**OpenGL Engine Modifications for Image Filters**

**Overview**

This project involved modifying the OpenGL engine to implement four image filters: Grayscale, Canny Edge Detection, Halftone, and Floyd-Steinberg Dithering. These filters were applied to the "Lenna" image, and the implementation was structured to be modular and reusable. Below are the changes made to the engine.

**Changes to the Engine**

**1. Created a New File: graphicsFilters.c**

* All filter implementations are located in this file.
* **Filters Implemented:**
  + Grayscale: ConvertToGrayscale, ConvertToGrayAveragescale
  + Gaussian Filters: ApplyGaussianFilter3x3, ApplyGaussianFilter5x5
  + Canny Edge Detection: GradientCalculation, NonMaxSuppression, HysteresisThresholding
  + Halftone: Halftone
  + Floyd-Steinberg Dithering: floydSteinbergDither
* **Utility Functions:**
  + LoadImageToArray for loading images.
  + SaveImage for saving processed images.

**2. Created a New Header File: graphicsFilters.h**

* Contains declarations for all implemented functions.
* Includes libraries: stb\_image.h and stb\_image\_write.h.

**3. Updated the main.cpp File**

* **Menu Integration:** Added a console menu for selecting filters:
  1. Grayscale
  2. Canny Edge Detection
  3. Halftone
  4. Floyd-Steinberg Dither
  5. Exit
* **Image Reloading:** Reloads the original image after each filter is applied to ensure correct results.

**Files Modified**

1. **graphicsFilters.c:** Contains all filter implementations.
2. **graphicsFilters.h:** Header file with function declarations and dependencies.
3. **main.cpp:** Updated to integrate the filters with a menu-driven interface.

**Usage Instructions**

1. **Filters Menu:**
   * Users can choose a filter by entering its number.
   * Processed images are saved in the output directory:  
     C:\Users\aseel\OneDrive\Desktop\BasicOpenGL-main (new)\output\_images\. (you should change the path.. )
2. **Filepaths:**
   * Input image: Lenna.png.
   * Output image names are based on the selected filter (e.g., grayscale.png, halftone.png).

**GitHub Repository:** <https://github.com/Aseel205/computerGraphics>