STORIA: In defense of children happiness in hospitals

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Abstract. Considering children are our future, them being alone and bored in tough moments would be a disservice to them and society. Therefore, we propose an innovative approach to entertainment in hospitals with pedagogical potential through the use of Artificial Intelligence. This initiative aims to foster the creation of stories collaboratively between young patients, parents, and hospital staff by using sketches as prompts. Our device adapts story-telling styles to different ages and even features a text-to-speech function that with the voice of a close relative can read the stories, providing comfort in such a hard situation. This would encourage them not only to draw, but also to read, write, create, and work together. The code of the project is publicly available at: https://github.com/joanlafuente/StorIA

1 Introduction

StorIA is an app for tablets that enables children to expand their imagination while learning and entertaining them during their hospital stays. Our app uses children's drawings and brief textual prompts to create new and innovative stories where they are the creators and that can be narrated by their loved ones.

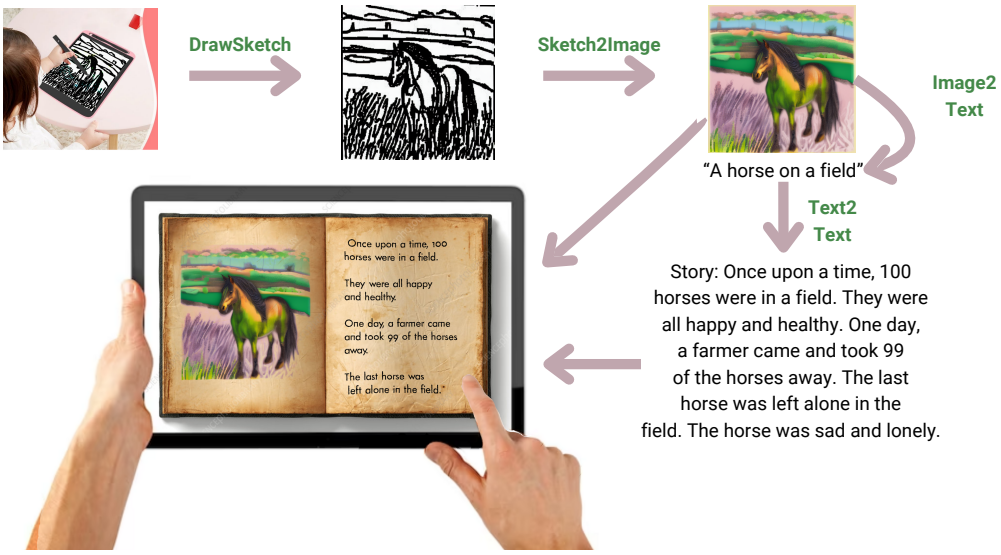

Fig. 1. Visual explanation of the device's functioning to generate one page of the story. Given a sketch, it generates a cartoon-like image, describes the image and uses it as a prompt for the story generation model. Lastly, both the image and story generated are displayed through the device in a book-like structure.

1.1 Relevance of the device

Play and rest are a natural part of childhood, and vital to normal development. Children learn, master experiences, express themselves, cope with anxiety, and develop skills through play and

recreational activities. Kids in hospitals find themselves constrained by the environment, making it difficult to interact with other kids and play like they normally would, which affects their social development and limits their creativity. Even though, in some hospitals, kids have special rooms to play different games and interact between them, in several situations, kids need to be isolated in their rooms or can only be visited by their parents or the medical staff. Moreover, entertaining kids is a challenging task, and even more so in these difficult situations and when there is no time to focus and spend time with them, which is mainly the case for medical staff, who are already very busy and have no free time to spend with kids.

It is known that patients' happiness is an important factor in the recovery period, since when individuals are happy, usually is easier for them to tackle difficult situations they might be in.

This device aims to provide an interactive and engaging activity for children, that can be used at hospitals by kids and entertain them during their stay at the hospital by promoting social interaction, creativity, and learning. By offering a tool for collaborative story creation, the device provides a therapeutic outlet for children to express themselves and connect with others during their hospital stay.

However, even if they leave the hospital, they are still encouraged to keep using it to maintain friendships with other children, they now have become part of a big and supportive community and have the possibility to be by the side of other children who are still in the hospital helping them deal with their stay.

Having said that, the app is supposed to be open and available for any kid from anywhere in the world who wants to use it and enjoy it since it's an entertaining device that doubles as a tool for learning and meeting new friends.

2 Context

Despite the growing interest in using artificial intelligence (AI) for educational and therapeutic purposes, there is a lack of commercially available devices specifically designed to convert children's drawings into stories through AI.

2.1 Previous work

There are similar contexts where AI has been used to help people in similar situations.

- **Therapeutic applications of AI in pediatrics:** AI is being explored for various therapeutic and pediatric applications, such as chatbots for anxiety management. However, these applications do not involve creative expression through drawing, which is a big novelty of our device.
- **Digital art therapy:** Digital art therapy has been explored to help children express their emotions and cope with their medical conditions. These programs often use simple drawing tools but do not leverage AI to enhance the artwork into book-quality pages.

2.2 Similar devices

Some other works explore the intersection of AI, storytelling, and child development, but none of them specifically focus on converting children's drawings into narratives like our device.

General-purpose AI story-generation tools are emerging, but these are not tailored to children's drawings or the specific needs of hospitalized children. In these applications, the children's participation is much more general, meaning that they choose the general topic of the story and maybe some interactive elements, and there is not that much participation from the kids. In our case kids are meant to be the creators with full power over the creative decisions, being able to choose not only the topic but how they want each page of the story to continue, how they want the main characters to look like, etc. Our device would be a tool to potentiate their stories, not a story generator itself.

