StudyMate: A Solution to Academically Focused Socialization at the University Level

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Abstract

One major concern among student populations is balancing school life with their social life. Oftentimes students face stressors from numerous factors, such as grades, professors, parents, stress, and mental health. StudyMate is a tool designed to help elevate those concerns, by connecting students with study partners with a focus on improving academics. Part of the project included a low-level user study to ascertain the impact the application could have on campus. Ultimately, the StudyMate project resulted in a well-rounded Android application geared toward helping students connect with their peers.

General Terms

Algorithms, Management, Design, Reliability, Human Factors, Standardization, and Languages

Key Words

1. **User Interface (UI):** Refers to the app frontend
2. **ML Kit**: Google Machine Learning Kit
3. **Study Groups:** An in-app concept associated with individual user groups (created by users)
4. **Study Spots:** Geofenced locations at the university level.

1. Introduction

One of the most challenging aspects of being a student is finding suitable study partners or tutors. With busy schedules and competing demands, coordinating study sessions with others who have similar availability can be a frustrating and time-consuming process. Moreover, new students often struggle to assimilate into the school environment, making it even more challenging to find the right people to work with. These obstacles can add to the overall stress of studying, making it more difficult to keep up academically. Students may find themselves overwhelmed with assignments, struggling to manage their time effectively, and feeling anxious about their academics.

To address these challenges, students may need to take a proactive approach to stress management. This could involve seeking out resources and support to help manage their workload and maintain a healthy work-life balance. For example, students could seek assistance from academic advisors or counseling services, which can provide guidance on managing academic stress and anxiety. Additionally, students may find it helpful to develop good study habits and time-management skills, such as working with other students and prioritizing tasks.

As a result, there is a growing demand for more online resources to aid in learning, such as interactive learning tools and online tutoring services. These resources can help bridge the gap between traditional classroom learning and the online environment, providing students with the support they need to succeed academically.

2. Background

Besides memorization and test-taking skills, there are a multitude of other factors which can impact one's academic performance. One important factor which can impact performance is socialization in the work environment. Socialization refers to one's inclination to work with others, and bond with peers. In particular, students who socialize and discuss more with their peers have better academic performance [3] [2]. This has proven to be particularly difficult as a result of the pandemic, which resulted in students being more isolated during their studies [2]. Therefore, it can be concluded that a valuable application for students would allow them to connect with other peers to both, accomplish academic tasks, and develop more social natures.

Furthermore, the environment a student works in can have an impact on their academic performance as well. Many universities offer private and public spaces to study, such as the library, private rooms, or other spaces. These spaces foster socialization and group work among students, by offering them a safe space to work. However, one challenge related to these spaces is finding an open place to study, which is not in use by other students or peers [4]. Students have the desire to use these spaces, either for group, or individual work, but face blockers when searching for available locations[4]. A practical solution would allow students to identify potential study locations away from home with a focus on ease of access.

3. Related Work

In relation to overall academic performance, the challenges students face in finding study partners or tutors can be daunting, but there is a range of non-centralized solutions available to help students overcome these obstacles. At the university level, some institutions offer their own programs and apps to facilitate connections among students. For example, Worcester Polytechnic Institute (WPI) has its own program called MASH, which stands for "Math and Science Help." This program allows students to find other student tutors which help them learn. However, this approach is often applied sparsely depending on the location. In particular, these programs largely depend on funding, and do little to help students establish good work-related bonds on campus.

In addition to university-provided solutions, various platforms offer paid tutoring services to students. Chegg Study, Learn To Be, Tutor Point, and Duolingo are just a few examples of such services. These platforms allow students to connect with qualified tutors who can help them with specific academic subjects and assignments.

These types of services can be beneficial for students, but have issues of their own. Firstly, these options are more generalized solutions and do not solve the problem at a university level. Oftentimes students have difficulty using general programs, like Duolingo, or Chegg Study, since they do not relate specifically to the course the student is taking. For example, Chegg Study may offer coursework relating to a broad topic, such as Calculus, but for more advanced topics there are slim pickings in terms of resources. Furthermore, these applications are individualistic and do not foster social relations among students. Many students rely on these apps merely to get answers, and not to understand the underlying process [5]. A better approach would be to connect students with the proper resources, like tutors, professors, or other study mates, at the same university in which they could discuss concepts and related material. This approach would both, help to establish a consistent and healthy academic relationship, as well as allow the student to receive the individualistic help they require.

