TASK-6

STEGANOGRAPHY:-

Steganography is the practice of concealing a message within another message or a physical object. In computing/electronic contexts, a computer file, message, image, or video is concealed within another file, message, image, or video.

WORKING OF STEGANOGRAPHY:-

Steganography replaces unneeded or unused bits in regular computer files (Graphics, sound, text) with bits of different and invisible information. Hidden information can be any other regular computer file or encrypted data.

Steganography differs from cryptography in a way that it masks the existence of the message where cryptography works to mask the content of the message.

Steganography sometimes used in conjunction with encryption. An encrypted file may still hide information using steganography, so even if the encrypted file is deciphered,the hidden information is not seen.

TYPES OF STEGANOGRAPHY:-

There are different ways to hide the message in another, well known are Least Significant bytes and Injection.

When a file or an image is created there are few bytes in the file or image which are not necessary or least important. These type of bytes can be replaced with a message without damaging or replacing the original message, by which the secrete message is hidden in the file or image.

Another way is a message can be directly injected into a file or image. But in this way the size of the file would be increasing accordingly depending on the secrete message

STEGANOGRAPHY IN IMAGE:-

Digital images are the most widely used cover objects for steganography. Due to the availability of various file formats for various applications the algorithm used for these formats differs accordingly.

An image is collection of bytes (know as pixels for images) containing different light intensities in different areas of the image. When dealing with digital images for use with Steganography, 8-bit and 24-bit per pixel image files are typical. Both have advantages and disadvantages 8-bit images are a great format to use because of their relatively small size. The drawback is that only 256 possible colors can be used which can be a potential problem during encoding. Usually a gray scale color palette is used when dealing with 8-bit images such as (.GIF) because its gradual change in color would be harder to detect after the image has been encoded with the secret message. 24-bit images offer much more flexibility when used for Steganography. The large numbers of colors (over 16 million) that can be used go

well beyond the human visual system (HVS), which makes it very hard to detect once a secret message, has been encoded.

Large amount of data can be encoded in to 24-bit images as it is compared to 8-bit images. The drawback of 24-bit digital images is their size which is very high and this makes them suspicious our internet due to their heavy size when compared to 8-bit images. Depending on the type of message and type of the image different algorithms are used.

Few types in Steganography in Images:

1. Least significant bit insertion:- Least Significant Bit (LSB) insertion is most widely known algorithm for image steganography ,it involves the modification of LSB layer of image. In this technique,the message is stored in the LSB of the pixels which could be considered as random noise.Thus, altering them does not have any obvious effect to the image.

2. Masking and filtering:- Masking and filtering techniques work better with 24 bit and grey scale images. They hide info in a way similar to watermarks on actual paper and are sometimes used as digital watermarks. Masking the images changes the images. To ensure that changes cannot be detected make the changes in multiple small proportions. Compared to LSB masking is more robust and masked images passes cropping, compression and some image processing. Masking techniques embed information in significant areas so that the hidden message is more integral to the cover image than just hiding it in the “noise” level. This makes it more suitable than LSB with, for instance, lossy JPEG images.

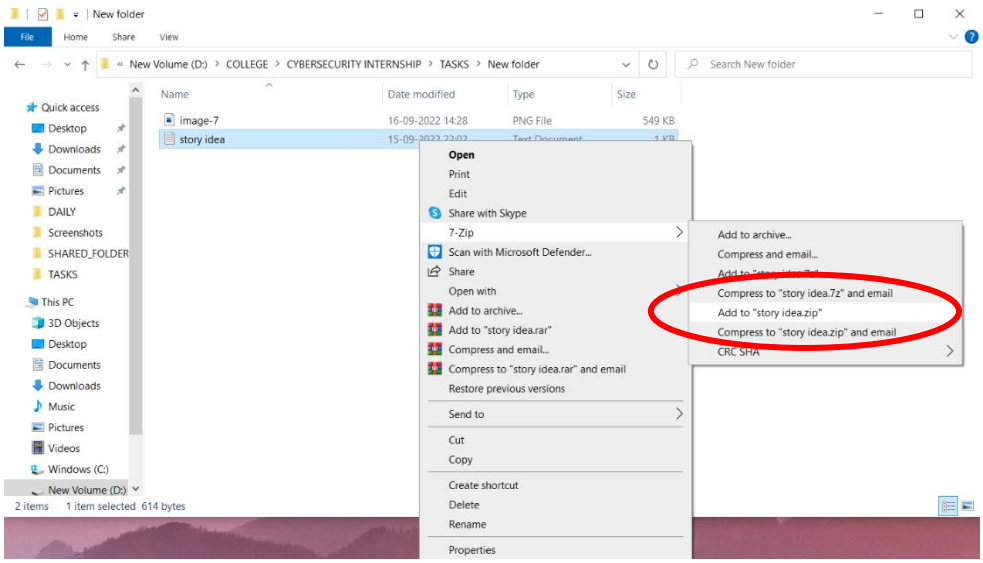
3. Redundant Pattern Encoding:- Redundant pattern encoding is to some extent similar to spread spectrum technique. In this technique, the message is scattered through out the image based on algorithm. This technique makes the image ineffective for cropping and rotation. Multiple smaller images with redundancy increase the chance of recovering even when the stegano-image is manipulated.

