Winter Project Intern Report

Topic: **Fingerprint Recognisation**

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ABSTRACT

A major approach for fingerprint recognition today is to extract minutiae from fingerprint images and to perform fingerprint matching based on the number of corresponding minutiae pairings. One of the most difficult problems in fingerprint recognition has been that the recognition performance is significantly influenced by fingertip surface condition, which may vary depending on environmental or personal causes. Addressing this problem, this paper presents a fingerprint recognition algorithm using white points and black points in an image through edge detection**.**

Experimental evaluation using a set of fingerprint images captured from fingertips with difficult conditions (e.g., dry fingertips, rough fingertips, allergic-skin fingertips) demonstrates an efficient recognition performance of the proposed algorithm compared with a typical minutiae-based algorithm.

In this paper, we propose to use white points and black points based image processing algorithm to effectively compress the fingerprints at a small cost in terms of matching accuracy. The white points and black points of fingerprints is analyzed and experimentally verified on databases of real photographs.

INTRODUCTION:

Image processing is the field of signal processing where both the input and output signals are images. Images can be thought of as two-dimensional signals via a matrix representation, and image processing can be understood as applying standard one dimensional signal processing techniques to two-dimensional signals. Image processing is a very important subject, and finds applications in such fields as photography, satellite imaging, medical imaging, and image compression, etc. [1].

Biometric authentication has been receiving extensive attention over the past decade with increasing demands in automated personal identification. Biometrics is to identify individuals using physiological or behavioral characteristics, such as fingerprint, face, iris, retina, palm-print, etc. Among all the biometric techniques, fingerprint recognition is the most popular method and is successfully used in many applications [2].

Typical fingerprint recognition methods employ feature-based image matching, where minutiae (i.e., ridge ending and ridge bifurcation) are extracted from the registered fingerprint image and the input fingerprint image, and the number of corresponding minutiae pairings between the two images is used to recognize a valid fingerprint image. The feature-based matching provides an effective way of identification for majority of people [3].

Here in this project we deal with the matching of white points and black points which are in turn obtained from edge detection. Edge detection is an image processing technique for finding the boundaries of objects within images. It works by detecting discontinuities in brightness. Edge detection is used for image segmentation and data extraction in areas such as image processing, computer vision, and machine vision.

LITERATURE SURVEY:

AUTHOR/YEAR	TITLE	PUBLICATION	REMARKS
Rafael C. Gonzalez; Richard E. Woods -2008	Digital image processing	pearson	Introduction to basic concepts and methodologies of digital image processing
D. Maltoni, D. Maio, A. K. Jain, and S. Prabhakar-2003	Handbook of Fingerprint Recognition	Springer	Basics of biometric recognition
Tinku Acharya and Ajoy K. Ray-2006	Image Processing – Principles and Applications	Wiley InterScience	Description of image processing concepts and techniques
Lin Hong-1998	Automatic Personal Identification Using Fingerprints	Thesis	Introduction to the automated identity verification using fingerprints
Y.C. Chang and J.F. Reid-1996	RGB calibration for color image analysis in machine vision	IEEE Transactions on Image Processing	Conversion of an RGB image to a Grayscale image
Oge Marques	Practical Image and Video Processing Using MATLAB	Wiley-IEEE Press	Image processing using edge detection technique by using wiener filter
Amos gilot-2013	Matlab	wiley	Introduction to MATLAB with applications

MOTIVATION:

The motivation for doing this project was primarily an interest in undertaking a challenging project in an interesting area of research. To prevent the malpractices in remote areas there is a need to automation of identity verification through biometric recognition. The opportunity to learn about a new area of image processing of biometrics not covered in lectures was appealing. The coding part in matlab has driven more interest towards the project.

The field of biometrics was formed and has since expanded on to many types of physical identification. Still, the human fingerprint remains a very common identifier and the biometric method of choice among law enforcement. These concepts of human identification have led to the development of fingerprint scanners that serve to quickly identify individuals and assign access privileges. The basic point of these devices is also to examine the fingerprint data of an individual and compare it to a database of other fingerprints.

