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NoteBuddy: An artificial intelligence powered notepad

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Abstract

NoteBuddy has been developed as a way of countering the increasing problems that learners face in terms of how they organize their learning resources, how they memorize learning information and how they use learning aids that meet the different learning attitudes. The platform combines traditional digital note-taking with advanced AI-powered features, such as automatic summarization, question-generation, voice-to-text and image-input, and intelligent reminder services, to provide a more productive and supportive academic environment that helps students to refine their academic work and process the information in a more effective manner. The design approach followed is user-centred paradigm, so that every functionality is compatible with the real requirements of students and is integrated into the normal study procedures of students. Based on the evaluation of the participants, the system allows students to organize the notes systematically, study teaching material with increased efficiency, study materials in various modalities and thus develop a better understanding and memory of the chosen material. Overall, NoteBuddy enhances the ability of students to plan, track and perform their learning tasks, thus encouraging effective, well-structured and adaptive learning approaches due to the integrated and smart digital application.

Keywords: *digital note-taking, AI-based learning, adaptive learning, customized learning support, optimization of the academic workflow*

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1. Introduction

Taking notes is an important educational tool, a way to provide students with information at any time. Allowing them to revisit earlier material enables students to learn throughout time. Because of this, note-takers are better at recalling material and getting better scores, especially when they go over their notes frequently (Huseyin, 2019). Research shows that taking notes is essential for students to perform better academically, as it helps with information retention and review (Chen et al., 2024; Voyer et al., 2022; Yıldırım, 2025; Al-Sharman et al., 2025). Notetaking can be done in multiple ways, including handwritten or digital. While digital notetaking uses computers or phones, handwritten notetaking, also referred to as the classic way, uses a pen and paper. In addition, each has its pros and cons (Mueller & Oppenheimer, 2014).

Previous research has shown that students who take handwritten notes perform better academically and retain information better (Yıldırım, 2025; Al-Sharman et al., 2025). This benefit is due to lower exposure to distracting social media and non-academic content, which often accompany digital notetaking (Morehead et al., 2019; Mueller & Oppenheimer, 2014). A limitation of manual notetaking, however, is the slower pace when writing down fast-paced lectures, which may cause the learner to miss some important details. Conversely, digital note-takers can take advantage of higher recording speeds, which, in turn, enable them to capture more information during fast-paced lectures (Bui et al., 2013). Digital notetaking has the additional benefit of enabling rapid and efficient information recall (Flanigan et al., 2020) and seamless access to supplemental materials, thereby enhancing the learning experience (Kim et al., 2019). However, digital notetaking is more likely to lead to less cognitive engagement and poorer understanding, due to verbatim copying (Mueller & Oppenheimer, 2014). It will also reduce students' learning efficiency due to distractions (Flanigan & Titsworth, 2020).

Artificial intelligence (AI), which has been groundbreaking in modern society (Hohenstein et al., 2023), has created numerous changes in teaching methods, the design of the learning curriculum, and the learning process (Motlagh et al., 2021). As regards the aspect of notetaking, Chen (2024) examined the interplay of AI chatbots and English as Foreign language (EFL) students using a collaborative notetaking strategy found that AI supports the collaborative notetaking process while promoting active learning and deeper understanding of the learning content. Collaborative note-taking environments have also been shown to improve knowledge construction and engagement among learners (Guribye & Lindström, 2009).

Moreover, integrating AI into the educational environment has enhanced the learning process, allowing students to improve their notes jointly and, in turn, their overall understanding (Schmidt et al., 2025). Intelligent tutoring systems and AI-driven educational tools further support deeper learning by guiding students through structured comprehension strategies (Létourneau et al., 2025). These innovations open the way to a variety of innovative solutions. Clearly defined functional requirements are important during the design stage to ensure that system functionalities are logically integrated with end-user needs and realistic academic operational scenarios.

In response to challenges in notetaking and potential solutions, the researchers developed the NoteBuddy, an AI-powered notepad. This project is a system comprising a notepad application with features standard to other notepad applications. It can capture information through voice recognition, record audio, and retrieve notes via voice feedback, making it easier to take notes hands-free. This application integrates with AI that can summarize and organize notes.

2. Literature Review

The practice of taking notes has significantly changed over the last ten years, driven by the adoption of mobile technology and AI in the educational context, with the concepts of usability, accessibility, and convenience becoming more prominent (Yang et al., 2020). For example, Hoh et al. (2019) proposed ScanNote, an optical character recognition-based mobile application that uses machine learning to scan text in hand or printed forms and increases the recognition rates. Studies indicate that the use of mobile devices for note-taking increased significantly during pre-clinical years but tended to decrease in later stages, often due to usability challenges (Pyörälä et al., 2019; Do et al., 2022). This trend highlights the need for more flexible and user-friendly tools (Voyer et al., 2022). Mosleh et al. (2015) concluded that most digital tools poorly support the cognitive learning process and thus limit the expression and strengthening of memory.

