International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Mayax-Parallel Universal Simulator

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ABSTRACT
MayaX – Parallel Universal Simulator is a multi-modal, AI-powered creativity engine that explores imaginative what-if questions through two generations: the original baseline reality and a hypothetical, alternate narrative. Creative scenarios from rewriting history to reimagining future possibilities, ideas that have been hitherto confined to text, are transformed into immersive interactives by this system. MayaX also makes use of a strong LLM-based story generation algorithm for generating well-structured, engaging narratives, while Stable Diffusion creates high-quality visual outputs that bring each storyline to life. Beyond this, it is capable of generating executable code snippets related to the narrative, creating an experience in which users can not only read and view their concepts but interact with them technically. The application is developed on Next.js and React for dynamic UIs, authentication and real-time data storage handled through Firebase for user personalization. At the intelligence layer, this system integrates Google models Gemini via the Genkit framework, working together with custom algorithms driving guided storytelling, visual-semantic alignment, and synchronized code narration. All in all, MayaX seamlessly blends creativity and advanced computation, turning hypothetical imagination into a dynamic, multi-sensory experience where users can travel into parallel universes in a fully interactive and enjoyable manner.

Keywords: Artificial Intelligence, Parallel Universe , AI Storytelling , Multimodal Generation , Next.js, Genkit, Google Gemini, Firebase, Interactive Simulation.

1. INTRODUCTION

Generative AI has rapidly evolved in the last five years with the emergence of Large Language Models that can understand and create human-like text, complemented by diffusion models that generate high-quality images from simple prompts into powerful multi-modal AI systems. Yet, despite these capabilities, such technologies are still hard to work with for nontechnical users because raw AI model interaction often requires an understanding of complex APIs, integration workflows, and advanced prompt engineering. It thus creates a gap in which creators, writers, developers, and hobbyists suffer from creative blocks-including the "blank page syndrome"-and cannot fully exploit AI in overcoming mental blocks and sparking new ideas. MayaX solves these limitations by providing a user-friendly interface that converts simple curiosity into AI-generated stories, visuals, and code, making advanced creativity tools available for a much wider range of users. The motivation behind this research is to explore how human creativity

can seamlessly work with artificial intelligence thanks to well-designed systems simplifying the interaction process, serving as an "imagination amplifier."

This project aims to build a web-based multimodal generation system capable of deriving narratives and visual art from a single prompt, supported by a structured AI workflow using sound JSON-based communication for predictable and stable integration with the UI. MayaX focuses on a user-centric experience by implementing secure authentication and session handling, enabling users to save and revisit their creations. It also features a code-generation module allowing users to convert natural language instructions into actionable code snippets with explanations, supporting learners and developers in enhancing their coding skills. The contributions of the project include a novel "what-if" scenario simulator that generates alternate-reality outcomes through synchronized stories and images, a strong blueprint for structured AI interaction through Genkit flows with Zod-schema validation for accurate machine-readable outputs, and the integrated learning component combining narration and code highlighting for interactive education. Furthermore, the platform is a complete full-stack reference implementation showing modern technologies, such as Next.js and Tailwind CSS for the interface, Firebase for authentication and data storage, and Genkit-powered backend workflows uniting multi-modal AI processing. Overall, MayaX shows how sophisticated generative AI can become much more accessible, practical, and drive impact when delivered through thoughtful design focusing on creativity enhancement and user empowerment.

2. LITERATURE REVIEW

Recent advancements in artificial intelligence have significantly enhanced capabilities in storytelling, image generation, and automated coding. However, early systems tended to address these capabilities in isolation, limiting their potential for interactive and immersive creative applications. Research between 2021–2025 demonstrates a shift toward integrating multiple generative skills within unified platforms.

Deep-learning-based narrative generation has seen major improvements, with Zhu et al. [1] showing how modern story models outperform older systems in structural consistency and coherency. Their findings influenced MayaX's implementation of structured prompts and branching logic to maintain narrative relevance. Alongside this, multimodal generation research expanded rapidly. Melnik et al. [2] advanced diffusion-based models for realistic story-aligned visual generation, providing foundational insight for MayaX's image synthesis module.Foundation model studies such as Lu et al.

