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바이오메트릭스 기술을 이용한 병원보안시스템

Hospital Security System using Biometric Technology

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요 약 최근 개인정보 보안의 중요성이 높아짐에 따라 보안 방법에 관한 연구가 활발히 이루어지고 있다. 그 중에서도 바이오메트릭스를 이용한 보안 시스템을 많이 연구 중인데, 특히 바이오메트릭스 기술을 이용한 인식은 인식률과 보안성에 있어서 매우 뛰어나다. 최근 병원의 의사 및 임직원에 대한 출입 보안이 강조 되고 있지만 유출이 쉬운 직원카드에 의한 출입 관리 시스템이 대부분이다. 기존에 나온 홍채인식을 이용한 연구의 문제점은 정확한 홍채 인식 알고리즘과 노이즈를 제거하기 위한 전처리 방법의 부정확성으로 인해 인식률이 떨어지는데 있다. 따라서, 본 논문에서는 기존 암호화 방식의 단점을 보완하기 위하여 생체 인식 중 인식률이 뛰어난 홍채 인식을 사용하여 병원에서의 출입 기록 관리 시스템에 적용한다. 또한 기존 방식에 비해 인식률을 높이기 위해 전처리 과정 시 눈썹 추출 마스크에 선 성분 마스크를 추가하여 정확한 전처리 방법을 제안하고 이에 따라 인식률을 향상시키는 방법을 제안한다.

Abstract Recently increasing importance of information security, personal security is reseached. Among them, biometrics research is very good at recognition and security particularly in terms of iris recognition. Recent hospital physicians and employees for access control is emphasized. But most of them, easy-employee card access control systems are used. It has difficulties of iris recognition on the issue of accurate iris recognition algorithm to eliminate noise and inaccuracy of pretreatment methods for recognition from existing research. Therefore, this paper complements existing encryption methods to the disadvantages of biometric iris recognition using high-access records in the hospital management system is applied. In addition to conventional pretreatment process to increase recognition eyebrows when mask line component added to the extraction mask, the correct preparation method, and accordingly proposed to improve the recognition of records management systems offer access to the hospital.

Key Words : Biometrics, Iris Recognition, Access Records Management System

I. Introduction

The information society is that it was a convenient and profitable with a benefit of privacy and abuse are followed dysfunction, such as information dissemination. In particular, the building's access control card or a password in a way that made many employees, but it is not well carried out due to the card losses and password security leakage. Accordingly, the security system, biometric technology has been actively in the movement to apply. It was called biometric fingerprint technology to a representative, face, voice, iris, and so on. Biometrics is the recognition that security, as well as the high security system has been applied. Among these biometric methods other than iris recognition accuracy of identification and security is excellent[2]. Also over 30 years will maintain its

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characteristics, due to muscle movement of the iris is almost no recognition at the user's contacts do not have many advantages, it is less objectionable. Above all, iris recognition, it is excellent compared to other types. Iris recognition also exists between the pupil and the whites using a unique iris pattern recognition unit to recognize and be recognized without direct contact, and other biometric technology has a higher accuracy and reliability. Therefore, iris recognition security system if applicable should be emphasized that security would be used. In this paper, we need personal information secure recognition from the hospital how to improve pre-offering efficient and encoding to perform iris region extraction and iris recognition access records management system was applied to the hospital[1].

Ⅱ. Related Research

1. Iris extraction method

The most important thing to recognize the iris extract is preparation and accurate. Asians, the eyelid is often obscure part of the pupil, iris, caused by shade of light. It is the difficulty of extraction because of the problem. In general, iris to represent the shape of a circular boundary zone to detect when an expression such as a circular path with a Gaussian function.[3]

$$\max_{(r,x_0,y_0)}|G_\sigma * \frac{\delta}{\delta r}\oint_{r,x_0,y_0}\frac{I(x,y)}{2\pi r}ds| \quad (1)$$

$$\max|\frac{1}{\Delta r}\sum_k((G_\sigma((n-k)\Delta r)-G_\sigma((n-k-1)\Delta r)) \cdot \sum_m I[k\Delta r\cos(m\Delta\theta)+x_0),(k\Delta r\sin(m\Delta\theta)+y_0)]| \quad (2)$$

The center point (x_0, y_0) and radius r by varying the radius of each center and circumference of a circle created by the gray level values of pixels along the back, plus, depending on the change of the radius r the maximum value of the difference between the whites of the eyes and the edge of the pupils, an expression that is returned from a minimum value is calculated by equation 2 pupils in the pupil and the iris is the edge.

