

**SOFTWARE
ENGINEERING AND PROJECT
MANAGEMENT 18CSC206J**

**IMAGE ENCODING AND DECODING
USING THE ENIGMA PROPERTIES**

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BUSINESS CASE

THE PROJECT

In bullet points, are the problems this project aims to solve or the opportunity it aims to develop.

- The main objective of this project is to present a more secured and computationally efficient procedure of encrypting and decrypting images using the enigma algorithm in comparison to the existing methods.
- To achieve more secured image processing for highly advanced technologies, a proposed algorithm can be the process used in enigma machine for image encryption and decryption. Enigma machine is piece of spook hardware that was used frequently during the World War II by the Germans.
- Even though the pivotal focus is given to safeguarding highly confidential images and videos of government organizations, equal priority will also be given to ensuring the implementation of this projects idea on personal image and video privacy , which shall be achieved by enforcing the same on social media platforms, and thereby ensuring that the right of ownership of pictures or videos are In the hands of the respected creators .

THE HISTORY

In bullet points, are the current situations the world is facing.

- Presently, we live in a world where privacy or cyber confidentiality is a myth especially due to the ease with which a visual media can be accessed without the prior permission of the user or the owner.
- The same condition also implies to highly confidential government images and documents, which can be easily hacked during an electronic transmission.
- Due to these unfortunate mishaps highly confidential documents are physically transmitted by hand and not transmitted electronically or stored in any cloud platform.

THE LIMITATIONS

Listed below are the factors that could prevent the success of this project.

- One of the biggest challenges this project shall face is the sheer amount of computational power that will be needed for this project's successful implementation.
- The next big hurdle will be to convince the common man and governmental authorities the capabilities and advantages of this project as there are always a doubt factor activated while entrusting personal photos and confidential documents to an external software.
- The successful running of this project will also require stable and fast internet connection

THE APPROACH

Listed below are the entities needed to complete the project.

- The project requires a well acknowledged image which has been accounted for by the owner.
- The image should be able to satisfy the pixel conditions necessary for the project and should be a decorative of the global R.G.B values.
- It also requires a secure database management system.

THE BENEFITS

Listed below are the benefits that this project will bring to an organization or the Common man.

- This project will be able to improve the confidentiality of the subjected entity and ensure only the person or organization which has the approval of the entity's owner will be able to access it.
- Coming to a more personal aspect, The project will help to improvise the way we see personal image and video privacy.
- Once the project is enforced on to social media platforms, the common user can be assured to the fact that his/her private entities remain to be so.

Arriving at problem statement

Purpose and Need:

- Numerous confidential images and blue prints of various governmental and military under cover establishments are leaked to their counter parts which jeopardizes the national security.
- Internet multimedia applications have become very popular in the past few years and Valuable multimedia contents such as digital images have swamped the internet.
- Though digital images play an important role in multimedia technology, it becomes more important for the users to maintain privacy as well.
- Even though Privacy is a myth. In this modern age of advancing technologies and its breaching is something that haunts almost everyone and every organization.
- But we need to do something to eradicate this myth.

Goals and Objectives:

- To enable users to encode and decode their audio and video messages with ease and thus helping them to be safe from the risk of privacy breach.

Audience:

- Image and video encryption have wide use in various fields including Internet communication, multimedia systems, medical imaging, Tele-medicine and more importantly military communications as the military is the primary user of such cryptography techniques.

STAKEHOLDERS AND PROCESS MODEL

IDENTIFYING STAKEHOLDERS

- The end users (i.e., security firms and construction companies etc.) would be satisfied by this project.
- The confidential files from end users can be encrypted and sent to their destination with any leak of information from files.
- End users, developers, shareholders have the power of making this project success or failure.
- Project developers provide all the resources.
- The end users are construction companies, armies, security firms, etc.
- The project manager has influence over other stake holders.
- Project manager is responsible for addressing the issues in the project.
- Project manager and developers can solve the potential problems in the project.
- Project developers are responsible for maintaining the application.
- The project manager and the developers have specialist skills which are crucial to the project

USER STORY – USER DESCRIPTION

User Story

- As an end user (common man), I want to ensure the pictures and videos I upload in social media and other platforms are safely encrypted and are accessed only by me and the ones I share it with.
- As an Governmental organization, the confidential images that we would like to transfer should not be interpreted by an external organization or personnel who has no appointed access to it.

Success Criteria

- The user must be able to successfully upload the image to our secured data base.
- The picture must be then successfully encrypted
- The encrypted data is then transferred through a secured channel
- The encrypted data is then decrypted back to the original image.
- This must be only done in the device that the user wanted the image to be delivered to.

Comparative Study with Agile

- There are various types of chaotic systems which were used for encryption by various authors
- Some of the examples are Arnold's cat map, logistic maps, piecewise linear chaotic maps, low and high dimensional chaotic maps, Lorenz chaotic system etc.
- Usually, high dimensional chaotic maps preferred over low dimensional chaotic maps due to the high security features.
- Each type of chaotic map came with its own different feature.

IDENTIFYING THE REQUIREMENTS FROM PROBLEM STATEMENT

REQUIREMENTS ELICITATION

- This paper mainly focuses on the different cryptographic algorithms used for the image encryption and decryption in the field of image security. Security has gained a lot of importance as information technology is widely used. Since, digital image has become an important medium of communication; researchers have come up with different techniques from time to time to ensure security of the images. Cryptography refers to the study of mathematical techniques and related aspects of Information Security like data confidentiality, data Integrity, and of data authentication. This paper presents a survey of different image cryptographic algorithms proposed in the last decades with some advanced methods. Moreover, it provides the various aspects used for the image security
- As digital images play an important role in multimedia technology, it becomes more important for the users to maintain privacy. And to provide such security and privacy to the user, image encryption is very important to protect from any unauthorized user access. Image and video encryption have applications in various fields including internet communication, multimedia systems, medical imaging, Tele-

medicine and military communication. Color images are being transmitted and stored in large amounts over the Internet and wireless networks, which take advantage of rapid development in multimedia and network technologies.

- Several cryptographic algorithms have been proposed up to now like AES, DES, RSA, IDEA etc. The image encryption techniques are different from the data encryption techniques. And there are several security problems associated with digital image processing and transmissions, so it is necessary to maintain the integrity and the confidentiality of the image. Moreover, digital images are comparatively less sensitive than data because any single change in the pixels of the does not change the entire image. In other words, a small modification of digital image is acceptable compared to data but it is more prone to attackers.

Feasibility Study

- **Portability:** - The application will be developed using python, Net language etc. this software will work both on Windows, Linux o/s and android devices. Hence portability problems will not arise.
- **Availability:** - This software will be available always.

Functional Requirements

The Functional Requirement document (also called Functional Specifications or Functional Requirement Specifications), defines the capabilities and functions that a system must be able to perform successfully. Functional Requirements should include:

- Descriptions of data to be entered into the system
- Descriptions of operations performed by each screen
- Descriptions of work-flows performed by the system
- Descriptions of system reports or other outputs
- Who can enter the data into the system?
- How the system meets applicable regulatory requirements.

The functional specification is designed to be read by a general audience. Readers should understand the system, but no particular technical knowledge should be required to understand the document.

Non-Functional Requirements

A Non-Functional Requirement is usually some form of constraint or restriction that must be considered when designing the solution. For the most part when people are talking about Constraints, they are referring to Non-Functional Requirements. Since system constraints are part of a “solution”, they should be documented in the System Specifications document.

Non-Functional Requirements have the same following characteristics:

- uses simple language
- Not ambiguous
- contains only one point
- Specific to one type of user
- is qualified
- describes what and not how

Non-Functional requirements tend to identify “user” constraints and “system” constraints. Business requirements should be kept pure and not reflect any solution thinking. A system constraint is a constraint imposed by the system and not dictated by a Business Need.

System Requirements

- RAM: Minimum 6 GB or higher.
- HDD: Minimum 500GB. (Presence of 256 GB SSD preferred)
- Processor: Core i5 Processor 9th Generation Intel or AMD

PROJECT PLAN AND PROJECT EFFORT BASED ON RESOURCES

ROLES AND RESPONSIBILITIES

- **Project Manager**

- ❖ Develops a project plan.
- ❖ Manages deliverables according to the plan.
- ❖ Recruits project staff. o Leads and manages the project team.
- ❖ Assigns tasks to team members.

- **Data Analyst**

- ❖ Responsible for accusation of data.
- ❖ Performs data cleansing.
- ❖ Analyses the quality of data.
- ❖ Analyses the trends and relations among various features.

- **Developer**

- ❖ The backbone that leads to the realization of the implementation aspect.
- ❖ Writes the code to test and train the model.
- ❖ Performs project design and development activities according to customer specifications.
- ❖ Works with manager in preparing project plan, budget, and schedule.

- **Project Team Member**

- Contributes to overall project objectives.
- Completes individual deliverables.
- Provides expertise.
- Documents the process.

- **Project Sponsor**

- Makes key business decisions for the project
- Approve the project budget
- Ensure availability of resources
- Communicate the project's goals throughout the organization
- Provide direction and guidance for project empowerment, key business strategies and project initiatives
- Participate in initial project planning, including developing the project chart and the project scope
- Evaluate the project's success on completion.

- **Business Analyst**

- Assist in defining the project
- Gather requirements from business units or users

KICK-OFF MEETING

- A kick-off meeting is an essential tool to communicate with stakeholders. If done correctly, it can help to execute the project with minimal obstruction, and one can finish the project with fewer obstacles.
- A kick-off meeting is one of the first meetings held amongst the project stakeholders when starting a new project.
- This meeting includes the high-level project stakeholders such as the project sponsor, management, and the project manager, as well as the team members and the project manager.
- This meeting plays a vital role because it gives a project manager the opportunity to define the common goal and the purpose of completing the project and as well build a consensus.

SCOPE STATEMENT

- A project scope, or project scope statement, is a tool used to describe the major deliverables of a project including the key milestones, high-level requirements, assumptions, and constraints.
- A project scope statement is a useful tool for future decision making when new change requests are considered to modify the project scope.
- An effective project scope statement includes-

- The key project objectives:
 - a) Key deliverables
 - b) Key milestones
 - c) High-level requirements
 - d) Assumptions and Exclusions
 - e) Any known issues or risk
 - f) Stakeholder review and approval

SCOPE BASELINE

- Scope baseline is referred to as the approved version of a scope statement, work breakdown structure (WBS), and its associated WBS dictionary, that can be changed only through formal change control procedures and is used as a basis for comparison.
- A project management plan is a document that describes how the project will be executed, monitored, and controlled.
- It integrates and consolidates all of the subsidiary plans and baselines from the planning processes including scope baseline, along with schedule baseline and cost baseline.

SCHEDULE AND COST BASELINE

➤ ***Schedule baseline*** is the approved version of a schedule model that can be changed only through formal change control procedure and is used as a basis for comparison to actual results. The project management contains the schedule baseline, used as a reference to

compare with the actual results to determine if a change, corrective action, or preventive action is necessary.

- ***Cost baseline*** is essentially an important facet of the project management plan that companies use to ensure success. Some of these cost baselines include resource baselines as well as production variations. These measurements of various project performance aspects ensure that cost is evaluated in regards to the overall yield of a particular project.

BASELINE MANAGEMENT PLANS

- A baseline management plan, also called a baseline plan, is a plan for adjusting the various project baselines.
- A baseline in project management is a clearly defined starting point for your project plan.
- It is a fixed reference point to measure and compare your project's progress against.

PROJECT EFFORT BASED ON RESOURCES

WORK BREAKDOWN STRUCTURE

- Each pixel in a colorful picture can be represented by RGB (Red, Green, Blue) value. The range of RGB values is 0 to 255 that states the red, green and blue intensity of a particular picture. These RGB values are accessed one by one and changed into another by various steps and hence it is not possible to track the original RGB value. In order to retrieve the original image, the receiver needs to know the setting of the enigma. To compare the decrypted image with the original one, these two images are subtracted and their results are also discussed in this project.
- Images of 144p, 240p, 360p, 720p, 1080p, 1440p and 2160p images of aspect ratio 16:9 were taken to get the data. The following graph shows that the relation between time and resolution and it can be concluded that this method is time efficient.
- The RGB values of a pixel is always in the range of 0-255, but MATLAB starts indexing from 1. So, all the parts have been modelled using the range 1-256, mapped the pixel values with 1 incremented, and decremented by 1 at the output. First, the plug-board is modelled by a certain matrix and swapped the desired element pairs (or block pairs) given by the plug-board settings into another matrix.

- Using our algorithm, an image was encrypted and the results are found as shown below:

ENCRYPTION PROCESS

Original Image	Encrypted Image
	
	
	

Figure 4: Encryption, (1) Original Image, (2) Encrypted Image

DECRYPTION PROCESS

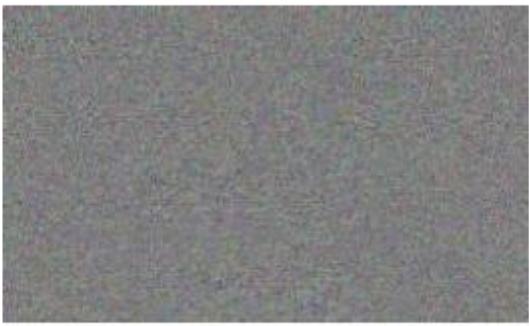
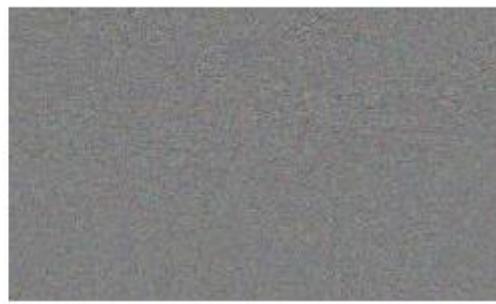
Original Image	Encrypted Image
	
	
	

Figure 4: Encryption, (1) Original Image, (2) Encrypted Image

PROJECT QUALITY AND RISK ANALYSIS

- ***Project Quality Management*** is the process for ensuring that all project activities necessary to design, plan and implement a project are effective and efficient with respect to the purpose of the objective and its performance.
- ***Risk analysis*** is the process that figures out how likely that risk will arise in a project. It studies uncertainty and how it would impact the project in terms of schedule, quality and costs if, in fact, it was to show up. Two ways to analyses risk is quantitative and qualitative.

