Villanova University

Sweet Dreamz

Written Report

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Background

The average adult forgets approximately 95% of their dreams, of which they experience four to six of per night, lasting about twenty minutes each. This encompasses a large portion of one's life that remains untapped. The average person spends one-third of their life sleeping, which means about 31.35% of the average life is spent experiencing dreams that they have no recollection of. In children, this portion of forgotten time increases, as adults recall up to 70% more of their dreams than children [6].

It is believed that dreams have three main functions, which are to store important memories and things learned, to weed out unimportant memories, and to sort through thoughts and emotions. Expanding on this further there are three areas of focus:

1. Emotional Processing and Regulation

   This is how someone deals with these events in their life and subconsciously sorts through their feelings toward them.

2. Childhood Executive Function

   This is the set of skills that give children the capacity to meet goals, display self-control, and stay focused, among other things, by storing important information and learned skills.

3. Memory Retention

   Sleep, and dream recall, in particular, are critical in the development and retention of memories, which only becomes more important at critical stages of life such as childhood and advanced age.

<u>Objectives</u>

The goal of this product is to create a physical product that enables the user to record their dreams and watch them the next day via a phone application. This has the potential to aid in memory development and retention, emotional processing, and executive function, as well as serving as a general entertainment source. While this product will be marketed toward the general public, it can also be used in a professional or medical setting, such as in pediatric sleep studies or research for cognitive deteriorative disorders, such as Alzheimer's. When designing our product, we considered four main categories of life improvement:

1. Processing of traumatic events

    In dreams, individuals sort through stressful or traumatic events subconsciously [6]. With our product, the user has the opportunity to view and dissect their emotions as an additional form of processing while awake.

2. Improvement of executive function

    Our product has the potential to be a useful tool in assisting in the progression of developmentally delayed children and those struggling with sleep disorders.

    a. Developmentally delayed children

        Critical developmental skills can potentially be improved by viewing dreams, where these skills are processed and improved upon, and this may be able to form and strengthen connections within the brain.

    b. Pediatric Sleep Studies

        One of the number one health concerns regarding children is their sleep patterns. As of right now, pediatric sleep studies typically focus on sleep patterns, breathing patterns, EKGs, EMGs, and EEGs. Our product can provide another insight into pediatric sleep issues regarding dream contents.

3. Delay of memory loss

    As an individual ages, the connections in their brain that assist in memory begin to falter, and with our product, we hope that older people can strengthen these connections by being reminded of what happens in their sleep and dreams, which is tied closely with memory retention. [5]

4. Entertainment

    Our product can provide the general public with another form of entertainment in addition to mainstream forms of entertainment such as television or film.

<u>Specifications</u>

Our tentative plan is to have our product market-ready in five years, giving us two years of research. Some specifications would be what subjects we choose to study to create the product because it will be based on their collective data. We need to have numerous subjects and make sure they range in terms of sleeping patterns, how often they dream, and how often they remember their dreams. This way, our product will be adaptive to everyone's specific sleeping schedules and patterns. In terms of performance, our app needs to be user-friendly and available for purchase. During our research, once the app is created, we could have our subjects use it to get feedback on its functionality. The reconstructed dream video should be ready to watch within 1-2 hours after your last dream. This gives time for the app to process all of the data throughout the night for the best possible reconstruction of a user's dream. We want to accommodate as many users as possible, so we could do a trial period before the product hits the market and give out the product and see if our app can handle at least 50% of the number of users projected to use the product in the first year.

Our first rollout on the market will be 50,000 units for the first quarter. There should be a troubleshooting team that works as a "help hotline" for at least the first half of the year that the product hits the market. This will help us stay on top of what is and isn't working with the app and different performance aspects.

<u>Feasibility Analysis</u>

      Our product will require a lot of research to ensure we can adapt previous brain scanning techniques to create the device. The possible approaches will consider different research methods, their benefits, and which one would be the best fit in terms of time, money, etc.

