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Multimodal Biometric system using Deep Learning Techniques

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Abstract: *The use of biometric for identification purposes requires that a particular biometric factor be unique for each individual that it can be calculated, and that it is invariant over time. Biometrics such as signatures, photographs, fingerprints, voiceprints and retinal blood vessel patterns all have noteworthy drawbacks. Although signatures and photographs are cheap and easy to obtain and store, they are impossible to identify automatically with assurance, and are easily forged. Human iris on the other hand as an internal organ of the eye and as well protected from the external environment, yet it is easily visible from within one meter of distance makes it a perfect biometric for an identification system with the ease of speed, reliability and automation. Iris recognition is regarded as the most reliable and accurate biometric identification system available. Iris recognition is an automated method of biometric identification that uses mathematical pattern- recognition techniques on images of the irises of an individual's eyes, whose complex random patterns are unique. In this work it is proposed to implement a face and iris recognition system, where iterative closest point algorithm (ICP) and deep neural network is used to segment the face, eye and iris region. A template of the detected region is created using template matching for recognition is based on features in real time enrollment system. The results shows that the proposed method is efficient for iris based biometric recognition*

Key Words: *Biometric System, Deep Learning.*

1. INTRODUCTION:

Biometrics refers to metrics related to human characteristics. Biometrics authentication (or realistic authentication) is used in computer science as a form of identification and access control. It is also used to identify individuals in groups that are under surveillance. Biometric identifiers are then distinctive, measurable characteristics used to label and describe individuals. Biometric identifiers are often categorized as physiological versus behavioral characteristics. Physiological characteristics are related to the shape of the body. Examples include, but are not limited to fingerprint, palm veins, face recognition, DNA, palm print, hand geometry, iris recognition, retina and odour/scent. Behavioral characteristics are related to the pattern of behavior of a person, including but not limited to typing rhythm, gait, and voice. Some researchers have coined the term behavior-metrics to describe the latter class of biometrics.[4][5]

More traditional means of access control include token-based identification systems, such as a driver's license or passport, and knowledge-based identification systems, such as a password or personal identification number. Since biometric identifiers are unique to individuals, they are more reliable in verifying identity than token and knowledge-based methods; however, the collection of biometric identifiers raises privacy concerns about the ultimate use of this information, a company's management with crucial information that could prevent the company from entering blindly into risky businesses[6][8]

2. RELATED WORK

In existing system, proposed a new feature extraction algorithm based on Independent Component Analysis (ICA) for iris recognition. A conventional method based on Gabor wavelets should select the parameters (e.g., spatial location, orientation, and frequency) for fixed bases. ICA is applied to generate optimal basis vectors for the problem of extracting efficient feature vectors which represent iris signals. The basis vectors learned by ICA are localized in both space and frequency like Gabor wavelets. The coefficients of the ICA expansion are used as feature vector. Then, each iris feature vector is encoded into an iris code. And also presented a private biometrics formulation which is based on the concealment of random kernel and the iris images to synthesize minimum average correlation energy

(MACE) filter for iris authentication. Specifically, the training images are multiplied with the user-specific random kernel in frequency domain before biometric filter is created. Another serious problem is that computer users have become too trusting. They routinely use the same password to enter both secure and insecure Web sites as well as their networks at work. In response to the proven lack of security provided by password authentication, network administrators are replacing network passwords with smartcards, biometric authentication, or a combination of the three. Smart cards are credit card-size devices that engender random numbers about every minute, in sync with counterparts on each entry point in the network. Smart cards work well as long as the card isn't stolen. A better choice to ensure network security is the use of biometrics. Their paper investigated the different biometric techniques on hand to determine a person's identity.[7][8]

3. MODEL AND ANALYSIS:

A feasibility study is an analysis that takes all of a project's relevant factors into account—including economic, technical, legal, and scheduling considerations—to ascertain the likelihood of completing the project successfully. Project managers use feasibility studies to discern the pros and cons of undertaking a project before they invest a lot of time and money into it. Feasibility studies also can provide a company's management with crucial information that could prevent the company from entering blindly into risky businesses.