Estimation of product Metric's

COCOMO MODEL

- Cocomo (Constructive Cost Model) is a regression model based on LOC, i.e. number of Lines of Code. It is a procedural cost estimate model for software projects and often used as a process of reliably predicting the various parameters associated with making a project such as size, effort, cost, time and quality.
- The initial estimate (also called nominal estimate) is determined by an equation of the form used in the static single variable models, using KDLOC as the measure of the size. To determine the initial effort E_i in person-months the equation used is of the type is shown below:
 - $E = a_a (KDLOC)^b$
 - $D = c(E)$
 - $P = E/D$
 - The value of the constant a and b are depends on the project type.

Software Projects	a	b	c	d
Organic	2.4	1.05	2.5	0.38
Semi-detached	3.0	1.12	2.5	0.35
Embedded	3.6	1.20	2.5	0.32

INTERMEDIATE MODEL

- The basic Cocomo model assumes that the effort is only a function of the number of lines of code and some constants evaluated according to the different software system. However, in reality, no system's effort and schedule can be solely calculated on the basis of Lines of Code.
- Classification of Cost Drivers and their attributes:

(i) Product attributes –

- Required software reliability extent
- Size of the application database
- The complexity of the product

(ii) Hardware attributes –

- Run-time performance constraints
- Memory constraints
- The volatility of the virtual machine environment
- Required turnabout time

(iii) Personnel attributes –

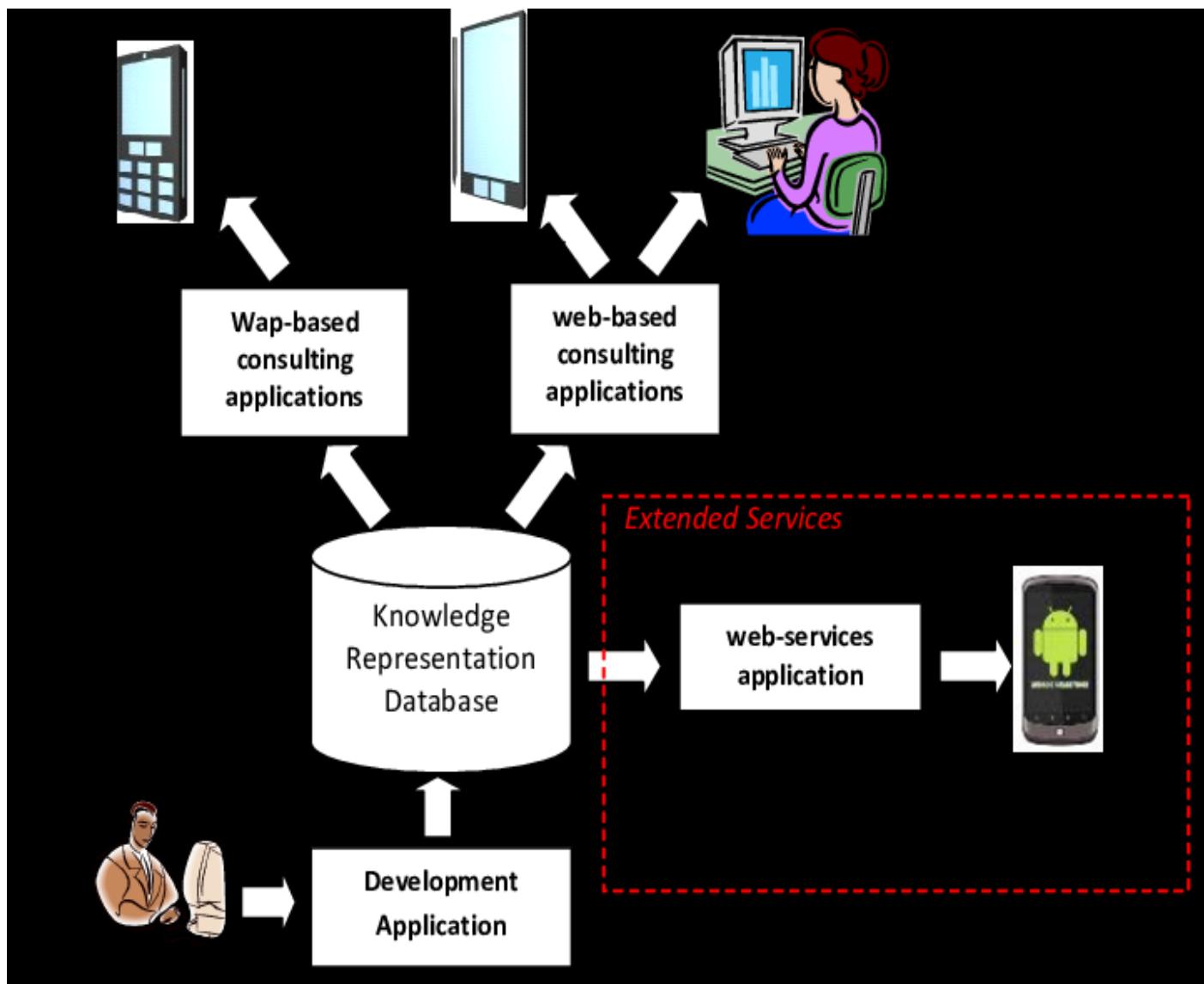
- Analyst capability
- Software engineering capability
- Applications experience
- Virtual machine experience
- Programming language experience

(iv) Project attributes –

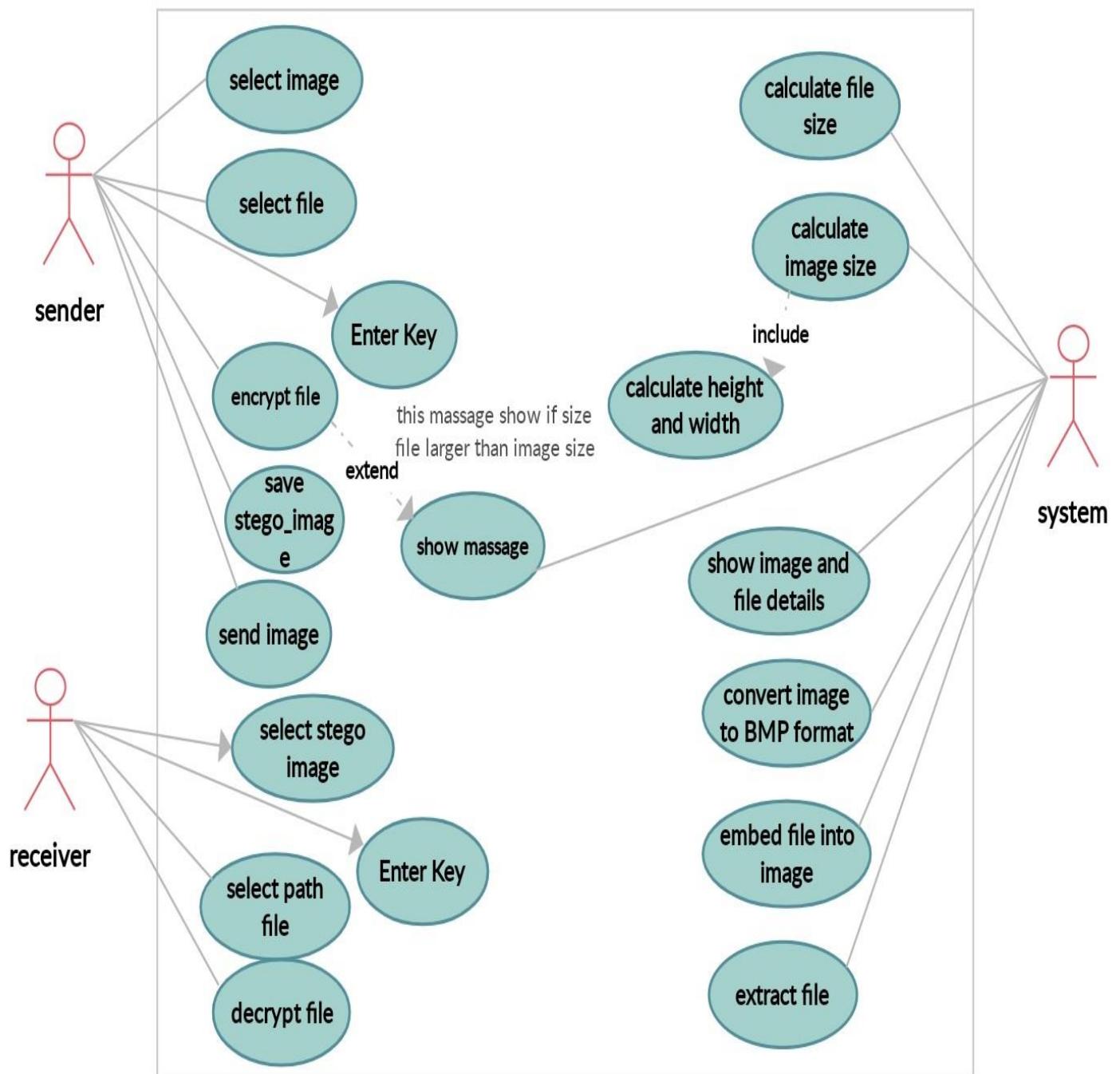
- Use of software tools
- Application of software engineering methods
- Required development schedule

