Team Emertxe



Introduction

Steganography What?



A practice of concealing a file, message, image, or video within another file, message, image, or video

Source: Google



Steganography Why?

- Hide secret credentials
- Detect data forgery
- Message Passing etc ..



Where?

- Military
- Intelligence agencies
- On line elections
- Internet banking
- Medical-imaging and so on.



How?

- Physical
- Prints and paints
- Puzzles
- Digital



Digital

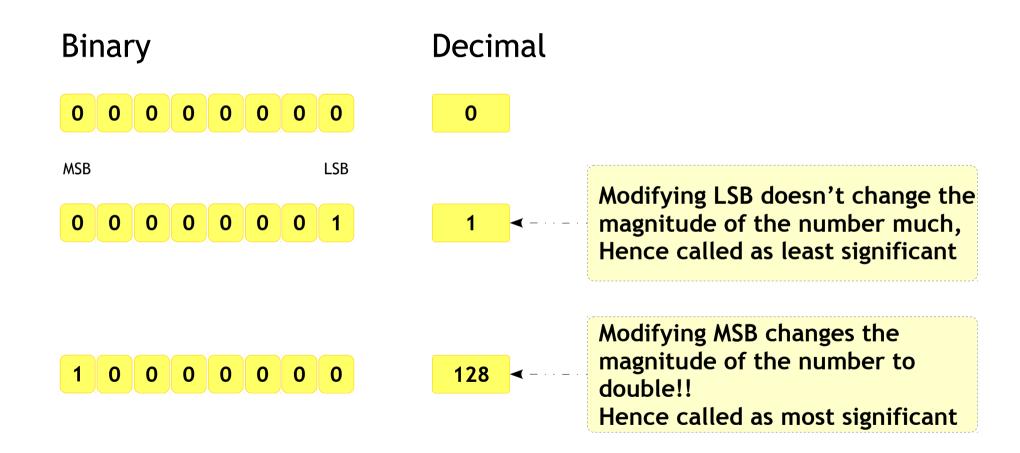


- Though there are different possible methods available, we would go with digital steganography
- In digital method the message is concealed within the lowest bits of images or sound files
- The current project expects us to implement LSB (Least Significant Bit) Image Steganography on a .bmp file
- Next, we need to understand some terminologies before implementation as put in the next slides



LSB







An Image



- A file which contains a picture elements (pixels)
- Fixed number of rows and columns of pixels
- These pixels would be grouped along with different informations and forms a format



An Image - Pixel



- A pixel is the smallest individual element, holding antiquated values that represent the brightness of a given color at any specific point.
- A pixel also can be said as a smallest addressable element in an all points addressable display device; so it is the smallest controllable element of a picture represented on the screen.
- Each pixel is a sample of an original image; more samples typically provide more accurate representations of the original.



An Image - Pixel



- The intensity of each pixel is variable.
- In color imaging systems, a color is typically represented by three or four component intensities such as red, green, and blue (RGB), or cyan, magenta, yellow, and black (CMYK).



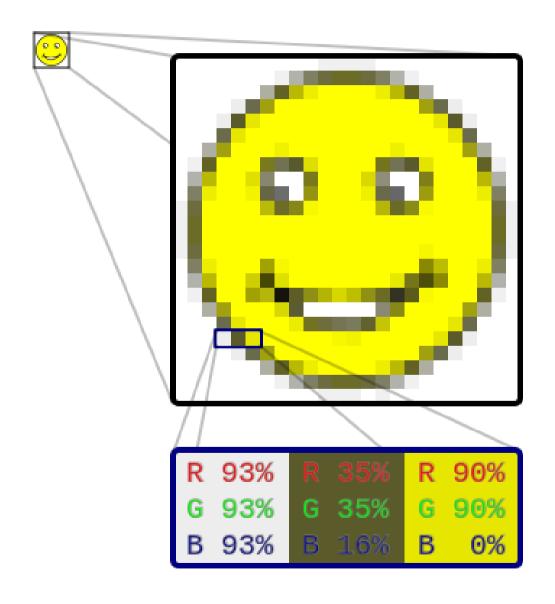
An Image - Format



- Image file formats are standardized means of organizing and storing digital images
- Image files are composed of digital data in one of these formats that can be rasterized for use on a computer display or printer.
- An image file format may store data in uncompressed, compressed, or vector formats.
- Once rasterized, an image becomes a grid of pixels, each of which has a number of bits to designate its color equal to the color depth of the device displaying it