By incorporating voice input, transcription services, and summative services, digital notepads address a range of deficiencies and foster complex interactions and cognitive engagement around digital notetaking (Costley & Fanguy, 2021). AI-assisted tools that support content refinement and generation can enhance how learners process and present information, but they also influence users' perceptions of credibility and trust in the produced content

(Hohenstein et al., 2023). Studies of user preferences also underpin the transition to digital solutions. Speed and ease of access were the key factors among millennial students in using mobile notetaking tools (Murtafi et al., 2020). Students make decisions about when and how to take digital notes in response to multiple factors within the learning environment, including lecture delivery, perceived pressure, and technological affordances (Arden et al., 2024). Recent studies further show that the effectiveness of note-taking depends not only on the medium but also on how learners review and revise their notes, with structured revision improving learning outcomes (Luo et al., 2016; Xu et al., 2024). Additionally, note-taking methods influence retention and cognitive load by affecting learners' motivation and long-term learning outcomes (Yıldırım, 2025). University students' perceptions of their own note-taking strategies influence how deeply they process information. For example, structured revision and reformulation practices are key to deeper learning, whether notes are taken digitally or on paper (Cojean & Grand, 2024). However, Stacy and Cain (2015) also cautioned about the potential for cognitive disengagement when taking passive notes with digital tools

Inclusive education and language acquisition are also helpful with AI-enhanced notetaking systems. The use of AI chatbot aids, in combination with collaborative notetaking (AI-CNT), improved EFL students' confidence, metacognitive awareness, and their ability to facilitate semantic understanding (Chen, 2024). AI-powered conversational tools, such as chatbots, have been shown to enhance students' learning interest and promote more interactive engagement during the learning process (Liu et al., 2024). Saini et al. (2023) addressed issues related to linguistic difficulty, disability, and distraction by proposing a new LNT framework and a multilingual notetaking tool powered by AI. These two services demonstrate that artificial intelligence can enhance the accessibility and personalization of education for different user groups.

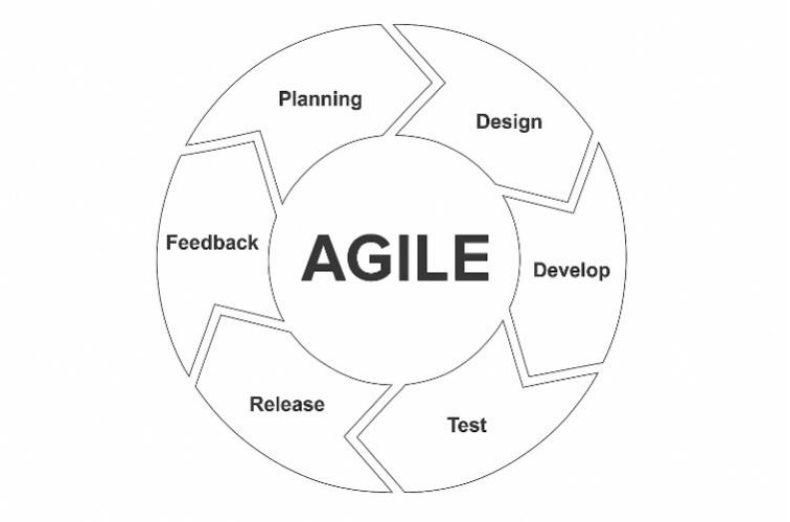
New developments continue to challenge the role of AI in education. For example, Sulima and Genash (2024) introduced an automated lecture note-taking system that converts lecture audio into structured notes. Similarly, the Multiverse AI Educator (Leelavathy et al., 2024) applied natural language processing and machine learning to summarize content, chatbot interaction, and administrative activity, which helped students become more independent. Studies have shown that the use of AI in communication can influence users' perceptions of trust and authenticity, emphasizing the importance of designing AI systems as supportive tools rather than replacements for human input (Hohenstein et al., 2023).

3. Methodology

The study adopted the Agile Software Development Life Cycle (SDLC) model in the development of NoteBuddy. The choice of the methodology was based on its iterative and flexible structure and, therefore, ensures continuous improvement and active involvement of the users. It was especially suitable in honing important aspects of system-level functionality, such as creation of notes, AI summarization and organization of folders, based on systematic feedback. Within every development cycle, the system was subject to refinement so as to become more and more aligned with the needs and expectations of users (Laoyan, 2025).

Figure 1

Agile Model Diagram



3.1. Planning

In this phase, the researchers defined the needs of the system and outlined the main functionalities of NoteBuddy. Descriptive quantitative research design was applied through an initial survey, where the researchers gathered information on the features that can be included in the system. A systematic sampling technique was used to select a sample of 415 participants to ensure that the data used for the development were reliable and based on user needs.

Functional requirements. The following are the features and functionalities:

User authentication. User login/logout systems to identify them. Reset passwords/ recuperate passwords.

Note creation and management. Add, delete and edit notes, add notes to folders or categories.

Study reminders. Delay notices to go through particular notes. Push notifications regarding time to study.

Reminders date-suggestion. Identifies time-bound phrases in a note automatically and then shows a pop-up icon to enable the user to determine a reminder at the specific time of the detected time or to ignore the suggestion.

AI summarization of notes. Break long notes down into brief yet clear forms, where alternatives to active recall learning should be available.

Voice-to-text note taking. Transcription Convert audio, recorded, into text notes or the speech itself can be converted into continuous text in real-time.

Image-to-text note taking. Extract text in uploaded pictures and translate it into text notes.

Export notes. Export notes or traced contents in the form of TXT files. Easy sharing through email and Google-drive platform.

Cloud synchronization. Keep store notes on the cloud with firebase.

User profile management. Updating profile (user name, password, email).