4. Methodology

To solve the mentioned problems above, the WPI development team designed the StudyMate application. The app was intended for usage at a university level, such as WPI. Students can easily access the application on their mobile devices, and integrate it with their academic life. Within the app, there are multiple features aimed at assisting students with their studies.

4.1 The StudyMate Goal

The goal of the StudyMate app was to, first, foster communication and socialization among peers at a university level, and second, to decrease the barriers associated with peer-to-peer learning, such as location, languages, resource sharing, and scheduling.

First, the socialization problem among (mostly new) students at universities. After COVID-19, many students still found their education to be impacted due to online learning and the lack of community [1]. Creating an app that directly connects students with their university, allowing them to find peers on campus, in the same course or project, can bridge that gap.

The basic chatting feature within the app allows students to find courses at their university based on department, course name, and instructor. Once in a study group, students are encouraged to chat with others, via the built-in chat feature. For example, some students may use the chat to ask homework questions or suggest potential meeting times for the group.

The goal of the chat feature is to foster communication with peers at the university, which could be long-lasting. For example, it is common for study groups to form among students based on individual courses. This is mostly true due to the fact that students in the same courses share the same plight, such as homework and exams. Therefore, these students can easily relate with one another and either offer their assistance or receive assistance.

Second, StudyMate aims to improve the work environment problems at all universities. The desire was to provide students with a centralized location in the app to check available study spots (rooms) throughout their university. Students can then reserve and invite classmates to that same room with a focus on academics. To accomplish this the application keeps a running track of the total number of users in designated Study Spots.

Furthermore, another challenge associated with academics is the process of documenting and reviewing notes. Many students take their notes via physical documents, such as paper and pen. However, the downside is that only one copy of their notes exists, making it difficult to share and reuse. To counteract this the team included Text Recognition and Text Translation to help organize and facilitate sharing notes, past work, and other course-related exercises. To bridge this gap, users each have a private repository of files within the app, which can store past notes, generate a transcript of the notes via an image, and translate notes to alternative languages. These files can then be shared across multiple users via downloads, or links. One popular usage was to generate a digital file of a physical piece of paper. For example, students could use their preferred method of note-taking, either with paper and pen, or other forms, while still being able to digitize them for sharing or external usage.

4.2 Development Process

The team's software development process closely followed the AGILE methodology. The team had weekly scrum meetings spanning a total of four sprints, each lasting around a week. Furthermore, the development process was split into multiple phases, including Wireframing, Prototyping, Testing, and Final Deployment.

5. Implementation

The StudyMate application was designed with native development in mind, focusing primarily on Android devices. Leveraging the Android platform, the app could support a range of Android devices and interfaces. The most critical components of the application were Firebase, Google Maps SDK, and ML Kit.

5.1 User Interface

An important aspect of any mobile application is the front-facing user interface (UI). The UI is responsible for allowing users to interact with the application logic and must be appealing to the user. In terms of the StudyMate application Figma and Android Jetpack were used to generate a basic UI. Figma was used to create basic screen mockups, without writing any code. From the Figma design Android Studio and Android Jetpack were used to implement the screen designs and program app logic. The design for the application had a focus on usability.

5.2 Application Backend

Firebase is a Cloud service for managing and storing app information. Using this platform allowed the app to integrate with real-time storage, and persist information upon reloads and restarts. For example, each user was required to create an account for the app, and the user details were stored in the Firebase server for persistent logins. Furthermore, the Firebase tool allowed for shared information among users, such as the Study Spots, and Study Groups which were created using the app. Firebase offered a free, easy-to-implement solution to data management via cloud assistance.

The downside of this approach was that it added reliance on internet access to the application. Due to the online nature of Firebase, each user would need to be connected to the internet to login into their account. However, the team decided that this was a necessary requirement since many other application features also require internet access. In the future, implementing offline features, such as file downloading, could be beneficial.

One key implementation based on Firebase was the Study Group feature. Each study group was required to be registered via the app UI and then stored in Firebase. All users could then see the registered Study Groups upon subsequent refreshes and restarts. On top of that, within Firebase, each location (university) would have a subsequent list of departments and courses. When registering the Study Group the user was required to specify the name, description, department, course name, members, and if the group was private.