Nearly everyone in the world is born with a fingerprint that is unique; a separate and comprehensively identifying attribute that sets us apart from the other 6.5 billon people that inhabit this world. It is because of this fact that the fingerprint has proven such a useful part of biometric security. The very reason that fingerprint scanners are useful can be found in this fact as well. However, this is far from the only reason they are used.

OBJECTIVE:

- The main objective is to verify the biometrics of a person by comparing them with data in the database.
- The project deals with the matching of white points and black points obtained from edge detection process of image processing of the biometric image with the image in the database.
- The image is converted from RGB to gray scale before undergoing edge detection.

- Database is created with all fingerprints of several persons.All undistorted fingerprints in database are black and white images.
- Input fingerprint is compared with that of database to identify user.
- If fingerprint is matched user details are shown else match not found is displayed.
- Input fingerprint can be a distorted fingerprint
- White points and black points of image are found to determine total matched percentage
- Based on total matched percentage user details will be displayed
- Image Processing is a technique to enhance raw images received from cameras/sensors placed on space probes, aircrafts and satellites or pictures taken in normal day-today life for various applications.
- An Image is rectangular graphical object. Image processing involves issues related to image representation, compression techniques and various complex operations, which can be carried out on the image data.
- The operations that come under image processing are image enhancement operations such as sharpening, blurring, brightening, edge enhancement etc. Image processing is any form of signal processing for which the input is an image, such as photographs or frames of video, the output of image processing can be either an image or a set of characteristics or parameters related to the image.
- Most image-processing techniques involve treating the image as a two-dimensional signal and applying standard signal-processing techniques to it. Image processing usually refers to digital image processing, but optical and analog image processing are also possible.
- Edge detection is the set of mathematical methods which aim at identifying points in a digital image at which the image brightness changes sharply or, more technically, has discontinuities or noise. The points at which image brightness alters sharply are typically organized into a set of curved line segments termed edges.
- From this the number of black points and white points are counted and are used to compare the images.

RGB to GRAY Conversion:

Humans perceive color through wavelength-sensitive sensory cells called cones. There are three different varieties of cones, each has a different sensitivity to electromagnetic radiation (light) of different wavelength. One cone is mainly sensitive to green light, one to red light, and one to blue light. By emitting a restricted combination of these three colors (red, green and blue), and hence stimulate the three types of cones at will, we are able to generate almost any detectable color. This is the reason behind why color images are often stored as three separate image matrices; one storing the amount of red (R) in each pixel, one the amount of green (G) and one the amount of blue (B). We call such color images as stored in an RGB format. In grayscale images, however, we do not differentiate how much we emit of different colors, we emit the same amount in every channel. We will be able to differentiate the total amount of emitted light for each pixel; little light gives dark pixels and much light is perceived as bright pixels. When converting an RGB image to grayscale, we have to consider the RGB values for each pixel and make as output a single value reflecting the brightness of that pixel. One of the approaches is to take the average of the contribution from each channel: (R+B+C)/3. However, since the perceived brightness is often dominated by the green component, a different, more "human-oriented", method is to consider a weighted average, e.g.: 0.3R + 0.59G + 0.11B.

Introduction to MATLAB

The name MATLAB stands for MATrix LABoratory. MATLAB was written originally to provide easy access to matrix software developed by the LINPACK (linear system package) and EISPACK (Eigen system package) projects. MATLAB is a high-performance language for technical computing. It integrates computation, visualization, and programming environment. Furthermore, MATLAB is a modern programming language environment: it has sophisticated data structures, contains built-in editing and debugging tools, and supports object-oriented programming. These factors make MATLAB an excellent tool for teaching and research.