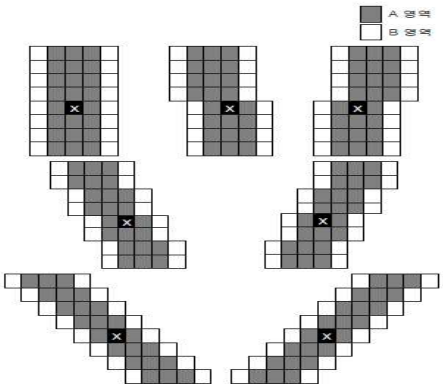

그림 1. 눈썹 추출 마스크
Fig. 1. Eyebrows Detection Mask

The pretreatment is accomplished in two ways. Through a circular boundary detection algorithm identified the center of the pupil and the iris, radial, and eyebrows are initiated on the basis of information extracted eyebrow masks as shown in Fig. 1 and the eyebrows are extracted. However, the pixels in the mask in this way and not come to agreement with real eyebrows would not detect. So the Prewitt and Sobel filter shown in Fig. 2 based on a line through the element detection mask is perfect to perform preprocessing.[4][5][6]

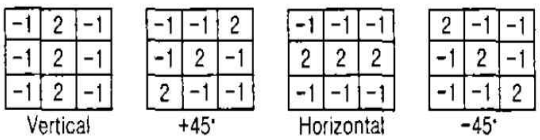

그림 2. 선 성분 검출 마스크
Fig. 2. Line Component Detection Mask

2. Iris Recognition

Iris recognition and normalization is coded in order to convert the polar coordinate system. The extracted iris region 3 and the equation is the polar coordinate

transformation. Polar coordinate system transformation is changed by the surrounding environment, regardless of the size of the pupil and the iris is always in the same area in order to extract iris features. Then normalization and encoding process is performed to extract the iris features code.

$$I(x(r,\theta),y(r,\theta)) \rightarrow I(r,\theta) \quad (3)$$

Normalization in the area of the polar transformed the entire width of the iris half part is extracted after unfolds. This process is carried out because circular iris region is harder to extract. Encoding process uses Gabor filters of different ways. This method is the most effective way and with a frequency filter as a particular frequency component and the direction with the image structure where the local information efficiently can be expressed, especially the iris, it is widely used as a complex texture information efficiently finding methods.

$$h_{(Re,Im)} = sgn_{(Re,Im)} \int_{p}\int_{\theta} I(p,\phi) e^{-i\omega(\beta_0-\phi)} \cdot e^{-(r_0-p)^2/\alpha^2} e^{-(\beta_0-\phi)/\beta^2} pdpd\phi \quad (4)$$

ω : wavelet frequency

α,β : wavelet size parameter

To normalize the iris region was extracted in the process such as Equation 4 through Gabor filter algorithm with 256-byte encodings.

3. Iris code comparisons

Iris codes are generated by the encoding process, and it consists of 0 and 1, that is the code of constant length. Iris image of a handsome one for the code by comparing the threshold and become aware hamming distance using a formula such as Equation 5.

$$HD = \frac{1}{N}\sum_{j=1}^{N} X_j (\veebar) Y_j \quad (5)$$

It can be increased recognition of the setting serves as a major factor of threshold. Therefore, how to set the threshold to select the initial weight vector is mostly used. This method uses the threshold as a way to limit the recognition, but it does not apply learning to recognize a specific input in the process. It should be selected how to set up the learning patterns of each class of input patterns for the first time the initial weight vector of that class. All the rest of the weight vector is set to 0. Learning patterns of each class, for approval to enter the new input pattern and the distance between the output node is calculated. A minimum distance is calculated as a distance weighted input pattern vector representing the class and is determined to match the class. Threshold determined in this way, the threshold is large compared with the same person hamming distances, large hamming distance value is recognized as a different person.

Ⅲ. Iris Recognition Access Control System

1. System Configuration

Biometric technology of iris recognition is applied to the hospital entrance and the security of personal information as one of the records management system.