Existing similar devices that we have found are the following:

- Oscar Bedtime Story Generator: This app allows users to input keywords or themes, and the AI generates a personalized bedtime story. While it sparks creativity, it doesn't prompt a child to draw.
- StoryWizard: This tool lets users create stories with interactive elements. However, it only requires text input and doesn't directly convert drawings into narratives.

3 Methods

Designing a technologically ready and genuinely useful device can be challenging. These are the different methods that have helped us better design the device: The interview takeaways, the technology readiness level, and how we envision experimentation spaces during the design process.

3.1 Interview Takeaways

- Self-Expression: It is often said that children can express themselves easier through drawings or stories, which are some of the main focuses of this product, so this could be a great tool for children to release stress or express themselves.
- Pedagogic potential: Interviews highlighted the educational value of storytelling and interactive play. Incorporating these elements can foster cognitive development and maintain educational engagement during hospital stays.
- Age Range: During the interview, we were asked about the intended age range of the product, something we hadn't considered before the interview. This made us realize the importance of the children's age when thinking about the drawings and the writing, prompting us to make text-to-speech functions for the younger children and set a range of approximately 7-12 years.
- Psychologic Assistance: Aside from the text-to-speech (TTS) function, we have been reassured that it would be a good idea to make the TTS mimic the voice of the parents so their children can enjoy some resemblance of their company while they cannot be with the child.
- Game Master: It was suggested the need for a game master that checks up what the child had been drawing or writing to get a glimpse into their mental state and ensure that there's no bullying, although we were told the risk of the latter is low.

We did one interview with Tatiana Rovira, a psychologist with several scientific works published related to the effect of stress and emotions. The interview was conducted on May 23 at her office. In the Annex B it can be found some transcribed phrases of the interview.

3.2 Technology Readiness Level

Technology Readiness Level (TRL) is a method to assess the maturity of a particular technology. It's a scale from 1 to 9, each level representing a different stage of development, from basic research to fully operational technology.

Now we will explain how our application evolved and progressed through the different technology readiness levels:

After identifying the problem, we conducted a research investigation to understand how Artificial Intelligence could be used to entertain kids. The objective was to understand the possible algorithms and derive the basic principles of the prototype, which helped to focus the efforts in concrete research directions.

Once we had the basic principles and concept of our application defined, we started with the research of the technology needed to develop the application. In doing so, we would require two types of generative AI models with completely different targets. The first would generate the images from the sketches and the second one would generate the texts, based on the sketch, the prior text, and the textual prompt, which would continue the story.

After finishing researching the technology required to develop the application, we designed a proof of concept to validate if the directions taken were in the correct path and to start creating

the first prototype, which consisted on the generation of one page of the history from a sketch. This helped us realize that tasks that we wanted to achieve were possible based on the current technology available and that we could move forward with the prototype, even though some technical aspects of the generative models were still not addressed, for instance, the consistency of the generated images.

After the first proof of concept, the objective was to validate the creation of a page based on the context of the previous ones, in other words generating a complete story with images, taking the first step towards completing the final product, resulting in a very early version with limited functionality.

Moving forward, we develop features to view and modify previous stories and make the application more complete in terms of features. We've also modified the application to make it more suitable for kids and make it easier to test this prototype in a relevant environment.

Based on the current device, we are at level 5. At this point, we are ready to make a test on a relevant environment, as we have explained before.

3.3 Experimentation Spaces

Experimentation spaces are important to develop and test the device. In our case, the primary motivation to do an experimentation space would be to test the device developed until now as well as co-create the device with the feedback given, as we think that to make a good social impact we must take into account the ideas of the involved actors. So, we could access the collective knowledge and possible users.

In addition, we think that would be interesting to test the device in an environment that is near to the environment in which it will be used. However, since hospitals are not the place to be experimenting, in these first stages, we think it would be better not to test the device in a hospital, and postpone it until the device is closer to completion. We propose to test this device with kids in a noncontrolled manner, allowing a closed group of children to download the app and give us feedback. Letting users use the device without supervision, will reassemble more to the real use of our device. Leading to an earlier identification and correction of possible problems that could originate during the deployment.

The users that are participating in our experimentation space would be co-creators and test users, as we think that it is important to use this participatory approach to find possible problems but also to co-create it with the final user. As if we do it in this way, we can develop a device that is more appropriate to their needs.

At this stage of TRL we think that we would not require any regulatory flexibility, as we consider that at this point it would be more useful to test our prototypes outside the hospital environment, being able to have more feedback and more lax regulation. Although, in the future, we think that having some regulatory flexibility would be useful to start the introduction of our device to hospitals.

Lastly, we think that the use of this participatory approach would allow gaining insights about the current regulation and how could it be changed in the future so it can make a greater good social impact.

To conclude, after looking at the different features that would be relevant to our experimentation space, we think that making a mix within test beds and living labs would be the best suited for the development of StorIA. Moreover, in a future with a higher TRL, we think that regulatory sandboxes would also suit perfectly our device development, as they would allow an easier introduction of the device to the hospital environment.

4 Device

StorIA is a tablet app that will use children's drawing and brief textual prompts and offer a story fitting for it. The child will draw a sketch (and optionally input a text prompt), and then offer an improved version of the drawing, painted and colored, and a description narrating it. The text's length can be selected according to the target audience's age.

