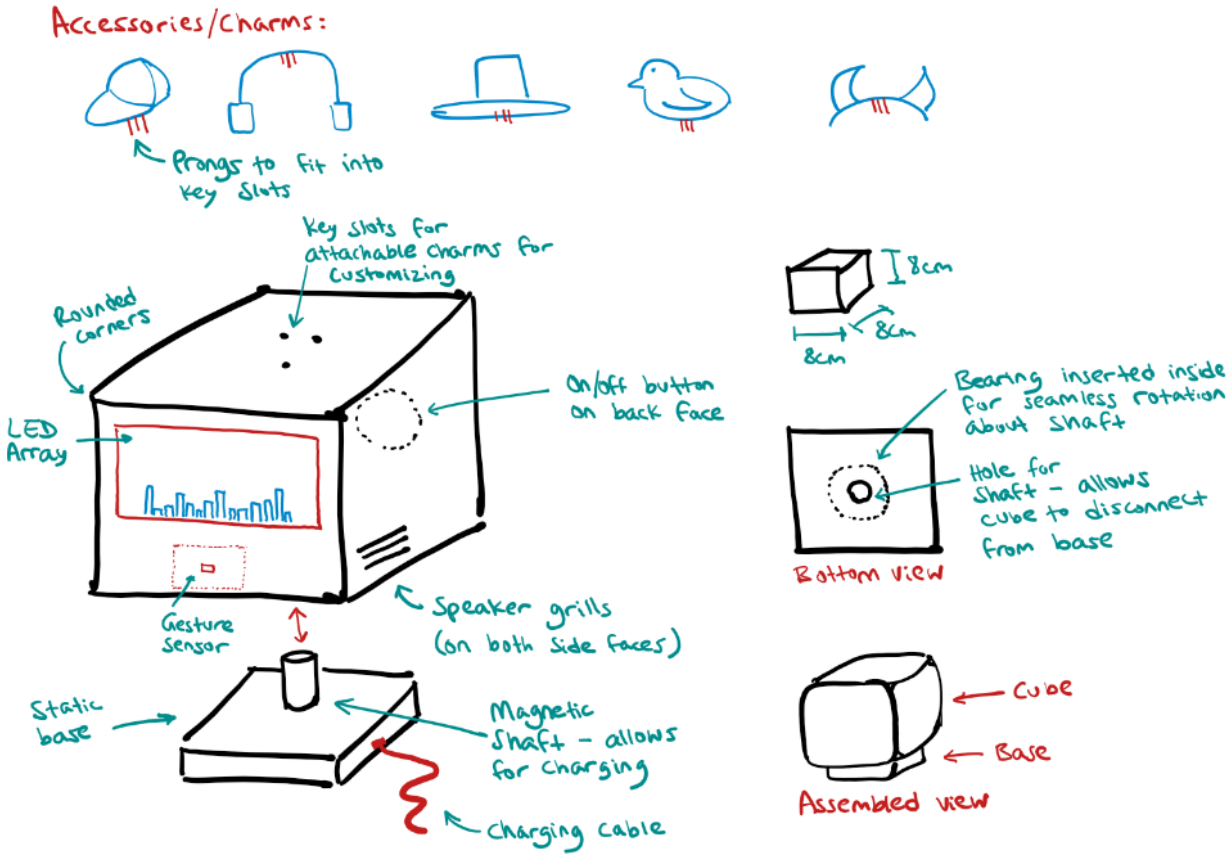
A5 - Product Prototyping and Implementation

