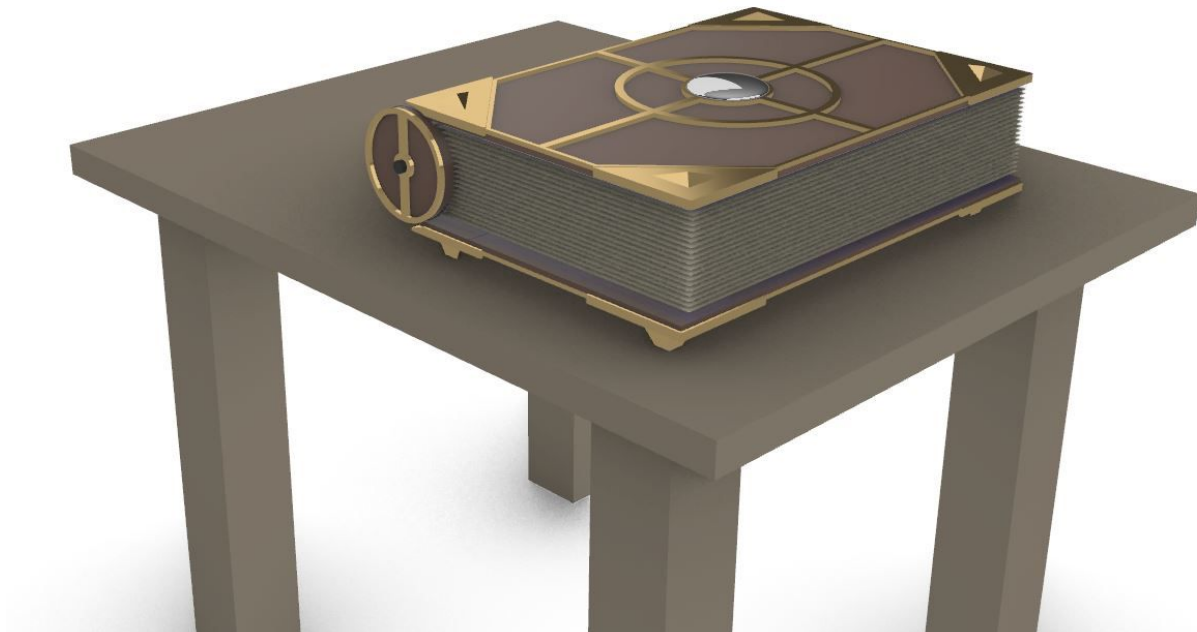


# PROJ02: Saga

Members: Dylan Arceneaux, Stephanie Claudino Daffara, Sophia Batchelor, Varda Shrivastava

Designing for Emerging Technology, Fall 2019



## Project Description

Getting your children to bed can be a long process, and sometimes the “just one more story” lasts forever. Introducing Saga the ultimate bedtime storyteller. Bedtime stories are important for both childrens’ literacy and language development, and their moral development; it’s how we’ve passed on knowledge since the beginning of time. Saga is for the “just one more story”, for the nights when you can’t get home from the office. It’s not just another bedtime story, Saga is a world your kids can explore. It gets kids involved in stories and books through it’s master storyteller’s choose-your-own-adventure stories. Saga doesn’t just read the story to the child, it makes them the story teller, allowing the child to choose what the character should do next with both small decisions to increase their vocabulary, and large ones that have moral lessons attached to them.

Saga. The adventure awaits.

# Index

<b>Project Description</b>	<b>1</b>
<b>Index</b>	<b>2</b>
<b>Observations</b>	<b>3</b>
Interviews	3
Interview 01	3
Interview 02	4
Interview 03	6
Research	7
Story Content	7
Conclusions and Design System	7
<b>Design Process</b>	<b>11</b>
Concept brainstorming	11
Concept Refinement	12
Ideation and Implementation	13
Physical Fabrication	13
Story of the Fabrication Process through Imagery	13
Connection of the Components in Relation to the Design	13
Saga's Stories	14
Companion App	21
Converging Story and Software	25
Design Challenges	26
Future Iterations	27
<b>Instructable style process document</b>	<b>28</b>
Intro	28
Parts	28
Digital Files	28
Steps	29
<b>Appendix</b>	<b>38</b>
<b>Links</b>	<b>38</b>

# Observations

## Interviews

### Interview 01

Location: Family Home

Duration: 1.5hrs

#### Context:

- Two children, Anna (7), and Eddie (5)<sup>1</sup>, and their parents were interviewed to gain insight into the stories and bedtime routine
- A draft of Saga's Strong Warrior story was then read to the kids as a bedtime story.

#### Key Insights:

- Keep Saga's questions closed to stop the children going off on their own tangents
- Have a feature so the parents could record their voices telling stories
- Have a range of stories for different ages
- Have story options that involve magic

#### Notes:

##### Parents

- Dad tells the story (the kids demand it) - it makes it hard to make them go to bed if he's not there - the mum had to FaceTime him in one night when he was traveling
- Their favorite story is *The Little Prince*
- Anna asks more questions and prefers ones with unicorns
  - Her favorite story is *The White Horse*
  - If a book has a toy or character associated with it then we can get that toy for her birthday
- It's hard to find stories that they both enjoy
  - Dr. Seuss was really big with both of them
- Eddie loved captain underpants and ones that are a little funnier - he's often hard to settle - The Dad told someone with a knight and tried to make it be like the story of King Arthur
  - He's at a much lower reading age
- The Dad said that it was fun to make up stories for them, but after a few minutes, he runs out of ideas so it's just so much easier to read a book

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<sup>1</sup> Names changed as the users discussed are minors.

- As a parenting team, the parents said that that like stories that have morals - there's one that's called *The Idea* about believing in yourself - the kids aren't as in to it but we like to know that the kids are getting something from the stories
- It normally will take 2 or 3 stories before they are either asleep or about to fall asleep
- We like to let them choose one story each and then Dad tells them one if we can, or else he'll read some of whatever book he's reading for himself it's the last story so it doesn't matter too much and the kids fall asleep pretty quick - [the mum] has caught him fallen asleep in there a few times after he's done that
  - The mum asks him not to read the violent parts but I don't think he listens
  - They're mostly James Patterson or Robert Ludlum (Bourne identity series)
  - Saga sounds amazing and I'm sure that the kids would love it
    - It would be great to have a feature that allows us to record our voices (especially the dad's voice)
    - The parents were concerned with saga and how long the loops would last for (and if the kids would they stay up all night reading the stories)

#### Kids

- They had seen lord of the rings!
- They wanted to hold the book and show me the collection of their stories
- They would try to read sections to me (of *The Little Prince*)
- Were really excited by the "surprise" of getting to tell the story with me
- They wanted ones with magic and would interrupt each time I asked an open ended question
- I said that they got a pet wolf and asked what they wanted to call the wolf and then David went on about how fluffy wolves were
- Not sure if it was because I was a "new" person or because of what they want to do
- Parents said that they had very active imaginations and so that it was typical
  - Should probably use closed questions for Saga
- They loved the magical sword and the fact that the hero of the story was a kid
- Anna loved that tree was a team sport
- David liked the description of the strong warrior and wanted more description of the warrior and less of the setting/world
- They weren't very interested in the world setting
- Being dramatic held their attention, but I couldn't pause for too long or they would ask something
- They picked the "moral right" path of teamwork and working together
- BOTH OF THEM FELL ASLEEP!

#### Interview 02

Location: Phone Call

Duration: 30 minutes

Context:

- Mother of a 5yr old

Key Insights:

- The child enjoys making her choice of what story to be read
- The child likes to interact with the reader (her mom), and the book itself (loves pop outs, textures, etc..)
- Books change based on themes that the parents want to teach (potty, loving yourself, feminine power, etc)

Notes:

- The mother tells the daughter “it’s time to sleep” and asks if she wants to take a friend or toy to bed with her and she’ll take a book or a toy.
- Then they go to the room, and she brushes her teeth and uses the bathroom.
- And then depending on what she chooses they interact with it.
- If it’s a book they read the book a bit, and then she gets sleepy and goes to sleep.
- About the books
  - Very varied
  - Very about tv shows
  - They are usually about animals (she loves animals right?) or math, because we are teaching her math
  - For example right now we have a book about potties and poop
    - Because we are trying to train her
    - And I try to bring a book that teaches her something relevant. For example right now she has a book about curly hair and how pretty it is (because she has curly hair). So it depends on the theme of the night or moment.
- Generally the books I have are physical
  - She likes to touch the book, or open the “pockets in the book” she loves discovering the book and interacting with it.
  - Now I am reading a book that helps me tell stories, because the power of storytelling is really powerful and helps teach a lot of themes
- Usually she chooses the book she wants to read.
- She likes when I read for her, she also sometimes pretends she is reading to me.
- She has her favorite books: she varies a lot though
  - Now she is reading about potty, and she loves one about a chick that tells his mom and dad “mom, dad, I am going!” and you think that he is going somewhere, but no, he is going to the bathroom, and she loved this books, loves being read this book
- Usually at night there is not that much reading time. It’s usually a short easy book, that takes 5-10 min. It usually happens that she asks to be read to at different times during the day.

- One book she wants me to read when I get back from school is one about differences and accepting differences.
- And we interact a lot, like she'll say "read this one ... and now this one" and so on, back and forth for about half an hour sometimes.
  - So usually a longer read is during the day than at night
- I make a list of books that I want to buy for her. That I find interesting or that I read something about.
- She usually interacts with me talking about the story
  - She doesn't really interact with the book itself, or ask for changes, but she does tell it in a completely new way, or invent a new scene that didn't exist. For example. When I read Amelia (the pilot), she invents a story about Amerlia's mom, that she was traveling and was in the stars. So she modifies the story.
- (about Saga) "I think the idea is cool. Because what is important, in my opinion is the presence and being together, so watching her be able to guide the story could be even more interesting. And of course with the parents intermediating and reacting together."

### Interview 03

Location: Berkeley Way West - Gopnik Developmental Psychology Laboratory

Duration: 1hr

#### Context:

- Alison Gopnik is one of the leading developmental psychologists and works with children aged 0-10
- A discussion was had with 2 of her PhD students about Saga and the content of the stories

#### Key Insights:

- Rhyming is good
- Using advanced language with irregular meters will help with language development
- It would be best to have them read along to understand the words as they are being said but that may not work with the physical product
- What will be key is the child's engagement with the material
- Spoken word is far better for the development of language in children than written so the idea of having an object that "reads" to the children is a very good one.
  - Try to avoid echolalia (the repeating of words and formats) as that stunts acquisition

## Research

The research for Saga's stories had two parts; the content and language of the stories, which included reading children's stories to understand how they were written as well as how to structure choose-your-own-adventure stories; and then general research on how to write stories and what is important to include in bedtime stories.

## Story Content

For the stories, several (~40) children's stories were read to inform the content and type of language. These were taken from Dr Seuss, <https://www.storyberries.com> and <https://www.freechildrenstories.com/age-5-8-1> which have free bedtime stories for kids. We also followed the Bandersnatch storyline from Netflix's story to learn more about how choose-your-own-adventure storylines were built. Several of Aesop's fables were also re-read and the group brainstormed which stories they remembered most as a kid

## Conclusions and Design System

From the research, we identified key aspects that informed all design decisions.

### **Naming "Saga"**

For naming the book and project, we wanted a strongly mythical name that was associated with words and stories. We researched the names of old gods in different mythologies and voted between Saga (Norse goddess of poets and stories), Adios (God of knowledge), and Lugh (Irish God of Light and Knowledge). We wanted a name associated with a mythos, but not one that was too well known (i.e. Athena). After a vote, Saga was chosen.