An Image - Format





An Image - Format - BMP



- The BMP file format (Windows bitmap) handles graphic files within the Microsoft Windows OS.
- Typically, BMP files are uncompressed, and therefore large and lossless; their advantage is their simple structure and wide acceptance in Windows programs



An Image - Format - BMP



54 Bytes Header

> RGB Data

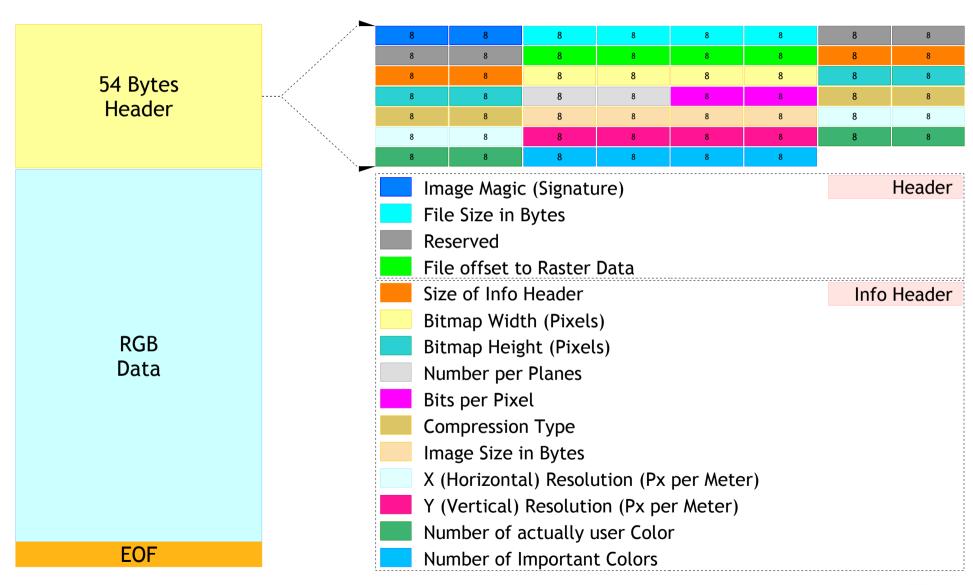
EOF

8	8	8	8	8	8	8	8
8	8	8	8	8	8	8	8
8	8	8	8	8	8	8	8
8	8	8	8	8	8	8	8
8	8	8	8	8	8	8	8
8	8	8	8	8	8	8	8
8	8	8	8	8	8	8	8
8	8	8	8	8	8	8	8
8	8	8	8	8	8	8	8
8	8	8	8	8	8	8	8
8	8	8	8	8	8	8	8
8	8	8	8	8	8	8	8
8	8	8	8	8	8	8	8
8	8	8	8	8	8	8	8
8	8	8	8	8	8	8	8
8	8	8	8	8	8	8	8
8	8	8	8	8	8	8	8
8	8	8	8	8	8	8	8
8	8	8	8	8	8	8	8
8	8	8	8	8	8	8	8
8	8	8	8	8	8	8	8
8	8	8	8	8	8	8	8
8	8	8	8	8	8	8	8
8	8	8	8	8	8	8	8
8	8	8	8	8	8	8	8
8	8	8	8	8	8	8	8
8	8	8	8	8	8	8	8