Detailed Sketch

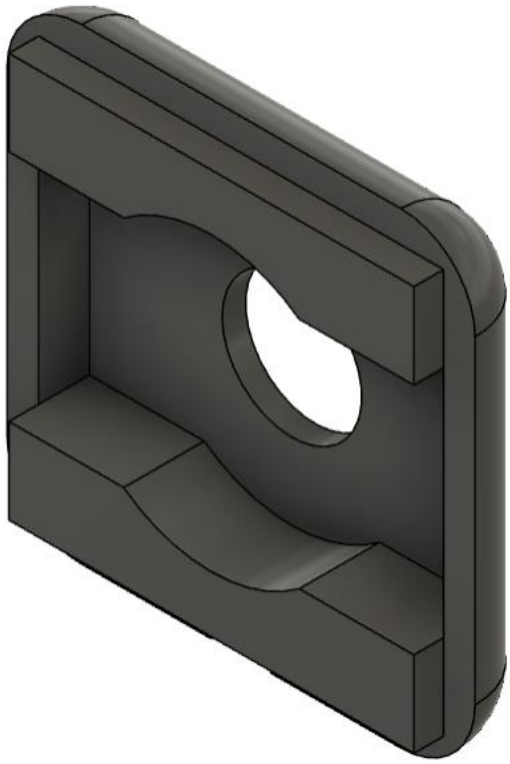


CAD Models

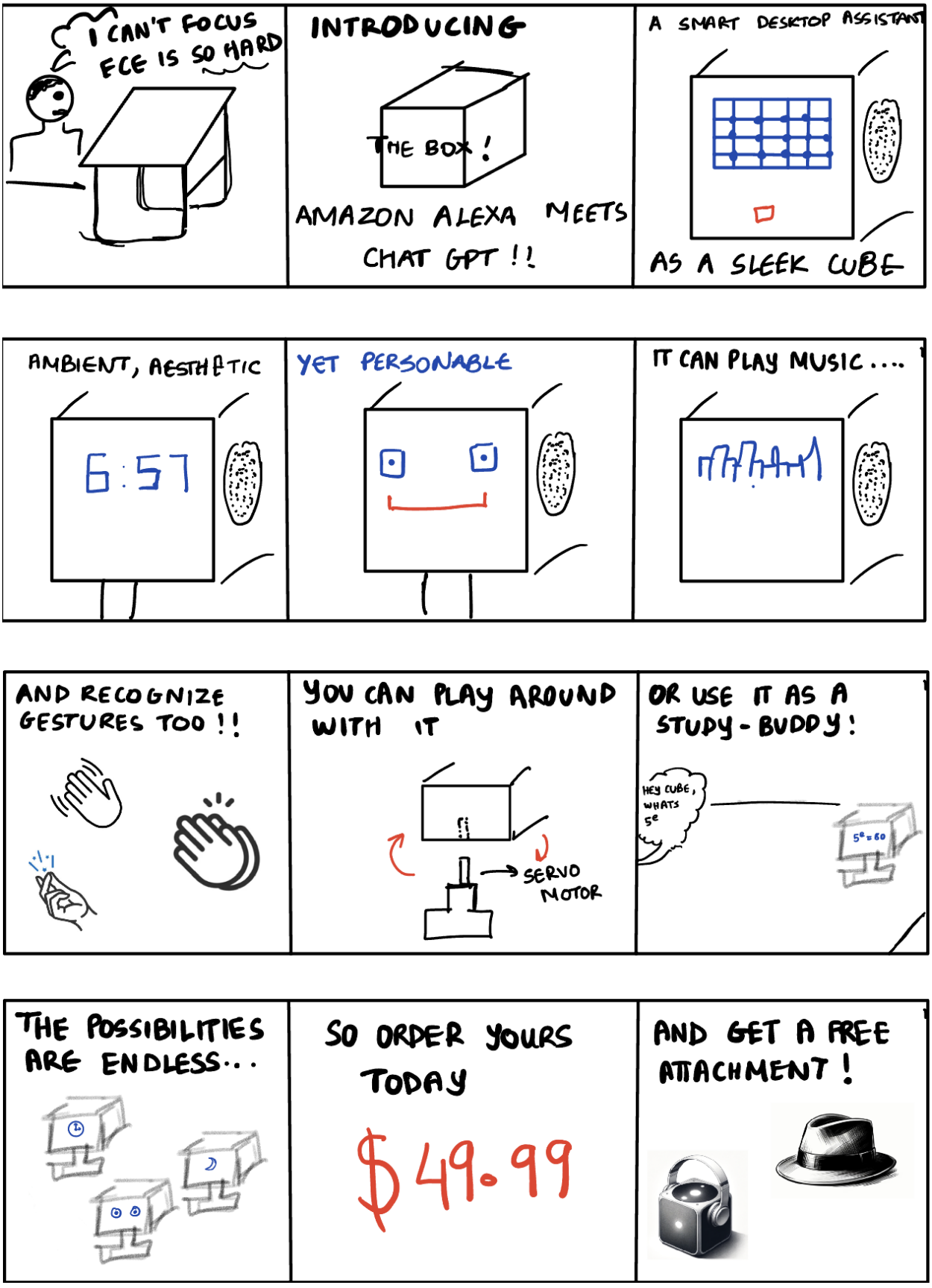
Assembly:

Attachable Accessories:

Individual Parts:

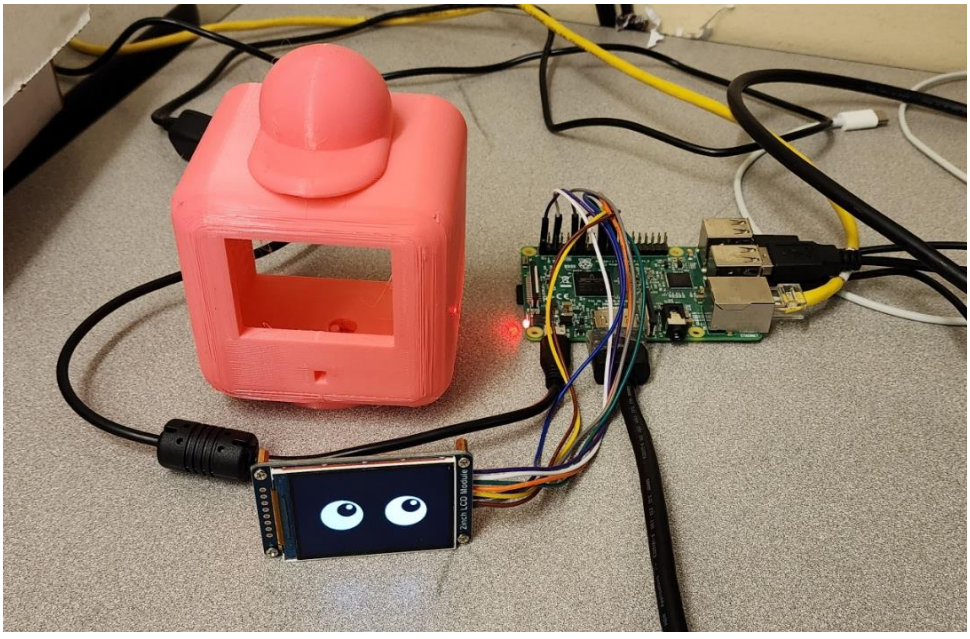
Cube Body:	Cube Back Plate:
	
Base:	
	

Usage Scenario Description



Prototype

Our low-fidelity prototype is physically functional with a working LCD display and capabilities for audio input and output via ChatGPT.



The functionality of our prototype is indebted to several files of code. A few snippets of the programming to develop the AI assistant's personality and conversation functionality can be seen below.

```python
import os
import time
import pyaudio
import speech_recognition as sr
import playsound
from gtts import gTTS

import elevenlabs
from elevenlabs import Voice, VoiceSettings, play, set_api_key, clone


import openai
import uuid
import os
import subprocess
import playsound
import tempfile
```