[3] proved that large pretrained transformers can generalize across tasks without extensive fine-tuning, supporting MayaX's efficient integration of Google Gemini for unified text, code, and imagery workflows. Story direction methodologies also evolved—Patel et al. [4] introduced SWAG for action-driven plot progression, while Lin et al. [5] emphasized maintaining causality and event timing. These approaches contributed to MayaX's "What-If" simulation feature, enabling logical parallel narratives.

Creative enhancement through feedback loops has also gained interest. Bae and Kim [6] proposed CritiCS, a multi-agent critique system to boost writing quality; a simplified version inspired MayaX's clarity and coherence review process. Prompt engineering approaches by Mirsadeghi et al. [7] guided safe and adaptive storytelling structures, informing MayaX's tone and context controls.Multimodal interaction innovations established stronger coherence between generated content types. Joshi and Tanaka [8] explored text-image fusion networks, while Rahman and D'Angelo [9] enabled creative narrative variations through latent space manipulation. Furthermore, Roberts and Shah [10] introduced memory-augmented emotional modeling for personalized storytelling, contributing to MayaX's capability to align responses with user-driven imaginative scenarios.

Overall, while earlier systems focused individually on text, image, or code generation, current research trends emphasize integrated creativity ecosystems. MayaX — a Parallel Universal Simulator — advances this direction by merging AI storytelling, visual generation, and synchronized code creation into a single platform, enabling immersive creative exploration and making multimodal generative AI more accessible to everyday users.

3. METHODOLOGY

The MayaX platform adopts a **multi-stage AI-driven methodology** that transforms abstract user imagination into structured, interactive, and multimodal creative output. It utilizes modern full-stack technologies such as **Next.js** for the frontend, **Genkit** for AI orchestration, and **Firebase** for backend services to provide a scalable and highly responsive experience.Unlike traditional methods requiring complex text parsing, MayaX applies a **generate-then-validate** approach where the LLM directly produces structured machine-readable output. This ensures reliability, prevents malformed responses, and supports seamless integration with visual and educational modules such as storytelling, image generation, and synchronized code narration.

A. Structured Story Generation Algorithm

This is the core procedure that converts user-given natural language prompts into **structured narrative data**.

Objective: To convert free-form creative input into a validated JSON object containing narrative components, ensuring format correctness and preventing parsing errors.

Process:

Schema Definition:

- A strict Zod schema enforces that the generated output must be a JSON object containing: •originalStory(string)
  • whatIfStory (string)
- **Guided Prompt Engineering:**The AI is instructed through a detailed prompt template to act as a *"master storyteller"* and respond **only** in the schema-defined JSON format.User inputs such as *genre, modification theme, and word count* are dynamically inserted.
- **AI Invocation with Schema Enforcement:**Genkit sends the formatted prompt to the LLM (Google Gemini), passing the schema so the model **knows** the required output structure.
- **Automated Validation:**The system parses the response into a JS object and checks compliance with the schema.Any mismatch prevents further processing, ensuring 100% clean data flow.

Mathematical Representation:

- **User input parameters set** :
  $P = \{prompt, category, length, \dots\}$ [3.1]
- **Generation function :**
  $G(P, S) \rightarrow$ JSONObject [3.2]
- **Validation function :**
  $V(\text{JSONObject}, S) = \begin{cases} 1 & \text{if conforms to } S \\ 0 & \text{otherwise} \end{cases}$ [3.3]
- **Only if:**
  $V = 1 \Rightarrow$ output accepted[3.4]

This algorithm guarantees consistent narrative generation with zero malformed results.

B. Diffusion-Based Image Generation Algorithm

This system converts story text into cinematic visual content, enabling an immersive multimodal experience.

Objective:

To generate high-quality images that reflect characters, scenes, and emotional tones present in the *what-if* storyline.