### **Mythos of Saga**

Since storytelling, and the passing down of knowledge, has such an axial role in human history we wanted to acknowledge that by building a specific mythos around Saga. The idea of an old tome, reminiscent of a magical spellbook, was used as inspiration and while in Seattle, a group member visited an old book store to understand the designs more. We decided on keeping to an ancient "tome" vibe for the project and make a physically large book form for Saga as a survey of American Households reported that twice as many children preferred physical books.



Books from Seattle Book Fair



Map and Botany Books from Seattle Book Fair



Image of “Ancient Tome” from Google Images

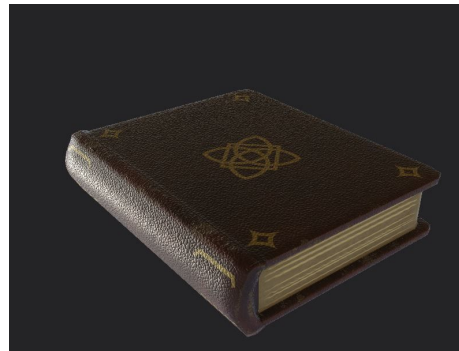


Image of “Spell Book” from Google Images

### The Pages

We wanted the pages to be lit to act a nightlight for kids. Stories carry messages, but they end with a happily ever after (or resolution) so that the children can go to sleep. From a survey of 49 stimuli, children listed “the dark” as the third scariest<sup>2</sup>, with 74% of children

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<sup>2</sup> Orgilés, M., Espada, J. P., & Méndez, X. (2008). Assessment instruments of darkness phobia in children and adolescents: A descriptive review. *International Journal of Clinical and Health Psychology*, 8(1), 315-333.



aged 4-12 being afraid of the dark<sup>3</sup>; we felt it was important to include lights as a key feature. We took inspiration from the accordion style nightlight books that are sold at MOMA in San Francisco.



Images of “Book night light” from Google Image Search

We spoke on the satisfaction of being able to flip pages and touch physical objects while reading and had original designs which involved thin acrylic pages that would be sanded on both sides so as to carry light down their length. This was not followed through to execution due to the costing of acrylic sheets and due to the technical difficulty of binding pages together within a mechanical book. The pages became one of the biggest design challenges for the project. The accordion design that made it through to the Final version of Saga was closer to the accordion book lights where we first drew inspiration.

### **Use of non-generated human voices**

The key of Saga is that it is a story teller.

A significant amount of time was spent recording the stories for Saga. Based on recent research<sup>4</sup> on virtual assistants and their voices, we decided to preserve the storytelling experience by having natural human voices read the stories. While we are entering a new age for voice interaction, we felt that the current state of voice assistants were not naturalistic in their cadence or emphasis which are important in the storytelling process. We looked into generated speech through deep fake speech editors but were not satisfied with their integration at this time.

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<sup>3</sup> Muris, P., Merckelbach, H., Ollendick, T. H., King, N. J., & Bogie, N. (2001). Children's nighttime fears: Parent-child ratings of frequency, content, origins, coping behaviors and severity. *Behaviour Research and Therapy*, 39(1), 13-28.

<sup>4</sup> Porcheron, M., Fischer, J. E., Reeves, S., & Sharples, S. (2018, April). Voice interfaces in everyday life. In *proceedings of the 2018 CHI conference on human factors in computing systems* (p. 640). ACM

This required that Saga's stories to be read in actual voices which required the recording of audio files. It meant that the kids reading Saga would not be able to name pets/items in the stories which limited the questions and interactions they could have - but we felt that the story options would fit well with what was found in our observations of keeping options closed so that the child wouldn't get too into the story and not go to sleep.

As a group we had 3 stories and one global voice of Saga. Each group member recorded a different story and its potential paths.

### **Inclusion of the parent**

There are falling statistics in parents reading bedtime stories to their children; only 87% of parents currently read bedtime stories to their children, with only 1 out of every 3 parents reading daily to their child. With the rise of e-books, the ease of streaming services, and recent shifts in working culture; it's become harder to maintain story time. In spite of this, the interaction between parent and child for bonding and secure attachment is highly important for childhood development. Consequently, we wanted to create a way for the parent to become involved in Saga's stories, without creating an additional technological obligation or changing their existing behaviour around storytime.

We did this by creating a companion application for Saga where the parent can add stories they recorded through the application directly onto Saga. This was in part inspired by the family we spoke to about Saga where the children would "refuse" to go to sleep until their dad had read them a story and how the mum had gone so far as to facetime her partner in order to coax the kids to sleep.

We also added a feature where the parent could see the story's timeline and what decisions their child had made in the story through the app. In that way the parent could ask, and have conversations with their child, about the events that Saga had read.

The bond between parent and child through the process of storytelling was one that we wanted to preserve with Saga, instead of creating a technology that would act as a replacement for the parent.

### **Morals**

It was important for us to have a story for each of us to read. We initially thought to base a story on parts of our lives to keep with the "life morals" goal but ended up finding it difficult to create "choose-your-own-adventure" aspects of what our lives could be like if we have done things differently. As a consequence the stories became quite long and complex and so we went back and started writing based on the current structure of a children's story.

We discussed what we remembered from the stories we read as kids and how they all “taught” something. We drew from the stories of Aesop’s Fables and decided that all the Saga stories would center around a moral lesson.

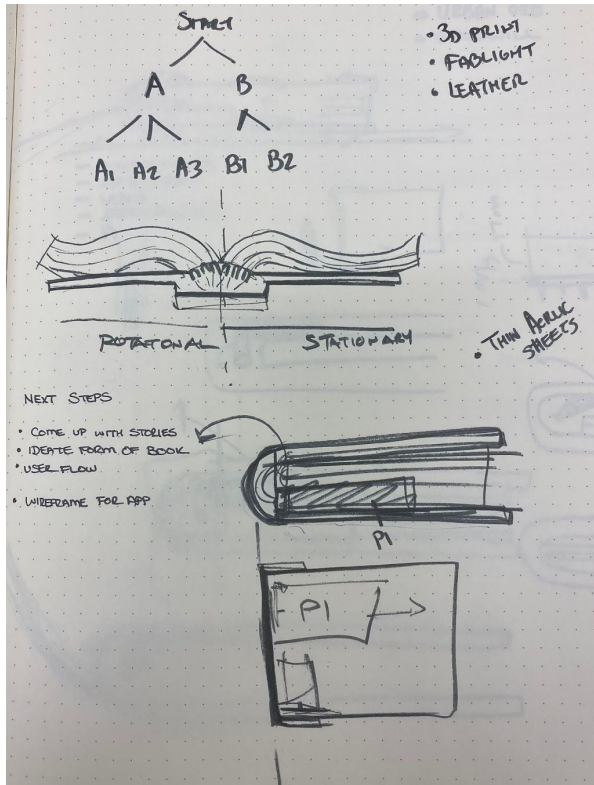
## Design Process

### Concept brainstorming

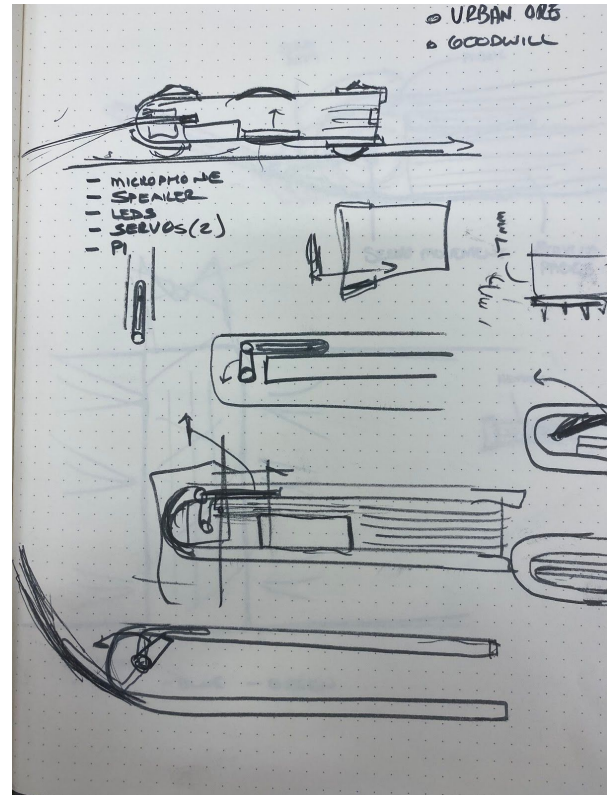
This was our first official meeting (after classes had been canceled because of power-outage issues), where we brainstormed and jotted down an array of different ideas and concepts we potentially could work on. We listed a couple everyday mundane objects such as a mirror, a notebook, and an alarm clock, and we talked about how they could interact with us through conversation. From this we came up with a self-loving-mirror, a capture-your-dreams-notebook and a conversational alarm clock, amongst a couple others. Finally we started to focus on the object of a book, that in many ways is becoming more and more obsolete. How could we make a book interesting again, and further, interesting enough to get a child off their iPad?

Inspired by old text-based games we stumbled upon the “choose your own adventure” game category. This type of game lends very well with a book, and for our purposes instead of typing out the interaction and decisions made, we would design our object to speak and listen for those forks in the story. This is how we ended up with Saga.

Towards the end of the meeting we started to make some key decisions and answered a couple important questions. Such as: what will this book look like? What will be the opening and closing mechanism? What type of materials will we use? As seen in the image below we were settling on the materials: 3D Print, FabLight cut metal, and Faux Leather. We also started a list of input/output devices needed such as a microphone, a speaker, LED lights, 2 servo motors, and a pi. We decided to target age range of 5-9 for the stories themselves.



The beginning ideation of the Saga device and how to build out the stories in conjunction with the physical prototype.



Beginning to develop the hinge mechanism and how the book will incorporate the hardware such as the Raspberry Pi.

## Concept Refinement

There was discussion around if Saga should stay true to its “book” concept, or if we should integrate a LCD screen with Saga for greater interaction with the user.

If Saga has a screen or e-reader in it to allow the child to read along, or if there was a way for them to visually select the story and get feedback from their selections. This was vetoed for several reasons.

Firstly because it went against one of the core design principles of the “mythos” of Saga. We chose an ancient tome as the core design to structure around and felt like hiding a computing screen within Saga went against that. The book was chosen to re engage children with storytelling and books in favor against screens and video content. Furthermore the research around screen time, blue light, and sleep hygiene<sup>5 6 7</sup> advised

<sup>5</sup> Cajochen, C., Frey, S., Anders, D., Späti, J., Bues, M., Pross, A., ... & Stefani, O. (2011). Evening exposure to a light-emitting diodes (LED)-backlit computer screen affects circadian physiology and cognitive performance. *Journal of applied physiology*, 110(5), 1432-1438.

<sup>6</sup> Foley, L. S., Maddison, R., Jiang, Y., Marsh, S., Olds, T., & Ridley, K. (2013). Presleep activities and time of sleep onset in children. *Pediatrics*, 131(2), 276-282.

against the inclusion of a screen into Saga's design. Saga is hidden technology - from the talking furniture in *Beauty and the Beast*, to the books that talked in *Harry Potter*; the concept of animated objects carries its own mythos, which is something we wanted to lean in to.

We decided to select the age range of 5-9 years old as those were the kids we felt would most enjoy the magical aspects of Saga and started brainstorming story ideas. Most of the ideas included animals or magic of some kind. We were initially worried about how quickly the stories could shift as the inclusion of 4 forks would result in 24 different stories. We discussed making stories that would loop back on themselves or having decisions that would not affect the path of the story in order to reduce the workload for the project. We started to iterate on the design and came up with the idea to use capacitive touch to activate Saga.