To implement real-time chatting, Firebase sockets were used. One of the many features of Firebase includes the ability to listen for real-time data updates. Within the app, each Study Group associated with the currently logged-in user had a snapshot registered, which would listen for updates in the data model. Each time a message was sent within the Study Group the Firebase object was updated to include the new message. This resulted in all users currently a member of that Study Group receiving an updated object snapshot for the new message. The message was then displayed on the UI for the user to read. Figure 1 below shows the basic chatting interface for the app.

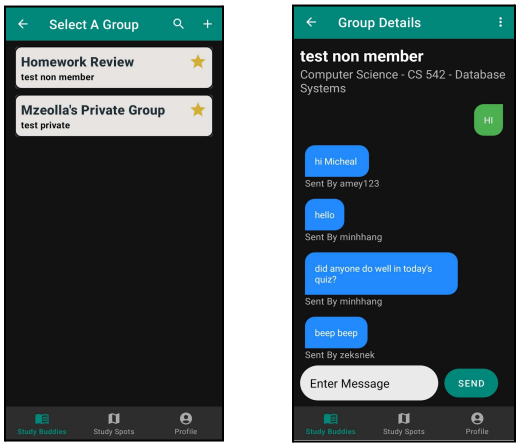

Figure 1: Groups View and Detail Chat View

Group members are also able to schedule study sessions for the entire group. To accomplish this users are allowed to enter their availability via a simple calendar UI on the profile page. This UI allows the user to set a weekly schedule, which highlights the times they are available. Furthermore, when scheduling a group meeting the algorithm will select the next available time when the most group members are available.

5.3 Location Sensing

The Google Maps SDK is an outward-facing tool for integrating Google Maps within any Android application. Google Maps was responsible for tracking user movement asynchronously and displaying a live map of registered Geofences. In particular, the SDK was used in relation to the Study Spot features within the app. This feature allowed the application to keep a running count of how many users were in select registered Study Spots. For example, students could register a Study Spot at their local library, and the app would track how many users were currently within the library. This feature proved to be particularly useful for finding a location (away from home)

to study or complete group work, providing a more academic-focused environment for the user. Users were also able to register other valuable information to the Study Spot, such as maximum occupants, name, and description.

Currently within the application only administrative accounts are able to create and modify Study Spots. This was limited for a few reasons, the most pressing being user privacy. Allowing users to register their own unique Study Spots could prove dangerous. For example, if one student was to register a Study Spot in a person's home, they could track when a user is out. Furthermore, the Google Maps SDK places a limit of 100 Geofences on each app, so only 100 Study Spots are allowed per location associated with the app. Moving forward, the development team will aim to work closely with the university administration to establish Study Spots responsibly.

When registering a Study Spot within the UI, the user must enter a name, description, and locational coordinates, such as longitude, and latitude. Other metadata information, like the creator, the date created, and more, are automatically sensed via the app state. Furthermore, users are allowed to register Parent Study Spots associated with each location. For example, if users generated a Study Spot for the campus library and room 101 within the library. The Room 101 Study Spot would have a parent location which was linked to the overall library Geofence within the app, allowing for an accurate count for both Study Spots. This implementation in particular encouraged users to use Study Spots to track empty rooms on campus.

Figure 2 below shows the basic UI for viewing the different application Study Spots. The user is able to see an overview page that includes the total number of guests in each spot and sub-spot. For example, the figure includes the Alpha Chi Rho study spot, which has two sub-spots associated with it. The Map view allows students to view all study spots in reference to campus. Study Spots are shown as a radius, and sub-spots are different colors.