User interface option. Make Dark mode and Light Mode possible, and the user experience is improved. Create responsive and user-friendly mobile application interfaces.

Flashcard mode. Write notes into flashcards to memorize faster.

Offline mode. Enable users to edit the notes saved without being connected to the internet.

Version history. Edit tracks and enable users to revert to old formats of notes.

Language translation. Add a feature of translating the contents of the notes into languages like English, Spanish, and French, etc.

Some limitations are apparent in the system. The NoteBuddy application needs a good internet connection to communicate with cloud-based services, i.e. Firebase that offers real-time data storage, retrieval and user authentication. Furthermore, the AI features, like the summarization and the flashcard generation, require constant connection to the external servers, e.g. deployed with Flask and cannot work in the offline environment. Nowadays, the platform is designed specifically to fit into mobile devices and does not have a fully functioning desktop variant. Also, the voice to text feature is prone to interference by ambient noise or poor microphone quality leading to poor transcription. These limitations define the current

weaknesses of the system and indicate future opportunities of its improvements and optimization.

Non-functional requirements. The following are the other features:

Compatibility. The system is designed to be compatible with mobile devices, specifically Android, and thus makes it user-friendly and easy to access to smartphone users.

Maintainability. The application has been designed so that it can easily be updated, debugged and modified without interfering with the overall system functionality.

Security. Only authorized users can gain access to notes and personal information and sensitive information is encrypted to protect user privacy.

Usability. NoteBuddy has a very clean and easy to use interface that enables users to navigate and use the system with the least amount of effort either by voice or manual input.

Reliability. The application provides reliable performance in a wide array of conditions, ensures proper transcription, summarization and reminder features.

Portability. Being a mobile app, NoteBuddy is quite lightweight and can be used on Android, which makes it appropriate to students and professionals that work in mobile environments.

Power efficiency. The system is designed to have the lowest power use when in the background and under constant voice recognition.

Scalability: NoteBuddy is created to support a growing number of notes, folders, and users without affecting performance of the system.

3.2. Design

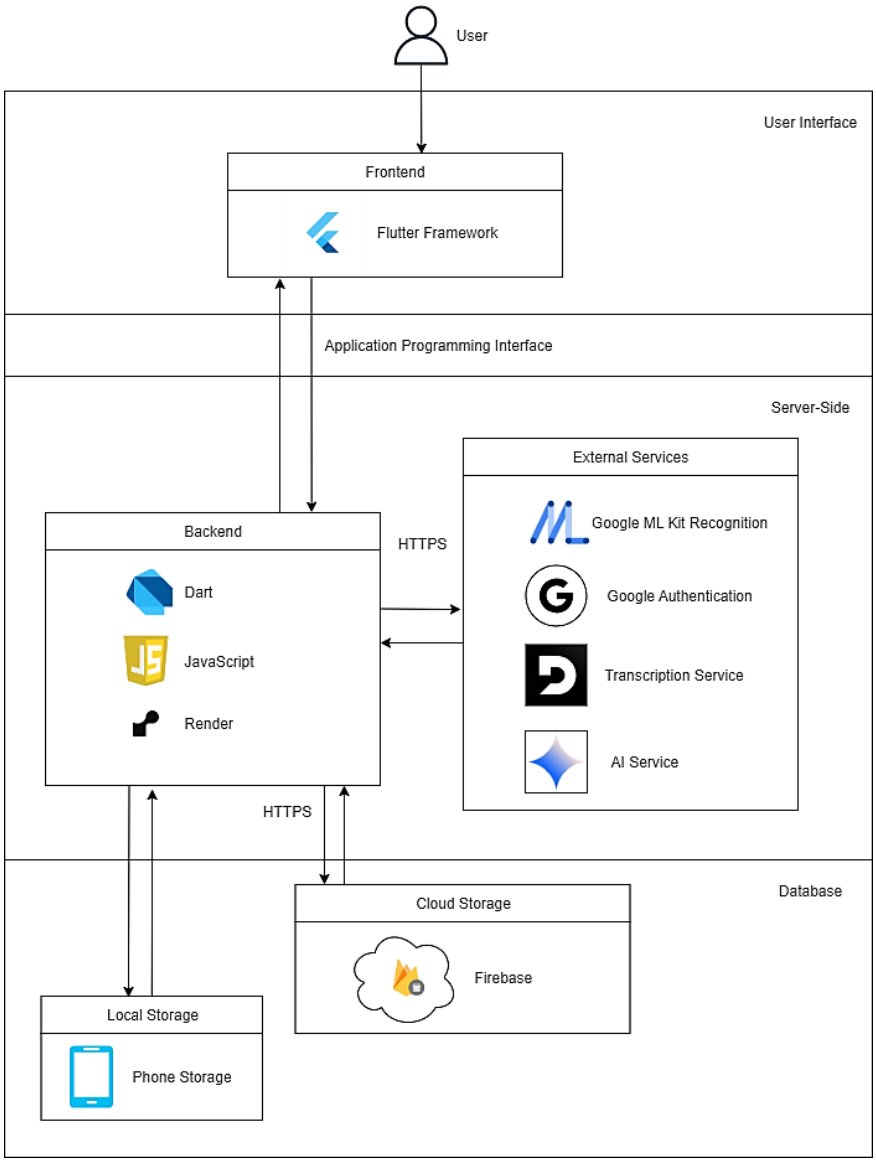
The design phase forms an important stage in the system development life cycle, during which an architecture of a system, its functionality and structure is framed in order to meet the needs of users and to meet the functional needs. At this point the researchers sampled various available applications to narrow down to what they considered as best-practice UI layouts, design patterns and colour palettes. The resulting insights were coded into hard-coded prototypes using dart, which generated a physical representation of the interface which can be empirically tested and fine. At the same time, the team thoroughly documented the technical layout of the system, Firebase integration, feature interactions and navigation path.

