Mobile-Accessible Seamless Agent (MASA): Using ChatbotLLM for Grounding Chatbots in Teacher-Provided Materials

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Abstract: One of the greatest challenges facing AI-driven educational chatbots is the issue of hallucinations. At its core, factual errors, logical inconsistencies, and fabricated content severely undermine the foundational principles of truth and rigor in education. While current research methods have reduced the incidence of hallucinations, they remain susceptible to retrieval noise and lack fine-grained teacher control due to their black-box nature. To address these limitations, this study adopts ChatbotLLM to develop a browser-based educational chatbot that is a Mobile-Accessible Seamless Agent (MASA) to minimize adoption barriers. At the end of this paper, the study proposes a comparative experimental plan to validate significantly reduced hallucination rates in knowledge comprehension, citation-oriented, and reasoning tasks. By prioritizing teacher-led control and curriculum fidelity, ChatbotLLM and MASA advance human-machine interaction models for trustworthy AI in education.

Keywords: Hallucination mitigation; educational chatbot; teacher-grounded retrieval; configurable ai control; mobile accessible

1. Introduction

Led by large language models such as ChatGPT, conversational AI bots have rapidly gained traction in higher education (Yan et al., 2024). With core features such as natural language multi-turn conversations, personalized adaptation, and real-time feedback (Lin, Huang & Yang, 2023), these tools simulate continuous interaction with human mentors, supporting student inquiries and becoming indispensable teaching aids (Zhao et al., 2023). However, these advantages come with significant drawbacks, most notably the hallucination issues (Ji et al., 2023).

Hallucinations cannot be eliminated, which are an inevitable outcome of model architecture design and trade-offs. Consequently, current research focuses on mitigating significant risks (Singh et al., 2025), with prompt engineering, fine-tuning, and grounding emerging as the three primary strategies (Ji et al., 2023; Joshi, 2025).

To address hallucination issues in conversational AI agents, De Silva and Chang (2025) design ChatbotLLM that adopts sentence transformer and cosine similarity to find question related paragraphs for users include client apps to choose the top N question related paragraphs, to tweak threshold of cosine similarity value, to opt in/out the use of large language model (i.e., Google Gemini) for response rephrasing and/or Retrieval Augmented Generation (RAG). This study presents a Mobile-Accessible Seamless Agent (a.k.a. MASA) that is a ChatbotLLM-enabled browser-based app for providing learners with straightforward and intuitive user experience.

2. ChatbotLLM

ChatbotLLM[1] (De Silva et al., 2025) is IEEE Northern Canada Section's Capstone Project Award winner project, is a system to train chatbots on the materials uploaded by users. ChatbotLLM is not only capable of learning from materials in traditional formats like PDF, PPT(X), DOC(X), and TXT, but also can read XLS(X), images in the documents and even MP3 with the help of Google's Speech Recognition library. When a course is created and the course materials are uploaded, ChatbotLLM has five modules working together to prepare the dataset for chatbot training. ChatbotLLM follows a three-tier architecture consisting of Presentation (Client App), Orchestration (API Endpoints), and Logic (Service Provider).

