Perspective Automated Inkless Fingerprinting Imaging Software for Fingerprint Research

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Fingerprint collection using ink-and-paper image is a conventional method i.e. an ink-print, transparent-adhesive tape techniques which are slower and cumbersome. This is a pilot research for software development aimed at imaging an automated, inkless fingerprint using a fingerprint sensor, a development kit of the IT WORKS Company Limited, PC camera, and printer. The development of software was performed to connect with the fingerprint sensor for collection of fingerprint images and recorded into a hard disk. It was also developed to connect with the PC camera for recording a face image of persons' fingerprints or identification card images. These images had been appropriately arranged in a PDF file prior to printing. This software is able to scan ten fingerprints and store high-quality electronics fingertip images with rapid, large, and clear images without dirt of ink or carbon. This fingerprint technology is helpful in a potential application in public health and clinical medicine research.

Keywords: *Fingerprint research, Imaging software, Automated*

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Finger and palm prints or dermatoglyphic characteristics are formed between the 11th and 24th weeks of intrauterine life and thereafter remain unchanged[1]. Each individual has a unique dermatoglyphic pattern configuration largely determined by the genetic profiles of the parents and the intrauterine environment[2,3]. Many techniques for the recording of dermatoglyphics have been recorded such as the adhesive tape with carbon paper technique[4,5], the adhesive tape with common oil pastel crayon technique[6], the modified Purvis-Smith method using a stamp pad, bond papers and roller[7]. An automated method for fingerprinting used in dermatoglyphic research should be enhanced due to conventional methods i.e. an ink-print, transparent-adhesive tape techniques are slower and cumbersome[8]. The transparent-adhesive tape method which is commonly used in the dermatoglyphic research needs several materials such as a transparent-adhesive tape, a black pencil for fingerprints collection and a magnifying lens[9,10] or a low-power binocular microscope[11] for fingerprint patterns analysis. The ink-print technique used by police departments needs an expensive, typical ink, rollers, which are messy and dirty. Moreover, both methods are time consuming. The present study is of a software development aimed at imaging an automated inkless fingerprint for collecting of fingerprinting data and easy analyzing for fingerprint pattern and ridge count.

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Material and Method

Materials used in the developed software for imaging an automated inkless fingerprint are as follows: (1) a Microsoft development tool visual studio.NET[12] with C#[13], (2) ID WORKS Integrator Software Development Kits; SDK[14] and (4) a PC camera.

The method is composed of two steps:

(1) construction of a program to connect with the fingerprint sensor using the ID WORKS Integrator SDK.

(2) construction of a program to connect with the PC camera.

Schematic of this method makes arrangements of a ten-fingertip printing and person's face images, then is stored in an electronic file with portable document format (PDF) before output printing (Fig. 1).

Results

The efficiency of the developed software is tested by touching each fingertip on a touch pad of the fingerprint sensor starting from the left hand; thumb, index, middle, ring, little fingers, followed by the right fingers of little, ring, middle, index, and thumb. These fingertips printing images and person's face are stored into a data base as a PDF file (Fig. 2) and are clearly seen compared to the transparent-adhesive tape technique. The average time consumed for ten fingertips collecting and printing is one minute which is 8-10 times faster than the conventional low-tech methods. The images of fingerprint-pattern and ridges obtained from this software are large and clearly seen by the naked eye. To obtain a copy of the automated inkless fingerprinting images is 100% compared to the original as its data processing is binary.

Discussion

With the development of biology techniques pattern recognition, neural networks and computer technique, Chinese researchers can build a large palm print reference data base and form expert systems with study function[15]. Based on this study, a novel method of imaging software for automated inkless fingerprinting was developed[16]. The novel method is the first automated inkless fingerprinting technique. A frontal area of each fingertip is automatically imaged though fingertip side views are hardly scanned. Fortunately, a dermatoglyphic researcher is capable of solving this problem by identifying core and delta points of fingerprint patterns. However, the validity of fingertip images compared to the conventional method needs to be tested. The contactless optical scanning of fingerprints with 180□ view which was developed by Palma et al[17] is enhanced in the future research for improving the fingertip both side views images of the present study.

Conclusion

The development of software for imaging an automated, inkless fingerprint is performed using a commercial fingerprint sensor used for personal identification. Arrangements of fingerprints and person's face images are stored in an electronic file with portable document format before output printing. The automated images of fingerprints patterns and ridges are large and clearly seen in one minute for a ten fingers printing collection. This software is quick to collect, store and download the images for a printout analysis. Therefore,