4. Encrypt and Scatter:- Encrypt and Scatter techniques hides the message as white noise and White Noise Storm is an example which uses employs spread spectrum and frequency hopping. Previous window size and data channel are used to generate a random number.And with in this random number ,on all the eight channels message is scattered through out the message.Each channel rotates,swaps and interlaces with every other channel. Single channel represents one bit and as a result there are many unaffected bits in each channel. In this technique it is very complex to draw out the actual message from stegano-image. This technique is more secure compared to LSB as it needs both algorithm and key to decode the bit message from stegano-image. Some users prefer this methos for its security as it needs both algorithm and key despite the stegano image. This method like LSB lets image degradation in terms of image processing, and compression.

5. Least significant bit insertion:- LSB modification technique for images does hold good if any kind of compression is done on the resultant stego-image e.g. JPEG, GIF. JPEG images use the discrete cosine transform to achieve compression. DCT is a

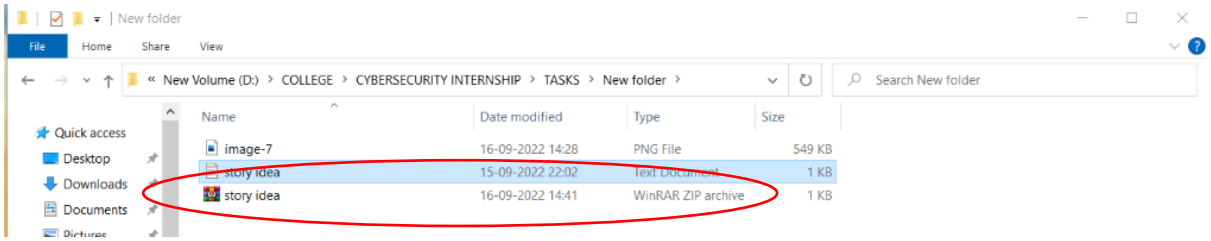
lossy compression transform because the cosine values cannot be calculated exactly, and repeated calculations using limited precision numbers introduce rounding errors into the final result. Variances between original data values and restored data values depend on the method used to calculate DCT.

Step-1:- convert the text into a zip file.



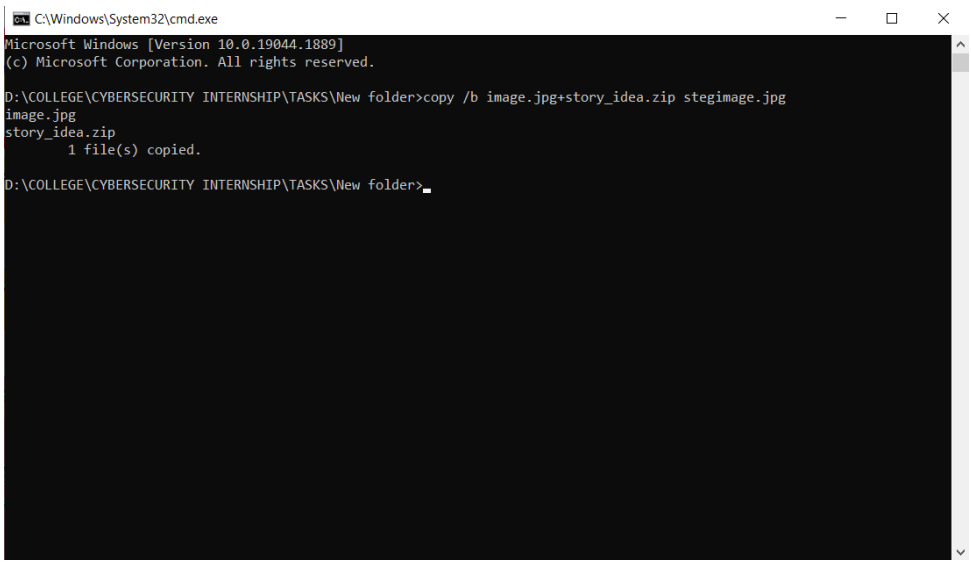
And the zip file is created.