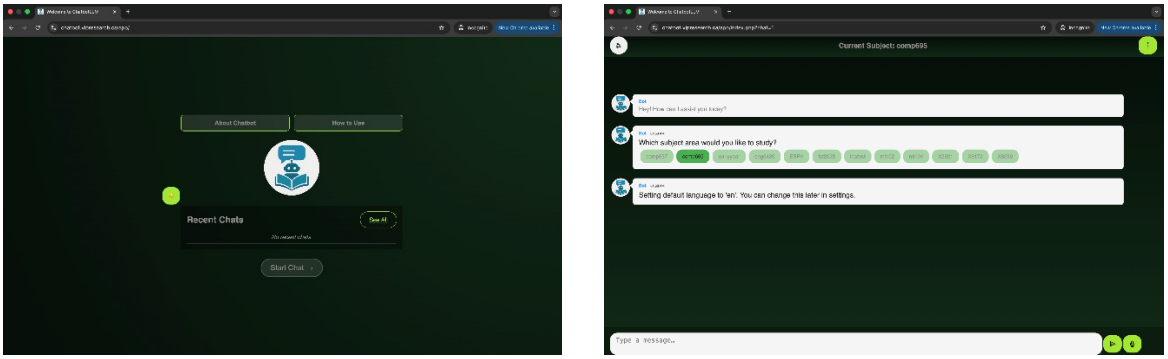
A learner can interact with ChatbotLLM and ask course related questions via a client app, for example, a LINE bot or a Discord bot. The client app will forward the learner's question to ChatbotLLM service provider. When ChatbotLLM service provider receives the request package, it first adopts sentence transformer and cosine similarity to search and identify the top N question related paragraphs from the teacher uploaded materials based on the pre-set cosine similarity threshold and top N value. According to teacher's setting (opt-out or not), ChatbotLLM will then use (or not use) large language model (Google Gemini) for either rephrasing and/or RAG before sending the response back to client app.

Different from other Generative AI tools or systems, all the responses were identified and generated by ChatbotLLM are based on the materials teachers provided instead of generating things based on everything it learned from Internet or other sources and trying to answer everything including hallucinations for its users include learners and client apps. So ChatbotLLM would tell users "NO, I don't know" if it cannot find any relevant content for user's question from the given materials uploaded.

3. Mobile-Accessible Seamless Agent (MASA)

To achieve Seamless Accessibility objective, the research team prioritizes frictionless user experience with mobile-accessible and simplicity design and develops Mobile-Accessible Seamless Agent (MASA[2]). Removing authentication barriers such as complex logins ensures instant access to learning materials on students' devices via a familiar, intuitive interface. MASA's UI/UX follows common mobile app patterns to minimize cognitive load and support natural, companion-like interaction between learners and the Chatbot service provider. This seamless accessibility effectively delivers the ChatbotLLM's core hallucination-mitigation mechanisms including teacher-grounded retrieval pipeline and configurable generative control.

When learners are told to use MASA for finding answers of course material related questions, they can see a clean mobile accessible landing page as Figure 2(a) shown below.



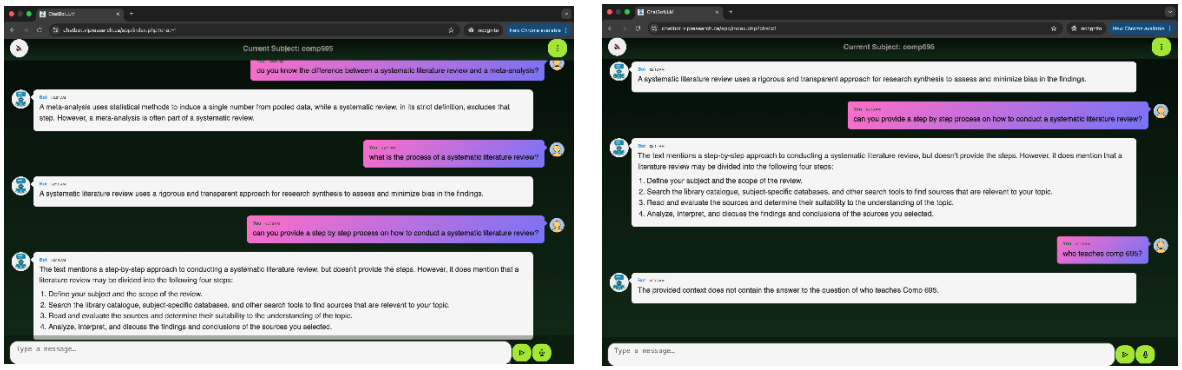
(a) MASA's landing page *(b) subjects offered and selected*

Figure 2. MASA, the browser-based client app

[1] https://chatbot.vipresearch.ca
[2] https://chatbot.vipresearch.ca/app

Besides starting the chat immediately, learners can also see the latest conversations with MASA on the landing page. As soon as they click “Start Chart →” button, they will be greeted and asked which subject they would like MASA to assist. Figure 2(b) shows the subjects available to the public – even when a subject is open to the public, teachers can still configure it by setup an access key to protect their uploaded content from learners other than their students.

