**LAB – 12**

**Name :** Shubham Pareshbhai Shingala

**Roll no. :** CE146

**College ID:** 19CEUOS159

**Aim:** Write a program to demonstrate Image Steganography operations:

Embed and Extract Hide 1 bit per pixel. Compute MSE (Mean Squared Error)

and PSNR (Peak Signal to Noise Ratio) values

* **Source Code:**

#include <bits/stdc++.h>

using namespace std;

#define DIMS 4         // image dimensions

#define MSG DIMS \*DIMS // input number size(in bits)

#define v2D vector<vector<int>>

v2D lsbEmbed(v2D img, bitset<MSG> num)

{

    for (int i = 0, k = 0; i < DIMS; i++)

    {

        for (int j = 0; j < DIMS; j++, k++)

        {

            bitset<8> t(img[i][j]); // convert decimal to binary

            t[0] = num[15 - k]; // assign bit to img pixel lsb bit

            string t1 = t.to\_string();

            img[i][j] = stoi(t1, 0, 2); // convert binary to decimal

        }

    }

    return img;

}

float MSE(v2D img,v2D stegoImg)

{

    float sum = 0;

    for (int i = 0; i < DIMS; i++)

    {

        for (int j = 0; j < DIMS; j++)

        {

            sum += pow(img[i][j] - stegoImg[i][j], 2);

        }

    }

    return (sum / (DIMS \* DIMS));

}

float PSNR(float mse)

{

    float temp = pow(255, 2) / mse;

    return (10 \* log10(temp));

}

int extract(v2D stegoImg)

{

    string msg = "";

    for (int i = 0; i < DIMS; i++)

    {

        for (int j = 0; j < DIMS; j++)

        {

            bitset<8> t(stegoImg[i][j]);

            msg += to\_string(t[0]);

        }

    }

    return stoi(msg, 0, 2);

}

int main()

{

    int n, x;

    cout << "Enter number(decimal): ";

    cin >> n;

    bitset<MSG> num(n);

    cout << "Enter cover Image:\n";

    auto img = v2D(DIMS, vector<int>(DIMS));

    for (int i = 0; i < DIMS; i++)

        for (int j = 0; j < DIMS; j++)

            cin >> img[i][j];

    v2D stegoImg = lsbEmbed(img, num);

    cout << "\nStego Image:\n";

    for (vector<int> vect1D : stegoImg)

    {

        for (int pix : vect1D)

            cout << pix << " ";

        cout << endl;

    }

    cout << "\nMSE: ";

    float mse = MSE(img, stegoImg);

    cout << mse;

    cout << "\nPSNR: ";

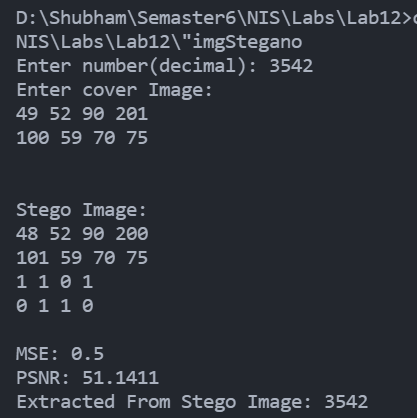
    cout << PSNR(mse);

    cout << "\nExtracted From Stego Image: ";

    cout << extract(stegoImg);

}

* **Test Case – 1:**

****