p-ISSN: 2252-3006
e-ISSN: 2685-2411

AI-Driven Mobile Children's Book Generator: A Case Study of Tema Insani Psychology Consultancy

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Abstrak

Perkembangan teknologi mendorong digitalisasi di berbagai sektor, termasuk dalam bidang psikologi dan literasi di Indonesia sehingga mendorong konsultan psikologi anak bernama Tema Insani untuk meningkatkan minat literasi anak dengan mempertimbangkan kondisi psikologis, neurodevelopmental disorder, dan perkembangan usia, yang selama ini masih bergantung pada peran orang tua dalam menyediakan buku. Solusi yang dihardirkan berupa pembuatan aplikasi berbasis mobile untuk membuat cerita bedtime story anak dengan mempertimbangkan usia, disorder, dan preferensi anak-anak. Aplikasi memiliki tracker membaca untuk melihat perkembangan literasi dari anak berdasarkan frekuensi membaca. Pengembangan dilakukan menggunakan metode agile, dengan bahasa utama yang digunakan dalam pengembangan aplikasi adalah Dart dengan SDK Flutter. Hasil pengujian dengan black box testing menunjukkan bahwa implementasi penggunaan aplikasi oleh orang tua pada anak di malam hari dapat meningkatkan frekuensi membaca dengan mengganti penggunaan perangkat dengan bedtime story. Pengembangan aplikasi diharapkan dapat membantu upaya Tema Insani menjembatani ranah psikologi, teknologi, dan minat literasi anak Indonesia.

Kata kunci: *Aplikasi Mobile, Bedtime story, Psikologi, Literasi*

Abstract

The advancement of technology drivesving digitalization across various sectors, including psychology and literacy in Indonesia. This motivates children's psychology consultant Tema Insani to enhance children's literacy interest by considering psychological conditions, neurodevelopmental disorders, and developmental age, which have so far relied heavily on parents' role in providing books. The issue presents a solution in the form of a mobile-based application that can generate bedtime stories tailored to children's age, disorders, and preferences. The app includes a reading tracker to monitor children's literacy progress based on reading frequency. The development uses the Agile methodology and Dart with Flutter SDK as the primary development language. The black box testing results show that using the app with children at night can increase reading frequency by replacing device usage with bedtime stories. The development of the app is expected to support Tema Insani's efforts to bridge psychology, technology, and children's literacy interest in Indonesia.

Keywords: *Mobile Application, Bedtime Story, Psychology, Literacy*

1. Introduction

The rapid development of technology in the digital age drives the migration of conventional methods to the digital world [1]. Technology offers benefits such as easier accessibility, broader information coverage, and practicality in use, with the key being data and information exchange [2]. The global impact is also felt with wider accessibility to information, accelerating digitalization as a key to development and resilience in the digital era. The urgency of digitalization efforts aligns with many other technological advancements. Proper digitalization can provide improved accessibility and practicality, such as increasing business process efficiency and competitiveness [3], [4].

p-ISSN: 2252-3006
e-ISSN: 2685-2411

Artificial Intelligence (AI) imitates human intelligence by computers [5]. AI comes in various forms like chat robots, knowledge extraction, AR enhancement, and automation. Its flexible capabilities allow integration into various aspects of life, including child capability development.

Recent studies show the declining literacy interest rate in Indonesia for young kids, rooting in the lack of parental contribution. The I-NAMHS survey in Indonesia in 2022 showed that one in three teenagers has mental health issues, reflecting a lack of psychological development from a young age due to the limited opportunities to explore through literacy.

Tema Insani is a child psychology consultation clinic owned by Ni Ketut Jeni Adhi, focusing on child psychological growth, especially at a young age. Psychologist Jeni introduced bedtime stories to enhance child psychological development, but this method requires additional costs and has limited story flexibility. To address these issues, an optimal solution can be achieved through AI-based applications. AI flexibility can facilitate bedtime story creation by deepening natural language processing and generation. One form of AI is LLM or Large Language Model, also used in Google Gemini, enabling deep language processing and flexibility to create complex stories with various prompts.