Step-2:- open command prompt in that directory and do the following command

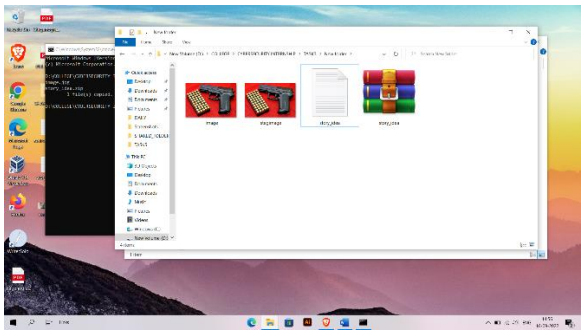


“copy /b <image.jpg>+<text_zip_file> <new_image_name.jpg>”

Ex:- copy /b image.jpg+story_idea.zip stegimage.jpg

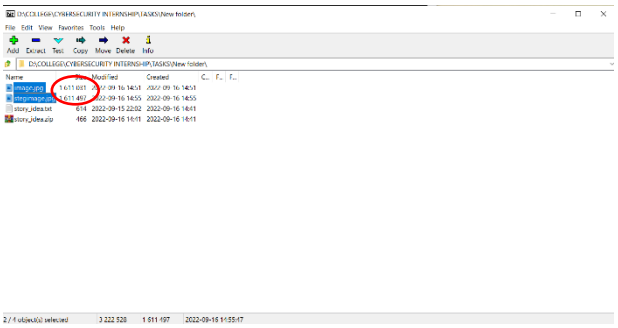


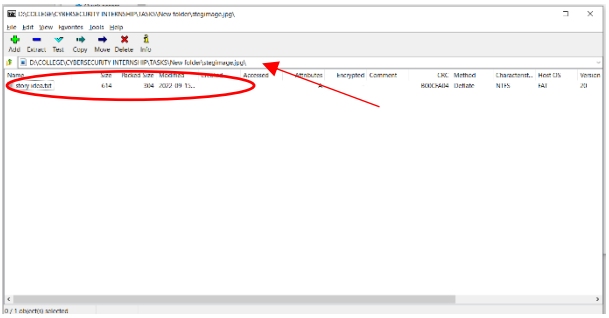
And we can see that a new image is created.



But there is a size change in the files, which means there is some extra information in that picture.

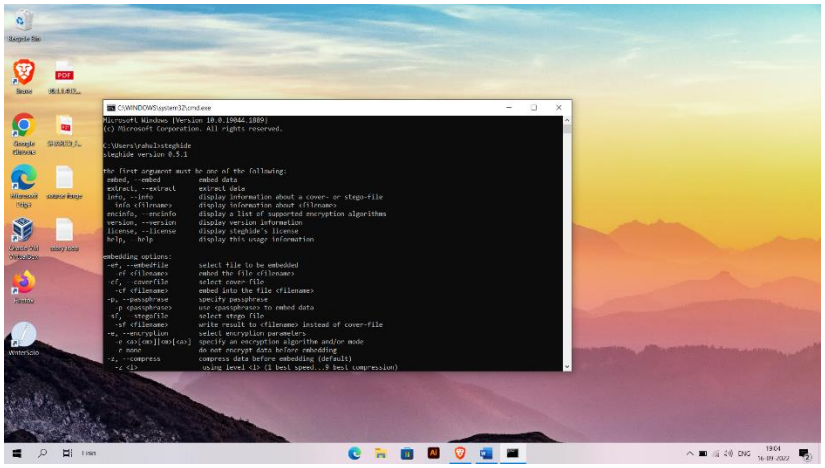
When we open the image in 7 zip file manager we can see that there is a text file inside the image.





