[i]CHAPTER 1
INTRODUCTION

ENVISION is the first ever banking application prototype to be implemented for Visually Challenged, Elderly and Illiterate People.

1.1 OVERVIEW OF THE PROJECT:

Banking is an information-intensive business and an early adopter of information technology (IT). During the last decade, banking functions have been virtualized on a massive scale. We have observed a shift from physical money to electronic payments, and the replacement of savings books, share certificates, and branch service advisors with online, digital alternatives.

In the era of provision of assistive technological usage to common people embarks the fact that first of the contextual activity areas in the comprehensive assistive technology model is that of Daily Living. Hence with the advent of digital banking and rise of online financial institutions, many think of the most basic banking transactions as tasks that no longer require assistance.

However, around 285 million visually impaired people globally do not have the privilege of such independence.

A survey titled “Disabled Persons in India: A Statistical Profile 2016” conducted by the Department of Empowerment of Persons with Disabilities (Divyangjan), Ministry of Social Justice & Empowerment in 2016 reminds us that the majority (69%) of blind and partially sighted people rely on the assistance of family, friends and others to manage their financial affairs. Thus, the technology solutions need to be designed to remove barriers to enable visually impaired and blind people enjoy independent living in their own home.

The rise of smartphone adoption and its extensive usage by consumers universally has provided ample opportunity for banks (both traditional and digital) to come up with targeted solutions for people with visual impairments, in order to make banking more accessible for them. Currently, few banks have introduced significant initiatives for these

customers. But in order to create truly customer-centric brand experiences, organizations must consider accessibility for all types of consumers. It doesn't have to be difficult. The technology solutions can range from some very simple low technology devices to very sophisticated and specialised high technology solutions with coverage of a wide variety of engineering methods. Some notable technologies already in the marketplace today include braille-language signage, special display keys, and talking ATMs, which are equipped with voice guides and earphone jacks.

Hence moving ahead in this trajectory, we have proposed a Mobile Banking Application prototype named ENVISION to assist banks in provision of its services to Visually Challenged Divyanjans.

1.2 PROJECT OBJECTIVES:

Everyone enjoys the independence of managing their financial affairs, including partially sighted and blind people. Today, technology is robust enough to help the visually impaired with their banking needs and facilitate their financial independence and inclusion. By offering specific solutions for the visually impaired, banks will not only attract new customers to the mix but will also be more socially responsible. Thus, the project entitled "**ENVISION – A Mobile Banking Application Prototype for the Visually Impaired, Elderly and Illiterate People"** has been developed to accomplish the following objectives:

1. To build a mobile banking application prototype for the visually impaired, elderly and illiterate people who form half the world population.
2. Reduce the stress faced by visually impaired people in carry out digital banking operations.
3. Implement the app in digital platform Android thereby reaching out to large sections of smartphone users.
4. Ease the way for several banks to implement the proposal in a common platform.
5. Enrich the participation of the users in Digital banking and making them friendlier to its daily use.
6. Introduce user friendly features to help reach elderly people in easing out mobile banking operations.

7. Provide provision of Regional language support and enrich pictorial representations to weed out inconvenience to illiterate people whose sect yearns to undertake mobile banking operations at ease.

1.3 MOBILE BANKING SYSTEM:

India has about 337 million smart phone subscribers, a number that is larger than the number of bank accounts or Internet users. Given the mobile tele-density of about 20% and development of secure mobile technology solutions, banks are well-positioned bridge the digital divide and introduce the unbanked sector to the financial mainstream.

In India, commercial banking industry has involved various financial innovations, which means shifting their focus from tradition banking to technology banking to satisfy the needs of their customers and to get competitive edge. Mobile banking is one such innovation. Mobile Banking is defined as doing various banking transactions like fund transfer, balance enquiry, investments, paying bills through the use of mobile phones. All the banks that are licensed and have branch in India are allowed to provide mobile banking services to their clients. This facility helps customers to transfer fund from one account to another account on a real time basis using mobile network.

We are aware that Internet Banking has helped the customers to access their account at any time. Customers could check out their account details, get their bank statements, perform transactions like transferring money to other accounts and pay their bills sitting in the comfort of their homes and offices. The main benefit is that cell phone is more portable than even the smallest notebook. Mobile banking is convenient. Anytime anywhere account access makes seat-of-the-pants one management possible.

Millions of dollars have been spent on building mobile banking systems which is one of the significant functions of the bank. Technically speaking most of the mobile banking services can be deployed using more than one channel. Presently, Mobile Banking is being deployed using mobile applications developed on one of the following four channels. 1) Interactive Voice Response 2) Short Messaging Service 3) Wireless Access Protocol 4) Standalone Mobile Application Clients.

Banks use mobile banking as an innovation strategy to outperform in this competitive market. It also helps banks to improve their performance and maintain their efficiency among the customers. Banks can get competitive advantage and generate superior return by effectively utilizing technological innovations. For this, continuous improvement in the banking product and mobile banking process is expected from banks. A sample Data shows that India will generate fee-based income through mobile banking of about Rs. 20,250 crores over the next five years; this is possible because of lower transaction cost, favourable environment and increased usage. This explains the impact of mobile banking on banks' revenue and growth.

CHAPTER 2
LITERATURE REVIEW

With the tremendous use of mobile in India, mobile services became a prospective alternative for the banking sector. This growth is supported by literature as well. Let us first look in to the literature perspectives of mobile banking.

Rugimbana (1995), Mobile banking transactions are gaining importance and having huge potential due to availability and facility to do transaction anytime and anywhere.

Vyas (2009), Banks should understand this trend and use updated methods. Various studies explained that banks need innovations and creativity in their banking facility to gain competitive edge.

Hsiu-Fen Lin (2011), Rapid advances in mobile technologies and devices have made mobile banking increasingly important in mobile commerce and financial services. Using innovation diffusion theory and knowledge-based trust literature, this study develops a research model to examine the effect of innovation attributes (perceived relative advantage, ease of use and compatibility) and knowledge-based trust (perceived competence, benevolence and integrity) on attitude and behavioural intention about adopting (or continuing to use) mobile banking across potential and repeat customers.

Gupta (1999); Pegu (2000); Dasgupta, (2002), Banks need to rethink about innovation in mobile banking beyond online banking and make mobility self-sufficient to satisfy customer needs and become powerful delivery channel to provide immediate access and complete control of their finances. This theory is confirmed by other researchers also and assures a bright future of mobile banking in India.

Safeena, Date, Kammani & Hundewale (2012); Lin (2010), Millions of investors are using cheaper handsets to make voice calls and do text in their daily lives. But still millions of new users of mobile cells are without the access of financial services in developing scenario. This is the important discussion point among various researchers.

Vyas (2009), They explained that banks should create awareness among customers and increase their customers by targeting non-online banking customers who have mobile phones but may not be using internet for banking, thus creating potential for mobile banking.

Karjaluoto et al. (2002), Data also shows that customers in urban/ metro area use mobile banking mostly to check account balance and followed by viewing last three transactions. Thus, constant and increasing use of mobile banking may encourage customers to use other facilities of bank.

Laukkanen (2007); Yang (2009), Banks should use this data and create awareness about mobile services. Use of mobile in banking is still in its nascent stage as compared with entire banking dealings.

Sadi & Noordin (2011), Banks should identify the benefits of mobile banking for users. In this domain, cost is one of the most significant factors which impacts mobile banking usage of customers. In their study, they found that customer attitude was correlated negatively with cost. Their intention to use mobile banking services decreases with increase cost; therefore, customer must be aware about the cost saving feature of mobile banking services through awareness.

Singh, Srivastava, and Srivastav (2010), who also supported the above research briefly explained that cost incurred by the customers have a negative impact on their intention to do mobile banking transactions.

Clark (2008), Mobile banking device is considered to be cost effective option for customers to manage transactions, get account information and do payments.

Sharma and Singh (2009), explained that the reason for less usage of mobile banking in India may arise because of security issues like frauds, misuse of accounts and user-friendly app. But these challenges in using m-payments may decrease with time and by increasing knowledge of mobile banking.

Cracknell (2004), It is hard for user using mobile banking for the first time or those who use it seldom.

Singh (2007), However, the challenges may increase for users; if some technical permission is required in their handsets for virtual money transactions.