Previous research with Proppian's System and AI-driven story generation focused on ontological and conceptual aspects of stories, but did not integrate psychological and child development aspects which plays a crucial part in better addressing the child's psychological needs, wrapped in the stories generated to increase literacy and mental wellbeing [6]. Another research utilizes AR in children's picture book shows an increase in psychological characteristics, indicating the possible positive effects of children-oriented applications. The research however shows that 41.07% of the participants are unable to use the technology due to their lack of knowledge, indicating a need for a simpler implementation of application [7]. The lack of research combining AI-driven story generators with child psychological development through bedtime stories indicates a gap. Based on the need to address these issues, an "AI-Driven Mobile Children's Book Generator: A Case Study of Tema Insani Psychology Consultancy" was designed.

2. Research Method / Proposed Method

This research was conducted at the Information Technology Campus, Udayana University, Bali Province. The allocated timeframe for the research was from January 2024 to September 2024.

2.1 Research Flow

Flowchart that visualizes of the research process, as shown in Figure 1.

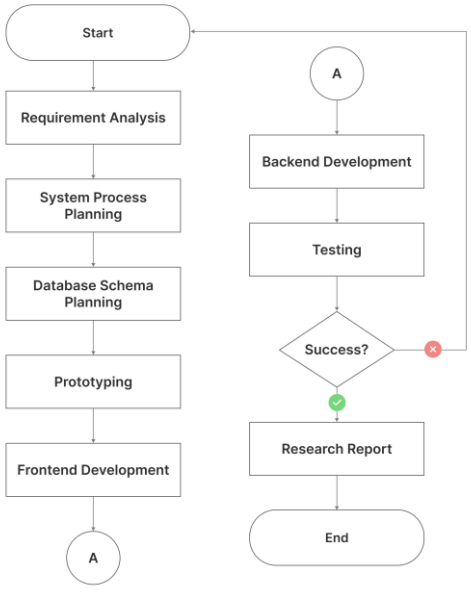

Figure 1. Research Flow

p-ISSN: 2252-3006
e-ISSN: 2685-2411

The flowchart above outlines the research stages. The first step involves analyzing the necessary requirements by collecting data directly and indirectly with Tema Insani. The next step is system design, followed by database scheme design, prototype system visualization, front-end development, and back-end system creation. After development, system testing is conducted. The final step before completion is report preparation.

LLM Selection is a critical aspect in application development. The selected Large Language Model (LLM) processes the generated stories. Several LLM options are available, but Gemini is the best choice as it integrates with Flutter, a Google framework. Gemini has its own code compatible with Flutter and is part of a Google One subscription, costing Rp 309,000 per month, providing access to storage and Gemini Pro. Given its economic value, Gemini is the chosen LLM for application development.

2.2 System Design Methods

The system development method is Agile using Scrum, which focuses on iteration and progress in small, manageable packages. This flexibility allows for easy adaptation to changing conditions and requirements. The division into different sprint groups aids in time management and setting priorities in mobile application development with Flutter.

2.3 Physical Data Model

A Physical Data Model, commonly referred to as PDM, is a representation of the design and implementation of a database [8].

