



UML Modeling for the Watermarking Image File Using Transform Method

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Abstract- Unified Modeling language (UML) is one of the important modeling languages used for the visual representation of the research problem. In the present paper, UML model has been designed for the watermarking in the image file using transform method because Digital watermarking is the process of embedding some information into a digital signal which is used to verify the authentication of image file or identity of its owner. In this paper digital signal is taken as picture and some information is embedded in to this file. At the time of transmitting a picture in the internet environment, picture as well as embedded information moves from node to node and at receiving end and one can get the authentic picture by extracting a embedded information from the watermarked image, which provide a secrecy in the image file. Watermarking is generally use in copyright protection systems which prevent unauthorized copying of digital media. The class diagram activity diagram and sequence diagram for the watermarking in the image file are depicted in this paper using the transformation technique.

Keywords- watermarking, Transform method, UML, Sequence Diagram.

I. INTRODUCTION

UML is a powerful modeling language used to represent the research problems visually. A lot of literature is available on modeling problems by the use of UML, but limited papers are reported in literature on applications of computer graphics. By the use of UML, Real time system based on UML is described by Selic and Rumbaugh [1]. The first represented of UML in the field of telecommunication sector is described by Holz [2]. The concept of UML was invented by the Greddy Booch et al. [3]. Sayeed [4] in his book on data compression explained about data compression technique. The computer architecture models which can be used for the further research work are available in [5]. The latest research in 2007 on distributed computing is reported by Martinez et al. [6]. UML based Vehicle control system is also reported in the literature by Walther et al. [7]. OMG is an important active group for inventing the different versions of the UML.M. Sun et al describe Research on embedding and extracting methods for digital watermarks applied to QR code images.

The research papers on these are [9, 10] which describes the UML diagram based on XML Meta data specification. Edge preserving compression technique using feed forward neural network is explained by Singh et al. [11]. In [12], watermarking methods as Invisible Watermarking based on creation and robust insertion-extraction of image adaptive watermarks is described by the author.[14] proposed the A wavelet based digital watermarking method using thresholds on intermediate bit values. [15] proposed the UML model with Performance Evaluation for the Multiplex system for the process which are executing in the Distributed environment.

The present research work is based on the design of the UML model how the image is get authenticate while transferring from one node to another node. The class, sequence and activity diagram are given for the said problem. By the use of proposed model one can easily develop software for watermark any image of any quality

very easily. Now a day MATLAB tools is very easy to develop any software relating digital image processing.

II. PROCESS

Let us first define the process which may be the group or block of instructions of program, macro, sub programs and subroutines. For defining the process, there is a need of the processing element. The processing element is defined as a stereotype and generally used to handle the concurrent process executing in the parallel and distributed environments. The following figure 1 shows the definition of processing unit

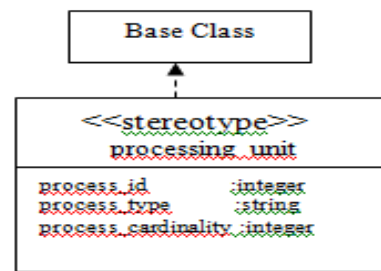


Figure 1. Definition of Processing Unit

The class diagram of process is defined in figure 2

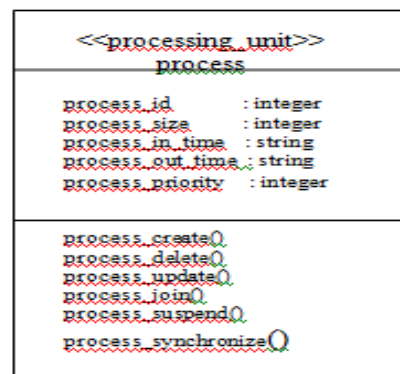


Figure 2. Class definition of process

The instance of the process is defined by the use of object xyz which is shown in figure 3:

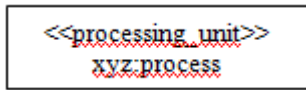


Figure 3. Instance of class

The set of the instances of the class process is modeled by the use of multiple objects which is shown below:

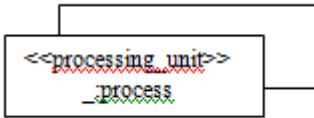


Figure 4. Multiple instances of object

In `_process` shows the name of multiple objects.