Biometrics is the science and technology of measuring and analyzing biological data of human body for increasing systems security by providing accurate and reliable patterns and algorithms for person verification and identification and its solutions are widely used in governments, military and industries. Single source of information in biometric systems are called unimodal systems and are perfect but they often suffer from some problems when they face with noisy data such as: intra-class variations, restricted degrees of freedom, spoof attacks and non-universality. Several of these problems can be solved by using multimodal biometric systems that combine two or more biometric modalities. Various methods, fusion levels and integration strategies can be applied to combine information in multimodal systems.[7]

3.1 DISADVANTAGES

- Using IRIS datasets for authentication Example: CASIA datasets
- Scanner based IRIS capturing
- Features are difficult to extracted and also redundant manner
- Accuracy can be less at recognition time
- Complexity is high in terms of computational steps

4. PROPOSED SYSTEM:

Today, biometrics recognition is a common and reliable way to authenticate the identity of a living person based on physiological or behavioral characteristics. It contains unique texture and is complex enough to be used as a biometrics signature. Compared with other biometrics features such as face and fingerprint, iris is a thin membrane on the interior of the eyeball. It is more stable and reliable, imitation is almost impossible. The iris is unique to people and patterns of iris are formed by six months after birth,stable after a year. They remain the same for life. Furthermore, iris recognition systems can be non- invasive to their users. The Security has become a main problem of concern among the people. Biometrics is robotic method of identifying a person based on physiological or behavioural uniqueness. Threat starts while an useless person tries to obtain access. A person verification system localizes facial landmarks and extracts biometrical features for face authentication. This includes image acquirement, segmentation, normalization, pattern generation and matching. Automatic iris recognition system is reliable for automatic personal identification. This research aims to recognize and identify iris among many that were stored in database. It is includes, after entered iris image, image preprocessing, feature extraction based on texture analysis using ICP algorithm to capture both local and global features details in an iris and iris identification (matching process) based on the distance between the new input iris and templates stored in the database then choose the minimum distance between them. So the score degree can determine the genuine or imposter person. The database can display information about any processed iris. The study conclusion that ICP algorithm was efficient distinguished and noise sensitive under different conditions[7]

4.1 ADVANTAGES

- Camera based implementation instead of Scanner implementation to reduce the cost
- Multi modal security
- Limited features are extracted
- Parallel classification using Neural network

4.2 SOFTWARE REQUIREMENTS HARDWARE REQUIREMENTS

- Processor: Intel processor 2.6.0 GHZ
- RAM : 1GB
- Hard disk : 160 GB
- Compact Disk : 650 Mb
- Keyboard : Standard keyboard
- Monitor :15 inch color monitor

4.3 SOFTWARE REQUIREMENTS

- Operating system : Windows OS
- Front End : .NET (C#)
- Back End : SQL SERVER
- Application :Windows application

List of Modules

- **Enrollment phase**
  - Image acquisition
  - Features extraction
- **Login phase**
  - Face Recognition
  - Sclera and Iris Recognition
  - Classification
- **Enrollment phase:**
  - In this module, user details are register into database
  - This module is used to admin for entering user features in database
  - Register the biometric data with their basic details such as name, mail id, mobile number and so on
- **Image acquisition:**
  - In this module, admin can capture face, sclera, iris images from web camera
  - First detect the face images using web camera
  - The images can be type and any size
  - Implement **ICP algorithm** to detect face images
  - **Curvelet transform** to detect sclera and iris These features are matched with data base using classification approach using **Neural network algorithm**
  - If there is match found means, user can be register into system, otherwise rejected

