CS 114 - Final Project
Cel Shading Milestone

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Current Progress

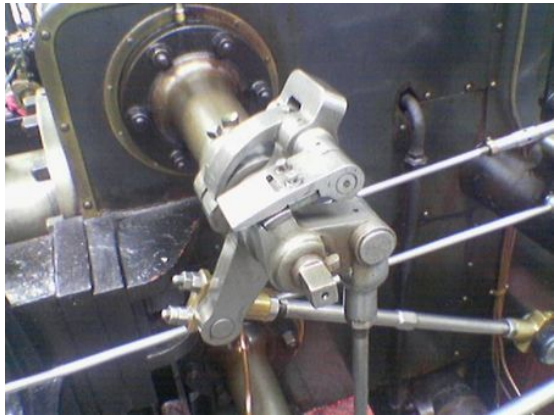
- Utilized Program Assignment 1's code structure as a base
  - Modified UI to accommodate the adjustable parameters of cel shading
- Implemented base version of cel shading
  - Created 3 variations of base version of cel shading, each with different number of bands
- Currently implementing the sobel operator for edge detection
  - Will have to reorganize the shaders to correctly implement the outlines of 3D models

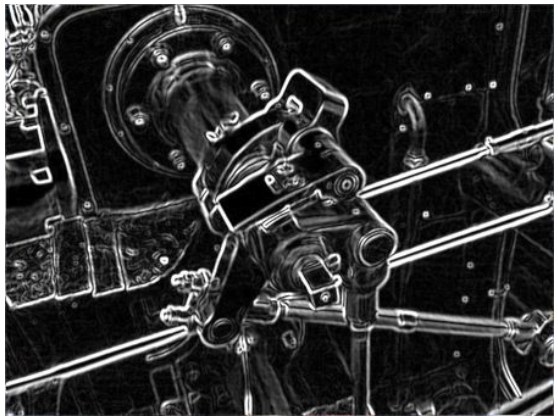
Sobel Operator

- 2D image filter that detects the edges of an image by calculating the differences in pixel intensity in each region.
- The algorithm looks for sharp changes in the vertical and horizontal directions and then combines them.

$$\mathbf{G}_x = \begin{bmatrix} +1 & 0 & -1 \\ +2 & 0 & -2 \\ +1 & 0 & -1 \end{bmatrix} * \mathbf{A} \quad \text{and} \quad \mathbf{G}_y = \begin{bmatrix} +1 & +2 & +1 \\ 0 & 0 & 0 \\ -1 & -2 & -1 \end{bmatrix} * \mathbf{A}$$

$$\mathbf{G} = \sqrt{{\mathbf{G}_x}^2 + {\mathbf{G}_y}^2}$$





Future Goals

- Immediate goals:
  - Include light power to modify cel shading
  - Increase the number of cel bands for further visualization of shader
  - Include more models and create sceneries utilizing 3D objects
- Additional goals if time persists:
  - Implement anti-aliasing to smooth out edges of cel shading
  - Create shadows from 3D model objects
  - Create objects of varying textures to visualize the varying effects of cel shading

Demo