MATLAB has many advantages compared to conventional computer languages (e.g., C, FORTRAN) for solving technical problems. MATLAB is an interactive system whose basic data element is an array that does not require dimensioning. The software package has been commercially available since 1984 and is now considered as a standard tool at most universities and industries worldwide. It has powerful built-in routines that enable a very wide variety of computations. It also has easy to use graphics commands that make the visualization of results immediately available. Specific applications are collected in packages referred to as toolbox. There are toolboxes for signal processing, symbolic computation, control theory, simulation, optimization, and several other fields of applied science and engineering. There are various tools in Matlab that can be utilized for image processing, such as Simulink, GUI etc. Simulink contains various toolboxes and image processing toolbox is one such example. Simulink is used for simulation of various projects.

MATLAB CODE:

```
clc;

clear all;

close all;

A=imread('test.jpg');// use test1.jpg if not want to show match not found.

A=rgb2gray(A);

figure,imshow(A);

title('accepted image');


J=wiener2(A,[5 5]);


BW1=edge(J,'canny');


matched_data = 0;

white_points1 = 0;

black_points = 0;

count=0;


x=0;

y=0;

l=0;

m=0;
```

```
for a = 1:1:300
   for b = 1:1:300
      if(BW1(a,b)==1)
         white_points1 = white_points1+1;
      else
         black_points = black_points+1;
      end
   end
end


 srcFiles = dir('C:\Users\RAKESH KUMAR\Documents\MATLAB\*.jpg');  % the folder in which ur images exists
for i = 1 : 1 : length(srcFiles)
   filename = strcat('C:\Users\RAKESH KUMAR\Documents\MATLAB\db\',srcFiles(i).name);
   M = imread(filename);
   M=rgb2gray(M);


J1=wiener2(M,[5 5]);


 BW2=edge(J1,'canny');


white_points2 = 0;
black_points = 0;
```

```
count=count+1;



for a = 1:1:300
    for b = 1:1:300
        if(BW2(a,b)==1)
            white_points2 = white_points2+1;
        else
            black_points = black_points+1;
        end
    end
end

 total_matched_percentage = (white_points1/white_points2)*100;

 if(total_matched_percentage >= 75)
    break;
end


end
if(total_matched_percentage >= 75)
    display('MATCH FOUND');
    filename = strcat('C:\Users\RAKESH KUMAR\Documents\MATLAB\db\',srcFiles(i).name);
```

```
    M= imread(filename);
    M=rgb2gray(M);
    figure,imshow(M);
    title('MATCHED FROM DATABASE');



else
    display('MATCH NOT FOUND PLEASE TRY AGAIN');
end
```

SIMULATED RESULT:

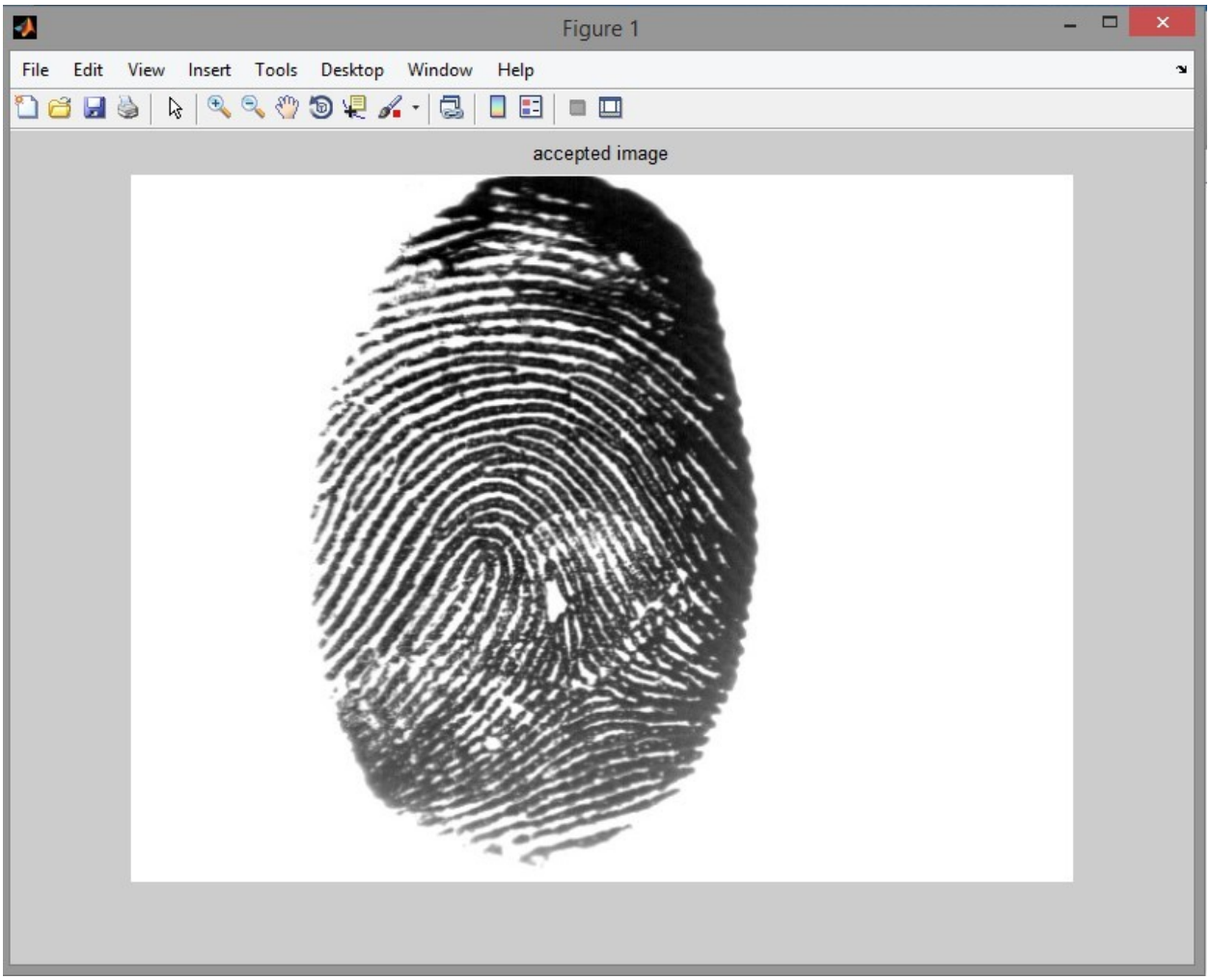

Fig a1: input fingerprint of user

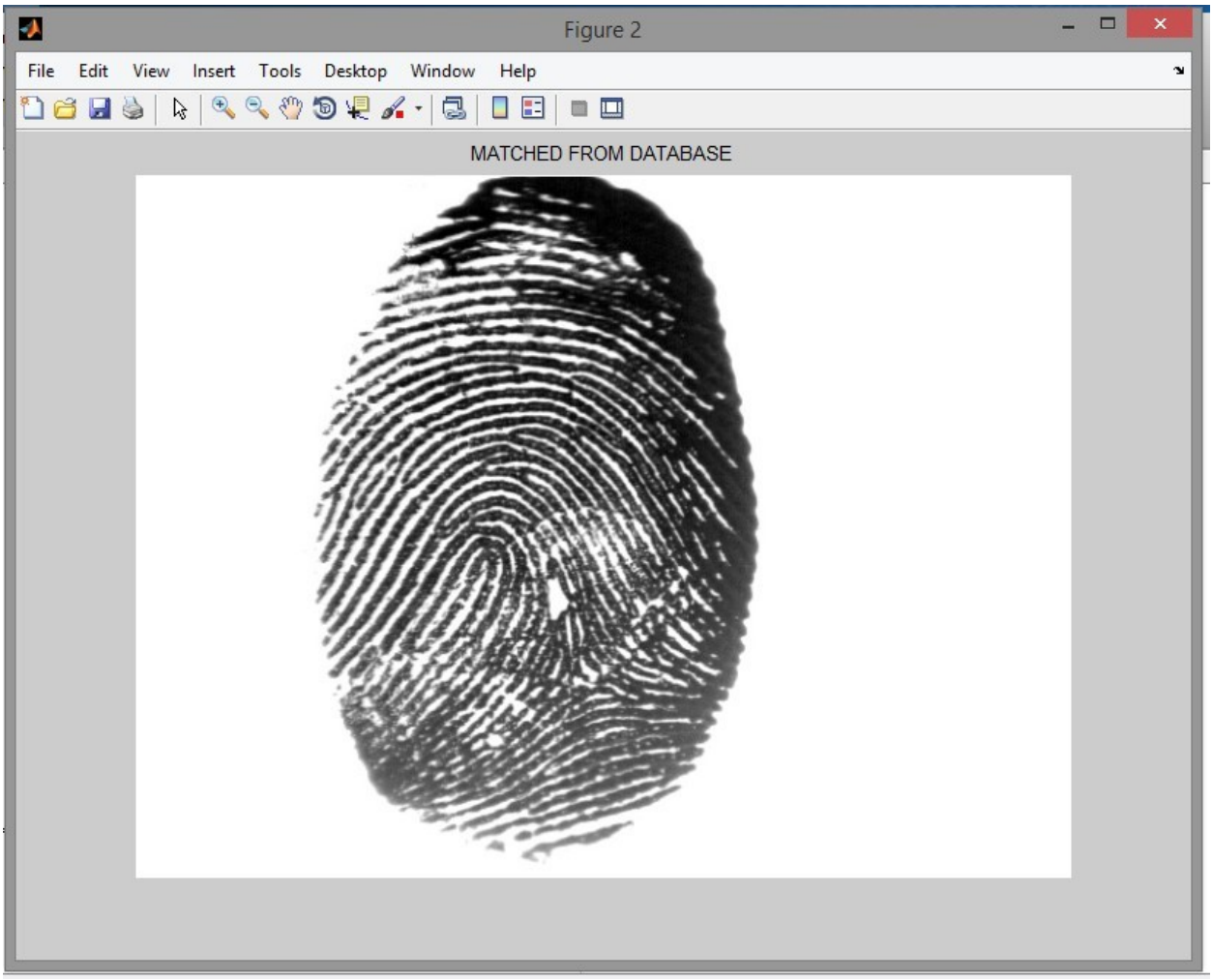

Fig a2: Matched fingerprint in the database

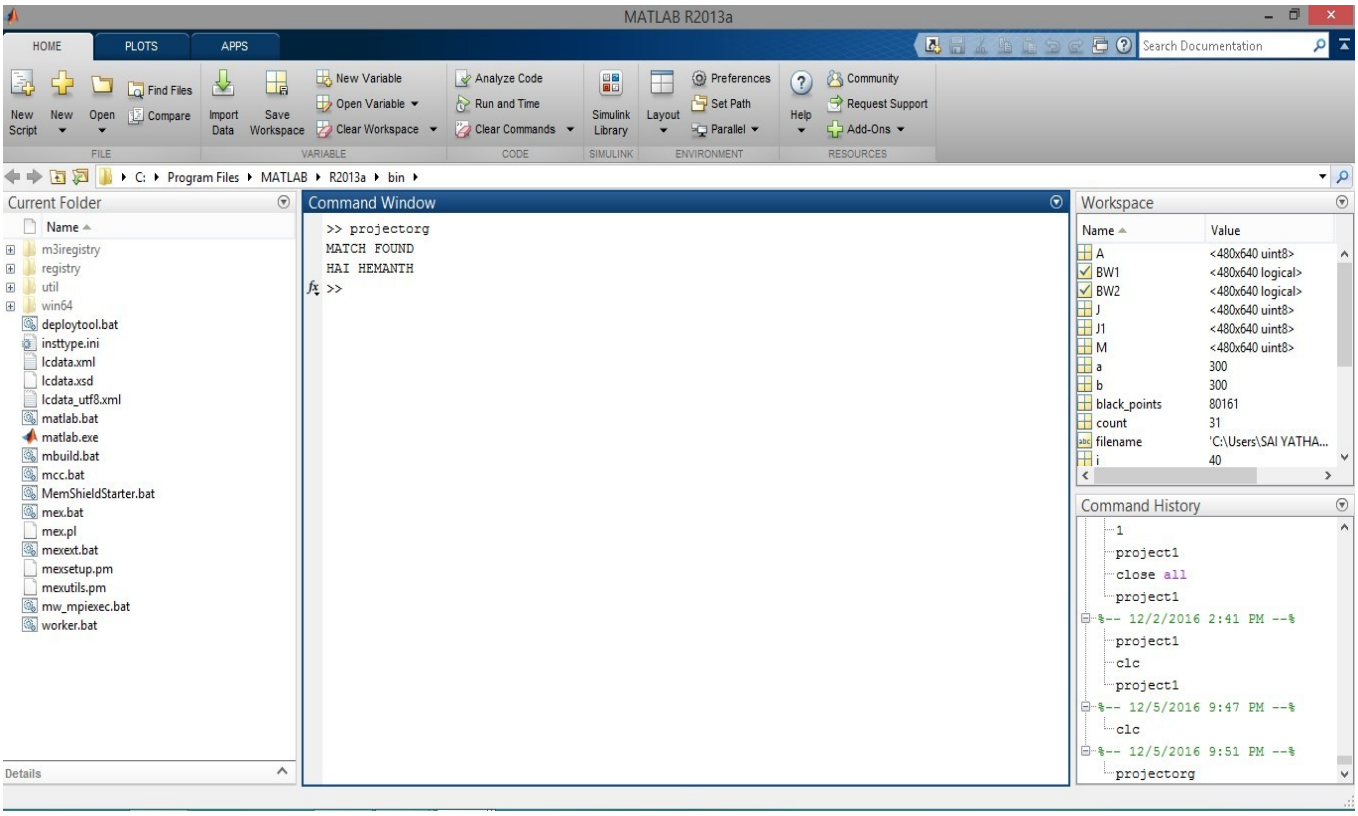

Fig a3: output in command window showing user details

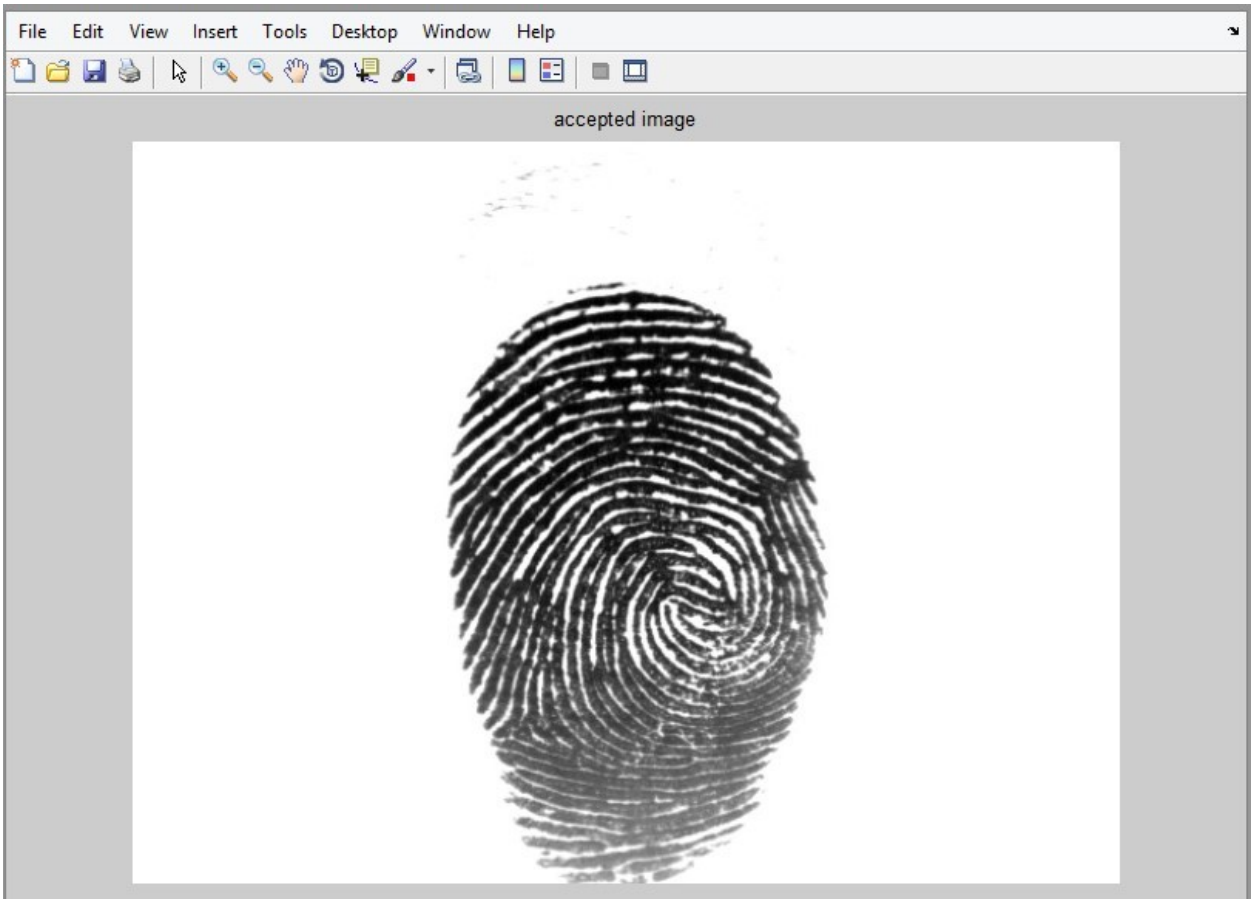

Fig b1: input fingerprint of unknown user

Fig b2: output in the command window showing match not found

CONCLUSION:

For over a century, fingerprints have been one of the most highly used methods for human recognition, automated biometric systems have only been available in recent years.