Since our device will use multiple drawings, it can be made together by different kids, and create a story with all of them, in a way that each kid contributes by adding a new page to the story. One of the main objectives is to have the children do stories in groups so they can play with their friends or arrive to meet new ones. Furthermore, we want them to be easily shareable for children who do not want to draw and to connect with children outside the hospital, along with a ranking as an incentive.

4.1 Technical Data Sheet

Our device is made mostly through a mixture of Artificial Intelligence, and App Development to make the interface described in the prior sections. In Figure 1, it can be seen the general pipeline that we use to generate the images, and in the appendix C you can find a more detailed figure of how we connect our models. Text from the sketches made by the kids. Let's dive into its inner workings.

- **Input:** Before we proceed, we need an input. For each page in our case, there is a sketch and a short text providing a short explanation to guide the Sketch2Img model.
- **Generation:** Once we have the input provided by the kid, we need to generate the image and a first version of the page text. For this task, we have used Hugging face (an open source of pre-trained models and other AI, ML, and NN-related material) models. Our pipeline is composed of the following parts:
  - **Sketch2Image:** We transform the child's sketches into an "upgraded" version, considering the context text provided, using StableDiffusionXL[1] diffusion model with a ControlNet and a Variational Auto-Encoder.
  - **Image2Text:** Once we have the generated image, we use Blip2[2] in order to make a precise description of the resulting image and use it to condition the story generation.
  - **Text2Text:** Finally, we use Mistral Large Language Model[3] to generate the text corresponding to the current page. If it is the first page of the book the model uses the child's prompt and the image description to generate the text, if it is a more advanced page it also takes into account the text of the previous five pages to follow up the narrative of the story.
- **Display and Saving:** Then the generated text and image are displayed and saved into the application.

Lastly, in Annex A there are some screenshots and explanations of how StorIA application works nowadays.

4.2 Actors involved

Understanding the social dynamics and the various agents involved in the implementation and use of StorIA within hospital settings is crucial for assessing its impact and effectiveness. This subsection delves into the key actors who interact with the device and their respective roles, interests, and potential implications.
Kids: The focal point of StorIA's utilization, children in hospitals are both recipients and active participants in the experience. Whether isolated in their bedroom or moving freely within the hospital, their primary interest lies in engaging with the device to alleviate boredom, foster creativity, and connect with peers. However, there are potential challenges such as bullying and disengagement from the outside world that need to be addressed.
Tablet: The tablet serves as the interface through which children interact with the app, creating and sharing stories. It acts as a gateway to entertainment, education, and socialization within the hospital environment.
Medical Staff: The medical staff, including doctors and nurses, play a pivotal role in overseeing

[1] https://huggingface.co/docs/diffusers/api/pipelines/controlnet_sdxl
[2] https://huggingface.co/docs/transformers/model_doc/blip-2
[3] https://huggingface.co/mistralai/Mistral-7B-v0.1

the use of the device, ensuring its appropriateness, and maintaining a safe environment for its utilization. While they recognize the potential benefits of StorIA in enhancing patient well-being and fostering connections, they also face challenges such as managing device usage schedules and addressing any negative impacts on patients' care.

Parents: Since parents are closely connected to their children, we should strive to put their minds at ease while their children are in the hospital and they are at work. For parents, this device is important as it can improve the child's happiness, and since they can record their voice to be used as TTS they can feel like they are doing something to help their kids when they are not able to be with them. Furthermore, this device can make children spend less time playing video games while doing an educational activity that promotes imagination, drawing, and reading competencies. However, the use of this device could have undesired effects on the children, there are some possibilities of bullying as well as child distraction. It could be the case that parents do not want their children to use that much technology.

Figure 2 is a representation of the actor network and how they interact with each other.

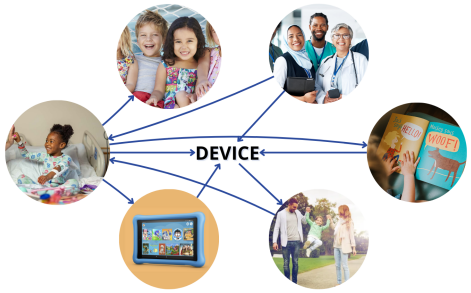

Fig. 2. Representation of the actor-network and its interactions

4.3 Legal Aspects and risk assessment

In order to take into account the legal aspects during the development of the device, we first must make a reflection about the risks that could imply the use of this device.

To make this reflection about the risks and impacts of StorIA we have looked at AI Act, which is the current European regulation for artificial intelligence. Which classifies artificial intelligence devices into four risk categories: Minimal, Limited, High and Unacceptable.

We consider that our device can be seen as a kind of chatbot that uses both image and text as input to generate images and text. For this reason, looking at the previously cited regulation, we would consider our device limited risk.

It is important to notice that chatbots are considered in the limited risk category as they contain several restrictions and filters when generating the outputs, which ensure a rating of low risk at least. These restrictions and filters ensure the generation of responsible, non-discriminatory, and correct outputs, which our device contains. In our case these filters are really important as our target audience is meant to be kids.

Although that, it has to be said that our device is meant to be used by kids. If we look at the high risk AI systems, we can see in the annexes that toys that contain AI are considered to be high-risk. If we see the app as a toy because it will be used by kids to play, we could consider it as a high-risk system. Despite that, from our point of view, toys are considered physical entities, not applications, which would make our device fall within the limited risk.

To finish, we think that it is important to state the different restrictions that would apply to our device. These implications would mainly be about transparency, meaning that the user must know that he or she is interacting with artificial intelligence. Also, as we explained before,

it would apply the need to filter the generated text and images to ensure that the generated content is responsible, non-discriminatory, and correct.