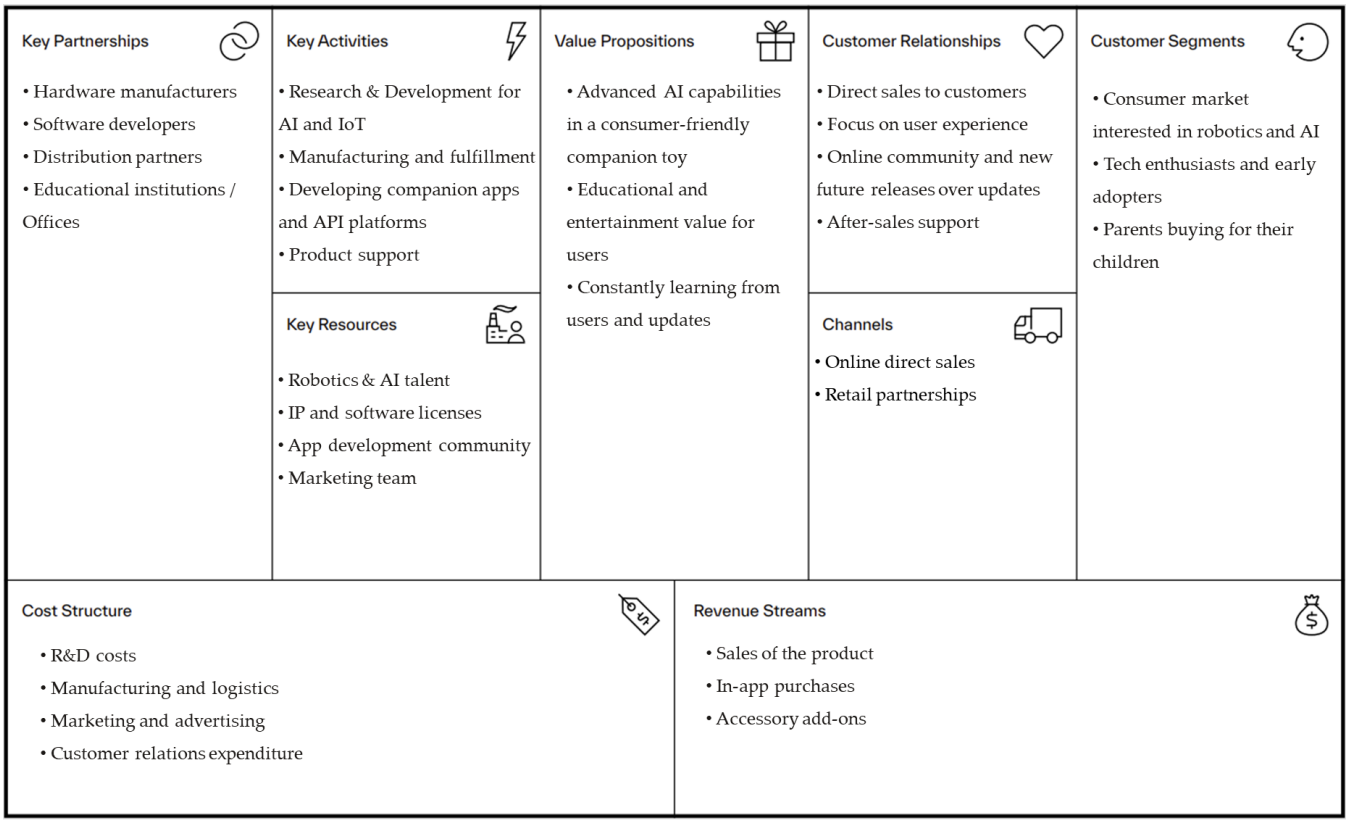
```python
    # Set the initial context for ChatGPT to act like Ted from the movie
    initial_context = "You are like Ted from the movie 'Ted'. Ted's voice, laced with a Boston accent, delivers his lines with a rhythmic sarcasm and a comedic timing that belies t

    while True:
        said = get_audio()
        if said is None or "stop" in said.lower():
            print("Stopping the program.")
            break

        if said:
            try:
                # Include the initial context in every conversation turn
                completion = openai.ChatCompletion.create(
                    model="gpt-3.5-turbo-1106",
                    messages=[
                        {"role": "system", "content": initial_context},
                        {"role": "user", "content": said}
                    ]
                )
                response_text = completion.choices[0].message.content
                print(response_text)
                respond(response_text)
            except Exception as e:
                print(f"An error occurred while trying to process the speech: {e}")

main()
```

Business Model Canvas



User Study

The cube was primarily amongst our largest expected target demographic – college students. Given it is not a high-fidelity prototype, the users were informed of ongoing developments to exclude from their feedback (ex: fitting the Arduino into the cube casing – for testing purposes, we have kept all pieces separate but plan for the final product to be well integrated and sleek. The following feedback was given from a variety of users.

