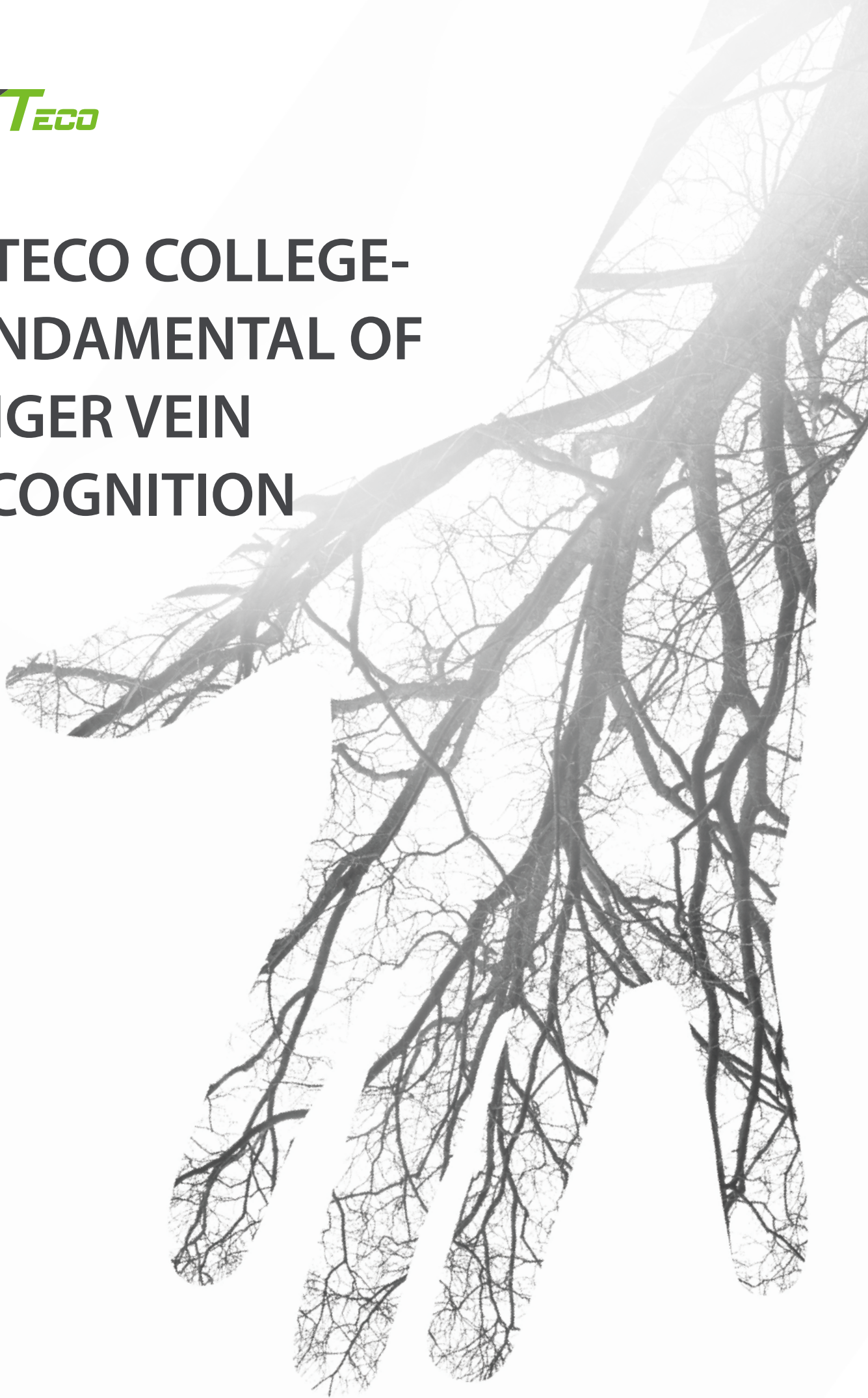
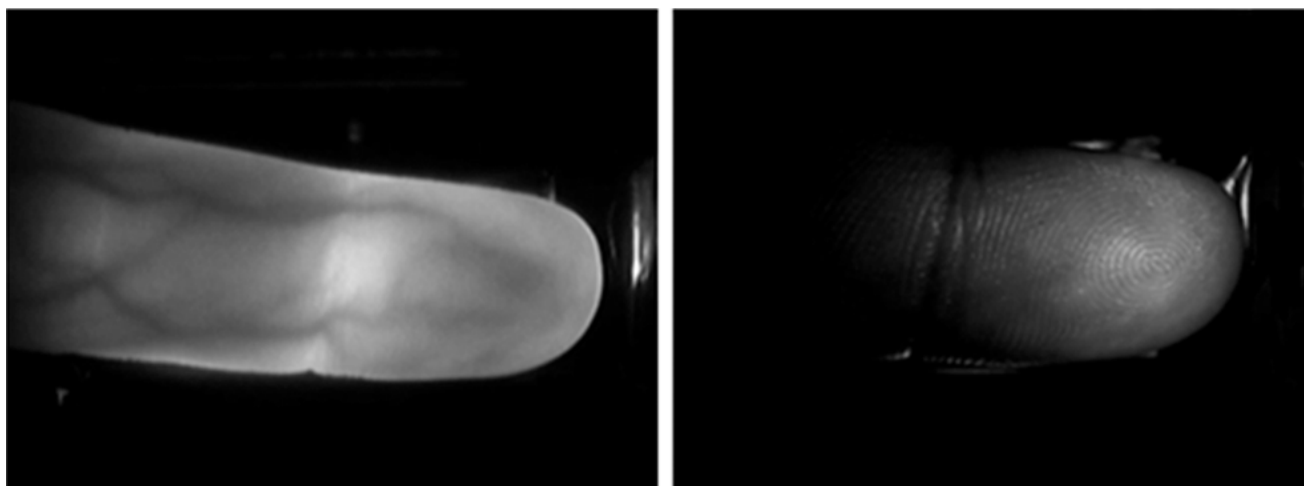




