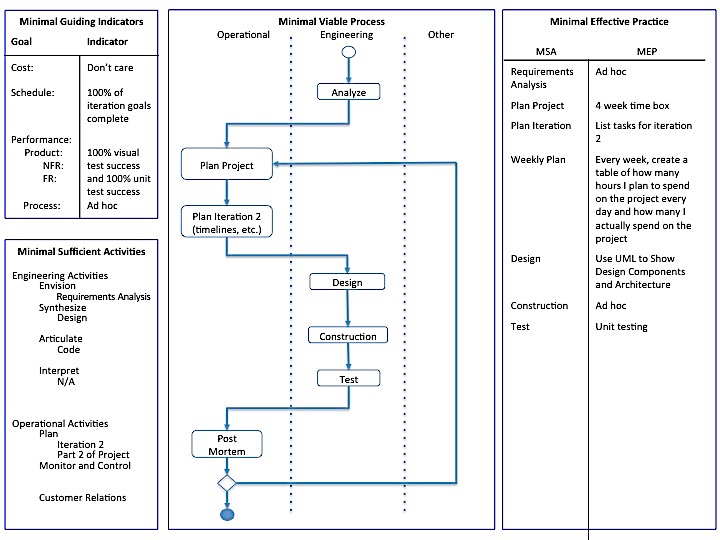
Iteration 4

# Process for Iteration 4



As mentioned in Iteration 3, a weekly plan will be added to this iteration. At the beginning of each week, I will plan how many hours a day I will spend working on the project. Throughout the week, I will also be keeping track of how many hours I actually spend on the project. This Minimal Effective Practice should help with time management. This iteration will be less productive since finals, Christmas, and New Years are all happening.

# Requirements Analysis

The requirements have not changed since Iteration 1. They are as follows:

Given a secret image file and two innocent image files, the tool should

* Be able to read in image files and store the pixel information
* Use the extended visual cryptography scheme to encode the secret image pixels into the two innocent images
* Store the encoded images in new image files
  + The filenames and location can be specified by the user. If not, the files are named share1 and share2 and gets stored on the Desktop.

Given two encoded image files, the tool should

* Be able to read in the files and store the pixel information
* Use the extended visual cryptography scheme to decode the secret image from the encoded images (similar to super imposing them)
* The image revealing the secret gets stored in a new image file
  + The filename and location can be specified by the user. If not, the file is named secretMsg and gets stored on the Desktop.

The visual cryptography tool will only work with PNG and JPEG images. The images involved with the encoding process must have the same dimensions. The tool can handle images of any coloring.

# Plans for Project

Iteration 1 (Sept. 11 – Oct. 9):

* Create a graphical user interface
* Get the tool working for strictly black and white images
* Test the tool to check the quality of the encoded shares and the decoded message

Iteration 2 (Oct. 10 – Nov. 6):

* Research visual cryptography schemes with gray scale images

Iteration 3 (Nov. 7 – Dec. 4):

* Implement the visual cryptography scheme with grayscale images
* Begin researching how to modify the current algorithm to handle color images

Iteration 4 (Dec. 5 – Jan. 1):

* Add the ability to encode and decode multicolor images

Iteration 5 (Jan. 2 – Jan. 29):

* Add unit tests for the components of the visual cryptography tool
* Analyze the tool and look for ways to improve efficiency (performance and memory storage)
* Add features to project to help boost robustness (i.e. add in checks to keep the user from breaking the tool easily)

# Plans for Iteration 4

* Add the ability to encode and decode multicolor images

# Weekly Plans

Week 1:

|  |  |  |
| --- | --- | --- |
| Day | Expected Hours | Actual Hours |
| Saturday, December 5th | 0 | 0 |
| Sunday, December 6th | 0 | 0 |
| Monday, December 7th | 0 | 0 |
| Tuesday, December 8th | 4 | 2 |
| Wednesday, December 9th | 0 | 0 |
| Thursday, December 10th | 0 | 0 |
| Friday, December 11th | 0 | 0 |

Week 2:

|  |  |  |
| --- | --- | --- |
| Day | Expected Hours | Actual Hours |
| Saturday, December 12th | 0 | 0 |
| Sunday, December 13th | 0 | 0 |
| Monday, December 14th | 4 | 0 |
| Tuesday, December 15th | 2 | 0 |
| Wednesday, December 16th | 0 | 0 |
| Thursday, December 17th | 0 | 0 |
| Friday, December 18th | 0 | 0 |

Week 3:

|  |  |  |
| --- | --- | --- |
| Day | Expected Hours | Actual Hours |
| Saturday, December 19th | 0 | 0 |
| Sunday, December 20th | 0 | 0 |
| Monday, December 21st | 0 | 0 |
| Tuesday, December 22nd | 0 | 0 |
| Wednesday, December 23rd | 0 | 0 |
| Thursday, December 24th | 0 | 0 |
| Friday, December 25th | 0 | 0 |

Week 4:

|  |  |  |
| --- | --- | --- |
| Day | Expected Hours | Actual Hours |
| Saturday, December 26th | 0 | 0 |
| Sunday, December 27th | 0 | 0 |
| Monday, December 28th | 4 | 6 |
| Tuesday, December 29th | 2 | 0 |
| Wednesday, December 30th | 2 | 0 |
| Thursday, December 31st | 2 | 2 |
| Friday, January 1st | 4 | 3 |

# Design

Figure 1: UML Diagram from Iteration 1

Note the design has not changed since Iteration 2.

Before changing the Java files to handle the gray scale images, I exported the PlantUML diagram of the visual cryptography tool. Figure 1 shows the class relations.

At the end of Iteration 3, my images were having problems with the embedded pixels blending with the innocent image pixels. In other words, it was obvious something was amiss with the encrypted images. If I was going to just fix the issue with the grayscale images, then I could apply dithering to smooth the pixel coloring. However, I would have to shift from dithering to half-toning with the color images.

Thus, I decided to focus on researching techniques for encrypting color images. The most promising technique I found came from Varalakshmi, R, and Parameswari, and it utilized Visual Information Pixel (VIP) synchronization. VIP synchronization helps hide the secret image pixel information inside the innocent pixels. The process for encrypting a secret image is as follows:

1. Gather and process the two innocent images and one secret image.
2. Half-tone the innocent images using error diffusion.
3. Split the secret image into three images. One image represents only the red concentration of the picture, the second represents the green concentration, and the third represents blue.
4. Perform VIP synchronization on the innocent images and the three secret images.
5. Use error diffusion on the encrypted shares to smooth any pixels that cause the encoded image to look as if they are hiding something.

Decryption for this technique does not require the user to have a computer. The images can be printed on transparencies and stacked to reveal the secret image.

# Construction

No construction was performed during Iteration 4. My focus was on exploring different techniques for encrypting colorful images and half-toning/dithering techniques.

# Test

No unit tests were added during this iteration.

# Post Mortem

Iteration 5 will be used to implement the proposed algorithm in the Design section and add unit testing.

# Resources

[1] Varalakshmi, L., R, P. and Parameswari, R. 2013. Extended Visual Cryptography for Color Images and its PSNR Analysis. International Journal of Computer Applications. 67, 17 (2013), 17-22.