

Ration Card Authentication Using Finger Vein

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ABSTRACT: In recent technologies, biometrics plays an important role for authentication in various applications. There are many biometric methods available for authentication, the finger vein will be highly reliable for personal identification. In current scenario, we are in need of high security identification due to high level of forgery, and also, biometric feature should be unique, universal, measurable, acceptable, collectable and permanence. Here, we have proposed a new approach which uses finger vein as the key aspect for ration card authentication.

KEYWORDS: finger vein, segmentation, gabor filter, comparative competitive code (C²Code), feature extraction.

I. INTRODUCTION

Public distribution system (PDS) is an Indian food security system. Established by the Government of India under Ministry of Consumer Affairs, Food, and Public Distribution and managed jointly with state governments in India, it distributes subsidized food and non-food items to India's poor. This scheme was launched in India on June 1997. Major commodities distributed include staple food grains, such as wheat, rice, sugar, and kerosene, through a network of fair price shops (also known as ration shops) established in several states across the country. Food Corporation of India, a Government-owned corporation, procures and maintains the PDS.

In coverage and public expenditure, it is considered to be the most important food security network. However, the food grains supplied by the ration shops are not enough to meet the consumption needs of the poor or are of inferior quality. The average level of consumption of PDS grains in India is only 1 kg per person / month. The PDS has been criticised for its urban bias and its failure to serve the poorer sections of the population effectively. The targeted PDS is costly and gives rise to much corruption in the process of extricating the poor from those who are less needy. Today, India has the largest stock of grain in the world besides China, the government spends Rs. 750 billion (\$13.6 billion) per year, almost 1 percent of GDP, yet 21% remain undernourished. Distribution of food grains to poor people throughout the country is managed by state governments. As of date there are about 500,000 Fair Price Shops (FPS) across India.

OVERVIEW

The central and state governments shared the responsibility of regulating the PDS. While the central government is responsible for procurement, storage, transportation, and bulk allocation of food grains, state governments hold the responsibility for distributing the same to the consumers through the established network of Fair Price Shops (FPSs). State governments are also responsible for operational responsibilities including allocation and identification of families below poverty line, issue of ration cards, supervision and monitoring the functioning of FPS. Under PDS scheme, each family below the poverty line is eligible for 35 kg of rice or wheat every month, while a household above the poverty line is entitled to 15 kg of food grain on a monthly basis.

A below poverty line (BPL) card holder should be given 35 kg of food grain and the card holder above the poverty line should be given 15 kg of food grain as per the norms of PDS. However, there are concerns about the efficiency of the distribution process.

PUBLIC DISTRIBUTION SHOP:

A public distribution shop, also known as fair price shop (FPS), is a part of India's public distribution system established by Government of India which distributes rations at a subsidized price to the poor. Locally these are known

as "ration shops" and chiefly sell wheat, rice, kerosene and sugar at a price lower than the market price at a price called Issue Price. Other essential commodities may also be sold. To buy items one must have a ration card (pink card). These shops are operated throughout the country by joint assistance of central and state government. The items from these shops are much cheaper but are of average quality. Ration shops are now present in most localities, villages, towns and cities. India has 478,000 shops constituting the largest distribution network in the world.

Fallouts of PDS are as follows, The public distribution system of India is not without its defects. With a coverage of around 40 crore below-poverty-line (BPL) families, a review of the PDS has discovered the following structural shortcomings and disturbances. Growing instances of the consumers receiving inferior quality food grains in ration shops. Deceitful dealers replace good supplies received from the F.C.I (Food Corporation of India) with inferior stock and sell FCI stock in the black market. Illicit fair price shop owners have been found to create large number of bogus cards to sell food grains in the open market. Many FPS dealers resort to malpractice, illegal diversions of commodities, holding and black marketing due to the minimum salary received by them. Numerous malpractices make safe and nutritious food inaccessible and unaffordable to many poor thus resulting in their food insecurity. Identification of households to be denoted status and distribution to granted PDS services has been highly irregular and diverse in various states. The recent development of Aadhar UIDAI cards has taken up the challenge of solving the problem of identification and distribution of PDS services along with Direct Cash Transfers. Regional allocation and coverage of FPS are unsatisfactory and the core objective of price stabilization of essential commodities has not met. There is no set criteria as to which family is BPL and which is APL. This non ambiguity gives massive scope for corruption and fallouts in PDS systems because those who are actually meant to be benefitted are not able to taste the fruits of PDS. Several schemes have augmented the number of people aided by PDS, but the number is extremely low. Poor supervision of FPS and lack of accountability has spurred middlemen who consume a good proportion of the stock meant for the poor. There is also no clarity as to which families should be included in the BPL list and which excluded. This results in the genuinely poor being excluded whilst the ineligible get several cards. Awareness about the presence of the PDS and FPS to poverty-stricken societies, namely the rural poor has been dismal. To avoid the

