JAVA Project

2nd Semester

A JAVA Program on hiding image in another image and the process of hiding data into another data is called steganography.

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Steganography

Introduction:

A java program through which you can easily hide any image to any other image of the same size and generate a secret image. You can give this image to anyone but if he/she wanted to check your hidden picture then he/she should have this program to reveal the hidden image from the given image.

I learned this concepts from duke university's javascript course in which they cleared the concept about the steganography then I applied it in Java only by using Java's built-in packages.

For your satisfaction check my certification from here:

1. Java Programming: Solving Problems with Software.
2. Programming Foundations with JavaScript, HTML and CSS

Before going to it's code we should have the domain knowledge of pictures that how can we hide any image in any other image then we will jump on the coding.

Domain Knowledge:

Lets dive deeper in the concepts of pictures. First of all, always remember everything is a number even a picture too. Every picture consists of pixels and a pixel consist of combination of colors. For my project, I chose RGB(Red-Green-Blue) mode because it's simpler to understand then CMYK mode.
It means each pixel color is made up of these 3 colors according to their intensities and these three colors have the range of 0-255. There is also another entity which is Alpha. This is for the transparency of the color not for making colors.
Now before discussing complex topic we should discuss the general concept which helps you to visualize the logic of steganography.

To Get General Concept:

For making things more easier, Lets suppose that these 3 colors (RGB) have the range of 0-99 and for more simplicity just take one color e.g. Red to discuss the concept of steganography.

Lets suppose there are two pixels one having Red Value=34 and other Red Value=72
Think if I remove the non-zero from one's place in 34 then I have 30 and it is not a big change in the picture. No one can see this change with their naked eye. And now I done this same step with another red value which gives me 70. Now I have two values 30 and 70. Now if I want to hide second image having value = 70 in the image having value 30. I can shift the 7 of tenth's place in one's place by dividing it by 10 (70/10=7) and add it in the first image which means 30+7=37 now 37 is the pixel of the secret picture. Now if we want to take the hidden image from this secret message having value 37 then we simply do a modulus to get reminder (37%10=7) and then multiply it by 10 (7x10 =70) then simply we can easily reveal the original image.

Working with real image:

Now you have understood that through this we can easily hide any image in any other but as you know in reality the ranges starts from 0-255 now that's the difficult task that how can we divide it into two.
Think about it and check that if we convert it into binary we will get 8 ones $(255)_{10}=(11111111)_2$
Now we can easily divide it into two parts first 4 bits for main picture and the last 4 bits for hidden picture but now you have to find the way that how can you manipulate with these bits. There are two ways but will discuss only the one which I used in my project.
We can use bitwise operator here to easily manipulate the bits. If you want to remove the last four bits from the main pic as we done in our previous example of removing 4 from 34 then we simply use Bitwise AND operator to get the selected bits only and we only want to take out the first four bits. Lets suppose we have the red value ,of main image, in binary is 0110 0101=RED to take out the four bits

RED & 0xf0

RED = 0110 0101
$(F0)_{16}$ =1111 0000
&_____
0110 000

Now we have taken out the first four bits from the main pic now we have to take out the first four bits from the image to be hidden and shift it to last 4 bits but first we shift 4 bits to left
Lets suppose we have the red value ,of image for hiding, in binary is 0011 0100=RED

Red >> 4
0000 0011

As you see that this has already zero in first 4 bits but that condition is not always true if we have the 1 in left most bit then after left shift we will get ones just like 1000 0101 >> 4 = 1111 1000
For prevention we should use that
RED & 0x0f

Now you have understood the concepts i am not discussing the procedure of revealing because it's same concept which I told.

I hope you understood this concept completely.