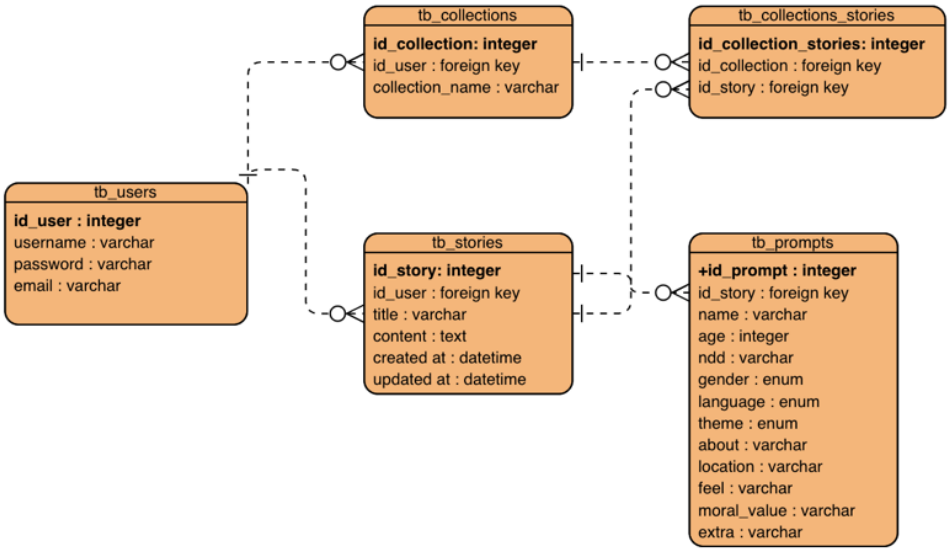

Figure 2. PDM

Developers can use this diagram as a reference and visualization for the data exchange that occurs within the application.

2.4 Prompting and Usability Testing

The Large Language Model (LLM), specifically Gemini AI, requires an input prompt to process and generate results. The input is designed to facilitate creating stories tailored to specific criteria such as character names, child age suitability, neurodevelopmental disorder, story plot, location, moral message, and more. The prompts used in application development specify these details and ask Gemini to generate stories using markdown syntax for proper display on the application. The implementation scheme of Gemini AI involves users inputting data into a form, storing it in variables, and using Flutter's functions to send prompts to Gemini. If the output doesn't match expectations, the prompt is resent. If the generated text is correct, the application displays the story text on the screen.

The main objective of developing the application is to create stories that align with children's prompts and needs. Pre-prepared prompt codes will be tested to ensure they are

p-ISSN: 2252-3006
e-ISSN: 2685-2411

suitable for the application. The results will be reviewed by a child psychologist. The table compares the story testing results generated by the prompt codes, which vary based on factors like the child's age, gender, profile, NDD, story theme, plot, setting, and moral message. The generated stories are adequate and can be implemented in the application development.

3. Literature Study

The literature review aims to identify previous researchers who have conducted studies on topics or problem areas like the one being investigated.

3.1 State of the Art

Similar topics have been addressed in previous research, which focused on automatic storytelling using AI, specifically character-centric neural storytelling models [9]. The generated stories revolve around predefined characters, with outputs constrained to specific contexts and environments surrounding the character. The main goal was to explicitly capture character information and integrate it into the subsequent plot creation. Results showed that the model performed more consistently than others, and survey respondents had positive preferences for the outputs. However, the fixation of all stories on one character limits creativity and potentially reduces the variety of stories that AI can produce.

Other research focused on developing different models, such as applications generating stories or images based on ambiguous sentences. These applications lack clear specifications, making the storytelling less comprehensive and continuity minimal. A framework that captures the context of previous outputs is needed, using an autoregressive framework with visual memory modules to maintain context across iterations. Results were positive, showing the ability to retain character and event context even with complex characters and settings.

Another study titled "A Hybrid Model for Globally Coherent Story Generation" addresses the challenge of creating a system that can track the entire history of stories previously generated. The problem stems from the system's nature of only producing stories based on the initial commands given during creation. The solution proposed is a model with a different operational approach.

Another study that serves as a reference for app development focuses on creating a language model that writes word by word. Developing a model that can perform planning helps in crafting more comprehensive stories. The technology used includes a predicate-argument structure that reads predicates from previous story paragraphs and makes predictions about the context to be generated next [10].

Other studies used as references create an encoder-decoder framework structure to generate Short Story Captioning (SSCap) by referencing provided images. This research focuses on developing a script that becomes a short story [11]. Another program called "Transformer" has more capabilities in generating stories but does not use specific codes. The combination of both functions using CVAE can integrate the positive aspects of Conditional Variational Autoencoder and latent variable models, enabling high-capability storytelling and story modification [12].