Positive Feedback:

- Sleek design
- Large potential to expand and add new features
- Customization and accessories
- Cheap price
- IoT and AI integration creates the potential to beat similar competitors (such as AI pets or Amazon Alexa).
- Good size
- Friendly face, amiable
- Portable
- Good versatility – can use it for helping with homework, keeping kids entertained, or helping with cooking in the kitchen.
- Fun to talk to
- Easy to play with and fidget with

Negative Feedback:

- Too verbose
- Limited practicality; it will not be the leading utilitarian product of its kind on the market. As a toy, the "problem it is solving" is subjective as "fun" is difficult to quantify.
- Takes too long to talk back
- Base will be expensive since it is a magnetic/wireless charger
- Cheap build quality
- Limited selection of accessories
- Limited functionality as a "toy"; it's just fun to talk to – you can't play games on it or interact with it too much physically as a toy.

Suggestions for Improvement:

- Improve conversations – become more colloquial and less chatty.
- Have it interface with a laptop and do work (write essays, send emails, send texts via phone, etc.)
- Ability to use GPT to control the hardware (motor). For example, ask it to face the sun and it rotates towards the light.
- Become adaptable and learn from user behavior for enhanced experience.
- GPT-4 model on a subscription basis.
    - Partnership with OpenAI to earn commission on every GPT-4 model sold (since a portion of sales go to OpenAI for the GPT-4 subscription)
- Restructure the AI network to avoid creating a new AI token for every model – keep the AI local to the device so that each request doesn't need to be sent and retrieved from the internet. This will improve its conversation speed.
- Ability to become a platform so developers and creators can make apps that leverage our product's hardware to improve its functionality. Creators can receive a commission.
- A weather feature such that the screen is lit up with a color to indicate that day's forecast in a quick and concise manner as soon as someone wakes up. Just from looking at the screen, they know how to dress for the day, can plan to bring an umbrella or not, etc.

Risk Assessment and Future Improvements:

In developing our innovative cube-based toy system, we recognize a spectrum of risks and opportunities for enhancement. This details our approach to mitigating risks while charting a path for future improvements, ensuring that our product remains safe, engaging, and ahead of market trends.

Customer-Centric Risk Mitigation Strategies:

1. **Safety First Approach:** Our cube's design, with smooth edges and robust construction, is inherently child friendly. However, we see room for improvement. Future iterations will explore advanced, child-safe materials, leveraging recent advances in non-toxic, impact-resistant polymers. This will not only make the cube more durable against rough handling but also softer to the touch, reducing any injury risk from accidental impacts.
2. **Enhanced Privacy and Security Protocols:** In an age where digital privacy is paramount, our commitment to protecting user data is unwavering. To this end, we plan to collaborate with leading cybersecurity experts to fortify our systems against emerging threats. This includes implementing state-of-the-art encryption technologies and secure communication protocols to safeguard user data from unauthorized access and ensuring compliance with global privacy standards.
3. **Responsiveness to Customer Feedback:** Regular engagement with our user community will help us identify and address safety, privacy, and usability concerns promptly. This feedback loop will be instrumental in guiding our product improvement efforts, ensuring that we stay aligned with customer needs and preferences.

Future Improvement Initiatives:

1. **Material Innovation and Design Evolution:** Research into new materials and design technologies is expected to yield significant improvements in the cube's durability and user-friendliness. Options include biodegradable plastics and composites that offer enhanced resilience to environmental factors and daily wear tear.
2. **Interactive and Adaptive Features:** The integration of a motor within the cube will mark a significant leap in interactivity, enabling it to respond to

environmental cues and user interactions more dynamically. Coupled with our plan to develop customizable bases, this will allow the cube to adapt its functions and personality according to different settings, such as aiding in educational activities in a child's room or serving as an office assistant.

