Objectives

- Reconstruct the control panel for better usability and interface consistency.
- Debug and enhance core functionalities, including image display, zoom, pan, and file operations.
- Refine and optimize UI layout and controls for improved user interaction and experience.

Activities

1. **Control Panel Reconstruction**
    - Redesigned control panel with the following features:
        - **Position and Layout**:
            - Fixed in the top-right corner, semi-transparent, and collapsible.
            - Collapsible headers for organized sections.
        - **File Operations**:
            - "Load Image" opens a modal dialog for selecting `.txt` files.
            - "Save Image" opens a modal dialog for inputting filename and saving as `.png`.
        - **View Controls**:
            - Zoom slider (0.1x–5.0x) and horizontal/vertical pan sliders.
            - "Reset View" button to fit the image to the viewport.
        - **Image Information**:
            - Displays dimensions, bit depth, range, mean, zoom level, and mouse position pixel values.
            - Displays "No image loaded" if no data is available.
    - Implemented modal dialogs for file operations with:
        - Directory navigation, file selection, and error handling.
        - Blocking interaction outside until closed.
    - Added a dynamically updating status bar for progress and errors.
2. **Debugging and Testing**
    - **Display and UI**:
        - Created an ImGui window for displaying the image.

        - Corrected the image display to grayscale mode by:
            - Configuring OpenGL textures to use a single-channel format.
            - Mapping single-channel values to RGB using a swizzle mask.
            - Adjusting alpha channel to 1.0 for opacity.
        - Forced fixed positions for control and display windows.
        - Prevented main window maximization to maintain layout integrity.
        - Removed the status bar for a cleaner interface.
    - **Save Functionality**:
        - Updated to save images as `.png` using `stb_image_write`.
        - Captured OpenGL framebuffer data using `glReadPixels`.
        - Integrated file dialog for selecting save location and filename.
        - Added feedback for successful saves or errors.
    - **Zoom Functionality (Part 1)**:
        - Replaced the slider with buttons:
            - "-" for Zoom Out (reduces by 10%).
            - "+" for Zoom In (increases by 10%).
            - "Fit to View" for resetting zoom to 1.0x.
        - Debugged issues with zoom application to the OpenGL viewport.
3. **Further UI Refinements**
    - Removed the ImGui window for image display and rendered the image directly in the OpenGL viewport.
    - Updated layout:
        - Control panel on the top, image rendering on the bottom of the control panel.
        - Added spacing and padding for clean separation.
    - Made the control window movable after initial use.
    - Ensured consistent layout, sizing, and visual hierarchy.
4. **Zoom Enhancements (Part 2)**
    - Fixed synchronization of zoom levels between the UI and OpenGL viewport.
    - Unified zoom behavior across:
        - Buttons (+, −).
        - Mouse wheel actions.
        - "Fit to View" functionality.

    - Added zoom limits (0.1x–10x) to prevent excessive zooming.
5. **Pan Functionality**
    - Addressed issues with image disappearance during panning:
        - Reduced panning speed with a `panSpeedFactor`.
        - Optimized event handling for accurate calculations.
        - Tested with adjustable speed for smoother control.
6. **Final UI and Functional Improvements**
    - Simplified the interface to focus on core controls:
        - Two columns: File Operations (left) and View Controls (right).
        - Removed "Reset" button from zoom controls.
        - Consolidated zoom functions into "+" and "-" buttons.
        - Maintained collapsible control panel for flexibility.
    - Enhanced the "Fit to View" feature to reset zoom to 1.0x and center the image.

Achievements

- Successfully reconstructed the control panel for improved usability and flexibility.
- Resolved grayscale display issues, enabling proper image visualization.
- Enhanced file operations with robust error handling and feedback mechanisms.
- Refined zoom and pan functionalities for consistent, intuitive behavior.
- Streamlined UI layout for clarity and simplicity, focusing on essential features.

Problems & Solutions

1. **Problem**: Image displayed in red channel instead of grayscale.
    - **Solution**:
        - Configured OpenGL textures for single-channel grayscale rendering.
        - Adjusted texture settings and applied a swizzle mask.
2. **Problem**: Zoom functionality inconsistencies.
    - **Solution**:
        - Unified zoom behavior across all controls.

        - Fixed UI and OpenGL viewport synchronization issues.
        - Set zoom limits to prevent extreme scaling.
3. **Problem**: Image disappearance during panning.
    - **Solution**:
        - Reduced panning speed with a `panSpeedFactor`.
        - Improved calculations for smooth, accurate movement.
4. **Problem**: Save function lacked `.png` support and feedback.
    - **Solution**:
        - Integrated `stb_image_write` for `.png` encoding.
        - Added file dialog and user notifications for saves.