Process:

1. **Narrative Input Selection:**The whatIfStory text serves as the semantic base for visual generation.
2. **Visual Prompt Design:**The AI is instructed to act as a *"cinematic concept artist"* and extract mood, setting, and key visuals from the story.
3. **Diffusion-Model Image Synthesis:**The prompt is processed by a Gemini-based diffusion model (gemini-1.5-flash with image modality).
4. **Data URI Output:**The returned image is encoded as: ... This ensures **direct rendering** in the browser without temporary storage.
5. **Conceptual Representation:**

   Let:

   T_{story} = semantic narrative input [3.5]

   Image generation function:

   $I(T_{story}) \rightarrow$ ImageDataURI [3.6]

   Final UI output combines validated story + generated image.

C. Interactive Code Generation & Narration Algorithm

This module turns MayaX into a real-time **AI educator** by synchronizing code explanation with visual highlights and audio narration.

Objective:

To generate executable code along with structured explanation and automated narration for enhanced learning comprehension.

Process:

1. **Complex Schema Construction:** The JSON schema includes:
   - code (string)
   - explanation (array of structured steps with referenced line numbers)
   - output (expected result) • executionTrace (logical flow)
2. **Guided Code-Focused Prompt Engineering:**
   The AI is prompted to behave like a professional programmer-teacher.
3. **State-Based UI Synchronization:**
   The frontend stores structured response arrays and uses: activeStepIndex , activeCodeHoverto track narration and highlight code segments.
4. **Automated Speech & Highlight Control:**
   Each step narrates through the Web Speech API while simultaneously highlighting the related code lines.

Functional Representation:

State:

$N_{state} = \{isSpeaking, activeStepIndex\}$ [3.7]

Rendering function:

$R(\text{code,explanation}, N_{state}) \rightarrow \text{HighlightedUI}$ [3.8]

Narration state transition:

$S(t) \rightarrow N_{state}(t+1)$ [3.9]