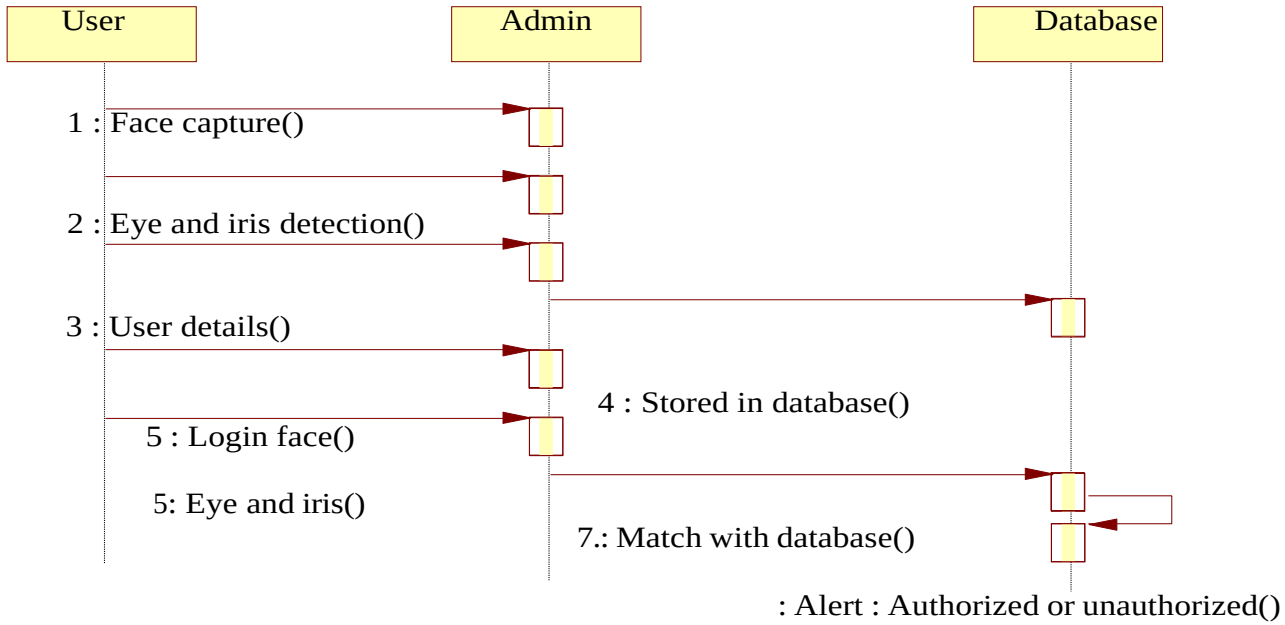

Fig.1-Sequence Diagram for Multimodal Biometric System

Login phase:

This phase is known as login phase

- User can enter into the system using user name and password
- After that capture the biometric images from web camera

- **Face Recognition:**
  - In this module, capture facial image from web camera
  - Facial features are calculated using ICP algorithm

- **Sclera or Iris Recognition:**
  - After that, implement curvelet transform algorithm to extract the features
  - First detect the location of eye and extract the Sclera features
  - Finally calculate the IRIS features

- **Classification:**
  - Extract the features such as face detection, sclera detection, iris detection

5. TESTING:

- **SYSTEM TESTING**

System testing, also referred to as system-level tests or system-integration testing, is the process in which a quality assurance (QA) team evaluates how the various components of an application interact together in the full, integrated system or application.

System testing verifies that an application performs tasks as designed. This step, a kind of black box testing, focuses on the functionality of an application. System testing, for example, might check that every kind of user input produces the intended output across the application[1][2].

- **VALIDATION TESTING:**

Validation is the process of evaluating the final product to check whether the software meets the customer expectations and requirements. It is a dynamic mechanism of validating and testing the actual product.

Validation is determining if the system complies with the requirements and performs functions for which it is intended and meets the organization's goals and user needs. Validation helps in building the right product as per the customer's requirement and helps in satisfying their needs.[2][3]