Other research takes on the issue of limited output variety from AI-generated stories. The solution offered in the research is a framework that allows the story-generating model to incorporate external knowledge in generating outputs [13]. Another journal discusses the development of a mobile application to help students' thematic learning [14]. The research shows a positive result towards the application implementation, indicating a positive impact in adapting learning process to a mobile application. The positive potential is also shown in other research, despite being a game based application, but is also a form of mobile digitalization and how it positively impacts the user [15] [16].

Research analyzing Khan Academy Kids apps shows that extensive screentime usage, when properly implemented, can positively affect literacy skills [17]. Another journal discusses automated story generation systems. Story generation systems can be divided into two types: interactive, where users or writers provide inputs step-by-step to design the story or continue a story draft; and non-interactive, where no continuous user input is needed [18].

3.2 Child development dan Bedtime Stories

Child development is a dynamic process that involves the growth of the brain and intelligence from ages 0 to 18 years. Brain development reaches about 50% by age 0-4 years,

p-ISSN: 2252-3006
e-ISSN: 2685-2411

80% by age 4-8 years, and 100% by age 8-18 years [19]. Child cognitive development includes speaking, learning, thinking, and motor skills. Language plays an important role in both verbal and non-verbal communication. Additionally, child character formation, especially in the preoperational phase (2-7 years) and operational phase (7-11 years), is also an indicator of mature development. Law No. 20 of 2003 emphasizes the importance of character development as part of national education.

Bedtime stories are a category of fairy tales meant for reading before sleep. These stories resemble fairy tales in that they have high imaginative content [20]. Their benefits extend beyond entertainment to include cognitive, affective, social, and conative development in children [21]. Bedtime stories help enhance vocabulary, attention retention, and emotional development in children. Reading is typically done at night to avoid interfering with sleep time, and these stories can boost melatonin production, which is important for the sleep-wake cycle [22]. Diversification of bedtime stories is crucial to capturing children's interest and meeting their diverse needs.

3.3 Large Languange Model

A Large Language Model (LLM) is a large-scale language model that represents the accumulation of various developments in the fields of artificial neural networks and natural language processing from the past [23]. The processes within an LLM system are derived from extensive training using large and diverse datasets, allowing the system to independently analyze word patterns and structures. The range of commands it can perform is very diverse, including complex data extraction and various functions. One actively evolving LLM is Gemini.

The development implemented in Gemini utilizes multimodal principles and is not restricted to text-only datasets. The result of the development with the model is Gemini’s ability to simultaneously process a variety of data forms. The output generated by Gemini depends on the initial input given by the user in the form of a prompt. These prompts can be tailored to produce stories appropriate for children's ages and conditions.

4. Result and Discussion

The results and discussion cover the outcomes of designing an AI-Driven Children’s Book Generator for a mobile platform in a Human-Themed Psychological Consultant Case Study.

4.1 User Interface Aplication

The design of the AI-Driven Children’s Book Generator Mobile Application, Case Study: Insani-Themed Psychology Consultant, involves several parties who interact with and use the application. Users begin the process of interacting with the app through the login page, where they enter their email and password to access their account. If a new user, they must first register by filling out a registration form that includes an email, username, and password. After successful login, users are directed to the home page which is the center of navigation for various application features. To create a story, users go to the create story page, where they fill out a form with the desired prompt. This input is then processed by Gemini AI to generate a story. If the user provides different inputs, such as using a more specific or random prompt through the randomizer feature, the resulting story results will match that input, creating a unique variation. The results of the story that have been created are displayed on the story results page, where users can read, save, or confirm that the story has been read. All saved stories can then be accessed back on the story collection page, complete with the option to read the details, share, delete, or edit the prompt to generate a new story. This stage ensures that the application can provide relevant and varied results based on the input provided by the user. A detailed overview of the system's interface is provided below.