Porteous (2006), Data revealed the availability of more mobile set than bank accounts.

Karjaluoto et al. (2002), Banks focus majorly on offering feasible facilities to customers like ATMs, smart card facility, point of sale facility etc. All this facility if provided through technology offers a substitute to deal with money without using cash.

Chian-Son Yu (2012), Fast advances in the wireless technology and the intensive penetration of cell phones have motivated banks to spend large budget on building mobile banking systems, but the adoption rate of mobile banking is still underused than expected. Therefore, research to enrich current knowledge about what affects individuals to use mobile banking is required. Consequently, this study employs the Unified Theory of Acceptance and Use of Technology (UTAUT) to investigate what impacts people to adopt mobile banking.

V Devadevan (2013), in this article titled as Mobile banking in India- issues and challenges mobile banking has an opportunity to adopt mobile users due to technological implementation. This article discussed about challenges which transaction limitation, security and authentication issues. This also highlighted some other issues related with mobile banking. The major problem was identified like facilities in mobile banking, different languages used for communication.

Muhmmad Zeeshan (2013), in their article Internet versus Mobile banking have compared that how internet banking differs from mobile banking. It explained that usefulness of internet and mobile banking are same but differs. Because the internet banking the user have to sit in front computer to operate longer time, but mobile banking is portable and easy to carry anywhere but still internet banking has used in superior level.

Bossi Masamila (2014), in this article State of Mobile banking in Tanzania and security issues tells about perception of Tanzania people. Most of them have mobile banking but not bank accounts. So mobile banking has been related big opportunity to increase the bank growth. Finally, there are number of opportunities to increase mobile banking user and surely mobile banking increases bank and country growth.

Harun R Khan (2014), in this article titled as Digital India: Emerging challenges and Opportunities for the banking sector. It discussed about Migration from cash to electronic payments and there are over 900 million mobile users in the country. RBI conducted number of awareness program to increase mobile banking users. The plan of digital India is connecting all the Gram Panchayat through broadband network by 2014.

Aijaz A. Shaikh, Heikki Karjaluoto (2015), the article analyses and synthesizes existing studies of m-banking adoption and maps the major theories that researchers have used to predict consumer intentions to adopt it.

The focus now shifts towards the narrative of visually challenged, elderly and illiterate people in banking.

Sudhir Rao Rupanagudi, Ajani. B. S., Varsha G. Bhat, K. Surabhi, P. R. Reshma, Shruthi G, Sarayu K. P, Sangeetha R, Rajesh Rao B & Vasanti S (2015), describes an approach wherein both the username and PIN for the ATM machine can be input using British Sign Language. It elaborates a cost-effective setup and also a high-speed algorithm for hand gesture recognition. All algorithms were first designed and developed in MATLAB 2011b and then later deployed as software using the Java programming language.

Shruthi. G, Sarayu. K. P, Sangeetha. R, Sanjoy Dasan (2015), ATM processing system is implemented to illustrate the possibility of using simple hand gesture as input which provides security. The efficiency of the system is based on how well the system understand the change in hand gestures. The System is helpful not only for visually disabled people, but even illiterate people can use the system and blind need not learn Braille as well. All that they need to know is the Indian sign language of digits.

Dhiraj Sunehra (2014), presented a prototype layout of an ATM access system which uses finger print technology. The system architecture includes finger print module, DC motor, LCD display. And all are interfaced to the PIC microcontroller. When a user places his fingerprint to the finger print module, the micro controller compares it with user database and displays the relevant details on the LCD display. When an authorized person is verified using finger print module the door is accessed using DC motor attached.

H. Lasisi, A.A. Ajisafe (2012), analyses a high-level model for the modification of traditional ATM systems to economically consolidate fingerprint authentication system. The paper come up with a framework for customer identification and authentication in Automated Teller Machines using Personal Identification Numbers (PIN), fingerprints and magnetic stripe cards as opposed to the traditional PIN and magnetic stripe cards verification method.

Le Hoang Thai, Ha Nhat Tam (2010), author proposed a fingerprint-matching approach, which depends on standardized fingerprint model to manufacture fingerprint from original templates. From the fingerprint templates in the database, we select one as mean image and apply Genetic Algorithms to find the conversions among them. Then, according to these transformations fingerprints are synthesized. Finally, a matching is done to show the effectiveness of the model.

Mary Lourde, R, Dushyant Khosla (2010), conducted a comparative study between two algorithms for fingerprint matching. Two algorithms were compared with a common database using MATLAB. Perhaps the most important fact understood through this paper is that the most efficient and effective method to improve the verification for any given system is to combine known algorithms in a way that we can capitalize on the advantages of each and use them to overcome the shortcomings of the complementing techniques.

M. Malarvizhi, M. Madlin Asha, S. Sinduja (2015), author proposed a method which is capable for the identification of the persons in a more accurate manner. Miniature and PHOG features were extracted based on the different feature extraction methods. The extracted features were encrypted in-order to keep it more secure. The encryption and decryption process are done using RSA algorithm. The classification method used increases the accuracy of the process since the classifier employs fuzzy logic and distance metric for the classification process.

Sayani Chandra, Sayan Paul, BidyutmalaSaha, Sourish Mitra (2013), authors tried to scheme out an authenticated way of securing our speech message. Speech message is converted into text. Then this secret text is fed to an encryption technique very similar to the RSA encryption. Here encryption is done using a unique set of keys that can only be generated by unique individual using his/her fingerprint. Moreover, the two set of keys increment the security level and hence protects our invaluable data from third unwanted parties.

Safnitha P Y, Sheena Kurian K (2014), author discuss about a unique method to ensure privacy by merging two different fingerprint patterns into a new one. The patterns of two different fingers are extracted and the minutiae positions of first pattern are overlapped with the orientation of the next one. The new template thus obtained is set as the virtual identity. On applying RSA algorithm to this virtual identity; a PKI key is obtained. These keys are in-turn used to store information in the database.

Mrs. R. Sridevi, S. Karthika (2014), proposes a novel method called Biometric-Crypto system for sending voice over internet. A secret key is generated from the fingerprint and is used for encryption and decryption of voice data packets. The key generation process is performed by powerful RSA algorithm. It is using this secret key that the voice data packet is encrypted as well as decrypted. It ensures better security

R. D. Salagar, Akshata Patil (2014), suggests a new method for authentication i.e. iris recognition. As iris pattern is unique it provides a secure method for authentication. Once the authentication phase is completed, any further transaction is performed using voice commanding by giving instructions through microphone. Iris recognition is performed in three steps namely; pre-processing, feature extraction and matching. This system not only promises security but also provides an opportunity to the differently abled ones.

Mrs. K. M. Sanghavi, Radhika Maru, Payal Kumat, Ankita Katariya, Ruchika Dudhediya (2015), suggests on implementing a innovative system which assists the visually impaired people in accessing email. Information is exchanged via speech format. The speech format is converted into text and is sent to the receiver. The text input is then converted to speech at the receiving end. Blind user can access mail via voice commands. Some predefined keywords like read, compose, send etc. are used.

Yekini N.A., Itegboje A.O., Oyeyinka I.K., Akinwole A. K. (2012), puts forward a new system where the access is authorized by just speaking through a microphone which is attached to the machine. It ensures that only authorized person is accepted whereas the unauthorized person is rejected. There are two phases mentioned in the system one being testing phase and the next being the training phase. Speaker recognition is performed in two steps which text dependent and other is being text independent.

K. Kanna1, Dr. J. Selvakumar (2015), proposes the concept of the voice-controlled Robert which can be controlled through specific voice commands. The voice module attached within (Easy V R), processes the input speech received. As soon as the input is received, the command is passed to the microcontroller of the robot which in turn analyses the message so as to perform necessary actions. The input speech signals are converted into digital signals by the module. These signals are transmitted through ZigBee module to the robot.

Pennam Krishnamurthy & M. Maddhusudhan Reddy, objectified to develop an embedded system which can be employed for ATM security. In this method, during the registration phase in bank; the bankers collect the fingerprint sample as well as the mobile number of the user. The details are then stored in the database. When the user accesses the ATM, he places his finger on the module. This fresh sample is compared with the one stored in the database; if the sample is matched, then a four-digit pin is sent to the enrolled phone number which is used as the OTP for transaction.

