

# Stud-e-Book: an intelligent eBook reader application using gesture recognition and user tailored recommendation

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**Abstract** — In this project, we aim to develop an e-book reader specific to study related books. What sets this application apart is the flexibility in use and different reading modes, including gesture recognition. Pages can be swiped using one hand by tilting the phone in each direction, or without hands by hovering over the proximity sensor. This allows multi-tasking with ease, all while reading a book. To simplify user experience, the app offers three book searching methods. One can use normal text or speech to search for a book, but they can also take a picture of a hardcover book and search for the same book in their online library.

**Keywords** — e-book, gesture recognition, optical character recognition, speech recognition, epub, recommendation system

## I. INTRODUCTION AND MOTIVATION

Information through various sources have always contributed to the well-being of humans. These information in the form of books, newspaper, magazines, etc. have played a vital role in the evolution of a man's knowledge. But of all, books have been a major source of gathering knowledge and implementing this acquired knowledge is what defines our human race. In the 2000s, the trend of electronic books (e-books) began, wherein, the same traditional copy of the book was now available in digital format and consisted of text, images, or both. But it was in 2010, that this concept became more popular and e-books overtook the traditional hardcover books. The main reason behind this was e-books were comparatively cheaper and could be bought from easily accessible hand devices such as Mobile, Tablet, etc. Moreover, the ease of availability of books on the e-commerce websites provided readers with a large selection of titles. And hence by 2014, 28% of the adults had read an e-book [1]. With e-books, one can easily have a bookmark reference and it also allows users to annotate pages. Although, e-books contain fiction and non-fiction, technical material is best for the e-books. With technical e-books such as

programming, one can learn any new technology and master it by understanding the coding examples.

Motivated with the technical advantage obtained from e-books, we developed a mobile application which lets users from various fields such as Astronomy, Biology, Chemistry, Engineering and Music read books and gain knowledge out of it. Now-a-days, though e-books are easily available, there is little flexibility available for the users. Moreover, hardcopies are difficult to carry everywhere as sometimes they are very bulky and heavy to accommodate. Thus, in such scenarios, e-books are the best options available to the users. Another problem associated with the e-books is you need enough of storage space in your device so as to read them on-the-go. To overcome this, we need a cloud storage of e-books, wherein the user can easily access them just based on the internet connections. Sometimes, a book picked by the user is not enough and the user would further like to gain more insight into that subject to master their knowledge. In such cases, a recommender system would best work for the users. Also, with e-books, one needs to manually swipe left and right to move to-and-from in the book. Hence, it becomes difficult for users to multi-task i.e. read along with cooking or doing other tasks. To overcome this, an e-book application with gesture recognition would provide users with more ease in reading and thus makes the learning process much interactive and fun!

## II. RELATED WORK

The e-book reader, integrated with the mobile device, is designed primarily for the purpose of reading digital e-books and periodicals. Their main advantages over printed books are portability, since an e-reader is capable of holding thousands of books while weighing less than one book, and the convenience provided due to add-on features. Some of the e-book reader apps are specially designed for portable devices such as kindle manufactured and marketed by Amazon, the device enables users to browse, buy, download, and read e-books, newspapers, magazines and other digital media via wireless networking to the kindle Store. [2.1] Kindle was first introduced in 2007 and now comprises a range of devices, including e-readers with e ink

electronic paper displays and kindle applications on all major computing platforms including Microsoft Windows, Android and IOS. Kindle support dictionary and Wikipedia look-up functions when highlighting a word in an e-book. The font type, size and margins can be customized as well.

The rest of the e-book reader apps are not specially designed for e-book device with e ink electronic paper display, they are compatible to most of the mobile devices such as smart phones and tablets. Google Play Books is one of the most advanced e-book reader apps, readers are able to choose materials from millions of best-selling e-books, comics, textbooks. Not only supports the reading displayed text as most of the e book apps do, it also provides audiobooks which allows user to listen to the book through the earphone or speaker of the mobile devices. With users' searching and browsing data, machine learning techniques are applied on data processing and data mining to observe and predict the preference of user's reading habits and make recommendation on the materials. The feature makes the modern e-book reader an intelligent agent and give readers more convenient and enjoyable reading experience.

