ICEST-2K24 [International Conference on Engineering, Science and Technology]
In Association with
International Journal of Scientific Research in Science, Engineering and Technology
Print ISSN - 2395-1990 | Online ISSN : 2394-4099 (www.ijsrset.com)

3-D Hand Geometry Based Recognition System for User Authentication Using Image Processing

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ABSTRACT

Biometrics which can be used for identification of individuals based on their physical or behavioral characteristics has gained importance in today's society where information security is essential. Hand geometry based biometrics systems are gaining acceptance in low to medium security applications. Hand geometry based identification systems utilize the geometric features of the hand like length and width of the fingers, diameter of the palm and the perimeter. The proposed system is a verification system which utilizes these hand geometry features for user authentication. This project introduces an inexpensive, powerful and easy to use hand geometry based biometric person authentication system. One of the novelties of this work comprises on the introduction of hand geometry's related, position independent, feature extraction and identification which can be useful in problems related to image processing and pattern recognition .Today students (class) attendance became more important part for any organizations/institutions.

Keywords: Hand geometry, hand features, radius distance methods, computational intelligence, hand biometric, palm geometry analysis, palm equations.

I. INTRODUCTION

Biometric characteristics such as palmprint [1], hand and finger geometry [2], fingerprint [3], Iris [4], etc. are mostly popular used in security systems over the traditional secure measures, password or ID cards. The biometric systems are more reliable because they cannot easily be lost, stolen, shared and duplicated. Palmprint features have advantages compared with other features. For example, palmprint has more information than fingerprint and it can be captured by low resolution devices such as digital camera, video camera. Furthermore, iris capture devices are more expensive than palmprint capture devices. The Principal lines and wrinkles are normally features extracted from palmprint image. The most researchers usually used them for identification process. The palmprint alignment which is the crucial preprocessing steps prior to the identification steps in the palmprint recognition system [5]. The previous works almost usedthree approaches for palmprint alignment. At the first approach, tangent-based approach [6] is a tangent calculation between two boundaries to find the key points for further used in palmprint alignment. A bisector-based approach [7, 8] is constructed the lines from the center of gravity of a finger boundary to find the key points. The last

approach is a finger-based approach [9]. Real-time face detection and recognition achieved through Viola-Jones method. Software captures images, stores in database. Automated system detects person using three-phase methodology.[21] This method used a wavelet to detect the fingertips to assign the key points. Most of the previous approaches usually used hand acquisition devices with guidance pegs [2, 6, 8, 9] to fix the hand position to avoid the scaling, translation and rotation problems for correctly palmprint image alignment. But this mechanism makes some user feel uncomfortable and the palm must be contacted to image capture device during acquisition process so it is not hygiene for the user. In this paper, we proposed a new contactless palmprint image alignment method and further used in the person identification We find the robust reference point in the middle of palm using distance map applied on the binarized hand image. We use radius distance methods to find the position of the fingertip and the concave of the finger from the hand contour which are served as fiducial points used to estimate the affine transformation matrix. The reference palmprint image can then be aligned against the query palmprint image. The distance map error can be computed and used for person identification.A pixel form can be used for user cryptographic security in pixel form [10].