p-ISSN: 2252-3006
e-ISSN: 2685-2411

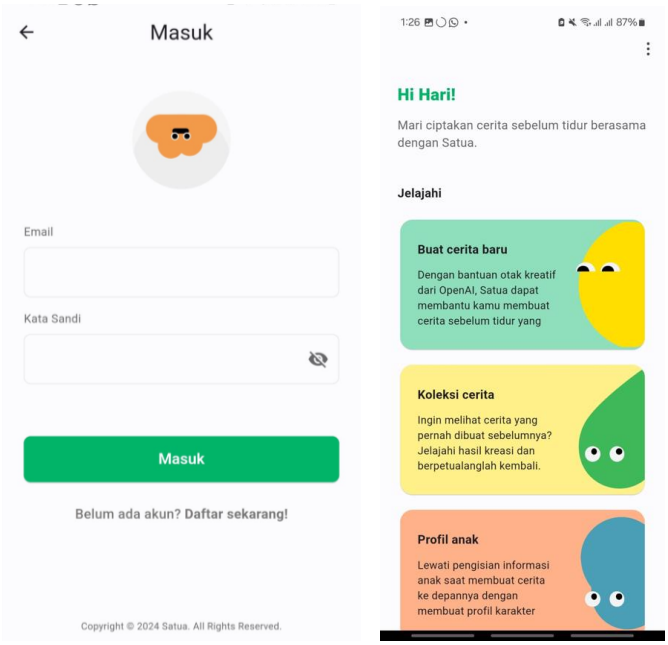

Figure 3. User Login and Home Display

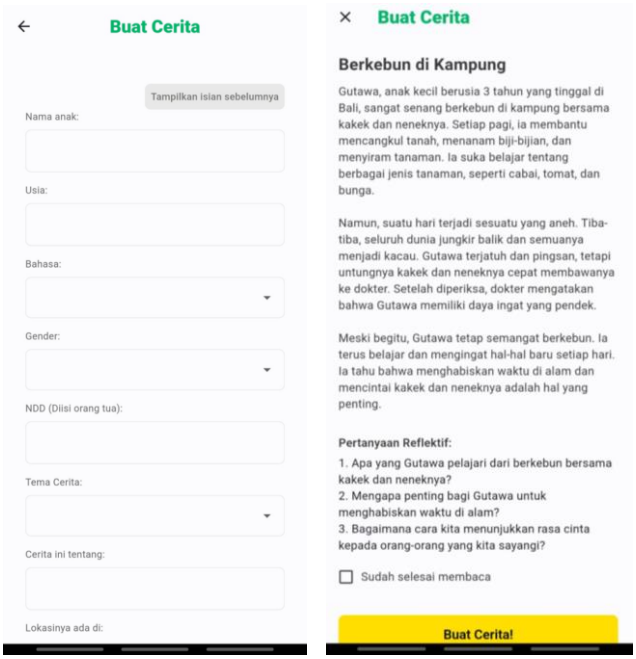

Figure 4. Home and Create Story Display

4.1. Black Box Texting Results

Blackbox testing is conducted to ensure the features are running well [24]. The first test conducted was for the authentication and user validation feature. The scope of this test ensures that users can register, log in, and validate if there is incorrect data. The results showed that all scenarios were successfully completed, so all features in this module were successfully executed. The next test examined the story creation and management feature. The scope of the test ensures that users can create, modify, view previously created stories, and delete stories.

p-ISSN: 2252-3006
e-ISSN: 2685-2411

The results showed that all scenarios were successfully completed, so all features in this module were successfully executed. The next test examined the Profile Management and Progress Tracker feature. The scope of this test ensures that users can access profile management (create, edit, and delete) and progress tracking. The results showed that all scenarios were successfully completed, so all features in this module were successfully executed**.** The results of testing the authentication and user validation features can be seen in Table 1.