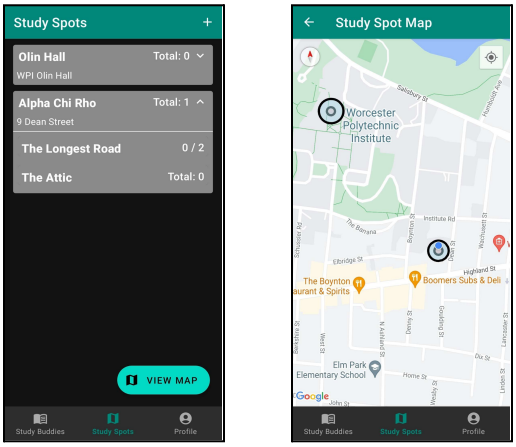

Figure 2: Study Spots and Maps View

5.4 Machine Learning Models and Usage

ML Kit is a publicly accessible machine learning kit that can be easily implemented in any Android application. It provides multiple preset machine learning models which each perform a unique purpose. In reference to the StudyMate app, the models that were integrated were the Text Recognition and Natural Language Translation models. The Text Recognition model was responsible for allowing users to scan physical documents like lecture notes to generate a full transcript from the document, and upload the document with the text transcript to the database. Furthermore, Natural Language Translation was implemented to allow users to translate their notes into different supported languages. For example, users can translate their professor's notes from English to their native language. Ultimately, the goal was to increase socialization by decreasing the barriers to sharing content.

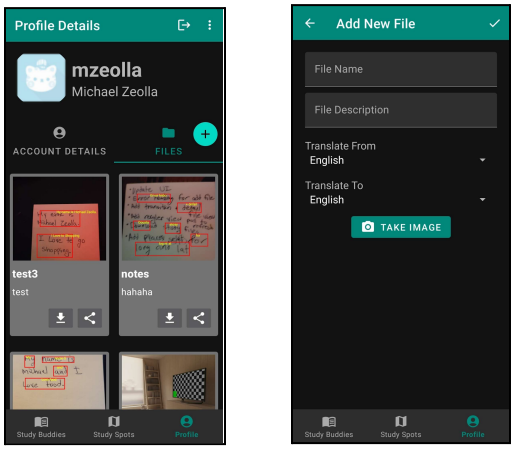

Figure 3: User File View and File Registration

When registering a new file for the account, the user is required to enter a name, description, the original language, a translation language, and an image. The file image is used to run Text Recognition and Text Translation. Assuming Text Recognition was able to infer text within the image, the text would then be translated to the inputted translation language. Also, the app would then register the text information returned from ML Kit on top of the original uploaded image. The file was then saved in Firebase to the proper user collection, along with the generated transcript, and translation if applicable.

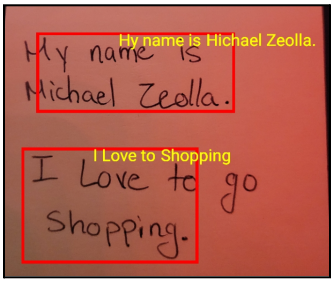

Figure 4: User File Generation

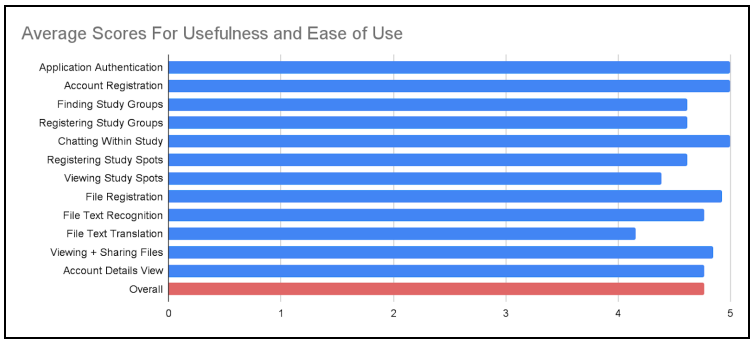

Figure 5: User Study Average Feature Rankings

6. Evaluation and Results

During the development process of the application, the team engaged in a small user study for the StudyMate app. The user study was focused on hammering down the design and app features, as well as entertaining the idea of a full-scale release. In total, there were 13 participants in the study, who each were given the opportunity to use the app and take a short Google Form.

To recruit testers the team conducted a word-of-mouth exposure, mostly relying on their peers attending WPI. For example, the team recruited testers from other students in their courses. No identifiable information was recorded during the study to prevent participant tracing. To that end, no demographic information was recorded to keep the testers anonymous.

Each user was provided with a version of the app on their Android device or a device provided to them. The testers were given minimal assistance and a list of tasks to complete while using StudyMate. Tasks included, but were not limited to, creating an account, adding a User File, and chatting in a Study Group. The questions were designed to elicit quantitative answers, mostly on a scale of one to five. Some questions were aimed at gauging the difficulty of the feature, while others focused on usability. For a full breakdown of the questionnaire view Appendix A below.