Avinash Kumar Ojha (2015), The traditional methods of ATM authentications have many security issues, so this paper employs a method of employing fingerprints as unique passwords. The fingerprint sensor identifies and stores the pattern in the form of a template. When the user accesses the ATM and enters the fingerprint; matching operation is performed. If authenticated, transactions can be performed. Else, two more chances are given to the user. If the patterns remain unmatched still; then buzzer will get switched on and an alarming message is sent to the original user's mobile number.

Though the challenges of banking for the visually challenged, illiterate and elderly people have been net in the trajectory of ATM, it is yet to spring up in the sector of mobile banking which has been in detailed proposed and implemented in this project "ENVISION".

CHAPTER 3
EXIXTING SYSTEM

Mobile payments were trialed in 1998 in Finland and Sweden where a mobile phone was used to pay for a Coca Cola vending machine and car parking. Commercial launches followed in 1999 in Norway. The first commercial payment system to mimic banks and credit cards was launched in the Philippines in 1999 simultaneously by mobile operators Globe and Smart.

3.1 MOBILE BANKING MODEL – EXISTING:

The development in Information and Communication Technology (ICT), comfort and access of services, and competition with peer forced banks to introduce Mobile Banking services in India. Mobile Banking can be broadly classified into Bank-led model and Mobile Service Provider Led Model. In the bank led model, only customers of a bank can avail the mobile banking service from the bank. With these facilitates, the customers can do various banking transactions as per their convenience. The Mobile Service Provider Model is totally different from bank-led model; in this the mobile customers those who don‘t even having the access of traditional bank account can do banking transactions through their mobile service provider.

Mobile banking services can be classified into:

- Inter Bank Mobile Payment Service (IMPS): Inter-bank mobile payment service (IMPS), which is a fund transfer service through National Payment Council of India (NPCI). This service lets you transfer funds from one account to another across banks within the country using your mobile phone. You can use the IMPS via your banks' app, USSD’S dial-in number, encrypted SMS banking or net banking.
- Bank Apps: Here you need to download your bank's application or software on your mobile phone via internet. This works on both GSM and CDMA handsets for Android and iPhone platforms.
- USSD-based Banking: For this type, all you have to do is dial the bank's service code and you can ask for information on your bank account. You don't need a Smartphone or high-end phone to use the USSD platform.

- SMS Based Banking: It is the most popular method of mobile banking in which notifications are sent via SMS on user's mobile number.
- Internet Based Mobile Banking: This way of banking is where you use your mobile screen like a computer monitor. In this service you required Internet connection whenever you are using this service.
- UPI -based Banking: UPI refers to Unified Payment Interface Solution and it is an interoperable payment system which enables quick payment using a unique identifier – Virtual Payment Address and is linked with your Bank account. UPI Solution offers multiple features such as simplified on-boarding, availability of different transaction types, multiple ways to execute payment and seamless user experience. UPI has emerged as a preferred retail payment option within the digital payment ecosystem. Payment can be done from Mobile, Web or other Application by knowing just unique remitter VPA. Similarly, payment can be received by account holder by giving a unique identifier. Unified Payment Interface thus allows making payment without knowing Beneficiary Account details.

The services offered under the mobile banking vary from one bank to another. The common services are Balance Enquiry, Mini Statement, Money Transfer and Utility Bill Payments.

3.2 INTERNATIONAL EXPERIENCE:

M-PESA – Kenya: M-PESA6 is the first mobile banking solution launched based on the Mobile Service Led Model in the year 2007 by the telecom operators Safaricom & Vodafone. It has become very popular among the customers and captured major market in Kenya.

SMART Money and G-Cash Philippines: Philippines launched SMART money7 which is an electronic wallet to do most of the banking transaction through mobile.

3.3 MOBILE BANKING IN INDIA

Banks are constantly adopting technology to expand its business and to reach different level of customers. Apart from ATM, Internet banking and other technology enabled services Mobile Banking is one of the services provided by banks to its customers. Astonishing

growth in telecommunication sector, its penetration including rural population and technology feasibility are the major factors for the introduction of Mobile banking services. Some banks in India are started providing the mobile banking service to their customers that include State Bank of India (SBI), Union Bank of India (UBI), Canara Bank, Punjab National Bank (PNB), HDFC, ICICI, Axis Bank, etc.

TABLE 1: TRENDS IN MOBILE BANKING

Year ended March	**NO. OF USERS (million)**	**VOLUME (million)**	**VALUE (billion)**
2011-12	12.96	25.56	18.21
2012-13	22.51 (73.69%)	53.31 (108.56%)	59.90 (228.49%)
2013-14	35.53 (57.84%)	94.71 (77.66%)	224.38 (274.59%)
2014-15	-	172 (81.60%)	1035 (361.27%)

Source: RBI (Figures in parentheses is change over previous years)

From table no.1, we can infer that the value of transactions through the mobile has shown a remarkable growth. RBI is also taking steps to provide accessible, convenient as well as cost effective services to mobile banking customers.

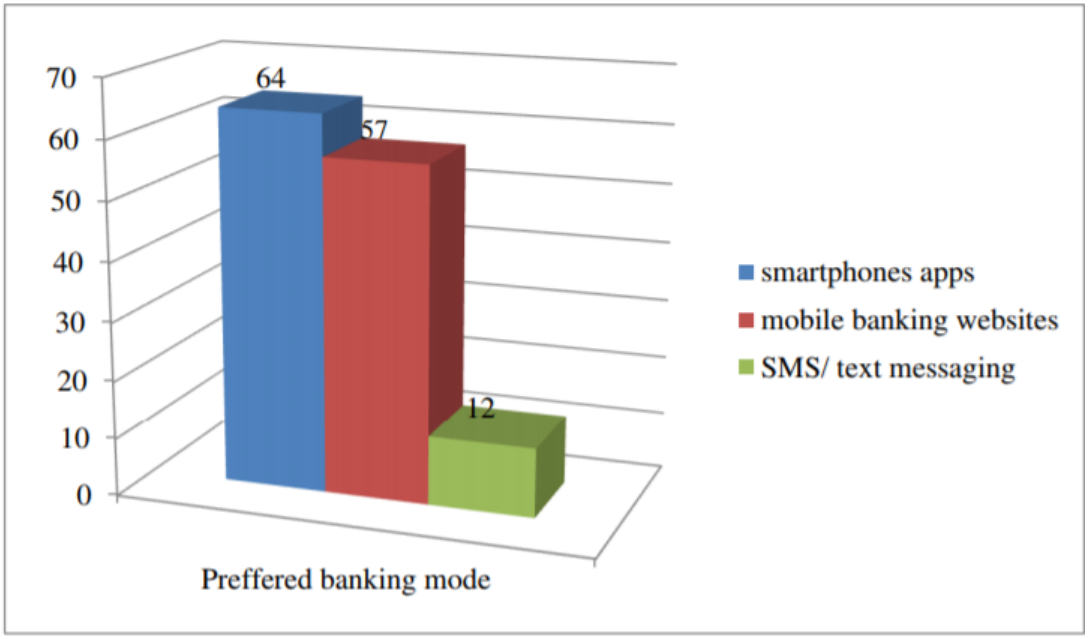

Figure 1: PREFERRED BANKING MODE (%)

Source: Congizant Business Consulting Report 2013

This graph shows the various banking mode which were preferred by customers. The smartphone apps were mainly used by various customers which accounts to 64 per cent. Mobile banking websites and SMS/ text messaging accounts for 57 per cent and 12 per cent. Consumers tend to prefer smartphone apps over mobile banking Web sites to access their accounts and a small percentage of consumers prefer text banking.

3.4 INDIAN TELECOM SECTOR:

India is the second largest telecom market in the world. Telecom industry in India is witnessing enormous growth with 1190.67 million subscribers as on 31st December 2017. The TRAI report indicates this figure includes 1167.44 million wireless subscribers and 23.23 million wireline subscribers in India. The tele-density at the end of December 2017 reached the mark of 91.90.

