

## Desktop Biometric: The Easy way for Biometric Authentication

**Ravinder Kumar<sup>1\*</sup>, Ramneek Kalra<sup>2</sup>**

<sup>1</sup>\*Department of CSE, HMR Institute of Technology and Management (Affiliated with GGSIPU), Delhi, INDIA

<sup>2</sup>Department of CSE, HMR Institute of Technology and Management (Affiliated with GGSIPU), Delhi, INDIA

*\*Corresponding Author: ravinder\_y@yahoo.com, Tel.: 011 – 27724115*

Available online at: [www.jcseonline.org](http://www.jcseonline.org)

Received: 20/Nov/2017, Revised: 29/Nov/2017, Accepted: 22/Dec/2017, Published: 31/Dec/2017

**Abstract**— Biometric is widely used as proper authentication of a person in an organization, Institute and at much more places. This is considered as original identification of one by offering different biometric techniques which includes Hand Biometric, Fingerprint Biometric, Face Biometric, Signature Biometric, Ear Recognition and many more. Considerably, every technique of biometric includes one or other negative outcome that enables one to use more technique to develop pure authentication of person. This paper reflects the use of personal fingerprint scanning biometric that gives proper giveaway of features of person's identification. The proposed research presents the content in very detailed way from introduction to biometric with specifically concentrated to fingerprint biometric and then integrating that real-time data with JAVA based software testing and developing innovative college student attendance system. The benefits of using proposed software give a new way to allot ids to professors and students with automation of sending attendance with customized options for need.

**Keywords**— Biometric, Real time Attendance, Fingerprint Matching, Person identification, Arduino UNO.

### I. INTRODUCTION TO BIOMETRIC

The important part of biometric is that knowing what exactly biometric stands for and how it makes one's work easy. Biometric helps to distinguish person's identification uniquely from others, which helps to gain important features like marking attendance, Establishing UI for storing, managing datasets etc. Biometric is an important factor that helps to take over many applications which can be used by biometric channel and helps to establish distinguished data. Biometric is thus defined as the process of identification based upon one different characteristic [1]. More Clearly, Biometrics is the field of Science that helps to identify from physical or behavioural characteristics. Some of these characteristics include fingerprints, face, ear, iris, hand geometry [2].

### II. BIOMETRIC TECHNIQUES

There are many biometric techniques that come under consideration which includes Face Recognition, Fingerprints, Signature Recognition, Handwriting Recognition, Ear Recognition, Iris Recognition, Retina Recognition, Keystroke Recognition, Voice Recognition, Gait Recognition and much more with coming scenarios. These different types of biometric techniques can be taken over as below:

#### A. Face Recognition

Face Recognition is far better than having scanners below your finger or having cameras attached all around. This type of recognition includes recognition and extracting features of emotions, expressions, color and other features of face.

This type of biometric technique can be used in marking attendance of students, marking security needs on an airport, railway station and the place where identification of person is needed. This type of recognition nowadays are much popular in software part or as part of operating systems like Windows 10 includes Windows Hello Settings that sign-in user with recognition of his/her face.

#### B. Fingerprint Recognition

This includes recognition of features of Fingerprint like Ridges, cuts and many features that a fingerprint includes. Fingerprint Recognition includes acceptance of test sample on the basis of either minutiae or bifurcation of fingerprints as explained in [3].

Fingerprint recognition can include many techniques that validates sample like getting data returned by Fingerprint Sensor which is used by many existing models which can be seen in [4]. They explain pattern analysis with each pixel included in text-based, class-based, ridge density-based and minutiae-based levels. This basis of different methods, make

a pyramid in the class of Fingerprint Recognition [4], [5], [6], [7].

#### *C. Signature Recognition*

Signature recognition comes under behavioural biometric technique which can be used for long time irrespective any features of fingerprint, face or any other part of body that uniquely identifies. This recognition is commonly popular in governmental papers.

