Multi-Biometric System for Newborn Recognition

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Abstract – Infant abduction, swapping, missing, illegal adoptions and kidnapping are increasing issues in the hospitals, birthing centers, health centers and in other places where multiple births occur simultaneously. The use of biometrics as a tool for authentication for adults has come into existence in all the application areas. Hence, a newborn personal authentication system is proposed for this issue based on multi biometrics. The finger print of mother matches with the Id of baby. An appropriate fusion scheme is implemented to overcome the drawbacks of a single modality.

Index Terms – Biometrics, Fusion, Match score-level, Multibiometrics, Newborn.

1. INTRODUCTION

A biometric system is essentially a pattern-recognition system that recognizes a person based on a feature vector derived from a specific biological characteristic that the people possess. Biometrics is a good and feasible choice to deal with this task considering several factors, i.e., easy usage, fast processing, and low cost, good accuracy, etc. Physiological biometric identifiers include fingerprints, hand geometry, ear patterns, eye patterns (iris and retina), facial features, and other physical characteristics.

Behavioral identifiers include voice, signature, key stroke, and others. Recently, apart from the conventional hard biometrics, a new class of soft biometrics is also emerging. These include height, weight, gender of the person, color of the clothes, hair color, etc. By using biometrics it is possible to establish an identity based on `who you are'. Depending on the application, a biometric system typically operates in one of two modes: verification or identification [1]. There is no doubt that biometric is one of the most important and effective solutions for this task.

The key to successful multi-biometric system is in an effective fusion scheme, which is necessary to combine the information presented by multiple biometric sources. The amount of the information available for fusion decreases after each level of processing in a biometric system. The raw data represents the richest set of information, while final decision contains just an abstract level of information. The system requires an integration scheme to fuse the information obtained from the individual modalities.

2. RELATED WORK

2.1 Newborn Biometric:

"On an average, over 40,000 children in India are reported missing every year, of which approximately 11,000 remain untraced. Where do they go?" (Haq: Report on Child Rights, New Delhi 2005).If such is a situation for the kids, it is even worse in the case of newborns' as reported in [2-7]. Prevention against baby swapping (intentionally / mistakenly) in some of the maternity hospitals, illegal adoption, baby girls killing, child abduction, multiple births in hospitals, birthing centers demand a tightly secure system. Hence, an effective biometric system can be implemented to overcome the various problems. Biometric authentication is the process where we want to identify or verify the infants to decide the further actions to be taken in case of any identity crisis.

The finger print of mother matches with the Id of baby. We manually store the babies from key Id in the database through keypad. We can enter the baby Id with it. The Id of baby is individual, it will not repeat again. Thus we matched both baby Id and mothers finger print then LCD will display three messages, first will be enter the baby's Id then second will be to place mothers finger print then if baby's Id and mothers finger print is matched then LCD will display a message "MATCHED" otherswise it will show a message like "NOT MATCHED" and the buzzer will get on.

2.2 Fingerprint database:

Fig.1 Fingerprint reader

The fingerprint of the newborn mother is also collected by means of a fingerprint scanner. The fingerprint scanner used is digital Persona U.are.U 4500 Reader, USB fingerprint reader as shown in figure 1. The images were captured simultaneously from the infant and the mother.

The sample fingerprint images collected are shown in figure 2.

Fig.2 Fingerprint Database

3. PORPOSED MODELLING

Now we adopt a more rigorous approach which involves the multi-biometric system to be exploited fully to render a decision over the newborn identity claim. An effective fusion scheme is implemented to fuse the information available from the multi-biometric sources and optimally give the final decision. The circuit diagram of the proposed system is shown in figure 3.

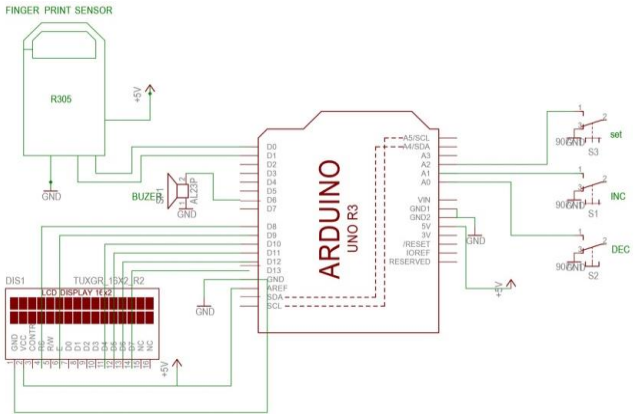

Fig.3 Circuit diagram of Multi-Biometric System for New Born Recognition

Finger print is taken with the help of fingerprint scanner and footprint of a newborn is scan with the help of laptop footprint scanner. The database of mother's fingerprint is given to the minutiae Extraction. The footprint of baby is taken with the help of baby footprint sensor. The database is given to the wrinkles extraction then matching process is done in between footprint of newborn baby and fingerprint of mother. The output of matching level is given to score level fusion. In the score level fusion the individual matching scores are combined to generate a single scalar score which is then use to make the final decision. It is given to the raspberry pi. The database matches then we can identify whose child is this. Message is given through the internet to the client mobile. Now we adopt a more rigorous approach which involves the multi-biometric system to be exploited fully to render a decision over the newborn identity claim. An effective fusion scheme is implemented to fuse the information available from the multi-biometric sources and optimally give the final decision.

3.1 Fingerprint recognition:

A fingerprint is the pattern of ridges and furrows (valley) on the surface of a fingertip. Ridges are the lines on the tip of one's finger. The unique pattern of lines can either be loop, whorl, or arch pattern. Valleys are the spaces or gaps that are on either side of a ridge. The most important features in fingerprints are called the minutiae, which are usually defined as the ridge endings and the ridge bifurcations [12]. A ridge ending is the point, where a ridge ends abruptly. A ridge bifurcation is the point, where a ridge forks into a branch ridge as shown in figure 4.