An Image - Format - BMP - Header

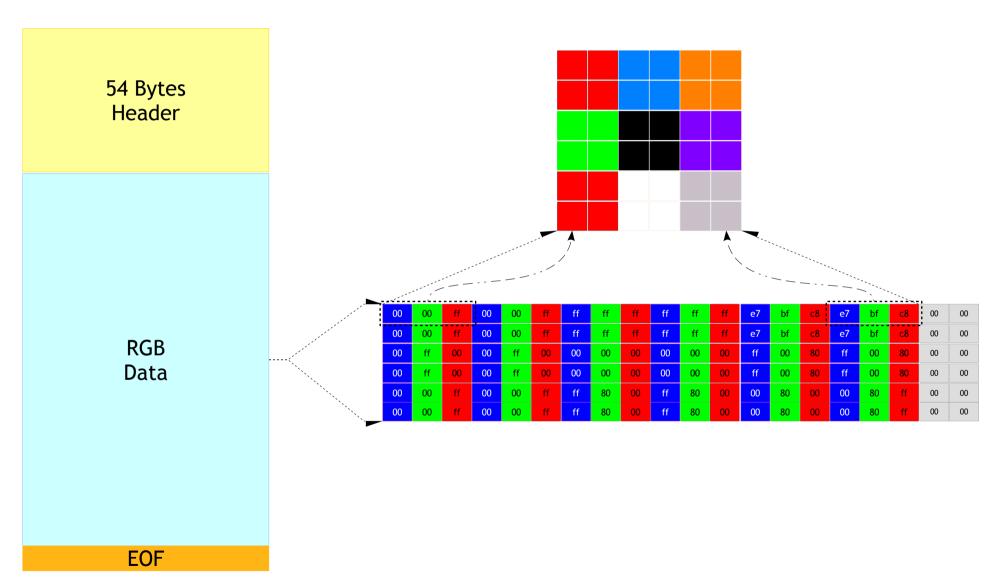






An Image - Format - BMP - RGB Data







An Image - Format - BMP - RGB Data



256x256_red_block.bmp

- The hex file of this image is provided with this slide
- Lets try changing the MSB of the RED element of a Pixel and see the effect
- You may do it as mentioned below

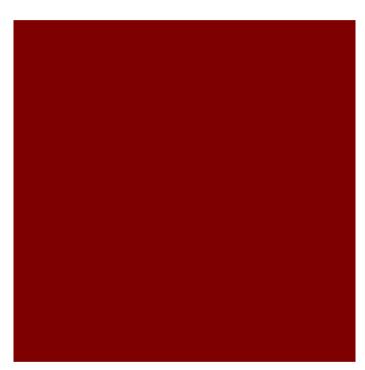
Screen Shot

```
user@user:~] sed -i '33,$s/ff/7f/g' 256x256_red_block.hex user@user:~] xxd -r -p 256x256_red_block.hex test.bmp user@user:~] eog test.bmp
```

You may observe the result



An Image - Format - BMP - RGB Data



256x256_red_block.bmp

- It is evident that by changing the MSB there is a huge difference in output
- Now let's do same by changing the LSB of the RED element of a Pixel

Screen Shot

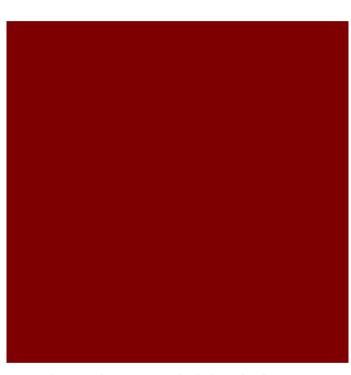
```
user@user:~] sed -i '33,$s/7f/7E/g' 256x256_red_block.hex user@user:~] xxd -r -p 256x256_red_block.hex test.bmp user@user:~] eog test.bmp
```

You may observe the result



An Image - Format - BMP - RGB Data





256x256_red_block.bmp

- Can you find the difference now??
- If yes!! you are super human





Summary



- This project expects us to Encode a message such a way that the quality of the image doesn't change much.
- So from the previous analysis we can do encoding of bits from the message in the LSB of the RGB data



Requirements

Usage - Help



Screen Shot

```
user@user:~] ./lsb_steg
./lsb_steg: Encoding: ./lsb_steg -e <.bmp_file> <.text_file> [output file]
./lsb_steg: Decoding: ./lsb_steg -d <.bmp_file> [output file]
user@user:~]
```



Usage - Encoding

Screen Shot

user@user:~] ./lsb_steg -e SkeletonCode/beautiful.bmp secret.txt

INFO: Opening required files

INFO: Opened SkeletonCode/beautiful.bmp

INFO: Opened secret.txt

INFO: Opened steged_img.bmp

INFO: Done

INFO: ## Encoding Procedure Started ##

INFO: Checking for secret.txt size

INFO: Done. Not Empty

INFO: Checking for SkeletonCode/beautiful.bmp capacity to handle secret.txt

INFO: Done. Found OK

INFO: Output File not mentioned. Creating steged_img.bmp as default

INFO: Copying Image Header

INFO: Done

INFO: Encoding Magic String Signature

INFO: Done

INFO: Encoding secret.txt File Extenstion

INFO: Done

INFO: Encoding secret.txt File Size

INFO: Done

INFO: Encoding secret.txt File Data

INFO: Done

INFO: Copying Left Over Data

INFO: Done

INFO: ## Encoding Done Successfully ##

user@user:~]