System architecture. Figure 2 shows the form of the NoteBuddy system broken down into four major layers. Application Layer is used as the front-end interface where interactions

between the users and the application take place. The Flutter framework was used for the front-end. Communication between the interface and the processes in the background is synchronized by the API Layer. Server-Side Layer is an implementation in Dart, JavaScript, and Render, which deals with core logic execution and external service integration, in this case, Google Authentication, Google ML Kit Recognition, Transcription Service, and AI Service. Lastly, Database Layer coordinates both the cloud storage through Firebase and local storage in the device of the user and therefore provides secure and easily accessible data management.

Figure 2

System architecture diagram



Use case diagram. As presented in Figure 3, the Use Case Diagram shows the key interactions between the user and the NoteBuddy system. It portrays a single User role, as students and instructors are granted the same list of functionalities. Such features include the editing, deletion, and creation of notes and the usage of AI-based features to summarize, create flashcards, and answer questions. More functions including the export of notes, the arrangement of reminders, and the management of folders are also embodied. As a result, the diagram provides a holistic view of the fundamental features of the system as a user.

Figure 3

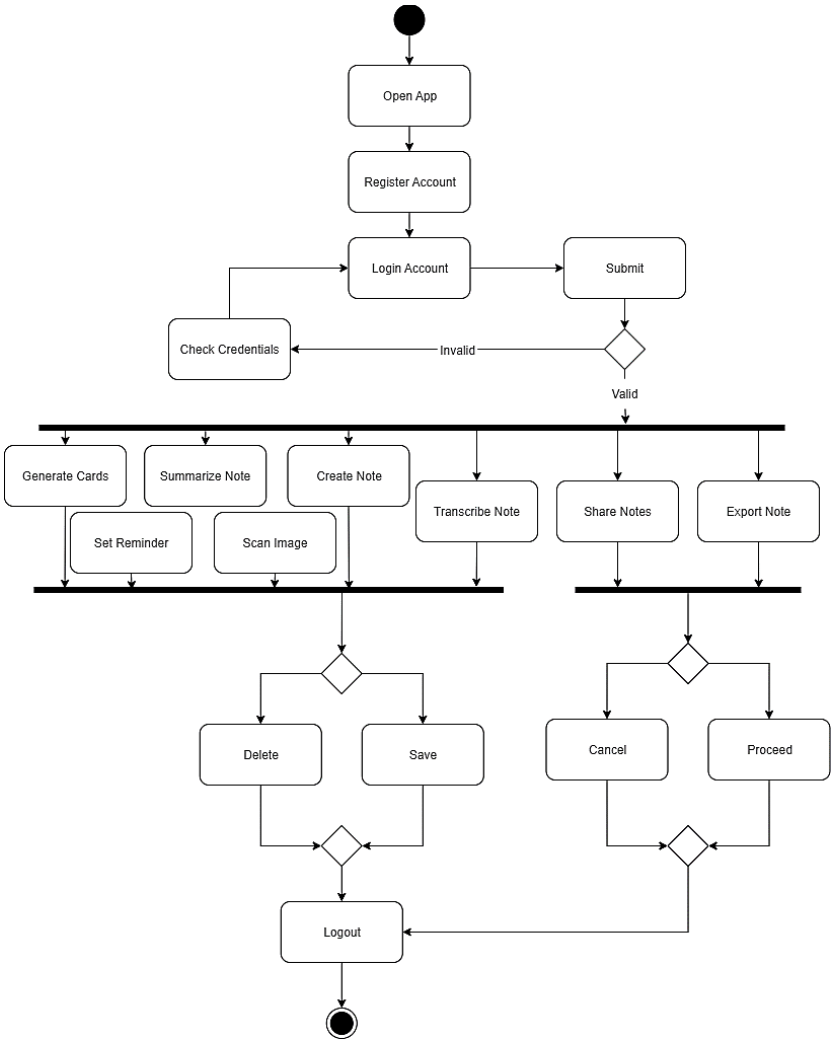
Use case diagram

Activity diagram. The Activity Diagram, as shown in Figure 4, shows the order of user actions in the NoteBuddy application. It starts with user authentication and moves on to key

processes, such as creation or update of notes, content summarization by the use of artificial intelligence, the sorting of notes into folders, and exporting the notes. The diagram shows the logical interrelationship between these processes which in turn reflects on the normal user behavior when interacting with the application.

Figure 4

Activity diagram



3.3. Develop

During this stage, the researchers executed the NoteBuddy system in line with the finalized design specification, front-end and back-end elements. The front-end has been designed to provide an easy to use interface to both students and instructors and provides features like voice transcription, image-to-text conversion (scan image), AI-based

summarization, flashcard creation, and ability to export documents to.txt files. NoteBuddy was built on the back-end with Flutter and Dart, and the cloud data storage was based on Firebase, the system was coded to ensure user authentication, connection to the database, and secure storage and retrieval of notes. Systematic testing and debugging were also carried out throughout development to ensure any given module had been properly tested before complete integration.