III. LOAD THE IMAGE

Process is use to load the image. In spatial coordinate system image is stored in the frame buffer of size $N \times N$ dimension. Each cell contain the coordinate of pixel (x,y) . In the gray scale scheme each pixel use 8 bits to store the information but in the colored scheme, three plane are there for each R,G and B. The monochrome image $f(x,y)$ is discretized both in spatial coordinates and gray level values to obtain the digital image. A digital image can be represented as matrix whose row and columns are used to locate a point in the image and corresponding element values give the gray level at that point.

$$F(x,y) = \text{MATRIX}[f(x,y)]$$

x vary from 1 to N and y vary from 1 to N .

in the MATLAB the function

`image = imread('file name')` is use to load the image.

IV. TRANSFORMATION OF THE IMAGE

In image processing spatial and frequency domain approaches are there but frequency domain approaches involve a very less computation time so this approach is widely used in image processing. There are different frequency transform approaches as *fourier transform* use for image enhancement and image reconstruction, *Discrete cosine transform* widely use for image compression and compression standard and *hotelling transform* use for recognition and aligning the object with principal eigen vector axis. The popular transform used for image watermarking is discrete cosine transform so it is discussed in this paper in detail. It is define as

$$C(u,v) = a(u)b(v) \sum f(x,y) \cos((2x+1)u\pi/2N) \cos((2y+1)v\pi/2N)$$

for $x= 0$ to $N-1$ and $y= 0$ to $N-1$

$f(x,y)$ is image in spatial coordinate system.

u and v varies from 0 to $N-1$.

$a(u) = \sqrt{1/N}$ for $u= 0$ and $\sqrt{2/N}$ for $u= 1$ to $N-1$

$b(v) = \sqrt{1/N}$ for $v= 0$ and $\sqrt{2/N}$ for $v= 1$ to $N-1$.

Cosine transform is real and orthogonal i.e $C^{-1} = C^T$ and it has a excellent energy compaction for correlated data.

In MATLAB the instruction used to transform the spatial coordinate into Discrete cosine transform is

`Image1 = Dct(image)`

V. WATERMARKING PROCESS

A watermarking system is as communication system consisting of three main elements: an embedder, a communication channel and a detector. Watermark information is as any new information is embedded into the signal itself; at the receiving end this information is extractable by the detector. Watermark information is embedded within the host signal before the watermarked signal is transmitted over the communication channel, so that the watermark can be detected at the receiving end that is at the detector. In the watermarking system we can say that embedding and extraction are the two steps in the watermarking. In embedding, some new information is embedded in to the original image using some key and at receiving end using the same key embedded information is extracted which shows the authentication of the original image.

A. Types of Watermark:

There are two kinds of watermarks, visible watermark and invisible watermark. In visible watermark the information is visible in the picture or video which identify the owner of the picture or media but in the invisible watermark information is added as digital data to audio, video or picture but it cannot be perceived as such but at the receiving end after detection the watermark image one can authenticate owner of the picture. A digital watermark is called robust it detect the watermark image after applying some transformation such as rotation, scaling and other. A digital watermark is called fragile if it fails to detect the watermark image after applying some transformation such as rotation, scaling and other.

B. Embedded Technique:

The embedding process is as follows.

The low frequency part contain the detail information of the image and high frequency part contain the approximate information of the image so for no change in the image we choose the high frequency part or smallest coefficients in the DCT matrix. The high frequency part is chosen in the DCT coefficient matrix of the original image which shows the approximate structure of the image.