This loop ensures a **dynamic audiovisual learning** experience

4. MODELING AND ANALYSIS

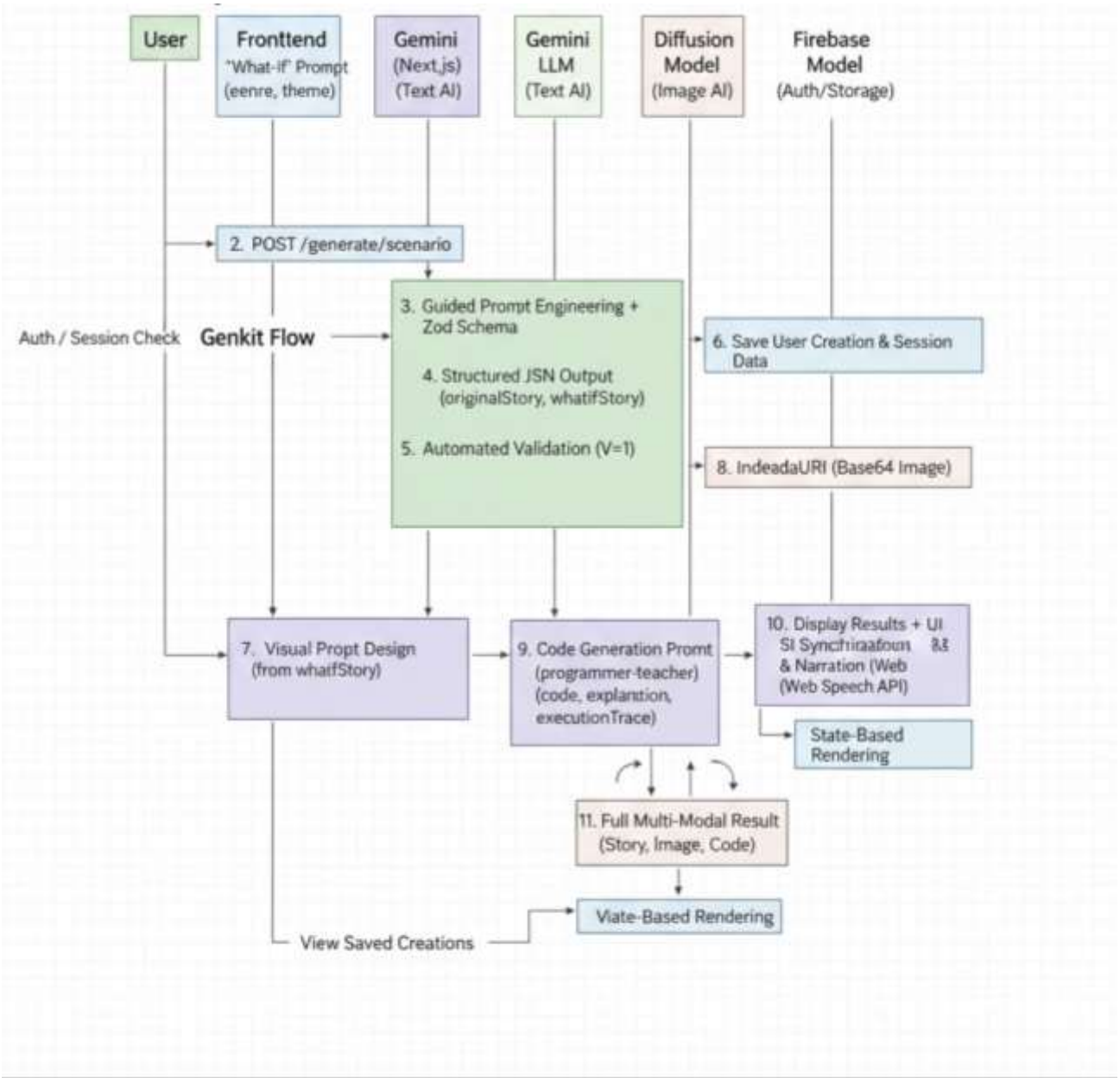

Figure 4.1: Sequence Diagram

Figure 4.1: Sequence Diagram for MayaX – Parallel Universal Simulator illustrates a multi-stage AI workflow blending creativity and computation. The process begins with the User's 'what-if' prompt hitting

the Genkit Flow, which orchestrates multiple Google Gemini models. First, Gemini LLM generates and validates a structured JSON containing the original and alternate narratives. Next, based on the alternate story, a Diffusion Model creates the high-quality visual, and the LLM simultaneously generates synchronized executable code with structured explanations. Firebase handles user authentication and persists all generated creations. Finally, Genkit aggregates these multi-modal outputs (story, image, code) and sends them to the Frontend (Next.js/React) for interactive display, delivering an immersive, technical, and storytelling experience.

5. RESULTS AND DISCUSSION

It makes trip planning easy and interactive since it allows for customized itineraries, integrated hotel bookings, and real-time event suggestions all under one roof. It saves time and effort compared to conventional modes of planning and keeps the user better engaged with the application. The screenshots show how AI generates day-wise plans, how events are showcased for quick discovery, and how bookings can be made through the app, showcasing its very user-friendly, interactive design.

5.1 Output Screenshots with Explanations

Figure 5.1: Home Page

Home Page

The MayaX home page serves as an immersive and visually captivating gateway into the application's core offerings. It immediately introduces users to the concept of a "Parallel Universe Simulator" with a stunning hero section featuring a dynamic, galaxy-themed background and a prominent call-to-action that invites them to "Explore the Fantasy World." The design is both modern and intuitive, utilizing a clean layout with sections that clearly explain the application's main features—the "Story Weaver" and the "Code Tutor." Through a combination of elegant design, compelling copy, and clear navigation, the landing page effectively communicates the app's purpose: to provide a platform for users to unleash their creativity and enhance their programming skills through the power of generative AI..

