Analysing compressed AKP file with BMP and TIFF format by considering number of colors of the image.

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***Abstract*-** Image processing is one of the widely used computation problem specifically identifying, understanding, beautification and compression. Today wide variety of image file formats is available with different clarity and size. This paper describes the basic process of compressing the bitmap image file and then comparing the compressed file with original one. The process involves lossless compression. Entire process is implemented in programming language and tries to understand various segments of bitmap file. Based on the number of unique colors in bitmap file, it compresses the file to store only single value for each different color and then comparative study of both the formats is applied using different charts to reach to a specific conclusion to achieve the desired performance criteria in form of size of the compressed file. File is compressed at some level of different colors and then after the technique applied is not suitable. To find out these criteria experiments are made on different colored image to reach to a conclusion. At last paper is concluded with future scope and enhancement.

***Index Terms*-** Image processing, Bitmap, Image Compression, lossless format, RGB model, Java API.

I. Introduction

Image processing refers to identifying, understanding and performing various operations on image files. Today we have wide image formats available including .bmp, .gif, .jpeg, .png, .tiff etc. each with different encoding scheme and different criteria. Selection of particular image format depends on the needs of an application. Some formats are lossy like jpeg [3] where some are lossless image compression formats. Each format has its own characteristics one of these is file size which is import due to space require to store it. Bitmap image file format is lossless format stores each pixel value with different values of Red, Green and Blues colors along with alpha value denoting the transparency of pixel. Today's computing area involves storing and managing images as part of its application. Storing images with minimum storage space is one of the requirements of computer applications. Bitmap image file is a good solution where quality matters but it requires more size on disk.

So researcher has made an effort to compress the bit map image file by developing an algorithm to compress the image file using the number of different colors existed in a given image file. Algorithm is implemented to achieve the desired compression ratio [6] and experimented on different image files to reach to a conclusion where the algorithm is suitable to implement and defines the criteria to use this compression technique. Conclusion criteria are achieved by comparing the compressed file with original one and one other format that demonstrate the success criteria of derived algorithm. Algorithm is implemented in Java programming language with the use of Java API. All experiments are performed on fixed size with different set of colored images.

II. Bitmap Image Format

A BMP file contains four set of information.

(1) File Heading Information
(2) Bitmap Heading Information
(3) Color Table Information
(4) Image Data Information

File heading contains 14 bytes. These 14 bytes are divided into different bytes with the details of file type, file size, some reserved bytes and pointer information from where image data of BMP file begins. Bitmap heading contains 40 bytes about detailed information of bitmap image. Color table contains the color information of image for bitmap indexing. Image data contains actual color of pixel values in binary form.

Monochrome image requires only a single bit of value to store black and white. Gray scale image requires byte information to store 128 different shades of black and white image. Color image uses RGB color model storing each pixel's red, green and blue color information [4]. The resultant color is the combination of all three color values. For example all three bytes having each bit value 1 represent color white where all bits 0 represents black. All other colors comes in between these two colors. Total 2^{24} combination resulting 16777216 different colors can be achieved. Researchers have taken width 400 pixels and height 300 pixels with 24 bit of color information so size of the given bitmap file is computed as 400*300*3+54 which equals to 360054 bytes results in 351 KB. This file is compressed using the technique of analyzing and identifying unique number of colors and compression is performed by reducing the color information of redundant colored pixels [5].

III. Bitmap Compression Model : AKP

Bitmap compression model uses Java API to extract 24 bit color information to find out the unique colors held in a given bitmap image. After finding each 24 bit pixel value it counts the

occurrence of each color. Image compression is performed to store only once each color value instead of storing the same color value for each and every pixel. Algorithm keeps track of pixel numbers sharing the same color. Compressed file contains heading information storing the information of image with resolution in pixel height and width. It stores the compressed binary file on disk drive. Compression ratio of image file is in reverse order of number of colors meaning that if file contains less number of color, high compression rate can be achieved while image having ,more number of colors compression performance may be deteriorate. Images having different color information having same number of different colors will have same compressed file size because to store any color three bytes are necessary but storing individual pixel color as used by bitmap format this techniques stores only a single color value for all similar pixels with indices of all sharing pixels. This compression model is named as AKP.