DESIGN

SYSTEM DESIGN ARCHITECTURE

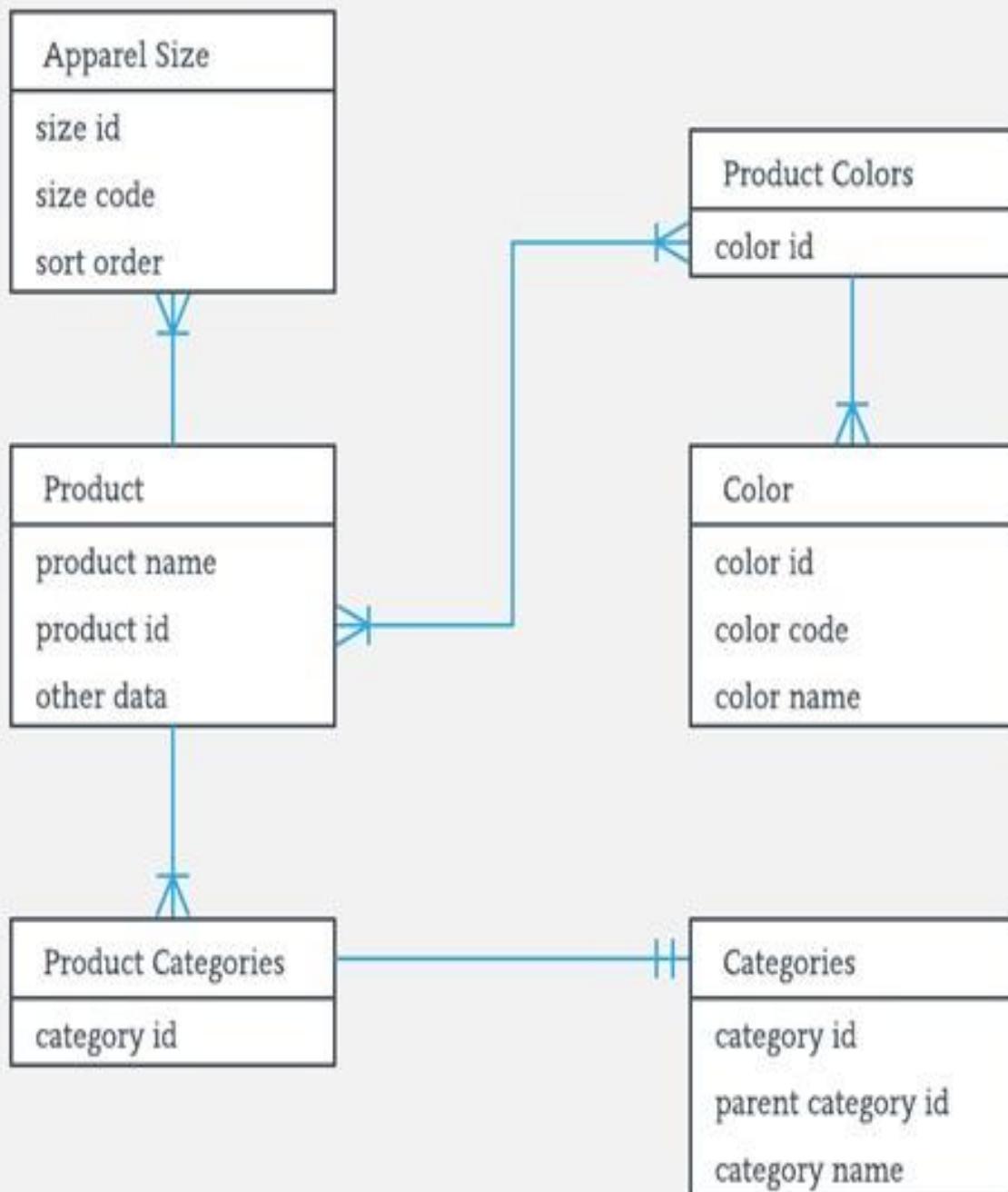


MODELING UML USE CASE DIAGRAM



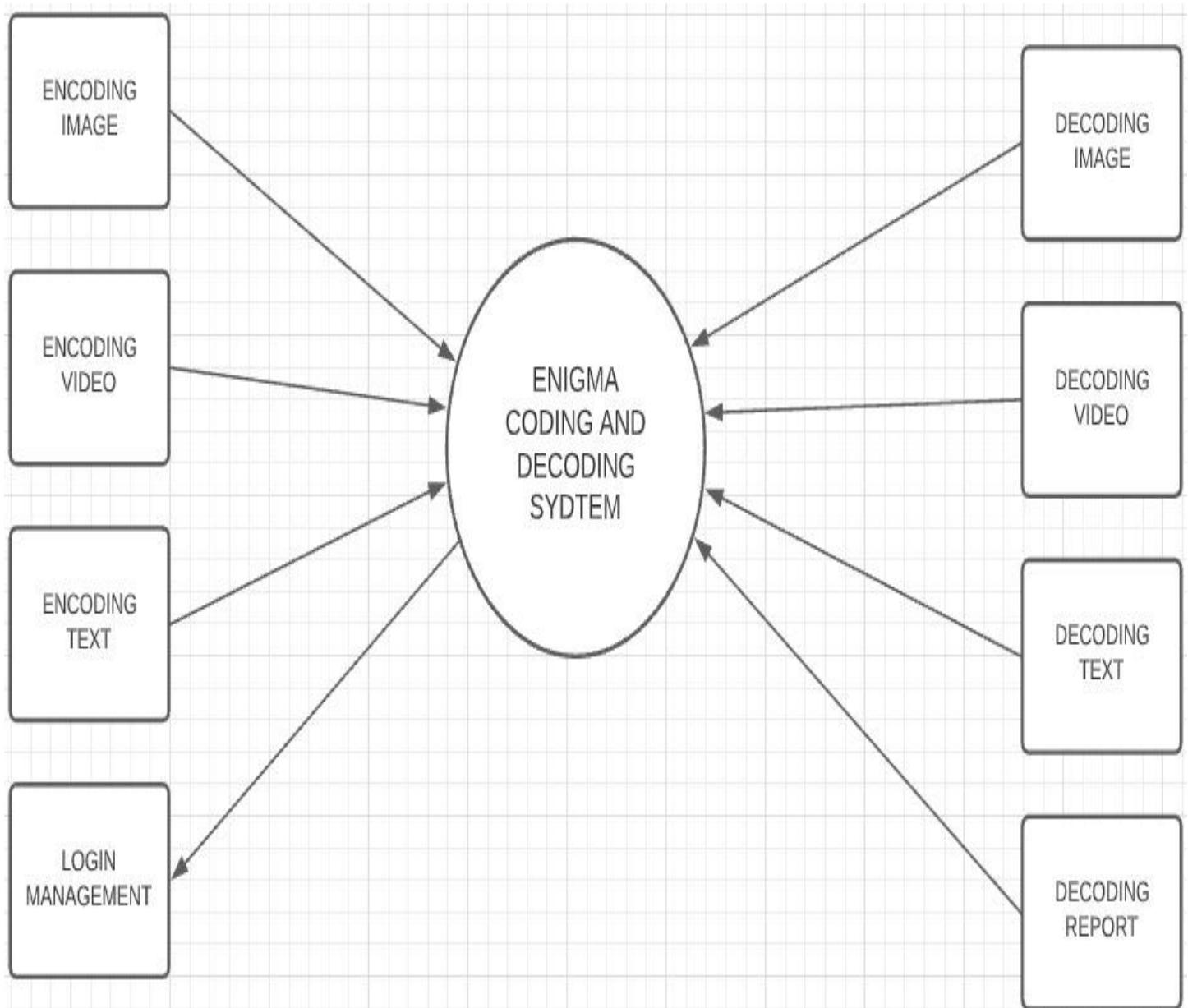
ER MODELLING FROM PROBLEM STATEMENT

ENTRY RELATIONSHIP DIAGRAM

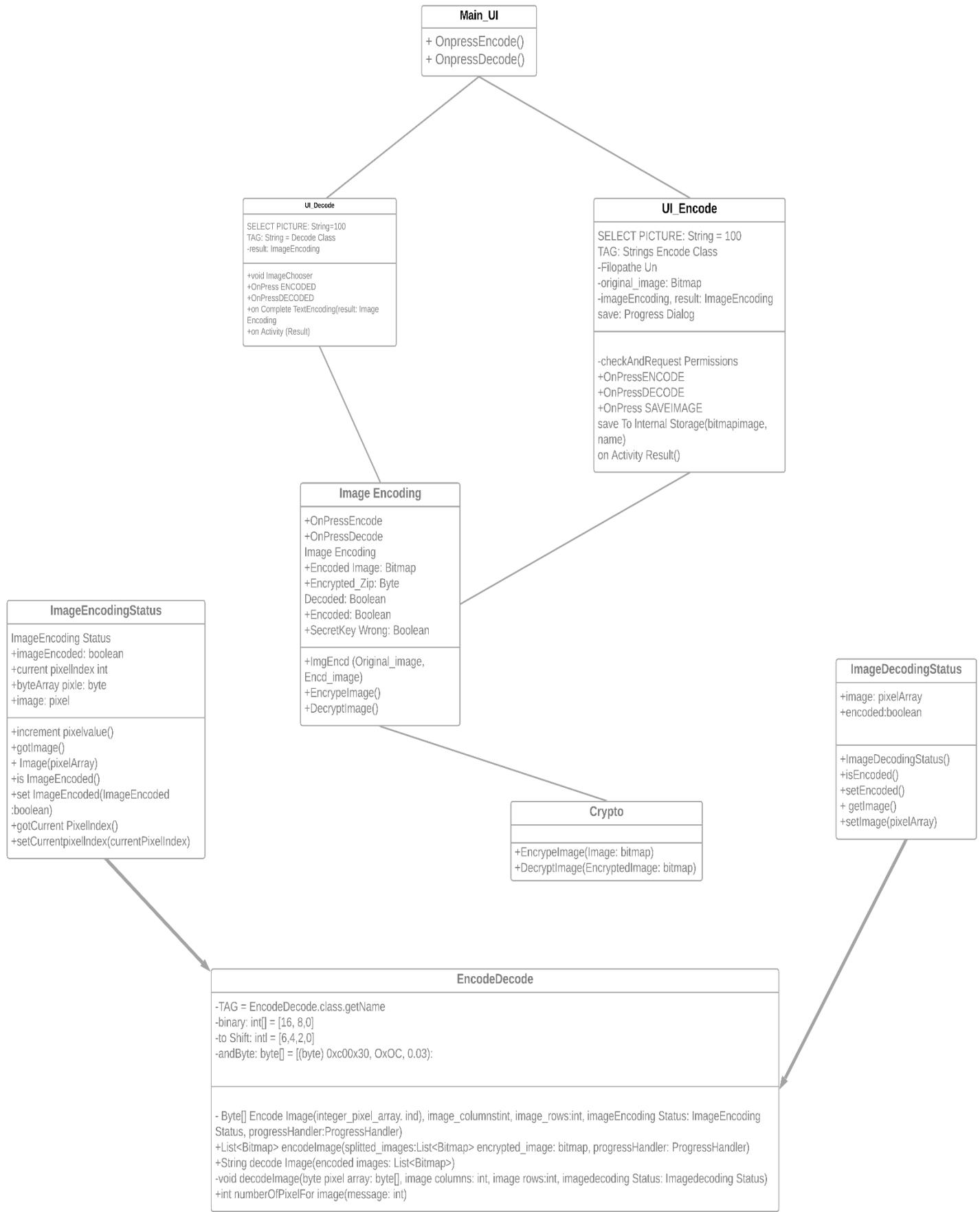


MODELING DATA FLOW DIAGRAM

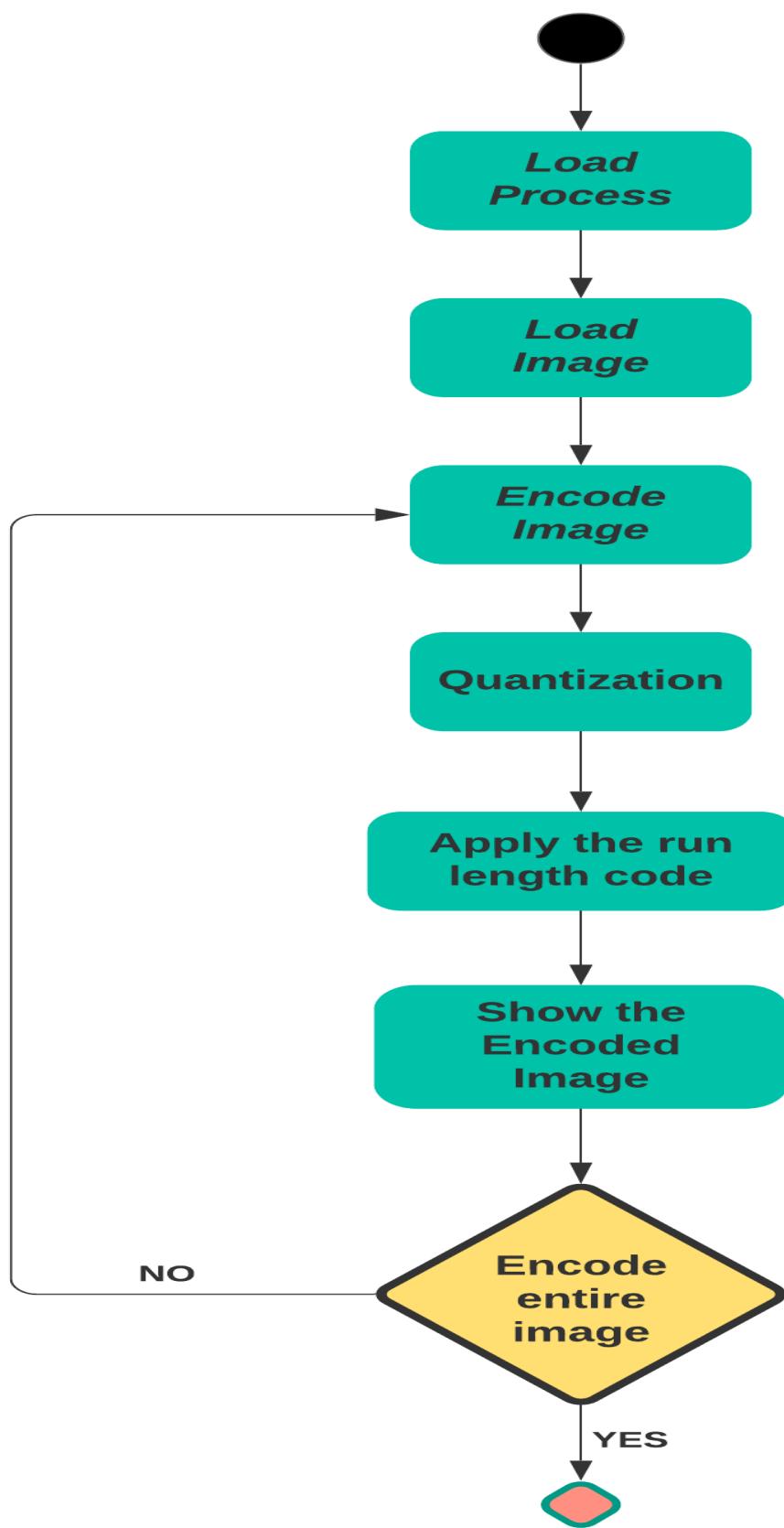
DATA FLOW DIAGRAM [DFD]