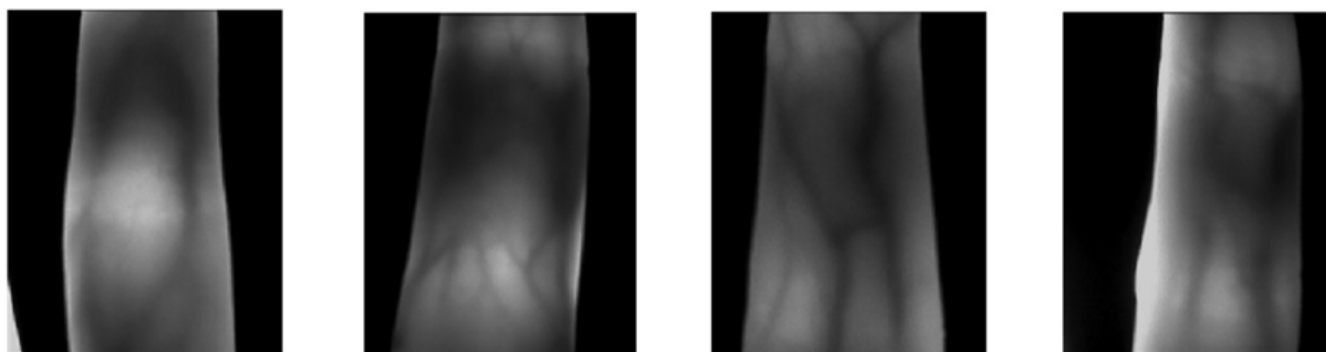
ZKTECO COLLEGE- FUNDAMENTAL OF FINGER VEIN RECOGNITION



What are Finger Veins?



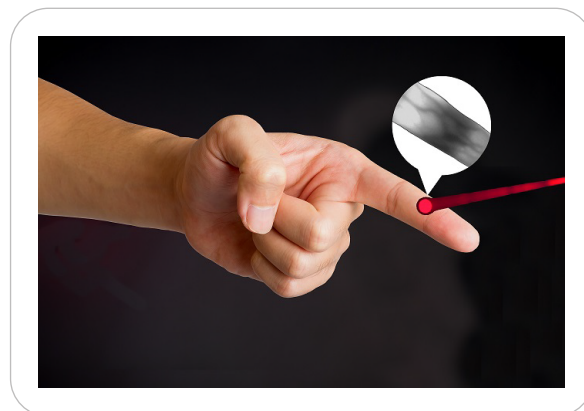
Veins are blood vessels which present throughout the body as tubes that carry blood back to the heart. As its name implies, finger vein is the tiny blood vessels inside fingers.

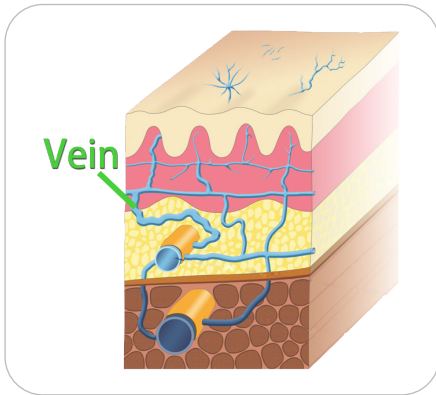


They grow in a pattern which is unique to every individual.

