Project group number, member names and zIDs

Group 8
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Project overview (max 200 words)

As technology advances, the demand for sophisticated audio applications grows. Custom hardware, particularly Field Programmable Gate Arrays (FPGAs), play a crucial role in meeting the specific requirements of advanced audio processing. In this project, we worked as a group of three to implement a custom microphone system using an FPGA-based Multiprocessor System-on-Chip (MPSoC) - the Xilinx Kria KV260. This project consisted of two previous milestones that focused on a) getting the data from the microphone, and b) saving the data as a wav file. Details on the final milestone will be discussed below

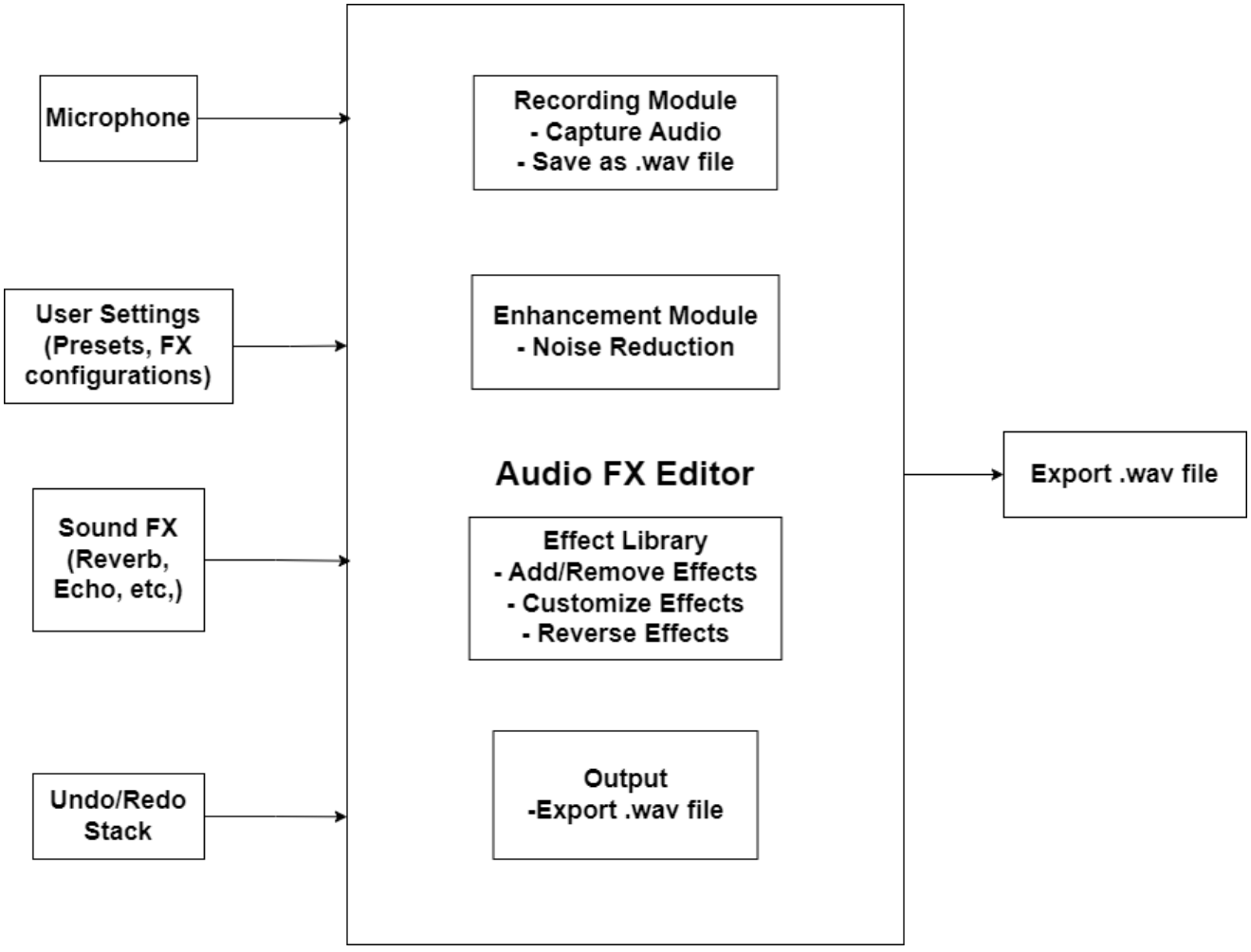
Current vision for Application - i.e. what do you think you will want to make (max 300 words)

The current vision for the project is to create an Audio FX Editor. This would allow users to record some audio and add any audio effects we plan to implement - such as pitching it up or down. Below is a list of our key features…