Since we are storing some data from the users, name, age, drawings, votes, etc. We have to take into account GDPR, ensure the correct management of this data, anonymize it when possible, and keep it secure. In addition, we will have full transparency about what data we keep and why we keep it.

5 Discussion

5.1 Changes during the device development

Our initial device consisted of an "individual" story generator, thus meant that we knew that the device was intended to take drawings and text and generate stories. However we believed it was lacking a bit of cooperatively, and to be able to create a full story, the kids needed to make to much drawings by themselves, which might make them tired before even completing the story. That is the reason we added the feature of making the generations cooperative, allowing kids to interact with others, while ensuring that the kids did not need to draw a complete book by themselves, despite still having the possibility.

After that, thanks to people with more expertise than us working with kids, they helped us realize that we had to take in mind the different ages targeted by the device, as it is not the same the capability of using the app for a four-year-old child, than for a ten years one, which is able to read and write by himself, that is the reason we had to adapt the app, to deal with the different ranges of age. One of the main implementations that helped us to deal with that, was adding the possibility to listen to the story. So instead of having to read it, the story would be read by the voice of one of your relatives, helping kids that cannot read to understand the stories, as well as allowing families to make stronger bonds by means of storytelling.

Other ideas that we think would be interesting to implement, given the feedback received, have been the possibility of randomly generating a topic in which to make the story for those kids that want to make a story but at this moment do not know about the topic, also this change would allow the app to be less repetitive as it would not be always the exact same task.

5.2 Impact of the device

In this section, we talk about the impact of the device both for the direct users of it, and in general for society.

5.2.1 Impact on users

Positive impact: The device enables cooperative interaction between children and parents, allowing them to make stories together and strengthen their bond. Reduction in the time that medical staff needs to spend entertaining the kids and giving them more time for cure tasks. Introduction of a pedagogical tool that kids use to learn, practice writing skills, and improve their drawing skills while they create the stories and thus impacting in their creative intelligence.

Negative impact: Despite our device being highly positive for society, there are some aspects to take into account that may be or become negative if not taken into account. In this section, we list some of the most important negative aspects along with our proposed solution to mitigate them.

Bias in the content Generation: Sociological studies highlight how children's stories often reinforce gender stereotypes and cultural biases, shaping young minds. For instance, research from Carnegie Mellon University shows that popular tales like "Cinderella," "Snow White," and "Sleeping Beauty" depict women as needing rescue and other studies also reveal that books like "Aladdin" and "Peter Pan" propagate stereotypes about Middle Eastern cultures and Native Americans, respectively, influencing children's perceptions. Generative AI models trained on

these biased stories inherit and could propagate these stereotypes. Kids view AI-generated stories as simple stories without critical context, making them more susceptible to these biases. This can have broader societal impacts, such as fewer women being considered for certain roles due to stereotypes.

Furthermore, we must to be very careful about the generated content, ensuring that the content is respectful of everyone, upholding all human rights and avoiding discrimination due to racism or other characteristics. Additionally, we need to ensure that the generated content is appropriate for children and not manipulative, as kids are particularly vulnerable to indoctrination.

Therefore, we believe adding filters to the content generated by Artificial Intelligence is vital to avoid giving kids incorrect biases.

Formation of clichés: It stands to reason that this device could theoretically further cause the formation of clichés or even bullying within the hospital, which would be quite bad and counter-productive to the original target of helping children. This is also the case with children outside the hospital, if any of them wanted to partake it wouldn't be strange if the original group was rather protective of their space.

5.2.2 Impact on non-users Despite not directly interacting with the device, non-users are also affected by it.

First of all, the more general impact would be on society itself. As children engage with educational and entertaining content through this device, they are likely to enhance their reading and writing skills. This improvement in literacy and cognitive abilities among kids can lead to a more knowledgeable and cultured society.

There is also a huge impact on hospitals, not only for possible modifications in caring plans, but also incorporating tablets into hospital settings requires adjustments in financial planning and budget allocation. It is essential for hospitals to include the cost of tablets in their financial budgets, in this way there are not any excluded kids. Additionally, broader budget considerations within Social Services are necessary to ensure equitable access to this technology across various types of hospitals. This inclusion will enable all healthcare institutions, regardless of their financial standing, to benefit from the innovative solutions offered by StorIA, thus enhancing the overall quality of pediatric care.

Finally, as the device is also considered pedagogical, the integration of the device into educational settings presents an opportunity for schools to innovate their teaching methods. There is a growing impetus for educational institutions to include such technology in their curriculum and teaching plans. By incorporating StorIA into the classroom, schools can provide interactive learning experiences. This integration not only supports traditional learning but also encourages the development of digital literacy skills, preparing students for a technology-driven world.

5.3 Citizen engagement

In the realm of citizen engagement, we differentiate between the engagement of actors directly involved with the device and the strategies for promoting engagement with broader society.

5.3.1 Direct Citizen engagement

When talking within the context of utilizing the tablet-based storytelling app StorIA, we witness a distinctive collaborative effort involving various agents. Unlike the previous section where we outlined the broad social dimensions and actors involved in the device's usage within hospital settings, here we delve deeper into the direct engagement of citizens, namely children, parents, and medical staff. Their collective involvement in the story-creation process not only enriches the narratives but also fosters a sense of shared ownership and collaboration, enhancing the overall experience for all participants.

Experimentation spaces: As we explained before, we think it could be interesting to use a mix of living labs and test beds during StorIA development. The use of living labs could allow for more citizen engagement as the final users would participate during the development where their preferences and ideas could be incorporated. This could produce a better application, more suited to the users needs and demands, in which all actors might be more engaged.