What is Finger Vein Recognition?

Finger vein recognition is a method of biometric authentication that uses pattern-recognition techniques based on images of human finger vein patterns beneath the skin's surface.

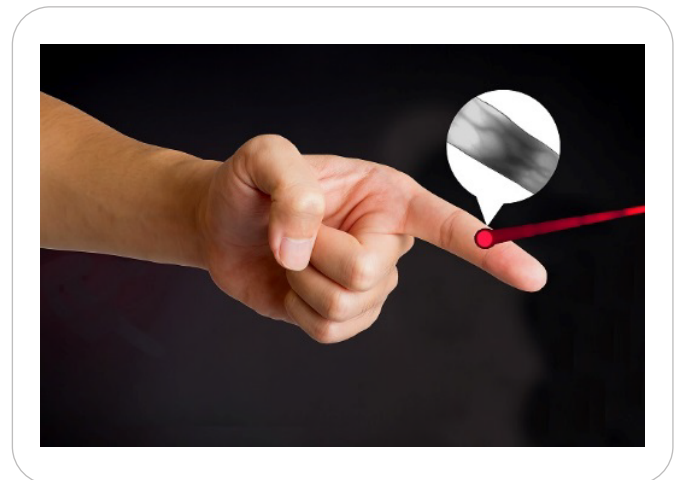




Finger vein recognition is one of many forms of biometrics used to identify individuals and verify their identity. Finger vein patterns are almost impossible to counterfeit because they are located under the skin's surface.

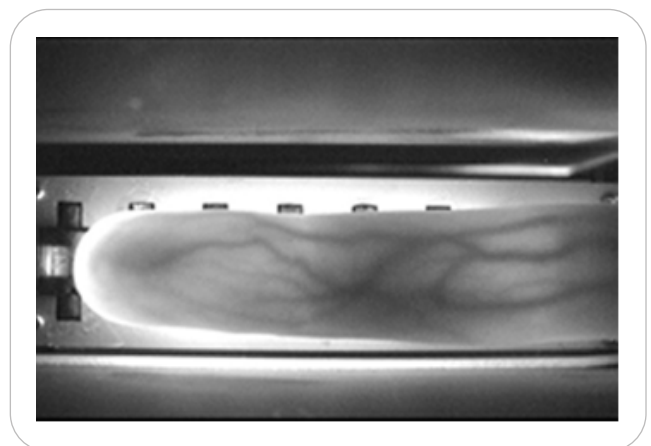
Technical Algorithm

1. The principle of finger vein recognition is to use infrared ray to capture the specified patterns of veins in fingers and match them with templates.
2. Finger vein is the inside feature of finger. The technique of finger vein recognition utilizes the reaction of hemoglobin of human blood and infrared ray with specified wave length. Bones, muscles, fat and skin in the finger will also affect veins, but the patterns and structure of veins cannot be changed. Therefore, CMOS module with high response curve of near-infrared ray and high transfer speed is usually used as finger vein scanner.



Capturing finger vein data

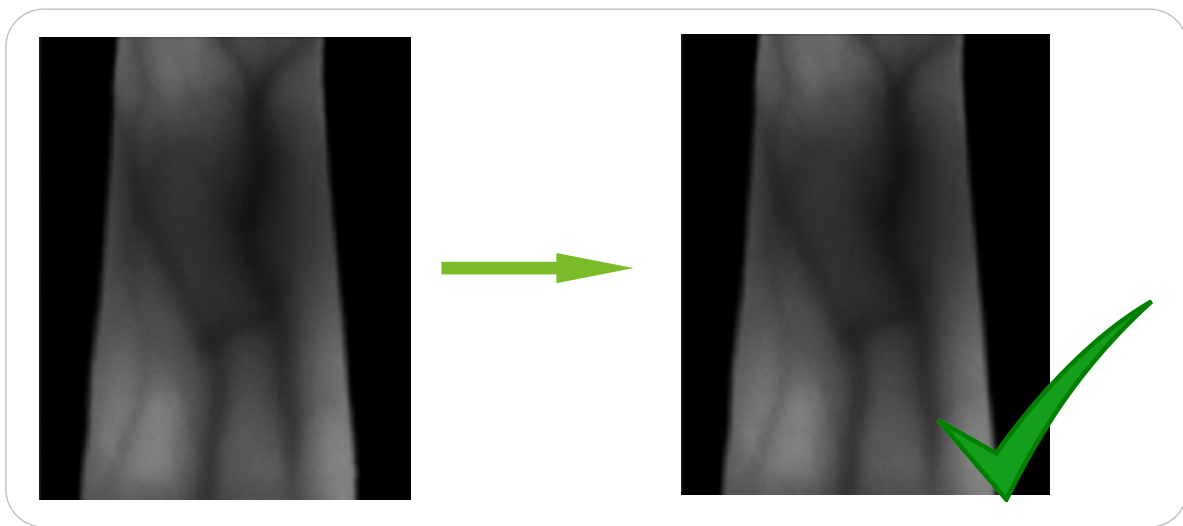
Finger vein image is captured in distribution pattern. Data mainly present in the position and distribution of vein. Terminal points, bifurcation points and turning points provide the largest amount of data and thus used as featured data.



