The development and prospect of iris recognition technology

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Abstract: This paper introduces the concept and advantage of the iris recognition technology. The developmental status of iris recognition technology is generalized. It analyzed the difficulty in the research. The future research trend of iris recognition technology is advanced.

1. Introduction

With the advent of the information age and the rapid development of computer science and technology, biometric technology, as an important branch of pattern recognition, has been increasingly applied to people's daily work and life. The physiological characteristics will gradually replace the existing passwords, keys, and become a habitual lifestyle of people, which will greatly facilitate people's future lives. Compared with other biometric technologies, the unique advantages of iris recognition technology in terms of acquisition, accuracy, and non-contact make it bound to become the mainstream biometric authentication technology in the future society.

As the most advanced biometric technology, iris recognition has incomparable advantages in several other common biometric technologies in terms of accuracy, stability, security, practicality and user acceptance. Surgery is difficult to change its structure; because the pupil changes with the intensity of light, it is impossible to replace a living iris with a fake iris, so the safety of iris authentication is extremely high. Moreover, iris authentication does not make the subject feel guilty or under investigation. The iris image can be obtained in a non-contact state, which does not infringe on the person, and is therefore more easily accepted by users [1].

2. Overview of Iris Recognition Technology

2.1 Implications of iris recognition technology

The appearance of the eye is composed of three parts: the sclera, the iris, and the pupil. See Figure 1. The sclera is the white part around the eyeball, which accounts for about 30% of the total area. It contains 65% of the rich texture information. In appearance, it is composed of many glands, folds, pigment spots, etc. It is one of the most unique structures in the human body. The formation of iris is determined by genetic genes, and the expression of human genes determines the shape, physiology, color and overall appearance of iris. The iris recognition technology uses the texture information of the human eye's iris to discriminate the person's identity information. Iris recognition technology can achieve very good accuracy, even if all human iris information is entered into a database, the probability of misunderstanding and rejection is one in a million. A few to dozens of orders of magnitude more accurate than any other biometric technology.
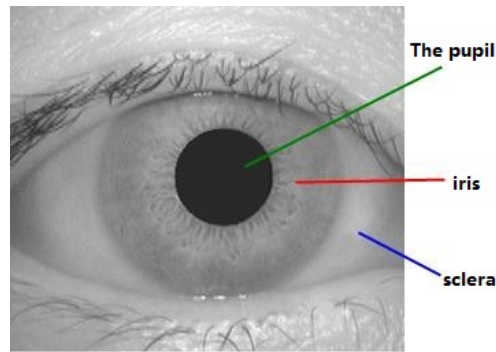
Fig. 1 human eye structure

2.2 Features of iris recognition technology

Iris recognition is a rapidly developing biometric technology in recent years. Compared with other biometric technologies, iris recognition has the following characteristics.

1) Non-contact

Unlike biological characteristics such as fingerprints and palm prints, iris images are collected in a non-contact manner, avoiding physical contact, and are easily accepted by users.

2) Stability

One year after human birth, the iris texture will remain stable and will not change with age and changes in the external environment. At the same time, the risk of changing the iris texture through surgery is extremely high.

3) Uniqueness

The iris texture is mainly determined by genetic factors and the environment during the development of the embryo. After a large number of observations and statistics, it is found that the iris texture of any two people is different, and even the twins or the left and right eyes of different people have different iris textures.

4) Highest accuracy

There are as many as 266 independent feature points available in the iris texture, which determines that this kind of biometric recognition method has a high recognition accuracy and a misrecognition rate is less than one ten-millionth [3].

5) Living body detection

The pupil is very sensitive to changes in light. The pupil radius will gradually decrease as the light increases, and gradually increase as the light weakens. Enlarging or shrinking the pupil will cause the iris texture to stretch or squeeze, so that the iris can be used. This feature enables live detection.