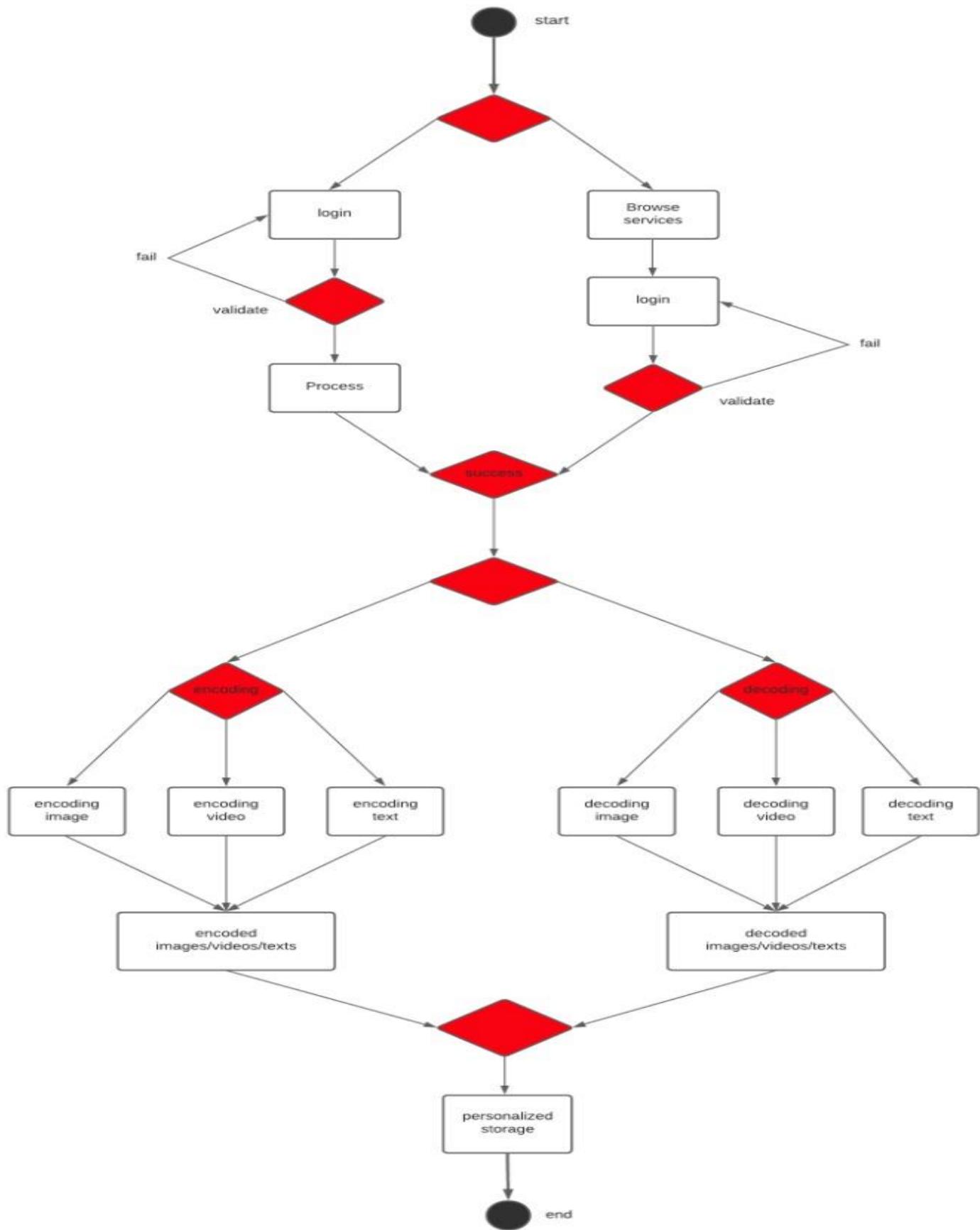
CLASS DIAGRAM



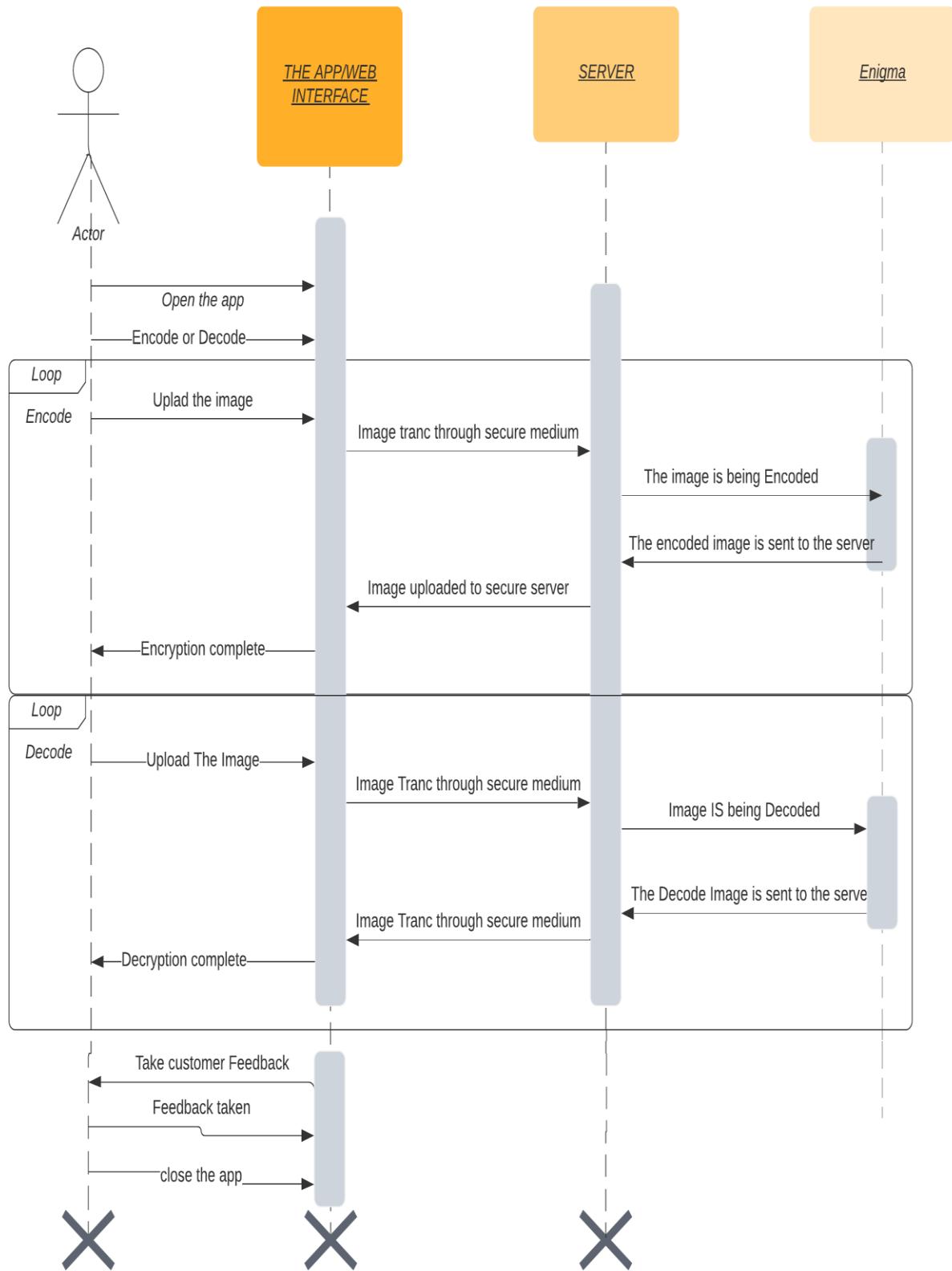
ACTIVITY DIAGRAM



STATECHART DIAGRAM

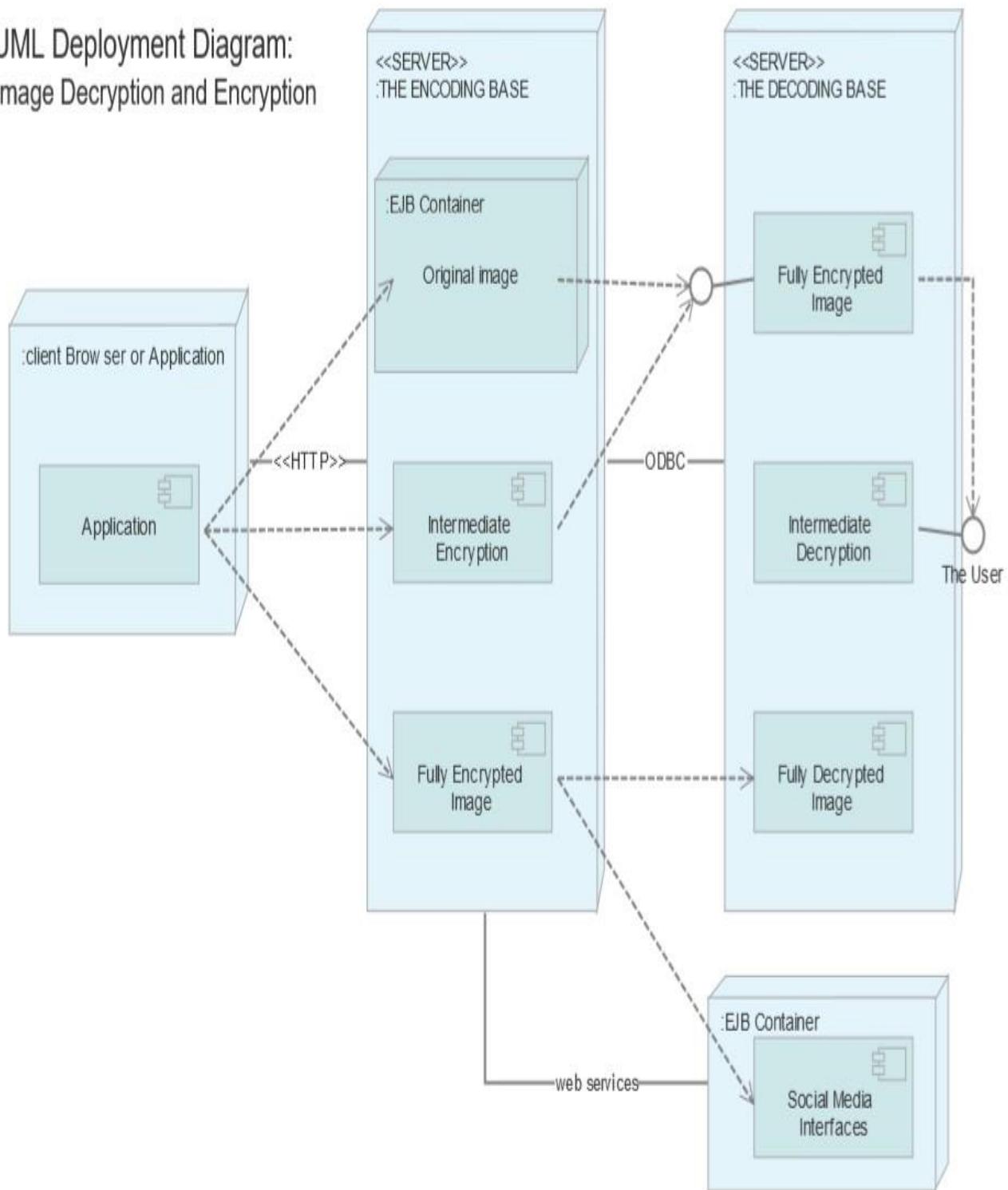


SEQUENCE DIAGRAM



DEPLOYMENT DIAGRAM

UML Deployment Diagram:
Image Decryption and Encryption



MODULE DESCRIPTION

PROGRAM CODE:

The Main GUI CODE:

```
import tkinter as tk
from tkinter import messagebox
from PIL import Image, ImageTk
from tkinter.filedialog import askopenfile
from Encryption_code import encrypt
from Decryption_code import decrypt

root = tk.Tk()
root.title("Image Encryption And Decryption")
canvas = tk.Canvas(root, width=900, height=600)
canvas.grid(columnspan=3, rowspan=4)
image=""
key=0
```

```
logo = Image.open('logo.jpeg')
logo = ImageTk.PhotoImage(logo)
logo_label = tk.Label(image=logo)
logo_label.image = logo
logo_label.grid(column=0, row=0, columnspan=3)
```

```
instructions = tk.Label(root, text="Select an image file on
your computer to encode it", font="Raleway")
instructions.grid(column=0, row=2)
```

```
def onEnter(e):
    e.widget['background'] = 'green'
```

```
def onLeave(e):
    e.widget['background'] = '#8B008B'
```

```
def open_file():
    global image, key
    image = askopenfile(parent=root, mode='rb',
title="Choose a file", filetype=[("png file","*.png")])
    if image == "":
```

```
b2["state"] = tk.DISABLED
b3["state"] = tk.DISABLED

else:
    b2["state"] = tk.ACTIVE
    b3["state"] = tk.ACTIVE
    b2['bg'] = b3['bg'] = "#8B008B"
    b2['fg'] = b3['fg'] = "white"

key = entry1.get("1.0", "end")
if(key == "\n"):
    messagebox.showinfo("Error", "Please Enter Key
Value")

else:
    key = int(key)

image = str(image)[26:-2]
return image

b1 = tk.Button(root, text="Browse",
command=open_file, font="Raleway", bg="#20bebe",
```

```
fg="white", height=2, width=15)
b1.grid(column=2, row=2)
```

```
key_label= tk.Label(root, text="Enter Your Unique Key(0-
256): ", font="Raleway")
key_label.grid(row=1, column=0)
entry1=tk.Text(root, height=1, width=6, font=("bold", 26,
))
entry1.grid(row=1, column=1, columnspan=2)
```

```
b2 = tk.Button(root, text="Encrypt",
command=lambda:encrypt(image,key),
state=tk.DISABLED, font="Raleway", bg="#20bebe",
fg="white", height=2, width=15)
```

```
b2.grid(column=0, row=3)
```

```
b3 = tk.Button(root, text="Decrypt",
command=lambda:decrypt(image,key),
state=tk.DISABLED, font="Raleway", height=2, width=15)
```

```
b3.grid(column=2, row=3)
```

```
b2 = tk.Button(root, text="Encrypt",
command=lambda:encrypt(image,key),
state=tk.DISABLED, font="Raleway", height=2, width=15)
b2.grid(column=0, row=3)
```

```
b3 = tk.Button(root, text="Decrypt",
command=lambda:decrypt(image,key),
state=tk.DISABLED, font="Raleway", height=2, width=15)

b3.grid(column=2, row=3)
```

```
if(b2['state'] == tk.ACTIVE or b3['state'] == tk.ACTIVE):
    b2.bind("<Enter>", onEnter)
    b3.bind("<Enter>", onEnter)
    b2.bind("<Leave>", onLeave)
    b3.bind("<Leave>", onLeave)
```

```
root.mainloop()
```

ENCRYPTION CODE:

```
def encrypt(path,k):
try:

# taking encryption key as input
key = k

# open file for reading purpose
fin = open(path, 'rb')

# storing image data in variable "image"
image = fin.read()
fin.close()

# converting image into byte array to
# perform encryption easily on numeric data
image = bytearray(image)
```

```
# performing XOR operation on each value of bytearray  
for index, values in enumerate(image):  
    image[index] = values ^ key
```

```
# opening file for writing purpose  
fin = open(path, 'wb')
```

```
# writing encrypted data in image  
fin.write(image)  
fin.close()  
print('Encryption Done...')
```

```
except Exception:  
    print('Error caught : ', Exception.__name__)
```

DECRYPTION CODE:

```
def decrypt(path,k):  
  
    try:  
  
        # take path of image as a input  
        path = input(r'Enter path of Image : ')  
  
        # taking decryption key as input  
        key = k  
  
        # open file for reading purpose  
        fin = open(path, 'rb')  
  
        # storing image data in variable "image"  
        image = fin.read()  
        fin.close()
```

```
# converting image into byte array to perform
# decryption easily on numeric data
image = bytearray(image)

# performing XOR operation on each value of bytearray
for index, values in enumerate(image):
    image[index] = values ^ key

# opening file for writing purpose
fin = open(path, 'wb')

# writing decryption data in image
fin.write(image)
fin.close()
print('Decryption Done...')

except Exception:
    print('Error caught : ', Exception.__name__)
```

Pictorial Documentations

CODE DEVELOPMENT SCREESHOTS

The screenshot shows the Spyder IDE interface with the following details:

- File Explorer:** Shows a project named "Image Encoding and Decoding" containing files: __pycache_, Decryption_code.py, Encryption_code.py, GUI.py, and logo.jpeg.
- Code Editor:** Displays Python code for a GUI application. The code uses Tkinter for the interface, PIL for image processing, and custom modules for encryption and decryption. It includes functions for opening files, displaying a logo, and handling file selection.
- Help Panel:** A "Usage" panel provides information on getting help for objects in the editor or console.
- Console:** An IPython console window is open, showing the Python version (3.8.5), copyright information, and a command to run the GUI script.
- Status Bar:** Shows LSP Python: ready, conda: base (Python 3.8.5), Line 40, Col 38, ASCII, CRLF, RW, and Mem 64%.

```
1 import tkinter as tk
2 from tkinter import messagebox
3 from PIL import Image, ImageTk
4 from tkinter.filedialog import askopenfile
5 from Encryption_code import encrypt
6 from Decryption_code import decrypt
7
8 root = tk.Tk()
9 root.title("Image Encryption And Decryption")
10 canvas = tk.Canvas(root, width=900, height=600)
11 canvas.grid(columnspan=3, rowspan=4)
12 image=""
13 key=0
14
15 logo = Image.open('Logo.jpeg')
16 logo = ImageTk.PhotoImage(logo)
17 logo_label = tk.Label(image=logo)
18 logo_label.image = logo
19 logo_label.grid(column=0, row=0, columnspan=3)
20
21 instructions = tk.Label(root, text="Select an image file on your computer to encode it", font="Raleway")
22 instructions.grid(column=0, row=2)
23
24 def onEnter(e):
25     e.widget['background'] = 'green'
26
27 def onLeave(e):
28     e.widget['background'] = "#B0B0B0"
29
30 def open_file():
31     global image, key
32     image = askopenfile(parent=root, mode='rb', title="Choose a file", filetype=[("png file", "*.png")])
33     if image == "":
34         b2["state"] = tk.DISABLED
35         b3["state"] = tk.DISABLED
36     else:
37         b2["state"] = tk.ACTIVE
38         b3["state"] = tk.ACTIVE
39         b2['bg'] = b3['bg'] = "#B0B0B0"
40         b2['fg'] = b3['fg'] = "white"
41
42     key = entry1.get("1.0", "end")
43     if(key == "\n"):
44         print("File selected")
```