## Ideation and Implementation

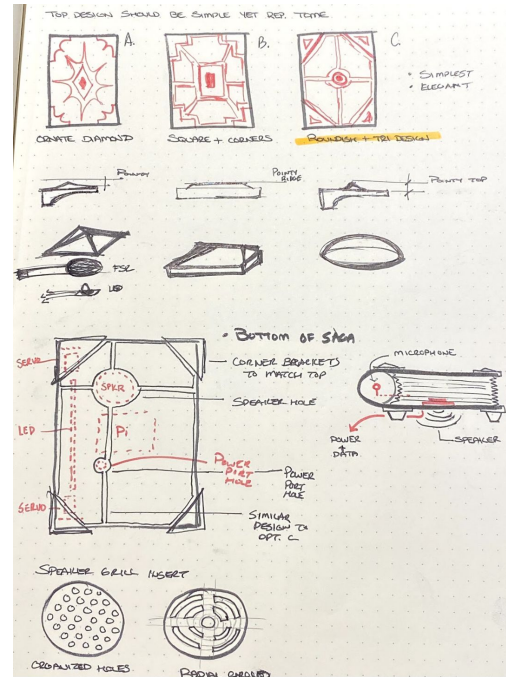
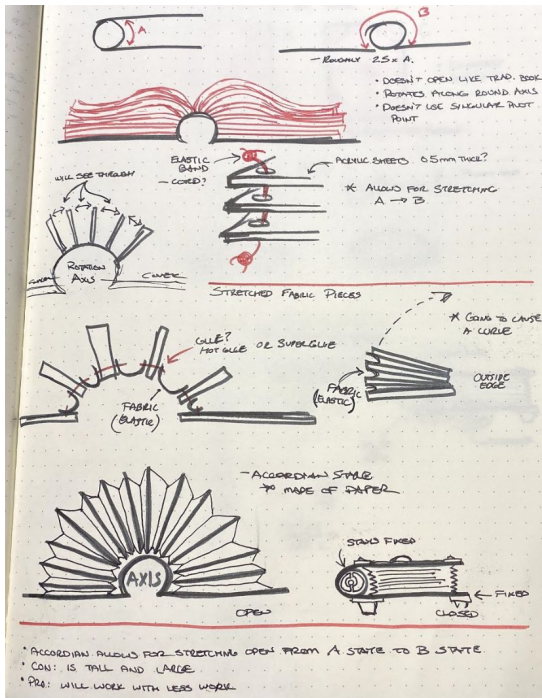
Saga has three distinct parts (1) the physical fabrication, (2) the Saga-made narrative stories, and (3) the companion application.

### Physical Fabrication

#### Story of the Fabrication Process through Imagery

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<sup>7</sup> Bedrosian, T. A., & Nelson, R. J. (2017). Timing of light exposure affects mood and brain circuits. *Translational psychiatry*, 7(1), e1017.



Developing the Pages to turn and how they will be interpreted by the children.

Mulling through ornamentation options, finally deciding on Option C.

### Connection of the Components in Relation to the Design

- The two servo motors had to be calibrated together in order for them to turn the front of the book's page. This part was tricky because the motors seemed to not be very exact in terms of where 0° and 180° are.
- We used a better microphone than the one provided in class because it recognized the voice much better and got responses quicker.
- We decided to use the same strip of neo pixels for the cover and the interior of the book. So we attached 1 single neopixel light to the end of the neopixel strip so that it could reach the cover of the book and light up the Gem.
- The FSR component was very easy to install and placed under the neopixel light, under the gemstone. The Gemstone had to be placed very lightly on top of the FSR and neopixel in order to not apply constant pressure on it.
- The neopixels are very faint within the pages if you are in a well lit room. But if you turn off the lights, which is the situation that Saga will be used in, then the neopixels are just bright enough to create a soothing effect.



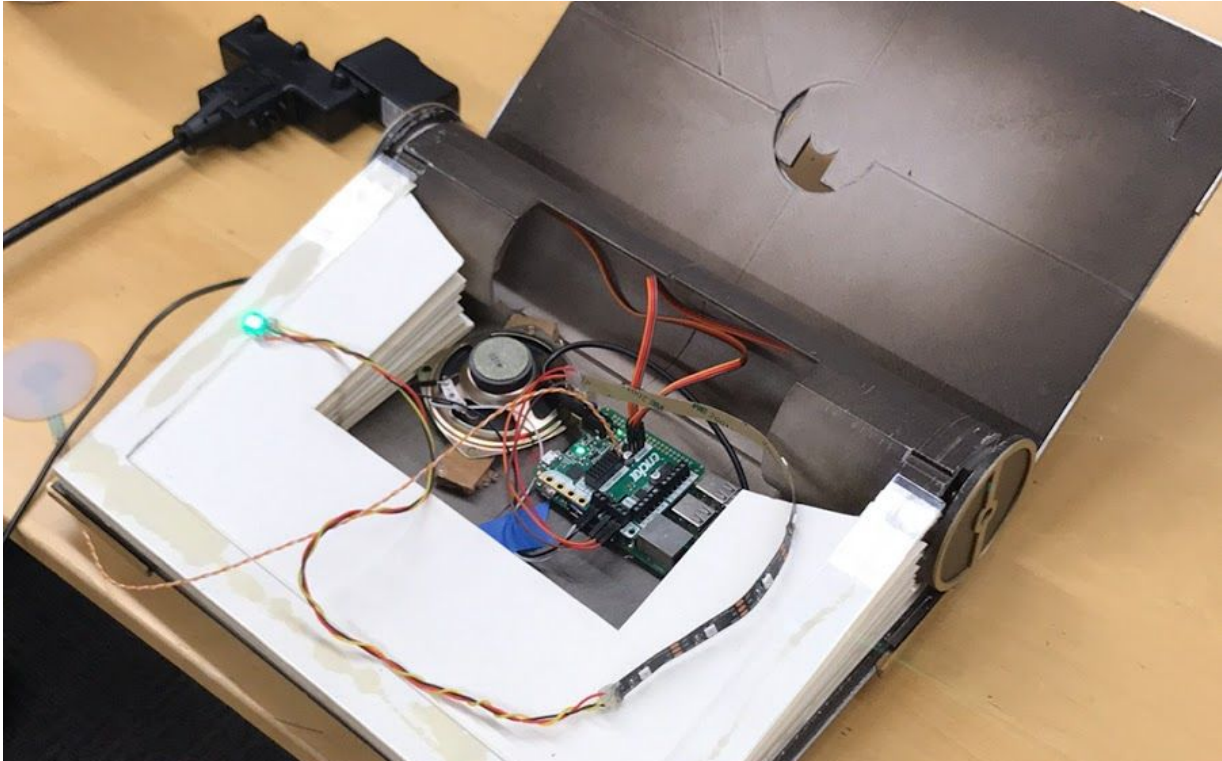


Image of all the components placed in Saga.

## Saga's Stories

For story writing we had to keep several pieces in mind. The language had to be simplistic enough to be understood, but complex to support their language development<sup>8 9</sup>, as well as keeping to a 7-15minute total story time which is the suggested best story length<sup>10</sup>.

Keeping with the design system of “moral” stories and the research, we paired three stories with three morals.

The Strong Warrior - Strength, Inclusion and Acceptance of Others, and Kindness

The Clever Magician - Knowledge, and Believing in Yourself

Pirates and Seamonsters - Adventure and Daring, and Curiosity

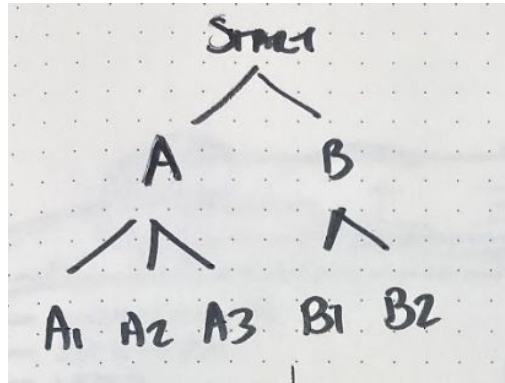
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<sup>8</sup> Berk, L. E., & Winsler, A. (1995). *Scaffolding Children's Learning: Vygotsky and Early Childhood Education. NAEYC Research into Practice Series. Volume 7.* National Association for the Education of Young Children, 1509 16th Street, NW, Washington, DC 20036-1426

<sup>9</sup> Chomsky, N. (2000). The Architecture of Language.

<sup>10</sup> <https://www.wikihow.com/Write-a-Bedtime-Story>

Initial designs included stories that would loop back on themselves, this was later discarded due to technical feasibility. Instead we decided to have decision trees and forks that would follow different paths.



Example of story forks

## Strong Warrior

Initial plans for The Strong Warrior storyline was drawn out and fixed to specific decisions.

*Once upon a time  
in a land not so far away*

*Will you stay, or will you go?  
a. Stay*

- *knowledge and strength*
- *Make friends*

*Blue book or green?*

- *Blue: a book of stories*
- *Green: pictures*

*Do you help your friend?*

- *N: then when you need help they don't help you*
  - *You get another chance*
  - *Will you help?*
  - *N: a storm comes, you are afraid,*



- Y: they give you a book

*The world is told through stories*

- Every legend has a little truth in it

b. Go

- Kindness and adventure
- Find adventures

*Mountain or forest*

### *Example of an early story outline*

The Strong Warrior's story line would center around the main character (the strong warrior) being very well known for their physical accomplishments and therefore becoming well known, but the reason they were loved by all was because of how they treated others - there would be several smaller choices involved that would add narrative to the story - but the core moral decision would be when new people came to the warrior's town and the warrior had to make a decision to include them in the town's activities or not. They were also given a choice to join a sports team with the newcomers which would result in the warrior winning the tournament.

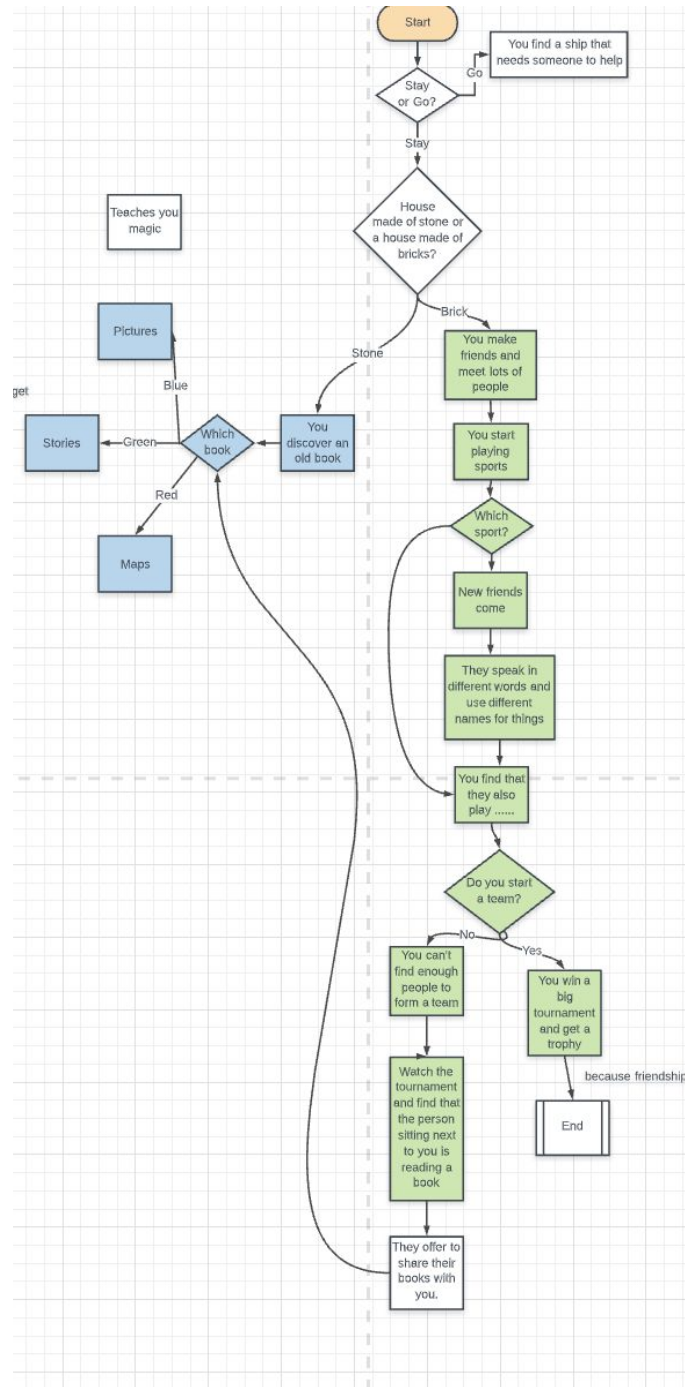


Image the diamonds denote decisions, the squares indicate story content  
 Green was used to categorize a central narrative with the blue a periphery narrative.