If we take a scenario of Banking System, then that banking services always includes signing of oneself over one or other document that validates the person for identification. Thereby, Signature Recognition includes every recognition of cuts, lines, curves of a signature. Also, the pen pressure, number of pen up and downs inclination and how one signs effectively for checking.

#### *D. Handwriting Recognition*

Handwriting Recognition is the key biometric technique that is a part of much research work like the one [8] which helps to tackle online attacks over this type of biometric recognition and evaluates FRR (False Reject Rate) and FAR (False Acceptance Rate). This type includes extraction features like curves made etc. In this one can check one's uniqueness by comparing with thousands of datasets as done in [9].

#### *E. Ear Recognition*

The most common feature that all humans have is Ear. Ear can be one of the most important identification part of body that comes to check uniqueness of oneself. Although this is a new biometric technique but gained usage under many applications like explained in [10] which took use of Three-Dimensional recognition of shape and presence of hair in front of ear. The dimensions of taking image sample under grayscale of ears enable to tackle all unexpected samples, one having hair covered over ear and one with motion when taking image.

#### *F. Iris Recognition*

Iris Recognition is one of the most important and uniquely distinguishes biometric technique that helps to take pattern analysis inside of eye. This is commonly used in aadhar database of Indian nation. Iris stands for difference between blood pattern and as took place in [11] which tells one with proper statistics under every situation while taking sample. This includes probability of not having two individuals with same iris.

#### *G. Voice Recognition*

The new and emerging technology is Voice Recognition that tunes the checking of uniqueness on the basis of tone, pitch and change in voice. This is widely nowadays used by many software technologies like unlocking phone by just saying "OK Google, Unlock my Phone" and similarly taken by other platforms like Apple Phone, Windows Phone and by much secure systems [12].

This type of recognition includes use of much real-time valued data and deep learning concepts with comparison with stored datasets and evaluating uniqueness of ones.

The proposed solution by [13] stands uniquely from others as they done this type of biometric techniques using Deep Neural Networks under Acoustic modelling.

### **III. PROPOSED BIOMETRIC TECHNIQUE**

This paper includes use of Fingerprint Recognition and evaluation of uniqueness through use of microcontroller commonly called as Arduino with the integration of fingerprint sensor R305 and transmitting dataset with Desktop Software at admin panel.

The most common algorithm for matching the fingerprint samples with the one stored in sensor comes with mode of 1:1 and 1:N and gives False Acceptance Rate (FAR)  $< 0.001\%$  and False Rejection Rate (FRR)  $< 0.1\%$  which gives at conclusion the security level to be high enough scoring 5 out of 5. Plus, this module helps to give average search time  $< 0.8$  sec.

Thereby, deploying finger samples on fingerprint sensor R305 gives results with the use Ratio of Relational Distance Matching as took explanation in [14]. This uses study of three common algorithms which includes- Direct Matching, Minutiae based Matching and Ratio of Relational Distance Matching which is in the scope of this paper. This proposed paper gives a way to use biometric as means of marking attendance of students at Institute/College/Educational Organization straight away at the entrance gate of classes.

This gives Head of Department of that stream to evaluate and analyze the presence and absence rate of students with user-friendly software made by use of JAVA Swing with online web-based database management system.

#### *A. Hardware End of Proposed Biometric Technique*

This paper as mentioned above proposed use of fingerprint biometric technique from the use of Fingerprint Sensor R305 with Arduino Microcontroller with use of Wi-Fi Module ESP8266. This section of paper includes the brief description

of Hardware End of proposed solution for marking attendance [14].

Thereby, Hardware End includes following common parts:

### 1) Arduino UNO

The most important controller of proposed scope is the Arduino UNO that is an open source microcontroller (UNO Board) for building up new projects, digital devices and much more depends upon developer that develops new innovative way to solve a problem. The common Arduino UNO board can be depicted as in Figure 1.