Children: Children stand as the primary architects of the narratives within StorIA. Their active participation is essential for the success of the storytelling process. Through their drawings, ideas, and imagination, children contribute unique perspectives and creativity to the stories. Their engagement not only facilitates self-expression and confidence-building but also promotes social interaction and learning, especially in the hospital setting where they may be isolated from other kids.

Parents: Parents play a pivotal role as guides and supporters in the storytelling journey. They offer encouragement and assistance to their children as they can help articulate their ideas, offer suggestions, and ensure that the stories created are suitable for their age and comprehension level. Additionally, parents' involvement creates a sense of collaboration and bonding within the family unit, enhancing the overall experience for the child.

Medical staff: Medical staff, including doctors and nurses, play a supportive role in facilitating the use of the story-creation device within the hospital environment. They ensure that the device is used safely and appropriately, provide guidance on incorporating story-creation activities into the child's care plan, and monitor the child's well-being throughout the process. Doctors also recognize the therapeutic benefits (or cons, if the tablet is proving to be detrimental, rather than helpful) of story creation in promoting emotional expression, coping skills, and psychological resilience among pediatric patients.
In the process of creating stories, it is essential to have agreement and cooperation among all participants to ensure a positive and enriching experience for the children. Each actor should bring valuable contributions to the story generation process, making it a collaborative and meaningful task

5.3.2 Promoting engagement

Promoting engagement within the interactive storytelling system entails employing various strategies to promote user participation and feedback, ultimately fostering a dynamic and enriching storytelling experience. We propose the following methods:

Gamification To further promote user participation, the system incorporates gamification elements. As stated before, StorIA will promote this by offering awards to the best stories of the month, but, this can be taken a step further and organize competitions between hospitals or ranges of age, along with a feature of story rankings.

Reinforcement Learning and User-Driven Narrative Branching The StorIA system would incorporate both user-driven narrative branching and reinforcement learning mechanisms to enhance user engagement and storytelling experiences. Users are empowered to modify story prompts, allowing the narrative to adapt based on their preferences, fostering a sense of agency and deeper engagement. Simultaneously, the system employs reinforcement learning and uses users' ratings to refine storytelling behavior. This iterative process enables the system to learn user preferences over time, generating stories that are increasingly appealing and improving in general quality over time.

5.3.3 Promoting knowledge generation

Facilitating knowledge generation through storytelling involves harnessing user feedback and creating a repository of diverse narratives. Here's how we can achieve this

Cloud-Based Story Storage. A cloud-based platform will be established for story storage. This platform allows pediatric patients across various hospitals and other users to access and contribute to a vast collection of stories. This then can be used as a dataset for other purposes. Moreover, user reviews will also be stored to identify the most well-received stories and features. These reviews can take the form of a short, standardized questionnaire with answer options to choose from, to quantify user enjoyment and take it into account for the development of future narratives.

User Analytics. User analytics can also be stored, data like the type of story accessed, the time the user spends on it, the number of clicks, and the reviews from children, parents, or medical staff. While ensuring user privacy, this data analysis facilitates the ongoing development of a rich and engaging narrative database.
By combining these methods, the system fosters a collaborative environment for knowledge generation through storytelling. User feedback through ratings, reviews, and the act of modifying prompts all contribute to the ongoing development of a rich and engaging narrative database.

5.3.4 Promoting innovation

To foster innovation and creativity, StorIA aims to explore new applications beyond hospital settings and traditional storytelling formats. By exploring its utilization in diverse fields where children are engaged, such as schools or summer camps, we can inspire creative endeavors beyond healthcare contexts. Furthermore, we could take it a step further by exploring domains like manga or comic creation. This would provide authors with new tools to spark creative story ideas and encourage innovative thinking.
By expanding into these areas, we're not only enhancing children's experiences but also fostering collaboration and creativity across different fields, pushing the boundaries of innovation in entertainment and education.

5.4 Issues to be attended in development and deployment

Deploying StorIA necessitates several precautions to ensure it is both safe and effective:

Content Filtering and Monitoring: Robust content filtering systems must be in place to ensure all generated images and texts are appropriate for children. This prevents the dissemination of any content that could be discriminatory, offensive, or harmful.

Training and Support for Medical Staff: Medical staff should receive training on how to integrate StorIA into their routine seamlessly, ensuring it complements rather than disrupts medical care. They should also be prepared to address any issues arising from the app's use.

Parental Controls: Incorporating parental controls will allow parents to monitor and regulate their child's app usage, ensuring it aligns with their values and expectations.

Bias in AI-Generated Content: The stories generated by AI models often show bias towards certain stereotypes. For example, doctors are usually portrayed as men, and men are often shown as white. This creates problems because it influences how kids understand the world. The bias in the model affects children's perceptions and decisions. When kids repeatedly see these biased portrayals, it limits their aspirations and reinforces harmful stereotypes. For instance, a girl might think she can't be a doctor because she rarely sees female doctors in stories or in engineering. Similarly, children of color might feel excluded from certain professions if they don't see themselves represented. Ensuring AI models generate diverse and inclusive content can help children develop a more balanced and fair understanding of society. Educating children properly to avoid reinforcing these stereotypes is crucial.

Psychological Impact Monitoring: Regular monitoring and assessment of the psychological impact on children using StorIA are vital. This includes checking for any signs of increased anxiety or adverse reactions related to the content or interaction with the app.

Accessibility Features: Ensuring the app is accessible to children with disabilities is essential. This includes features such as text-to-speech, adjustable font sizes, and compatibility with assistive technologies.