We also can use steghide and embed a message into a image.

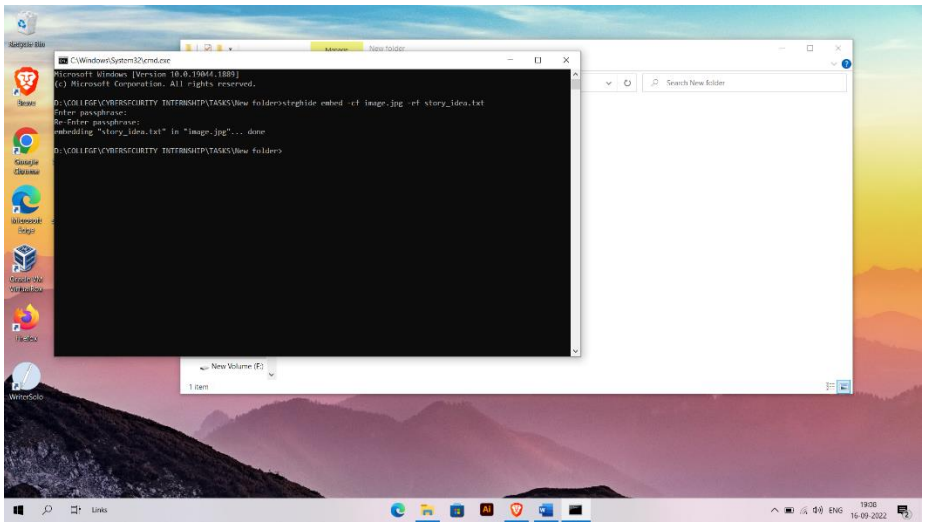
Steghide has many arguments that can be used for desired outputs.



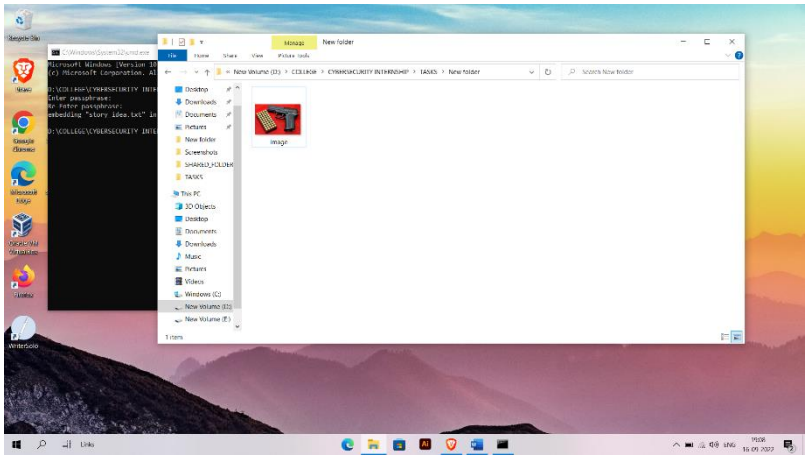
Step-1:- we apply the command. (steghide embed -cf <image.jpg> -ef <text_file_to_be_embeded.txt>)

Ex:- steghide embed -cf image.jpg -ef story_idea.txt

We see that the text is embedded with a passphrase



Now we can delete the file to later extract it.

