The Impact of Compression Algorithm on Multimedia E-Learning Systems

1. Dr. Sabri Mansour
The Faculty of Applied Administrative & Financial Sciences-Tripoli
Sabrikm_2012@yahoo.com

2 .Dr. Nasser Telesi
The Facility of Electronic Technology-Tripoli
NaserTelesi @Gmail.com

الملخص: -

نظم الوسائط المتعددة لها تأثير كبير على –التعليم، حيث إنها نقلت التدريب والتعليم من اختصاص المعلم فقط إلى التركيز على الطالب. بحيث يمنح التعلم الإلكتروني فرصة للأفراد لأخذ دروس تعليمية سواً على الاقراص الليزرية DVD أو عبر فضاء الويب وإعطاء مناخ نظري افتراضي على الويب من خلال اتصالات الطلاب بالمعلمين ونقل مواد الدروس التعليمية التي تعتمد على الصوت والصورة. توفر استخدام الصوت والصورة الذكيان للطلاب أنواعًا مختلفة من الوسائط لتنسيق أسلوب التعلم الخاص بهم، وإضفاء الطابع الشخصي على نقل المعلومات والدروس متعدد الاستخدامات مما يؤدي إلى تحسين قابلية تعلم الطلاب. في التخصص الذي يدرسونه، تحدثنا عن كيفية تحسين جودة البيانات من خلال طرق وأساليب التصميم القائمة على الوسائط المتعددة، وبالمثل ميزنا النتائج السلبية والمفيدة لاستخدام الصورة والصوت للطلاب في التعلم الإلكتروني. أخيرًا في هذا البحث، يحاول الباحثين عرض وإثبات أهمية وتأثير تقنية خوارزميات البيانات المضغوطة للوسائط المتعددة في لأنظمة التعلم الإلكتروني ومساهمتها في حل مشكلة مساحة التخزين ونقل الملفات ,واستخدامها للتعليم عبر الإنترنت.

Abstract:

Multimedia systems have a huge effect on our everyday life learning exercises as they have moved the training from educator-focused to student-focused. E-learning gives occasions to individuals to take courses on the web and give a virtual homeroom climate on the web through educator-student connections, course material conveyance dependent on intuitive sight and sound. Intelligent sight and sound offer students various types of media to coordinate their learning style, give personalization of versatile substance conveyance, which improved students learning viability. In this section, we have talked about how data quality will improved by media-based composing apparatuses and approaches, likewise distinguished the negative and constructive outcomes of utilizing intuitive sight and sound for students in E-learning. At last, the center given around momentum E-learning mixed-media innovations, their exploration difficulties, and future patterns on peer-to-peer communication-based advances. In this paper, the research demonstrates the importance and impact of multimedia compressed data technology in the field of E-learning and its contribution to solving the problem of storage space and transferring files over the Internet.

Keywords: Internet, Multimedia System E-Learning, Multimedia, compression, Learning, Online Learning, Lossy, Lossless

1. Introduction

The function and job of interactive multimedia systems have been the subject of numerous examinations. This segment means to reveal insight into the principle works around there. Client intuitiveness is a significant component of all-around planned interactive multimedia courseware. Truth told, scientists have indicated that an intuitive learning climate can create a powerful guidance and learning framework (Harper and Hedberg, 1997).

In various examination concentrates by Mayer, the outcomes show that utilizing multi-modular guidance is more powerful than utilizing any single-mode (Mayer, 1997; Norhayati and Siew, 2004). In other words, this finding shows that media do affect learning, through the instructional prospects that they empower.

For instance, in light of Mayer's exploration, one could express that when utilized fittingly, the video medium ought to be more viable than radio, since the last cannot give visual data. The introduction of thoughts in visual structure has ended up being especially significant as it helps the instructive cycle.

An audit by different analysts of studies that have examined the viability of effectiveness multimedia in learning recommended that the individuals who utilized PC-based interactive media guidance performed better as far as grades contrasted and the individuals who received instruction through traditional classroom lectures.

1.1 Definition of E-learning: It can be defined as: "An educational system to provide educational or training programs to students or trainees at anytime and anywhere using interactive information and communication technology such as (the Internet، television channels، e-mail، computers، and teleconferences) in a synchronous or are not synchronized " (Ahmed. I. Albarrak, 2007).

Second definition: E-learning can considered a method of education that depends on providing educational content, conveying skills, concepts to the learner on information and communication technologies. In addition, their multimedia in a way that allows the student to active interact with the content, the teacher, and colleagues in a synchronized or asynchronous manner in time, place, and speed that suit the circumstances. The learner and his ability, and managing all educational scientific activities and their requirements electronically through the electronic systems designated.