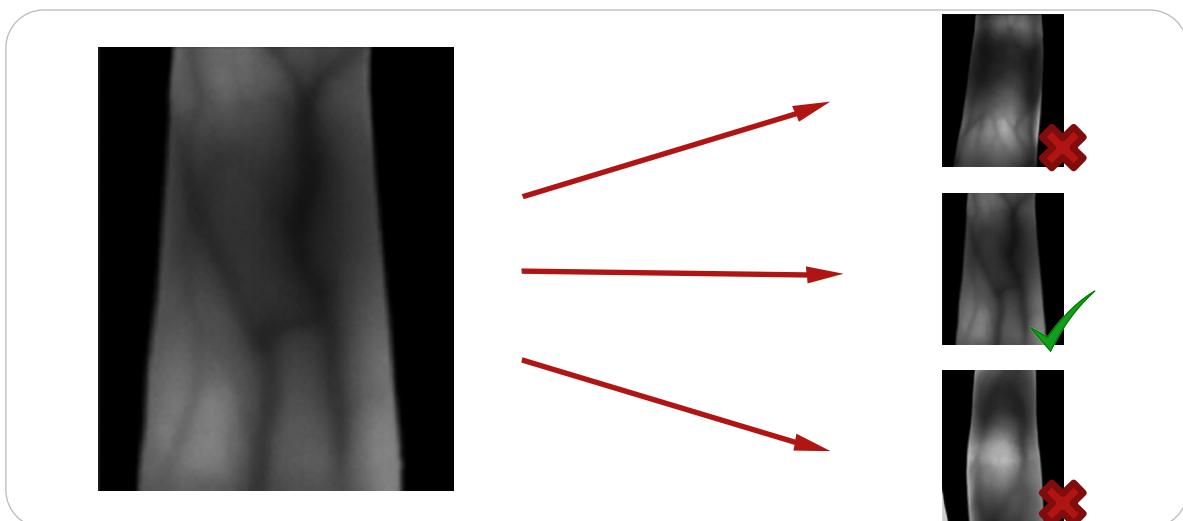
Finger Vein Features Extraction and Matching

1. Fingerprint and finger vein features matching is the process of matching the present finger vein with the pre-saved finger vein templates, and to determine whether 2 finger vein images are captured from the same finger. There are two major types of matching finger vein: Finger Vein Verification and Finger Vein Identification.

2. Finger Vein Identification (1:1) means storing a person's personal information and finger vein features in database in a certain effective format, and re-collecting finger vein image information for 1:1 matching with the stored features and determining whether two features are from the same finger. In the meantime, the matching of finger veins may be performed in various methods including fingerprint, finger vein and fingerprint & vein.



3. To process finger vein recognition, no other information of the user is needed. Finger vein image data captured on site will be compared with several saved data one by one, and try to match within those data. This is a "1:N" comparison.



Existing finger vein features include vein pattern, vein texture, minutiae points and learnt features

1. Vein line characteristic: Capturing the pattern from finger vein grayscale image. These features present a better topographical structure of veins.

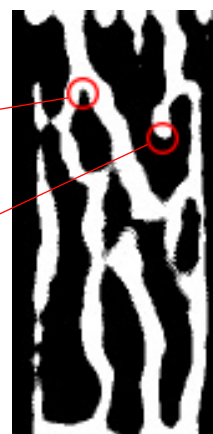


2. Vein texture characteristic: During the process of finger vein recognition, the texture characteristics of image are mainly presented in partial binary codes. The binary codes are transformed by the comparison of the grayscale of existing pixels and grayscale of area pixels.

3. Minutiae point characteristic: The minutiae points of finger vein recognition refers to the terminal points and bifurcation points of blood vessels.

Bifurcation Point

Terminal Point



4. Learnt features: Through machine learning methods, features of finger vein can be extracted. For example, through dimensional reduction by Principle Component Analysis to the effective area of finger vein image can be captured the feature of main component amount of finger vein image.