Bullying management : We must take into account the bullying possibilities that could arise by using this app. As this device might be used by kids from and outside the hospital (or adults), there could be some circumstances that could end up in bullying through StorIA, and we must decide how to modify the application to reduce the probability of bullying happening as well as define some protocols in case it happened, although, during the interview with the psychologist, we arrived to the conclusion that within hospitalized kids it was a very remote possibility.

By addressing these precautions and issues, StorIA could be deployed minimizing potential risks, ensuring a safe and enriching experience for all users.

6 Future Directions of StorIA

Looking ahead, there are several future directions and potential enhancements for StorIA:

Model improvements and story consistency: Continuously refining the AI models used in StorIA to ensure consistency among generations and improve the quality of generated content. This includes enhancing the algorithms responsible for image generation from sketches and text generation based on prompts, with a focus on maintaining coherence, realism, and consistency in the generated stories. Meaning that if the story has some characters, those should not change on the different pages of the story. For instance, if a character has blonde hair on the first page, it should not be black on the second one.

Integration of Advanced Features: Exploring the integration of advanced features such as natural language processing (NLP) for more nuanced story generation, sentiment analysis to tailor stories based on the emotional state of the child, and adaptive learning algorithms to personalize the storytelling experience for each user.

Integration with Educational Content: Integrating educational modules can transform hospital stays into opportunities for both creative expression and educational advancement, making learning more engaging.

Long-Term Impact Assessment: Conducting longitudinal studies to assess the long-term impact of StorIA on children's well-being, social development, and educational outcomes. This involves tracking metrics such as cognitive skills development, emotional resilience, and social interactions both during and after hospital stays.

Exploring these future directions will enable StorIA to evolve into a more comprehensive and effective tool for promoting creativity, learning, and emotional well-being among children in hospitals and beyond.

7 Conclusions

As discussed throughout this report, StorIA represents a significant innovation in enhancing the hospital experience for children. By enabling them to create and share stories based on their drawings and brief textual prompts, StorIA aims to alleviate feelings of isolation and loneliness, fostering social interaction, creativity, and learning. The app's alignment with the crucial role of play in child development and the positive influence of happiness on recovery underscores its importance in pediatric care settings.

Learning's from the process

Throughout the development of StorIA, several key learnings have emerged, shaping both our understanding of the project and our approach to its implementation. These insights not only reflect the technical challenges encountered but also highlight the broader implications and considerations for future development:

Understanding Social Impact: While performing this project we have reinforced the importance of designing technology that addresses social issues, and that can impact on society. By aiming to create a tool that enhances children's literacy and creativity, we have gained insights into how technological solutions can contribute to educational equity and empowerment.

User-Centric Design: Although we did not directly collaborate with children, we recognized the importance of considering the needs and perspectives of our target audience. This project underscored the necessity of involving users in the design process to ensure that the tool is relevant, engaging, and effective.

Addressing Bias in AI: Developing StorIA has highlighted critical ethical considerations, especially the need to address biases in AI-generated content. We have learned that creating diverse and inclusive content is essential to avoid reinforcing harmful stereotypes and to promote equality and representation.

Interdisciplinary Approach: The project emphasized the value of an interdisciplinary approach, integrating insights and ideas not only from technology or technophiles but including all kind of mentalities and ways of reasoning. This perspective is crucial for creating solutions that are not only technically sound but also socially relevant and impactful.

Future Directions: Although the device has not been fully developed, the project has highlighted areas for future improvements, such as ensuring consistency in AI-generated content and incorporating user feedback. Planning for these future directions is essential for the project's continued relevance and impact.

These learnings have provided a solid foundation for our future endeavors in social innovation, equipping us with the knowledge and skills to develop technology solutions that address social challenges. While StorIA is still in its developmental stages, the insights gained from this process will undoubtedly inform and enhance our approach to future projects aimed at creating positive social change.
In conclusion, StorIA holds significant potential to transform the hospital experience for children, making it more engaging and supportive of their emotional and social needs. By carefully addressing the precautions in deployment and leveraging the learnings from the development process, StorIA can continue to evolve and expand its positive impact on children's lives.

8 Annexes

A StorIA application

In this section it can be seen some images with explanations of the different parts of StorIA application nowadays.