IV. Comparative Study Of Images with Only Single Color of Information

Once the given image file is compressed then it is compared with the original one with other format .tiff. All the experiments are performed on the image file with height 400 and width 300 resolutions. The compressed image file is a binary file with extension .apk is taken. Following table contains information of each file with unique color and file size. Seven different colored image files are tested and result of compression is listed in form of number of bytes required to store image file. Name of files are chosen to directly reflect the colors used in the image file. All files having a single color regardless of color compressed in a same sized image file as it removes color redundancy.

Analysis of Single colored file size			
File Name	**BMP**	**TIFF**	**AKP**
BLUE	360054	360484	120012
BLUE-RED-SHADED	360054	360484	120012
GREEN	360054	360484	120012
GREEN-BLUE-SHADED	360054	360484	120012
RED	360054	360484	120012
RED-GREEN-BLUE-SHADED	360054	360484	120012
RED-GREEN-SHADED	360054	360484	120012

Table 1 : Analysis of Single colored file size

The above table shows information about 7 single colored images originally drawn using paint tool in BMP format and then converted to other formats using java tool developed by the researcher. To better compare the given file sizes following chart represents the graphical comparison of the above tabular data.

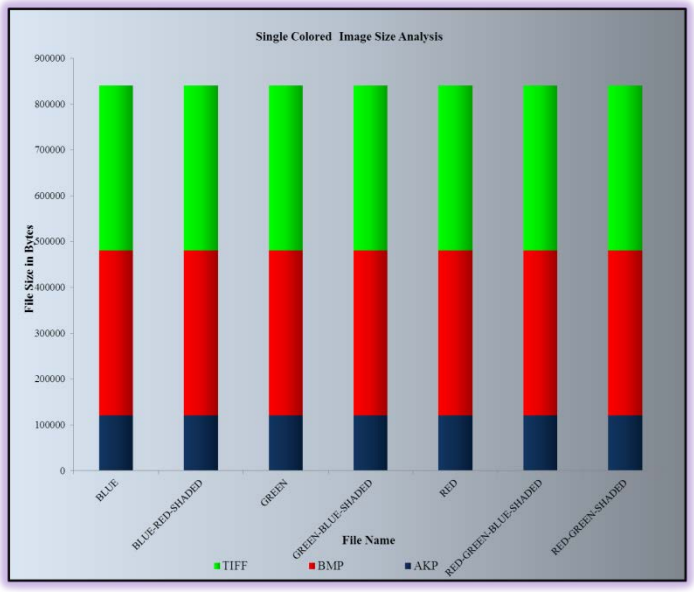

Figure 1 : Stacked Column Chart for comparison of single colored image compression

In above chart the stacked column chart shows file size analysis of AKP, BMP, and TIFF file. The X axis shows file name where Y axis shows file size in bytes. AKP file type is compressed file type. From the above graph it can be observed that AKP file format requires less storage compared to BMP and TIFF formats. In chart Blue color represents AKP, Red color represents BMP and Green color represents TIFF.

V. Comparative Study Of Images with Multi Colors of Information

Algorithm is tested for images having two different colors. Following table contains information of each file with two different colors and file size. Three different colored image files with two different colors are tested and result of compression is listed in form of number of bytes required to store image file. Name of files are chosen to directly reflect the colors used in the image file. All files having two colors regardless of colors used compression takes place as same sized image files after removing color redundancy.

Combination of colors is used as Blue with Red, Green with Blue and Red with Green. First column is the name of the image file, second column is the size required by BMP file, third column is the size of TIFF file format and forth column shows size of AKP file. Comparison of AKP compressed file having two colors with AKP compressed file having one color shows difference of three bytes.

Following Table 2 represents the two color image analysis with different file formats.

Analysis of Two Colored Image Compression			
File Name	**BMP**	**TIFF**	**AKP**

BLUE-RED	360054	360484	120015
GREEN-BLUE	360054	360484	120015
RED-GREEN	360054	360484	120015

Table 2 : Analysis of Two Colored Image Compression

The above table shows information about 3 two colored images originally drawn using paint tool in BMP format and then converted to other formats using java API. The following chart gives better visual comparison of image data given above in the tabular form.