1. Approach 1: TDI and EEG

      In this approach we would explore the TDI method, Targeted Dream Incubation. TDI is aimed toward the middle descent of consciousness where the brain has started to enter a dream state, but the subject's senses are still engaged, and they can hear [1]. We will use TDI to guide the subject's dreams and record their EEG's aiming to reconstruct a video of the dream. We will have to adjust which part of the brain we are scanning since EEG's. After the subject is done dreaming they will be woken up and immediately asked to describe their dream while it is on their mind and ideally it should be similar to what we guided it to using TDI. Then, we can compare accuracy with our reconstructed video.

2. Approach 2: Lucid Dreamers and MRI

      The second approach would only use subjects who experience frequent lucid dreaming. Lucid dreamers are conscious while asleep and can remember and alter their own actions in their dreams [2]. Since they are more likely to remember what goes on in their dreams, we would use them as subjects and they can more easily certify the accuracy of our video reconstructions. However, this research wouldn't be the best since not all people are lucid dreamers so it might create a product that isn't applicable to everyone. We would also explore MRI scanning which also scans the brain, similar to EEG [3]. However, the MRI scans would require more intense and expensive machinery and this would in turn complicate the device we construct as well.

      The first approach will be used to design our product. This approach was chosen because the research and final device will apply to the whole population instead of a specific group of people such as lucid dreamers. Also, the EEG will make for a more comfortable design for the user.

## Proposed Approach- Technical aspects of each task

1. EEG Scans

   The EEG's need to be adjusted to scan a human's brain during unconsciousness so we will be focusing on areas such as the lingual gyrus and posterior cortical "hot zone" which indicates when a person is dreaming. Below are two graphics of different brain waves an EEG picks up: Beta, Alpha, Theta, and Delta as well as a picture indicating where the lingual gyrus is located.
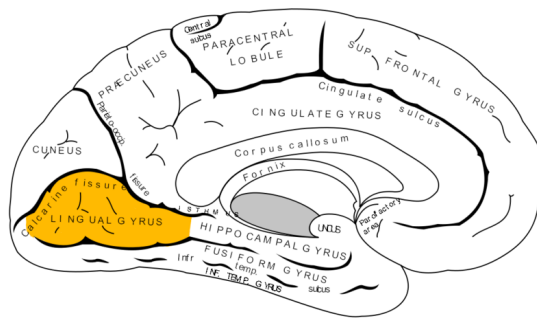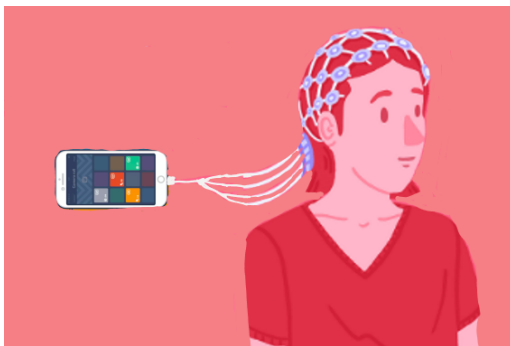

[Figure 1]

Lingual Gyrus
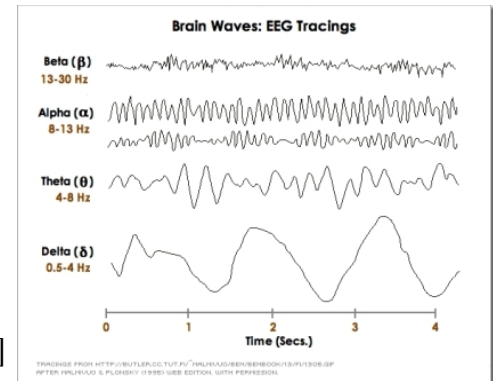
[Figure 2] Brain Waves Chart

2. Creation of device

   We want to create a device that is functional and practical for people to use. This means it needs to be comfortable since the user will wear it while sleeping. Our design will be a nightcap with an EEG scanning device implemented in it. The device will plug into a phone or other viewing device so the scans are recorded and the videos can be uploaded. This will most likely be through an app where our EEG software can use the user's input and create the dream video. Below is a picture with a tentative design of our product.

