**Project Constraints Essay**

**CS Senior Design**

**Group: Vision Vanguards**

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**Introduction**:

The development of a karaoke web app involves a multitude of considerations and challenges. Beyond the technical aspects, several topical areas introduce constraints that can impact the viability and ethical implications of the project. In this essay, we will explore some primary constraint topical areas and discuss their relevance to the project.

1. Economic Constraints:

Economic considerations play a pivotal role in the development of any project. In the context of our karaoke web app, several economic constraints need to be addressed:

a. *Budgetary Limitations:* The availability of funds significantly influences the choice of technologies, tools, and resources for the project. Whether the project is funded personally, by a company, or through other means, it will impact the scope and quality of the final product. Relying on freeware or open-source solutions may reduce costs, but they may come with limitations in terms of features and support. A lot of software is now open-source, free to use to the public, however, if the software needed for the project is not open-source, then that software will be bought out of pocket from the authors listed above. Another constraint is the possibility that a laptop being used for this application does not have a webcam built into it. A separate webcam may need to be purchased out of pocket from the authors listed above to combat this constraint.

b. *Scalability and Maintenance Costs:* As the project aims to provide a user-friendly and engaging experience, scalability is crucial. The choice of database solutions, whether local or cloud-based, must align with the project's budget. Scaling up to accommodate a large user base can be costly, and these ongoing maintenance expenses must be factored in.

c. *Economic Impact:* Consideration should also be given to how the project may contribute to economic development. For instance, if the app becomes successful, it may create opportunities for content creators, musicians, and developers, potentially fostering economic growth in the entertainment and tech industries.

2. Ethical Constraints:

Ethical considerations are paramount when developing a karaoke web app, as it directly influences users' experiences and moral implications:

a. *User Engagement and Well-being:* The project should prioritize user well-being by providing a positive and enjoyable experience. This includes ensuring that the scoring system is fair and transparent, and that the app does not induce negative emotions or behaviors. Ethical concerns also extend to issues such as cyberbullying and harassment prevention, as these can arise in user interactions.

b. *Content Rights and Intellectual Property:* Incorporating song lyrics and music into the app raises ethical concerns related to intellectual property rights. Developers must ensure they have the necessary licenses and permissions to use copyrighted material. Unauthorized use could result in legal repercussions.

3. Security Constraints:

Security is a critical aspect of the project, given the potential risks associated with web applications:

a. *Data Security and Privacy*: Users' personal information, including registration data and performance recordings, must be securely stored and protected from unauthorized access. Breaches of data security can have severe legal and ethical implications. Since the karaoke application has a video component, security of the users is of top priority. Users will want to be assured that the video feed inputted into the application will not be saved in any way and will not be distributed. Privacy of users’ video feed is a major constraint for this karaoke application. Protecting user data, particularly vocal recordings in the case of audio processing, from unauthorized access and breaches is crucial. Ensuring the integrity and confidentiality of user data while also safeguarding the app against various other threats is not reasonably within the scope of this project, but we must at least implement some basic security measures to mitigate this.

b. *Malware and Cybersecurity Threats:* The project must be developed with security in mind to prevent the spread of malware, data theft, and other cybersecurity threats. The integration of third-party APIs for features like scoring and leaderboard could introduce vulnerabilities if not properly managed.

4. Professional Constraints:

Using computer vision in a senior design project is a risky move because University of Cincinnati does not have a computer vision course. This means that the learning of this component for the karaoke application will be strictly learned from scratch without the help of a structured class format. Online forums and articles are going to be the main method of learning.

5. Legal Constraints

The primary concern with audio processing for the karaoke app are the potential legal concerns with the music that we use. Compliance with copyright laws regarding the usage of songs and their lyrics is critical to avoid infringement issues. Licensing agreements with publishers and artists or their representatives are things that are simply unfeasible and out of the scope of this project, which may severely limit the diversity of musical choices that we can include in the project.

6. Diversity and Cultural Constraints

One of the major challenges of this portion of the project is ensuring that the audio processing algorithms we use cater to a diverse range of vocal styles and pitches. While it would be very easy to simply tell users to match the song exactly, we feel that this is not in the spirit of the karaoke app that we wish to design. As a result, ensuring that all users can sing all songs and have a shot at a good score is paramount, and ensuring that there is no bias in accent or pitch is very important, but also a difficult constraint.

**Conclusion:**

In conclusion, the development of our karaoke web app is a multifaceted endeavor characterized by economic, ethical, and security constraints that demand meticulous attention. These constraints necessitate strategic planning, prudent budget management, ethical mindfulness, and robust security measures to create a user-friendly and ethically responsible application. Balancing these constraints will be pivotal in determining the project's success and its broader impact on users and the community.

Moreover, incorporating webcam access in our application poses significant security considerations, particularly regarding the privacy of user video feeds. Safeguarding this aspect remains a top priority throughout the development process. Additionally, the integration of complex algorithms for computer vision and addressing associated challenges require extensive research and thorough comprehension of the material.

Furthermore, the introduction of audio processing technologies introduces a host of potential constraints, including legal, security, and diversity considerations. These constraints will be diligently addressed through extensive research, brainstorming, and rigorous testing to effectively mitigate potential issues. The project team is committed to overcoming these challenges to deliver a karaoke web app that not only meets technical expectations but also adheres to ethical standards, ensures user data protection, and promotes inclusivity.