Fig.4 a Ridge ending b. Ridge bifurcation

The captured fingerprints must be pre-processed to segment the unwanted regions [7]. The estimation of the ridges is followed by an effective minutiae extracting algorithm that involves ridge map, thinning and post processing using morphological functions. Now, the minutiae are represented in a format that stores the x, y co-ordinates along with the orientation angle information [7]. An alignment based elastic string pattern matching is used and a similarity measure is the performance metric used.

4. RESULTS AND DISCUSSIONS

A newborn fingerprint database is established. In total, the database contains 240 images from 40 newborns' captured at the Primary Health Center, Medavakkam-Chennai, India. Six images were collected from the right foot of each newborn. In accordance with that a fingerprint database is also established from the corresponding 40 mothers of the newborn using an USB fingerprint reader. Six impressions of thumb were collected from every one of them. Totally, the database consists of 480 images (240+240). One image is selected for training for both the modalities and the rest of the images were for testing. Hence, there are 40 training images each for both footprint and fingerprint. Similarly, there are 200 images each for both footprint and fingerprint. The experiments were conducted on a personal computer with an Intel Pentium

B960 processor (2.20 GHz) and 4.0G RAM configured with Microsoft XP and LabVIEW 11.0 software. The system is graphical-user-interface based and menu driven. The necessary image preprocessing can be easily done by selecting the image directory. The time taken to give a decision over the claim is few seconds.

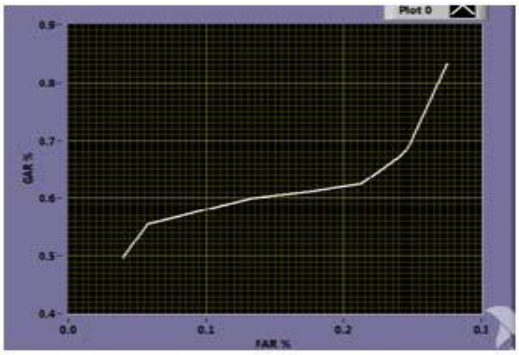

Fig.5 ROC curve

The recognition accuracy has constraints due to the problems faced while acquiring the image i.e. more background which cannot be removed fully and hence an exact ROI is difficult to extract, number of images captured. The accuracy of the proposed system can be further enhanced by considering large database, by having a better image acquisition protocol.

5. CONCLUSION

We have presented a detailed description in designing a multi-biometric system for newborn recognition. In addition we improve the efficacy and the performance speed is also considerably increased for the multimodal biometric fusion system proposed is promising. Multimodal biometric data fusion of several biometric modalities combines the information provided by each unimodal modality to obtain a final decision. We have presented a brief review of our related work in designing an appropriate biometric system for the identity verification of the newborn. Experimental results show that the efficacy and the performance speed is also considerably increased for the multimodal biometric fusion system proposed the results are promising. Multimodal biometric data fusion of several biometric modalities combines the information provided by each unimodal modality to obtain a final decision. It has been demonstrated that multimodal fusion increases the robustness of the recognition system to obtain a recognition decision even when one or more of the biometric decisions cannot be accomplished.

REFERENCES

[1] M. P. Down and R. J. Sands, ―Biometrics: An overview of the technology, challenges and control considerations,‖ *Inf. Syst. Control J.*, vol. 4, pp. 53–56, 2004.

[2] G Hemantha Kumar and Mohammad Imran,‖Research Avenues in Multimodal Biometrics‖, *IJCA* Special Issue on ―Recent Trends in Image Processing and Pattern Recognition‖RTIPPR, 2010.

[3] S.Balameenakshi. S.Sumathi,‖ Biometric Recognition of Newborns: Identification using Footprints‖, *Proceedings of 2013 IEEE International Conference on Information and Communication Technologies (ICT 2013)*, 737-742, Tamilnadu, India

[4] Hai-Yang Cai, *et al* ―Newborn Footprint Recognition using Orientation Feature‖, Neural Computing & Applications: 1-9, Dec ICIC 2010.

[5] S.Balameenakshi, S.Sumathi and R.Rani Hemamalini,‖Identity Verification of Newborn Using Biometrics‖, *International Journal of Engineering Research and Applications (IJERA*) ISSN: 2248-9622 National Conference on Advanced Communication & Computing Techniques (NCACCT-19 March 2013, Chennai).

[6] Peter, W. I. L. D. "Single-sensor hand and footprint-based multimodal biometric recognition."

[7] Anil Jain, Karthik Nandakumar, Arun Ross,‖ Score normalization in multimodal biometric systems‖, *Pattern Recognition* 38 (2005) 2270 – 228.

[8] Horng, Shi-Jinn, et al. "An improved score level fusion in multimodal biometric systems." *Parallel and Distributed Computing, Applications and Technologies, 2009 International Conference on*. IEEE, 2009.

[9] Sahoo, Soyuj Kumar, Tarun Choubisa, and Mahadeva Prasanna SR. "Multimodal biometric person authentication: A review." *IETE Technical Review*29.1 (2012): 54.

[10] L. Hong, A.K.Jain, S. Pankanti, and R. Bolle, ―An identity authentication system using fingerprints,‖ *Proc. IEEE*, vol. 85, no. 9, pp.1365–1388, Sep. 1997.

[11] Utkarsh Gupta et al,―Score Level Fusion of Face and Finger Traits in Multimodal Biometric Authentication System‖ *IJCA* Proceedings on International Conference and workshop on Emerging Trends in Technology.

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