Early drafts of the stories included rhyming couplets around all decision trees. This was done to differentiate the “choice” moments which would require the child to respond to a question from any questions asked of characters in the story itself. The non-rhyming was written largely in prose or iambic hexameter because of the lyrical cadence which, when read aloud, the group thought sounded soothing.

**Draft Excerpts from The Strong Warrior:**

*On a rolling just outside of town a brave young warrior was raised two old army sailors*

*The child was taught the arts - could carry a tune as well as any bard and their mastery of language was unparalleled*

*But what they were best at - were feats of strength*

*From the moment they could walk, the young warrior was running faster and climb higher than any other child their age.*

*The neighbours were talking hurried in groups. Whispering to themselves with worried looks and frowns.*

*Some new people had come to town and they weren't like you*

*But they brought music and baked good, and danced when their feet with the ground*

*Your friend turned to you and asked what should we do?!*

*One day, it was a Tuesday I think, there was a rather loud knock on the front door (\*play knocking sound\*)*

*Come join for dinner! you said with a smile*

*There's water and bread, and you can stay a while*

*There were cheers all around as the joyousness spread*

*As the old man laughed and lifted up his head*

*For your kindness we are thankful, He said and shook your hand*

*We will take care of your town and tend to the land*

Due to the length of narratives, we cut back story length to make a decision occur approximately every 90 seconds. In future iterations, there would be more decisions loaded into the first 5 minutes of the story, and then a logarithmic decrease in decision to content ratio so as to help the child fall asleep and passively listen to the story.

For the full story see the Appendix

**The Clever Magician**

**Read by Sophia Batchelor**

The Clever Magician started as a story about believing in yourself and what you can be capable of, it has both a long and a short version (which is used for demos as the short version posits a question approximately every 45-60 seconds). It is the core story of Saga.

The themes in The Clever Magician were slightly darker than in the other two stories we had brainstormed. The first moral that runs through the story is to believe in yourself and how you are capable of anything:

*You are about to face many tests, and even monsters that may attack  
But young one I have a secret to tell you, one that you may already know, for you have  
magic in your veins - and if you learn how to use it, you can find your way back*

*Excerpt from The Clever Magician Early Draft*

We wanted to include morals that would keep children safe, but not make them afraid of the dark or going to sleep. One of the early events in the story involves the child wandering off. We were going for a “Narnia” vibe where there are other worlds that are sisters to our own, but we wanted to imbue the moral lesson of not wandering off alone to the child so in one of the forks the child “dies”<sup>11</sup> and wakes up in another world. While it may seem dark to include this in a children’s story, there is research showing that the early introduction of “scary” concepts such as death through story helps children understand and develop healthy coping mechanisms when faced with these concepts in real life<sup>12 13 14</sup>. There are also several examples in children’s media that made us feel comfortable with including this<sup>15</sup>.

The Clever Magician is also unique in that it breaks the fourth wall and directly speaks to the reader. We wanted to use The Clever Magician as an onboarding story. The first fork can be started by the parent who knows what Saga can do, which then models the decision behaviour for the child. This allows a child who is at the younger end of our targeted age bracket to understand how they can interact with Saga. A later fork the speaks directly to the reader and explains that they have the ability to control what happens in the story by making choices.

*Now reader again, I must interject  
For there is a piece of this story I must not neglect  
This land is not like the one you know*

---

<sup>11</sup> A fairy tale death where they wake up in another world and then eventually find their way back

<sup>12</sup> Lansdown, R., & Benjamin, G. (1985). The development of the concept of death in children aged 5–9 years. *Child: care, health and development*, 11(1), 13-20.

<sup>13</sup> Tu, W. (1999). Using Literature To Help Children Cope with Problems. ERIC Digest D148.

<sup>14</sup> Lansdown, R., & Benjamin, G. (1985). The development of the concept of death in children aged 5–9 years. *Child: care, health and development*, 11(1), 13-20.

<sup>15</sup> Finding Nemo, Big Hero 6, Marley and Me.

*It is controlled by the where you think the warrior should go*

*Excerpt from The Clever Magician where Saga breaks the fourth wall.*

Writing this story was what changed the design of the stories to be all rhymes. After a night of writing<sup>16</sup>, we decided that the cadence of the story sounded better as rhymes. In the final version of The Strong Warrior and The Clever Magician, we wrote the stories entirely in hexameter with rhyming couplets. This was done to meet the difference between comprehension and language complexity - which would satisfy the childrens' language development - and the "story telling" mythos as most well known spells<sup>17</sup> often rhyme. The rhyming was difficult at times and would often break rhythm but overall we feel like created a cohesive story that was more enjoyable to listen to. It was slightly more in the style of Dr Seuss (with less comical nonsense) which we decided would make it more likeable to a wider age range.

Two important notes about The Clever Magician are the names of "Taelie", and "Eligere". The land of "Taelie" that the child comes from, is derived from the name of the Norse god of stories. The land that the child wakes up in, Eligere, is the latin conjugation of the verb "eligo" (to choose) in second person singular future-passive indicative. This would mean that eligere approximates would translate to "in the future, you will choose" or "you may make a choice" which we chose in order to reflect the fact that the child is controlling where the story goes through their choices.

See Appendix for Story

### **The Oracle of Life** **Read by Dylan Arceneaux**

The Oracle of Life started off as a wholesome comic that was shared in our group chat during the power out while we were having trouble with fabrication. The group found the comic and it inspired a story as we felt like the comic had a good moral message.

---

<sup>16</sup> And a very nice Marlborough Chardonnay

<sup>17</sup> Double, double, toil and trouble, fire burn and caldron bubble - Sala-gadoola-menchicka-boo-la bibbidi-bobbidi-boo, Put 'em together and what have you got? Bibbidi-bobbidi-boo - oompaloompa-doom-pa-dee-do, I have a perfect puzzle for you.



Comic that inspired the Oracle of Life story

It's the only story that doesn't rhyme and is written in irregular prose. The version on Saga is also not a choose-your-own-adventure story, unlike the other stories. We have a written version of The Oracle of Life that is a call-response/choose-your-own-adventure version, however we wanted to show the ability that Saga has to read stories that are not just the choose-your-own-adventure preloaded ones. This was to demonstrate how parents would be able to load on additional stories that their children already enjoy onto Saga for Saga to read.

Full Oracle of Life Story in the Appendix.

## Companion App



*Image of the first screen when the Saga Companion App has been opened*

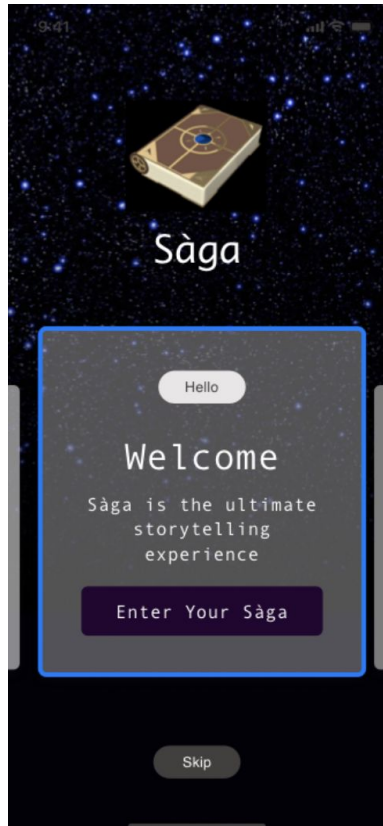
The Saga Companion App serves as the parent's point of contact with Saga. There were a few key features that we wanted to include which was an axis around a core idea of parental involvement in the Saga experience. The homepage of the app shows your child's point in their story, and the latest decisions that they made so that parents can check their home screen and be able to ask their child about the specific fork that they chose last night.

Parents also have access to a "library" which shows the most recent or current story, as well as the other stories loaded onto Saga. From the bottom toolbar parents can also access the store which will contain curated stories that can be loaded onto Saga, the recording area where the parent can record their voice telling stories and load the files onto Saga, a control panel, and analytics.

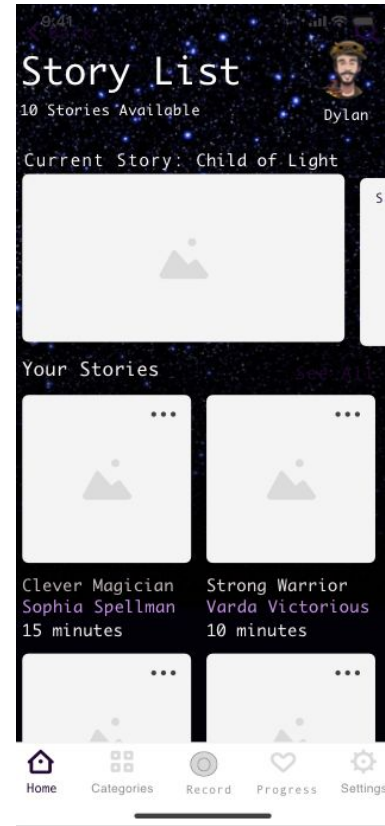
The Controls page of the app sets hours that Saga can be activated so that children can't get up and read Saga at night when they should be sleeping.

The Analytics page is to help parents understand the stories that are being read and the reading level of their child. Every Saga story will have an assigned reading comprehension, creativity metric, and vocabulary level. We wanted to include this so that parents can gain insight into the educational value of Saga for their child.

Initial Wireframes of the Saga Companion App:



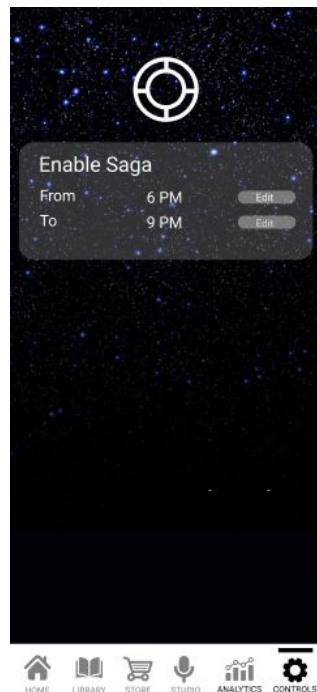
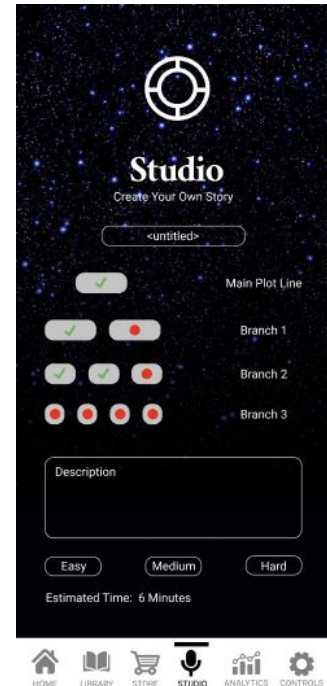
*Early draft of Saga App Start Page*



*Early Wireframe of Saga App Homepage*

**Final Version of the Saga Companion Application:**





Top left to bottom right:  
Image of Saga App startpage,  
image of Saga App Library,  
Image of Saga App's Studio  
for parents to record their  
voices, Image of Saga App's  
analytics, Image of Saga  
Apps Parental Controls page.