3. **Platform Development and Open Innovation:** Transforming the toy into an open platform is a strategic move to encourage community-driven innovation. By making our APIs accessible to developers, we aim to cultivate a vibrant ecosystem where third-party applications can add diverse functionalities to the toy. This not only enriches the user's experience but also creates a competitive moat, deterring potential market entrants.
4. **Sustainability and Eco-friendliness:** Recognizing the growing concern for environmental impact, we are committed to making our product as eco-friendly as possible. This includes exploring recyclable materials and energy-efficient electronics, as well as optimizing our manufacturing processes to minimize carbon footprint.
5. **Global Compliance and Standards Adherence:** As we expand into international markets, adhering to diverse regulatory standards becomes crucial. Our product development roadmap includes ensuring compliance with international safety and quality standards, tailoring our product to meet region-specific requirements, and engaging with global regulatory bodies.
6. **Customer Education and Engagement:** To maximize the product's potential and user satisfaction, we plan to invest in customer education initiatives. This includes developing comprehensive user guides, interactive tutorials, and community forums where users can share tips, tricks, and feedback.

In conclusion, our risk assessment and future improvement plan are designed to ensure that our cube-based toy system remains a safe, engaging, and innovative product. Through a combination of customer-centric approaches, strategic product development, and a commitment to continuous improvement, we aim to set new standards in the smart toy industry, delivering exceptional value to our users and stakeholders.

Feasibility and Viability

This section delves into the technical and market feasibility of our interactive cube, examining manufacturing intricacies, market viability, financial planning, and risk management to ensure a holistic evaluation.

Manufacturing Design and Complexity:

1. **Addressing Manufacturing Challenges:** While the cube's minimalist design is aesthetically pleasing and safe, it presents unique manufacturing challenges. Producing the rounded edges and integrating hidden electronics require precision engineering and advanced manufacturing techniques. To address these challenges, we propose the adoption of automated assembly lines and precision molding techniques, which can efficiently handle these complexities at scale.
2. **Material Selection and Cost Analysis:** The use of lightweight, durable polymers is crucial for balancing safety and ergonomics. However, sourcing these materials at a reasonable cost is a challenge. We plan a comprehensive cost analysis, exploring various suppliers and materials to find an optimal balance between quality and affordability. This approach will ensure that we maintain our competitive pricing while not compromising on the cube's quality.
3. **Scalability and Supply Chain Robustness:** A robust supply chain is pivotal for scalability and meeting market demands. Our modular design offers flexibility in production and customization, but it also necessitates a dynamic supply chain capable of handling diverse components and rapid changes in production volumes.

Target Audience and Market Research:

1. **Detailed Market Research for Product-Market Fit:** To validate the cube's appeal to our target demographic (users aged 10 and above), we have conducted extensive market research. Surveys and focus groups with potential users indicate a strong interest in interactive, educational tech toys. Additionally, our market analysis reveals a growing trend in STEM-based learning tools, positioning our product at the intersection of education and entertainment.
2. **Competitive Landscape and Differentiation:** Our competitive analysis underscores the sparse AI tech-toy market, providing us a unique opportunity to position the cube as a pioneering product. We differentiate our offering through its advanced AI capabilities, customization options via interchangeable bases, and potential educational value, appealing to both leisure and learning contexts.

Financial Strategy and Risk Management:

1. **Balanced Pricing Strategy:** Our financial strategy focuses on balancing production costs with market competitiveness. This includes exploring revenue streams such as selling additional bases and offering a subscription model for enhanced AI functionalities. The goal is to position the product as an affordable, high-quality option in the tech-toy market.
2. **Funding and Capital Acquisition:** We plan to explore various options, including venture capital, crowdfunding platforms like Kickstarter, and angel investors. This diverse funding approach will provide us with the necessary capital to scale production and marketing efforts.
3. **Risk Management and Future Improvements:** We recognize the importance of continually addressing risks related to technology, market dynamics, and production. This includes enhancing cybersecurity measures, given the product's internet connectivity, and exploring non-internet-connected alternatives for features like camera integration to eliminate privacy concerns. Future improvements will focus on material durability, advanced cybersecurity, and developing the cube as a platform for third-party applications. The concept of creating an adaptable ecosystem with interchangeable bases also presents significant potential for market differentiation and growth.