Let us take some simple binary image as watermark image which is to be embedded in the original image let us take it as $N(i,j)$.

The high frequency part of the DCT transform matrix is modified as –

When $N(i,j) = 0$, $DCT(i,j) = DCT(i,j) + DCT(i,$

$j) \times 10$. (The width and height of the binary image should be no larger than half the width and height of the original image.) Other wise no change. The new DCT matrix are processed with the inverse DCT transform to obtain the image with the watermark in it

C. Extraction Technique:

After getting the watermark image, DCT transform is calculated, let us take it is DCT1 and DCT of original image is calculated, now let it as DCT2, now match the two high frequency, if $DCT1[i,j]=DCT2[i,j]$ then $N[i,j]= 1$ else $N[i,j]= 0$. In this way extraction of the binary image can be found at the receiving end for authentication purpose.

VI. UML DIAGRAM OF WATERMARKING AN IMAGE

Unified Modeling Language is powerful Tool for modeling of object oriented software system UML class Diagram is shown in Fig-6 and 7 which shows how the classes are associated to each other for watermarking the image and Activity Diagram and Sequence Diagram are also shown in this paper. In the sequence diagram one can see that how message passing take place among the different classes. It also shows that how long time that all classes involve in Execution. Activity diagram shown in figure 10, which shows systematic steps involved in watermarking image of any type.

A. Class Diagram:

Class diagram shows the association between the classes.

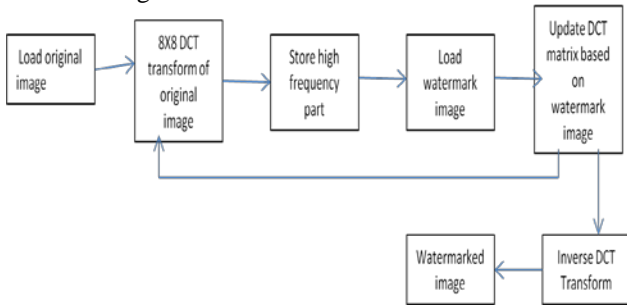


Figure 6. Uml class diagram for embedding an image in original image

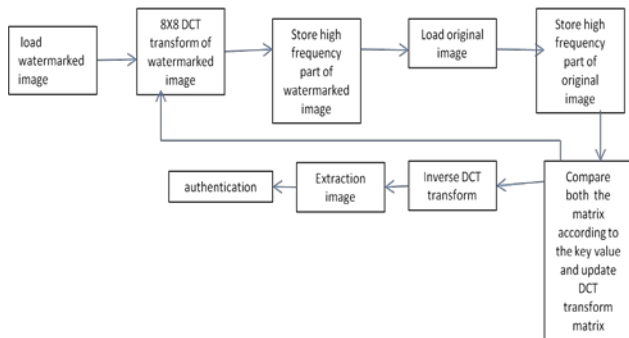


Figure 7. UML Class Diagram for extracting an image from original image

B. Sequence Diagram:

Sequence diagram shows the execution time of executing each class in the processing means how much time each classes executing in the events.

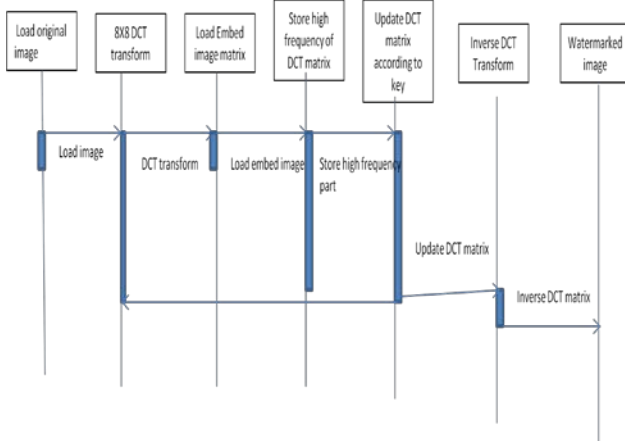


Figure 8. Sequence Diagram of embedding an image in original image.