2.3 Development Status of Iris Recognition Technology

Iris biometric technology is a multi-disciplinary high-tech that integrates mathematics, optics, electronics, and physiology and computer science. In the mid-1930s, people began to imagine using iris to identify identities, but it was not until the 1990s that iris recognition technology became a reality. In 1987, eye specialists Aransafir and Leonardflom first proposed the concept of automatic iris recognition using iris images, but they did not develop a practical application system. Until 1991, Johnson at Los Alamos National Laboratory in the United States implemented an automatic iris recognition system. In 1993, John Daugman implemented a high-performance automatic iris recognition prototype system. In 1996, Richard Wildes developed an authentication system based on iris recognition [2]. Since 2000, the National Physical Laboratory (NPL) has been commissioned by the Communications Electronics Security Group (CESG) of the British Government. Through extensive experimental research, it has analyzed and published seven typical human biometric recognition technologies The experimental results. The laboratory's report on the above-mentioned human biometric recognition technology believes that iris recognition is the most accurate, hardest to counterfeit and fastest processing biometric recognition technology.

At present in our country, the iris recognition industry is in the early stage of growth. On the one hand, through the agency of foreign products, the product system of iris recognition technology has been initially established, and technical standards are being drafted. Enterprises represented by the Beijing Institute of Automation, Chinese Academy of Sciences Beijing Zhongke Hongba Technology Co., Ltd. have launched early products similar to foreign iris recognition In recent years, in the context of the development of "Great Security, Great Defense" in the Second Academy of Astronautics, the Key Laboratory of Metrology and Calibration Technology of Beijing Institute of Radio Metrology and Testing has increased its research efforts on iris recognition technology. At present, the long-distance iris recognition equipment at the international advanced level has been developed. The iris recognition equipment is comparable to foreign equipment in terms of recognition distance, reliability, and anti-interference. At present, it is currently used in domestic coal miners' attendance, enterprise staff attendance, and banking There are already signs of using iris recognition in areas such as safes and vault access control. On the other hand, in terms of market conditions alone, the iris market is constantly being subdivided. The development of the iris recognition industry is still at the stage of "digestion and absorption". It is in contrast to other mature biometric technologies such as fingerprints, palm prints, and human faces Compared with recognition, the iris recognition industry has not yet reached scale and generalization, and it is urgent to further promote and develop [5].

2.4 Difficulties in the research of iris recognition technology

Although the iris recognition technology has developed rapidly in recent years, if we want to make iris recognition products enter the large-scale promotion stage, we need to overcome the following difficulties:

1) The diameter of the iris is small, generally about 11mm. To obtain a sufficiently clear iris image, the resolution of the image acquisition device has higher requirements, which increases the hardware cost of the device [4].

2) Overcome image blur caused by human eyes shaking, eyeball rotation, and reflection during image acquisition.

3) At present, because the research of iris recognition technology is in its infancy, there is no unified and widely accepted iris image library for researchers to use. At the same time, there is no uniform standard for iris images. As a result, equipments of different manufacturers are incompatible with each other, and the substitutability is not strong.

4) Some iris recognition devices also require a certain degree of cooperation from the user. It is necessary to repeatedly adjust the distance, posture, and even direct physical contact with the device to successfully complete the entire iris recognition process, resulting in a user-friendly experience.

5) As the iris recognition device is a new thing, at present, no authoritative department can give an objective evaluation of the safety and reliability of the iris recognition device, which causes ordinary people to have doubts about the performance of the device.

3. Iris recognition outlook

In a modern society with a rapid development, people will have higher requirements for identity recognition technology. Driven by demand, iris recognition technology will have considerable development; future membrane recognition technology will have the following development trends:

1) Improve the recognition distance; long-distance (> 3m), ultra-long-distance (> 10m) recognition devices will meet the needs of users in the process of identification, and the device needs to have good anti-motion blur, anti-shake and other functions.

2) Miniaturization of the system; miniaturization of the iris device increases portability and facilitates integration with other products, such as integration with electronic products such as mobile phones and tablets, which will greatly expand the application range of iris recognition products and improve related electronic products Security.

3) Increase human-computer friendliness; through the development of large depth of field, large field of view lens, fast zoom, focusing lens, other auxiliary positioning devices, etc., the iris recognition device can quickly and accurately capture the user's clear iris image. The iris recognition device is changed from passive to active, reducing or even requiring the cooperation of the user. The recognition device itself determines the position of the user's eyes according to various sensors, and actively focuses on collecting the user's iris image.

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