TABLE 2: TELECOM SUBSCRIBERS & TELE-DENSITY IN INDIA (WIRELESS + WIRELINE)

Total Subscribers	1,190.67 Million
% change over the previous year	3.38%
Urban Subscribers	688.25 Million
Rural Subscribers	502.42 Million
Market share of Private Operators	89.31%
Market share of PSU Operators	10.69%
Teledensity	91.90
Urban Teledensity	168.29
Rural Teledensity	56.66

TABLE 3: TELECOM SUBSCRIBERS & TELE-DENSITY IN INDIA (WIRELESS)

Total Wireless Subscribers	1,167.44 Million
% change over the previous year	3.55%
Urban Subscribers	668.44 Million
Rural Subscribers	499.00 Million
GSM Subscribers	1,162.20 Million
CDMA Subscribers	5.24 Million
Market share of Private Operators	90.45%
Market share of PSU Operators	9.55%
Teledensity	90.11
Urban Teledensity	163.44
Rural Teledensity	56.28

3.5 RESERVE BANK OF INDIA REGULATION:

The following are the Reserve Bank of India (RBI) Guidelines issued to provide Mobile Banking Service in India:

- Only such banks which are licensed and supervised in India and have a physical presence in India will be permitted to offer mobile payment services to residents of India.
- The services should be restricted to only to bank accounts/ credit card accounts in India which are KYC/AML compliant.
- Only Indian Rupee based services should be provided.
- Banks may use the services of Business Correspondents for extending this facility, to their customers. The guidelines with regard to use of business correspondent would be as per the RBI circular on Business correspondents issued from time to time.
- The Risks and Controls in Computers and Telecommunications guidelines will equally apply to Mobile payments.
- The ―Know Your Customer (KYC) and ―Anti Money Laundering (AML) as prescribed by RBI from time to time would be applicable to customers opting for mobile based banking service.

3.5.1 TRANSACTION LIMITS IN MOBILE BANKING:

- Only Indian rupee transactions and these transactions are allowed within India only.
- Per day transaction cap of Rs.50000 has been removed by RBI, and every bank can change this cap depending upon their risk.
- Transactions without end-to-end encryption is Rs.5000/- (SMS Based).

3.5.2 SECURITY AND AUTHENTICATION:

The highlights of security and authentication guidelines provided by the RBI on Mobile Banking:

- The mPIN or higher standard of mechanism should be used to authenticate the Mobile Banking customer.
- End-to-end secure encryption mechanism should be followed in transactions.
- Bank should conduct regular information security audits on the mobile banking systems to ensure complete security.

3.6 ISSUES AND CHALLENGES IN MOBILE BANKING:

The rapid technology development in Mobile technology like 2G, 3G, 4G has become major challenges for banks. It is visible that the bank which started Mobile Banking in the form of SMS banking, then adopted application (software) based model for traditional mobile handsets, the evaluation of Smart phones, mobile operating system and Mobile Apps posed the banks to adopt the current technology.

The customers are mostly using ATM and online banking services. Most of the customers feel comfortable without mobile banking. They also feel that, there are chances of misuse in mobile banking due to mobile handset theft.

3.7 DRAWBACKS OF EXISTING SYSTEM:

- In Bank apps, it needs specific bank application software on mobile phone via internet.
- In SMS banking when mobile switches off, it fails to receive the message.
- In internet banking, regular access of internet is must.
- In internet banking, due to internet access it consumes more cost.

CHAPTER 4
PROPOSED SYSTEM

As discussed above in the literature review there has been no sign of banking ease for visually challenged, elderly and illiterate people. Thus, this project proposes a Mobile Banking application prototype entitled "ENVISION". One or more banks have provision of its implementation with the proposed functionalities in the project and its future work. This is also evident from the yearning of Visually challenged people who are in sizable population in India and possess moral independence to use it.

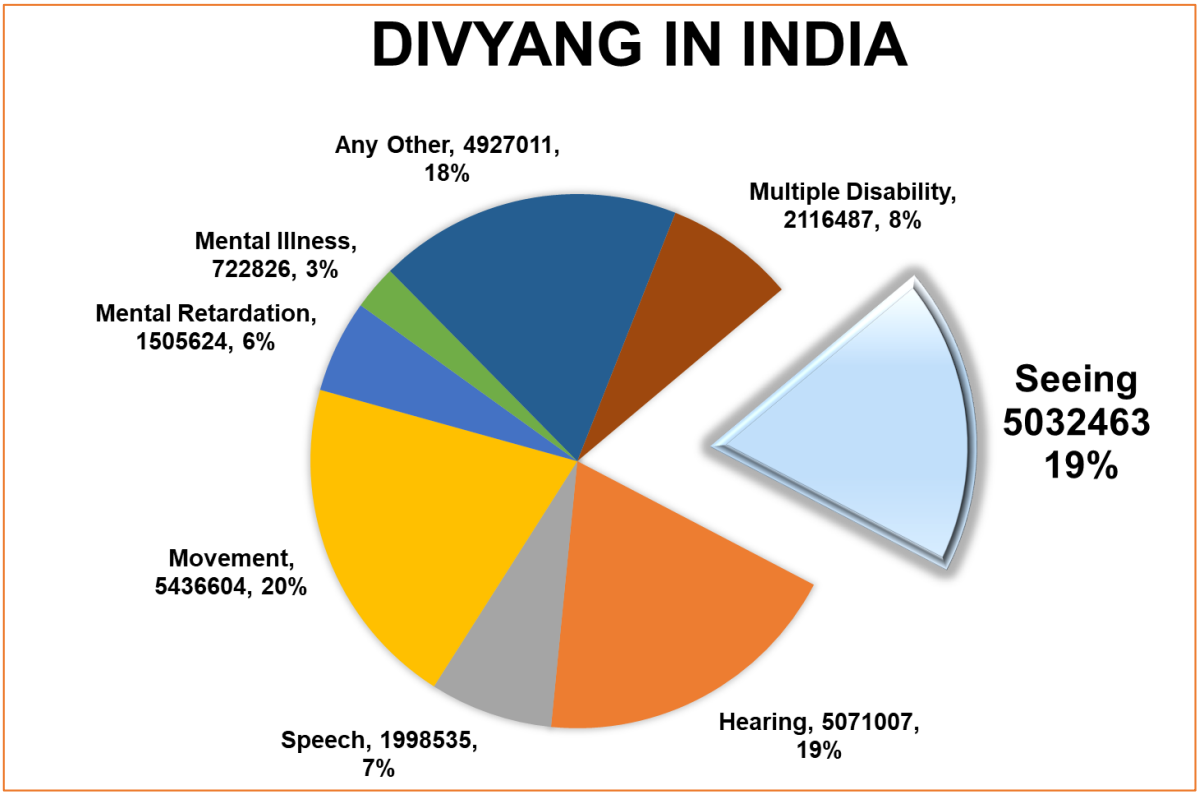

Figure 2: DIVYANG IN INDIA (%)

Source: Disabled Persons in India: A Statistical Profile 2016

4.1 SYSTEM SPECIALITIES:

The following are the app features:

1. You can tap anywhere on the screen. The app will read out the first option on the first tap, the second one on the second and so on.

2. Overall, swipe right signifies Yes, and Swipe left signifies no/back/cancel.
3. Biometric authentication makes typing a PIN unnecessary.
4. Using headphones with the app is mandatory - this ensures privacy.
5. Voice based mobile number entry
6. Dual speech communication. User to app and vice versa.
7. Automatic OTP detection.

4.2 Innovation Model:

The proposed **"ENVISION - A MOBILE BANKING APPLICATION PROTOTYPE FOR THE VISUALLY IMPAIRED, ELDERLY AND ILLITERATE PEOPLE"** is an innovation model hub in the banking sector yet. The four features of:

1. TAP
2. SWAP
3. HERE
4. SPEAK

testifies the application to be a model of innovation and user friendly to the concentrated sects in the project.

The model proposed eliminates and distinct the application from normal ones albeit the following:

- Keyboard typing and Braille language independent application.
- App is linked to the phone's language. So, if a user selects a regional language on their phone, the app will also be working on that language (To be undertaken in incremental version).
- Portable application built with the requirements of the visually impaired in mind.
- Banking security and user-friendly features.

CHAPTER 5
SYSTEM DESIGN AND IMPLEMENTATION

The project is aimed at implementing a mobile banking application prototype to develop its technology and then demonstrate how it could be beneficial to Visually Challenged, Elderly and Illiterate people and financial institutions as mobile payment system is one of the biggest hits in India. This will enable mobile network operators who connect to the everyday reality of the customers, diversify in what is known as a growing market and also implement security measures to ensure a safe and secure mobile banking transaction.