1.2 Definition of Multimedia

Multimedia is any combination of the following elements delivered by the computer; texts, graphic art, and sound. When users control the elements, it is called interactive multimedia. If the structure of linked elements is provided, through which the user can navigate, interactive multimedia becomes hypermedia (Meena Singhal, 1997).

1.3 Multimedia Elements

Multimedia is comprised of several elements including text, graphics, sound, video, and animation.

- **Text:** Text is a collection of abstract characters that a format specification allowed to appear in an instance of the format. Text is perhaps the most fundamental element of any multimedia project. Students can compose and edit their text. Text-based information can also be gathered from resource CDs and the Internet.

- **Graphics:** A picture or illustration, also called an image. The formats of graphics may be GIF, JPEG, BMP, and several others. Graphics can incorporated into a multimedia project in the form of photographs or designs in both 2D and 3D. Graphic images can imported from a variety of resources such as the Internet, a digital camera, a scanner, or resource CDs.

- **Sound:** Acyclic propagation of energy through a medium at a constant velocity. E.g. sound pressure waves through the air. Sound can added to a multimedia presentation from a variety of sources. Original sounds can be recorded using a microphone and programs such as Final Cut Pro or Smart Sound (Drini, M., Kirovski, D., and VO, H. 2007).

- **Animation:** Animation is a process of the rapid display of drawing frames. It usually consists of a static background and objects (cells), which appear to be moving across the background.

- **Video:** akin to a film, video also consists of a series of   frames   slightly different from each other that, when rapidly displayed in sequence, make the object appear to move, just   like in animation (Vaughan, T. 1994)

1.4. Multimedia Systems A Multimedia System is a system capable of processing multimedia data and applications, multimedia system is characterized by the processing, storage, generation, manipulation, and rendition of Multimedia information. (S. Dal Lago et al., Armida, 1997).

Characteristics of a Multimedia System: Multimedia system has four basic characteristics:
- Multimedia systems must be computer-controlled .
- Multimedia systems are integrated.
- The information they handled must represented digitally.
- The interface to the final presentation of media is usually interactive.

2. Multimedia Compression Algorithms:
Data compression is the removal of redundant data, reducing the number of binary bits necessary to represent the information contained within that data. To achieve the best possible compression requires not only an understanding of the nature of data in its binary representation but also how humans interpret the information that the data represents (G Stephen Kinnear, 1999).
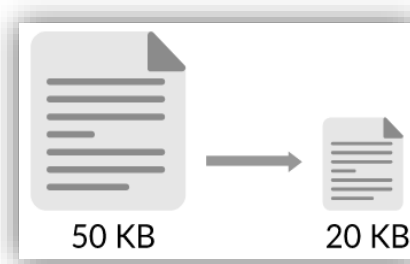

Figure.1 Size comparison between Compression and other Format

2.1. The Impact of Multimedia Compression Algorithms for E-learning Systems:

Following are the generic benefits or advantages of multimedia Data Compression:
- It helps to occupy less disk space or storage space. This is because when compressed, the quantity of bits used to store the information reduced.
- Compressed data is read/written faster than original data.
- It enables faster file transfer on the internet due to a reduction in file size. Moreover, file compression can zip up several small files into a single file for more convenient email transmission.
- Data compression is byte-order independent.
- Data compression has a variable dynamic range that depends on the algorithm used during compression.

2.3. Compression Algorithms Types:

There are two main types of file compression, lossless and lossy :

2.3.1. Lossless compression algorithms: search for long strings of code and have a method to replace them with shorter strings. Lossless compression can recreate the entire file exactly as it was (Shawn McClainm, 2002).

2.3.2 Lossy compression algorithms: search through the code to find pieces that it can delete. While lossy compression cannot used on program files, it can used on multimedia files, where there is often information in the files that Human senses cannot detect. When lossy compression is used, the file may appear to be identical, but it is very different at the code level .Lossy compression can be a very effective way to save bandwidth and memory for E-learning media.

Lossy compression algorithms and their implementations proposed in previous studies Data loss can cause significant image quality issues in multimedia system

```
┌─────────────────────────┐
│    Input source file    │
└─────────────────────────┘
             │
             ▼
┌─────────────────────────┐
│    Lossy Compression    │
│       algorithm         │
└─────────────────────────┘
             │
             ▼
┌─────────────────────────┐
│  Output Compressed file │
└─────────────────────────┘
```
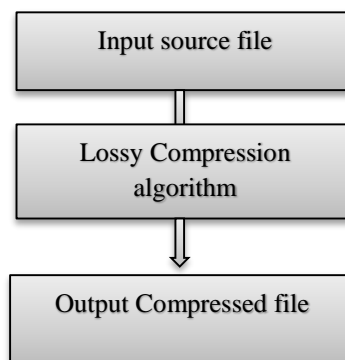
Figure.2 Compression Process steps

3. Methodology:

Lossy algorithm compression brings about lost information and quality from the original form. Lossy compression usually connected with image files, like JPEGs, however, can likewise utilized for sound records, like MP3s. The lossy of image files might appear as

jagged edges or pixelated regions. In sound files, the lossy algorithm may create a boor sound or lessen the unique scope of the sound.