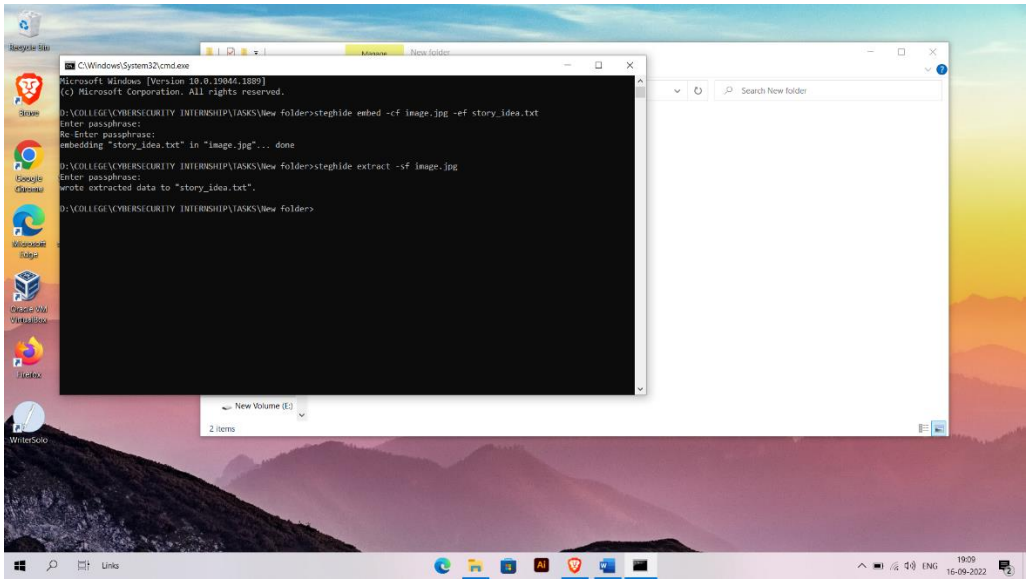


Step-2:- now to extract we use the command. (steghide extract -sf <image.jpg>)

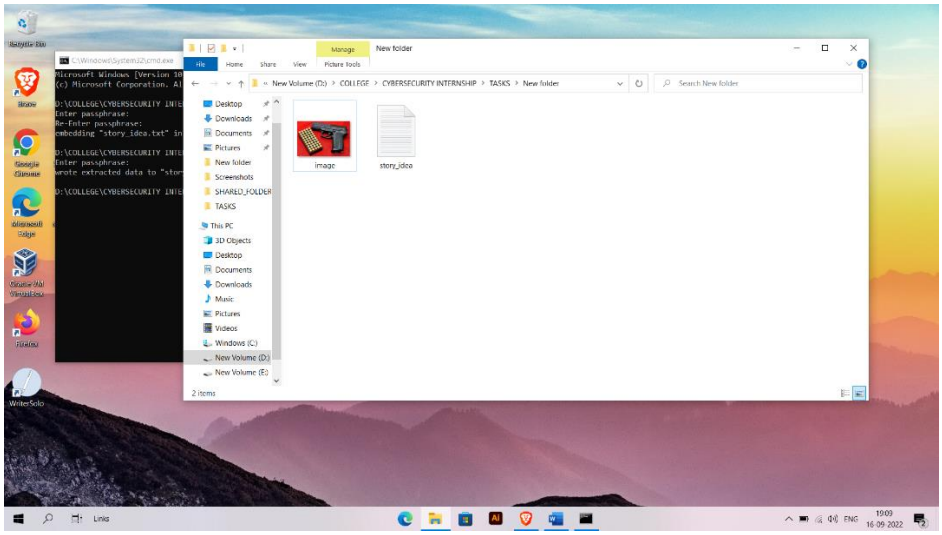
Ex:- steghide extract -sf image.jpg

Then it will ask for the pass phrase that is also a password.

After entering the password we see that the file is extracted out.



We can see that the file is extracted.



Other image steganography methods are:-

Steganographic Tools

Tool	Description
Stegosuite	Hide text inside any image
Stegohide	Hide secret file in image or audio file.
Xiao Steganography	Free software that can be used to hide secret files in BMP images or in WAV files.
SSuite Picsel	Portable application to hide text inside image file
OpenPuff	Tool to conceal files in image, audio & flash files
Camouflage	Tool that lets you hide any type of file inside of file.

STEGANOGRAPHY IN AUDIO:-

Implanting secrete message into an audio is the most challenging technique in Steganography. This is because the human auditory system (HAS) has such a vibrant range that it can listen over. To put this in perspective, the (HAS) recognize over a range of power greater than one million to one and a range of frequencies greater than one thousand to one making it extremely hard to add or remove data from the original data structure. The only weakness in the (HAS) comes at trying to differentiate sounds (loud sounds drown out quiet sounds) and this is what must be exploited to encode secret messages in audio without being detected.

Below are the lists of methods which are commonly used for audio Steganography.

