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Smart Services in Academic Libraries thorough integration with Face Recognition Technology

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Abstract: *Over the years Libraries have been adapting to every situation that they are faced with and moving forward to consolidate their existence and to provide better service to their users, to achieve this, they have been adopting modern technology to secure their collection as well as deliver speedy services. Libraries have moved on from manual issue systems to barcoded records and user identity cards, to RFID tags, to biometric identification for users. Face recognition technology is the new in, this paper discusses the areas of a library that can benefit from implementing Face Recognition Technology and suggests the benefits and drawbacks of this technology.*

Key Words: *Face Recognition Technology, Biometric, Smart Libraries, Library Automation.*

1. INTRODUCTION:

Academic libraries form an integral part of education and are responsible for imparting knowledge to the youth of the country, thus ensuring good citizens who are responsible for the development of the nation. Libraries have a long and well-known history of preserving the materials in their possession, starting with closed access to the use of the latest technology to preserve its resources and make them available to its users through modern means of data access and data transfer. Libraries have been using technology to collect, maintain, process user data. Biometric technology namely finger scanning system has been approved in many sectors to mark attendance, so also is the case in many educational institutes and this data was used for identifying library users. The recent wave of covid-19 infections has resulted in a hold being placed on finger biometrics due to the fear of the spread of infection as everyone is required to place their fingers on the detection system. Face recognition technology does not require close contact with an individual and can prove useful in authenticating his identity. Also mistaken identity due to loss of identity cards can be overcome using this technology

2. LITERATURE REVIEW:

Lin, S. (2002) (1) in his paper "Introduction to Face Recognition Technology" states that Face recognition is the most non-intrusive, user-friendly approach, and explains the factors that affect face recognition as well as several face recognition algorithms and their inability to identify identical twins. D. Voth (2003) (2) discusses Face Recognition Vendor Test (FRVT) which has enabled face recognition that can mimic the human ability to recognize faces and systems that can distinguish between identical twins. Petland & Choudhary (Feb 2000) (3) discusses current technologies, face recognition technology, and its possible applications. They also discuss behaviour monitoring based on facial expressions. Rabia & Arabnia (2009) (4) in "A survey of Face Recognition Techniques" discusses the various methods of image analysis used for Face recognition along with their advantages and disadvantages, a list of application areas that use this technology is also provided. Bagal & Saindane (2019) (5) in "Librany- a face recognition and QR code Technology-based Smart Library system" discusses a system that uses face recognition and QR codes to automate the book issue – return system thus expediting the issue-return process. There is much literature available that explains the various aspects of face recognition technology, along with their advantages and disadvantages, based on the literature available this paper attempts to integrate various services in an academic library with face recognition technology.

WHY FACE RECOGNITION?

Biometrics is the science of measuring physiological or behavioural characteristics that verify a persons' identity. This is possible if each person has distinct characteristics that are invariant over a period and can be measured

quantitatively. Physiological biometrics are based on measurements and data that are based on direct measurement and varication of a part of the human body.
The various biometric solutions that are presently available are

- Facial Recognition – Here the images of the overall facial structure, shape, and proportion of the user's face are measured, along with the facial expressions. These are then stored in the database to create the identity of the individual
- Finger-print Recognition –Images of the ridges and valleys on the finger surface are captured and stored in the database.
- Voice Recognition – The voice tract and the accent of each voice are unique and this aspect is used in voice recognition technology.
- Iris Recognition – The colour of the eyes is determined by the genetic makeup of each individual, and the pattern of the iris varies from person to person, and can be used to identify individuals.
- Retina Recognition – Retina recognition is 70 times more accurate than iris recognition as for iris recognition the scan is done from a distance whereas for retina recognition the scans are done when the person's eyes are near the eyepiece.
- Veins Recognition – This technology makes use of recognition of the pattern of the veins in the human hand, this can be done by passing the hand through Infra-red light and recording the pattern of the veins.
- Hand Geometry – The shape of the hand, dimensions of the fingers can be used for identification purposes as they vary from individual to individual.
- Signature / Handwriting Recognition – This technology is used in the daily transaction such as banks, here the shape (dips – groves and peaks) of the handwriting is used for recognition purposes.
- DNA Recognition – Each person's DNA contains some characteristics inherited from their parents. The amount of Variable Number Tandem Repeat (VNTR) that repeats at several distinct loci is determined by DNA profiling. An individual's DNA profile is made up of the amount of VNTR. The collection of the DNA profile is a time-consuming and complex process that necessitates a physical sample such as blood, saliva, hair, and so on. This type of recognition system is not usually preferred because it necessitates highly sophisticated and expensive equipment.

Biometric devices using fingerprint recognition are small, affordable, and easy to operate, further, they can be integrated with various software for optimum usage and hence are preferred. However, since every person must touch the surface of the biometric machine to establish their identity the chances of spreading communicable infections increase, hence alternative methods of identification are required. Face Recognition Technology has the benefits

- Does not require physical contact for identification
- Highly accurate.
- Can be integrated easily with the existing hardware
- No Swiping of cards, remembering passwords, pin details is required.
- Camera and image capture devices can be used
- Results can be easily compared and matched.
- Details cannot be shared or distributed
- Only biometric that allows identification in one too many environments.

