

Empowering Mathematics Personalisation for Dyslexic and Colour-Blind Students through MIT App Inventor with GenAI Integration

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Abstract:

MIT App Inventor¹ is a user-friendly visual programming platform designed to facilitate building mobile phone and tablet applications (apps) through an interactive interface. It allows users to design the graphical user interface (GUI) and program functionalities for apps without extensive coding knowledge (Mir & Lluca, 2020).

The Universal Design for Learning (UDL) principles include multiple means of engagement, representation, and action and expression, ensuring that instructional methods are flexible and diverse to effectively meet all learners' needs (CAST, 2018). Therefore, designing and developing educational apps aligning with these principles can potentially support students' education (Rao et al., 2021).

In this concise paper, the authors investigate the development of an educational app (chatbot) using the MIT App Inventor platform, focusing on mathematics accessibility tailored for students with dyslexia and colour blindness. The personalised chatbot offers assistance and guidance in mathematics learning for primary education students. Integration of generative AI enriches the chatbot's capabilities, enabling dynamic interactions and customised learning experiences. This app incorporates features to accommodate diverse learners, specifically emphasising engagement and accessibility, aligning with the (UDL) principles.

The chatbot is equipped with advanced capabilities such as speech-to-text (STT) and text-to-speech (TTS) (Trivedi et al., 2018), enabling seamless interaction through both spoken and written communication. Moreover, the OpenAI API is used for generative AI integration to generate natural responses, while key parameters such as temperature, tokens limit, and logit bias² (Finnie-Ansley et al., 2022; Wu et al., 2023) are managed to optimise the chatbot's performance. Temperature regulates the diversity of generated text, while the token limit ensures responses remain coherent and relevant within a reasonable length by limiting the maximum number of words or symbols it can process in a single interaction. Logit bias steers conversations towards relevant topics or specific answers like yes or no (Chung et al., 2023).

Additionally, an integrated accessibility tool enhances the user experience for dyslexic and colour-blind students by allowing control over background colour, font size, colour, and type. For smartphones equipped with an accelerometer, an extra feature enables users to control background colour by simply shaking the device, with shaking sensitivity dictating colour selection intensity for a personalised experience.

Figure 1 presents the initial vision of the chatbot through MIT App Inventor's Graphical Interface Editor, representing the app's layout, while Figure 2 shows part of the chatbot's coding blocks through a block-based programming interface. These components highlight MIT App Inventor's robustness in empowering users to create dynamic and interactive mobile applications, including chatbots.

¹ <https://appinventor.mit.edu/about-us>

² https://platform.openai.com/docs/api-reference/chat/create#chat-create-logit_bias

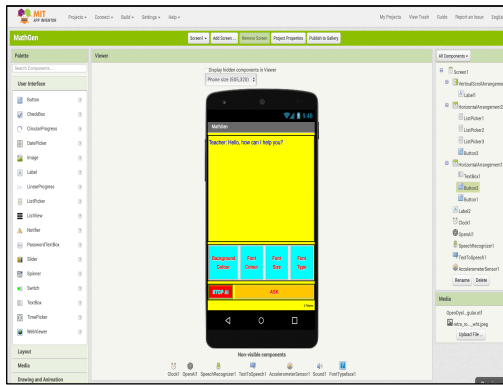


Figure 1: MIT App Inventor graphical interface editor

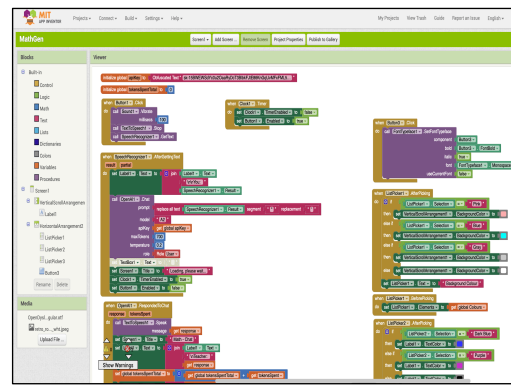


Figure 2: The coding blocks page

Tokens spent during response generation can be translated into meaningful metrics aligned with student learning and interaction with the app. These metrics can include measuring the depth of engagement, the richness of content (conversation), and the overall effectiveness of the learning experience. For example, tokens spent could correlate with the complexity and coherence of responses generated by the chatbot, reflecting the depth of understanding and relevance to student queries. By monitoring the tokens spent during generation, educators and developers can gain valuable insights to enhance the learning journey and foster meaningful interactions within the app.

This app demonstrates the potential of technology in fostering inclusive educational experiences through the use of MIT App Inventor and the integration of generative AI. By adhering to UDL principles and aiming to enhance accessibility, the app aims to empower learners of all abilities to succeed in mathematics education, regardless of any challenges they may face.

Keywords:

MIT App Inventor, Dyslexia, Colour blindness, Chatbot, Mathematics, Universal Design for Learning (UDL).

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