II. RELATED WORKS

Many researchers have proposed uni-model and multi-model biometric authentication system. Wenming Yang, et al [1] proposed comparative competitive coding for personal identification by using finger vein and finger dorsal texture fusion". G.Radha et al [2] proposed Sclera vein recognition using Y-shape descriptor and finger vein recognition using repeated line tracking based feature extraction method to effectively eliminate the most unlikely matches respectively. Naoto Miura et al [3] proposed a paper in which Infrared light is used to capture an image of a finger that shows the vein patterns, which have various widths and brightnesses that change temporally as a result of fluctuations in the amount of blood in the vein, depending on temperature, physical conditions, etc. To robustly extract the precise details of the depicted veins, we developed a method of calculating local maximum curvatures in cross-sectional profiles of a vein image. This method can extract the centerlines of the veins consistently without being affected by the fluctuations in vein width and brightness, so its pattern matching is highly accurate.

Jinfeng Yang et al [4] proposed a clear view on finger vein recognition using Gabor filters.

Adams Wai-Kin Kong et al [5] proposed a paper which presents a new method for extracting features from palmprints using the Competitive Coding Scheme and angular matching.

Jinfeng Yang et al [6] introduced a new and robust approach for finger-vein ROI localization, and then proposes a new scheme for effectively improving the visibility of finger-vein imageries.

Jian-Gang Wang et al [7] presented a multimodal personal identification system using palmprint and palm vein images with their fusion applied at the image level. The palmprint and palm vein images are fused by a new edge-preserving and contrast-enhancing wavelet fusion method in which the modified multiscale edges of the palmprint and palm vein images are combined.

III. SYSTEM OVERVIEW

FRAMEWORK OF THE PROPOSED SYSTEM:

System consists of three stages namely,

- a) Image acquisition
- b) Segmentation
- c) Feature extraction

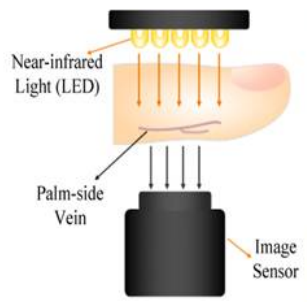
IMAGE ACQUISITION:

Image acquisition is defined as the act of retrieving an image from a source, usually a hardware-based source, which can be passed through whatever processes need to occur afterward.



(a)

Fig(a) explores, the person should place their finger in the sensor, which senses and captures the image of the finger vein. The person should place their finger in an exact position, otherwise the device will not detect the finger vein.



(b)

Fig(b) explains a clear view of the previous figure. When the finger is placed in between the LED and the image sensor, infra red light falls on the finger from the upper side at the same time the vein is sensed from the lower side by the image sensor. This image after that undergoes segmentation and feature extraction.

IMAGE SEGMENTATION:

Image segmentation is a process which is typically used to locate objects and boundaries in images.

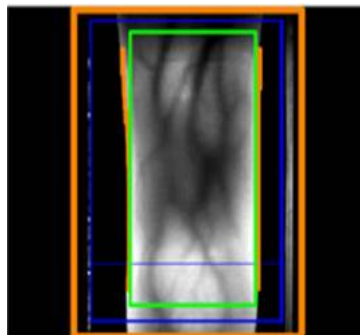
In order to perform segmentation edge detection masks are found using gradient operator shown in fig(c). The condition to detect an edge is

$\text{Value of gradient} > \text{Value of threshold}$
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1	0	-1	-1	0	1
2	0	-2	-2	0	2
3	0	-3	-3	0	3
4	0	-4	-4	0	4
5	0	-5	-5	0	5
6	0	-7	-6	0	7
7	0	-7	-7	0	7
6	0	-6	-6	0	6
5	0	-5	-5	0	5
4	0	-4	-4	0	4
3	0	-3	-3	0	3
2	0	-2	-2	0	2
1	0	-1	-1	0	1

(c)
Edge Detection Masks

After the edge detection mask is obtained boundaries are set to find the region of interest and to segment the image. Two boundaries namely the horizontal and the vertical boundary are set to 100 and 200 pixels respectively shown in fig(d).