Table 1. Authentication and User Validation

Scenario	Expected Results	Test Results
User registration	Accessing the register page, the account was successfully created.	Testing Successful
Testing the validation of registration inputs	If the field is empty, a notification will appear letting the field not be empty.	Testing Successful
User login	Login is successful if the data entered is correct, and an error notification appears if the data is incorrect.	Testing Successful
Access the app's home page	Access the customer dashboard page when the login has been successful	Testing Successful

Table 2. Story Creation and Management

Scenario	Expected Results	Test Results
Access the story creation page	Accessing the register page, the account was successfully created.	Testing Successful
Testing the *autofill* feature on the name field for autofill.	The name, age, gender, and NDD fields are auto-populated according to the selected profile.	Testing Successful
Creating a story	Login is successful if the data entered is correct, and an error notification appears if the data is incorrect.	Testing Successful
Indicates that the user has finished reading the story.	The story marker that has been read has been successfully checked and updated when viewing the report later.	Testing Successful
Save story feature	Saved stories, a pop-up of successfully saved stories will appear, giving you the option to go to *the gallery* or return to the main page.	Testing Successful
Story gallery	The story gallery page is successfully accessed, displaying a collection of stories that have been created with a working sort option.	Testing Successful
Detail story gallery	The detailed story gallery can be opened, displaying stories that have been saved before.	Testing Successful
Edit story	The top right menu option can be opened, giving you the option to edit the story, enter the *prompt* page, and be able to modify *the prompt* to create a new story.	Testing Successful
Delete Story	Stories can be deleted.	Testing Successful
Share stories	Stories can be shared to other apps as text format	Testing Successful

Table.1 Profile Management and Progress Tracker

Scenario	Expected Results	Test Results
Profile Management	Access the profile management page	Testing Successful
Profile creation, editing, and deletion.	Profiles can be created, with age set automatically when entering a date of birth. The results of the profile can be viewed in the story list, edited, and	Testing Successful

	can be deleted.	
Progress Tracker	The *progress tracker page* is accessible, displaying data on the number of stories read on a daily, weekly, and monthly basis.	Testing Successful

4.2 User Testing Results

The reading frequency at the end of the week was recorded as 7 times, with 2 readings on the last day. This testing was done over 7 days on 5 users and summarized on the last day. The results showed an increase in reading frequency after using the application, indicating positive behavior. The average increase was 1.17 stories per day. Another qualitative test was conducted to analyze the strengths and weaknesses of the application and gather feedback for future improvements.

> *"If before, I had to buy many books to get a lot of stories, now it seems that technology can generate stories directly from the device. It's convenient, no need to hassle. My suggestion is in the picture. My child usually leans towards visuals. When the story is read at night, he likes to ask about what it looks like, how the characters are shaped, and so on. The rest is already very useful." – Parent 3*

The app is seen as functioning smoothly and helping effectively. It caters well to children with specific conditions, adjusts stories to child age, and generates engaging content. Some parents appreciate it as an alternative to children scrolling social media at night and see it as an opportunity for bonding with their children. Suggestions for improvement include adding visual images to enhance interest and story visualization, more comprehensive progress trackers, and language adjustments to better match children's ages, especially in Indonesian stories.

5. Conclusion

After developing a mobile application with a case study on the Consultant Psychologist Tema Insani, several conclusions were drawn. The application utilizes Dart with the Flutter SDK for multi-platform integration, state management through GetX, and stores data in Google Firebase. Gemini AI is used as the LLM model for implementation. Stories are tailored to children's conditions and preferences using appropriate prompting to ensure the output meets their needs. Technical testing, including black box and user testing, was successful, showing that the application effectively increases children's literacy interest with an average reading frequency of 1.17 stories per day and enhances parent-child bonding through bedtime stories. For future research, it is recommended to enhance the user experience of the application by providing random templates, implementing passcode authentication, adding text-to-speech and visual media features, and increasing sample testing for more accurate results.

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