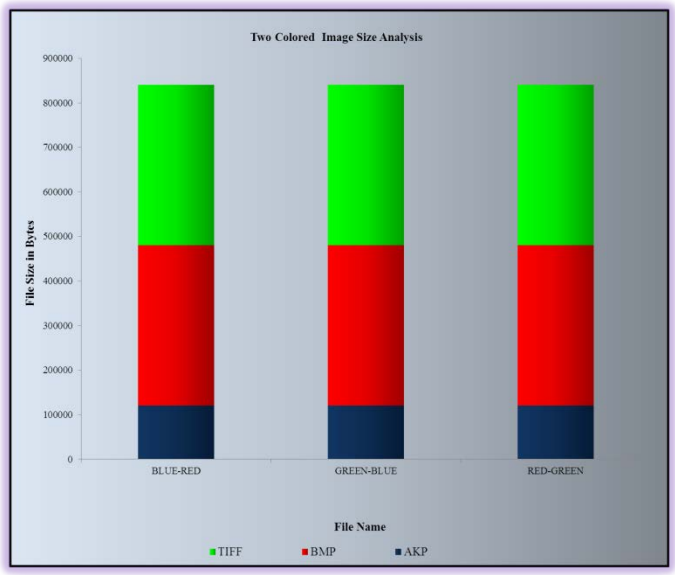

Figure 2: Stacked Column chart for comparison of two colored image compression

In above chart the stacked column chart shows file size analysis of AKP, BMP, and TIFF file. The X axis shows file name where Y axis shows file size in bytes. AKP file type is compressed file type. From the above graph it can be observed that AKP file format requires less storage compared to BMP and TIFF formats. In chart Blue color represents AKP, Red color represents BMP and Green color represents TIFF.

VI. Comparative Study Of Images with Three Or More Colors of Information

Algorithm is tested for images having three or more different colors. Following table contains information of a file with three different colors and file size. Three different colored image file with three different colors are tested and result of compression is listed in form of number of bytes required to store this image file. Name of files is chosen to directly reflect the colors used in the image file.

Colors are used as Red, Green and Blue as three different colors. First column is the name of the image file, second column is the size required by BMP file and third column is the size of TIFF file format. Comparing the compressed file having one or two colors with compressed file having three colors increases by very few bytes.
Following Table 3 represents the three color image analysis with different file formats.

Analysis of Three Colored Image Compression			
File Name	**BMP**	**TIFF**	**AKP**
RED-GREEN-BLUE	360054	360484	120018

Table 3 : Analysis of Three Colored Image Compression

To better compare the given file sizes following chart represents the graphical comparison of the above tabular data. Comparison is based on single file with three color image file.

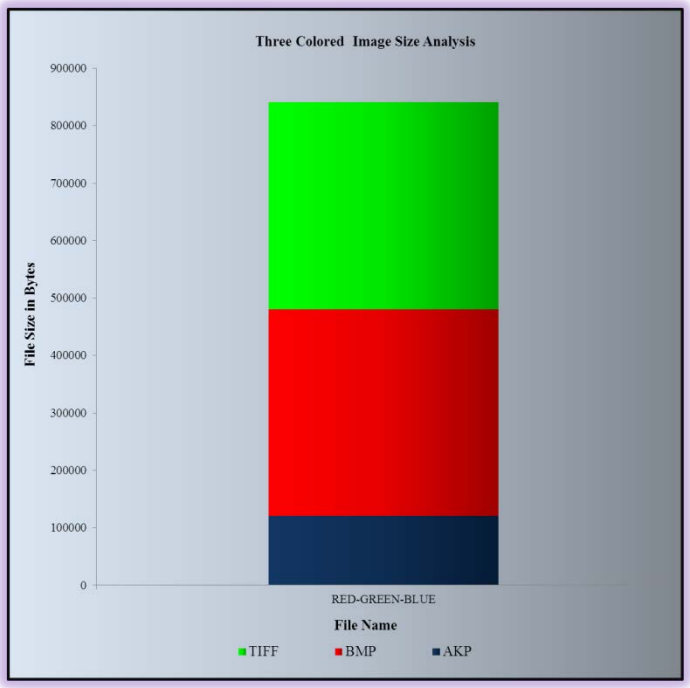

Figure 3: Stacked column chart for comparison of three colored image compression

The above stacked column chart shows comparison of three colored image file size analysis of AKP, BMP, and TIFF file. The X axis shows file name where Y axis shows file size in bytes. AKP file type is compressed file type. From the above graph it can be observed that AKP file format requires less storage compared to BMP and TIFF formats. In chart Blue color represents AKP, Red color represents BMP and Green color represents TIFF.