II. LITERATURE SURVEY

1. **Yutthana Pititeeraphab, Chuchart Pintavirooj "Identity Verification Using Geometry of Human hands":**A Palmprint, biometric characteristics, was mostly found in civil and commercial applications for security system because it has more reliable and easy to capture by low resolution devices. This research focuses on the development of hand identification and hand geometry using hand fea-tures, including the length of the hand, length and width of each finger, size of palm. We use radius distance methods to find the position of the fingertip and the concave of the finger from the hand contour. The radius distance method is highly flexible, accurately detecting the curves of fingertip and concave of finger.
2. **Zhizhong Han , Baorui Ma, Yu-Shen Liu , Member, IEEE, and Matthias Zwicker "Reconstructing 3D Shapes From Multiple Sketches Using Direct Shape Optimization**":3D shape reconstruction from multiple hand-drawn sketches is an intriguing way to 3D shape modeling. Currently, state-of-the-art methods employ neural networks to learn a mapping from multiple sketches from arbitrary view angles to a 3D voxel grid. Because of the cubic complexity of 3D voxel grids, however, neural networks are hard to train and limited to low resolution reconstructions, which leads to a lack of geometric detail and low accuracy. To resolve this issue, we propose to reconstruct 3D shapes from multiple sketches using direct shape optimization (DSO), which does not involve deep learning models for direct voxel-based 3D shape generation. Specifically, we first leverage a conditional generative adversarial network (CGAN) to translate each sketch into an attenuance image that captures the predicted geometry from a given viewpoint.
3. **Jiayun Wang, Jierui Lin, Qian Yu, Runtao Liu, Yubei Chen, and Stella X. Yu "3D Shape Reconstruction from Free-Hand Sketches":**Sketches are the most abstract 2D representations of real-world objects. Although a sketch usually has geometrical distortion and lacks visual cues, humans can effortlessly envision a 3D object from it. This suggests that sketches encode the information necessary for

reconstructing 3D shapes. Despite great progress achieved in 3D reconstruction from distortion-free line drawings, such as CAD and edge maps, little effort has been made to reconstruct 3D shapes from free-hand sketches. We study this task and aim to enhance the power of sketches in 3D-related applications such as interactive design and VR/AR games.

4. **Johnson I Agbinya Human Palm Geometry Modelling for Biometric Security Systems:**Palm print modelling and recognition systems have been extensively studied. Palm shape or palm geometry has had lesser attention paid to its study because of the difficulties associated with shape definitions and modelling. This paper reports on experimental determination of human palm geometryequations.Experimentaldetermination of human palm geometry was undertaken using measurements of hands of 14 subjects drawn from a mixture of racial and gender backgrounds. By also analysing scanned images of their hands, characteristic measurements of their palms were determined. Characteristic expressions describing the geometry of human hands are proposed. model can use the dataset needed for bot detection on its own.
5. **Hesham Hashim Mohammed *, Shatha A. Baker*, Dr. Ahmed S. Nori** "Biometric identity Authentication System Using Hand Geometry Measurements:**In recent years hand geometric dependent biometric system has shown to be the quite acceptable biometric trait and suitable for security applications. It has been recognized as an effective means of authenticating identity in a variety of commercial applications as a result of better hardware and improved algorithms.
6. **MarcosFaundezZanu,"BIOMETRIC VERIFICATI ON OF HUMANS BY MEANS OF HAND GEOMETRY1":** This Paper describes a hand geometry biometric identification system. We have acquired a database of 22 people, 10 acquisitions per person, using a conventional document scanner. We propose a feature extraction and classifier. The experimental results reveal a maximum identification rate equal to 93.64%, and a minimum value of the Detection Cost Function equal to 2.92% using a Multi Layer Perceptron Classifier.
7. **Min-Yu Wu a , Pai-Wen Ting a , Ya-Hui Tang a , En-Te Chou a , Li-Chen Fu a,b,"Hand pose estimation in object-interaction based on deep learning for virtual reality applications q,q" :** Hand Pose Estimation aims to predict the position of joints on a hand from an image, and it has become popular because of the emergence of VR/AR/MR technology. This paper develops a system that accurately estimates a hand pose in 3D space using depth images for VR applications. We propose a data-driven approach of training a deep learning model for hand pose estimation with object interaction. In the convolutional neural network (CNN) training procedure, we design a skeleton-difference loss function, which effectively can learn the physical constraints of a hand. Also, we propose an object-manipulating loss function, which considers knowledge of the hand-object interaction, to enhance performance.
8. **Johnson I Agbiny," Human Palm Geometry Modelling for Biometric Security Systems":**Palm print modelling and recognition systems have been extensively studied. Palm shape or palm geometry has had lesser attention paid to its study because of the difficulties associated with shape definitions and modelling. This paper reports on experimental determination of human palm geometry equations. Experimental determination of human palm geometry was undertaken using measurements of hands of 14 subjects drawn from a mixture of racial and gender backgrounds. By also analysing scanned images

