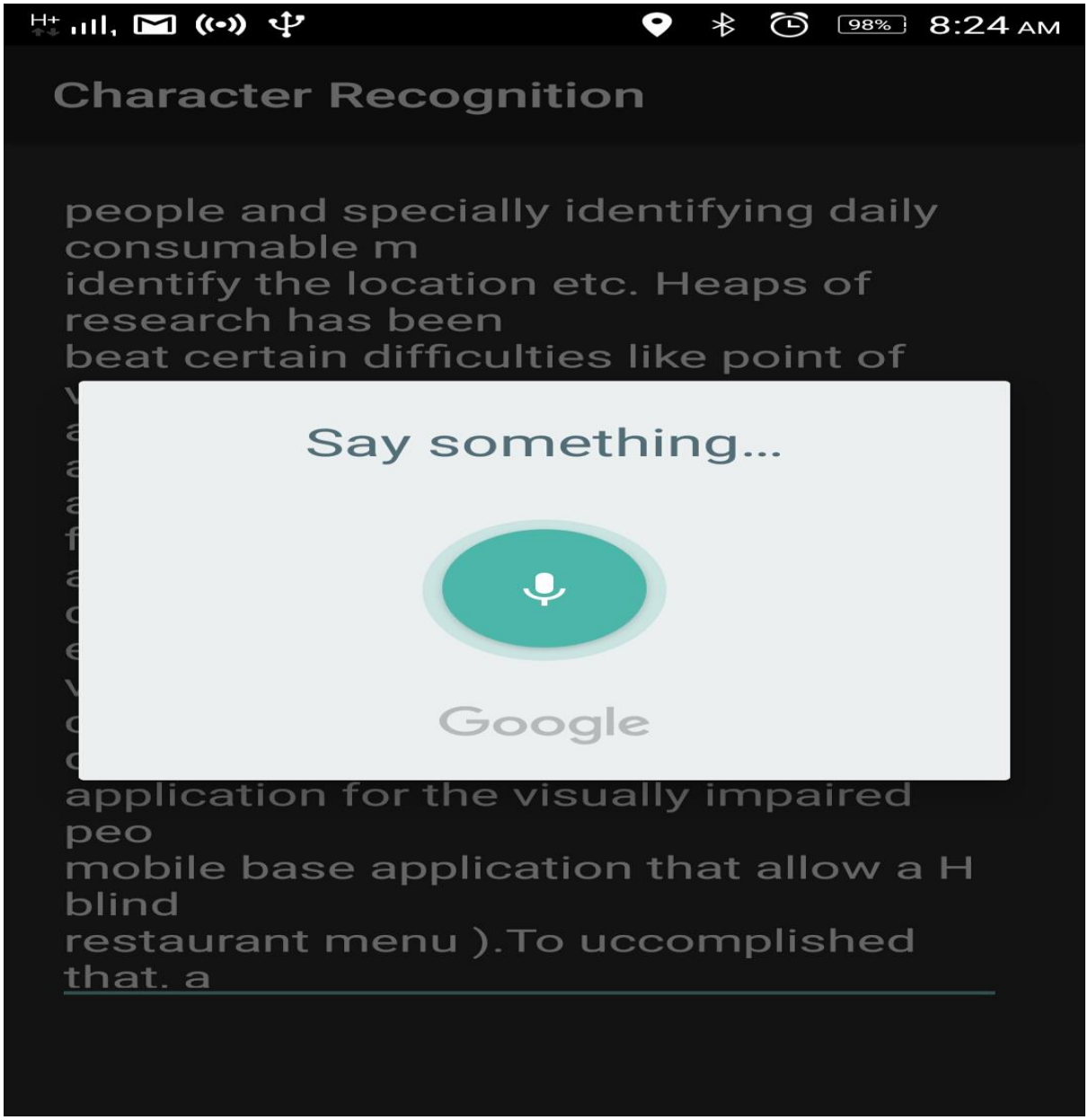

**AP 4: Capturing Face**




**AP 5: Face Verified**




**AP 6: Recognizing Text**




**AP 7: Character Recognition**