3. THE PROCESS INVOLVED IN THE IMPLEMENTATION OF FACE RECOGNITION TECHNOLOGY:

Biometric systems namely fingerprint technology has been used in educational institutes to monitor student and staff attendance, this data was integrated with library systems to provide statistics, user identification, and circulation propose. The switch over to Face recognition Technology would involve two types of comparisons.

- Verification – here the system compares the individual to who they are
- Identification – here the system matches the individual with the list in the database and provides a list of matches

The procedure of integration of Face Recognitions involved the following processes

- Enrollment – Users were allotted a schedule during which their details were registered as follows
  - Name of the User
  - The Facial expressions are captured and stored in the database with an unique user-id

- The facial expressions are checked automatically multiple times for quality. Hazy and unrecognizable scans are rejected.
- The information gathered is saved in a centralized database.

- Verification

  The captured data is verified to ensure recognition. The match or no-match is indicated by the system in less than a second, in case of a mismatch the old data is selected and deleted from the system and a new entry is made using the same user-id.

  Verification ensures that the data stored is comparable and can be easily recalled.

- Identification

  When the person approaches the system, the face is scanned, and the system searches the entire database for a match of the enrolled users.

- Authorization

  The system permits various levels of authorization; hence schedules can be set for allowing access to individuals based on sections permitted to visit, time, number of days, etc.

This captured data can now be integrated with various systems (computers, servers, etc.) using middleware and software. The middleware helps the scanner (camera's) database to run effectively across the networks. The middleware and the software used by the Face Recognition System form an integral part and are responsible for its efficiency and effectiveness, it binds the scanning devices with the computers or servers of the library.

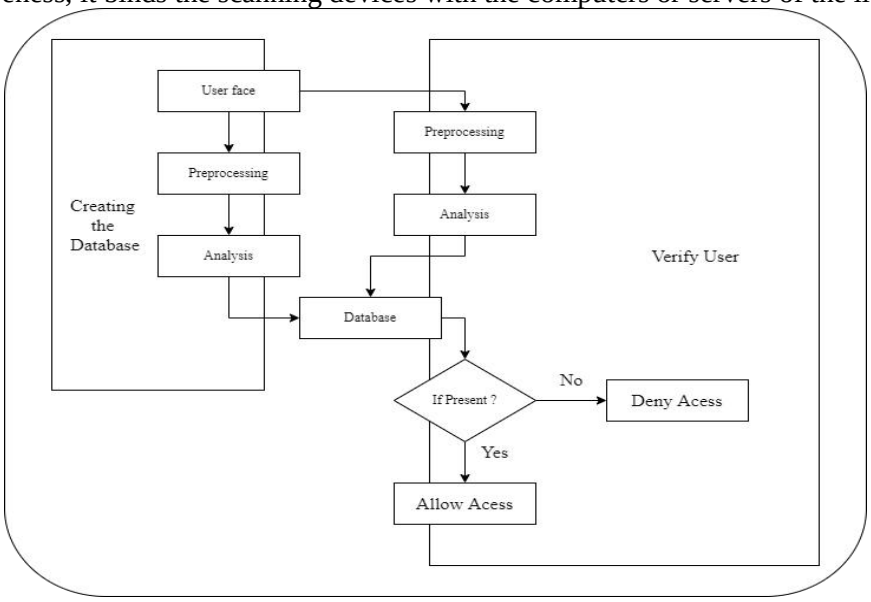

Fig 1. Flowchart of face recognition user authentication.

4. APPLICATION OF FACE RECOGNITION TECHNOLOGY IN ACADEMIC LIBRARIES:

Access to library premises – The Face Recognition system is mounted on the wall near the library door; the reader scans the face and compares it to the pre-recorded data; only authorised individuals are allowed to enter the premises. This ensures the premises' security as well as safety.

Fig 2. Implementation of face recognition device.

Controlled access to library networks – Most of the libraries work in a digital environment, users access e-resources using usernames and passwords, There can be security lapses due to hacking, sharing of passwords, loss of passwords, etc. These problems can be overcome by integrating Face Recognition in the library network to ensure that the e-resources are available to authorized users.

Controlled check-outs - The drawbacks associated with issuing Library Cards / Reader's tickets, misuse due to exchange of Library Cards / Reader's tickets, loss of cards is prevented. Integration of the Facial data with the library software enables only registered users to check-out library materials.

Generation of statistics – Statistics such as the number of footfalls, details of members accessing a service at a time can be easily generated.

5. CONCLUSION:

Biometric technologies are developing rapidly, so also the cost gets reduced with each new technological development, Face recognition technology provides a fast method of authentication and can be easily integrated with the library's software, Academic libraries can benefit through this technology to ensure security, easy and faster service to the users. However, one needs to consider the availability of a service provider for the integration of the software.

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