VII. Comparative Study Of Images with Different File Formats And Three Colors.

By analyzing of the above file compression data and chart comparative study of different colored images with different file formats is obtained.

All above different colored image compression is analyzed by gathering data and obtaining the chart for better comparison, it can be observed that compressed file of AKP format requires less storage than other two types of formats. Following table shows the average file size for all three different formats with different number of colors image files.

Average size of image with different color count.			
Color Count	**AKP SIZE**	**BMP SIZE**	**TIFF SIZE**
1	120012	360054	360484
2	120015	360054	360484
3	120018	360054	360484

Table 4: Average size of image with different color count.

The above table shows summary information of 11 images containing single or multiple colors from RED, GREEN and BLUE, originally drawn using paint tool in BMP format and then converted to other formats like AKP and TIFF using java tool developed by the researcher.

In the table, first column shows Color Count of files which is ONE, TWO or THREE. Second column shows size of AKP file in bytes, third column shows size of BMP file in bytes, forth column shows size of TIFF file in bytes respectively.

It is observed from the above table that average file size for each of the images is less in AKP format as compared to BMP and TIFF formats. Graphical representation using stacked column chart of the tabular data gives effective visualization. Chart contains three parts in which first represents average size of single colored images, second represents average size of two colored image and third one represents average size of three colored image.

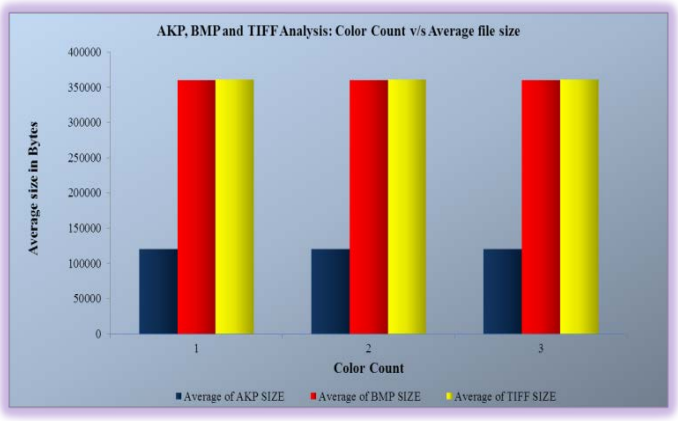

Figure 4: Bar chart for Average file size v/s color count analysis

The chart shows file size analysis of AKP, BMP and TIFF file with reference to number of colors used for the images. The X axis shows color count where Y axis shows file size in bytes. AKP file type is shown with dark blue color, BMP file type is shown with red color and TIFF file type is shown with yellow color. The chart shows size of BMP and TIFF is almost same and file size of AKP is about 1/3rd of BMP and TIFF.

VIII. CONCLUSION

By analyzing the table-1 to table-4 and figure 1 to figure 4, following conclusion can be drawn.

1. Size of compressed AKP file is smaller as compare to BMP and TIFF in case color count being ONE.
2. Size of compressed AKP file is smaller as compare to BMP and TIFF in case color count being TWO.
3. Size of compressed AKP file is smaller as compare to BMP and TIFF in case color count being THREE.
4. The size of BMP and TIFF are almost similar but greater than compressed AKP file.
5. Size of BMP and TIFF can be determined by the following presented formula[1]
   Image size = width * height * color model (bytes) + header size.
   Researchers have taken width:400 pixels, height:300 pixels and color model: 24bits.
   So size of BMP images =400*300*3+54.
   =360054 bytes.
   =351KB
   This outcome is exactly similar to the outcome of BMP column of table-1 and table-2, which proves the success of formula.
   In the similar way TIFF file has header size of 484 bytes.
   The size of TIFF images =400*300*3+484.
   =360484 bytes.
   =352 KB.

The idea here is implemented is image compression based on number of different colors but more experiments and improvement is required in order to compress files with more number of colors. For multi color images, this compression technique should be verified and analyzed. But when the number of colors is less this mechanism improves size performance criteria far better than formats like BMP and TIFF. Further experiments and optimization to this technique can be obtained as a future scope.

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