1. LSB coding:- Using the least-significant bit is possible for audio, as modifications usually would not create recognizable changes to the sounds. Another method takes advantage of human limitations. It is possible to encode messages using frequencies that are indistinct to the human ear. Using frequencies above 20.000Hz, messages can be hidden inside sound files and can not be detected by human checks.

2. Parity coding:- Instead of breaking a signal down into individual samples, the parity coding method breaks a signal down into separate regions of samples and encodes each bit from the secret message in a sample region's parity bit. If the parity bit of a selected region does not match the secret bit to be encoded, the process flips the LSB of one of the samples in the region. Thus, the sender has more of a choice in encoding the secret bit, and the signal can be changed in a more unobtrusive fashion.

3. Phase coding:- Phase coding attends to the disadvantages of the noise inducing methods of audio Steganography. Phase coding uses the fact that the phase components of sound are not as audible to the human ear as noise is. Rather than introducing perturbations, this technique encodes the message bits as phase shifts in the phase spectrum of a digital signal, attaining an indistinct encoding in terms of signal-to-perceived noise ratio.

4. Spread spectrum:- In the context of audio Steganography, the basic spread spectrum (SS) method attempts to spread secret information across the audio signal's frequency spectrum as much as possible. This is comparable to a system using an implementation of the LSB coding that randomly spreads the message bits over the entire audio file. However, unlike LSB coding, the SS method spreads the secret message over the sound file's frequency spectrum, using a code that is independent of the actual signal. As a result, the final signal occupies a bandwidth in excess of what is actually required for broadcast.

5. Echo hiding:- In echo hiding, information is implanted in a sound file by introducing an echo into the separate signal. Like the spread spectrum method, it too provides advantages in that it allows for a high data transmission rate and provides superior strength when compared to the noise inducing methods. If only one echo was produced from the original signal, only one bit of information could be encoded.

Therefore, the original signal is broken down into blocks before the encoding process begins. Once the encoding process is completed, the blocks are concatenated back together to create the final signal.

Tools used for audio steganography:-

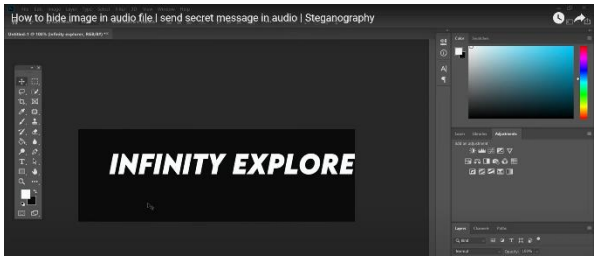
WavstegPermalink

WavSteg is a python3 tool that can hide data and files in wav files and can also extract data from wav files.
You can get it from github

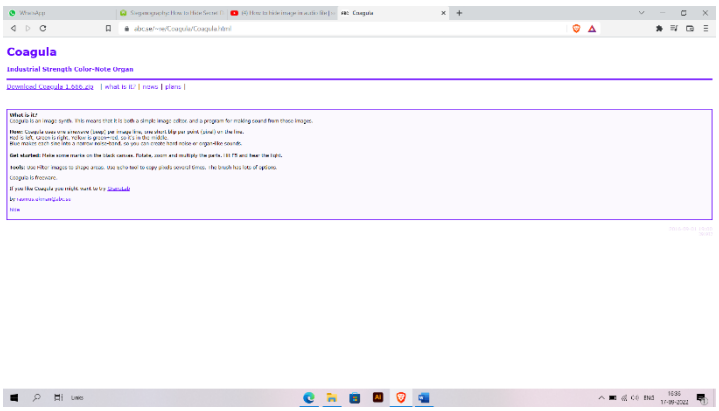
Sonic visualizerPermalink

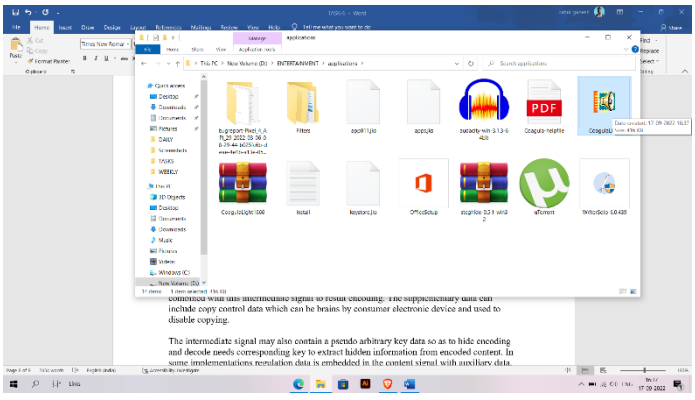
Sonic visualizer is a tool for viewing and analyzing the contents of audio files, however it can be helpful when dealing with audio steganography. You can reveal hidden shapes in audio files.