Figure 1. Common Depiction of Arduino UNO Board

As seen in Figure 1, one can observe different common parts like analog pins, Digital pins, USB Connector, Power Connector and much more which can be seen. The six analog pins at down-bottom of image is used for inputting and outputting analog data from another integrated module with it. These analog pins are responsible for connection to other devices and to develop more circuits. Moving to Digital Pins, these pins are responsible for digital data in-out transmission that is, 1s and 0s data exchange. This can be used for LEDs, Motors, Bluetooth Modules and much more modules. One can see the first two pins in the section of Digital Pins that is, Rx and Tx which is commonly used for Receiving and transmitting the data from other devices connected. These are the most important two pins those are used by Bluetooth Module, Wi-Fi Module, Fingerprint Module [15].

### 2) Fingerprint Sensor R305:

Another important component used in this hardware end is use of Fingerprint Sensor R305 which is Digital Signal Processing chip established under this module. This sensor works like follows [14]:

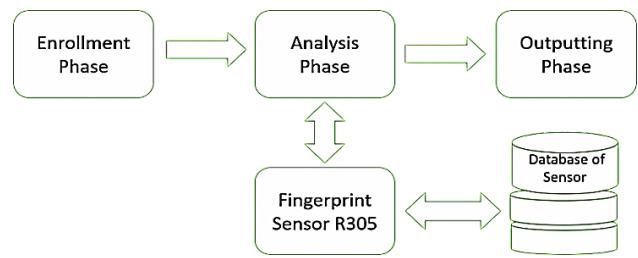


Figure 2. Data Flow Diagram of Fingerprint Sensor R305

*Enrolment Phase:* This phase of working of Fingerprint Sensor helps to get input from user on the sensor that gives a sample input for further steps.

*Analysis Phase:* This phase helps to analyze the fingerprint sample inputted by user in enrolment phase and just that sample is bi-directionally passed to sensor as shown.

*Fingerprint Sensor R305:* The sensor after getting sample from initial stage of Analysis Phase renders the image, makes some calculations on the basis of Ratio of Relational Distance Algorithm and then finds the features of that supplied sample with the database of sensor. Also, the fingerprint sensor has the memory for storing upto 1000 fingerprints and with successful false acceptance rate less than 0.001% which stands all other models of optical sensor used by other products of biometric away. This takes all models as in terms of low cost, high efficiency [16].

*Outputting Phase:* After successful comparison of features of sample with database of fingerprints stored in its memory, gives away the output in the form of percentage of matching if found to user at serial monitor.

### 3) Wi-fi Module:

Another integrated module used in this hardware end comes out to be Wi-Fi Module commercially known as Wi-Fi Module ESP8266, which is the bridge to connect online database over connected system (more precisely, Desktop Software) [17], [18]. This module is low-power, highly-integrated Wi-Fi solution with compatibility of temperature ranging from -40°C to 125°C. This module will help in greater extent of transmitting data to and from Attendance Software. The sample depiction of Wi-Fi Module ESP8266 can be seen from Figure 3.

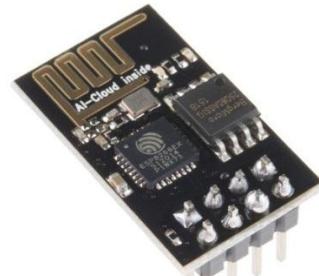


Figure 3. Depiction of Wi-Fi ESP8266 Module

#### 4) Software End of Proposed Biometric Technique

Coming to software end, this paper till now has briefly described the common used hardware part to establish an attendance biometric product. This section of Paper includes the description of software end including used algorithm for analyzing uniqueness of supplied input sample.