Usage - Encoding

Screen Shot

user@user:~] eog SkeletonCode/beautiful.bmp steged_img.bmp &

[1] 4103

user@user:~]



Original File



Encoded File



Usage - Decoding

Screen Shot

user@user:~] ./lsb_steg -e SkeletonCode/beautiful.bmp secret.txt INFO: ## Decoding Procedure Started ##

INFO: Opening required files INFO: Opened steged_img.bmp

INFO: Decoding Magic String Signature

INFO: Done

INFO: Decoding Output File Extenstion

INFO: Done

INFO: Output File not mentioned. Creating decoded.txt as default

INFO: Opened decoded.txt

INFO: Done. Opened all required files

INFO: Decoding File Size

INFO: Done

INFO: Decoding File Data

INFO: Done

INFO: ## Decoding Done Successfully ##

user@user:~] cat secret.txt Kattappa killed Bahubali !! user@user:~] cat decoded.txt Kattappa killed Bahubali !!

user@user:~]



Usage - Error Handling



Screen Shot

user@user:~] ./lsb_steg -e SkeletonCode/beautiful lsb_steg: Encoding: lsb_steg -e <.bmp file> <.txt file> [output file]

user@user:~]

Screen Shot

user@user:~] ls -l SkeletonCode/beautiful.bmp secret.txt

-rw-r-- r-- 1 user user 2359350 Nov 14 17:19 SkeletonCode/beautiful.bmp

-rw-rw-r-- 1 user user 29982720 Nov 14 20:06 secret.txt

user@user:~]

user@user:~] ./lsb_steg -e SkeletonCode/beautiful.bmp secret.txt

INFO: Opening required files

INFO: Opened SkeletonCode/beautiful.bmp

INFO: Opened secret.txt

INFO: Done

INFO: ## Encoding Procedure Started ##

INFO: Checking for secret.txt size

INFO: Done. Not Empty

INFO: Checking for SkeletonCode/beautiful.bmp capacity to handle secret.txt

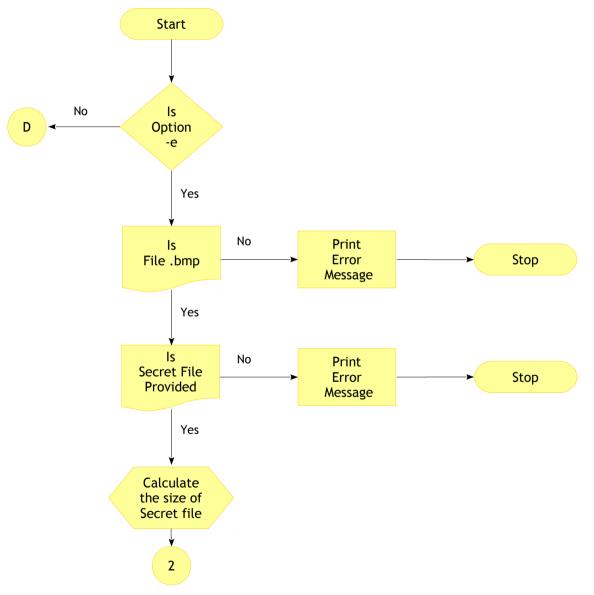
ERROR: "SkeletonCode/beautiful.bmp" doesn't have the capacity to encode "secret.txt"

user@user:~]

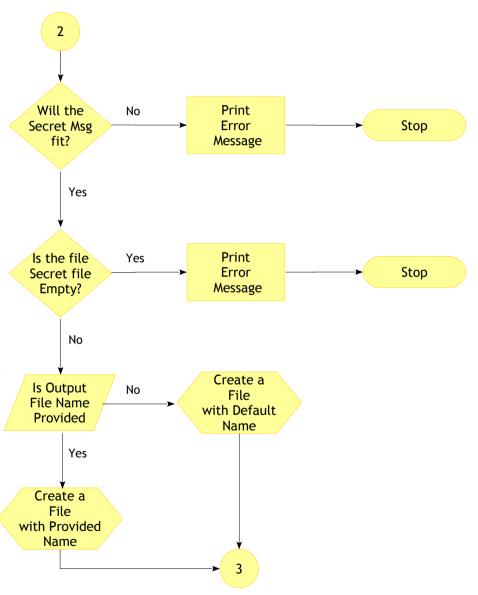
• The above are few, you may handle all possible error.