### III. METHODOLOGY

Our approach involves using Android Studio to develop an app that would make study material easily accessible to people and provide ease of use. The methodology consists of using Firebase authentication to authenticate the users once they have created an account in the application. Further, to store the e-books in e-pub format we use Firebase Storage functionality. The Firebase database consists of schemas of user credentials, list of books and a recommendation table. When a user first opens the app, he is directed to the Sign-Up/Sign-In page. On successful login, the user is directed to the homepage, where he has access to two tabs; Recent Reads and Library. The Recent Reads and Library consists of a search bar wherein the user can search the books by inputting the text, using voice or by using the camera. The Library consists of books from various categories and when the user picks one of those, he can read the book in two forms; WebView and TextView. The webview parses the e-pub files and hence has a nice formatting for the books whereas the textview simply provides with text data of the book. Another such functionality implemented for the books include increasing/ decreasing the font-size. Furthermore, to swipe across the pages of the books, we have implemented Gesture Recognition. There are two types of Gesture recognition; Air-Gestures and Tilt-Gestures also known as No Hand Mode and One Hand Mode respectively. The No Hand Mode operates based on the how to tilt the phone. If you tilt the phone downwards to 45 degrees, the book goes to the previous page whereas if you tilt is upwards at the same angle, it moves to the next page. Similarly, for the One Hand Mode, if a user places their hand on the screen for 2s, the book goes to the previous pages and if the hand is placed for 1s, it moves to the next page.

The Recent Reads consists of the books recently read by the user along with the Recommendation section. Here, we track the last page of all the books read by user. And hence, users can continue reading where they left off. Based on the books read by

the user, we recommend similar books, which helps user in gaining a deeper insight of the subject being read.

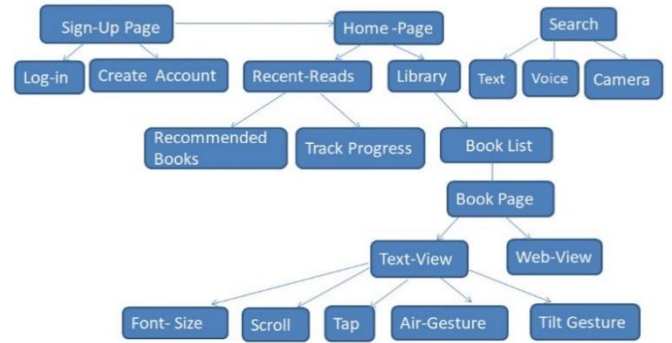


Fig. 1 Methodology and workflow of the ebook application, explaining the used modules and associated features

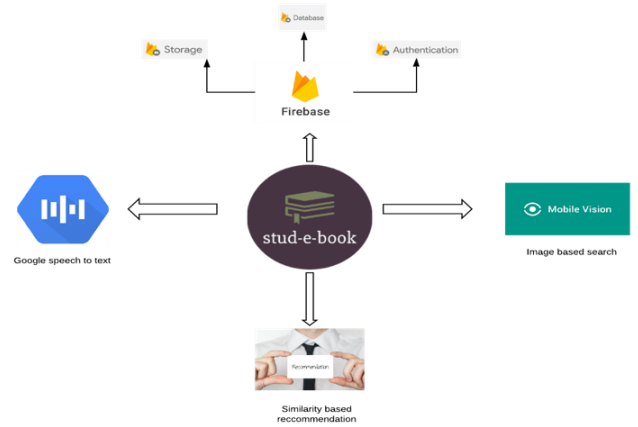


Fig 2 System architecture – the modules and 3<sup>rd</sup> party libraries used with respect to the application

#### A. Description of the Database

Our Storage consists of epub books, from different categories within academia such as Music, Engineering, Astronomy, Physics, Computer Science, Chemistry etc.

In the real-time database, we store user information for authentication and authorization, and their current books along with the progress, to allow and keep the same experience in different devices.

## IV. IMPLEMENTATION

For the implementation, Android Studio and some third-party modules have been used.

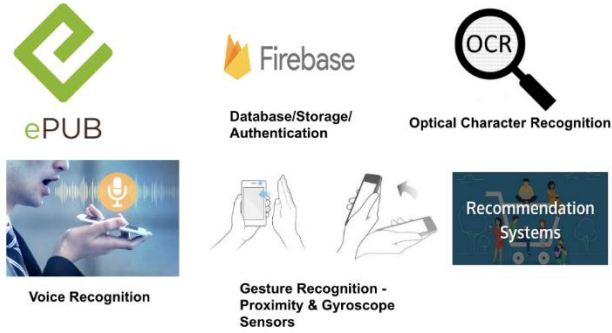


Fig 3 A list of android modules and external used libraries in the implementation phase

### A. ePUB Parser Library

Epub Parser is a java library for parsing epub files which lets you read epub content page by page.