This project is about verifying authorised access to a person by matching his fingerprint with the provided database by using image processing technology. This work is successfully implemented and evaluated. The arrived results were significant and more comparable. It proves the fact that the fingerprint image enhancement step will certainly improve the verification performance of the fingerprint based recognition system. Because fingerprints have a generally broad acceptance with the general public, law enforcement and the forensic science community, they will continue to be used with many government's legacy systems and will be utilized in new systems for evolving applications that require a reliable biometric. Thus the advent of this system would enable the personnel identity verification through computerised process. This will preclude the unauthorised practices.

FUTURE SCOPE:

- This system can be implemented in a few years, with recent development in technology and coding so that the image processing is faster and more convenient to use on daily basis.
- External memory can be provided for storing the database, which can be later accessed for comparison.
- Audio output can be introduced to make it user friendly for illiterate users.
- Retina scanning can also be developed.

REFERENCES:

[1] Rafael C. Gonzalez; Richard E. Woods (2008). Digital Image Processing. Prentice Hall. pp. 1–3. ISBN 978-0-13-168728-8.

[2] D. Maltoni, D. Maio, A. K. Jain, and S. Prabhakar, Handbook of Fingerprint Recognition. New York: Springer-Verlag, 2003.

[3] Tinku Acharya and Ajoy K. Ray (2006). Image Processing - Principles and Applications. Wiley InterScience.

[4] Lin Hong. "Automatic Personal Identification Using Fingerprints", Ph.D.Thesis, 1998.

[5] Y.C. Chang and J.F. Reid RGB calibration for color image analysis in machine vision-IEEE Transactions on Image Processing, 1996.

[6] Oge Marques, Practical Image and Video Processing Using MATLAB, Wiley-IEEE Press.

[7] Amos gilot, MATLAB, Wiley.