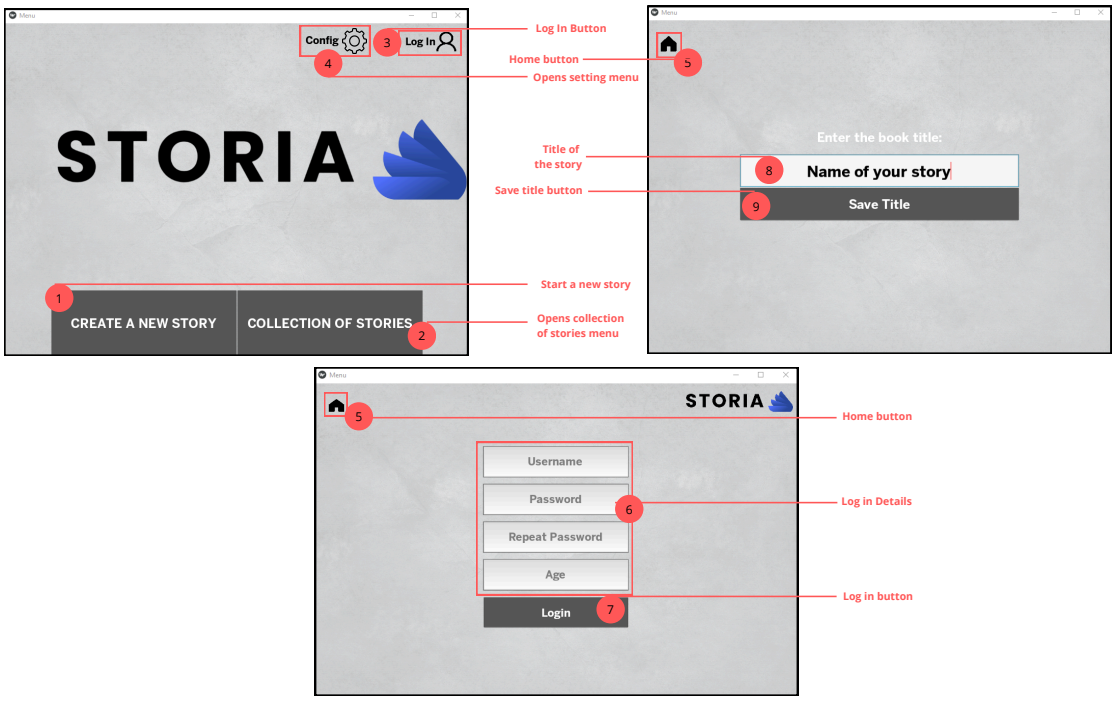

Fig. 3. Home screen.

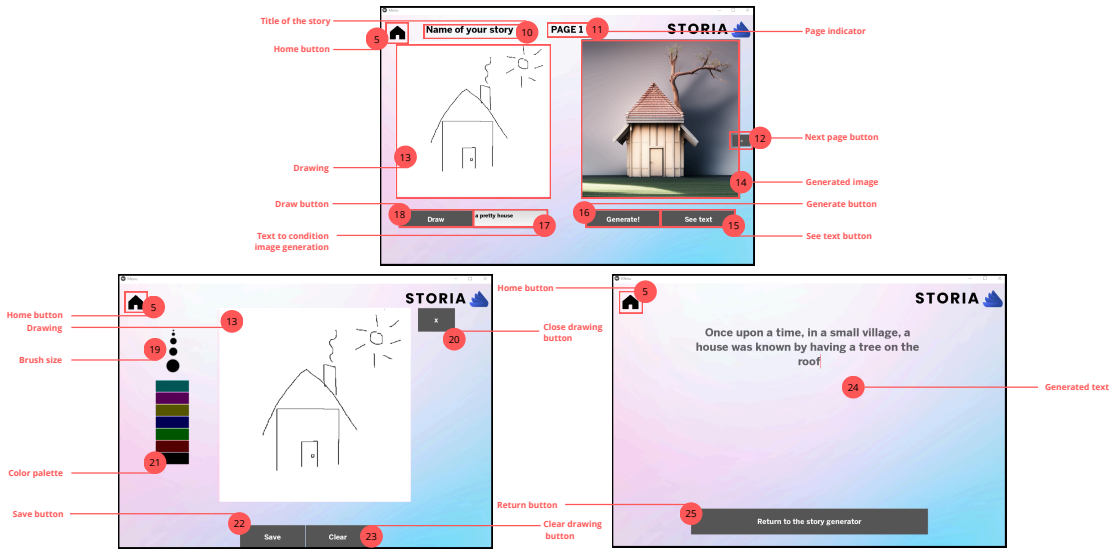

Fig. 4. Screens to create and modify the books.

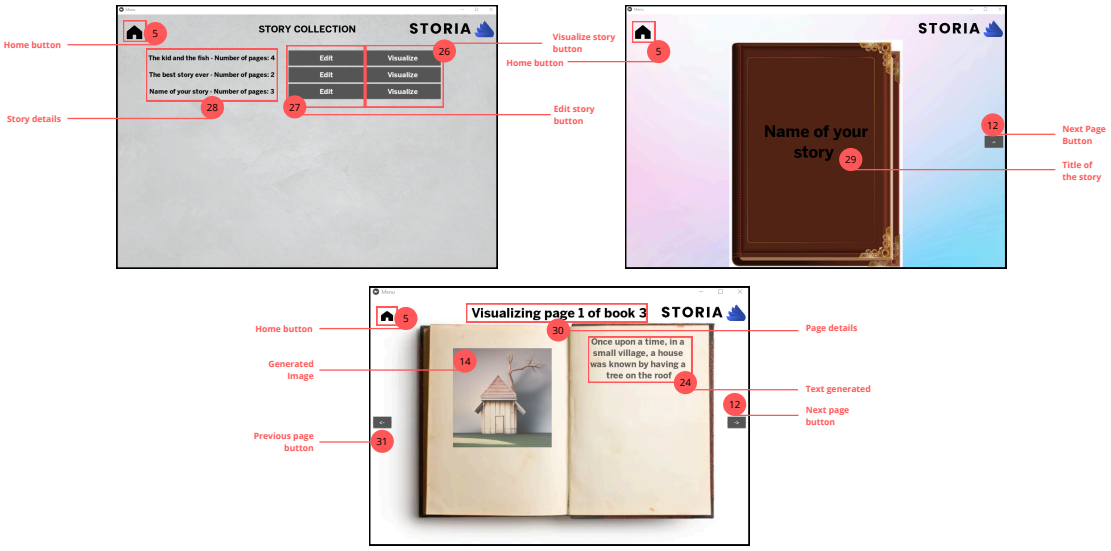

Fig. 5. Visualization of the created books screens

Here you can see an explanation for each of the dots on the previous figures:

1 **Create Story**: Initiates the creation of a new story.
2 **Opens Collection of Stories Menu**: Opens the menu to view the collection of stories.
3 **Log In Button**: Opens the log-in interface.
4 **Opens Setting Button**: Opens the settings menu.
5 **Home Button**: Navigates to the main home screen of the application.
6 **Log In Details**: Displays the log-in details interface.
7 **Accept Log In Button**: Confirms the log-in details and proceeds.
8 **Title of the Story**: Displays or inputs the title of the story.
9 **Save Title Button**: Saves the title of the story.
10 **Title of the Story**: Displays the title of the story.
11 **Page Indicator**: Displays the current page number of the document.
12 **Next Page Button**: Navigates to the next page of the document.
13 **Drawing**: The area where the user can create drawings.
14 **Generated Image**: Shows the image that has been generated by the system.
15 **See Text Button**: Allows the user to view the text associated with the generated image.
16 **Generate Button**: Initiates the image generation process based on the provided text or other conditions.
17 **Text to Condition the Image Generation**: Inputs text to condition or influence the image generation process.
18 **Draw Button**: Activates the drawing tool, allowing the user to draw on the screen.
19 **Brush Size**: Allows the user to select the size of the brush for drawing.
20 **Close Drawing Button**: Closes the current drawing interface.
21 **Color Palette**: Provides a selection of colors for drawing.
22 **Save Button**: Saves the current work, including any drawings or generated images/text.
23 **Clear Drawing Button**: Clears the current drawing, erasing all the contents.
24 **Generated Text Button**: Displays the text that has been generated by the system and allows you to modify it.
25 **Return Button**: Navigates back to the previous screen or home page.
26 **Visualize Story Button**: Allows the user to visualize the current story.
27 **Edit Story Button**: Opens the interface to edit the story.
28 **Story Details**: Displays the details of the story.
29 **Title of Story**: Displays the title of the story.
30 **Page Details**: Displays the details of the current page.
31 **Previous Page Button**: Navigates to the previous page of the document.

B Interview Questions and Answers

What do you think about the project?

Any activity that distracts a child in a hospital is good. Moreover, this one has various competencies that also give it an educational component, making it a plausible tool for self-work for them to continue practicing playfully and amusingly, and there is quite a bit of evidence that positive emotions from a positive state, even if temporary, can aid recovery, and while there is little evidence due to how difficult it would be to observe, there have been some studies supporting it strengthening the immune systems.

By allowing parents presence even when they are not there, the imaginative work that allows them to momentarily escape from what they are experiencing. It can be used by a specialist to make the story about what they are going through. Because children often express themselves more with drawings and stories when talking as if it happened to someone else, especially at certain ages, than when they have to explain how they feel. Making a story about their life in the hospital can reveal things that give some idea of how they are doing.

Indirectly, this can improve their coping, as being distracted and happy might make you eat better, sleep better that day, and de-emphasize things or make more friends, All of this helps with the illness.

How stress affects the recovery from illnesses?

Even though an illness is stressful, you can experience it in two ways: everything is very bleak, or you can say, 'Let's get through this.' All of this affects you, whether you like it or not, sometimes more strongly, sometimes less.

We see the potential for it to generate positive emotions related to satisfaction and creativity, and that in itself is good. This might help to experience the rest of the things with less discomfort.

C Detailed image showing connection between models

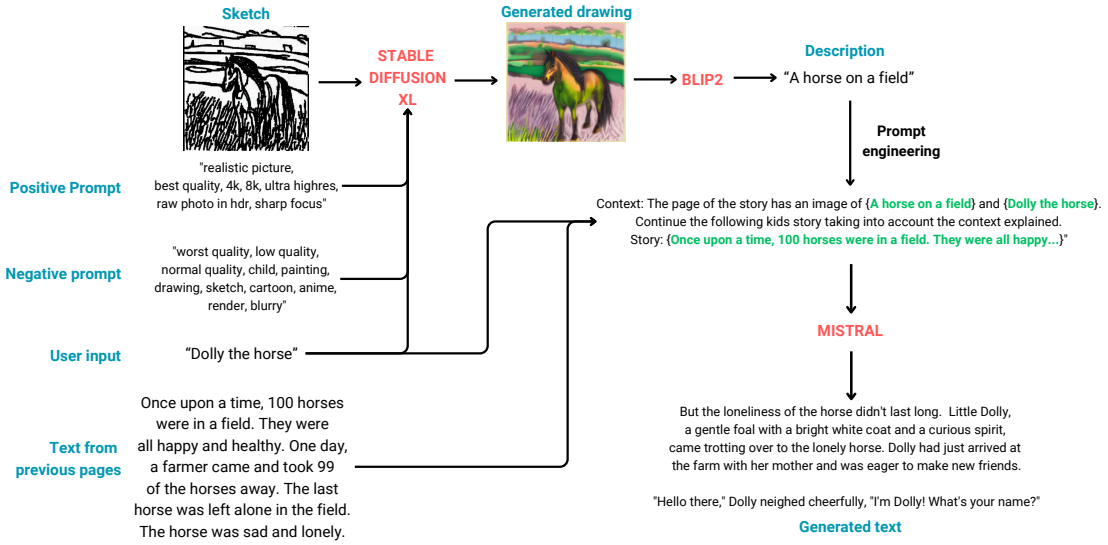

Fig. 6. Figure showing the communication between the different models used, you can observe how we take the drawing as input for stable diffusion as well as a positive prompt, a negative prompt, and the user input. Then the output is fed into blip2, which describes the image, and this description along with the text generated from previous pages and a small sentence from the user describing his drawing is fed into mistral to continue the story.