5.1 SYSTEM ARCHITECTURE:

The system architecture of the proposed system "ENVISION" is depicted in figure 3. The architecture diagram with client layer, bank server, database and client user are developed in flow from a visually impaired user to the common users on other side. This architecture is also composed of the future work flow that includes the various banking operations.

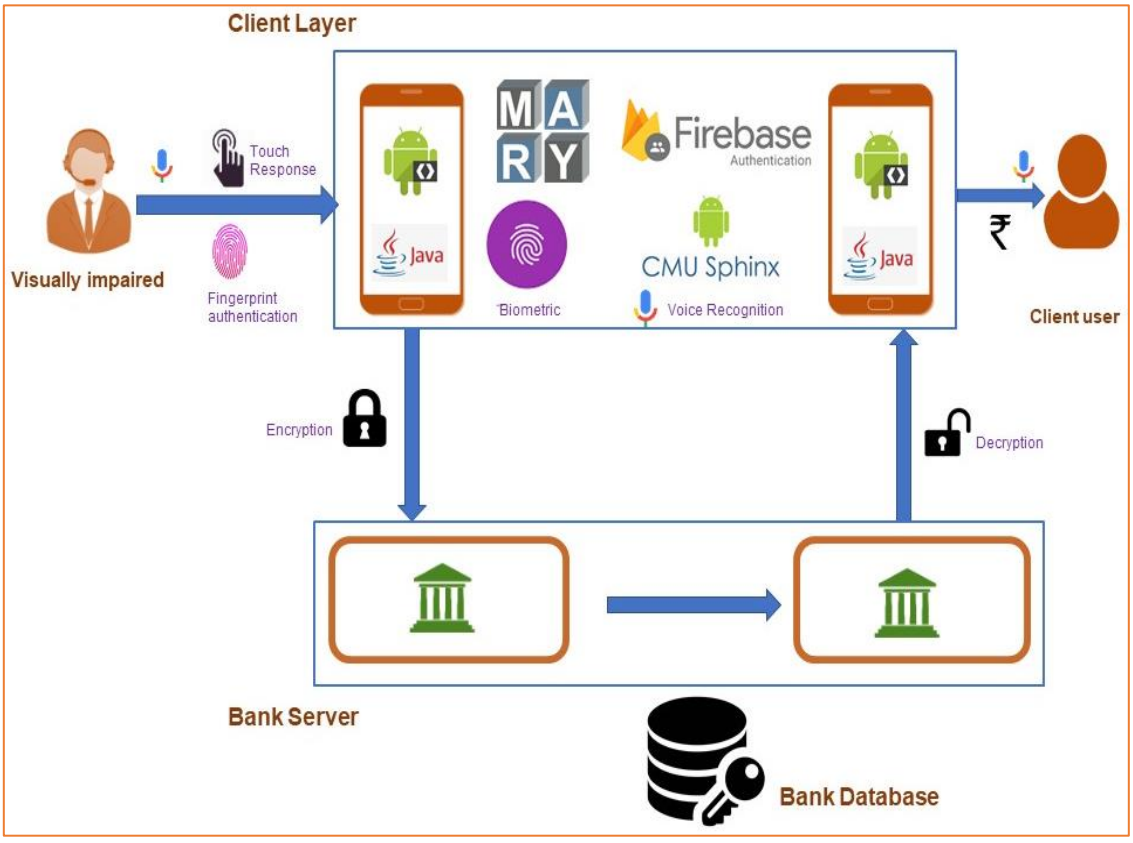

Figure 3: ENVISION SYSTEM ARCHITECTURE

5.2 TECHNOLOGY STACK:

Technology is the brain behind any system that is offered to the users. Let's take a deep look in to the various technologies that have been employed in ENVISION. To note that all the technologies offered are open sourced (except for a few services it offers) and hence is up for grabs to be developed as a commercial product with very less cost involved.

1. MARY (TEXT TO SPEECH SYSTEM):

MaryTTS is an open-source, multilingual Text-to-Speech Synthesis platform written in Java. It was originally developed as a collaborative project of DFKI's Language Technology Lab and the Institute of Phonetics at Saarland University. It is now maintained by the Multimodal Speech Processing Group in the Cluster of Excellence MMCI and DFKI. As of version 5.2, MaryTTS supports German, British and American English, French, Italian, Luxembourgish, Russian, Swedish, Telugu, and Turkish; more languages are in preparation. MaryTTS comes with toolkits for quickly adding support for new languages and for building unit selection and HMM-based synthesis voices.

2. CMUSPHINX (OPEN SOURCE SPEECH RECOGNITION TOOLKIT):

CMUSPHINX collects over 20 years of the CMU research. All advantages are hard to list, but just to name a few:

- State of art speech recognition algorithms for efficient speech recognition. CMUSphinx tools are designed specifically for low-resource platforms
- Flexible design
- Focus on practical application development and not on research
- Support for several languages like US English, UK English, French, Mandarin, German, Dutch, Russian and ability to build a model for others
- BSD-like license which allows commercial distribution
- Commercial support
- Active development and release schedule
- Wide range of tools for many speech-recognition related purposes (keyword spotting, alignment, pronunciation evaluation)

3. FIREBASE AUTHENTICATION (AUTOMATIC OTP DETECTION):

Firebase is a mobile and web application development platform developed by Firebase, Inc. in 2011, then acquired by Google in 2014. Firebase evolved from Envolve, a prior startup founded by James Tamplin and Andrew Lee in 2011. Envolve provided developers an API that enables the integration of online chat functionality into their websites. After releasing the chat service, Tamplin and Lee found that it was being used to pass application data that weren't chat messages. Developers were using Envolve to sync application data such as game state in real time across their users. Tamplin and Lee decided to separate the chat system and the real-time architecture that powered it. They founded Firebase as a separate company in September 2011 and it launched to the public in April 2012. Firebase AUTH is a service form this family launched in 2014 that can authenticate users using only client-side code. It supports social login providers Facebook, GitHub, Twitter and Google (and Google Play Games). Additionally, it includes a user management system whereby developers can enable user authentication with email and password login stored with Firebase.

4. OPENBR (BIOMETRIC AUTHENTICATION TOOLKIT):

A communal biometrics framework supporting the development of open algorithms and reproducible evaluations. OpenBR is supported on Windows, Mac OS X, and Debian Linux. The project is licensed under Apache 2.0 and releases follow the Semantic Versioning convention. Internally the code base uses the CMake build system and requires Qt and OpenCV. OpenBR is a framework for investigating new modalities, improving existing algorithms, interfacing with commercial systems, measuring recognition performance, and deploying automated biometric systems. The project is designed to facilitate rapid algorithm prototyping, and features a mature core framework, flexible plugin system, and support for open and closed source development. Off-the-shelf algorithms are also available for specific modalities including face recognition, age estimation, and gender estimation.

5.3 DATA FLOW DIAGRAM:

The Data Flow Diagram Level 0 & 1 emphasis on the work flow of the ENVISION system which is embarked below. The functionalities in work flow order are:

1. Biometric Registration
2. Mobile Number Registration
3. Automatic OTP Detection
4. Authorization
5. Matching Account Details and its Retrival
6. Customer display