### B. Firebase

Firebase is a development platform that provides real-time database and backend as a service. [4] We used the following services:

- 1) *Firebase Storage*: a scalable storage service that supports uploading and downloading objects to Google cloud storage.
- 2) *Firebase Database*: realtime database service that lets you store and sync data in a cloud-hosted NoSQL database
- 3) *Firebase Authentication*: backend service that supports user authentication using passwords, phone numbers, google, twitter and facebook accounts

### C. Google Vision API - Optical Character Recognition

An API that detects text within images in more than 50 languages [5]

### D. Voice Recognition – SpeechRecognizer:

Android service that converts speech to text [6]

### E. Recommendation System

Machine Learning techniques to detect similar books for recommendation, using cosine similarity as a metric.

We have used the aforementioned modules accordingly for our implemented features.

The project was implemented in Android Studio, using java 8. There are three Activities. The Login, Sign-Up and the Main Screen.

The Login and the Signup activities is where we use Firebase Authentication service to allow for user login and profile creation, their authentication and authorization accordingly.

From the activity of the Main Screen we inflate two fragments that will serve as two specific tabbed screens.

The first fragment displays the last read books and the progress in the books, that we retrieve from the real-time firebase database service. This fragment also contains the recommended books associated with their recent reads and history, that we calculate using our Recommendation System which works by finding books with similar titles using cosine similarity between all titles and displays the ones above a certain threshold.

In the second fragment, we display our books from the storage, emulating an infinite scroll, by display 20 books at a time and with the scroll, we retrieve books from the Firebase Storage.

In the search bar, we use the Speech Recognizer android module to offer the feature of looking for a book using speech as well as looking for a book online by taking a picture of the hard copy book, and using Google Vision API to perform Optical Character Recognition and read the title of book.

Should the user want to jump to a specific page, we have a search bar within the book view fragment, where you can specify the page you want to go to.

We display the books in android fragments, page by page using the ePUBParser library to read the content.

## V. EVALUATION AND RESULTS

### A. User Study

The app was circulated amongst 12 friends for evaluation. The distribution of this population was 6 students, 2 developers and 4 working professionals from other sectors. The population considered for the survey were people who used apps to read e-book. A pre-survey and a post-survey were conducted. The pre-survey was focused on understanding how often people use e-book readers, and the features that they desired on the e-book readers.

### B. Results

Out of 12 participants, 4 of them use e-books very often, 7 use them often and 1 person uses them sometimes. This is dependent on their background.

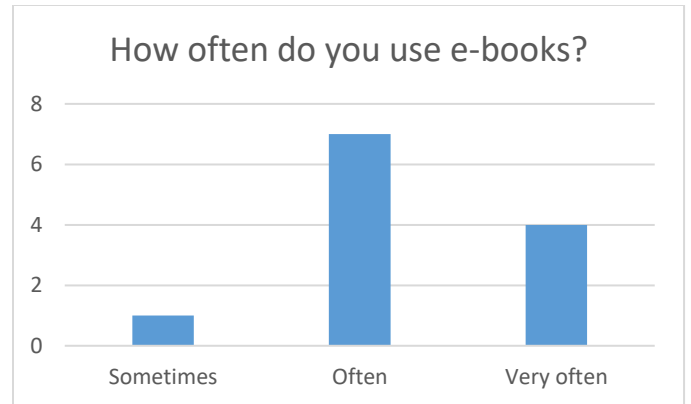


Fig. 3 Survey response distribution for the frequency of e-book usage

The post survey was focused on evaluating the developed application and possible expansions that could be made to the application.

Based on the pre survey, some of the features that were requested by the users were added to what we had already planned like providing customizable font sizes for users.

In the post study, we also asked participants to rate our app, in a 5-star rating system. Out of 12 participants, 3 gave it a 5-star rating, 5 of them gave our application a rating of 4, 3 participants rated it with 3, and only one participant gave it a reference of 2.

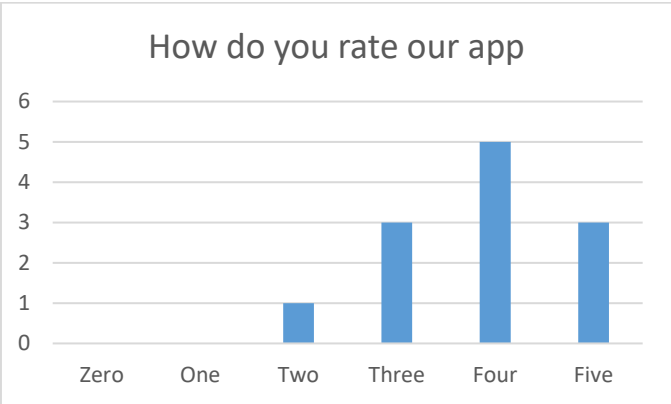


Fig. 3 Survey response distribution for the rating of the app

In the post study, in addition to getting reviews about our application, we also wanted to know how well the sensors performed on different devices as the touchless page swipe was one of the primary features.