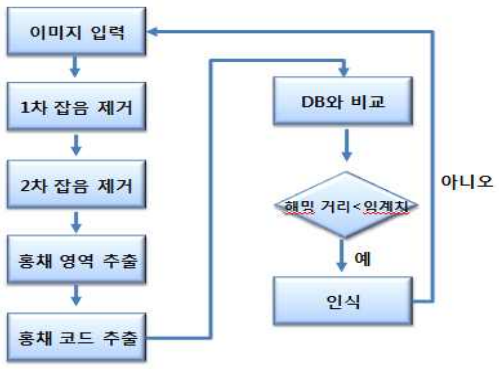

그림 3. 시스템 흐름도
Fig. 3. System Flowchart

Shown in Fig. 3 the input received from the circular edge detection through eye image to extract the iris region on recognition to remove unwanted elements

proposed in this paper to perform a preprocessing step. Iris feature extraction, conversion to polar coordinates through a process of normalization and the iris code after execution of the process of encoding are extracted. Hamming distance through the iris code extracted to obtain the iris code generated by the learning algorithm is compared with DB. How to compare the system in comparison with the threshold set on is a system for recognition. This paper, the configuration of the system is shown in Fig. 4.

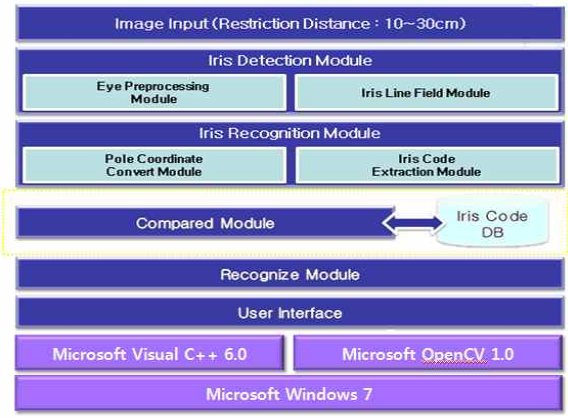

그림 4. 시스템 아키텍처
Fig. 4. System Architecture

In order to perform the imaging system, the distance limit is 10 ~ 30cm image to enter the eye images. Because the iris image could be cropped in near limited distance, it can be applied to limit the distance of the eye image on the process of iris recognition.

```
// 눈썹 추출 알고리즘
For m = 0 to m < mask size then
  p[a] ← Calculated mask gray pixel
         value of A area ;
  p[b] ← Calculated mask gray pixel
         value of B area ;
  p[m] ← Difference value of p[a] and
          p[b] * 1.5 ;
  p[t] ← Average value of the iris
         area ;
If (p[m] >= p[t]) then
  Decide noise ;
Else
  Decide Iris area ;
End ;
```

그림 5. 눈썹 추출 알고리즘
Fig. 5. Eyebrows Detection Algorithm

```
// 선 성분 알고리즘
hori_mask ← [-1,-1,-1],[2,2,2],[-1,-1,-1];
vert_mask ← [-1,-1,-1],[2,2,2],[-1,-1,-1];
+diag_mask ← [-1,-1,-1],[2,2,2],[-1,-1,-1];
-diag_mask ← [-1,-1,-1],[2,2,2],[-1,-1,-1];

For m = 0 to m < mask size then
  h[m] ← Absolute value of difference
         pixel value x and x+2 ;
  v[m] ← Absolute value of difference
         pixel value y and y+2 ;
  +d[m] ← Absolute value of difference
          pixel value x and x+2, y
          and y+2 ;
  -d[m] ← Absolute value of difference
          pixel value x and x+2, y+2
          and y ;
End ;
```

그림 6. 선 성분 알고리즘
Fig. 6. Line Component Algorithm

2. Preprocessing

The iris detection module consists of preprocessing and iris detection region. Preprocessing module is the existing extraction eye brow and Prewitt and Sobel filter mask detection and line component perform preprocessing. Extraction eyebrows is only the eyebrows and eye makeup such as mascara if it doses not detect line components, because detection of disadvantage when you apply the mask preparation process as well as the exact iris region extracted. Fig. 5 and Fig. 6, to perform the preprocessing algorithms. A case of extraction algorithms such as the eyebrow area and B area to obtain the pixel values of the gray level of the entire iris area compared with the average gray level pixel value is a way of operation. At this point, B area, the value of the A zone is smaller than the gray level is 1.5 times the weighting. Fig. 6, the line element algorithm for horizontal, vertical, +45 °, -45 ° direction for the eyebrows, the eyebrows, the iris area covered is only a filtering algorithm. To remove noise in video images based on iris detection module with a circular boundary detection algorithm with a circular area of the iris are extracted.

Iris recognition module in the previous steps that can be recognized based on the extracted iris region into the code to perform the task. Polar coordinate conversion module converts the extracted iris region polar coordinate system through the feature extraction

algorithm can extract iris code after coding process module through the iris area of the Gabor filter algorithm makes a 256-byte encoding.