Editor

C:\Users\gauth\Imange Encoding and Decoding\GUI.py

File: GUI.py

```

30 def open_file():
31     global image, key
32     image = askopenfile(parent=root, mode='rb', title="Choose a file", filetype=[("png file", "*.png")])
33     if image == "":
34         b2['state'] = tk.DISABLED
35         b3['state'] = tk.DISABLED
36     else:
37         b2['state'] = tk.ACTIVE
38         b3['state'] = tk.ACTIVE
39         b2['bg'] = b3['bg'] = "#8B008B"
40         b2['fg'] = b3['fg'] = "white"
41
42     key = entry1.get("1.0", "end")
43     if(key == "\n"):
44         messagebox.showinfo("Error", "Please Enter Key Value")
45     else:
46         key = int(key)
47
48     image = str(image)[26:-2]
49     return image
50
51 b1 = tk.Button(root, text="Browse", command=open_file, font="Raleway", bg="#20bebe", fg="white", height=2, width=15)
52 b1.grid(column=2, row=2)
53
54 key_label= tk.Label(root, text="Enter Your Unique Key(0-256): ", font="Raleway")
55 key_label.grid(row=1, column=0)
56 entry1=tk.Text(root, height=1, width=6, font=("bold", 26, ))
57 entry1.grid(row=1, column=1, columnspan=2)
58
59 b2 = tk.Button(root, text="Encrypt", command=lambda:encrypt(image,key), state=tk.DISABLED, font="Raleway", bg="#20bebe", fg="white", height=2, width=15)
60 b2.grid(column=0, row=3)
61 b3 = tk.Button(root, text="Decrypt", command=lambda:decrypt(image,key), state=tk.DISABLED, font="Raleway", height=2, width=15)
62 b3.grid(column=2, row=3)
63
64 b2 = tk.Button(root, text="Encrypt", command=lambda:encrypt(image,key), state=tk.DISABLED, font="Raleway", height=2, width=15)
65 b2.grid(column=0, row=3)
66 b3 = tk.Button(root, text="Decrypt", command=lambda:decrypt(image,key), state=tk.DISABLED, font="Raleway", height=2, width=15)
67 b3.grid(column=2, row=3)
68
69 if(b2['state'] == tk.ACTIVE or b3['state'] == tk.ACTIVE):
70     b2.bind("<Enter>", onEnter)
71     b3.bind("<Enter>", onEnter)
72     b2.bind("<Leave>", onLeave)
73     b3.bind("<Leave>", onLeave)
74
75
76
77 root.mainloop()
78

```

File Edit Search Source Run Debug Consoles Projects Tools View Help

C:\Users\gauth\Imange Encoding and Decoding\Encryption_code.py

File: Encryption_code.py

Source

Usage

Here you can get help of any object by pressing **Ctrl+H** in front of it, either on the Editor or the Console.

Help can also be shown automatically after writing a left parenthesis next to an object. You can activate this

Variable explorer Help Plots Files

Console 1/A

```

1 def encrypt(path,k):
2     try:
3         path = path
4         fin = open(path, 'rb')
5         image = fin.read()
6         fin.close()
7         image = bytearray(image)
8         for index, values in enumerate(image):
9             image[index] = values ^ k
10        fin = open(path, 'wb')
11        fin.write(image)
12        fin.close()
13        print('Encryption Done...')
14    except Exception as e:
15        print('Error caught : ', e)
16
17

```

Python 3.8.5 (default, Sep 3 2020, 21:29:08) [MSC v.1916 64 bit (AMD64)]
Type "copyright", "credits" or "license" for more information.

IPython 7.19.0 -- An enhanced Interactive Python.

In [1]: runfile('C:/Users/gauth/Imange Encoding and Decoding/GUI.py', wdir='C:/Users/gauth/Imange Encoding and Decoding')

In [2]:

LSP Python: ready conda: base (Python 3.8.5) Line 1, Col 1 ASCII CRLF RW Mem 68%

~\Imange Encoding and Decoding - Spyder (Python 3.8)

File Edit Search Source Run Debug Consoles Projects Tools View Help

C:\Users\gauth\Imange Encoding and Decoding\Decryption_code.py

GU.py Encryption_code.py Decryption_code.py

Source Console Object

Usage

Here you can get help of any object by pressing **Ctrl+H** in front of it, either on the Editor or the Console.

Help can also be shown automatically after writing a left parenthesis next to an object. You can activate this.

Variable explorer Help Plots Files

Console 1/A

Python 3.8.5 (default, Sep 3 2020, 21:29:08) [MSC v.1916 64 bit (AMD64)]
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In [1]: runfile('C:/Users/gauth/Imange Encoding and Decoding/GUI.py', wdir='C:/Users/gauth/Imange Encoding and Decoding')

In [2]:

LSP Python: ready conda: base (Python 3.8.5) Line 1, Col 1 ASCII CRLF RW Mem 68%

```
1 def decrypt(path,k):
2     try:
3         path = path
4         fin = open(path, 'rb')
5         image = fin.read()
6         fin.close()
7         image = bytearray(image)
8         for index, values in enumerate(image):
9             image[index] = values ^ k
10        fin = open(path, 'wb')
11        fin.write(image)
12        fin.close()
13        print('Decryption Done... ')
14    except Exception as e:
15        print('Error caught : ', e)
```

~\Imange Encoding and Decoding - Spyder (Python 3.8)

File Edit Search Source Run Debug Consoles Projects Tools View Help

C:\Users\gauth\Imange Encoding and Decoding\GUI.py

GU.py Encryption_code.py Decryption_code.py

Source Console Object

Usage

Here you can get help of any object by pressing **Ctrl+H** in front of it, either on the Editor or the Console.

Help can also be shown automatically after writing a left parenthesis next to an object. You can activate this.

Variable explorer Help Plots Files

Console 1/A

Python 3.8.5 (default, Sep 3 2020, 21:29:08) [MSC v.1916 64 bit (AMD64)]
Type "copyright", "credits" or "license" for more information.

IPython 7.19.0 -- An enhanced Interactive Python.

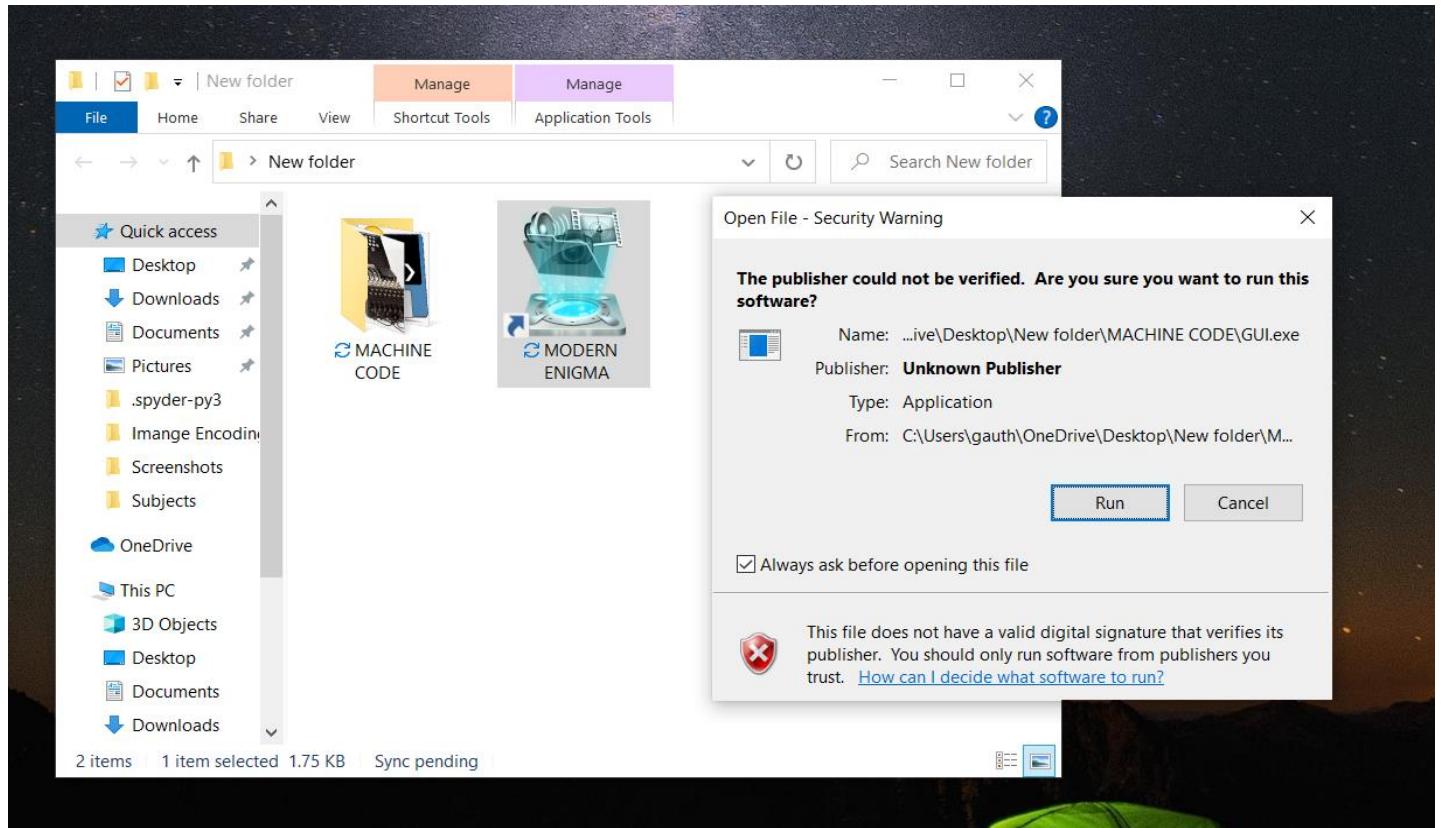
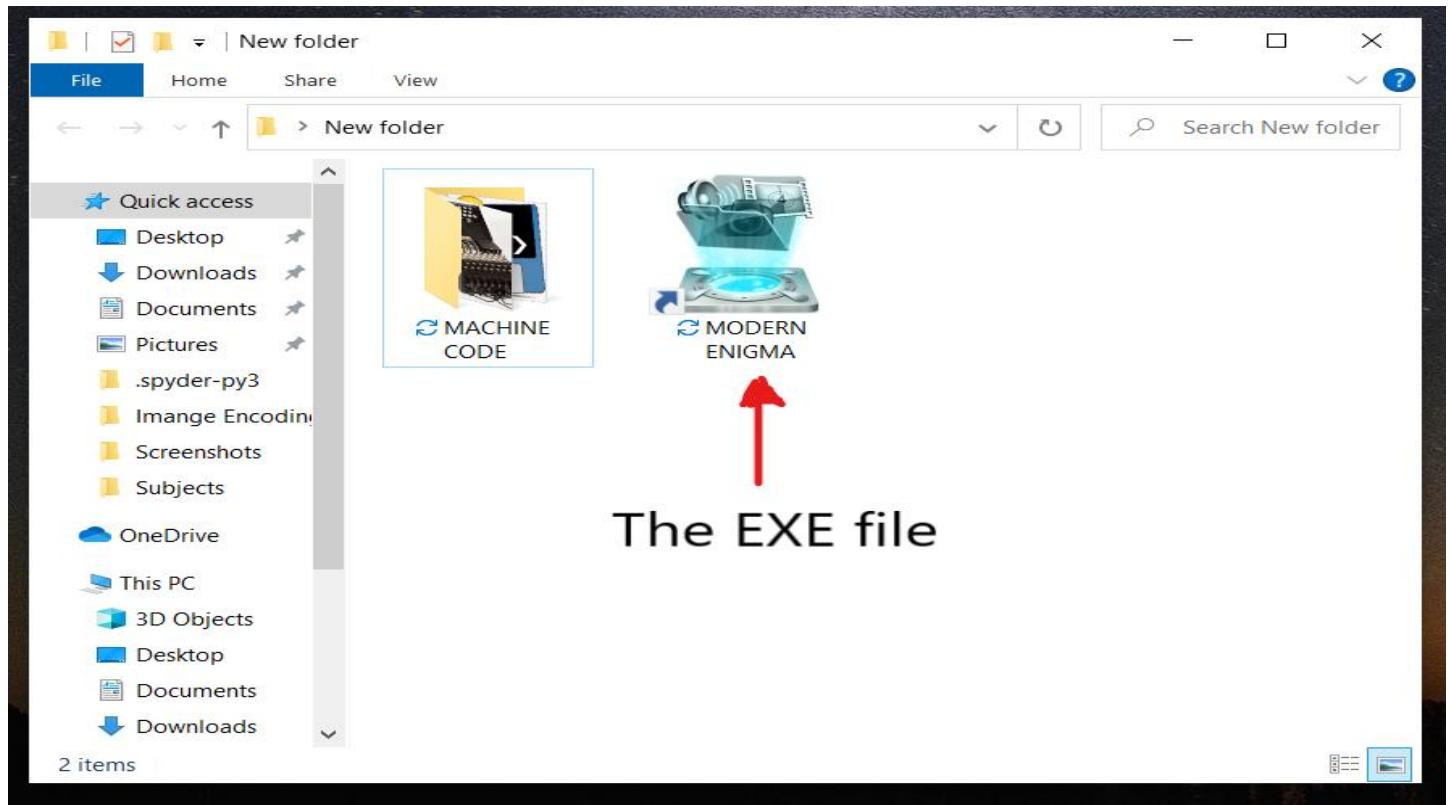
In [1]: runfile('C:/Users/gauth/Imange Encoding and Decoding/GUI.py', wdir='C:/Users/gauth/Imange Encoding and Decoding')

In [2]:

LSP Python: ready conda: base (Python 3.8.5) Line 78, Col 1 ASCII CRLF RW Mem 67%

```
1 import tkinter as tk
2 from tkinter import messagebox
3 from PIL import Image, ImageTk
4 from tkinter.filedialog import askopenfile
5 from Encryption_code import encrypt
6 from Decryption_code import decrypt
7
8 root = tk.Tk()
9 root.title("Image Encryption And Decryption")
10 canvas = tk.Canvas(root, width=900, height=600)
11 canvas.grid(columnspan=3, rowspan=4)
12 image=""
13 key=0
14
15 logo = Image.open('Logo.jpeg')
16 logo = ImageTk.PhotoImage(logo)
17 logo_label = tk.Label(image=logo)
18 logo_label.image = logo
19 logo_label.grid(column=0, row=0, columnspan=3)
20
21 instructions = tk.Label(root, text="Select an image file on your computer to encode it", font="Raleway")
22 instructions.grid(column=0, row=2)
23
24 def onEnter(e):
25     e.widget['background'] = 'green'
26
27 def onLeave(e):
28     e.widget['background'] = '#8B008B'
29
30 def open_file():
31     global image, key
32     image = askopenfile(parent=root, mode='rb', title="Choose a file", filetype=[("png file", "*.png")])
33     if image == None:
34         b2["state"] = tk.DISABLED
35         b3["state"] = tk.DISABLED
36     else:
37         b2["state"] = tk.ACTIVE
38         b3["state"] = tk.ACTIVE
39         b2['bg'] = b3['bg'] = "#8B008B"
40         b2['fg'] = b3['fg'] = "white"
41
42     key = entry1.get("1.0", "end")
43     if(key == "\n"):
44         b2['bg'] = b3['bg'] = "white"
```

Program Execution Screenshots



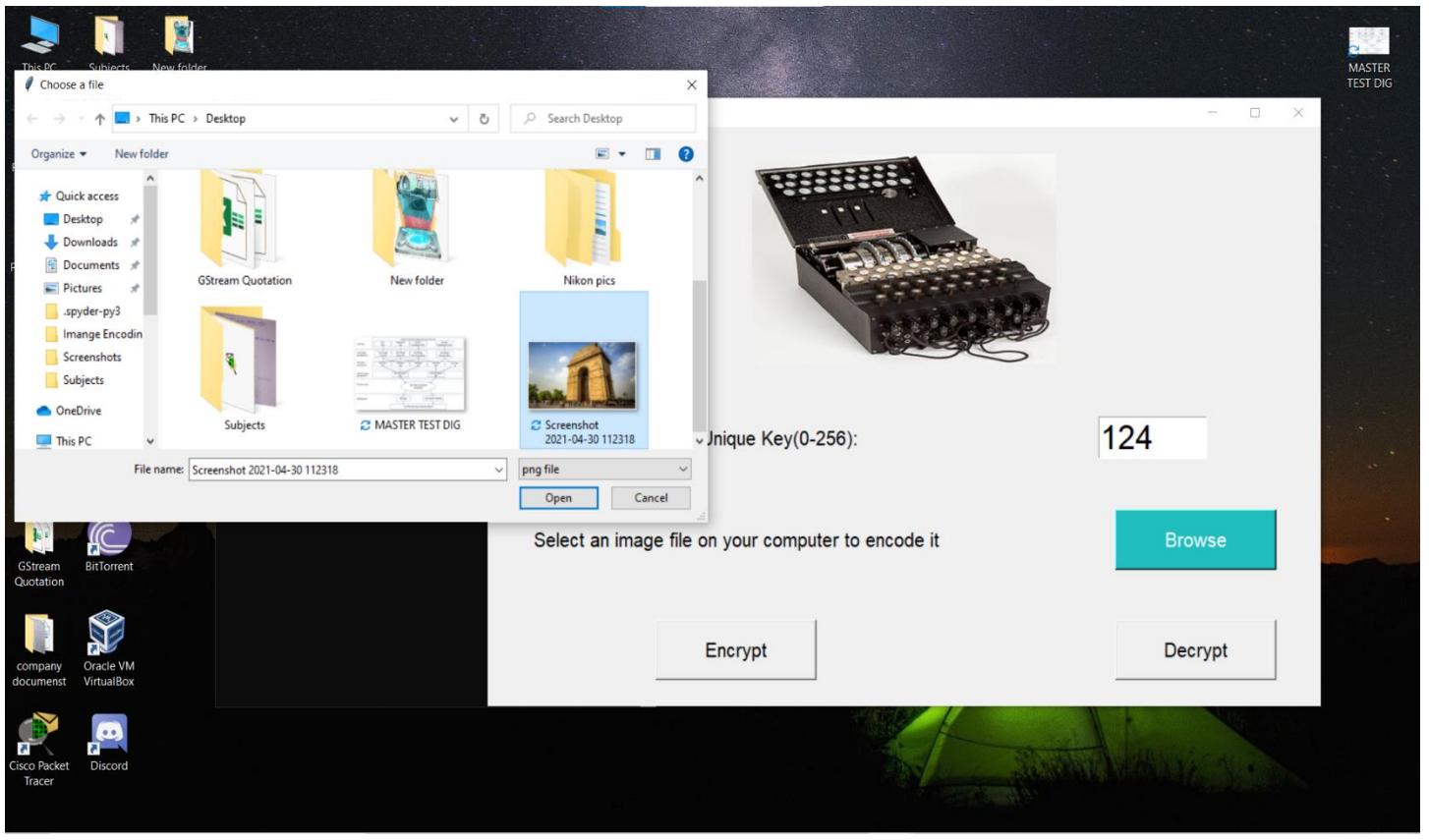
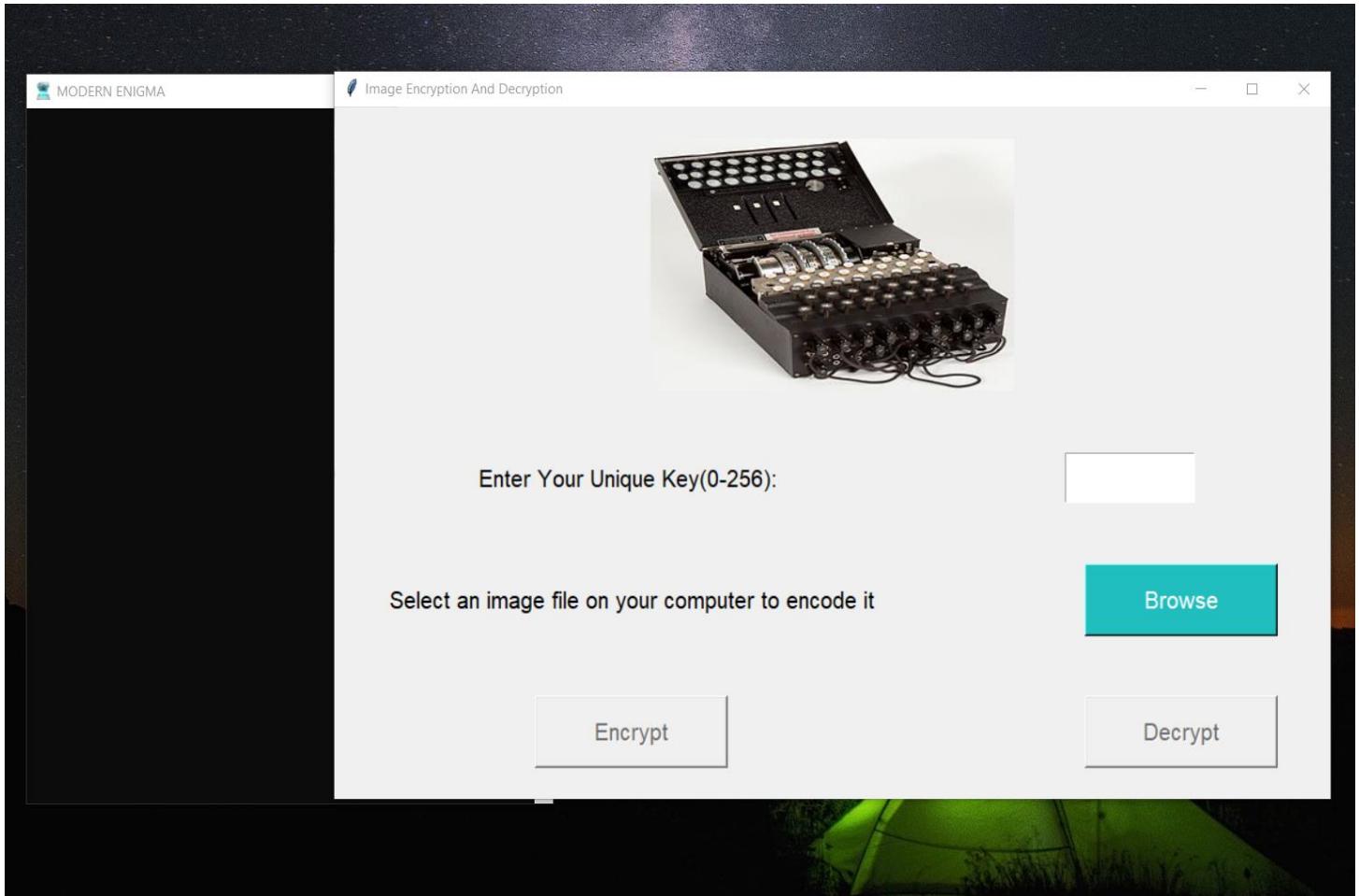