## Converging Story and Software



Turning the stories into code was a complicated process. The organization of each story, and each story's branch was meticulously designed and architected to properly work and scale if needed.

Currently each story is organized such that they contain a dictionary with “branch” words as keys and a function that plays the audio file associated with that word.

A story gets selected by a voice command dictating what story wants to be heard. Once this has happened the software knows what dictionary to look up possible branches is. So every following branch/option that is told to the narrator, the software will search within that story's dictionary to fetch the proper branch and read out the rest of the narrative. Every interaction is received through a microphone or an FSR (force sensitive resistor) and gets paired with certain outputs driven by servo motors, the neopixel lights, and the speaker.

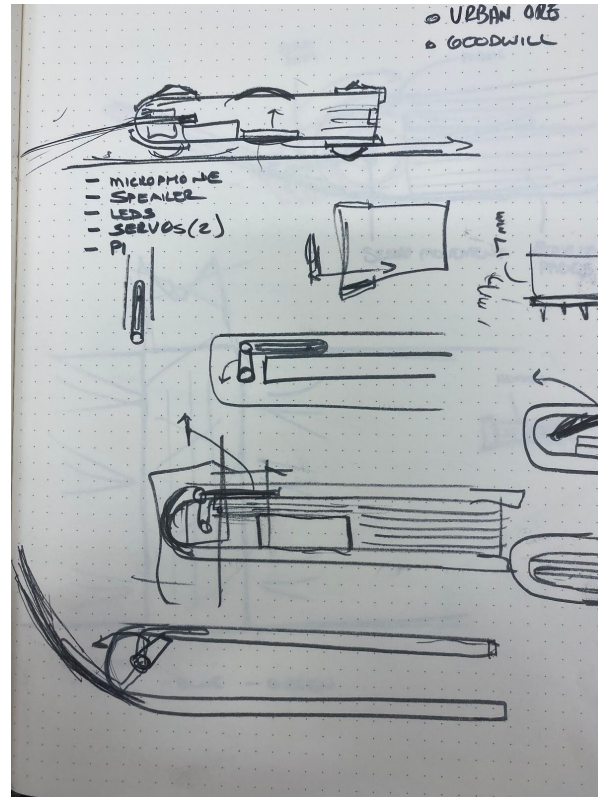
### Interactions List:

- Whenever a story wants to be heard:
  - input: the parent or the child presses down on Saga's gemstone which triggers the FSR sensor.
  - output:
    - the gemstone glows rainbow, cycling through different lights lit up by a single Neopixel behind it.
    - Saga is then in “awake” mode, and asks, through the speaker, in a soothing voice what kind of story do you want to hear tonight and then waits for a response.

- The Gemstone fades in and out white light while it waits for a response.
- When the child talks to saga to start a story.
  - input: voice audio received through a mic
  - output:
    - Servo Motor turns on and opens the book.
    - Lights flicker Green once an audio command has been accepted.
    - Saga finds the story to tell and starts telling it through the Speakers.
    - For each story, the lights shine a different color. Currently the warrior story is green and cyan, the magician story is blue and purple, and the oracle is yellow and red.
- While the story is being told:
  - Output: neopixel lights glow, fading in and out colors related to the story being told. Once the branch is done and the narrator is waiting for a decision, the lights from the neopixels inside the book glow on and off in “breathing” mode signaling that it is waiting for a response.
- When the child picks a fork in the story.
  - input: voice audio received through a mic
  - output:
    - Once the fork is an accepted answer, the lights shine green to show confirmation.
    - Then the lights go back to fade in and out the colors related to the story.
    - Audio continues to play through the speakers telling the rest of the story.

## Design Challenges

The pages of Saga was one of our most difficult design challenges. Initial designs included using thin acrylic sheets that would be sanded on both sides so as to best carry light, however due to financial and technical constraints were dropped at the physical prototyping stage. Due to both the position of the internal mechanical components (motors, pi, speakers, lights, and wiring), and the rotational axes of the book, the pages could not be bound to the back of the book. We considered using a 2 way stretch fabric (most likely lycra based) that the pages could then be glued or sewn onto which would account for the rotation of the book’s spine, however there would still not be enough room for the internal components.



Initial sketches on how to attach the pages and the motor within the spine

We chose to have accordion pages which was in line with some of the original discussions around the book design with neopixel lights in the spine that would light up the pages.

We considered having art or design on the pages themselves that would fit stylistically with the stories, however that would restrict the content of the stories that could be loaded onto Saga - it would be difficult to tie ancient runes to The Very Hungry Caterpillar.

We discussed the parchment that would be used for the pages and felt different types of vellum and parchment. We wanted something thick that felt physically worn and textured when you run your hands over it as we discussed what we liked most about the notebooks we personally wrote in. We had discussed using coffee staining and matches to burn the pages to give them an "old" look like the "treasure maps" our parents had made for us as we were growing up, but the coffee would have changed the material properties of the paper and increased its rigidity.

## Future Iterations

As of 10/25 there is only 1 completed story that is loaded on Saga. Future iterations will flesh out entire stories.

We would like to revisit the tolerances that we built into Saga's fabrication to have a more streamlined design.

There are additional

## Instructable style process document

step by step making of the work

### Intro

This document covers step by step assembly and function of the Saga

## Mechanical Parts

- 1 Raspberry Pi
- 1 Crickit Hat for Raspberry Pi
- 1 NeoPixel LED strip (9 LEDs)
- 1 NeoPixel Single LED
- 1 FSR (Force Sensitive Resistor)
- 1 Speaker
- 35 Sheets of 35lb Drawing Paper
- 2 U-Shaped 0.125" Acrylic Cutouts
- 2 MG9662 Servo Motors

## Digital Files

Code: <https://github.com/BrainonSilicon/DETSaga>

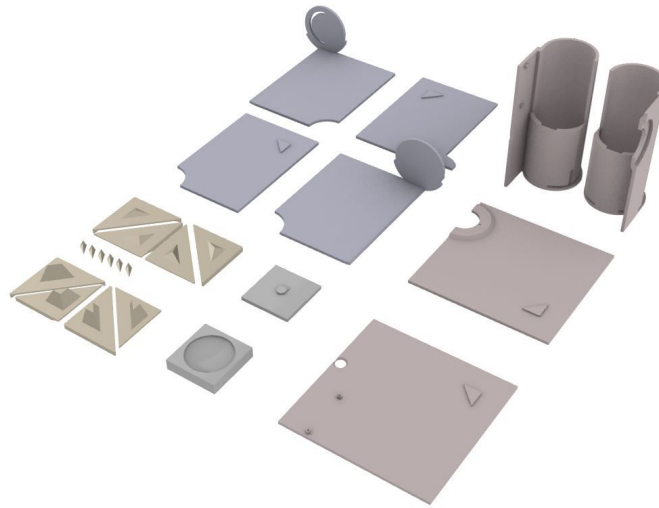
3D printable parts: **See Google Drive Link in the Appendix**

Laser cut parts: **See Google Drive Link in the Appendix**

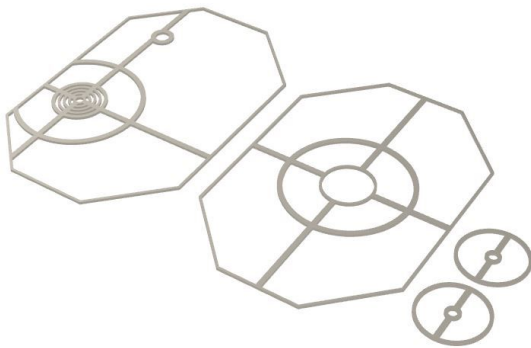
FabLight Files: **See Google Drive Link in the Appendix**

## Steps

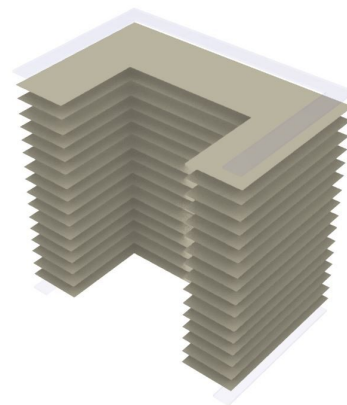
Step 1 - 3D Print the Book Covers and Ornamentation, FabLight Cut Panels, and 3D Print the Silicone Mold.



3D Printed book covers, ornaments, and Silicone Mold.



Fab Light Cut panels.

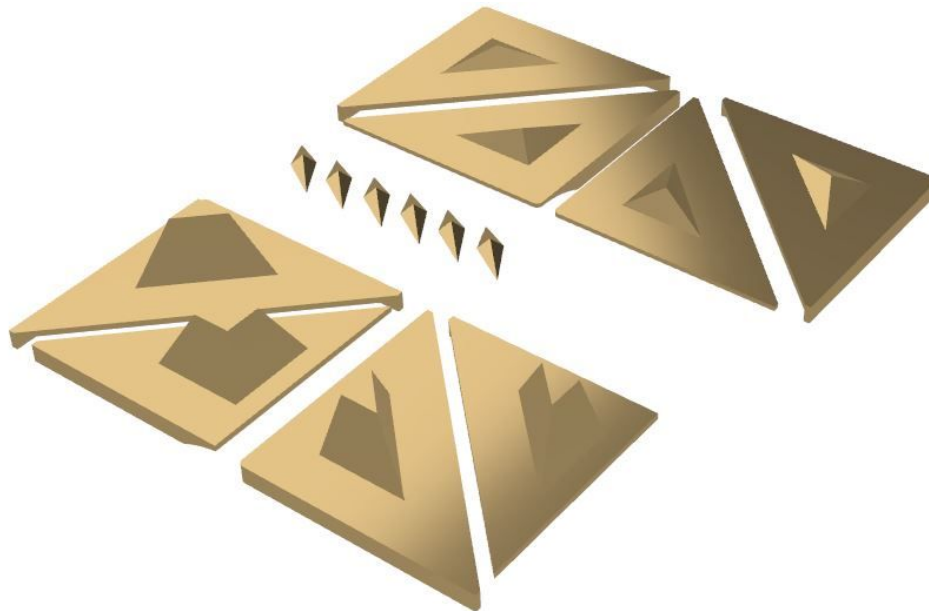


Laser cut paper pages.

