Abstract- The main issue in content based image retrieval is to extract feature that represent image content in a database. Query image is retrieved from image database by visual contents of image which deals with the retrieval of most similar image in Content Based Image Retrieval (CBIR). In this paper color features are extracted using color moments and texture features are extracted using HAAR wavelet. Then the distance between query image and image in the database is calculated. The proposed system has demonstrated a promising and faster retrieval method on a WANG image database containing 1000 general-purpose color images. The performance has been evaluated by comparing with the existing systems in the literature.

Keywords- CBIR, HAAR Wavelet Transform, Color Moment, Similarity Measure.

I. INTRODUCTION

The rapid growth of digital image processing technology in recent years has helped the user to find multimedia information easily which has become a hot research topic at present. Image retrieval plays an important role in multimedia information retrieval technology. Generally image retrieval is based on query image, extraction feature or an image set which is related to query image in image database [1].

Image retrieval is classified in three categories: text based, content based and semantic-based [2]. Content Based Image Retrieval is proposed in early 1990’s [3]. CBIR is a technique which uses visual contents to search images from an image database

Remarkable progress has been made in the past but there are many challenging problems which still attract researchers from multiple disciplines. One of the main challenges in image processing is image retrieval to extract information from data such as recognizing particular color or textures from large database.

In 1979, a conference was held in Florence on Database Techniques for Pictorial Application [4]. Earlier techniques were generally based on textual annotation of images, where traditional database techniques are used to manage images. Difficulties faced by text based retrieval became severe as the volume of digital images produced by scientific, medical and other applications increased dramatically [5]. The efficient management of the rapidly expanding visual information became a problem which formed the emergence of content based image retrieval techniques (CBIR).

II. RELATED WORK

Gang Hou et al [1] proposed a novel image feature descriptor, namely texture structure histogram (TSH) for content-based image retrieval. This method using the color and edge orientation information to describe the image texture structure information. Considering the HSV color space conforms to humans' visual perception mechanism, the feature extraction is conducted in the HSV color space.

Manimala Singha and K. Hemachandran et al [6], they proposed a method called Wavelet Based Color Histogram. Through wavelet transformation and color histogram color and texture features are extracted. Then using similarity measures distance between images is calculated for.

III. PROPOSED SYSTEM

Generally CBIR performs two functions: feature extraction (FE) and similarity measurement (SM). In feature extraction, features like color and texture are extracted by giving query image and then images are retrieved from large image database [5]. The size of feature vector is small in the order of hundreds of elements.

In similarity measurement, distance is calculated between the query image and images in the database and the one having highest similarity to the query image is retrieved. Fig.1 shows the block diagram of CBIR system.
IV. COLOR EXTRACTION

An RGB color space image is converted into HSV color space. We have use color moments for color feature extraction. The distribution of color in an image lies in the assumption that the color moments can be interpreted as a probability distribution. These probability distributions are characterized by a number of unique moments (e.g., normal distributions are differentiated by their mean and variance). The procedure for computing color moments is same as computing moments of a probability distribution. The first color moment can be interpreted as the average color in the image and can be calculated by using the following formula:

$$E_i = \sum_{j=1}^{N} \frac{j}{N} P_{ij}$$  \hspace{1cm} (1)

Where:
- N = number of pixels in the image
- P_{ij} = value of the j-th pixel of the image at the i-th color channel

The second color moment is the standard deviation, which is obtained by taking the square root of the variance of the color distribution:

$$\sigma^2 = \sum_{i,j} \left( P_{ij} - E_i \right)^2$$  \hspace{1cm} (2)

Where:
- E_i = mean value, or first color moment, for the i-th color channel of the image.

The third color moment is the skewness:

$$\alpha = 3 \sqrt{\sum_{i,j} \left( P_{ij} - E_i \right)^3}$$  \hspace{1cm} (3)

Out of three colors first two color moments namely mean and variance are extracted [7]. Color histogram and color moments give information of each pixel in an image and based the color features it can be differentiated. As color moments give similarity between two images. These similarity values are then compared with the images in database which are used for tasks like image retrieval.

V. TEXTURE EXTRACTION

Texture features of an image are extracted by co-occurrence histograms. RGB image given as an input is converted into grey scale image. Color histograms are set of bins where each bin represents the pixels in an image.

Grey Level Co occurrence Matrix (GLCM)

GLCM is defined as, in GLCM \( n_{ij} \) are the number of occurrences of pixel value (i, j) lying at distance d in the image. The co occurrence matrix \( P_d \) have dimensions n x n, where n are the number of grey levels in the image.