Firstly, the algorithm used for fingerprint matching and Feature Extraction is “ratio of relational distance matching” which is taken under consideration of research work [18] which explains this algorithm as the means of distance between minutiae of two fingerprint images as taken if N1 and N2 minutiae points and then, the output of percentage of matching is counted from M which is another variable equal to intersection of N1 and N2 ( $M = N1 \cap N2$ ) whose magnitude decides the acceptance of fingerprint sample to system. Now, taking over proposed Attendance Desktop Software, this software is developed under the use of JAVA Swing and connected Database “Microsoft Azure” for which MySQL service is under used. This software is usable by Head of Department of particular stream as like Computer Science Engineering, Electrical and Electronics Engineering, Civil Engineering, Mechanical Engineering, MBA etc. depending over college database. Since, before in sections, mentioned that this paper is under used by college purpose or Institute purpose to mark attendance of students with different functions what other costly services offer like one stated Realtime Attendance System that offers much features ranging from  $\square 10000$  -  $\square 40000$ , which gives one to spend much cost over the whole machine. But, this paper is under that consideration that offers same services but with more efficiency and low cost with proper fabrication of product.

The Software desktop application can be taken in consideration as follows:

*Welcome Page:* The welcome frame of software gives user-friendly touch to user (HOD or Admin) and gives away a “Let’s Get Started” Button to move further in software as shown in Figure 4.



Figure 4. Welcome Frame

*Login Page:* Next, when user clicks over logo “Checktime Attendance System” or to button, one moves further to what is called “Login Page/Frame”. This offers one to login to dashboard which offers various functional Radio Buttons like Student Adder Master, Data Transfer, Data Processing, View Reports, Send Mail, and Exit as depicted by Figure 5.

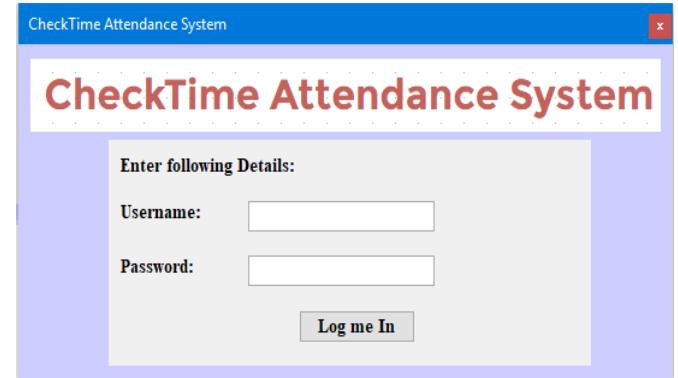


Figure 5. Login Page of CheckTime Attendance System

*Dashboard Page:* The important and foremost frame of whole software end is Dashboard which includes Radio Buttons as Student Adder Master, Data Transfer, Data Processing, View Reports, and Exit. The whole description of each function is taken in brief as follows:

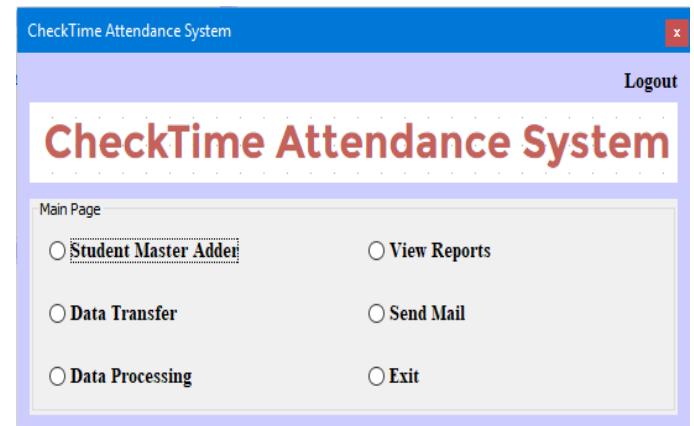


Figure 6. Dashboard of CheckTime Attendance System

*Student Adder Master:* This Radio Button gives user to add new student record after finishing one session or one year. This also offers to update the record if any existing data is to be updated like year of a student when students shifts from one year to other. The records that are to be supplied to connected MySQL Database Management System is somewhat like Fingerprint Sample (from connected Fingerprint Sensor R305), Enrolment Number, Student’s Name, Father’s Name, Gender Specification, Mobile Number, Class, Semester and Year like shown in Figure 7.