If you want to tell this concept to whole class then I am ready to present it completely online. You can ask from me for more info

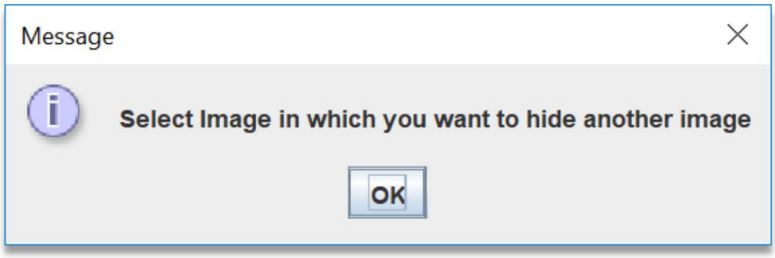
Now lets start the coding and how I use it and it's working.

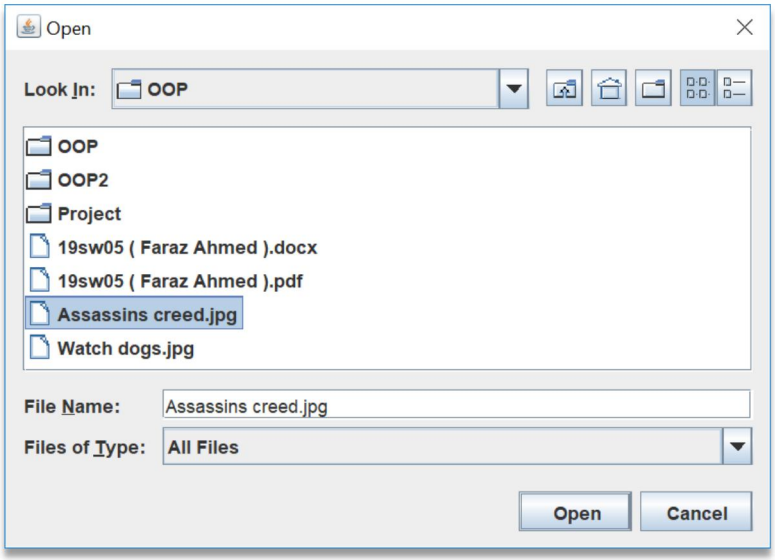
WORKING

1) Simply run this program in cmd by typing `java Sw05`.

2) Then a dialog box appear for selection of the process which you want.

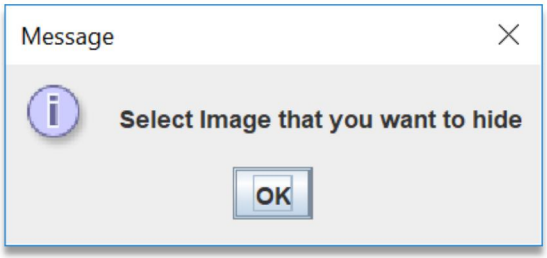
3) First we will hide any image behind another but remember both images should be of same size. Now first we will select the image which we want as a main image in which we want to hide another image. So after confirmation dialogue box a browser dialogue box appear to select the file. And I selected the picture named “Assassins Creed” for main pic.





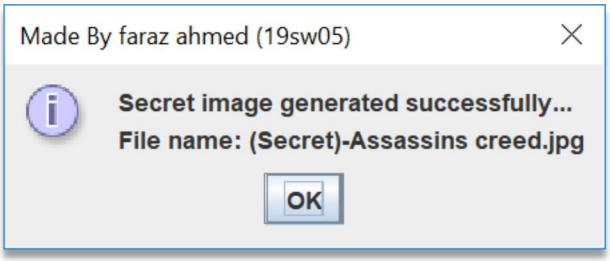
Assassins creed

4) Now same steps for taking an image for hiding named Watch dogs of same size 1920x1080.



Watch dogs

5) Now A secret picture will be generated by the name of Assassins creed with prefix of (secret)- e.g. (secret)-Assassins creed.