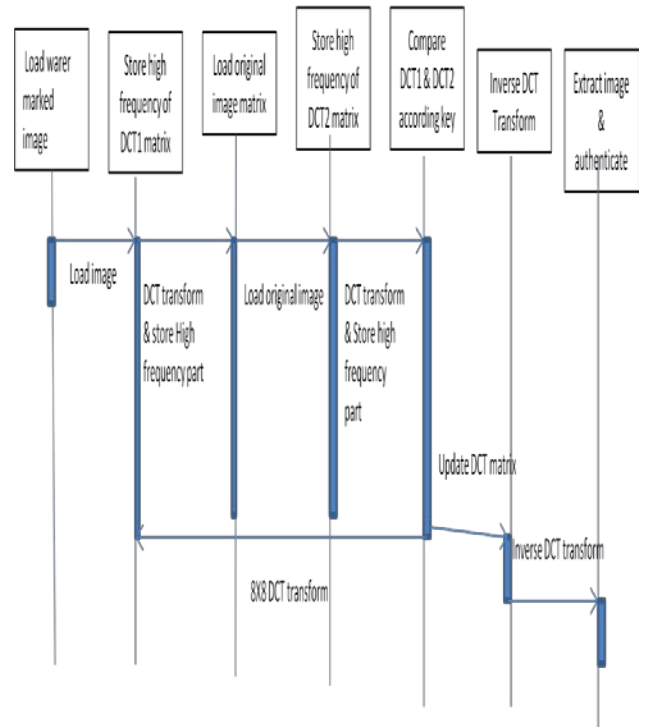


Figure 9 Sequence Diagram of extracting an image from original image.

C. Activity Diagram :

Activity diagram which shows systematic steps involved in watermarking image of any type.

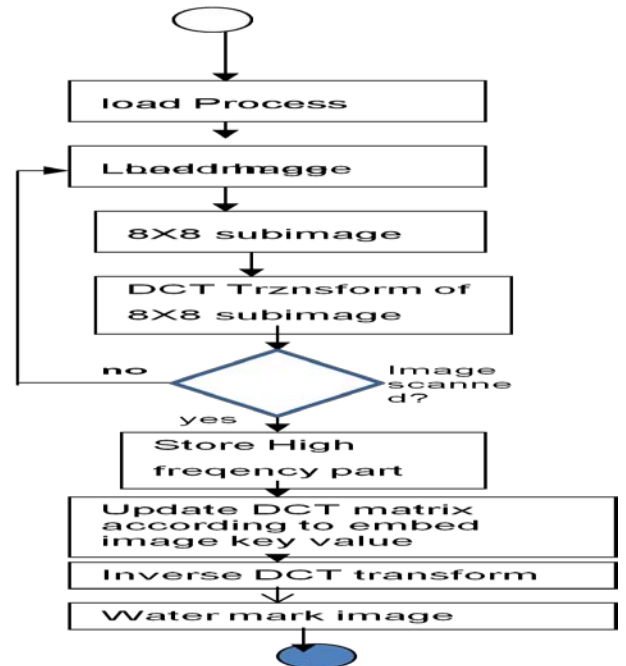


Figure 10. Activity Diagram of embedding image in original image

VII. CONCLUSIONS

All the application of image processing can be easily implemented with the help of UML modeling such as image segmentation, detection of line, compression of an image and many of others. After design coding can be easily implemented by image processing software MATLAB. With the help of wavelet transform method one can also watermarked the image file in less execution time for authenticate purpose.

VIII. REFERENCES

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Short Bio Data for the Author

Dr Deepa Raj is assistant professor in the department of computer science in the Babasaheb Bhimrao Ambedkar University, She has many international and national research papers in the reputed journal. Her area of interest is software Engineering, image processing and computer Graphics.