Description of the prototype. The prototype is a demonstration of the NoteBuddy system, which is expected to be used as a prototype of its general functionality and user interface designs. Customers interact with the software to make, maintain, and archive their notes in the most efficient way possible. The system includes a simple authentication system to ensure secure access to the system, hence giving a clear picture of how the end implementation is going to operate.

Figure 5

User login

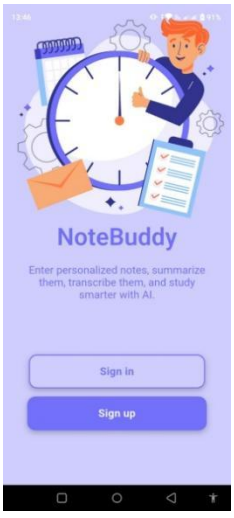


Figure 6

User authentication

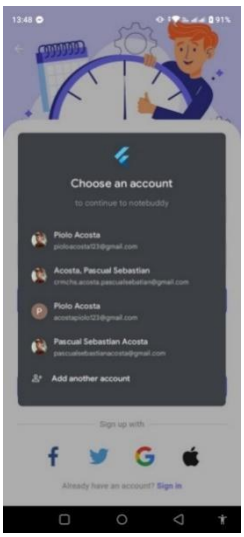


Figure 7

User homepage

The user's email and password are required to Sign In or Sign Up, in order to access the application (Figure 5). In addition, users have the option to authenticate using external services like Google and Facebook or X and verification systems are in place to guarantee the use of secure authentication (Figure 6).

As shown in Figure 7, NoteBuddy has a well-structured and neat interface on its home page, where the user can access his/her notes, folders, and more important features. It takes into account quick navigation to make notes, use AI technology, and sort out facts effectively.

Figure 8

Key features

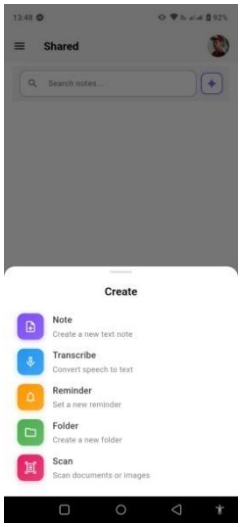


Figure 9

User settings

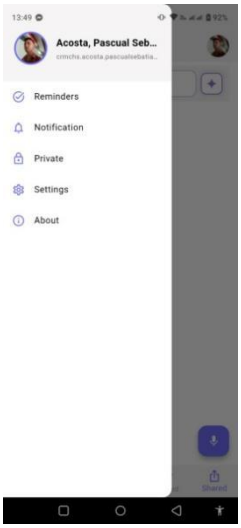
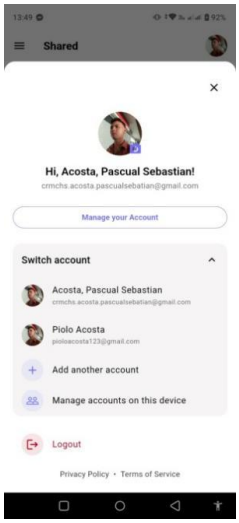


Figure 10

User logout



Within this application, this specified section gives the user full access to vital functionality, that is, the creation of notes, transcription services, study reminders, folders, and scanning capabilities (Figure 8).

As shown in Figure 9, the settings section of NoteBuddy offers users with quick access to the necessary functionalities like Reminders, Notifications, Private, Settings and About. This design allows easy navigation and offers user experience through a single and convenient panel, having all the essential tools.

The log out section (Figure 10) will allow the user to log out of the application safely, alternate among various accounts or manage the existing account. It equally offers profile settings, where users are allowed to edit personal information or associated sign-in methodologies.

3.4. Testing

In this stage, the researchers conducted a variety of tests in the team in order to determine the stability and performance of the system. This involved implementation of the application and checking performance measurements in the console when the build was completed, and unit tests. In the case of the latter, the members of the team downloaded the APK version of the application and tested the functionality of the separate components, such as voice transcription, creation of notes, and summarizing, to ensure that the individual modules would act accordingly. Integration testing was also carried out to ensure that there

was interaction between features like voice input, AI processing and the ability to make reminders and note management. These internal tests helped the team to pick up and correct possible problems on time hence making sure that the system runs smoothly before any outside user can review it.

The main problem found during the internal testing is the accuracy of transcription and character recognition. These issues depend on a number of variables such as the equipment used, distance between the source, and quality of the records and images. The accuracy of the detection is directly dependent on the quality of the device be it a speech recognition microphone or an optical character recognition (OCR) camera. As an illustration, the quality of devices can be low and this can result in distorted sounds or blurry pictures; therefore, it affects the accuracy of audio to be transcribed or the images to be identified. The distance is also very important; a microphone or camera that is too distant to the source will degrade the recording process and the speaker will have low clarified speech or the text will be unclear. In OCR, the image must be clear; light, focus and resolution are some of the factors that might greatly influence the recognition of characters. Other slight deviations like angled text or shadows can impair the ability of the system to distinguish characters in the right way. All these problems often contribute to lower accuracy, requiring the better calibration of devices, perfect positioning, and improvement of environmental conditions in order to perform better.