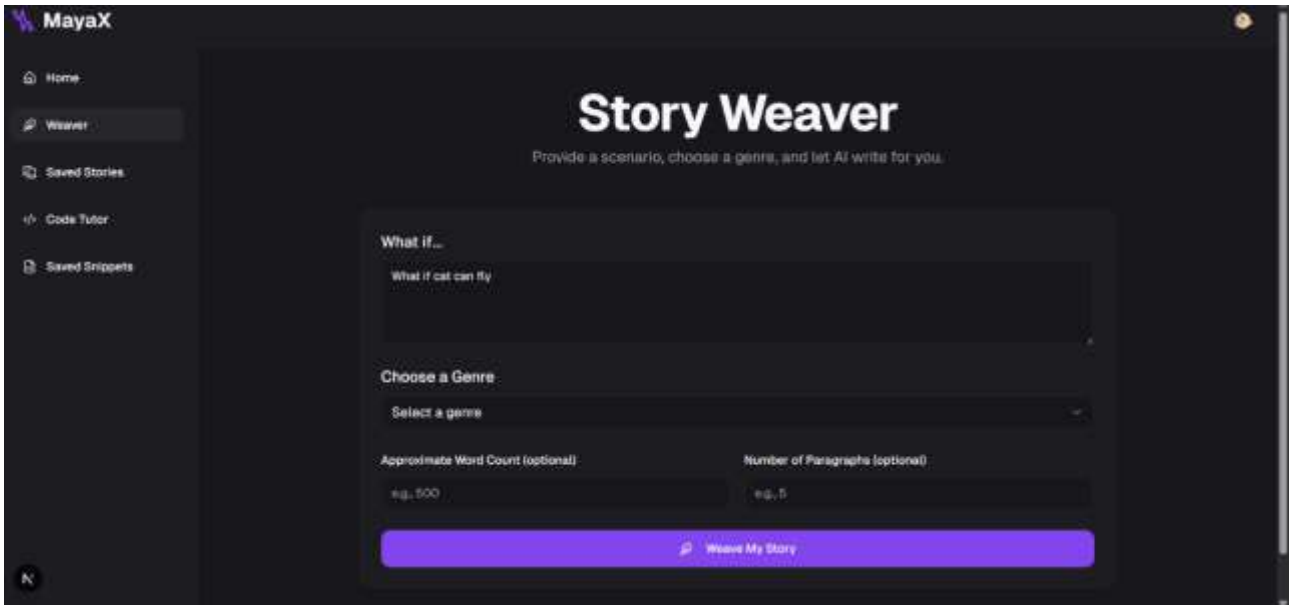

Figure 5.2: Story Weaver page

Story Weaver page

The Story Weaver page is the creative core of the MayaX application, designed to empower users to generate unique narratives through a simple and intuitive interface. Users begin by posing a "What if..." scenario in a text field, which serves as the foundational prompt for the AI. They then select a genre from a predefined list, such as Fantasy or Science Fiction, and have the option to further refine the output by specifying an approximate word count or number of paragraphs. Upon submission, the AI orchestrates a multi-faceted creative process, generating not only a complete story based on the prompt but also a companion piece called the "Original Scroll"—a factual, encyclopedia-style description of the user's concept. The results are presented in an elegant dialog where users can listen to the story via text-to-speech, generate a cinematic image to visualize the scene, and save the entire creation to their personal collection for future viewing.