(d)
ROI Localization and segmentation

FEATURE EXTRACTON

The segmented and the optimized image of the finger vein and iris respectively are applied to the Gabor filter to pre-process the image. Gabor filter is the best extraction tool. The Gabor filter gives three types of output such as magnitude code, Phase code and Orientation code. These outputs can be used both by individual or combining all the codes and apply to a system. In this paper, we propose a new combines the magnitude code and orientation code of Gabor filter [1]. A two-dimensional even-symmetric Gabor filter can be defined in equation (1)

$$G(x, y) = \exp\left(-\left(\frac{x_\theta^2}{\sigma_x^2} + \frac{y_\theta^2}{\sigma_y^2}\right)\right) \cos(2\pi f x_\theta)$$

where $\begin{bmatrix} x_\theta \\ y_\theta \end{bmatrix} = \begin{bmatrix} \cos \theta & \sin \theta \\ -\sin \theta & \cos \theta \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} \dots(1)$

Here, f denotes the filter center frequency, θ is the orientation parameter as in (2), and

$$\theta = \frac{j\pi}{J} \quad J = \{0, \dots, J - 1\} \quad \dots(2)$$

σ_x and σ_y , are the standard deviations of the elliptical Gaussian envelope, x_θ and y_θ are rotated versions of the coordinates (x, y) of the Gaborfilter. The number of Gabor filters J is fixed to 6.

3.5 Magnitude Preserved C² Scheme

The CompCode scheme [1] has been widely used in palm-print and FKP recognition. Here, we applied the CompCode scheme as our feature extraction method. Image I^k convolves with Gabor filter bank G^k. At each pixel I^k(x, y), the orientation that corresponds to the minimal response of the Gabor filters (i.e. negative response with greatermagnitude) represents the trend of the line, thus the orientation number is kept as OrientCode^k as in (3)

$$Orientcode^k(x, y) = argmin_j \{I^k(x, y) * G^k(x, y, \theta_j)\} \dots(3)$$

where* stands for the convolution operation. OrientCode^k(x, y) ranges from 0 to J-1 [5]. The magnitude code is given in (4).

$$Magnocode^k(x, y) = \frac{ceil((M^k(x, y) - t_{min}) / \frac{(t_{max} - t_{min})}{N})}{N} \dots(4)$$

wheret_{max} = max(W_{km}(x, y)), and t_{min} = min(W_{km}(x, y)), W_{km} is the m x m square region centred at position (x, y) of M_k, andN is the number of quantization levels. The values of MagnCode_k are within the range of 1 to N. The Fig6 shows the CompCode image [1].

Algorithm for Comparative Competitive Coding scheme[1].

Input OrientCode(v), MagnCode(v)
Output c²code

If Orientcode(v) = Magncode(v)
then c² code=Orientcode(v)

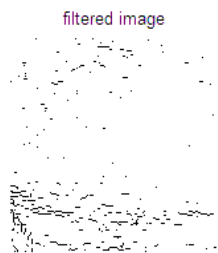
If Orientcode(v)<Magncode(v)
thenc² code=Orientcode(v)

If Orientcode(v)>Magncode(v)
thenc²code=Magncode(v)

The above figure shows the algorithm of comp code. The outputs of the gabor filter, i.e. Magncode and Orientcode are considered as the input. By considering some pixels in position(x,y) with their Magncode and Orientcode values form three situations.

- i. Orientcode(v)= Magncode(v) (1)
- ii. Orientcode(v)< Magncode(v) (2)
- iii. Orientcode(v)> Magncode(v) (3)

In situation (1) both the values are equal so we can simply set C² code=Orientcode(v). If Orientcode is greater than the Magncode means then set Orientcode as a C² code else set Magncode as C² code. The resulting fusion map is named the comparative competitive code (C²Code) [1].



(g)

Final image stored in database

IV. CONCLUSION

This paper presents a new effective biometric to provide authentication for ration card by the key factor finger vein. Finger vein authentication will be effective when comparing with other biometrics. Forgery is not possible with finger vein, as it differs for every individual. This will blackout the duplicate ration cards and duplicate authentication. It also cannot pay way to the PDS shop owners who is selling the subsidized foods and goods in the black market. Vein scanning cannot be done without the knowledge of a person because scanning of vein can only be done with exact positioning of the finger. The only limitation in this method is, that the cost of the image capturing device which is used in this proposed system is expensive which itself becomes an advantage for reducing the rate of forgery, because the person who performs forgery also needs appropriate expensive devices to carryout forgery.

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