[Figure 3] Product Demo Picture

3. Formation of reconstructed dreams

Through our app the user's dreams will be analyzed and formed into a rewatchable video. This will be ready to view as soon as your data is analyzed. Our app will have to be protective of users' data and will require a password to enter the app as it contains personal information. But we can also add an interactive aspect to our app by turning it into a social media platform as well where you can post clips of your dreams and people can watch them and comment or share.

Non-technical Aspects

This product has the potential to have a meaningful impact on the world. Since people are generally interested about their dreams there most likely will be a demand for the product and hit high profit margins. Also, the product is applicable to the general population so we have a huge market of people to sell to. In addition to commercial success, dream recall can help with emotional processing, childhood executive functioning and memory retention [4]. So our device could be useful for mental health purposes or memory loss related injuries. This would make a really positive impact on people's lives and general wellbeing. It could also be a form of connection worldwide if we utilize our app as a social media platform where people can post their dreams and follow other users who have the device. Ethically, we will need to be sure to secure users data since it contains information on their specific brain wave patterns and personal reconstructed dreams. Overall, Sweet Dreamz has the potential to help people with a range of memory related issues and general memory strengthening.

Project Management

While creating this project, it was assessed that the major tasks that needed to be completed in order for this project to succeed were as follows:

1. Research and development
   ○ This would include designing and prototyping.
2. Testing
   ○ The main components that would need to be tested are the effectiveness, safety, and comfort of the product.
3. Financing production and distribution
   ○ Before any progress can be made, we would need to obtain financial support from sponsors and investors.
4. Manufacturing
   ○ Manufacturing this product requires multiple steps. These steps include establishing a manufacturing location, obtaining necessary manufacturing licenses, and establishing a system to ensure we have all the parts needed to continuously build our product.
5. Distribution
   ○ Once the manufacturing system is in place, we will need to find an effective distribution method.
6. Marketing
   ○ In order to promote our product, we will work to create website ads, commercials, and other forms of advertising.

Scheduling

Although many factors will be at play during the development of this project and many things could change, this is a brief outline of our initial schedule for this project to take.

In April 2022	Development and research will begin.
In December 2024	Research and development are finished by the end of 2024 and testing will begin.
In June 2025	Testing is finished by the summer of 2025 and the manufacturing process begins. In addition, production of a commercial and development of website ads begin.
In September 2025	With a manufacturing system in place, the product will start being mass-produced, and all advertisements will be finished.
In October 2025	The first *Sweet Dreams* hit the open American market and the advertisements are released.
In January 2026	*Sweet Dreams* is now available internationally.
In January 2027	With good sales, we can begin to grow the company by building more manufacturing sites and production of a new dream scanning product begins.

Budgeting

Below is our initial cost evaluation for the project. This current cost analysis creates 50,000 units of our product per quarter.

Task	Estimated Cost
Research and Development	10 million USD
Testing and Prototyping	5 million USD
Obtaining parts and components (per quarter)	10 million USD
Manufacturing (per quarter)	5 million USD
Cost of advertising (per quarter)	2.5 million USD

The current cost evaluation results in an estimated cost of 32.5 million for the first quarter and a cost of 17.5 million for every quarter after that. If each unit is sold at $450 and all 50,000 units are sold per quarter, then our total revenue is 22.5 million per quater. Supposing we continue selling the product at this rate, our company will see a profit after ¾ of a year.

- Let x represent the number of quarters the company needs to break even. This is assuming the company spends 32.5 million in the first quarter and 17.5 million every quarter after that. In addition, the equation assumes that the company's revenue is 22.5 million per quarter.
  - $22.5x = 32.5 + 17.5(x-1)$
  - $22.5x = 15 + 17.5x$
  - $x = 3$
  - ¾ = 0.75 years

Facilities and Resources

In order for this company to be operational, our team has concluded that the following facilities and resources will be necessary.

- Facilities
  - Research facility (employees mainly Cognitive psychologists and computer engineers)
  - Manufacturing site (factories)
  - Distribution Facilities
  - Support team facilities
- Resources
  - Factory equipment
  - Inventory management
  - Human resources (for employees)
  - Financial resources (control the company budget)

References

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