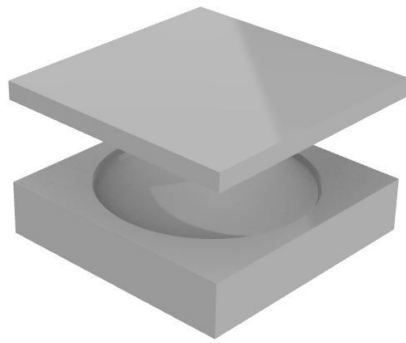




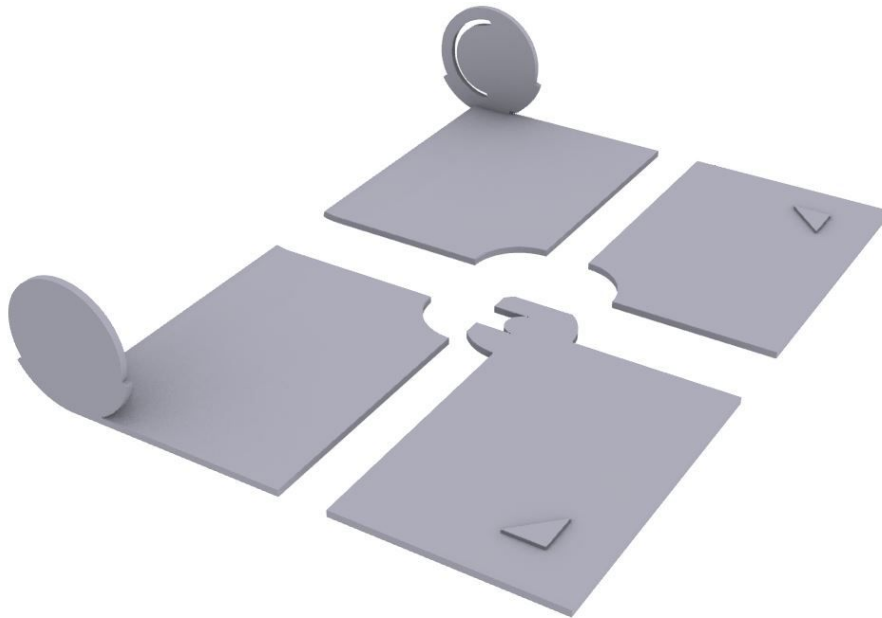
Step 2 - Paint the Ornamentation Pieces and Ornamentation Panels brass.



Step 3 - Prepare and cast the Silicone Gem Stone.

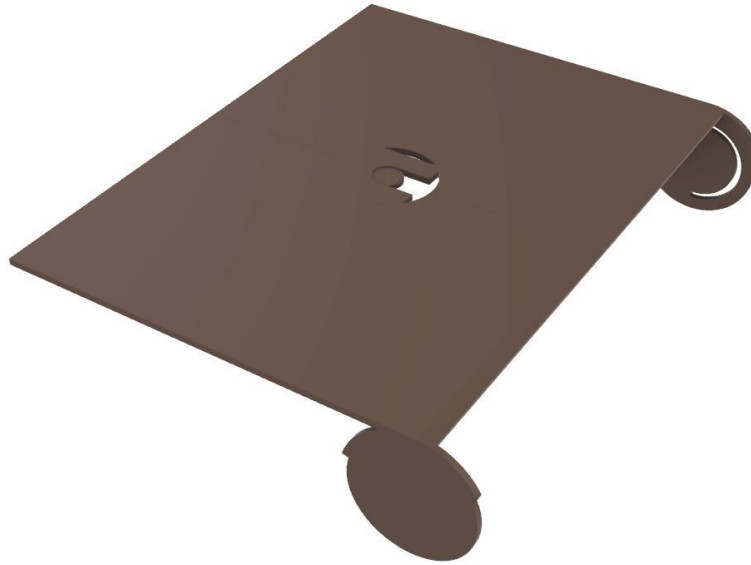


Step 4 - Assemble and fuse the Book Top Cover pieces.

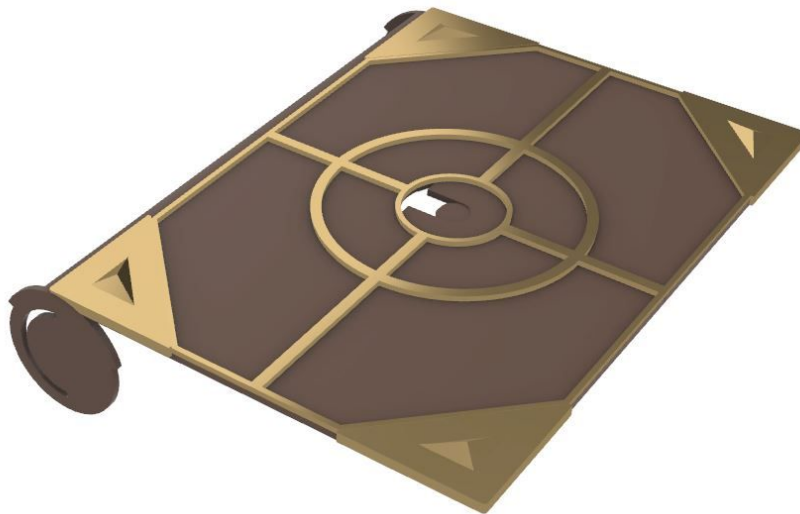


Step 5 - Paint the Top Brown.



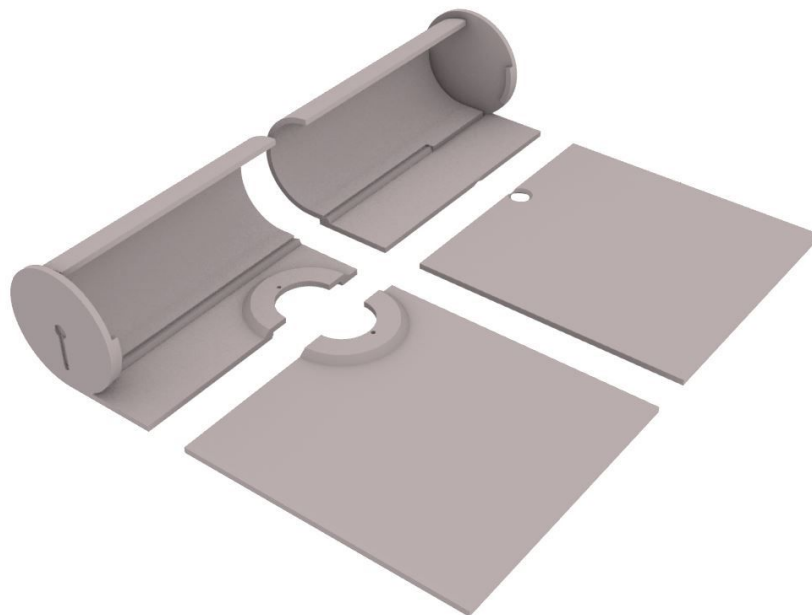


Step 6 - Affix the Ornamentation Pieces and Ornamentation Panel to the Book Top Cover.

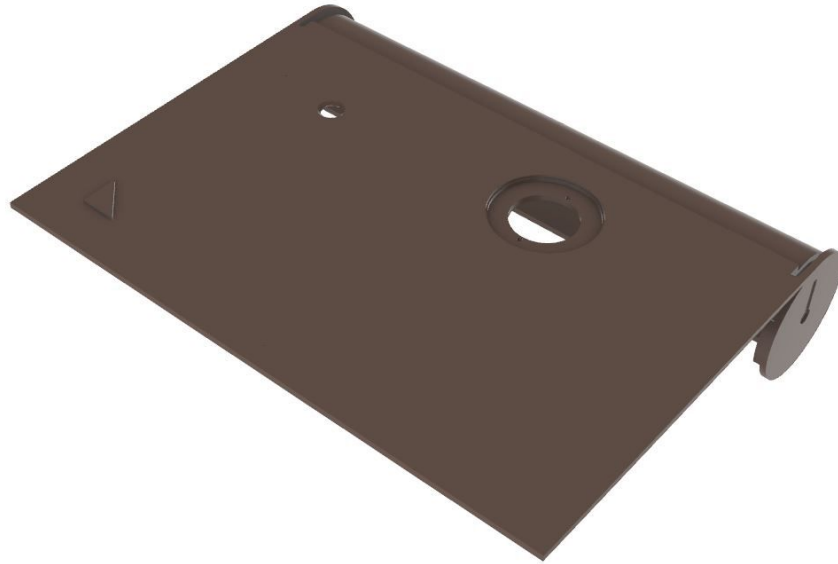




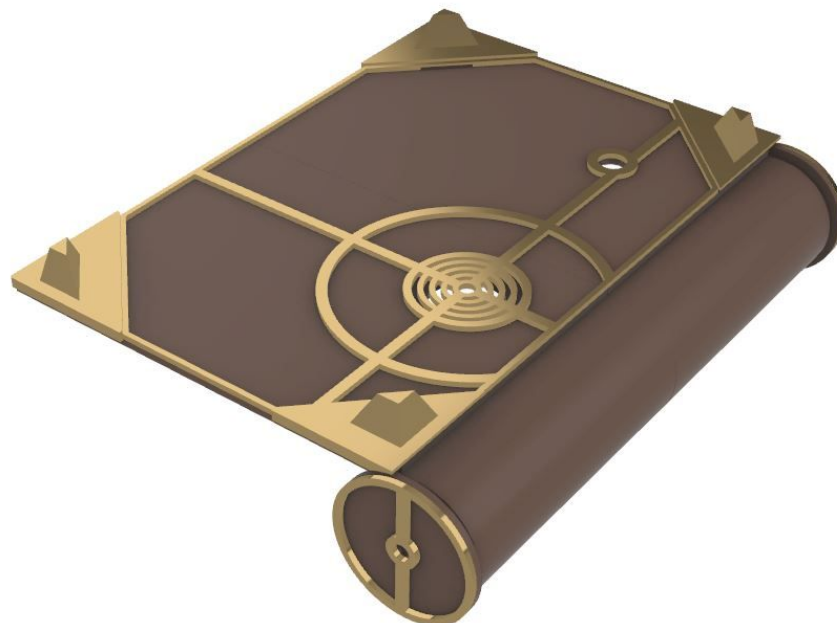
Step 7 - Assemble and fuse the Book Bottom Cover pieces.



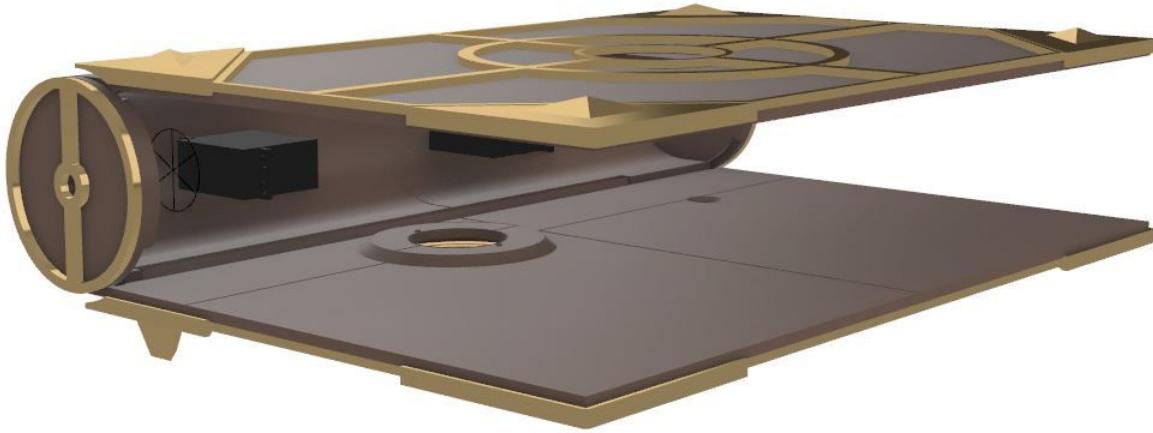
Step 8 - Paint the Book Bottom Cover Brown.