IMAGE BEFORE ENCRYPTION

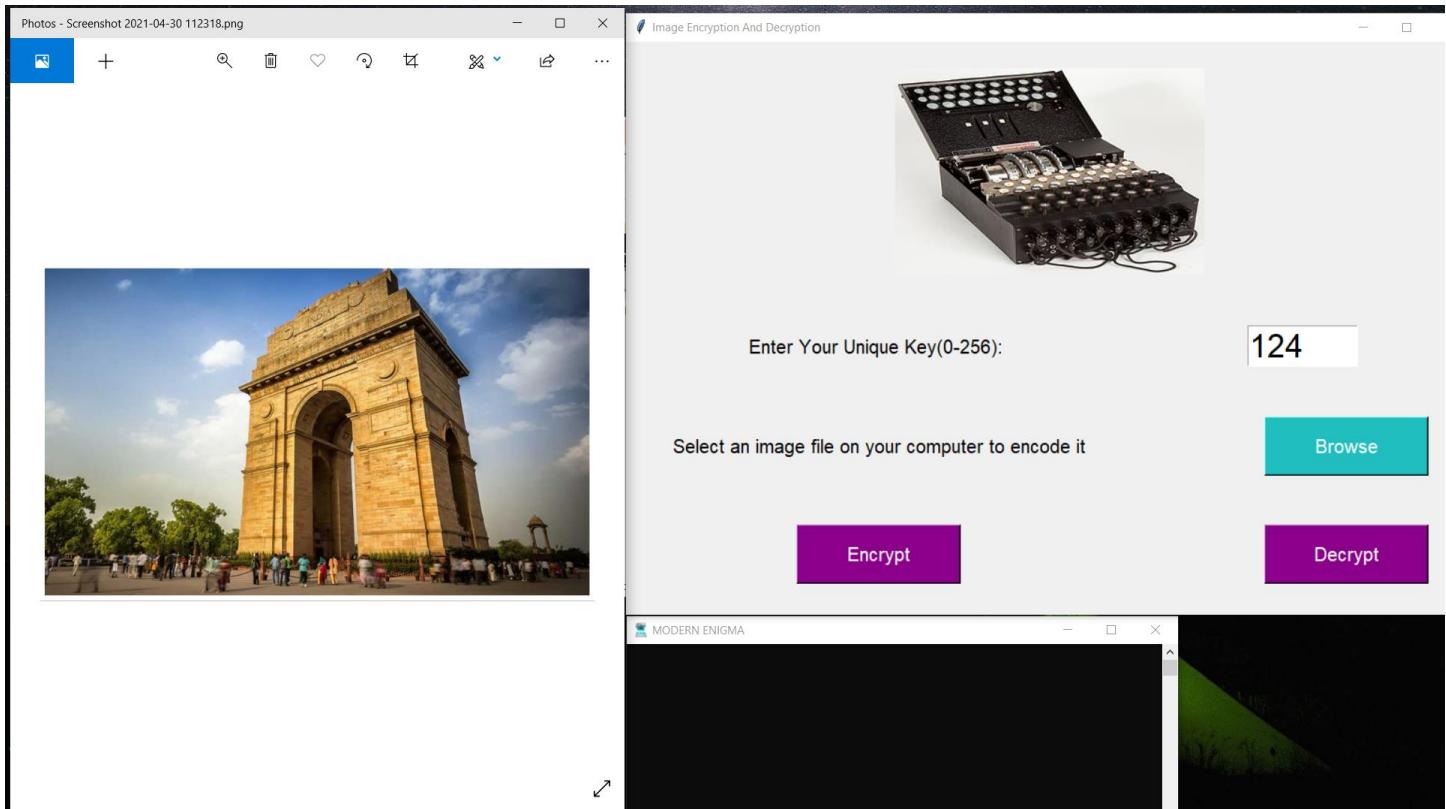


IMAGE AFTER ENCRYPTION

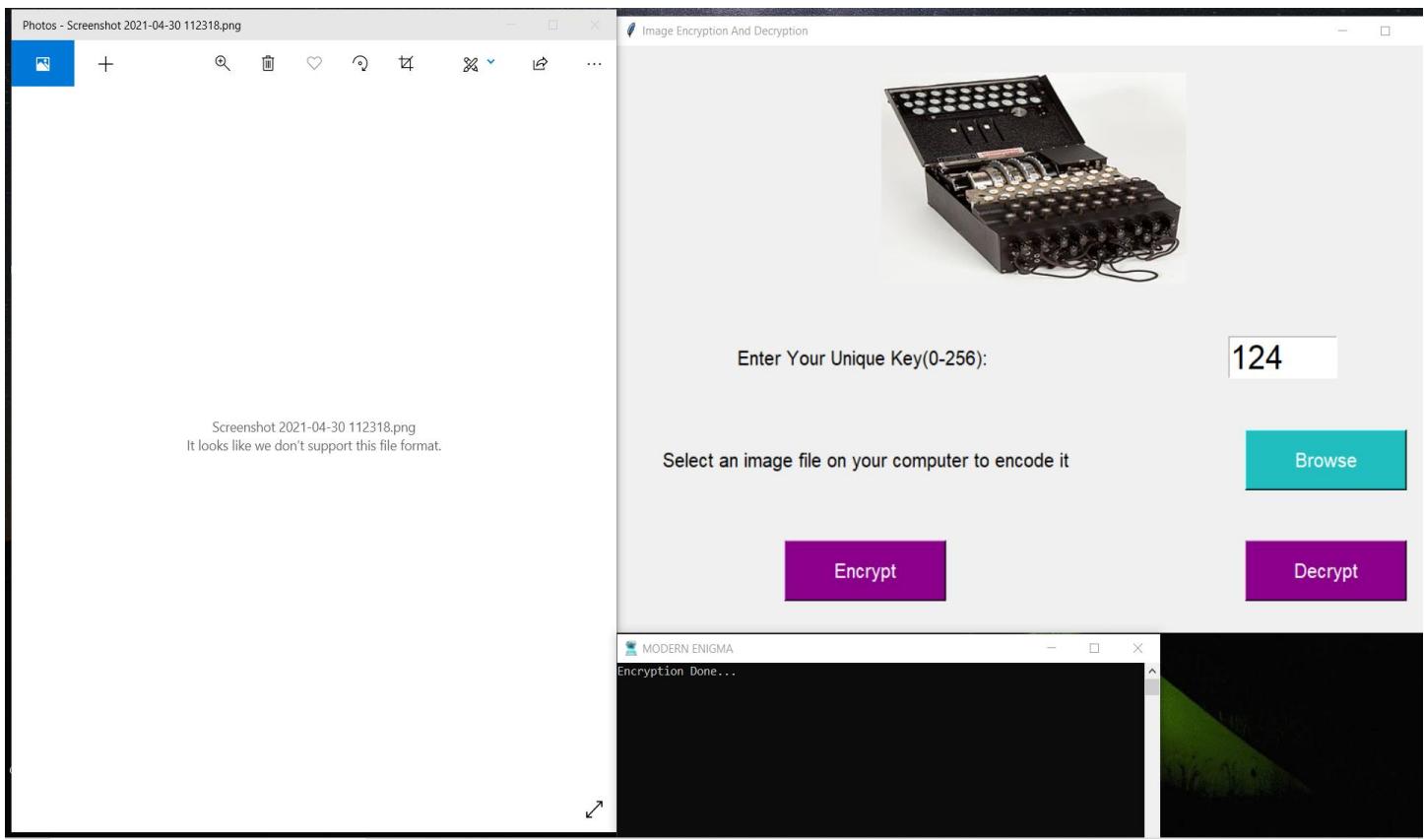


IMAGE BEFORE DECRYPTION

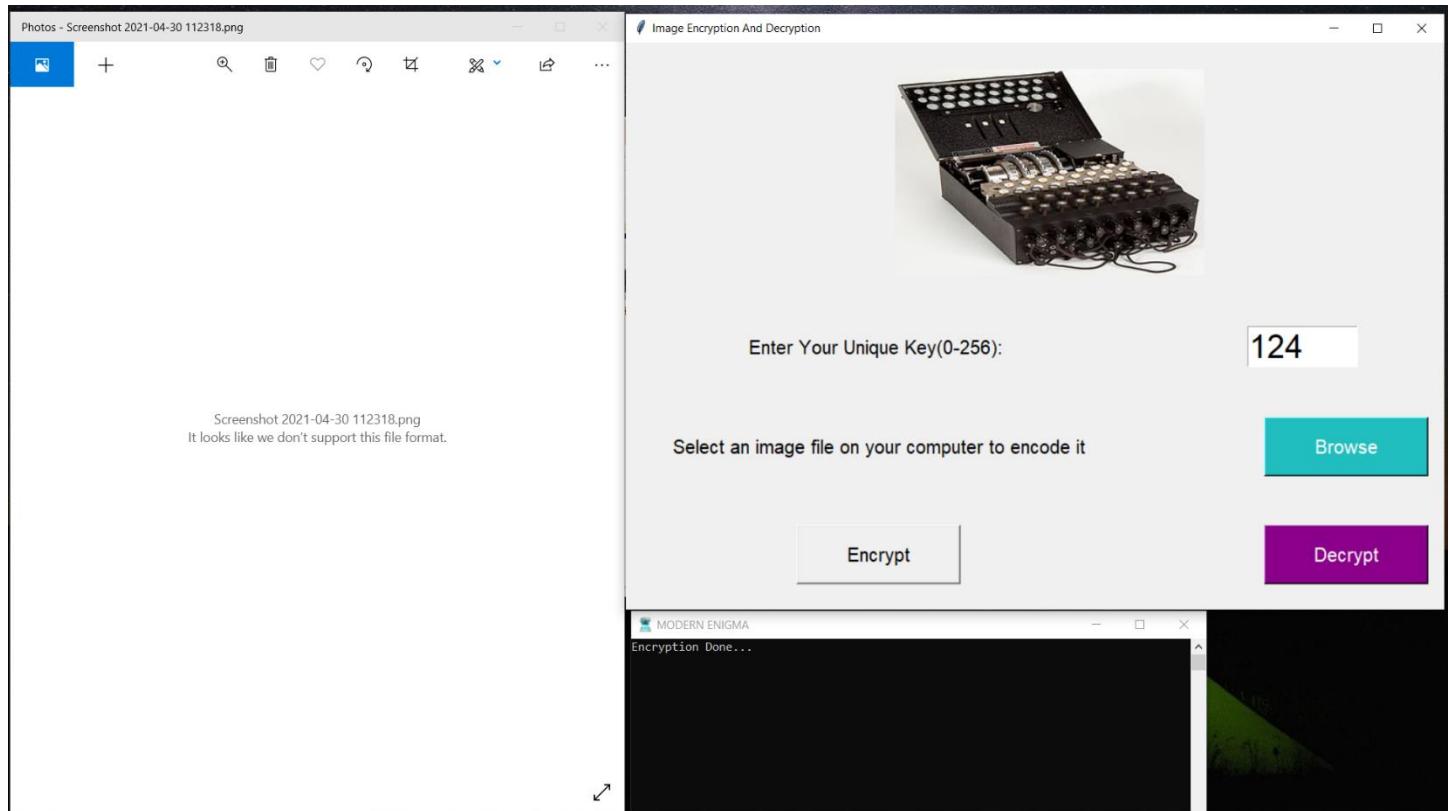


IMAGE AFTER DECRYPTION

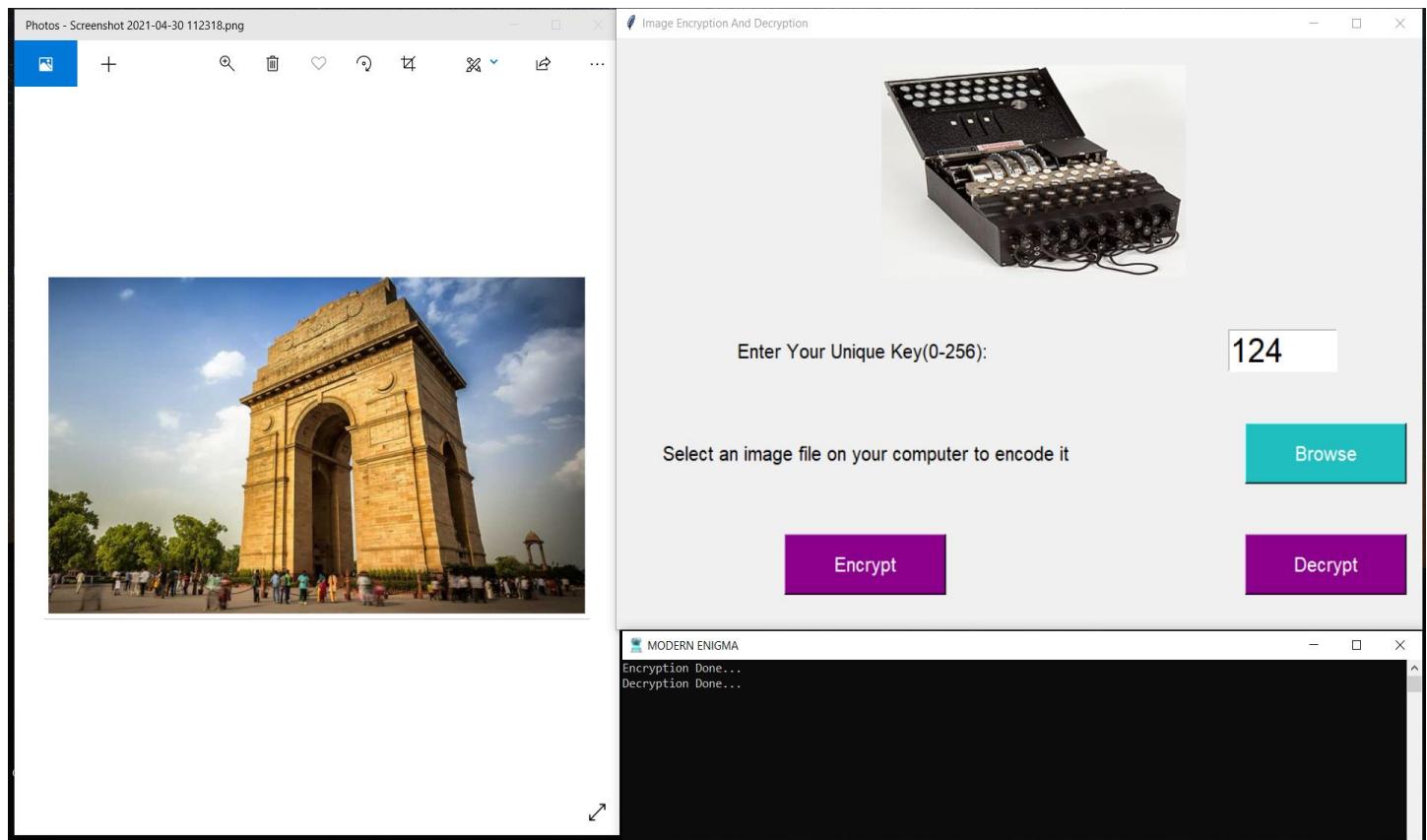


IMAGE AND BYTRATE COMPARISON

IMAGE BEFORE ENCRYPTION

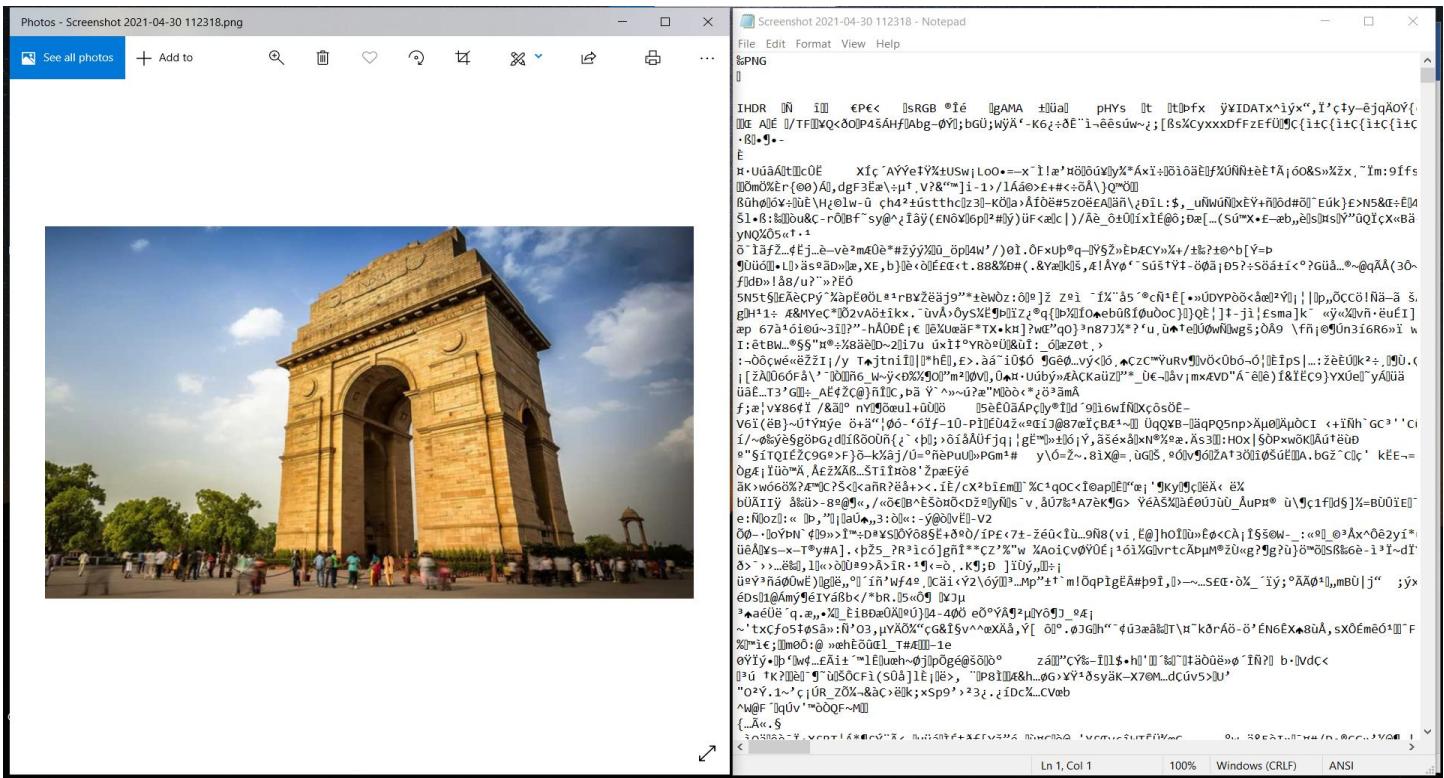
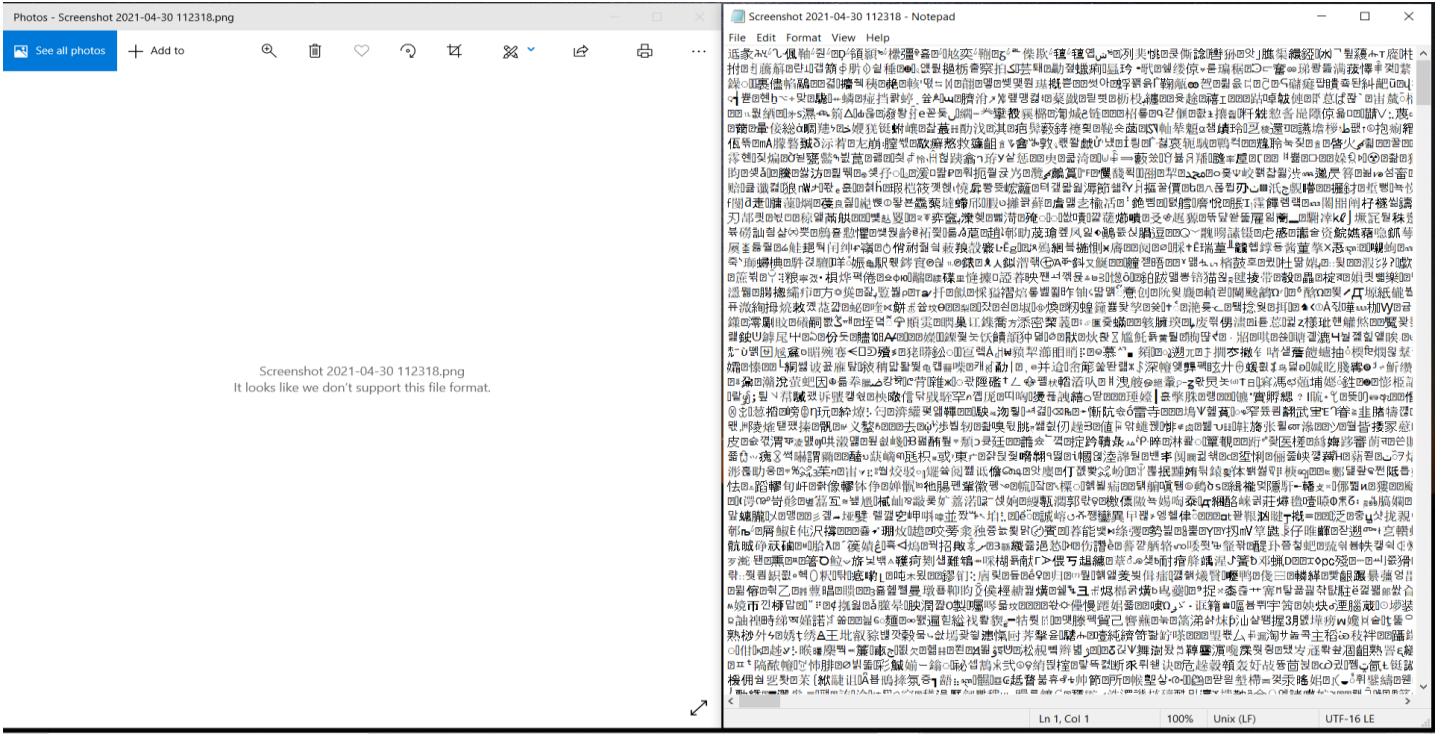