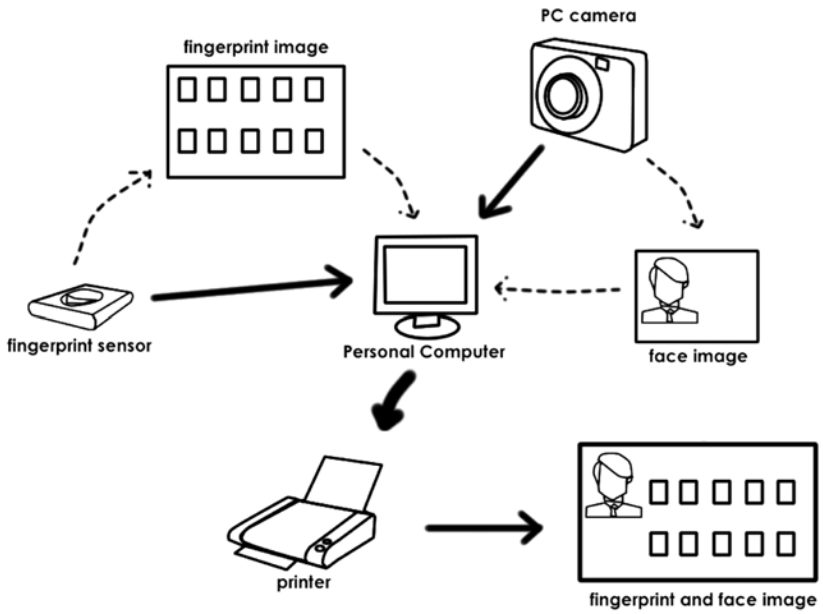

Fig. 1 Schematics of an automated inkless fingerprint image

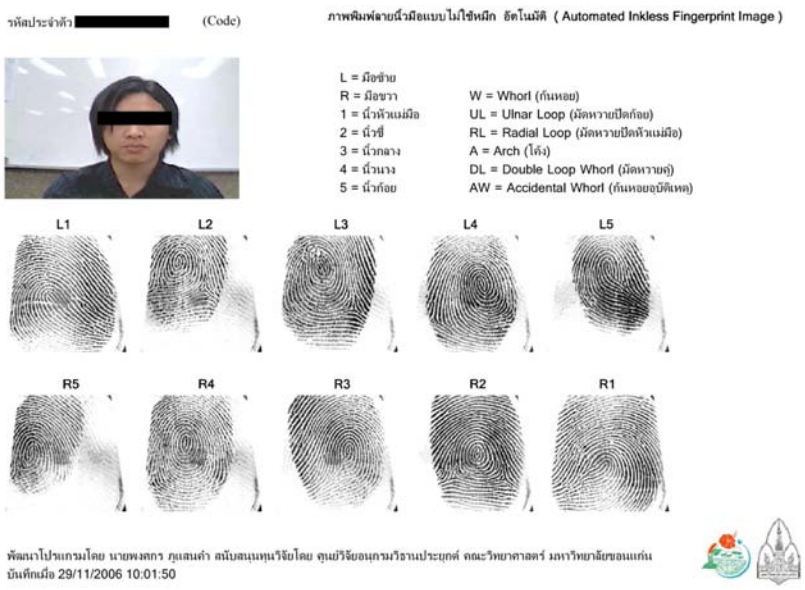

Fig. 2 A PDF printout of fingertips printing using a fingerprint sensor, a PC camera, and the developed imaging software

it is an enhanced method for dermatoglyphic research in public health, clinical medicine, and in forensic science.

The automated inkless fingerprinting imaging software invented by the authors is patented by Department of Intellectual Properties, Thailand.

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โปรแกรมพิมพ์ภาพลายนิ้วมืออัตโนมัติปราศจากหมึกสำหรับการวิจัยลายนิ้วมือ

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ภาพพิมพ์ลายนิ้วมือแบบใช้หมึกและกระดาษ เป็นเทคนิคดั้งเดิมที่ใช้พิมพ์ลายนิ้วมือ ดังเช่น เทคนิคหมึก-พิมพ์ เทคนิคเทปกาวใส เป็นต้น มีวิธีการยุ่งยากและใช้เวลา งานวิจัยนำร่องนี้มีวัตถุประสงค์เพื่อพัฒนาโปรแกรมซอฟท์แวร์พิมพ์ภาพลายนิ้วมือแบบไม่ใช้หมึก โดยใช้อุปกรณ์ เครื่องอ่านลายนิ้วมือ และชุดพัฒนาโปรแกรม ของบริษัทเอกชนกล้องถ่ายรูปที่ใช้กับเครื่องคอมพิวเตอร์ส่วนบุคคล และเครื่องพิมพ์ โดยการเชื่อมต่อกับ เครื่องอ่านลายนิ้วมือ เพื่อรวบรวมภาพลายนิ้วมือ แล้วบันทึกลงในฮารดดิสก์ โปรแกรมนี้ยังเชื่อมต่อกับกล้องถ่ายรูปฯ เพื่อให้สามารถบันทึกภาพใบหน้าหรือบัตรประจำตัวประชาชนของเจ้าของลายนิ้วมือได้ด้วย ภาพลายนิ้วมือจะถูกจัดเรียงอย่างเหมาะสมในรูปของกระดาษอิเลคโทรนิค (PDF) ก่อนจัดพิมพ์ โปรแกรมนี้ สามารถพิมพ์ภาพลายนิ้วมือได้ทั้งสิบนิ้วด้วยคุณภาพสูง รวดเร็ว ขนาดใหญ่ สะอาด ไม่เลอะเทอะหมึกหรือคาร์บอน การทำสำเนาจะให้ความเหมือนกับต้นฉบับทุกประการ และสามารถบันทึกเป็นไฟล์ PDF ได้ เทคโนโลยีการพิมพ์ภาพลายนิ้วมือด้วยโปรแกรมนี้จึงมีประโยชน์ในการวิจัยด้านการแพทย์และสาธารณสุข