Following the conclusion of the study the team began to analyze the results. Overall, many of the features were rated very positively, receiving mostly four and five responses. Figure 5 above shows the total breakdown for key metrics in the study. Each feature was ranked on a scale from 1-5 in terms of Difficulty and Ease Of Use. A score of one implies not useful, and difficult, and a score of five indicates easy to use and useful.

The Study Group feature, which included live chatting, received high scores in usability and ease of use. Both registering and finding Study Groups received a score of 4.5, while Live Chatting within Study Groups received a high score of 5. This is likely due to the fact that these features are quite similar to other applications. For example, in the modern app space, there are many apps that focus on connecting users and allowing them to chat. In relation to StudyMate, the implemented design was also quite simple and intuitive. The most notable comment this feature received was that the UI could be more "impressive" in terms of visuals.

One of the more controversial features, while still receiving majority scores of four or five, was the Study Spot feature. There are a few reasons why this feature was the most controversial, including privacy and ease of use. Many testers were hesitant to rely on this feature since it relied on tracking their location. Yet, these testers still indicated they could gain value from such a feature. It is also possible to implement the ability to turn off location sensing in a future iteration of the StudyMate app. Furthermore, testers found the current UI, including parent spots and sub-spots to be a bit confusing at first. The reason for this confusion was that users could not visually denote the distinction between the two. In the next iteration adding a text explanation of each feature, and its intended use case, could reduce confusion. In the end, the Study Spot feature still received a total rating of 4.3 out of 5, proving it was a valuable addition to the app.

Lastly, the User File feature, implementing both Text Recognition and Text Translation, received very positive remarks. Many testers mentioned how this feature in particular was quite interesting and beneficial for them. For example, one tester spoke about how this could be used to digitize their notes from class and share them with friends. However, in reference to Text Translation, the study was skewed to English speakers. As such, many testers indicated that while this feature could be beneficial, and they envision a use for it, they likely would not use it in the future. The usefulness of this feature depends on the multilingual needs of the user. In general, these features have proven that modern ML Kit models can help improve student life and note-taking. Overall File Registration received a score of 5, while Text Recognition and Translation received scores of 4.7 and 4.1 respectively.

The final question in the user stay questionnaire was intended to ascertain if testers would consider using this app in the future. Eleven of the thirteen testers, 85%, stated that they would use the application in the future. From these results, the team concluded that StudyMate was

a useful application targeted at college students. Figure 6, below supports these claims with quantitative data.

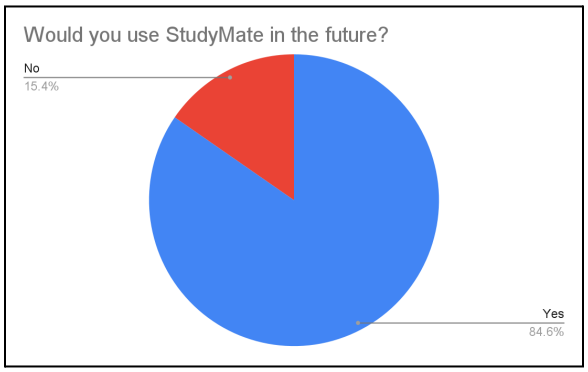

Figure 6: Future StudyMate Usage

The development team also wanted to ascertain the effectiveness of developing a dual iOS application in the future. To that end, the user study included a question that asked participants to include what device type they use in their daily life. Based on the very limited study, the results showed that while the majority, 61% of participants used an Android device, 38% used an iOS device.

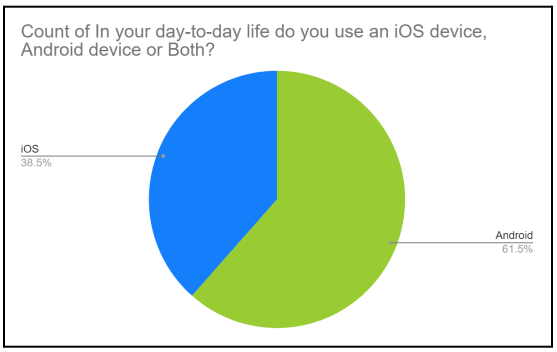

Figure 7: Device Type Demographics

Some limitations of the user study are in relation to recruiting participants and the sample size. Many of the participants were students at the same university. Due to this fact, some students might feel pressured to give the app a better rating. To help counteract this the team affirmed that the input of each respondent would be anonymous. The team encouraged testers to give critical feedback and be as harsh as necessary, to collect valuable results. Furthermore, the study only consisted of 13 total participants. While this amount can help ascertain a base understanding of app feedback, a larger study could be beneficial.