In the fig. 2 given below are 15 pairs of pixel in image which fulfil this spatial separation. As there are only three grey levels therefore \( P_d(i, j) \) is 3 x 3 matrix.

Algorithm for GLCM

- First count all pairs of pixels, the first pixel having value i, and its matching pair displaced from the first pixel by d having value of j.
- This value is entered in the ith row and jth column of the matrix \( P_d[i,j] \).
- As \( P_d[i,j] \) is not symmetric, it’s not necessary that number of pairs of pixels having gray levels [i,j] should be equal to the number of pixel pairs having gray levels [j,i].
- So texture features like contrast, correlation, energy and homogeneity are then extracted from each image.

HAAR Discrete Wavelet Transform

Wavelet transforms are popularly used because it decomposes an image into orthogonal components because of its better localization and computational inexpensive properties [8, 9].

- First extract the Red, Green, and Blue Components from an image.
- Then decompose each Red, Green, Blue Component using Haar Wavelet transformation to get appropriate vertical, horizontal detail of an image.
- Calculate the similarity matrix of query image and the image present in the database.
- Repeat the steps from 1 to 3 for all the images in the database.
- Retrieve the images.

At each level (scale), the images are decomposed into four frequency sub-bands, LL, LH, HL, and HH where L denotes low frequency and H denotes high frequency.
VI. SIMILARITY MEASURES

In content based image retrieval, similarity measurement is performed by giving a query input and the result is a set of likely images from the database. The images having highest similarity to the query images are retrieved. And the retrieval result is not just a single image but a set of images with highest similarities.

VII. PERFORMANCE EVALUATION

The performance of retrieval of the system can be measured in terms of its precision and recall [6].

Recall measures the ability of the system to all the models that are relevant and is defined as,

\[
\text{Recall} = \frac{\text{Number of relevant images retrieved}}{\text{Total number of relevant images}} = \frac{A}{A + C}
\]

Precision measures the ability of the system to retrieve only the models that are relevant and is defined as,

\[
\text{Precision} = \frac{\text{Number of relevant images retrieved}}{\text{Total number of images retrieved}} = \frac{A}{A + B}
\]

Where A represent number of relevant images that are retrieved, B represent number of irrelevant items and C represents number of relevant items those were not retrieved.

VIII. EXPERIMENTS AND RESULTS

The approach is implemented by using MATLAB. Above algorithms are applied on around 200 images. The results obtained are discussed in this section.

Image database containing 200 images are in JPEG format of size 384x256 and as shown in Figure 3. The search is usually based on similarity rather than the exact match.

A query image is selected from an image database and the retrieval process is carried out.

Fig.3. Image Database

Fig.4. Selecting query input image as dinosaur

Fig.5. Retrieved images of dinosaur from image database.
Similarly another query image is executed and images are retrieved and performance evaluation is carried out.

In content-based image retrieval systems performance evaluation is a crucial task since it is very difficult to determine the relevant sets. The commonly used performance measurement parameters for the evaluation of retrieval performance are, precision and recall. As the whole database was known each image of the database was used as query image. For each query image both precision and recall values were obtained.

**IX. PERFORMANCE EVALUATION**

From the results the accuracy of the proposed system is calculated. Table 1 shows the analysis of the results based on the accuracy measurements.

<table>
<thead>
<tr>
<th>Image category</th>
<th>Precision</th>
<th>Recall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sea</td>
<td>75</td>
<td>46.07</td>
</tr>
<tr>
<td>Tree</td>
<td>75</td>
<td>45.05</td>
</tr>
<tr>
<td>Building</td>
<td>62.5</td>
<td>40</td>
</tr>
<tr>
<td>Dinosaur</td>
<td>62.5</td>
<td>46.06</td>
</tr>
<tr>
<td>Rhinoceros</td>
<td>75</td>
<td>43.07</td>
</tr>
<tr>
<td>Beach</td>
<td>87</td>
<td>40</td>
</tr>
<tr>
<td>Female</td>
<td>87</td>
<td>46</td>
</tr>
</tbody>
</table>

The table 1 shows the accuracy achieved for every image. The total accuracy obtained for feature extraction is 75.07 %.

**CONCLUSION**

In this paper we have proposed an efficient CBIR method based on the Haar wavelet transform, GLCM and color moments. Color moments are used as the properties are rotation invariant and GLCM for texture features which calculates the relation between two pixels that increases the accuracy. In experimental part the proposed method prove successfully on retrieving images from the database using precision and recall.

**REFERENCES**