In the following graphs, we visualize the distribution and response that the users gave when asked about the aforementioned performances.

Out of 12 participants, 11 of them did not face any difficulty when using the swiping functionalities and one of them had faced some difficulty.

We took this into account and improved upon our sensor accuracies on the next iteration.

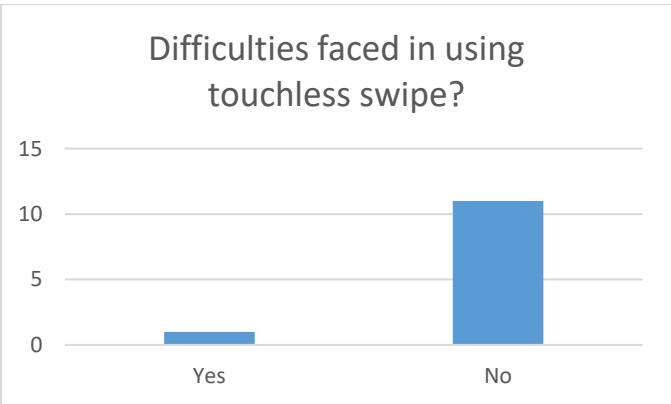


Fig. 4 Survey response distribution for whether they have faced difficulties in the swiping modes

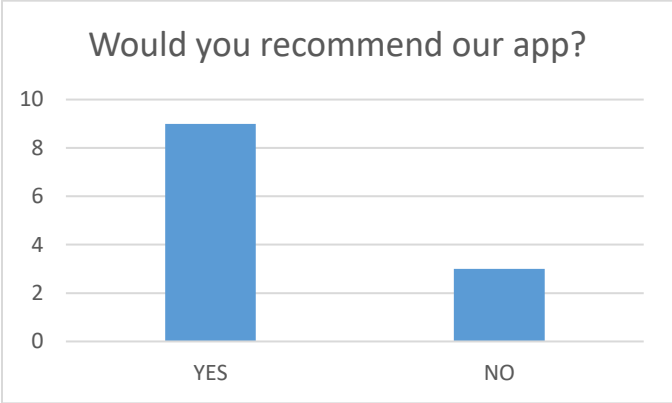


Fig. 5 Survey response distribution for the likeliness of recommending our application to other peers

VI. DISCUSSION

Based on the evaluation results it was observed that majority of the reviewers liked our app. This was because, since most of the e-books do not have flexibility with respect to the swipe functionality, the two different modes of gesture recognition provided them with more ease in reading. Moreover, many applications require users to download books and maintain in their device storage, using cloud storage functionality helped the users read more books even with less device space.

VII. CONCLUSION

The majority of students and even working individuals use ebooks almost on a daily basis instead of hard cover books. Taking into account the integrated services in our application, specifically the gesture recognition functionality, for hand-free or one-hand reading mode, we have concluded that they are crucial in improving user experience and willingness to read a book at any given time and setting. These features were proven to be novel and important, given the results of our evaluation studies. The importance will increase when the stored books will cover even more categories, as that will increase the user base and change the current demographics.

VIII. FUTURE WORK

Experimentation and testing were limited due to the time restrictions of this project and will be included in the future work. Initially, in our future scope, we intend to add unit and integration tests for our existing features, so that our code is more resilient towards new features being added. Once we have a solid codebase, we plan to integrate new features taking user feedback into consideration.

Since our books primarily consist of academic books, the vocabulary used is usually of a higher and more difficult level. We plan to add a feature that allows to highlight words and sentences and be able to look up and show their meaning in real time.

Our app was tested in mobile devices as well as tablets, due to the fact that most people prefer to read in different sized screens.

In our future work, we intend to improve greatly over the user experience for tablets specifically.

Furthermore, we plan to add user boredom recognition and push notifications to remind them to continue reading a book they have started or suggest a new similar book to start with. This will also induce an increase in intellectual abilities and productivity amongst our users, considering the books are mainly of an academic background.

And finally, throughout our app usage and version releases, we plan to increase our book base, by adding a variety of books in different categories.

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