3.1 Why Lossy Compression Algorithms for Multimedia System :

Lossy compression most commonly used to compress multimedia systems and multimedia data such as audio, video, images, especially in applications such as streaming media and internet telephony. The most widely used lossy compression algorithm is the discrete cosine transform DCT (Ahmed Nasir, T. Natarajan, and K. R. Rao, 197).

Discrete Cosine Transform: The technique applied to image pixels in the spatial domain to transform them into a frequency domain in which redundancy can identified .In JPEG compression, the image divided into 8×8 blocks, and then the two-dimensional Discrete Cosine Transform (DCT) applied to each of these 8×8 blocks. In JPEG decompression, the Inverse Discrete Cosine Transform (IDCT) applied to the 8×8 DCT coefficient blocks. DCT and IDCT defined as follows: DCT:

$$F(u,v) = \frac{1}{4}C(u)C(v)\sum_{i=0}^{7}\sum_{j=0}^{7} f(i,j)\cos((2i+1)u\pi/16)\cos((2j+1)v\pi/16)$$

Since lossy compression eliminates information from the original file, the subsequent file regularly occupies significantly less plate room than the original one. For instance, a JPEG picture might decrease a picture's record size by over 80%, with minimal observable impact. Essentially, a packed MP3 document might be one-10th the size of the first sound record and may sound practically indistinguishable.

The use of lossy is very suitable for designing an e-learning systems curriculum it produces very small files compared to other compression technology as well because we do not need multimedia media data with great accuracy, especially in images, but we need small data to store and transfer them over the Internet.

The researchers used the image data type JPEG that is one of the most important types of compressed images widely used in applications, as well as the audio file type MP3 it is also considered one of the most popular types of compressing audio files with a small size compared to the rest of the types of uncompressed audio files.

JPEG: This stands for Joint Photographic Experts Group. The name of a standard for lossy data compression of digitized still images. JPEG can also be used for motion video compression (which MPEG was designed for) and has some advantages over MPEG.
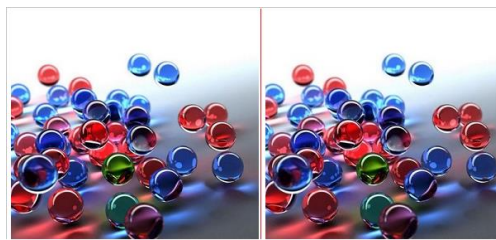

Figure.3 Different Size BMP 197 KB & JPEG 33KB

The figure.3 shows an example of two images used, the first image, with JPEG data compression format and the size only 33 KB, and it gives a good resolution, the other

image with BMP data compression format, its size 197 KB, the difference in size between them is very clear, moreover, the quality of resolution is however not as much as the difference in size.

MP3: MP3 stands for MPEG-1 Layer 3. It is a compressed audio file format, a way of making a standard music file smaller. It works by removing sound, which either the human ear cannot hear, or which is masked by other sounds (Halsall, F.2001).
A compressed MP3 file can be as little as 10% of the original WAV file size (Which considered a digital audio a raw e and designed by IBM). This means by using MP3 compression, a 50 MB WAV file can be compressed to as little as 5 MB. To make the file size so small, some of the original audio data must remove. This process called 'Lossy Compression' and a byproduct of this compression is a slight loss in audio quality.
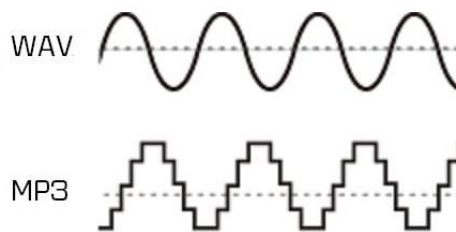

Figure.4 Different Between WAV and MP3 Frequency

3.2. Shifting to the Image Compression Format:

By using suitable multimedia software programs specialized in the image, such as Adobe Photoshop for the image, the formats changed to files with a smaller size for multimedia data so that the results were:
The table.1 and chart.1 illustrates the differences in size between JPEG and BMP files, and the compression ratio between original image size and compressed image size can reach 85.71, 91.42, and 91.28% using Lossy Compression Algorithms. In addition, the statistical chart and table below illustrate how the JPEG format can support the development of e-learning systems by increasing the contents of the curriculum further, as well as the ease of sending and using files over the Internet due to its small size by reducing the amount of storage space for images.