7. Future Work

Following the completion of the StudyMate prototype app the team reviewed future improvements and drawbacks. This was done firstly, to help shed light on some potential drawbacks of StudyMate and secondly, to propose additional features which could be fruitful for future iterations of the application.

Like many other Crowd Sensing applications, which involve tracking users by opportunistic or participatory sensing, StudyMate suffers from a lack of users. Crowd Sensing services, like Geofencing, require other users, besides the main user, to have the application installed. The more users participating in the sensing, the more reliable the information. In terms of StudyMate, Geofencing via the Maps SDK requires other users to also have StudyMate installed to properly track the number of users in Study Spots. As the number of users grows, sensing will become more reliable within the app. Furthermore, a potential area of future work is implementing alternative crowd-sensing implementations to mitigate the drawbacks of native Geofencing.

Of the future features proposed, a few stretch ideas stood out to the development team. Firstly, a general User Interface (UI) redesign could help to engage users. The current StudyMate application was a proof of concept, focusing more on features rather than visuals. With the end goal of this application being to get adopted into the both Android and Apple app stores, a more user-friendly UI could boost the user experience overall. The group relied on a rough Figma for the initial development, but involving a more experienced designer could result in a better app.

One other additional feature could be a school-sanctioned tutoring service in the app which allows students who have already taken a class to offer their tutoring services. By partnering with the university, StudyMate can allow registered tutors to find needy students. Teachers may also use the app to help as well. For example, the professor of a course could register their own individual Study Group, and encourage students in the course to join the group for announcements.

Furthermore, implementing a method for users to share Study Files within the application would allow users to work with each other, without relying on third-party tools. Currently, if a user wanted to share their private app files with others, they would either share the file link or download and share the file itself. While both solutions are acceptable, a better alternative could be to allow users to share files within the app's UI and have shared files appear within other users' resources on the profile page.

Lastly, the StudyMate application is only currently supported on Android devices. Researching and implementing an iOS version of the application can help to reach a wider audience. As highlighted in the user study above, there is a benefit to developing a native iOS application. On a larger scale, in the United States, it is estimated that iOS controls 57.78% of the market share, and globally Android controls 71.95% [6]. This process would involve replicating many of the Android app features on the iOS application.

8. Conclusion

The resulting StudyMate application is a well-rounded mobile-friendly solution to forming social bonds among peers. It has been proven to be effective at uniting members at a university level and contains multiple features which aim to connect students and remove social barriers. Future adoption across different universities, including Worcester Polytechnic Institute, can result in a more positive user experience. The extent of this project has shown that free technological solutions for socialization with an academic focus are applicable and possible.

9. Acknowledgements

The team would like to offer thanks to Professor Agu at Worcester Polytechnic Institute for educating them on the proper design and principles associated with Android Development and Machine Learning.

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Appendix A - User Study Questionnaire

Formal User Study for the StudyMate application. All participants will be kept confidential, and no identifiable information will be collected. The aim of this study is to assess the current app prototype and discover any potential changes which could benefit the app.

Survey Task List:

- Open the application
- Register Account
- Login into Account
- View Study Groups
- Chat in one of the Study Groups
- View the Study Spots
- View the Profile Details Page
- Register a new User File
- Perform Text Recognition and Text Translation on a User File
- View + Share a User File

Question 1: In your day-to-day life do you use an iOS device, an Android device, or Both?

Question 2: Have you used similar study tools, like Chegg Study?

Question 3: Rate the following app features on a scale from 1 to 5, with 1 meaning the feature was not useful and difficult to use and 5 meaning it was useful and easy to use.

- Application Authentication
- Account Registration
- Finding Study Groups
- Registering Study Groups
- Chatting Within Study Groups
- Registering Study Spots
- Viewing Study Spots
- File Registration
- File Text Recognition
- File Text Translation
- Viewing + Sharing Files
- Account Details View

Question 4: Will you use StudyMate in the future?