of their hands, characteristic measurements of their palms were determined.A pixel form can be used for user cryptographic security in pixel form[10].Author presented an algorithm for detecting and preventing Node isolation attack where attacker become the sole MPR of victim and isolated the victim from the rest of the network.[12].

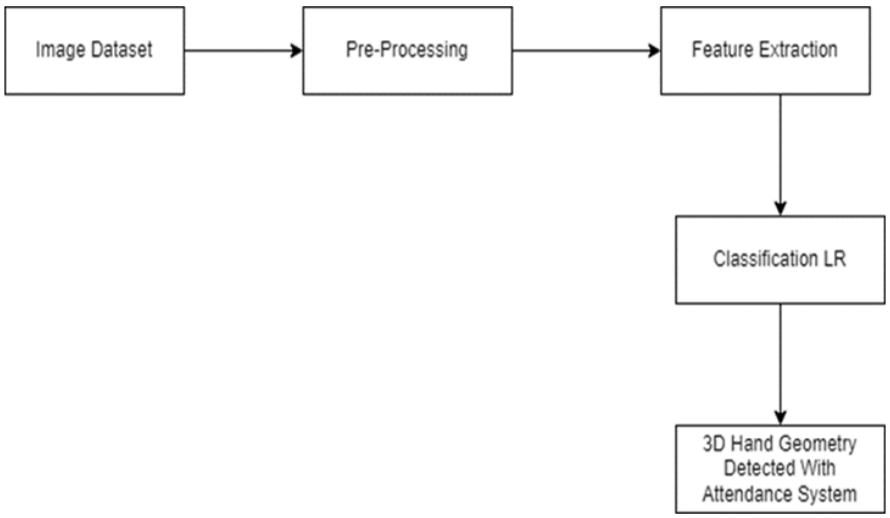
The detailed survey given in this paper [15].

Pharmaceutical innovation faces challenges. Research merges quantum computing and machine learning to revolutionize drug discovery, simulation, and safety assessment for expedited progress.[20]

III.PROPOSED SYSTEM

A) **ProblemStatement:**The Userauthentication is a critical component of ensuring the security and privacy of various systems and applications. Traditional methods like passwords and PINs have proven to be vulnerable to attacks, and more robust and secure authentication methods are needed. One such method is hand geometry-based recognition, which utilizes the unique geometric features of an individual's hand for authentication purposes. Identify relevant features from the 3D hand geometry data that may contribute to attendance prediction.

B) **Block Diagram:**



C) **REQUIREMENTS**

I. Hardware Requirements:

- Processor - Intel i5
- Speed - 3.1 GHz
- RAM - 4Gb(Min)
- Hard Disk - 256GB

II. Software Requirements:

- Operating System- Windows

- Database - SQLite
- Language -Python
- IDE -Spyder

D) RESULT SCREENSHOTS AND DISCUSSION:

Here this section covers the result of implemented project.

Fig. Login Page

The login page added the biometric authentication details of the users, enhancing touch less authentication and System Security.

Fig. Registration Page

The registration page ensecure the the user's data stored in the database and the information of the user's for the attendance.

