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3D Hand Geometry Based Attendance System

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ABSTRACT: Biomatric has become popular to categorize people based on their physical or behavioural characteristics in today's society where information security is essential. Hand geometry-basedbiometrics systems are gaining acceptance in low to medium security applications. Geometric features of the hand, such as the finger length and width, the palm diameter, and the radius, are used in hand geometry-based identification systems. The proposed system is a Hand based attendance system which utilizes these hand geometry features for student attendance process. This project introduces an inexpensive, powerful and easy to use hand geometry based attendance system. This work introduces a new approach to feature extraction and identification related to hand geometry that is position independent. It can be used in problems pertaining to image processing and pattern recognition.

KEYWORDS: Biometric, Hand-Geometry, Authentication, Verification.

I.INTRODUCTION

Biometric has become popular to categorize people based ontheir physical or behavioural characteristics in today's society where information security is essential. Hand geometrytechnologies are gaining acceptance in low- and medium-security applications. Hand geometry-based identificationsystems leverage the geometric characteristics of the hand,such as its length and width of the fingers, diameter of thepalm and the perimeter for identification purposes. The proposed system is a student attendance system which utilizesthese hand geometry features for student's attendance. The purpose of this project is to introduce a Hand Based Attendance System based on hand geometry that is inexpensive, powerful, and easy to use. The application of handgeometry's position-independent feature extraction and identification can offer significant advantages in tasks involvingimage processing and pattern recognition. Presently, students' attendance has become a crucial aspect for organizations and institutions. The traditional approach of taking attendance through verbal calls or signing on paper is highlytime-consuming and insecure, thus proving to be inefficient.

In this paper, we present a manual-to-computerized approachfor managing students' attendance, aiming to enhance convenience and ensure data reliability. Hence, the classroom incorporates ubiquitous computing systems to efficiently manage students' attendance through the utilization of a humanpalm print scanner. The purpose of the system is to establishan attendance management system that relies on a palm printscanner. Students are required to use their palm to mark theirattendance, ensuring that only authentic students' attendanceis recorded during class. This system utilizes the webcam toelectronically capture attendance and subsequently records itin a database. Students attendance there are easily seen in theInterface.

II.RELATED WORK

1. Paper Name: Human Palm Geometry Modelling for Biometric Security Systems.
Author: Johnson I Agbinya
Abstract: :Palm shape or palm geometry has received relatively less attention in research due to challenges associated with defining and modelling its shape. In this paper, we present the findings of experimental research focused on determining equations related to human palm geometry. This paper presents the results of an experiment conducted to determine human palm geometry equations. The experiment involved measuring the hands of 14 subjects, representing diverse racial and gender backgrounds. By analyzing scanned images of the participants' hands, their palm features.
2. Paper Name: "An Augmented Reality Application with Hand Gestures for Learning 3D Geometry.
Author: Hong-Quan Le, Jee-In Kim
Abstract: Geometry, a captivating field of mathematics, offers numerous approaches and holds close relevance to our daily lives. However, students often perceive learning geometry as not only unpleasant but also challenging. Traditional materials such as pens, papers, blackboards, textbooks, and conventional teaching methods like drawing and narrative

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instruction may not adequately support geometry learning. To tackle this challenge, this paper introduces a framework that leverages augmented reality (AR) and hand gesture recognition technologies as a software tool to enhance the field of geometry education. The integration of these technologies into a unified system offers a solution to current challenges in geometry education, providing students with a more accessible and convenient approach to studying geometry.

3. Paper Name: Haptic Rendering of 3D Geometry on 2D Touch Surface Based on Mechanical Rotation.
Author: :Seung-Chan Kim, Byung-Kil Han , DongSoo Kwon
Abstract: :This paper introduces a robotic surface display that mimics the physical orientation of virtual 3D geometry when touched on a 2D flat screen. The approach put forward enables the visualization of surface orientation in 3D geometry, allowing users to tactually acquire relative geometric information. This aspect holds great importance in the perception of haptic objects in real-world scenarios Leveraging the planar nature of touch surfaces, the system utilizes a rotation matrix to manipulate the orientation of a surface with minimal mechanical movements. This is achieved by utilizing available partial geometric information (i.e., normal vector at the point of touch).

4. Paper Name: Hand Control AR: An Augmented Reality Application for Learning 3D Geometry.
Author: :Rui Cao, Yue Liu
Abstract: The conventional method of learning geometry falls short in providing adequate support for novice students, as geometric figures are limited to 2D representations on a blackboard or in a book. Considering the intuitive nature of Augmented Reality (AR) in facilitating geometry learning, this paper introduces an interactive AR system. This system allows students to manipulate 3D objects directly and naturally using hand gesture-based interactions. Furthermore, it enables students to intuitively explore the spatial relationship between spheres and polyhedrons

III.PROPOSED ALGORITHM

A. *Logistic Regression Algorithm:*

- Regression is Machine Learning algorithms, which comes under the Supervised Learning technique. It is employed to predict the categorical dependent variable by utilizing a specified set of independent variables.
- Logistic regression is a statistical technique that predicts the outcome of a categorical dependent variable. Therefore the outcome must be a categorical or discrete value. The possible outcomes can be either Yes or No, 0 or 1, true or false, and so on. However, rather than providing precise values of 0 and 1, logistic regression yields probabilistic values that range between 0 and 1.
- Logistic Function (Sigmoid Function): The sigmoid function is a mathematical function employed to transform predicted values into probabilities. The logistic regression value must fall within the range of 0 and 1, without surpassing these limits, resulting in a curve that takes the shape of an "S." The curve in the shape of an "S" is referred to as the Sigmoid function or the logistic function.
- S(x)= 1 1+ex