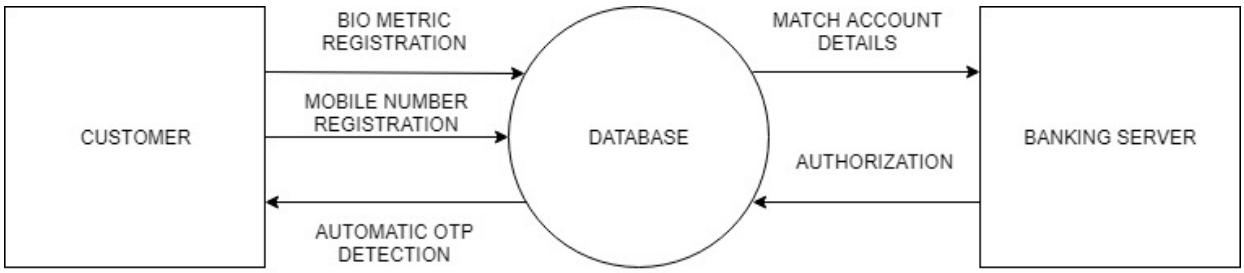

Figure 4: ENVISION LEVEL 0 DFD

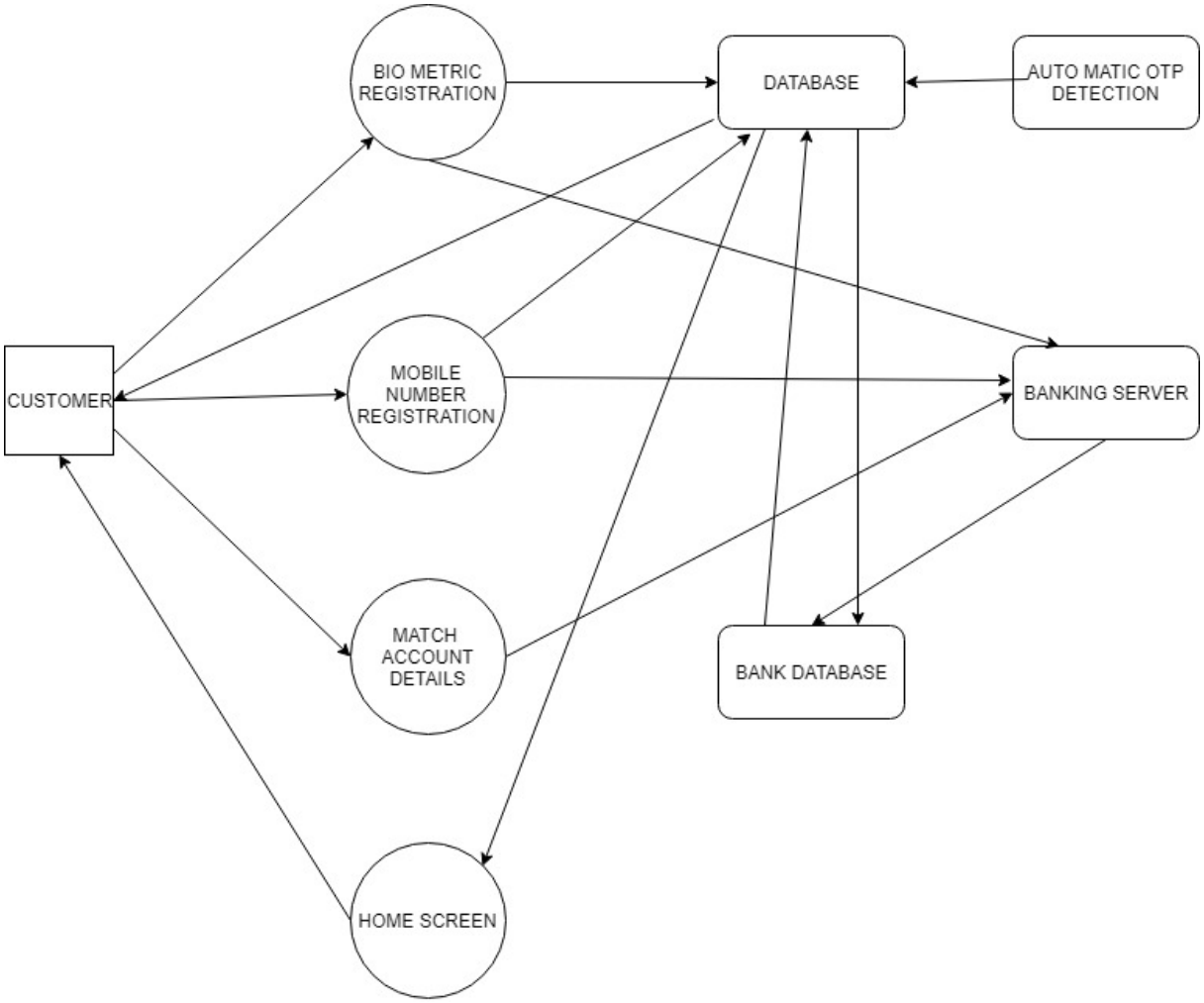

Figure 5: ENVISION LEVEL 1 DFD

5.4 INNOVATION MODULES:

This proposed project consists of 3 innovative technological modules. These modules have been implemented with Visually challenged people in consideration. These modules form the operational capabilities of this application. The three innovative modules are as follows:

1. Android Splash
2. Dual Speech Technology
3. Touch & Swipe Technology

5.4.1 ANDROID SPLASH:

Android Splash Screen is the first screen visible to the user when the application's launched. Splash screen is one of the most vital screens in the application since it's the user's first experience with the application. Splash screens are used to display some animations (typically of the application logo) and illustrations while some data for the next screens are fetched. This technology has been introduced as a part of the system to felicitate the illiterate people about the application.

ANDROID SPLASH (JAVA):

```
private static int SPLASH_TIME_OUT = 5000;
@Override
protected void onCreate(Bundle savedInstanceState)
{
super.onCreate(savedInstanceState);
setContentView(R.layout.activity_main);
} SPLASH_TIME_OUT;
```

ANDROID SPLASH (XML):

```
android:src="@mipmap/splashscreen"
```

5.4.2 DUAL SPEECH TECHNOLOGY:

As the application addresses the major concerns of Visually challenged people the Dual Speech Technology is implemented in the application. The Dual speech Technology refers to application to user and user to application speech and hearing methodologies. As the

use of keyboards are completely untenable speech inputs are the application basis. Also, Speech technology is sub divided to 1. Text to Speech and 2. Speech to Text modules.

Google Text-to-Speech is a screen reader application developed by Google for its Android operating system. This open source module has been implemented in ENVISION. It powers the application to read aloud (speak) the text on the screen which supports many languages. Text-to-Speech are also used by apps such as Google Play Books for reading books aloud, by Google Translate for reading aloud translations providing useful insight to the pronunciation of words, by Google Talkback and other spoken feedback accessibility-based applications, as well as by third-party apps. The application currently consists of voice data for English language and in future work voice data for each language will be added to the application system. Text-to-speech technology has become quite popular, along with digital assistants such as Apple's Siri, Google Voice, Microsoft's Cortana, Amazon's Echo/Alexa and Facebook's M, to name a few.

Speech is a complex phenomenon. People rarely understand how is it produced and perceived. The naive perception is often that speech is built with words and each word consists of phones. The reality is unfortunately very different. Speech is a dynamic process without clearly distinguished parts. It's always useful to get a sound editor and look into the recording of the speech and listen to it. All modern descriptions of speech are to some degree probabilistic. That means that there are no certain boundaries between units, or between words. Speech to text translation and other applications of speech are never 100% correct. That idea is rather unusual for software developers, who usually work with deterministic systems. And it creates a lot of issues specific only to speech technology.

The common way to recognize speech is the following: we take a waveform, split it at utterances by silences and then try to recognize what's being said in each utterance. To do that, we want to take all possible combinations of words and try to match them with the audio. We choose the best matching combination. There are some important concepts in this matching process.

First of all, it's the concept of features. Since the number of parameters is large, we are trying to optimize it. Numbers that are calculated from speech usually by dividing the speech into frames. Then for each frame, typically of 10 milliseconds length, we extract 39 numbers that represent the speech. That's called a feature vector. The way to generate the

number of parameters is a subject of active investigation, but in a simple case it's a derivative from the spectrum.

Second, it's the concept of the model. A model describes some mathematical object that gathers common attributes of the spoken word. In practice, for an audio model of senone it is the gaussian mixture of its three states - to put it simple, it's the most probable feature vector. From the concept of the model the following issues raise:

- how well does the model describe reality?
- can the model be made better of its internal model problems and
- how adaptive is the model if conditions change?

The model of speech is called Hidden Markov Model or HMM. It's a generic model that describes a black-box communication channel. In this model process is described as a sequence of states which change each other with a certain probability. This model is intended to describe any sequential process like speech. HMMs have been proven to be really practical for speech decoding.

Third, it's a matching process itself. Since it would take longer than universe existed to compare all feature vectors with all models, the search is often optimized by applying many tricks. At any points we maintain the best matching variants and extend them as time goes on, producing the best matching variants for the next frame.