As soon as a subject is chosen, learners can start asking any teaching materials related questions. Figure 3(a) shows that they not only can use keyboard to enter their questions but also can use microphone to “talk” to MASA with its speech-to-text function’s help – just like what they can do within commercial social messaging apps (e.g., Facebook Messager, Google Chat, LINE, WeChat, WhatsApp, etc.). Similarly, MASA can also talk back due to it having built-in text-to-speech function. Of course, if learners don’t want to “hear” from MASA but only see the text MASA typing, then they can click the speaker icon at top-right hand side on the screen to mute (or unmute) MASA. To avoid hallucination, MASA will not attempt to answer any question it cannot find correspondent content from the uploaded materials teachers uploaded as Figure 3(b) shown.



(a) asking questions with keyboard/mic *(b) MASA will not attempt to answer*

Figure 3. Asking MASA teaching material (non-)related question

4. Evaluation Plan

To validate the effectiveness of the educational chatbot proposed for mitigating hallucination issues, a comparative experiment was designed. This experiment plans to recruit 60 university students as participants from the university course *Introduction to Artificial Intelligence Technology* to minimize domain knowledge differences. Participants will be randomly assigned to either an experimental group or a control group. The experimental group uses MASA with ChatbotLLM service provider. This chatbot permits responses only based on textbooks and academic literature uploaded and verified by instructors. The control group uses MASA with a large language model (LLM) with unrestricted knowledge sources.

The experiment will have pre-test, chatbot usage, post-test, and questionnaire survey stages. At pre-test stage, all participants will complete a 10-minute pre-test to assess their prior knowledge of relevant learning content, ensuring comparability between the experimental and control groups at baseline. Subsequently, participants from both groups entered the 30-minute chatbot usage stage, where they will complete assigned learning tasks using their respective chatbot via two different links. At this stage, the interaction logs, including student questions, chatbot responses, and corresponding timestamps, are collected. At the post-test stage, all participants will complete a 10-minute post-test of equivalent difficulty to the pre-test but with non-repetitive questions to evaluate changes in learning outcomes. Finally, participants will complete questionnaires. The study will employ Gray and DiLoreto’s (2016) satisfaction scale to subjectively evaluate perceptions of the chatbot’s technical output and overall satisfaction (Shin & Sok, 2023).

The evaluation is investigating the hallucination mitigation effectiveness and learning outcomes. First, an objective hallucination assessment metric will be constructed. This study

plans to invite two domain experts with relevant disciplinary backgrounds to independently annotate the chatbot-generated responses, judging whether they contain factual errors, fabricated or misattributed information, or logical inconsistencies, all indicative of hallucination phenomena. Building on this, the study will calculate differences between the two chatbots in overall hallucination incidence and distribution across hallucination types. Additionally, the experiment will compare pre- and post-test performance differences between participant groups to evaluate the chatbot's impact on learning effectiveness.

5. Conclusion

Hallucination remains an inherent challenge in educational applications of large language model-based chatbots. ChatbotLLM strictly adheres to a single source of truth derived exclusively from teacher-uploaded and verified authentic textbooks or academic literature, eliminating reliance on parameterized knowledge and reducing retrieval noise at its source. This paper presents the MASA (Mobile-Accessible Seamless Agent), a browser-based instructional dialogue chatbot that advances the emerging trend of teacher-led instructional foundations and configurable safety layers (Kasneci et al., 2023; Yan et al., 2025). A limitation of this study is the lack of empirical validation. To address this, we plan to conduct a comparative experiment to empirically validate the effectiveness of these mechanisms.

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