



Junior Design Project
CSE299 Proposal Report

Title of Project: Recallo

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Recallo

Individual Contribution Table

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Proposed System	Wahidul Islam Ziad	
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Recallo: AI-Driven Spaced Repetition and Recall Boosting for Academic Success

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I. INTRODUCTION (HEADING I)

Many students forget most of their learning because they don't review it at the right time. As exams approach, it becomes increasingly difficult to identify which topics need revision. To address this, we propose Recallo, an AI-powered tool designed to track memory decay and can predict when someone is likely to forget something and help them review just in time.

A research paper of George A. Miller's shows that people can only remember about five to nine items from short-term memory [1]. This shows that there is a limit to how much our brain can memorise. Another paper written by Mingzhi Chen on the Knowledge Tracing Model. He presents a model that tracks students' knowledge states in real time, on the behaviours of both learning and forgetting [2]. The model tracks forgotten information over time and predicts when it is likely to be forgotten so that it can review the concept at the right time.

Reddy and his colleagues are working on improving spaced repetition apps for long-term memory preservation [3]. They developed a recall technique to balance learning new things and reviewing the earlier ones. Roediger and Butler showed that learning is more effective when I test myself by trying to recall the information that I have read rather than just reading a thing again and again [4]. Their research shows that recalling information will help us to strengthen our memory. This technique, known as the retrieval technique, is an effective way for students to enhance their learning.

Murre and Dros (2015) replicated Ebbinghaus' forgetting curve and confirmed that memory decays rapidly over time, but it can be recalled with timely reviews [5]. Tabibian et al.(2019) proposed a paper on human learning via space repetition optimization, which helps to remember things in a more efficient way than traditional fixed review schedules. It's about learning data and memorization algorithms, traditional review techniques of every learner [6].

Recallo helps students remember better by sending reminders at the right time using AI. It tracks which topics students often forget and adjusts future reminders based on that. The system delivers these reminders through quizzes, short text reviews, or flashcards. Before exams, it highlights which topics need more focus based on past performance. Students can upload notes, monitor their progress, and receive daily smart revision tasks through a simple interface

II. LITERATURE REVIEW

Recent studies in AI, reinforcement learning, and spaced repetition have shown promising effects on human learning. Research has shown that AI agents can dynamically adjust review schedules to improve long-term retention and overall learning efficiency [22]. Other findings emphasize that consistent practice—both in human and artificial cognition—helps reinforce memory and strengthen understanding [23]. The effectiveness of intelligent tutoring systems has also been demonstrated, particularly in how they adapt to individual learner progress and provide timely, personalized feedback [24]. Broader investigations have highlighted the impact of tools like automated feedback and content personalization in improving student performance [25]. Additionally, studies confirm that spacing learning sessions across increasing intervals leads to significantly better retention compared to massed learning [26]. Some researchers also focus on the emotional aspect of learning, showing how AI-based support systems, like chatbots or collaborative interfaces, can reduce anxiety and enhance learner confidence and motivation [27], [29]. Lastly, reviews of new educational technologies provide insights into how AI, along with other innovations, is helping reshape learning through automation, personalization, and immersive digital environments [28], [30]. The article explains how students can remember information for a longer period of time through using spaced repetition along with self-examination. Based on a study of how our brain stores and retrieves memories, it suggests an easy way to improve learning [12]. More important than the amount of time spent in school, according to this study, is how that time is used. It demonstrates that gradually reviewing information is more effective than doing it all simultaneously [13]. Based on each student's performance, the algorithm presented in this work adjusts the amount of repetition of each topic. It encourages slow learners to give more time to difficult topics and less time to easier ones [14]. AI tutoring programs help students learn more effectively by providing individualized lessons based on their requirements [15]. This study presents models predicting students' potential performance based on their knowledge and abilities [16]. Teachers can take the help of AI to make their classes easier and more attractive. It also improve the learning environment [17]. Testing our ownself helps our memory much more than just reading any material again and again [18]. Spaced repetition also helps the computer programs to learn more effective by training neural networks [19]. Spaced repetition and retrieval

practise in homework will improve the learning of the student and also improve the environment of the learning [20]. This study shows that a student's learning abilities and knowledge can be predicted by analyzing their achievements [21]. By using individual characteristics into the traditional forgetting curve, Ebbinghaus' forgetting curve shows how AI can more accurately predict memory loss [07]. The Backpropagation Algorithms examines how well deep learning methods particularly LSTMs predict achievement among students[08]. They believe that using educational games instead of more conventional approaches makes studying more interesting and enjoyable[09]. The cognitive load theory explains how students use online learning environments, particularly those that use artificial intelligence[10]. A broad summary of how AI is transforming education by allowing personalised instruction that adapts to each student's needs [11].

The insights from these works align closely with the vision of Recallo. The use of reinforcement learning to optimize review schedules supports Recallo's plan to personalize review sessions based on individual patterns [22]. Emphasizing regular, adaptive learning trajectories further validates our approach to spaced repetition [23], [26]. The success of intelligent tutors and chatbots suggests exciting enhancements for Recallo, including immediate feedback and motivational messaging [24], [27]. Most importantly, Recallo aims to integrate cognitive reinforcement, emotional support, and intuitive interface design into a single platform—bridging the current gap in educational tools. By doing this, Recallo not only builds upon existing research but also introduces a comprehensive, user-friendly solution to support long-term learning. Recallo and the concept are similar in that they both encourage repeating over information at the right times to make learning easier for students [12]. This concept may be used by ReCallo to organize reviews better [13]. ReCallo can adjust to each student's speed and ability by using comparable clever algorithms [14]. ReCallo may include AI capabilities to provide learners with personalized support and direction [15]. Such models might be used by ReCallo to determine when students might want further assistance [16]. ReCallo can use to improve the training and give more real time feedback [17]. ReCallo uses quizzes and tests to improve student memory by the retrieval practice [18]. ReCallo can use these rules to improve the schedule reviews for the users [19]. ReCallo can design the smart practise task to improve the learning style [20]. ReCallo can use this predictions to make the learning environment more effective [21]. These papers collectively support Recallo's core idea of using AI to enhance learning and reduce stress. By taking individual student characteristics into account, the research on Ebbinghaus' forgetting curve provides a blueprint for developing an intelligent memory-tracking system [07]. The individual AI techniques Recallo can use to predict when students might struggle are discussed in the Backpropagation Algorithms review [08]. According to research from Students' Perceptions of Using Educational Games, Recallo's quizzes and prompts can become more interesting and motivating they [09]. Additionally, Recallo's design is informed by the Understanding Participation of Students study to make sure students genuinely want to use