The CMUSPHINIX open source speech recognition tool kit is based on the above process which is implemented in this ENVISION system.

DUAL SPEECH TECHNOLOGY (JAVA):

1. TEXT TO SPEECH

```
TextToSpeech t1;
t1 = new TextToSpeech(getApplicationContext(), new TextToSpeech.OnInitListener()
{
@Override
public void onInit(int status)
{
if (status != TextToSpeech.ERROR)
```

```
{
t1.setLanguage(Locale.UK);
t1.speak("Welcome to Envision", TextToSpeech.QUEUE_FLUSH, null);
}
}
}
```

2. SPEECH TO TEXT

```
private final int REQ_CODE_SPEECH_INPUT = 10;
{
voiceInput = (TextView) findViewById(R.id.editText);
Intent intent = new Intent(RecognizerIntent.ACTION_RECOGNIZE_SPEECH);
intent.putExtra(RecognizerIntent.EXTRA_LANGUAGE_MODEL,
RecognizerIntent.LANGUAGE_MODEL_FREE_FORM);
intent.putExtra(RecognizerIntent.EXTRA_LANGUAGE, Locale.getDefault());
intent.putExtra(RecognizerIntent.EXTRA_PROMPT, “Please Speak your phone number");
startActivityForResult(intent, REQ_CODE_SPEECH_INPUT);
}
```

5.4.3 TOUCH AND SWIPE TECHNOLOGY:

As the application addresses the major concerns of Visually challenged people the Touch and swipe technologies have been implemented from the present libraries of android.

GESTURE DETECTOR (SWIPE TECHNOLOGY): Detects various gestures and events using the supplied MotionEvents. The OnGestureListener callback will notify users when a particular motion event has occurred. This class should only be used with MotionEvents reported via touch (don't use for trackball events). This class is implemented as:

- Creating an instance of the GestureDetector for your View
- In the View#onTouchEvent(MotionEvent) method ensure you call onTouchEvent(android.view.MotionEvent). The methods defined in your callback will be executed when the events occur.

- If listening for OnContextClickListener#onContextClick(MotionEvent) you must call onGenericMotionEvent(android.view.MotionEvent) in View#onGenericMotionEvent(MotionEvent).

GESTURE DETECTOR (JAVA):

```
private GestureDetectorCompat gestureObject;
gestureObject = new GestureDetectorCompat(this,new LearnGesture();
class LearnGesture extends GestureDetector.SimpleOnGestureListener{
@Override
public boolean onFling(MotionEvent event1,MotionEvent event2,float velocityX,float
velocityY)
{
if (event2.getX()>event1.getX())
{
Intent intent = new Intent( VoiceActivity.this,MainActivity2.class );
startActivity(intent);
}
else
{
if (event2.getX()<event1.getX())
{
}
}
return true;
}
```

5.5 FEATURAL MODULES:

This proposed project consists of 3 featural modules. These modules have been implemented with Visually challenged, Elderly and Illiterate people in consideration. These modules form the Security and data retrieval capabilities of this application. The three innovative modules are as follows:

1. Biometric Registry
2. Mobile Number Registry
3. Secure Automation of One Time Password

5.5.1 BIOMETRIC REGISTRY TECHNOLOGY:

The main feature of ENVISION is to make its operations user friendly towards Visually Challenged people. For the visually impaired audience, biometric login solutions and further advancements in artificial intelligence can actually accelerate their entry into mainstream banking. Thus, the Open source BIOMETRIC technology is implemented in this prototype.

BIOMETRIC REGISTRY (JAVA):

```
public void startAuth(FingerprintManager fingerprintManager,
FingerprintManager.CryptoObject cryptoObject)
{
CancellationSignal cancellationSignal = new CancellationSignal();
fingerprintManager.authenticate(cryptoObject, cancellationSignal, 0, this, null);
}
@Override
public void onAuthenticationError(int errorCode, CharSequence errString) {
this.update("There was an Auth Error" + errString, false);
}
@Override
public void onAuthenticationFailed()
{
this.update("Auth Faild", false);
}
@Override
public void onAuthenticationHelp(int helpCode, CharSequence helpString) {
this.update("Error" + helpString, false);
}
@Override
public void onAuthenticationSucceeded(FingerprintManager.AuthenticationResult result)
{
context.startActivity(new Intent(context, VoiceActivity.class));
 ((AppCompatActivity) context).finish();
}
private void update(String s, boolean b) {
```

```
TextView paraLabel = (TextView) ((Activity) context).findViewById(R.id.paraLabel);
ImageView imageView = (ImageView) ((Activity)
context).findViewById(R.id.imageView3);
paraLabel.setText(s);
if (b == false) {
paraLabel.setTextColor(ContextCompat.getColor(context, R.color.colorAccent));
}
else
{
paraLabel.setTextColor(ContextCompat.getColor(context, R.color.colorPrimary));
}
}
}
```

5.5.2 MOBILE NUMBER REGISTRY:

ENVISION being a financial banking application need to abide to certain guidelines of Reserve Bank of India the apex body of financial governance. Thus, as part of its guidelines Mobile number registration for all its applications need to be implemented. But with focus on our criteria we have implemented voice based Mobile Number Registry.

```
case REQ_CODE_SPEECH_INPUT: {
if (resultCode == RESULT_OK && null != data) {
ArrayList<String> result = data
.getStringArrayListExtra(RecognizerIntent.EXTRA_RESULTS);
voiceInput.setText(result.get(0));
String toSpeak = voiceInput.getText().toString();
Toast.makeText(getApplicationContext(), toSpeak, Toast.LENGTH_SHORT).show();
t1.speak(toSpeak+"                    to confirm the number swap right, or to re-enter swap
left", TextToSpeech.QUEUE_FLUSH, null);
}
}
```

5.5.3 SECURE AUTOMATION OF ONE TIME PASSWORD:

ENVISION focuses on high level of safety in terms of access and in advancements of technological solutions automation of One-time password will also benefit our considerate sect as they only receive the acceptance notification.

SECURE AUTOMATION OF ONE TIME PASSWORD (JAVA):

```
String code = editText.getText().toString().trim();
if (code.isEmpty() || code.length() < 6)
{
editText.setError("Enter code...");
editText.requestFocus();
return;
}
verifyCode(code);
}
```

5.6 MATCHING AND RETRIVAL OF BANK ACCOUNT:

The major part of this financial application is to display the bank account of the user which is implemented with the basis of dummy Aadhaar database set. The matching data pattern is explained via Figure 6. We are well aware of the benefits and composition of Aadhaar. The data set of Aadhaar consist of Biometric details, mobile number, iris data, bank accounts etc. Thus, all of the above have been evolved in our project thus making it possible of the matching and retrieval of Bank account of the user with registered biometric and mobile number.

USER BANK ACCOUNT DISPLAY (RESULT PAGE JAVA CODE):

```
public void onInit(int status) {
if (status != TextToSpeech.ERROR) {
t1.setLanguage(Locale.UK);
t1.speak("Welcome                " +
"As per our data records your bank accounts are" +
"" Bank +
""Branch +
""Account no +
"Confirm and Swap Right", TextToSpeech.QUEUE_FLUSH, null);
```