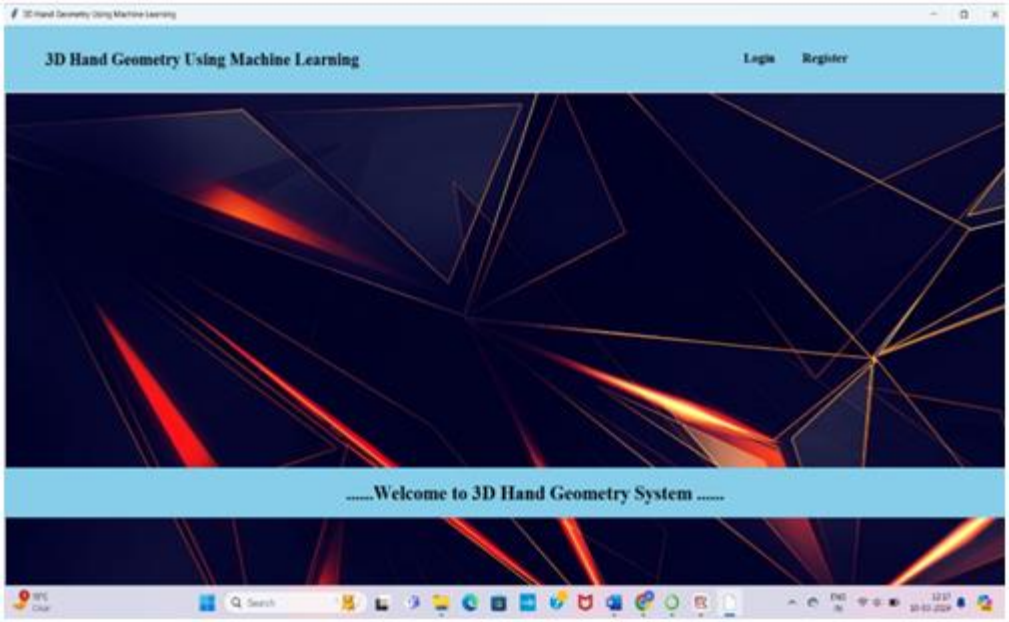


Fig. GUI Page

The GUI(Graphical user interface) page has for the our starting page and it's included the login and registration button, enhancing the user's point of view

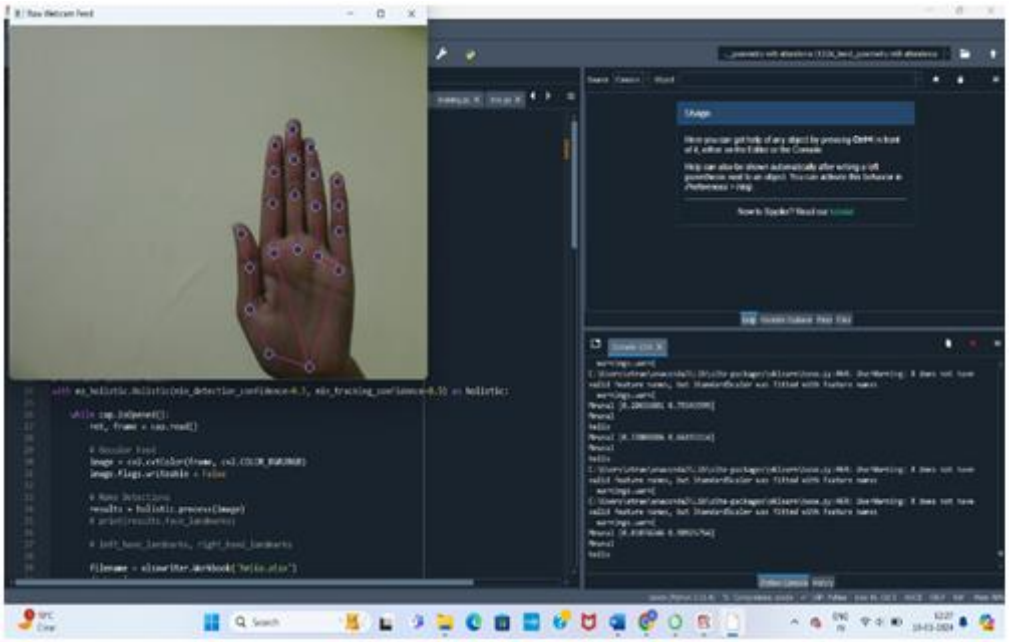


Fig. Hand Geometry For Detection

The hand geometry page for authentication of the user's name and roll number for ensuring the attendance and stored the data provides the secure touchless attendance system.