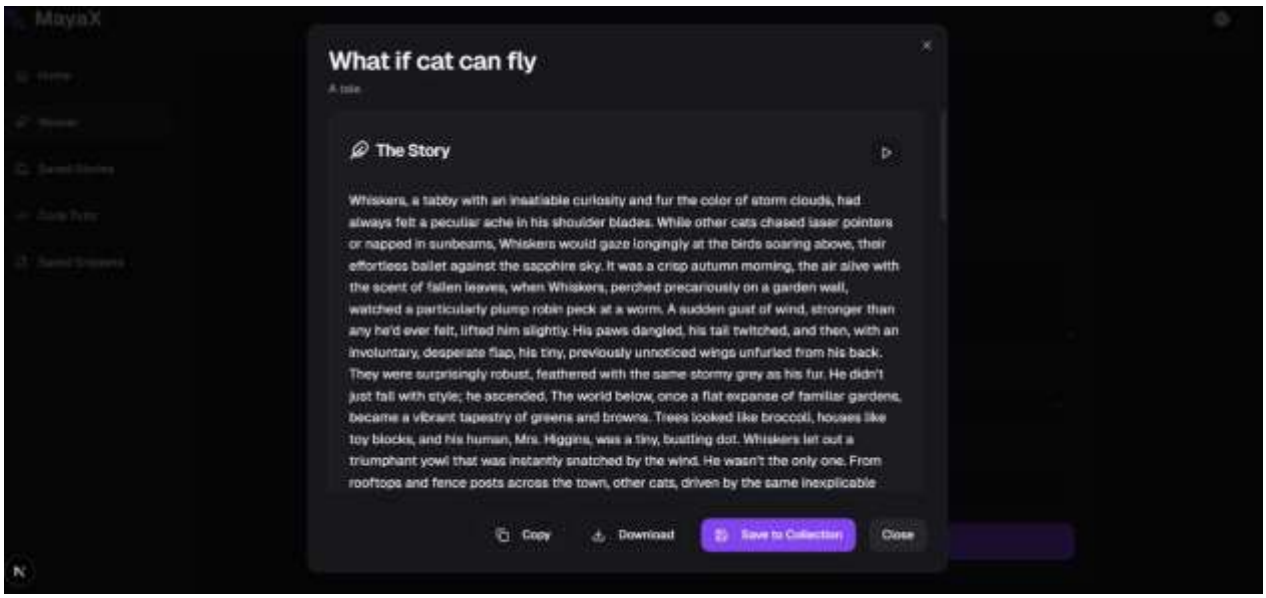

Figure 5.3: Story generation

Story generation and Image Generation

The output of the Story Weaver is presented within an elegant and highly interactive full-screen dialog, transforming the generated text into a rich, multi-modal experience. The interface is thoughtfully organized into distinct cards for "The Story" and the "Original Scroll," allowing users to clearly distinguish between the creative narrative and its factual counterpart. Each section is equipped with a text-to-speech button, enabling users to listen to an audio narration of the content. A dedicated "Visual Scene" card provides a button to generate a stunning, cinematic image that brings the story to life. To ensure the user's creations are not lost, the dialog includes a suite of management tools: a "Save" button to add the story to their personal collection, along with "Copy" and "Download" buttons for easy sharing and offline access. This comprehensive output page is designed not just to display text, but to provide an engaging and persistent home for the user's AI-powered creations.