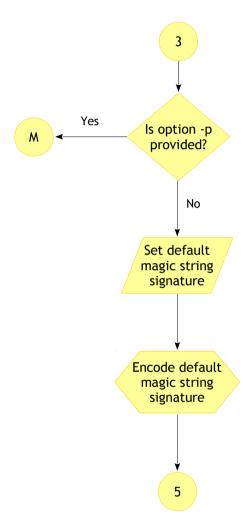
Design



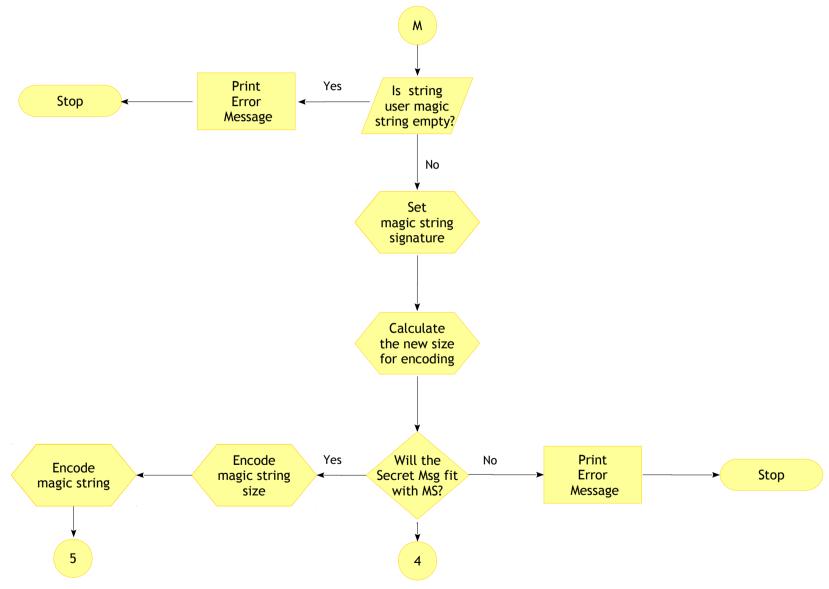




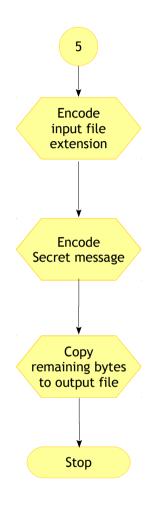






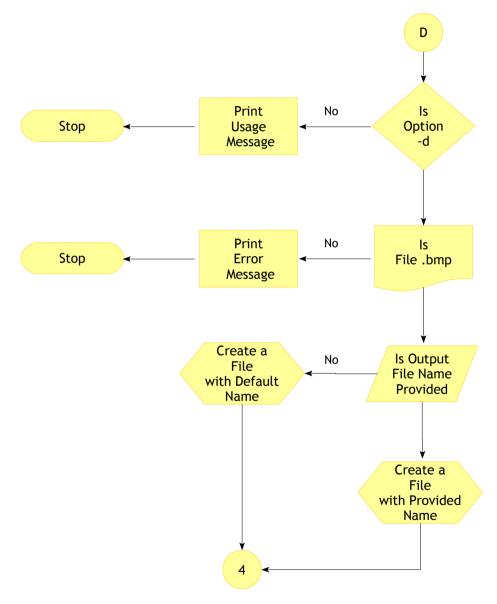






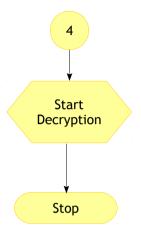


Design - Decoding





Design - Decoding







Code Skeleton

Code Skeleton



Please refer the provided code skeleton with these documents



References

References

- https://en.wikipedia.org/wiki/Steganography
- https://en.wikipedia.org/wiki/Pixel
- Header Informations
 - http://www.ue.eti.pg.gda.pl/fpgalab/zadania.spart an3/zad_vga_struktura_pliku_bmp_en.html
- Image Reference
 - https://engineering.purdue.edu/ece264/15au/hwim ages
 - http://graphicatoz.blogspot.in/