Figure 7. Student Adder Master Frame of CheckTime Attendance System

**Data Transfer:** Next, coming to Data Transfer Radio Button which supplies Proctor or Class Teacher of that particular class to pass on the database of class with proper formatting report which is automatically done by software itself in coming View Reports Frame with respect to Time Table of that class. This frame of transferring helps to give required documents of attendance to Head of Department with no hectic of marking attendance or calculating it and manipulating short attendance or required details by head. So, overall it simplifies 80% of work of proctor regarding attendance maintaining. The Frame too offers connected Mail Service with the use of SMTP protocol in programming used. Also, attaching database file in the format of .sql, .xls or any attendance document format to be mailed with mail sending service to Head.

Figure 8. Data Transfer Frame of CheckTime Attendance System

**Data Processing Frame:** This frame of data processing offers real-time attendance from network-connected hardware end of proposed biometric machine which is established in each and every entrance gate of class. The student when enters the class the machine verifies supplied fingerprint of student with the database and supplies results over LCD Connected with machine. The positive verification outcome is supplied to Data Processing frame which marks attendance of that particular student according to time and subject by referring to stored Time Table of that class.

**View Reports:** This part of software end gives user to see and analyze the number of subjects he/she having in particular stored time table of his/her class as shown in Figure 9.

Figure 9. View Reports Frame of CheckTime Attendance System

**Send Mail:** This last frame of software helps user to supply any feedback/issue/complaint/suggestion to developer's mail box. This too uses Email-Service using SMTP Protocol as shown below in Figure 10.

Figure 10. Send Email Frame of Check Time Attendance System

#### B. Advantages of Proposed Biometric Technique

There are many advantages that one can observe after using the proposed solution to Attendance Biometric Technique. This can be counted as follow list:

This technique is platform-independent and can be used over any operating system platform either it is Windows, Linux or Macintosh. This also helps to migrate and transfer the software as well as machine to any other college or institution.

The machine is efficiently differing from other biometric component since it offers False Acceptance Rate as less than 0.001% which is a successful point in using this machine.

The software end offers various features for a college purpose for eliminating the use of huge register work and not to maintain any paper-work and promotes use of Digital Data

Storage Scheme which too reflects promotion to our Respected Prime Minister Sir's Vision of Digital India.

The whole system is very low in cost as compared to other models of attendance system with estimated cost of  $\square$  3000 and which count to be more of other models.

### C. Disadvantages of Proposed Biometric Technique

Turing up the coin, the proposed system has also some disadvantages which can be seen as followed list:

There is dependency of JAVA which is compulsorily to be installed to the user's system over which one wants to install it.

There should be active Internet Connection all the time with college' time schedule since the verification of fingerprint sample is done with connected online Database System to main Database Isolation and Integration.

## IV. CONCLUSIONS

Overall, this paper gives overview of use of biometric in the terms of marking attendance with connected machine made up over microcontroller. Also, the rapid use of biometric gives one to deploy that over many applications to establish reliable and secure method of validation and authentication.

Thereby, the whole biometric class is being used globally as fact of security needs and establishes common system which can identify the uniqueness between humans.