6. RESULTS & DISCUSSION:

Iris based authentication system results are shown in the following figures

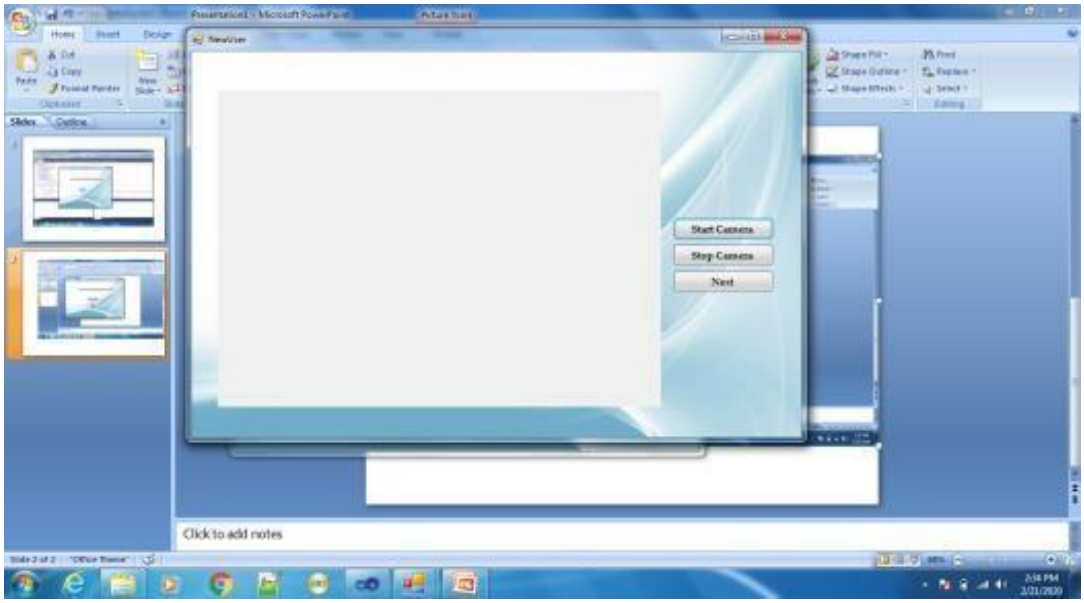

Fig2-Face Eye Iris based Authentication System-Home page

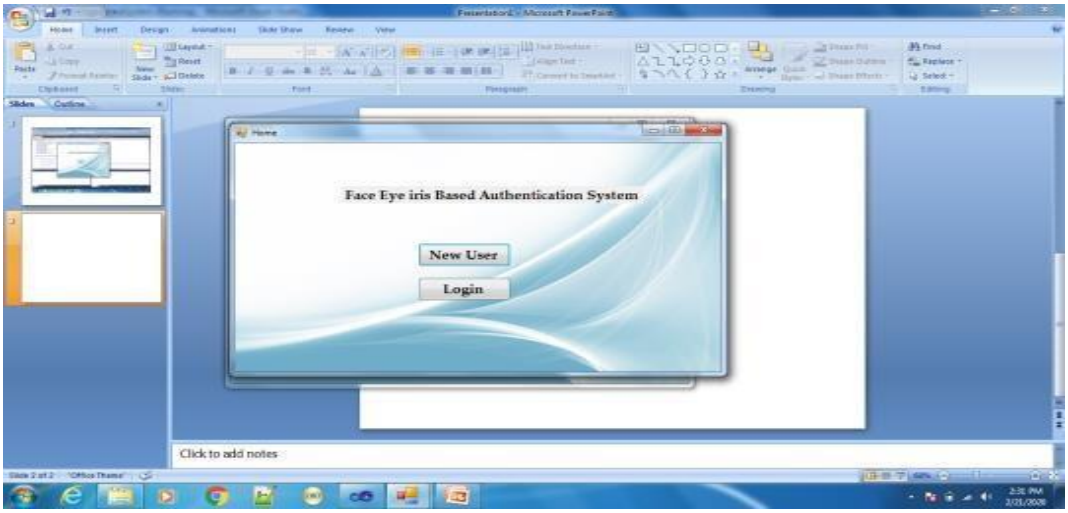

Fig3-Face Eye Iris based Authentication System-Login page

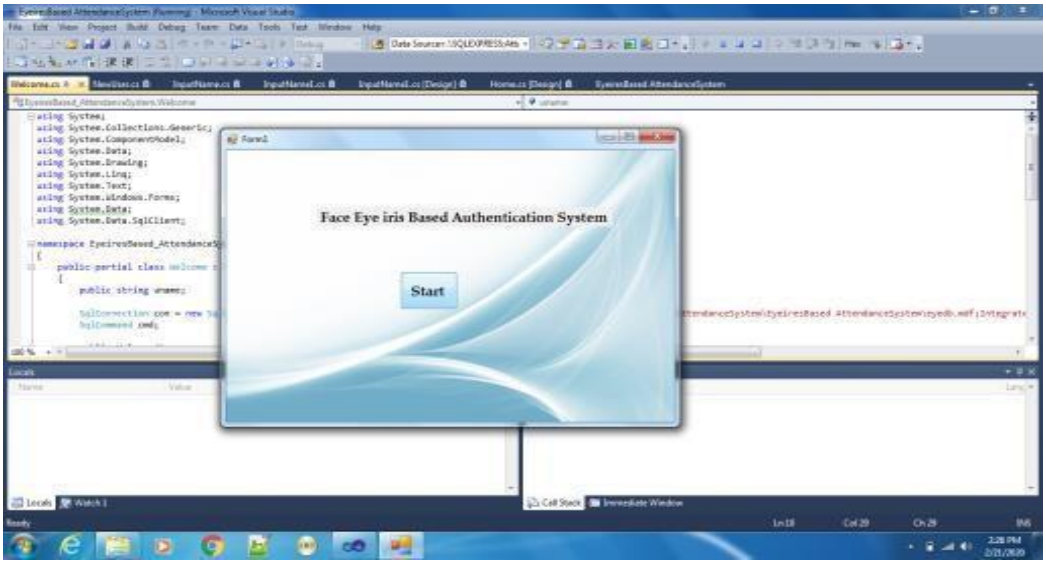

Fig3-Face Eye Iris based Authentication System

7. CONCLUSION:

This paper surveyed major mechanical point of view and esteem of the key advancement in unimodal and multimodal biometrics. We examined about general design of biometric framework and in detail biometric combination strategies. We portrayed late work in biometrics utilizing Face,Finger, and ECG. It is additionally seen that execution of multimodal biometrics conquer constraints unimodal biometrics frameworks. There are various multimodal biometric arrangements in being for confirmation of an individual anyway accumulation of appropriate modals, inclination in ideal combination level and excess in the caught highlights are few challenges in designing multimodal biometric solution that needs to be solved.

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