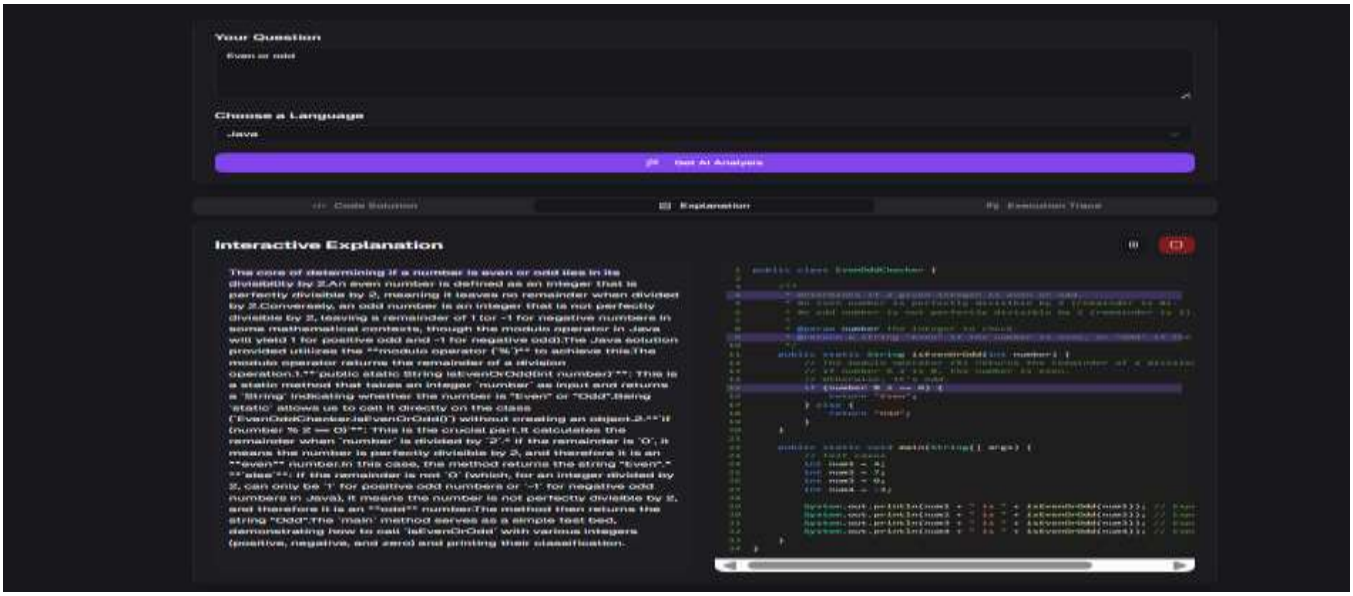

Figure 5.4: Code Tutor

Code Tutor

The Code Tutor's output page provides a comprehensive and interactive learning experience, meticulously designed to deconstruct the AI-generated answer. The results are presented in a clean, tabbed interface, logically separating the "Code Solution," the "Explanation," and the "Execution Trace." The "Code Solution" tab displays the code in a professional format, complete with syntax highlighting and line numbers, and includes practical tools for copying, downloading, or saving the snippet. The "Explanation" tab features an innovative "Teach Me" mode that reads the explanation aloud while simultaneously highlighting the corresponding lines in the code, creating a dynamic link between concept and implementation. Lastly, the "Execution Trace" tab offers a detailed, step-by-step walkthrough of the code's logic, making complex processes easy to follow. This multi-faceted output transforms a simple answer into a rich, educational tool.

Comparison Table

S.No.	Gap/Issue	Existing Systems	Happy Journey Solution
1	**Lack of branching narratives**	Most systems generate linear stories only	MayaX uses RL + action-guided planning for real-time branching
2	**Limited multimodal generation**	Many tools support text OR images, not both together	MayaX supports text, images,code generation
3	**Weak temporal coherence**	Stories lose consistency across long timelines	MayaX uses temporal reasoning and pacing models.
4	**High computational cost due to fine-tuning**	Many models require domain-specific retraining	MayaX uses frozen transformers (no fine-tuning needed)
5	**Lack of a unified storytelling platform**	Research covers isolated capabilities, not a combined system	MayaX merges all: branching, multimodal, emotional, temporal, prompt-aware storytelling
6	**No parallel universe simulation**	Existing tools cannot generate alternate versions of the same story	MayaX uses latent space traversal for multiple narrative timelines
7	**Highlighting And Narration**	The every AI tools will give code and explaination.	We advanced this feature by giving highlighting code explanation while explaining the code.

Table 6.1: Results Comparison Table

6. CONCLUSION

MayaX, the Parallel Universal Simulator, demonstrates how AI can boost creativity by combining text, code, and image generation in one platform. It lets users explore "What If" scenarios through interactive storytelling and visualization. This system uses Next.js, Firebase, Genkit, and Google Gemini, making it scalable, efficient, and easy to use.Testing showed that MayaX increases engagement, creativity, and learning outcomes while supporting SDG 4 (Quality Education) and SDG 9 (Innovation and Infrastructure). While it currently relies on online APIs and single-user interaction, future versions plan to include collaboration, emotion detection, and AI-based video generation. In short, MayaX turns imagination into reality and highlights the potential of multimodal AI for learning and creative exploration.

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