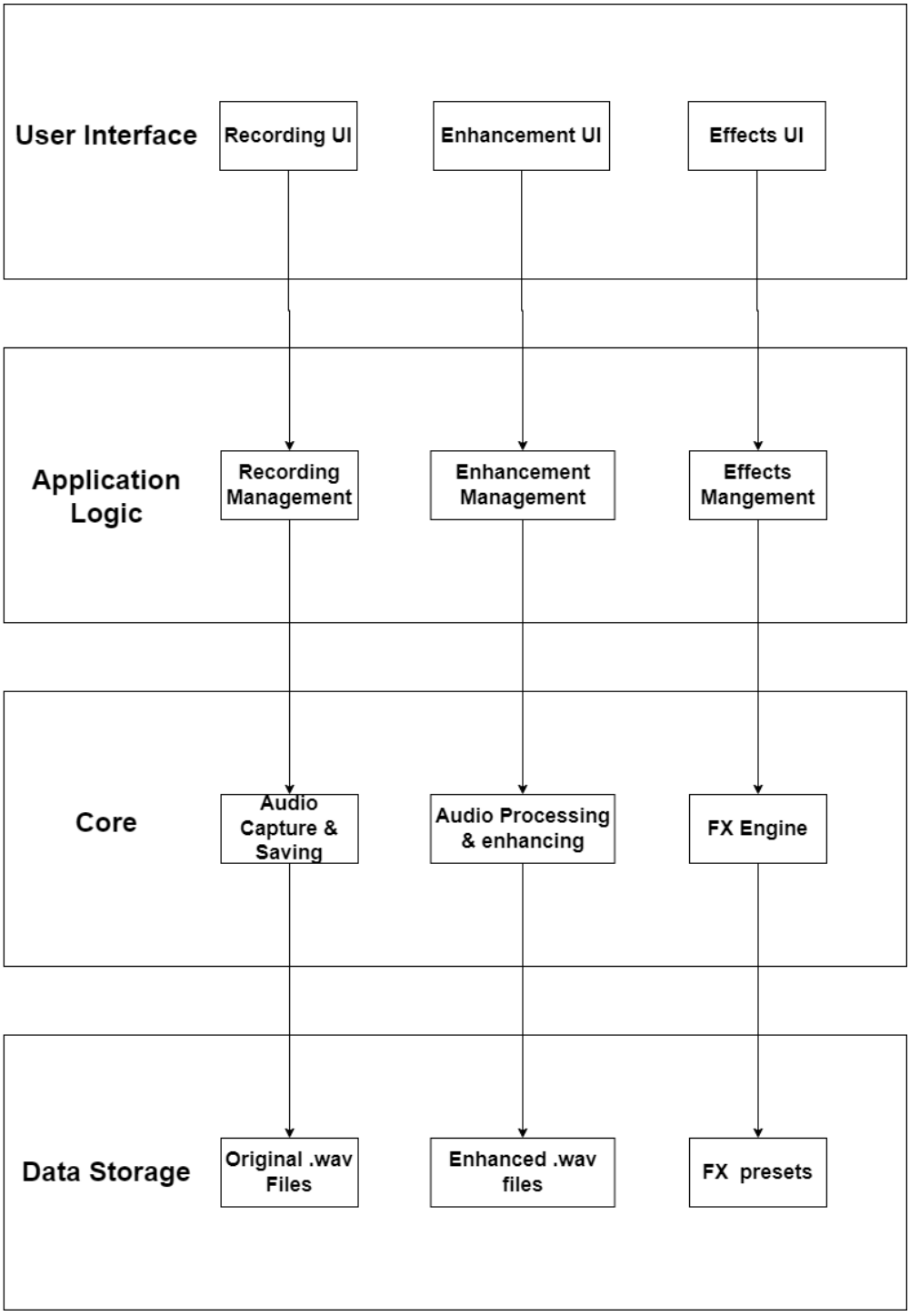
Key Features:

1. Microphone to WAV: Directly record sound via a microphone and save it instantly as a high-quality WAV file.
2. Diverse Sound FX Library: Access a vast collection of sound effects to apply to your WAV files, from spatial effects like reverb and echo to creative distortions and filters.
3. Reverse Effects: Experiment with your sound by reversing the applied effects, adding a unique dimension to your audio projects.
4. User-Friendly Interface: An intuitive interface that simplifies the complex process of audio editing, helping user to navigate through the features with ease
5. Non-Destructive Editing: Edit freely without the worry of losing your original recordings; all effects are applied non-destructively.
6. Customizable Presets: Save your settings as presets for quick application in future projects, ensuring efficiency and consistency.

A 1-page high-level "system diagram" which shows all completed aspects of your project + the future planned aspects



A 1-page "architecture diagram" which shows components of your project + the future planned aspect



Explanation of project plan diagrams

User Interface (UI):

- Recording UI: Where the user initiates and monitors audio recording.
- Enhancement UI: Where the user selects and applies various enhancements to the recorded audio.
- Effects UI: Where the user browses, selects, and configures audio effects, and accesses the reverse effect functionality.