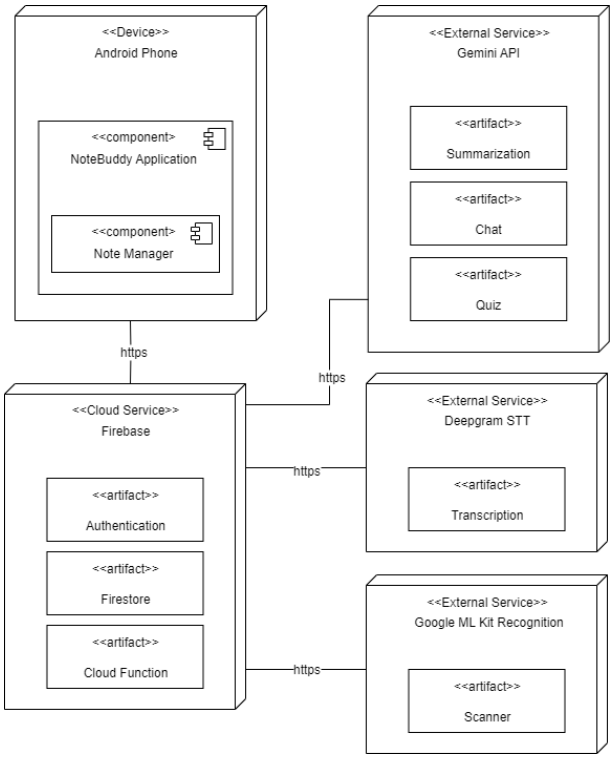
3.5. Release

NoteBuddy release phase focuses on finishing all the features of the system and ensuring that the application is entirely convinced to the modified requirements that have been confirmed under the testing phase. The general release process is in line with the ISO 25010 standard of quality with special considerations made on maintainability, compatibility, and flexibility. This compatibility contributes to the subsequent improvement and the sustainability of the system in question in the long run, thus maintaining the stability and the applicability of the NoteBuddy application to a changing educational environment.

Deployment diagram. The diagram serves as an outline of the release or deployment of the application, which depicts the allocation of software elements in the environment to ensure smooth delivery. The deployment diagram presents the critical nodes such as Android phone, Gemini API, Firebase, Deepgram STT and the dependencies among these nodes.

Figure 11

Deployment diagram



The deployment diagram shows the different nodes that the project requires, with its components and artifacts. The diagram defines the physical architecture of the system, which is the hardware nodes that the software components are deployed on, and how the different components interact.

3.6. Feedback

This stage ensured that NoteBuddy met the functional, expectation, and security requirements of the NoteBuddy users. To examine the system's performance and user-friendliness, UAT was implemented consisting of thirty-two respondents. During the UAT feedback was gathered to determine improvements and to identify areas for improvement related to usability, performance and functionality. The knowledge achieved of the process were useful in terms of gauging the degree to which the application was responsive to genuine user needs, which had strengths both in functionality and user experience, as well as aspects that would be worth refinement. The responses received were critical in confirming the effectiveness, reliability and functioning of NoteBuddy in general, hence making sure that the final system meets the expectations of the target users by a wide margin.

4. Findings and Discussion

Table 1

ISO 25010-based evaluation result

Characteristic	Weighted Mean	Verbal Interpretation
Functional Sustainability	4.36	Very Effective
Performance Efficiency	4.10	Effective
Compatibility	4.07	Effective
Reliability	4.13	Effective
Security	4.05	Effective
Flexibility	4.30	Very Effective
Safety	4.30	Effective
Overall Weighted Mean	4.18	Effective

***Legend**:* 1.00-180 = Note Effective, 1.81-2.60 = Slightly Effective, 2.61-3.40 = Neutral, 3.41-4.20 = Effective, 4.21-5.00 = Very Effective

As presented in Table 1, the developed system obtained an overall weighted mean of 4.18, which is interpreted as "Effective." This indicates that users generally perceived the system as functional, reliable, and capable of meeting their needs, aligning with the standards of the ISO/IEC 25010 quality model. The high rating suggests that the system's core features are well-implemented, contributing to a satisfactory user experience. This finding is consistent with studies showing that well-designed digital and AI-assisted learning systems improve usability and user satisfaction when essential functionalities are effectively delivered (Arden et al., 2024; Voyer et al., 2022; Leelavathy et al., 2024). However, while the system achieved an "Effective" rating, the results indicate opportunities for improvement in Security, Compatibility, and Performance Efficiency. These aspects are critical to overall system quality, as they influence user trust, accessibility across platforms, and system responsiveness. Previous research supports this, noting that limitations in performance and compatibility can negatively affect user experience and system effectiveness (Costley & Fanguy, 2021; Kim et al., 2019; Xu et al., 2024). Therefore, enhancing these areas may further improve user satisfaction and elevate the system's rating to "Very Effective" in future iterations.

5. Conclusion

This study created and deployed NoteBuddy, a smart note-taking application that eliminates the shortcomings of the old manual system of handling notes. The system was

designed to make the notes of the students more organized, easily accessible, and easy to use, besides incorporating new functionalities like summarization, quiz creation, and image-to-text translation. The feedback provided by users also shows that the platform is extremely functional, intuitive, and well-received, which confirmed the design of the system as well as the methodology behind it. NoteBuddy is a successful project that facilitates the way one studies, making note-taking, reviewing and organization of information easier, quicker and more engaging to students. The project shows how digital tools can be practically used in the educational process, which benefits the academic efficiency and effectiveness of learning significantly.