IMAGE AFTER ENCRYPTION



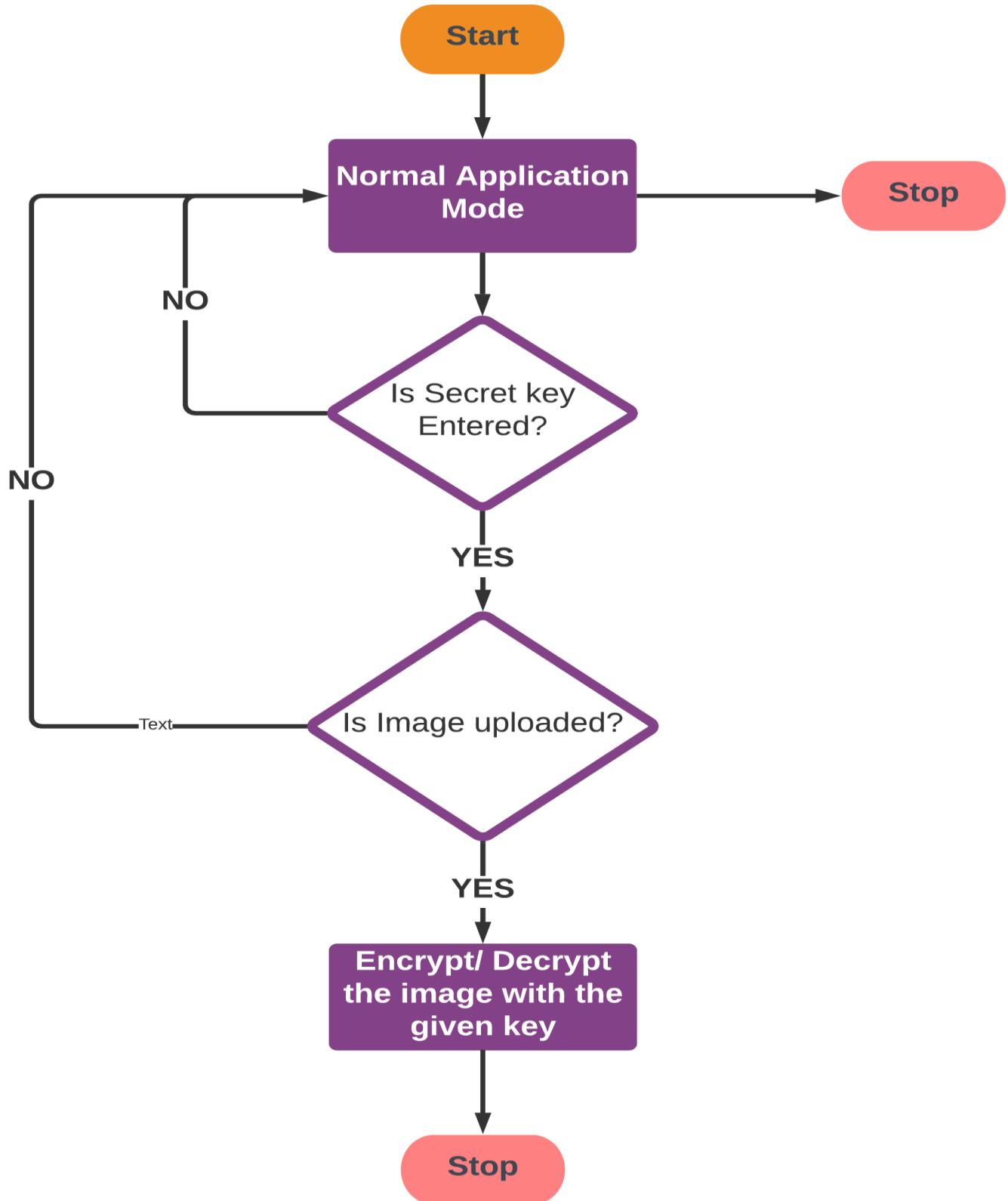
ADDITIONAL REQUIREMENTS

- Support for users from Linux & iOS platforms.
- Support for importing the images/videos/texts from local files .
- Support for exporting the images/videos/texts to user's local files.
- Support for applying custom backgrounds.
- Support for applying custom themes.
- Feature for managing soft copy of the encoded/decoded images/texts.
- Feature for sharing the encoded/decoded images/videos/texts on different platforms.
- Feature for giving custom key for the encoding of the images/videos/texts.
- Support for exporting the encoded product to different website

ADDITIONAL ISSUSES

- Issue while switching from one network to another network
- Issue while generating two-way authentication request
- Issue while dumping encoded file and saving encoded file in cloud
- Issue with network analyzer on bigger networks
- Issue with mismatch of pin pointing
- The selected image/text/video/location in the website and the local files.
- Issue with graphical user interface and clarity of instructions.

CONTROL FLOW DIAGRAM



SOFTWARE TESTING

Testing Frameworks

Testing framework used to test the "Network Helper" is a module-based testing framework and data driven testing framework.

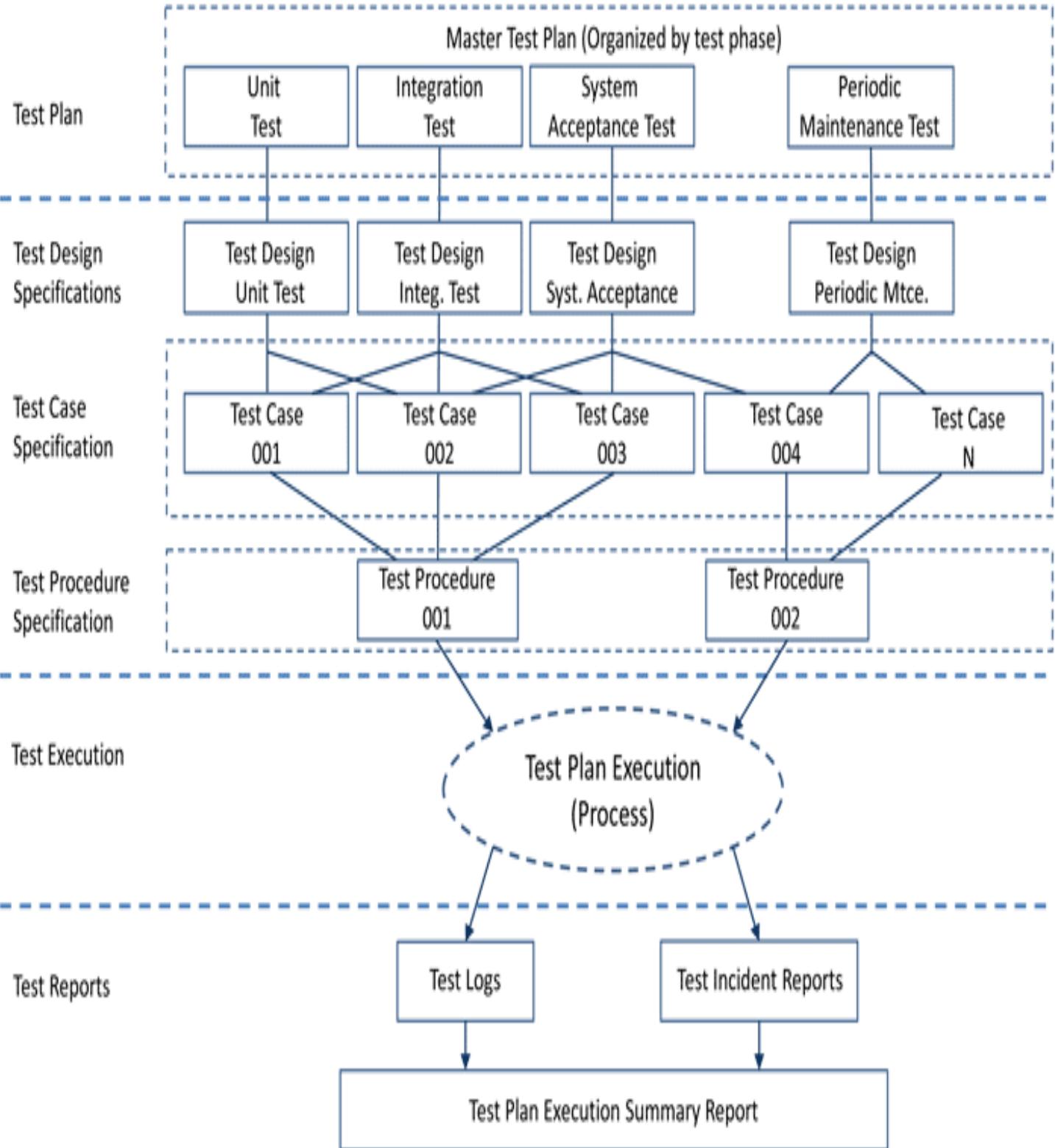
- **Module Based Testing Framework**

Module based testing framework is based on the concept of abstraction one of the popular OOPS concept. Here the application is divided into a number of logical and isolated modules. An independent test script is created for each module. The modules are separated by an abstraction layer so that any change in the section does not affect the module.

- **Data Driven Testing Framework**

It is often required to test functionality multiple times with different set of input data. Here, instead of putting the test data in the test script, it is advised to keep the data in an external database. This will help in segregating the test script logic and test data from each other. This is exactly what test data driven framework does. The external database could be anything like XML, CSV, or ODBC repository. The data is generally kept in 'Key Value' pair.

MASTER TEST PLAN FLOW DIAGRAM



MASTER TEST PLAN

Testing Objective	Focusing on performance issue
Test Items	Login system, Registration system, Version control system
Features to be Tested	Key Range, Multi-level Encryption and Decryption, Getting correct image format
Approach	Method - Manual Testing
Required Hardware / Software	A PC with minimum 4GB of RAM, python tools, Also supports Android and IOS platforms.
Risks	Situation where users enter invalid key, Instability of the product , High attrition rates
Estimate	<ul style="list-style-type: none">• Cost including Tax And Other Charges to be announced after prolific usage• Heavy Concession to be provided for usage in government and military related usages or implementations.

MANUAL TESTING

Test area	Input	Test Description	Output/Result
Key value for the encoding and decoding	Key value="" "	The value at which image code is incremented. The value should be between 1-256	Tested
Browsing for the image to be encoded / decoded	Browse = "selecting from the local files"	The browsing can be done to choose the image that user wanted to encode /decode	Tested
Encoding	nil	This converts the image into a code and add increment of the key value the which is assigned by the user	Tested
Decoding	nil	This converts the already encoded image in to code and decrement the key value assigned by user from the image code	Tested

CONCLUSION

- The Project “Image Encoding and Decoding using Modern Enigma properties” will prove to be highly efficient in countering the highly speculated rumor that personal and communal privacy is a myth in this modern era.
- Considering the time taken for the encryption and decryption process, this method is fast enough to use for various purpose. Also, based on the requirement of the level of security and ease of use, various encryption parameters can be flexed. The proposed method is not only secured but also maintains integrity. This algorithm is highly suitable for the digitalized system because of the image processing performed efficiently.
- The Project can do wonders if we are able deploy the same to all popular social media platforms, this will ensure and enhance the privacy features of the common user.
- The Project will also give the user the ability to change the combination of the algorithm and send it to different receivers that can only be accessed by a specific combination which similar to a message with a pin code.
- The next anticipated modification of this Project will enable Further modifications of this algorithm can be used on file types other than just image files.

REFERENCES

- The Image Encryption and Decryption using Enigma Algorithm [IEEE] :- Research paper by Md. Towsif Abir.
- All the diagrams and charts presented are created using Lucid chart and related software's.
- All the programming has been done using Anacondas Spyder IDE in Python Language.
- "Encryption 101: What It Is, How It Works, and Why We Need It," Security News - Trend Micro IN, [Online]. Available: <https://www.trendmicro.com/vinfo/in/security/news/online-privacy/encryption-101-what-it-is-how-it-works>.
- K. D. a. B. S. Patel, "Image encryption using different techniques: A review," *International Journal of Emerging Technology and Advanced Engineering*,