Step 1:- create a image with a bit map extension, where the text is white and the background is black.



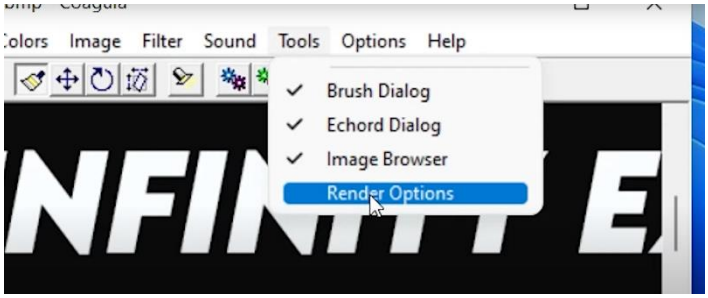
Step-2:- now download a software called coagula to convert the image that has text into an audio file.

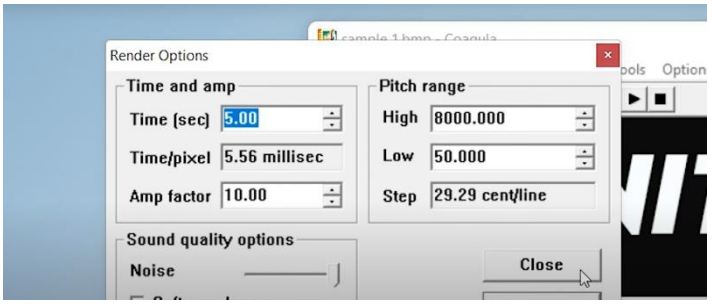




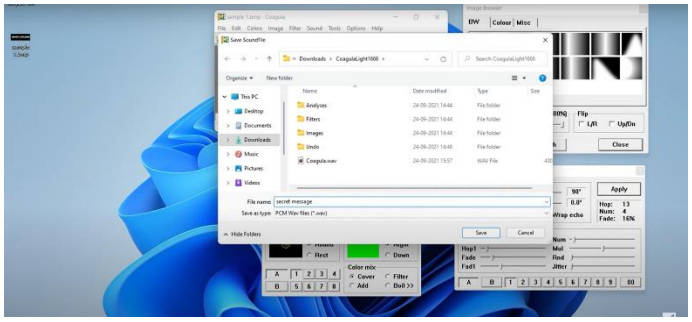
step-3:- we open the image in coagula

tools>render options (to convert the image into audio)



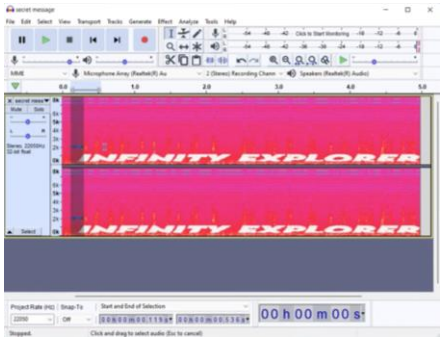


and save the audio in the desired folder.

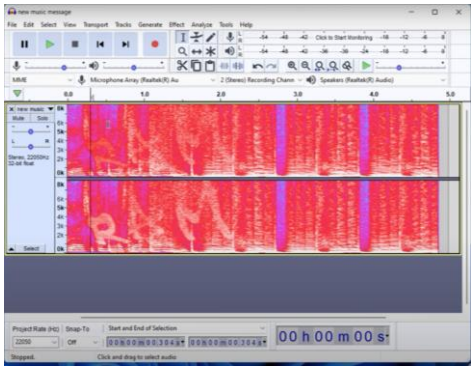


Step-4:- now import the image into audacity.