Based on the findings, the following are recommended for the improvement and future sustainability of the NoteBuddy system.

Enhancement of security features. The evaluative assessment showed that the security has received one of the lowest ratings, despite strong user acceptance. In order to improve data security and user privacy, it is advised that future developers should upgrade the security structure to use non-decryptable data encryption, implement strict password management, use multi-factor authentication (MFA) and make frequent automated vulnerability scans. This sort of fortification is expected to reduce the issue of unauthorized access, hence, improving overall system reliability.

Improvement of system compatibility across devices. The empirical data shows that NoteBuddy has proven to show good performance with most of the devices, but its compatibility profile has not been the best. Future study needs to focus on the interface to support a wider range of screen sizes, hardware requirements, and operating system versions. Increasing browser compatibility, responsiveness, and ensuring that it works reliably and will open up accessibility and improve the overall user experience.

Optimization for better performance efficiency. One of the low-scoring metrics was performance efficiency. The researchers indicate that programmers should simplify the background operations, minimize response time, and optimize the effectiveness of database search to increase the system responsiveness. Moreover, caching systems and optimization of the functions that are resource-heavy, e.g., voice note processing, AI-assisted summarization, and optical character recognition, can help improve the overall experience of the users.

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Institutional Review Board Statement

This study was conducted in accordance with the ethical guidelines set by Cebu Roosevelt Memorial Colleges. The ethical review and approval were waived for this study.

AI Declaration

The authors declare the use of Artificial Intelligence (AI) in writing this paper. In particular, the authors used Quillbot and Chatgpt in searching appropriate literature, summarizing key points and paraphrasing ideas. The authors take full responsibility in ensuring proper review and editing of contents generated using AI.

References

Al-Sharman, A., Shalash, R. J., Omran, T. A. M., Elsayed, R. M., Warfa, I. A., Adawi, W. S. E. A., Aljaberi, A. O., Alabdooli, A. A., Arumugam, A., Ramakrishnan, S., Saad, N., Ahbouch, A., Bani Issa, W., Hijazi, H., Kim, M., Hegazy, F., & Nashwan, A. (2025). Exploring the impact of note taking methods on cognitive function among university students. *BMC Medical Education, 25*(1), 1218. https://doi.org/10.1186/s12909-025-07593-x

Arden, B., Norris, J., Cole, S., & Gamble, S. C. (2024). Digital notetaking in lectures: How students adapt to a multi-faceted university learning environment. *Cogent Education*, *11*(1), 2373552. https://doi.org/10.1080/2331186X.2024.2373552

Bui, D. C., Myerson, J., & Hale, S. (2013). Note-taking with computers: Exploring alternative strategies for improved recall. *Journal of Educational Psychology*, *105*(2), 299–309. https://doi.org/10.1037/a0030937

Chen, A., Murphy, D. H., Brabec, J. A., Bjork, R. A., & Bjork, E. L. (2024). The effects of lecture speed and note-taking on memory for educational material. *Applied Cognitive Psychology, 38*(1), e4166. https://doi.org/10.1002/acp.4166

Chen, M. R. A. (2024). AI chatbot interaction in collaborative note-taking for EFL learners. *Educational Technology Research and Development*, *72*(1), 45–62. https://doi.org/10.64152/10125/73586

Cojean, S., & Grand, M. (2024). Note-taking by university students on paper or a computer: Strategies during initial note-taking and revision. *British Journal of Educational Psychology*, *94*(2), 557–570. https://doi.org/10.1111/bjep.12663

Costley, J., & Fanguy, M. (2021). Collaborative note-taking affects cognitive load: The interplay of completeness and interaction. *Educational Technology Research and Development*, *69*(2), 655–671. https://doi.org/10.1007/s11423-021-09979-2

Do, D. H., Lakhal, S., Bernier, M., et al. (2022). Drivers of iPad use by undergraduate medical students: The Technology Acceptance Model perspective. *BMC Medical Education, 22*, 87. https://doi.org/10.1186/s12909-022-03152-w

Flanigan, A. E., & Titsworth, S. (2020). Taking notes on college lectures: The role of laptop versus longhand and working memory capacity. *Computers & Education*, *144*, 103698. https://doi.org/10.1016/j.compedu.2019.103698

Hoh, Y. M., Tan, Y. W., & Goh, W. W. (2019). ScanNote: A mobile app for capturing handwritten and printed text using OCR and machine learning. *International Journal of Educational Technology in Higher Education*, *16*(1), 12–19. https://doi.org/10.37934/ard.124.1.7789

Hohenstein, J., Kizilcec, R. F., DiFranzo, D., & Naaman, M. (2023). Artificial intelligence in communication impacts language and social relationships. *Scientific Reports*, *13*, 5487. https://doi.org/10.1038/s41598-023-30938-9

Hüseyin, Ö. (2019). Impact of note taking during reading and during listening on comprehension. Educa*tional Research and Reviews*, *14*(16), 580–589. https://doi.org/10.5897/err2019.3812

Kim, Y. G., Lee, J. H., & Park, H. S. (2019). The impact of digital resources on student learning: An empirical study. *Educational Technology & Society*, *22*(4), 42–53. https://doi.org/10.70767/ijetr.v1i2.300