The program will start with the person recording their audio after pressing a ‘start’ button. There will be a menu screen that allows the user to choose their preferred settings. Then they press an on-screen ‘Add Chosen Effects’ button and the adjusted .wav file will be saved in the same location as the original.

Application Logic:

- Recording Management: The logical component that manages the recording operations, invoking the core engine for audio capture.
- Enhancement Management: Manages audio quality improvements, relaying user preferences to the core processing engine.
- Effects Management: Controls the selection and application of effects, including the reversal of effects, by interacting with the FX engine.

This is the link between the two other parts. This sends the information about the effects chosen by the user to the core engine, where these choices are put into action.

Core Engine:

- Audio Capture & Saving: This core component handles the direct audio capture from the microphone and saves the data as WAV files.
- Audio Processing & Enhancement: The processing component applies enhancements to improve audio quality based on defined algorithms.
- FX Engine & Reversal: This engine applies the selected effects to the audio and also handles the reverse processing.
- Data Storage:
- Original WAV Files: Stores the initial raw audio files as captured from the microphone.
- Enhanced WAV Files: Saves the enhanced audio files post-processing.
- FX Settings: Retains the user's settings for effects, including custom presets and configurations.

This focuses on the continuation of the M2 and M3 logic. The logic of the working M3 that saves the data from the microphone must be adapted to write code that allows for the new wav file to have data written into it and saved. Since the data is being changed

however, it is more in depth than milestone 3, with each bit within the data sample needing to be adjusted.

Plan to complete the project, with tasks and assignments

Task 1: User Interface Development - Alyssa
Aim: To create an intuitive and visually engaging user interface that allow users to interact seamlessly with the recording, enhancement, and effects features of the software

Outcome: This task is completed once a fully functional UI, including Recording UI, Enhancement UI and Effect UI. Each of them provides a comprehensive set of controls and visual feedback mechanisms to simplify the user's interaction with the software. The UI should be user-tested to ensure ease of use and should adhere to modern design standards for accessibility and responsiveness.

Task 2: Application Logic Implementation - Zixiao
Aim: To develop the application logic that acts as the intermediary between the user interface and the core engine. This includes implementing the recording management, enhancement management, and effects management modules.

Outcome: Robust application logic that accurately processes user commands, manages audio data flow, and ensures non-destructive editing capabilities. This logic will facilitate the application of audio enhancements and effects according to user adjustments and presets. This task is completed when smooth and efficient data handling is completed, i.e. you can see that the user choices are being sent to the 'backend' via a print statement in the terminal displaying the choices.

Task 3: Core Engine and Data Storage Construction - Dhruv
Aim: To build the core audio processing engine that will handle audio capture, processing, enhancement, and effect application. Additionally, to establish a reliable data storage system for managing the various audio files and settings.
Outcome: A high-performance core engine capable of executing real-time audio capture and processing tasks with low latency and high fidelity. The data storage system should offer efficient data retrieval and storage solutions for raw, enhanced,and effect-applied audio files, as well as user settings for various effects. The outcome should ensure data integrity and provide a foundation for potential scalability and feature integrations. You can tell this section is complete when the new, final .wav file is playing with the desired effects.

Justification of plan - why should you be "funded" / this product be "sold"? Aim for 300 words.

The Audio FX Editor software represents a significant leap forward in accessible audio enhancement technology. This software is strategically positioned to meet the growing demand for high-quality audio content, which is pivotal in media production, content creation, and the burgeoning podcast industry.

Firstly, the ease of use and integration of advanced features within a user-friendly interface make it an attractive investment. By simplifying the complex process of audio editing and effects application, Audio FX Editor can significantly reduce the barrier to entry for amateur and professional audio producers alike. It addresses a key market need: high-quality sound production without the steep learning curve typically associated with professional audio software.

Moreover, the modular design of Audio FX Editor ensures a flexible and scalable solution that can adapt to the rapidly evolving digital media landscape. Whether for individual creators or production studios, the ability to record, enhance, and manipulate audio in real-time presents a robust value proposition. The non-destructive editing and real-time processing features enable users to experiment and iterate on their work without the risk of losing the original content, fostering creativity and innovation.

In an era where content is king, the importance of crisp, clear, and captivating audio cannot be overstated. Audio quality directly impacts audience engagement and retention, and by empowering creators to produce pristine audio, Audio FX Editor will play a crucial role in the content creation pipeline.

Furthermore, the reverse effects functionality opens new doors for sound design, allowing users to craft unique audio signatures that stand out in a crowded marketplace. This feature alone could be a selling point for game developers, filmmakers, and music producers looking to differentiate their sonic landscapes.

Finally, the product's potential for regular updates and the addition of new features provides a future-proof investment. This ensures that consumers have access to cutting-edge audio processing capabilities that keep pace with industry standards and user expectations.

In conclusion, funding Audio FX Editor is not just an investment in software but an investment in the future of digital audio content creation. With its user-centric design, innovative features, and market relevance, Audio FX Editor is well-positioned to capture a significant share of the audio production software market.