IV.SYSTEM ARCHITECTURE

Hand geometry recognition relies on extracting a hand pattern that encompasses various parameters, including finger 3 length, width, thickness, curvatures, and relative location. Hand geometry pertains to the geometric composition of a hand, encompassing measurements such as finger lengths, widths at different points along the fingers, palm diameter, palm thickness, and more. While these features may not possess the same level of distinctiveness as other biometric characteristics (such as fingerprints), they offer the advantage of being easily.

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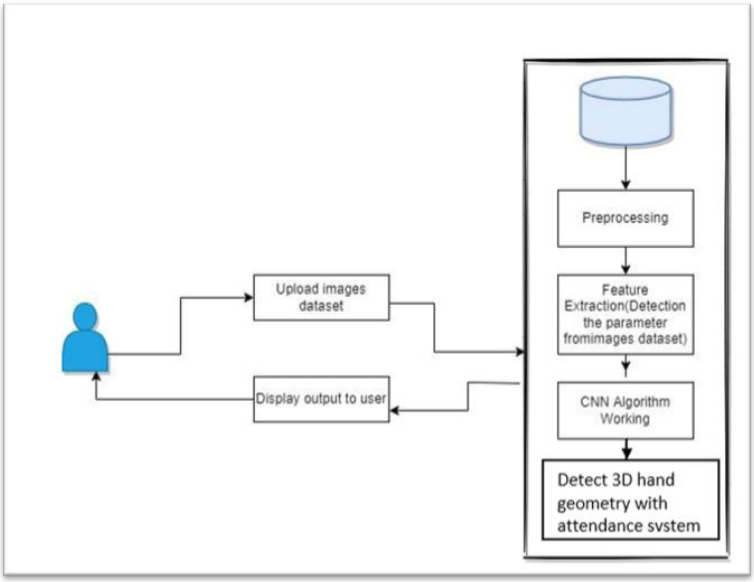

Fig. System Architecture

V.SIMULATION RESULTS

- **Image Acquisition:** Image acquisition is the first step in a 3D hand geometry system. The image acquisition involves capturing and storing the image in coordinates form, from vision sensors like colour digital cameras, monochrome and colour CCD cameras, video cameras, scanners, etc. The image acquisition system comprises of a light source, digital camera/scanner. The input image is a colour/grayscale image of a hand. In the proposed system, images are obtained using a digital camera. It is necessary that the fingers are separated from each other. However, it is not necessary to stretch the fingers as far apart as possible. Instead, the hand should be positioned in a relaxed state with the fingers comfortably separated from each other.
- **Image Pre-processing**: The next stage is image pre-processing module Image pre-processing involves preparing an image for subsequent analysis and utilization. Images captured by a camera or similar techniques may not be initially in a suitable form for image analysis routines. They may require various enhancements, such as noise reduction, simplification, enhancement, alteration, segmentation, filtering, and more. The primary purpose of the processing module is to ready the image for feature extraction. Image pre-processing module consists of following operations:
    - Gray scale image
    - Noise removal
    - Edge detection

- **Hand Feature Extraction:** There are several features that can be extracted from the 3D hand geometry of the hand. One of the prominent features that can be derived from hand geometry is the positions of knuckles and joints. By storing and analysing the positions of these structural landmarks on the hand, including the knuckles of fingers and the joints of the palm, valuable features are obtained. The finger lengths measured from the base to the tip, the lengths of individual fingers contribute significantly to the overall hand geometry representation. Similarly, finger widths measures the widths of fingers at various points, such as the base, middle, and tip, distinct features are extracted to enhance the accuracy of hand geometry analysis. Then this extracted features are stored in the coordinates form.
- **Matching:** The matching stage provides the means to determine the identity of a student. When a student attempts recognition in a biometric system, the user's generated features coordinates will be compared against the coordinates stored in the database. In the verification, this comparison is done only against the claimed identities coordinated.
- **Decision:** After running the matching algorithm, a recognition decision is made whether it is a hand of which student according to the match found. If the hand geometric features matches the recognition attempt it is considered as a student.

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VI. CONCLUSION AND FUTURE WORK

This project has presented a new approach to achieve more reliable personal authentication using extraction of 3D hand geometry features. The proposed system acquires hand images in a contact –free manner to ensure high user friendliness and also to address the hygienic concerns. Simultaneously acquired range and 2D images of the hand are processed for the feature extraction and matching. We introduced two new representations, namely finger surface curvature and unit normal vector, for 3D hand geometry based biometric measurement. Simple and efficient metrics are proposed for the matching of pair of 3D hand images. Match scores from 3D hand geometry matchers are combined to obtain a highly reliable authentication system. Our research also suggests that significant performance improvement can be achieved By combining hand geometry information extracted from a user's 3D hand images, these features can be achieved. In this paper, we discuss the approach and methodology utilized for this purpose. A preliminary experiment demonstrates a teacher can classify any student's attendance according to their use. Any teacher can take the records and generate graph according to their use.

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