Wild iris code with the above process, the learning algorithm is generated by the comparison module compares the iris code, DB and when the comparison method is used to thaw the streets. Initial weight vector calculation method using the threshold value is set lower than the same person through the threshold, higher will be recognized as a different person.

Ⅳ. Experiments Results and Discussion

Technologies to evaluate the performance criteria is the recognition rate. The hamming distance threshold in comparison with that recognition is the most important process, in which accurate iris recognition that interfere with the extraction and noise is a preprocessing step to filter out. In this paper, the existing brow line component detected in the extraction mask is applied the mask for a total of 2 accurate iris region extraction completely removed, as well as the recognition of the noise increased. The proposed method was used to evaluate the performance and test using OpenCV 1.0 Visual C++ 6.0 and the experimental results shown in Fig. 7. Color and gray-level image obtained by an experiment involving the eyebrows, the iris region was removed and that the eyebrows are detected in addition to maintaining the results can be obtained.

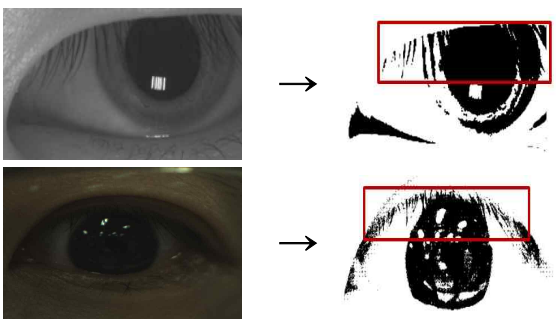

그림 7. 실험 결과
Fig. 7. Testing Result

The total proposed method through two kinds of experiments The first experiment was to evaluate the performance in whole visual noise is filtered much evaluated. Data, a total of 10 times in five patients who were measured in the experiment results shown in Table 1, the minimum error of 0.10, the maximum error was 0.26, the average error of 0.17.

표 1. 잡음 필터링 오차율
Tab. 1. Noise Filtering Error Rates Testings

	User A	User B	User C	User D	User E
1	0.14	0.15	0.18	0.23	0.15
2	0.24	0.12	0.17	0.10	0.19
3	0.12	0.20	0.12	0.19	0.17
4	0.11	0.21	0.11	0.13	0.20
5	0.18	0.17	0.10	0.17	0.23
6	0.19	0.19	0.26	0.19	0.12
7	0.20	0.13	0.20	0.14	0.15
8	0.15	0.23	0.18	0.12	0.23
9	0.16	0.11	0.19	0.20	0.11
10	0.26	0.10	0.22	0.14	0.24
avg	0.175	0.161	0.173	0.161	0.179

The second experiment performed the first experiments that assessed recognition of the user based on the experimental target and the reference to the experimental data is the same as the first experiment, the experimental results shown in Fig. 8, at least 92.8%, 95.1% with an average maximum recognition rate of 94%.

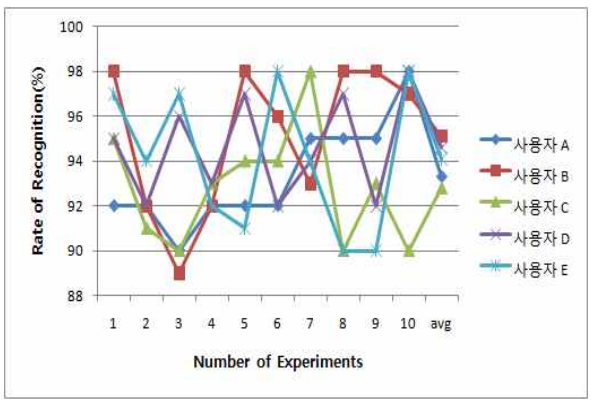

그림 8. 사용자 인식률
Fig. 8. Users Recognition Rates Testings

Ⅴ. Conclusion

The biometrics is growing technology for security systems. Among them, compared to other technologies, iris recognition technologyhas been applied to many security systems. In this paper, using iris recognition access hospital records management system was designed and implemented, a new preprocessing method to improve recognition is proposed. In the process of recognition occurs error expansion into other areas, particularly important where personal information security will be applied to reduce possible errors. Therefore, the improvement of iris recognition algorithms and learning algorithms can reduce the margin of error. In the future, it will improve the recognition of a new iris recognition algorithm, accurate method for threshold setting and a new learning algorithm is expected to study. Also stressed the importance of personal information security as to be applicable in other environments will expand the area.

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