And watch it in spectrogram.



Now if we export a new audio under this file and save both the audios as a single file we get a final output something like this.



STEGANOGRAPHY IN VIDEO:-

In video steganography, a video file would be embedded with supplementary data to hide secret messages. In the process, an intermediate signal which is a function of hidden message data and data of content signal would be generated. Content data (video file) is then combined with this intermediate signal to result encoding. The supplementary data can include copy control data which can be brains by consumer electronic device and used to disable copying.

The intermediate signal may also contain a pseudo arbitrary key data so as to hide encoding and decode needs corresponding key to extract hidden information from encoded content. In some implementations regulation data is embedded in the content signal with auxiliary data. This regulation data consists of known properties enabling its identification in the embedded content signal. This encoding is robust against scaling, resampling and other forms of content degradation, so that the supplementary data can be detected from the content which might have been degraded.

There are different approaches for video steganography apart from the above mentioned. Most widely known are listed and discussed below.

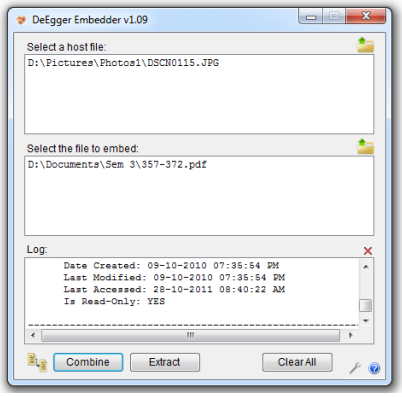
1. Least Significant Bit Insertion:- This is the most simple and popular approach for all types of steganography. In this method the digital video file is considered as separate frames and changes the displayed image of each video frame. LSB of 1 byte in the image is used to store the secret information. Effecting changes are too small to be recognized by human eye. This method enhances the capacity of the hidden message but compromises the security requirements such as data integrity.

2. Real time video steganography:- This kind of steganography involves hiding information on the output image on the device. This method considers each frame shown at any moment irrespective of whether it is image; text .The image is then divided into blocks. If pixel colors of the blocks are similar then changes color characteristics of number of these pixels to some extent. By labeling each frame with a sequence number it would even be easy to identify missing parts of information. To extract the information, the displayed image should be recorded first and relevant program is used then.

Tools:-

DeEagger is one of the tools for video steganography to embed text files into a video and to extract embede text from a video.

1. Select Your Host file via drag and drop or using browser button
2. Select the file which you want to embed via drag and drop or by using browser button
3. Click on *Combine*
4. Now a dialog will come which will allow you to store the embedded file on your disk.



DeEgger Embedder:-

That's all. Now your file is completely hidden in the hist file and secure from third person. Now you need to transfer that file to your friend.

Once your friend received that file, he or she will again use **Degger embeddR** to separate the files from each other. To extract the file you can follow this steps

1. Select the received file as host file
2. Click on *Extract*
3. That's all. Now a pop up will appear on your screen asking you location for saving embedded file

STEGANOGRAPHY IN DOCUMENTS:-

Steganography in documents just focuses on altering some of its characteristics. They can either be characteristics of text or even text formatting. Below are few ways listed and discussed to implement the same.

Since everyone can read, encoding text in neutral sentences is doubtfully effective. But taking the first letter of each word of the previous sentence, one can see that it is possible and not very difficult. Hiding information in plain text can be done in many different ways. One way is by simple adding white space and tabs to the ends of the lines of the document .The last technique was successfully used in practice and even after a text has been printed and copied on paper for ten times, the secret message could still be retrieved.

Another possible way of storing a secret inside a text is using a publicly available cover source, a book or a newspaper, and using a code which consists for example of a combination of a page number, a line number and a character number. This way, no information stored inside the cover source leads to the hidden message. Discovering it depends exclusively on gaining knowledge of the secret key.

Setting background color and font color is one of the mainly used staganographic approach. This method is focused for Microsoft word documents. Choose predefined colors and set font and background colors of invisible characters such as space, tab or the carriage return characters. R,G,B values are 8 bits means we have allowed range of 0 to 255.Most of the viewers would not feel interested about color values of these invisible characters hence 3 bytes of information is easily hidden in each occurrence of space,tab or carriage return.This approach needs no extra information to hide required bits.