it [10]. From Extensive examination of AI in Education, the goal is personalised AI learning, confirming that tailored experiences significantly improve learning outcomes [11].

Although we already know that these methods are effective, the study says that we still need to figure out how to more effectively match them to the particular requirements of each learner [12]. Although spaced practice has proven effective, we still need to determine the ideal time intervals for each topic [13]. Adaptive spaced repetition helps learners with different abilities improve their retention [14]. Although AI can be helpful in providing individualized support, not everyone can now access it easily [15]. Personalized instruction can be guided by predictive analytics [16]. This AI resources must be easily integrated into the systems [17]. Retrieval practise is a proven way to boost our long-term learning [18]. Spaced repetition works more better in both humans and machines [19]. A well designed homework improves learning significantly [20]. We know that student's performance is affected by their learning style [21]. Research on memory retention modelling shows that predicting the forgetting curve is much better when we not only consider time but also consider personal habits and topics [07]. With large amounts of online learning data, deep learning like LSTMs has been shown to be very successful at predicting student achievement [08]. We've also discovered that when challenging subjects are presented in an enjoyable, game-like way, students find them more motivating [09]. Importantly, studies point out that the development of interesting and useful AI learning tools depends on theories like Cognitive Load and Technology Acceptance [10]. From the literature, it is clear that spaced repetition substantially enhances long-term memory by preventing rapid forgetting [26]. Flexible, adaptive review schedules outperform static ones in maintaining knowledge retention [22], [26]. AI-driven personalization—such as intelligent content selection and timing adjustments—is now well established in learning technologies [25], [30]. Reinforcement learning, specifically, has proven effective at creating adaptive scheduling mechanisms that respond to learner feedback [22]. Intelligent tutoring systems have consistently shown success in offering real-time assistance and guiding students through challenging material, improving performance across subjects like programming [24]. Furthermore, in online learning contexts, emotion-aware tools like AI chatbots help sustain motivation and reduce anxiety, which boosts overall engagement and effectiveness [27]. Altogether, these findings highlight a solid foundation for integrating AI and personalized repetition strategies in educational platforms.as a whole, these observations provide a solid basis for the application of AI and personalized repetition strategies in educational resources.

The study says that we still need to figure out how to more effectively match them to the particular requirements of each learner [12]. We still need to find the best timing gaps for different types of information and learners [13]. More classroom testing is required to find out how well it works for various student types [14]. To make AI teaching accessible and user-friendly, further effort is required [15]. For immediate help, these models need to be used

throughout learning rather than only after [16]. Developers should build more AI tools which will be simple to use on the existing educational platforms [17]. Research should find which type of retrieval work is more effective on various kinds of learning materials [18]. More testing is needed to use it effectively for human learners [19]. Teachers need more simple tools to create this essential homework assignments [20]. More effort needed to use the predictions on the ReCallo project and to use those predictions more effectively [21]. To discover further future discoveries could involve making AI smart enough to analyse a student's confusion or frustration in real time to help them while struggling with a topic [07]. We can discover how AI makes a topic but in a new manner and unique way [08]. Another work scope for Learning purposes is how AI can help students to do critical thinking and process complex thoughts [09]. As technology advances, more fields are being discovered, making AI constantly optimised with memory and learning beyond a single course [10]. Despite these advances, several gaps remain. Many AI-based learning solutions are tailored to specific subjects and do not generalize well across different domains [24]. Reinforcement learning approaches, though promising, require more extensive testing in diverse, real-world educational settings [22]. Most commercial spaced repetition tools rely on fixed schedules or basic heuristics and lack true personalization based on individual forgetting patterns [26]. Also, cognitive learning tools and emotional support functionalities generally exist in separate silos; integrating both could significantly enhance user engagement [27], [29]. Usability and accessibility are still issues: many AI systems are too complex or lack sufficient transparency, which can deter learners, especially those less tech-savvy [26], [30]. Finally, there is a clear need for platforms that combine adaptive scheduling, emotional support, and user-centered design into a cohesive, user-friendly system [28].

III. PROPOSED SYSTEM

A. Software Tools

For Frontend

- React.js for UI framework
- Bootstrap CSS for styling

For Backend

- Node.js + Express.js for server side framework
- Rest API to handle frontend request
- Python for AI engine.
- Supabase for the Postgres development platform

AI & NLP Model

- OpenAI API for quiz/question generation, summarisation, etc.
- Scikit-learn/Numpy for a custom memory prediction model

Database

- Supabase (Postgres development platform)

B. Datasets

. This project uses user-provided data and real-world datasets to understand student learning and forgetting behaviour.

IV. CONCLUSION

As future scope of this project we are planning to launch Recallo App with the room Feature. Furthermore, audio commands, attention tracker and efficient features like the pomodoro method.

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