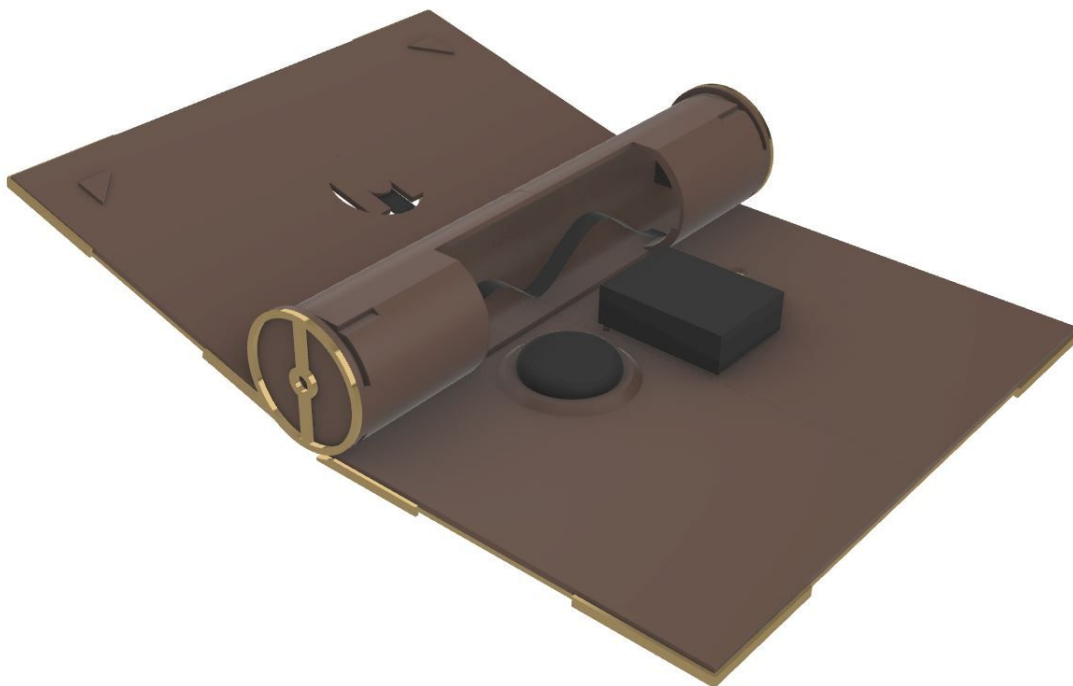
Step 9 - Affix the Ornamentation Pieces and Ornamentation Panel to the Book Bottom Cover.



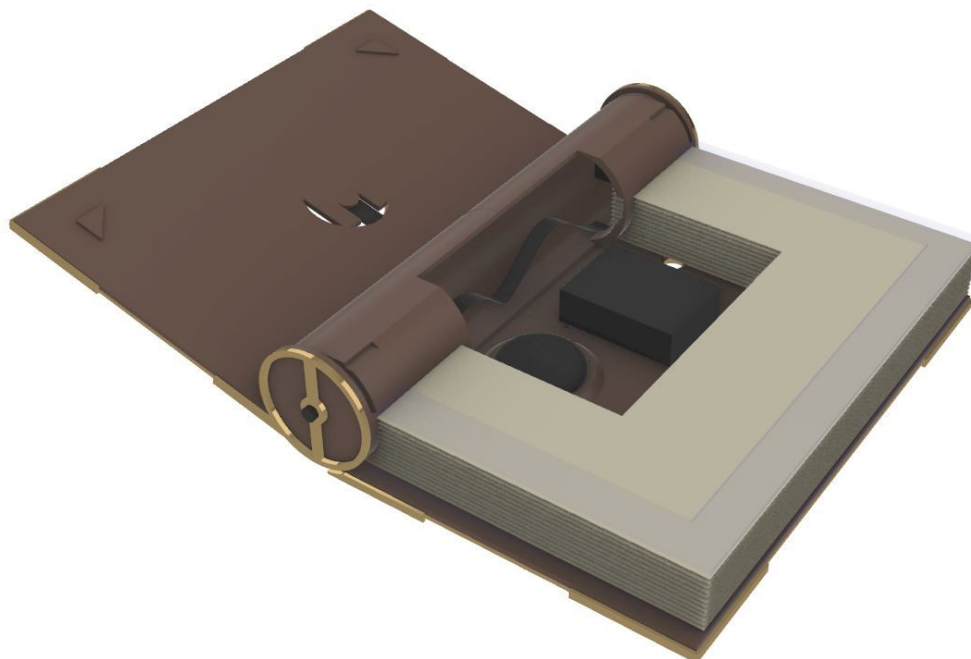
Step 10 - Attach the Book Top Cover and the Book Bottom Cover with the two Servo Motors.



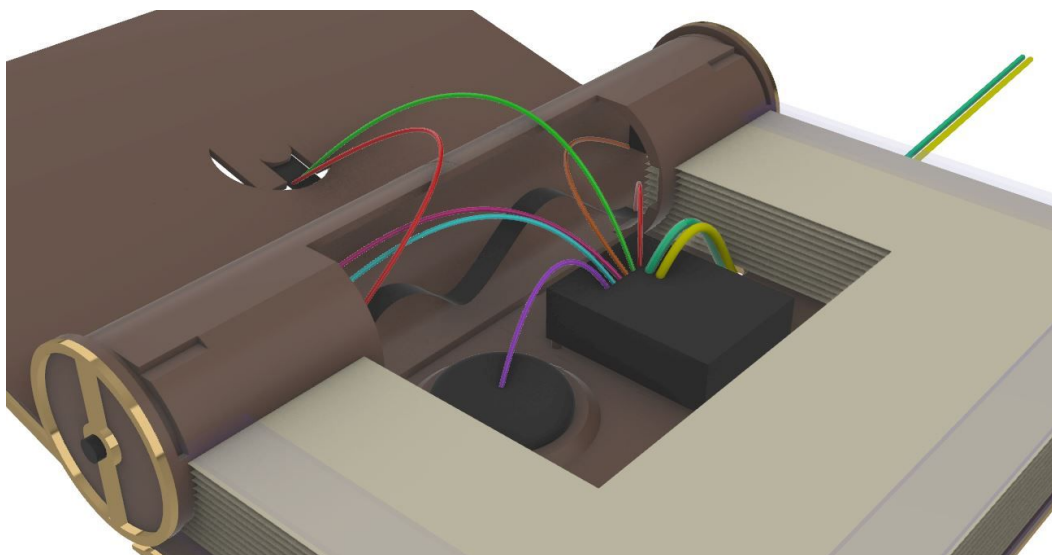
Step 11 - Complete the Hardware Integration with a Speaker, Raspberry Pi, Strip of LED Lights, Force Sensitive Resistor, and a Microphone.



Step 12 - Attach the Pages with the Acrylic Plates to the Book Bottom Cover.



Step 13 - Wire in the Hardware to the Raspberry Pi.



**LED Strip and Gemstone LED** (Connected to DOUT of LED Strip)

**Force Sensitive Resistor**

**Servo #1**

**Servo #2**

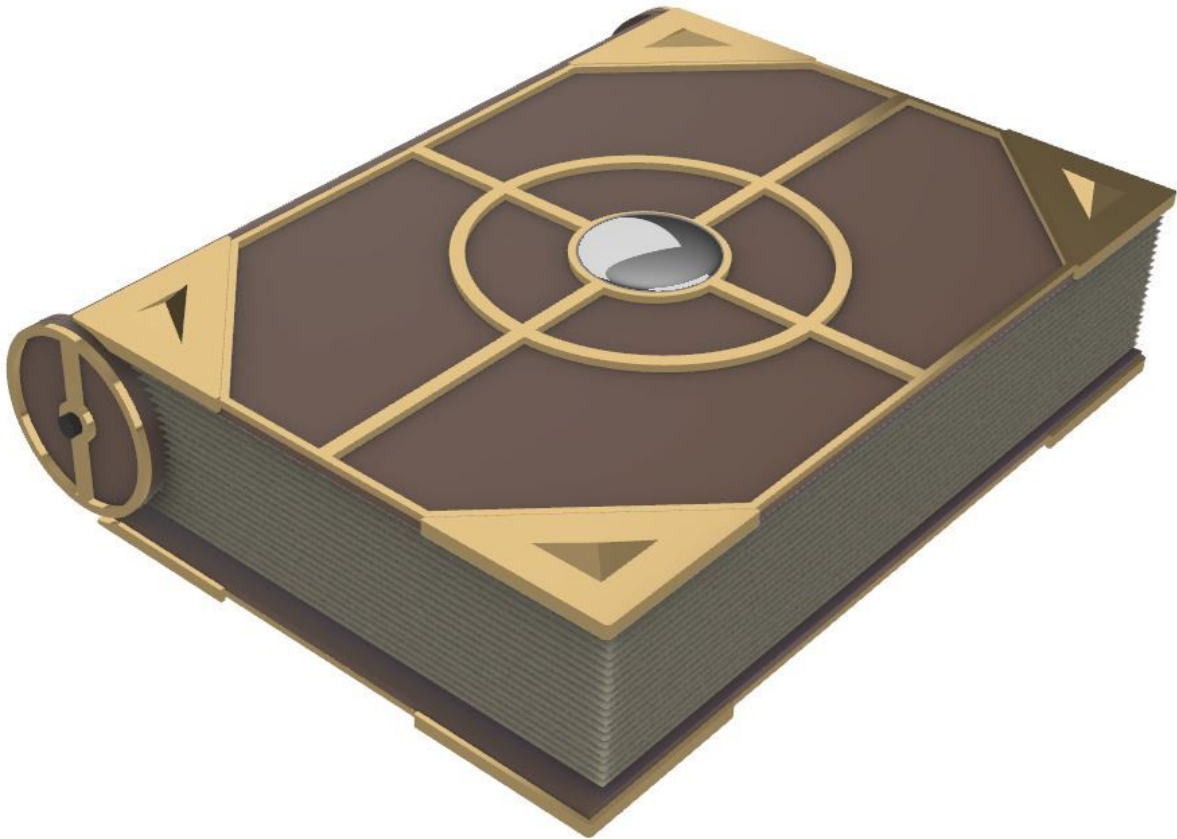
**Microphone**

**Speaker**

**Data Connection to Computer**

**Power Cable**

Step 14 - Affix the Pages to the Book Top Cover and Affix the Gemstone to the Book Top Cover.







## Appendix

### Stories

#### **The Strong Warrior**

*Once upon a time in a land very far away.  
Where the sun lit up the night, and the stars shone all day*

*It was a wonderful place with mountains so tall  
You could follow the river all the way to a waterfall*

*There was a king and queen who ruled fair and true  
The people were happy and always had something to do*

*The land was green and full of food to eat  
At every table there was room for an extra seat*

*And that, is where we begin our story*

On a rolling just outside of town  
a brave young warrior was raised by a tailor and a sailor

The child was taught the arts and could carry a tune as well as any bard  
Their mastery of language was unparalleled  
But what they were best at were feats of strength  
From the moment they could walk, the young warrior was running faster  
And climbing higher than any other child their age.

They continued to grow up strong, eating everything they could.

*They made their parents proud and brought honor to their name.  
But they knew that to forge their own life, they needed less of the same*

*Now all grown up, the brave young warrior sought a home  
Somewhere they could stretch out and call their own*

*Walking through the town and a plan in mind  
They came across a realtor's sign*

*Houses for sale!, A large sign said  
Hello Warrior, I have just the choice for you, the realtor said*

*The first, it's a winner, a house of clay  
Wide windows, and a yard with lots of room to play*

*Across from the one, and down two doors  
Is a house of stone with two open floors*

*So Warrior, you have a choice to make  
Between the stone or clay, which house will you take?*

Now all grown up, the brave young warrior sought a home  
And walked down a winding path searching with hope  
The warrior preferred two houses over the rest,  
On one side lay a hut of clay,  
A stone cabin on the other  
Should the warrior choose the house of clay or the house of stone?