Laoyan, S. (2025, February 20). *What is Agile methodology? (A beginner's guide) [2025]*. Asana. https://asana.com/resources/agile-methodology

Leelavathy, N., Sujatha, B., Sindhu, B., Manikanti, Y. D., Geethanjali, P., Ravi Kumar, K., & Prabhu, K. A. (2024). Innovative learning assistance through the Multiverse AI Educator using natural language processing. *Indian Journal of Science and Technology*, *17*(47), 4975–4983. https://doi.org/10.17485/IJST/v17i47.3789

Létourneau, A., Deslandes Martineau, M., Charland, P., Karran, J. A., Boasen, J., & Léger, P. M. (2025). A systematic review of AI-driven intelligent tutoring systems (ITS) in K–12 education. *NPJ Science of Learning, 10*(1), 29. https://doi.org/10.1038/s41539-025-00320-7

Liu, C. C., Chiu, C. W., Chang, C. H., & Lo, F. Y. (2024). Analysis of a chatbot as a dialogic reading facilitator: Its influence on learning interest and learner interactions. Ed*ucational Technology Research and Development*. Advance online publication. https://doi.org/10.1007/s11423-024-10370-0

Luo, L., Kiewra, K. A., & Samuelson, L. (2016). Revising lecture notes: How revision, pauses, and partners affect note taking and achievement. *Instructional Science*, *44*(1), 45–67. https://doi.org/10.1007/s11251-016-9370-4

Morehead, K., Dunlosky, J., & Rawson, K. A. (2019). How much mightier is the pen than the keyboard for note-taking? A replication and extension of Mueller and Oppenheimer. *Educational Psychology Review*, *31*(3), 753–780. https://doi.org/10.1007/s10648-019-09468-2

Mosleh, M. A. A., Baba, M. S., Malek, S., & Alhussein, M. A. (2015). Challenges of digital note taking. In *Lecture Notes in Electrical Engineering* (pp. 211–231). Springer. https://doi.org/10.1007/978-3-319-24584-3_19

Motlagh, F., Fard, M., & Nami, Y. (2021). The role of AI in transforming education: Teaching, learning, and curriculum. *Education and Information Technologies*, *26*(4), 4511–4530. https://www.ijfmr.com/papers/2024/6/30800.pdf

Mueller, P. A., & Oppenheimer, D. M. (2014). The pen is mightier than the keyboard: Advantages of longhand over laptop note-taking. *Psychological Science*, *25*(6), 1159–1168. https://doi.org/10.1177/0956797614524581

Murtafi'ah, M., Asmiyah, S., & Fitriah, F. (2020). Is technology-based note-taking more preferable for millennial students? Exploration of English students' note-taking habit. *IJET (Indonesian Journal of English Teaching)*, *9*(2), 207–216. https://doi.org/10.15642/ijet2.2020.9.2.207-216

Pyörälä, E., Mäenpää, S., Heinonen, L., Folger, D., Masalin, T., & Hervonen, H. (2019). The art of note taking with mobile devices in medical education. *BMC Medical Education, 19*(1), 96. https://doi.org/10.1186/s12909-019-1529-7

Saini, M., Arora, V., Singh, M., Singh, J., & Adebayo, S. O. (2023). Artificial intelligence inspired multilanguage framework for note-taking and qualitative content-based analysis of lectures. *Education and Information Technologies*, 28(1), 1141–1163. https://doi.org/10.1007/s10639-022-11229-8

Schmidt, D. A., Alboloushi, B., Thomas, A., & Magalhaes, R. (2025). Integrating artificial intelligence in higher education: Perceptions, challenges, and strategies for academic innovation. *Computers and Education Open, 9*, 100274. https://doi.org/10.1016/j.caeo.2025.100274

Stacy, E. M., & Cain, J. (2015). Note-taking and handouts in the digital age. *American Journal of Pharmaceutical Education, 79*(7), 107. https://doi.org/10.5688/ajpe797107

Sulima, S., & Genash, A. (2024). Automated lecture note-taking system. *Information and Telecommunication Sciences*, *15*(2), 20–24. https://doi.org/10.20535/2411-2976.22024.20-24

Voyer, D., Ronis, S. T., & Byers, N. (2022). The effect of note-taking method on academic performance: A systematic review and meta-analysis. *Contemporary Educational Psychology*, *68*, 102025. https://doi.org/10.1016/j.cedpsych.2021.102025

Xu, L., Cai, S., Liu, Y., Chen, J., Peng, S., & Andrasik, F. (2024). The effects of the medium of note-taking on the delayed learning effect of college students: A mediated moderation model. *Behavioral Sciences*, *14*(9), 756. https://doi.org/10.3390/bs14090756

Yang, H. H., Shi, Y., Yang, H., & Pu, Q. (2020). The impacts of digital note-taking on classroom instruction: A literature review. In L. K. Lee, L. H. U, F. L. Wang, S. K. S. Cheung, O. Au, & K. C. Li (Eds.), *Technology in education: Innovations for online teaching and learning* (Vol. 1302, pp. 62–72). Springer. https://doi.org/10.1007/978-981-33-4594-2_6

Yıldırım, M. (2025). The effects of note-taking methods on lasting learning: The role of motivation and cognitive load. *Frontiers in Psychology*, *16*, 1697151. https://doi.org/10.3389/fpsyg.2025.1697151