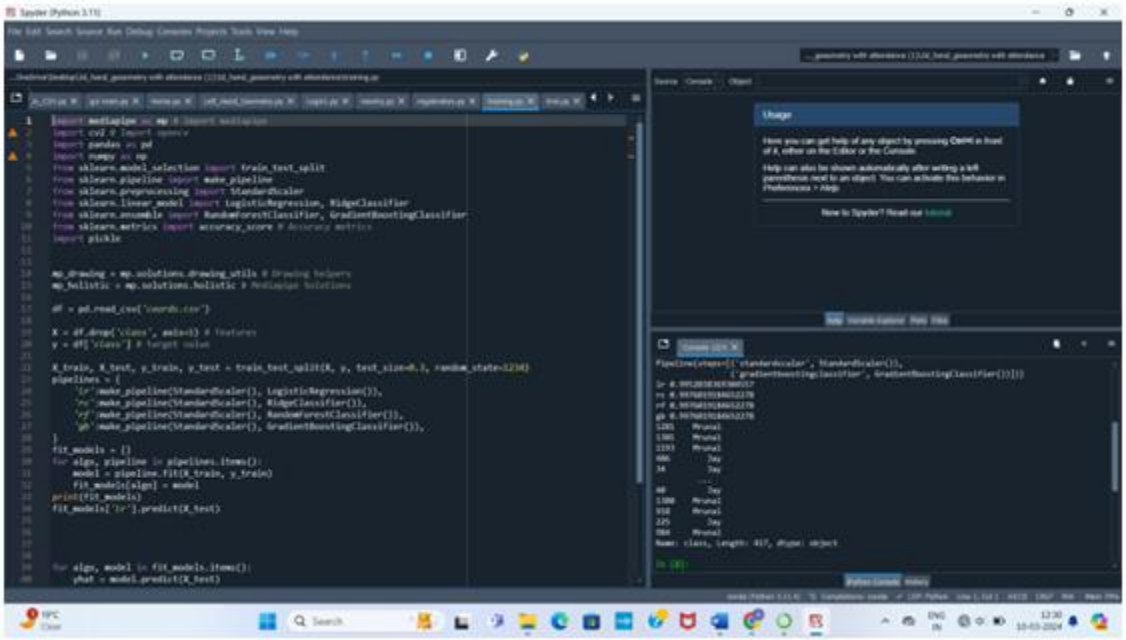


Fig. Final Page

The page of Training is used to take the student 3D hand geometry and scanning the whole hand of the student. Train the dataset by using the hand cords and this makes more secure system.

IV. RESULT DISCUSSION

3D hand geometry analysis involves the examination of various hand dimensions and shapes in three-dimensional space. This technology is often employed for biometric purposes, security systems, or virtual reality applications. The discussion can encompass accuracy, applications in authentication, potential privacy concerns, and advancements in capturing and processing 3D hand data.Display Screenshots showcasing the results obtained by the Machine Learning models like Logistic Regression.

V. CONCLUSION

The development and implementation of 3-D Hand Geometry Based Recognition System For User Authentication represent a significantstepforwardinthesafely using of the touchless attendance system,offeringpromisingsolutionstoaddressthe challenges posed by the infectious diseases.The conclusion is that we proposed the new contactless palm print alignment method with the general web camera and the screen. This method used the corresponding key points from the fingertips and the concave of the fingers to find the affine transformation matrix which was used to align set of inquiry palm-print image against set of reference palm print image. To improve the specificity for person identification, another features vector which contains the physical parameter extracted from the finger and palm including the length and width of

the finger was used. The proposed technique was tested successfully for person identification. The result is very promising with 90% accuracy.

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