**Draft of the Strong Warrior Story:**



give the option of stone or clay

describe the house and the scene and the friends

Do you stay inside or go play sports with your friends

New people come to town

Do you let them stay, or do you ignore them?

Do you invite them to play the sport?

One day, it was a Tuesday I think, there was a rather loud knock on the front door (\*play knocking sound\*)

*The neighbours were talking hurried in groups. Whispering to themselves with worried looks and frowns.*

*Some new people had come to town and they weren't like you*

*But they brought music and baked good, and danced when their feet with the ground*

*Your friend turned to you and asked what should we do?!*

two new folk came up to you, right in the middle of the town

They had a request

*Come join for dinner! you said with a smile*

*There's water and bread, and you can stay a while*

*There were cheers all around as the joyousness spread*

*As the old man laughed and lifted up his head*

*For your kindness we are thankful He said as he shook your hand*

*We will take care of your town And tend to the land*

### **The Clever Magician (Long)**

Now, tuck yourself in bed and let me tell a story,

Of an old kingdom past, and a child destined for glory

This child was like almost every other,

Was loved by their siblings, father and mother.

In the far off land of Taelie they grew up so strong  
But as with all things in life, nothing ever lasts long

One night things changed and the child wandered out  
Down a long twisted path and into a maze they went  
Suddenly they were lost and there was no one about

The child grew cold as the sun went down for the night  
Hands shivering with no coat and no sign of a campsite

At dawn their family woke and felt such fear  
For they could find no sign of the child that they held so dear

Their father searched the town, down every street and alley  
Their mother called into every house until a crowd did rally

At last they found the child and a medic was found  
The father was full of hope, but then sank to his knees on the ground

For the doctor spoke true when he finally did lift his head  
A hush fell over the crowd because the child was dead

And yet.....Once upon a time, in a far away land  
A child from another world woke up instead

As I said earlier, this no ordinary child, and this was no ordinary place. The child was born of two great warriors, the best Taelie had ever seen - Their parents were the kingdom's champions, who could wield any weapon. But the weapon they taught best, and the one the child was most skilled in, was the weapon of knowledge and of a clever mind.

Looking at their surroundings, the child gauged what could be done. There were no road signs or markers, so no real way to figure out where they were. It was incredibly confusing, and something seemed off - there were trees all around that seemed so tall they touched the sky. The child stood up and brushed off the golden leaves that had got stuck in their hair.

And seemingly out of nowhere, they noticed what, almost looked like a mirror. It was half hidden by moss and leaves scattered at the base; there was this odd dewy mist that dimmed its shimmer which was why they almost missed it - but it was a mirror all the same

They rose to their feet and walked cautiously over - and as they did so, the mist started to clear. The child saw their parents, as if there were just right there. The father on his knees, the mother standing strong - both with tears in their eyes but the child didn't know why.

The image faded as fast as it had appeared, and in its place words started to form in a glowing bright light.

"Young one, I am sorry" the words first read.

"This is Eligere, and for now you are dead

But this is not the end, and there is hope to be had  
So fill your heart with courage, there is no need to be sad

You are about to face many tests, and even monsters that may attack  
But young one I have a secret to tell you, one that you may already know, for you have magic in your veins - and if you learn how to use it, you can find your way back"

The light faded and the mirror once again misted over. Well that was only slightly helpful, the child said. I know that I can get back, I just don't know how! Looking around once again, the child noticed two more things - off to their right they could see mountains and path that led to their base. To the left they could hear the crashing waves that could only mean that the sea was near. But for now they had a choice,

Do you go right towards the mountains, or left towards the sea?

### **Clever Magician Demo Version**

### **STORY THREE SHORTENED**

*Now, tuck yourself in bed and let me tell a story,  
Of an old kingdom past, and a child destined for glory*

*This child was like almost every other,  
Was loved by their siblings, father and mother.*

*In the far off land of Taelie they grew up so strong  
But as with all things in life, nothing ever lasts long*

1. *Stumbling into a grove, the child came to a fork in the path  
To their right was a river, to the left a merchants staff*

*This is the moment where you first have to choose*

*Right or left, make your choice, you have nothing to lose*

**A River**

*Turning right the child made off down towards the river  
It was a risky choice as night fell and their hands started to shiver*

*The child walked up to the water and boarded the boat  
Feeling colder by moment in their thin summer coat*

*Slowly they drifted off into a dreamless sleep  
as the boat took them further out into the deep*

*Awake the the next morning no longer at sea  
The child tried to figure out where on earth they could be*

*As is if in answer to the child's mental note  
A ghost of light appeared and in a kind voice they spoke*

*"Child I know that you but feel quite lost,  
I might help you find your way for but a small cost"*

*Far off from the land that was hidden by the mist  
A lone voice called "Child are you lost? Let me help you, I insist!"*

**Aa/Ab.**      *So now you come to another decision  
Do you call back to the figures, or follow the apparition?*

**Aa.      Ghost**

Sorry no story

**Ab. Figure**

Sorry no story

**B. Valley**

*Towards the staff the child went  
At a valley they found themselves, and begun their descent*

*Thinking about their home and the warmth from the fire  
The child's feet dragged as they began to tire*

*Looking around for a place to rest  
A hollowed out tree filled with moss looked best*

*At dawn their family woke and felt such fear  
For all through the house could find no sign of the child they held dear*

*In the woods they found the child with frost on their head  
A hush spread over the family because their child was dead*

*And yet.....Once upon a time, in a far away land  
A child from another world lifted up their head*

*And that is where our story begins tonight  
For there are adventures to be had by a child of light*

Looking at their surroundings, the child gauged what could be done.  
The last thing they remembered were the days fading rays of sun

It was incredibly confusing, and something seemed not quite right  
The trees had golden bark and reached to quite an immense height

Brushing off the leaves that has been tangled in their hair  
The child now noticed a mirror that seemed to just appear

*Now reader again, I must interject  
For there is a piece of this story I must not neglect*

*The land the child woke in is not like the one you know  
Instead is controlled by the where you think they should go*

*So now, dear reader, you have a choice to make  
Should they go towards the mirror and see their fate?*

## **Ba and Bb**

The child rose to their feet and walked cautiously over  
To the mirror adorned with words and an etched four leaf clover

In a long scripted font that looked written by hand

Words appeared in the mirror and shared a message most grand

“Young one, I am sorry” the words first read.  
“This world is Eligere, and for now you are dead

But this is not the end, and there is hope to be had  
So fill your heart with courage, there is no need to be sad

You are about to face many tests, and even monsters that may attack  
But young one you have magic in your veins so you will be able to find your way back.”

The light faded and the mirror with a poof disappeared  
It would seem this world really was quite weird

Well that wasn't helpful! The child exclaimed  
I must find a way home, I simply can't refrain

*Looking around once again, the child noticed two more things  
to their right there was a high an arch made of bright golden rings*

*Directly opposite to left one could hear the crash of waves on rock  
The sound's only interruption was an occasional seagull squawk*

*With no more information or map in hand  
The decision it seemed was between arch or sand?*

Sorry no story  
The warrior finally bridged the hill and saw the Oracle

They didn't appear as an impressive figure, or have a halo around their head. The clothes they wore was not adorned or made from a precious silk. There was no altar to leave a gift, nor a council table from which they may judge.

The Oracle was dressed in a simple brown cloak, and was facing out into the distance - at the tides that were lapping against the cliff face. There was a stillness. And no For the energy of the universe radiated from that figure, and there was no mistaking that this was whom that warrior had come to see.

Striding over, the warrior took one knee at the crest of the hill before the Oracle and asked the question they had carrier with them across the seas.

*“I have come to learn how to live forever”*

The Oracle of Life turned towards the warrior

It was not a face that the warrior saw - but a feeling

A feeling of breakfast at home with a table full of friends.

It was the feeling of a sunset and of the way light filters through the leaves in a forest.

The feeling was of the first breath you take in the morning, and of the hug your parents give.

Of dinners and laughing so loud your cheeks hurt.

It was a feeling of life itself radiating from the heart of every being on earth.

An oracle has no face - because oracles are as old as time themselves - and the Oracle of Life is older than even that

The warrior stood up, unsure if they had been heard

"Oracle", they asked,

*"how can I live forever".*

The Oracle did not reply straight away but paused before picking an object off of the ground.

In a voice that rumbled deeper than the sound ships made when leaving harbour

*"To live forever, be difficult to forget"*

The warrior was flabbergasted.

"How!" They exclaimed.

*"How can I not be forgotten!"*

More confused than before, and mentally scrambling

*"Do I need to create art and become the best artist in the world?!"*

*"Should I become famous and be known by every person alive - surely that would mean that I would not be forgotten?"*

The oracle was silent. They had been brushing the leaves and dirt off the object they picked up.

The warrior leaned in, maybe what the oracle had found was what the warrior needed to never be forgotten.

But after a moment, the warrior saw that it was just an ordinary acorn.



Frustrated after a long journey - after a lack of answers - and because they were afraid.

The warrior threw up their arms in the air. *"If I become the most powerful person in history, have monuments built in my honour. If I own the most land and be so important that everything I say get written into law. Is that how I will not be forgotten. Everyone knows the most powerful people in the world".*

Pacing now. The warrior thought to his mother in their small village, they thought of the captain who helped them cross the sea. They thought of the people who believed in their journey both to see the Oracle and subsequently learn the secret to live forever. Turning back towards the Oracle now with another question on their mind, the warrior saw the Oracle bend down to the earth and place the acorn in the small hole they had just made.

*"Just tell me Oracle"* the warrior begged  
*"What should I do so that I will not be forgotten?"*

The Oracle knelt down and scooped the dirt back onto the acorn. And in that voice that struck every piece of fabric of the universe, the Oracle replied

*"You should be kind".*

For the Oracle had seen champions come and go, they had seen the birth and death of cities and of the gods those cities were built to worship. It had seen every star and black hole in existence. And it knew that the greatest strength in all the universe, was the strength of kindness.

## Links

Video	
Presentation	
Saga Interactions	<a href="https://docs.google.com/document/d/1dlm5xDvN4vIKrb_YGVtISxF4QYLamAblyflkaQUWn1I/edit?usp=sharing">https://docs.google.com/document/d/1dlm5xDvN4vIKrb_YGVtISxF4QYLamAblyflkaQUWn1I/edit?usp=sharing</a>
Saga Stories	<a href="https://docs.google.com/document/d/1ml68vRa8WNzzT6Nu_AVDG4c8fOg-fTdkVPEJ-11pvik/edit">https://docs.google.com/document/d/1ml68vRa8WNzzT6Nu_AVDG4c8fOg-fTdkVPEJ-11pvik/edit</a>

Saga Companion App	<a href="https://www.figma.com/proto/ZNLxA9B2SpFZeG5Nj1L6Ek/Saga-Companion-App?">https://www.figma.com/proto/ZNLxA9B2SpFZeG5Nj1L6Ek/Saga-Companion-App?</a>
Landscape image	
Code	<a href="https://github.com/BrainonSilicon/DETSaga">https://github.com/BrainonSilicon/DETSaga</a>
CAD Files	<a href="https://drive.google.com/open?id=17hUOQIz2oaJsasyYDZtVWrz6ZHaTwYKo">https://drive.google.com/open?id=17hUOQIz2oaJsasyYDZtVWrz6ZHaTwYKo</a>
Image	