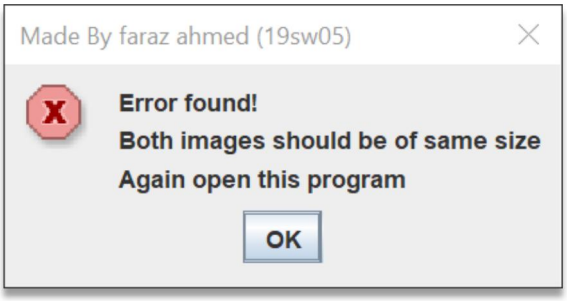


6) Program will be ended and the new file will be created at the destination of my java's class file.

(secret)-Assassins creed

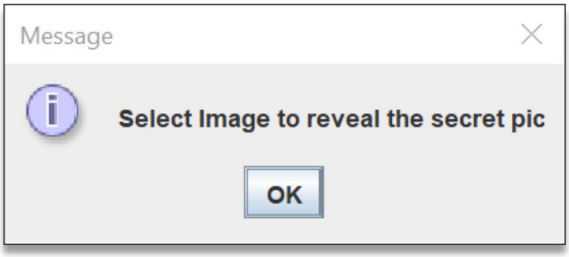
You can find some artifacts in the picture which means here is some message behind it.

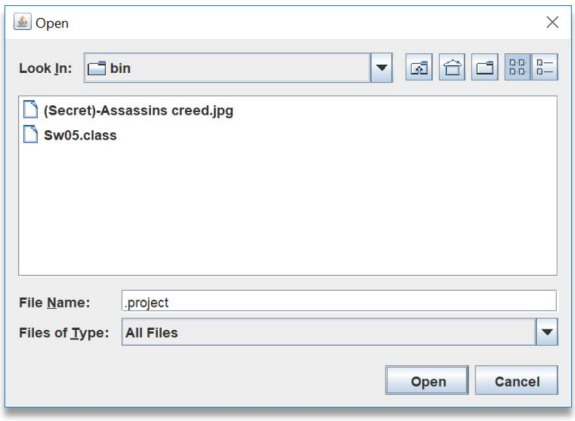
If you choose two files of different sizes or doesn't select any file then the error message will pop-up



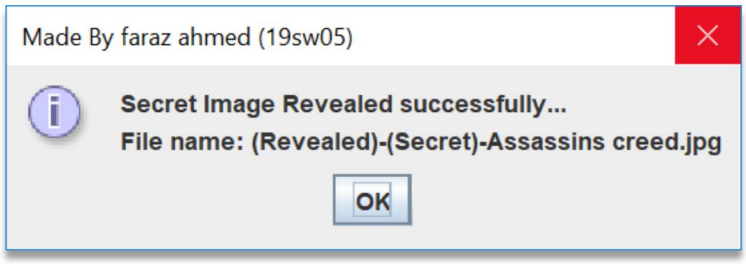
7) Now we will find the hidden picture by selecting the option of "**reveal the hidden image".**

8) Now select the (secret)-Assassins creed to reveal the hidden image.





9) After selecting the image in the filechooser dialogue a message of successful generation of hidden picture will pop-up and a new file will be generated with the same name + prefix of (revealed)-.



(revealed)-(secret)-Assassins creed

And the picture will be successfully generated.

Now let's discuss the code's main points.
I used the io package for taking file input and bufferedimage for dealing with pictures and store it into a buffer memory. First of all I select the file then read the Image file by ImageIO class and assign it to the bufferedimage to deal with it.
And use GUI components for providing easy environment for user.
I want to discuss one thing which is colors. In bufferimage I take ARGB mode A for alpha which discussed earlier above.
As you know integer data type has 32 bits space if we have 4 entities Alpha, Red, Green and Blue each having 8 bits means 8x4=32 bits means and integer data type can easily contain these 4 entities but now we have to take out 8 bits which we want. By the help of bitwise operator same
And simply after manipulating we will combine all the entities by the help of bitwise OR.

I think everything is already cleared because most of the things covered in the domain knowledge.