## REFERENCES

- [1] R. Kumar, "Hand Image Biometric Based Personal Authentication System", Intelligent Techniques in Signal Processing for Multimedia Security, Springer International Publishing, pp. 201-226. 2017.
- [2] V. E. Sharapova, O. Ivanova, G. Denis and S. Yuliia, "Web-based application to collect and analyze users data for keystroke biometric authentication," 2017 IEEE First Ukraine Conference on Electrical and Computer Engineering (UKRCON), Kyiv, Ukraine, pp. 917-922, 2017
- [3] A. Ross, A. K. Jain, "Multimodal biometrics: An overview" Signal Processing Conference, 2004 12th European. IEEE, 2004.
- [4] R Kumar, "Fingerprint matching using rotational invariant orientation local binary pattern descriptor and machine learning techniques", International Journal of Computer Vision and Image Processing (IJCVIP), Vol. 7, No. 4, pp. 51-67, 2017.
- [5] R. Kumar, P. Chandra, M. Hamandlu, "A Robust Fingerprint Matching System Using Orientation Features", Journal of information processing systems, Vol. 12, No. 1, pp. 83-99, 2016.
- [6] N. K. Ratha, K. Karu, S. Chen, and A. K. Jain. "A real-time matching system for large fingerprint databases" Vol. 18, no. 8, 799-813, 1996.
- [7] Barman, Subhas, et al. "An efficient fingerprint matching approach based on minutiae to minutiae distance using indexing with effectively lower time complexity." Information Technology (ICIT), 2014 International Conference on. IEEE, 2014.
- [8] D. P. Lopresti, D. R. Jarret "The effectiveness of generative attacks on an online handwriting biometric." In AVBPA, pp. 1090-1099, 2005.

- [9] K. Karl, C. Vielhauer, T. Scheidat, D. Franke, and J. Dittmann, "Handwriting Biometric Hash Attack: A Genetic Algorithm with User Interaction for Raw Data Reconstruction" In Communications and Multimedia Security, pp. 178-190, 2010.
- [10] P. Yan, K. W. Bowyer, "Biometric recognition using 3D ear shape." IEEE Transactions on pattern analysis and machine intelligence, Vol. 29, No. 8, pp. 1297-1308, 2007.
- [11] J. Zuo, N. K. Ratha, J. H. Connell, "Cancelable iris biometric", In Pattern Recognition, 2008. ICPR 2008. 19th International Conference on, pp. 1-4, IEEE, 2008.
- [12] H. Geoffrey, L. Deng, D. Yu, G. E. Dahl, A. Mohamed, N. Jaitly, A. Senior", Deep neural networks for acoustic modeling in speech recognition: The shared views of four research groups." IEEE Signal Processing Magazine, Vol. 29, No. 6, pp. 82-97, 2012.
- [13] R. K. Das, , S. Jelil, S. R. M. Prasanna, "Development of multi-level speech based person authentication system", Journal of Signal Processing Systems, Vol. 88, No. 3, pp. 259-271, 2017.
- [14] D. A. Kumar, T. U. Begum, "A Comparative Study on Fingerprint Matching Algorithms for EVM", Journal of Computer Sciences and Applications, Vol. 1, Issue 4, pp. 55-60. 2013.
- [15] V. D. Bergh, B. T. Vermeulen, S. Pollin, "Analysis of Harmful Interference to and from Aerial IEEE 802.11 Systems", Proceedings of the First Workshop on Micro Aerial Vehicle Networks, Systems, and Applications for Civilian Use, ACM, pp. 15-19, 2015.
- [16] H. H.Teng, S. C. Jo, "Compact optical fingerprint capturing and recognition system", U.S. Patent No. 6,870,946. 22 Mar. 2005.
- [17] Y. A. Badamasi, "The working principle of an Arduino." Electronics, Computer and Computation (ICECCO), 2014 11th International Conference on. IEEE, 2014.
- [18] A. Ijari, "An Approach of Automated class Attendance using face recognition-Based on haar cascade classifier feature." Imperial Journal of Interdisciplinary Research Vo. 3, No.5, 2017.

## Authors Profile

Dr. Ravinder Kumar received Ph. D. in IT from GGSIP University, Delhi in 2013 and M. Tech. degree in Computer Science & Engineering in 1998 from GJ University of Science and Technology, Hisar, India. Since 1999, he has been with the University School of ICT, GGSIP University, Delhi. Currently, he is Professor and Head, Department of CSE with HMR Institute of Technology and Management Delhi, India. His research interest is in the image processing and biometrics. He has 18 years of teaching experience and 8 years of Research Experience.



Ramneek Kalra, B.Tech in Computer Science Engineering, HMR Institute of Technology and Management, New Delhi. Software Development as Major Field.