Table.1 Difference between JPEG & BMP Format

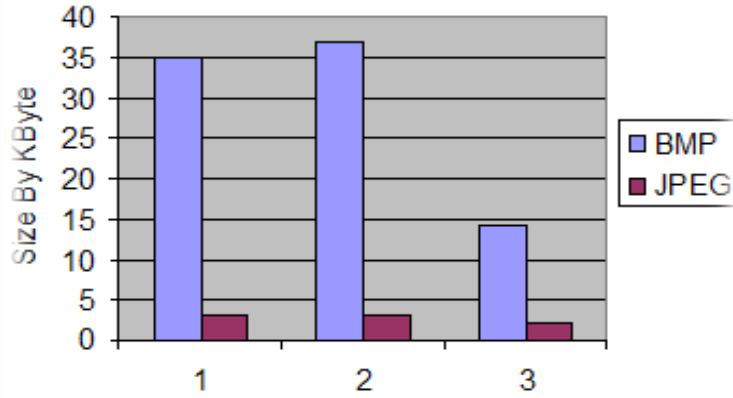| File name	BMP(KB) Original Image	JBEG(KB) Compression Image	Compression Ratio
Iamge1	35	3	91.42%
Image2	37	3	91.89%
Image3	14	2	85.71%

Chart.1 Difference between JPEG & BMP Format

3 .Shifting to the Audio Compression Format:

Another technique that is very important to use to reduce the file size for e-learning systems is reducing the number of sound files by shifting files to an MP3 data compression format. Initially, the sounds were recorded using WAV data compression format, and consequently, they converted into MP3 format.

Table 2 Difference WAV & MP3 Format

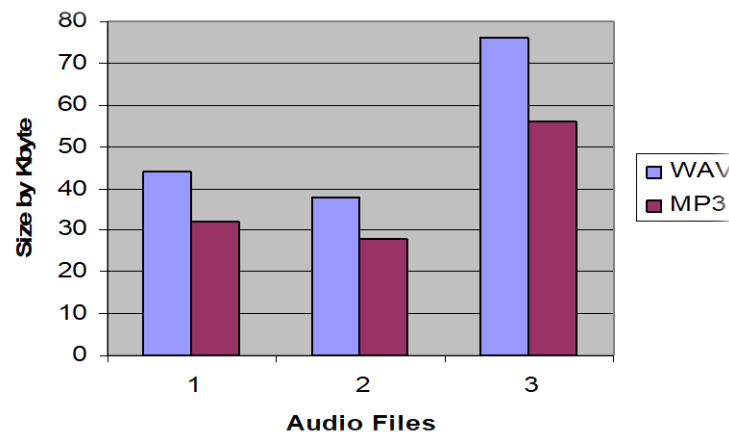| File Name	WAV Original Audio	MP3 Compression Audio	Compression Ratio
Sound1	44	32	27.27%
Sound2	38	28	26.31%
Sound3	76	56	26.31%

Chart.2 Differences between WAV & MP3 Format

Table 2 and Chart 2 indicate that MP3 is a better technique to manage and control the storage space when compared to MP3 format. table.2and chart.2 illustrates the difference

of size between MP3 and WAV, and the compression ratio between original image size and compressed image size can reach 27.27%, 26.31% and 26.31% using audio Lossy Compression Algorithms. In addition, the statistical chart and table below illustrate how the JPEG format can support the development of e-learning systems by increasing the contents of the curriculum further, as well as the ease of sending and using files over the Internet due to its small size by reducing the amount of storage space for images.

4. Conclusion:

The white paper discussed the importance of using multimedia data compression for designing the Curriculum E-learning, in this white paper appropriate multimedia compression was used to reduce the amount of storage space. A prototype was designed to prove that employing appropriate technology could help designers to include more information in their products with less storage requirement; the small size of the application also makes it easy and quick to use as an online application. Technology is for compressing multimedia data. This technology is for compressing multimedia data, which helps the e-learning process, which is widely used at present. We can summarize the benefit of using media compression technology as follows:

- Real-time multimedia streaming and Peer-to-Peer (P2P) multimedia file Sharing have persistently been of incredible interest.
- Technological challenges in networked multimedia can seen from the viewpoints of interoperability and network, performance and price, and Data transmission.
- The development of multimedia computing has expanded the demand for massive Multimedia data, thus compression procedures are very important.
- Compression procedures can categorized into two groups, which are lossy compression and lossless compression.
- Lossy compression is usually larger in magnitude compared to lossless Techniques.
- Lossless compression reduces the number of data bits when it allows the exact original data to reconstruct from the compressed data.

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