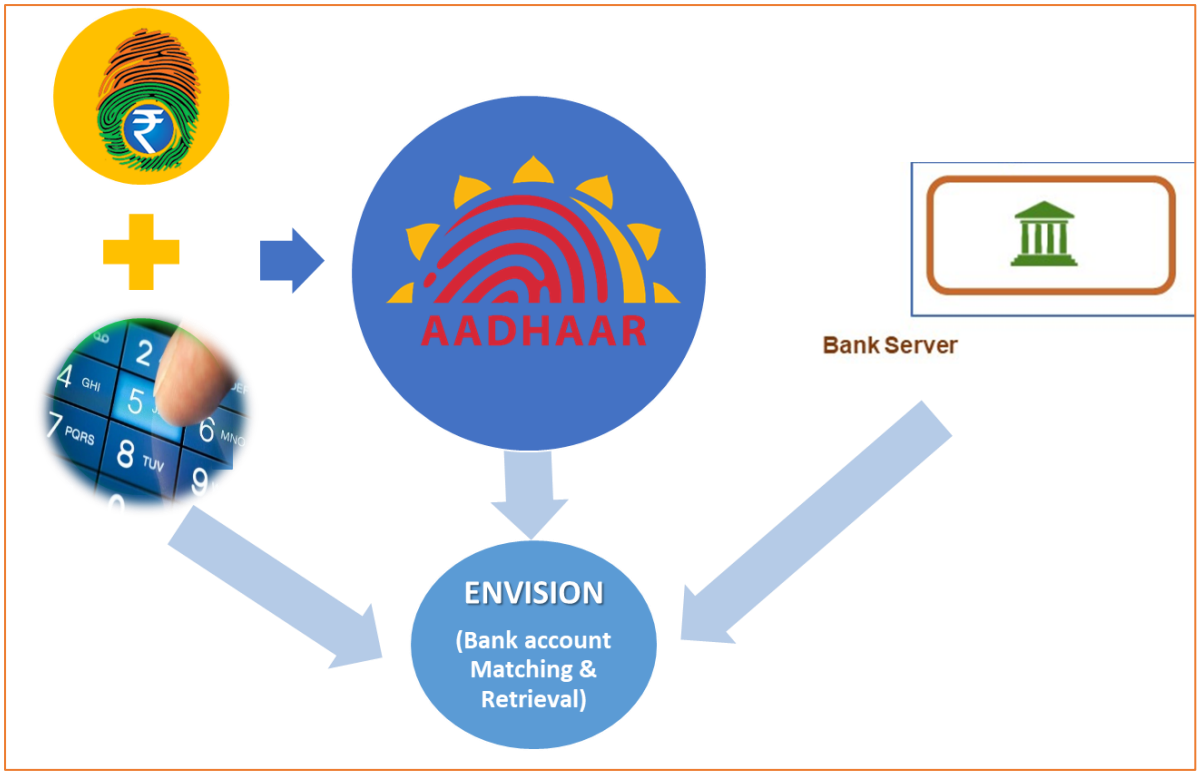

Figure 6: MATCHING AND RETRIVAL OF BANK ACCOUNT IN ENVISION

CHAPTER 6
SYSTEM REQUIRMENTS

To be used efficiently, all mobile applications need certain hardware components or other software resources to be present on the mobile. These prerequisites are known as system requirements and are often used as a guideline as opposed to an absolute rule. Most software defines two sets of system requirements: minimum and recommended. With increasing demand for higher processing power and resources in newer versions of software, system requirements tend to increase over time. Industry analysts suggest that this trend plays a bigger part in driving upgrades to existing computer systems than technological advancements. A second meaning of the term of System requirements, is a generalisation of this first definition, giving the requirements to be met in the design of a system or sub-system. Typically, an organisation starts with a set of Business requirements and then derives the System requirements from there.

6.1 MINIMAL HARDWARE REQUIREMENTS:

Processor: 2.2GHz Snapdragon 626 Octa-core

RAM: 4 GB

Kernel Version: 3.18.71-perf

6.2 MINIMAL SOFTWARE REQUIREMENTS:

Operating system (OS): ANDROID

Coding Language: JAVA

Android Version: API 15, Android 4.0.3 (IceCreamSandwich)

Frontend: eXtensible Markup Language

Backend: PHP

Database: Mobile registry database and Banking account matching database.

CHAPTER 7
RESULTS AND DISCUSSION

The ENVISION application is successfully built in the open source ANDROID platform. All technologies used in building the application are open sourced. The application developed has met the expectations in fulfilling its need to serve Visually Challenged, Elderly and Illiterate people. From the Android splash screen, the flow leads to Biometric registration then to Mobile number registration followed by security check using One-time password for mobile number deducted automatically. Then the application matches the two obtained data to retrieve the bank account of the user successfully and enter the banking operations. The work relating to the banking operations is slated in the future work section.

USER BANK ACCOUNT DISPLAY (RESULT PAGE JAVA CODE):

```
public void onInit(int status) {
if (status != TextToSpeech.ERROR) {
t1.setLanguage(Locale.UK);
t1.speak("Welcome                " +
"As per our data records your bank accounts are" +
"" Bank +
""Branch +
""Account no +
"Confirm and Swap Right", TextToSpeech.QUEUE_FLUSH, null);
```

CHAPTER 8
CONCULSION AND PROPOSED WORK

Thus, the implementation of the first ever prototype in banking for visually challenged, elderly and Illiterate people has been done successfully. Future work is hence proposed as follows:

1. Future work promises banking actions like balance inquiry, loan request, ATM finder, mobile recharge and even payments can be done from the app in its current state.
2. Keeping the illiterate sect in focus the app future work proposes that the app is linked to the phone's language. So, if a user selects a regional language on their phone, the app will also be working on that language.
3. The future works proposed will follow its implementation in the concept of TAP, SWAP, HERE and SPEAK.

8.1 PROPOSED INNOVATIONS:

Just link the present work with 3 innovation modules the Future work also promises 'Add Payee' feature an untenable innovation. When the user selects the 'Add Payee' feature, the app only asks for the phone number of the payee to be added (this is done through a series of taps to get the number right, which, although is a long process, is only a one-time operation for each payee). Once that is provided, the app will send a link to the payee and the payee will have to enter their own details, and once that is done the transaction can be done.

APPENDIX

IMPLEMENTATION SCREENSHOTS:

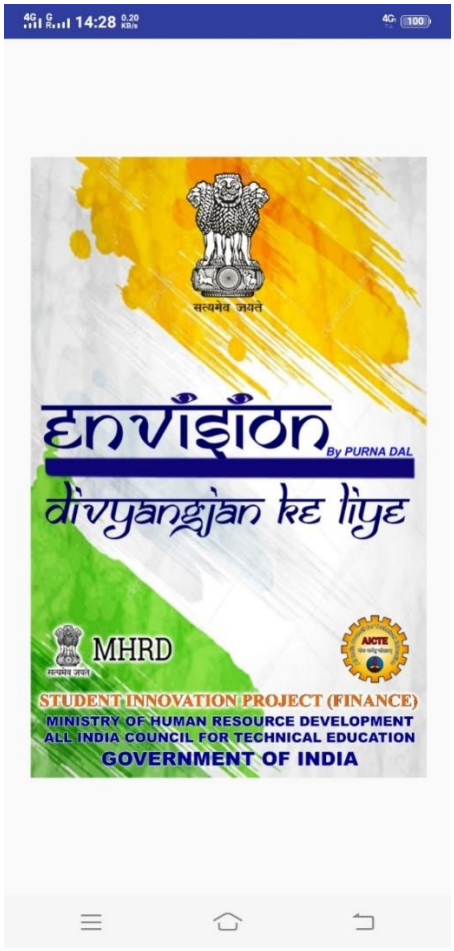

Fig: Android Splash

Fig: Mobile Number Registry

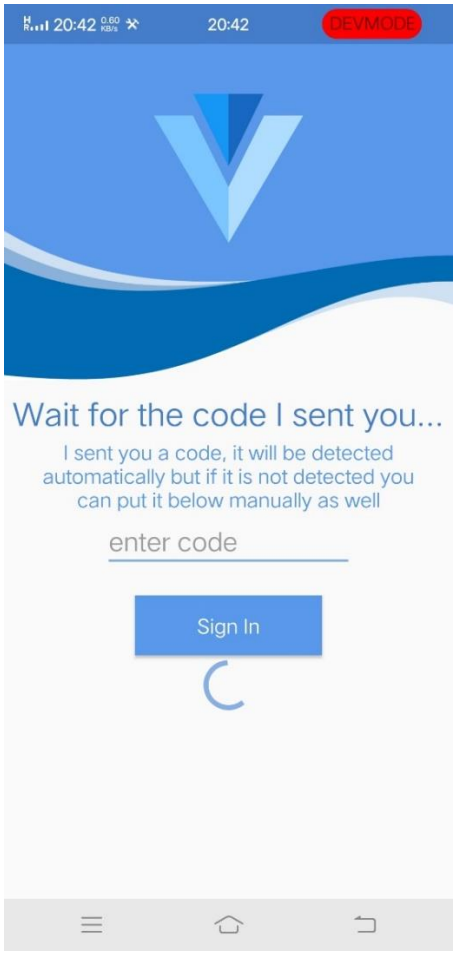

Fig: Secure Automatic OTP

Fig: Biometric Registry

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