In summary, our comprehensive evaluation indicates strong feasibility and viability for the interactive cube. With a strategic approach to manufacturing challenges, in-depth market research validation, a balanced financial strategy, and proactive risk management, we are confident in the product's potential to make a significant impact in the tech-toy market.

Circular Design

Incorporating circular design principles into the development of the interactive cube can significantly enhance its sustainability, longevity, and overall environmental impact. Circular design focuses on creating products that are more durable, reusable, recyclable, and environmentally friendly. This approach not only aligns with global sustainability goals but also addresses the growing consumer demand for eco-friendly products. Here are how the principles of circular design could be applied to the interactive cube:

1. Sustainable Material Selection:

- **Biodegradable and Recyclable Materials:** Replace traditional polymers with biodegradable plastics or recyclable materials. This shift ensures that at the end of the product's life cycle, its components can either decompose naturally without harming the environment or be recycled into new products.
- **Eco-friendly Electronics:** Consider using components that are not only energy-efficient but also made from recycled materials. This includes the PCB (Printed Circuit Board) and other electronic components.

2. Modular and Repairable Design:

- **Ease of Disassembly and Repair:** Design the cube in a way that parts can be easily disassembled and replaced. This modular approach not only makes the product more repairable but also allows users to upgrade certain components instead of replacing the entire product.
- **Standardization of Components:** Utilize standardized parts where possible. This reduces manufacturing complexity and makes it easier for users to find replacement parts.

3. Product Life Extension:

- **Durable Design:** Enhance the durability of the cube to extend its lifespan. This can be achieved through robust design practices and the use of high-quality materials that can withstand wear and tear.
- **Software Updates:** Continuously update the cube's software to ensure it remains functional and relevant over a longer period, reducing the need for hardware updates.

4. End-of-Life Strategy:

- **Take-Back Programs:** Implement take-back or recycling programs where consumers can return the cube once it is no longer needed or functional. This ensures that the materials are either reused or recycled.

- **Recycling Instructions:** Provide clear instructions on how to recycle the cube. This could include information on separating different materials and where to send or drop off the product for recycling.

5. Sustainable Manufacturing Processes:

- **Energy-Efficient Production:** Optimize manufacturing processes to minimize energy consumption. This could involve using renewable energy sources in production facilities.
- **Waste Reduction in Manufacturing:** Implement manufacturing practices that reduce waste, such as lean manufacturing techniques or closed-loop systems where waste products are reused.

6. Eco-friendly Packaging and Distribution:

- **Sustainable Packaging:** Use packaging materials that are either recyclable or made from recycled materials. Additionally, design packaging to be minimalistic to reduce waste.
- **Efficient Distribution:** Optimize planning to lower carbon emissions associated with transportation. This can be achieved by localizing production or using carbon-neutral shipping methods.

7. User Engagement and Education:

- **Educational Initiatives:** Educate users about the sustainable features of the product and how they can contribute to its circular lifecycle, such as proper recycling practices.
- **Community Involvement:** Engage with the community for feedback on improving the product's sustainability and to raise awareness about the importance of circular design.

By integrating these circular design principles, the interactive cube can significantly reduce its environmental footprint while offering a sustainable, user-friendly, and durable product. This approach not only aligns with modern sustainability practices but also caters to a growing market segment that values environmental consciousness in their product choices.

References

1. OpenAI. 2022. OpenAI GPT-3 (Version 3.5). Retrieved from https://www.openai.com/models/gpt-3
2. Google AI, "Google Text-to-Speech Python API, Retrieved from "https://cloud.google.com/text-to-speech/docs/reference/libraries/python
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