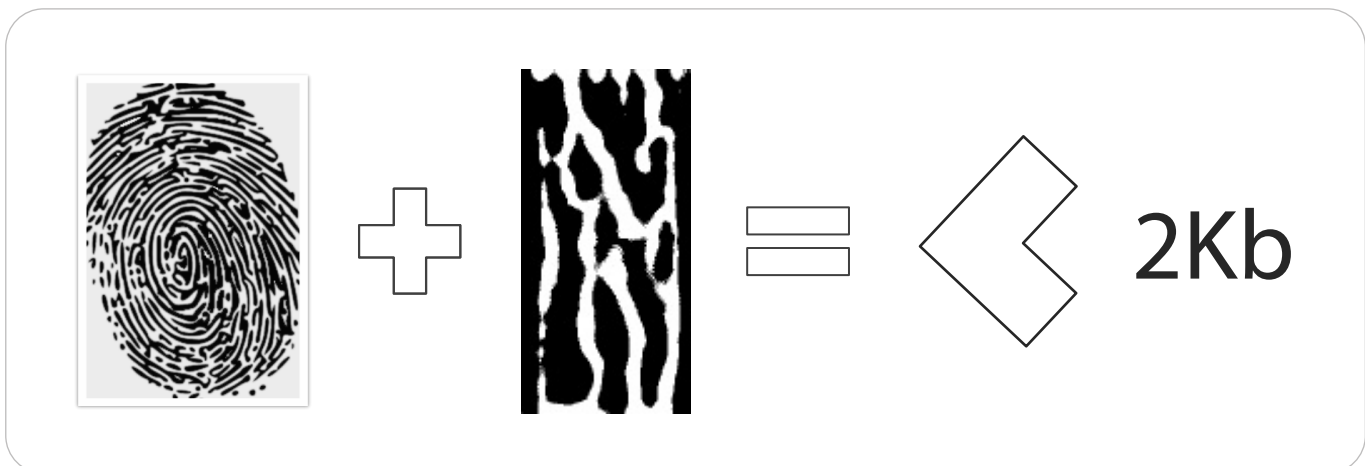
Main Features of combining fingerprint and finger vein technology

1. Since finger veins are covered by skins and invisible to human eyes, there are lower risks of spoof or duplicated vein features, and it is even lower of the combination of fingerprint and finger vein features, which provide higher anti-spoof ability;



2. Suitable for large-scale users: the combination of fingerprint and finger vein verifications can reduce rejection and failure of verification and enables applications with a large number of users;

3. Small Storage Space Required: the template of fingerprint and finger vein is lower than 2Kbyte.



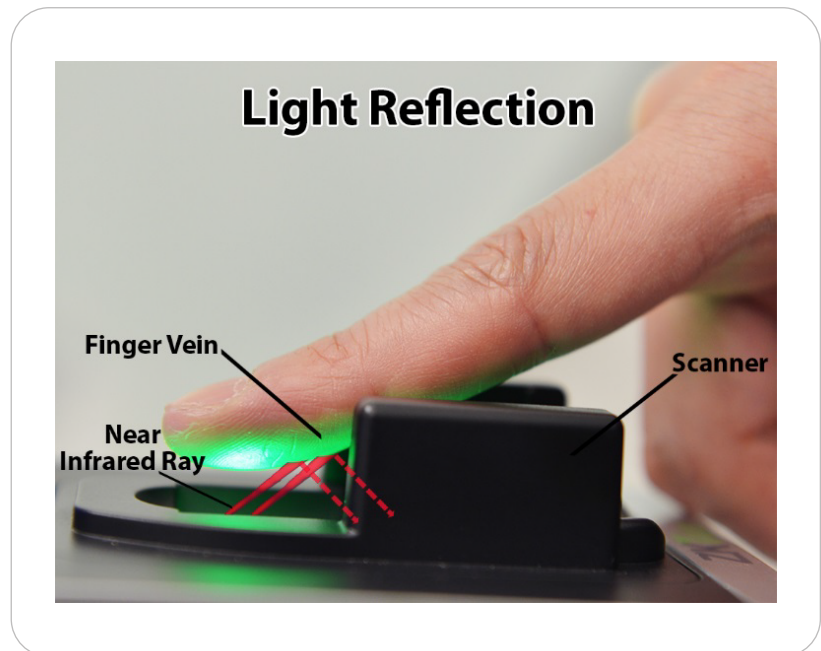
Types of Finger Vein Scanners

Finger Vein Scanners can be diversified mainly into 2 types: Light Reflection and Light Transmission.

1. Light Reflection

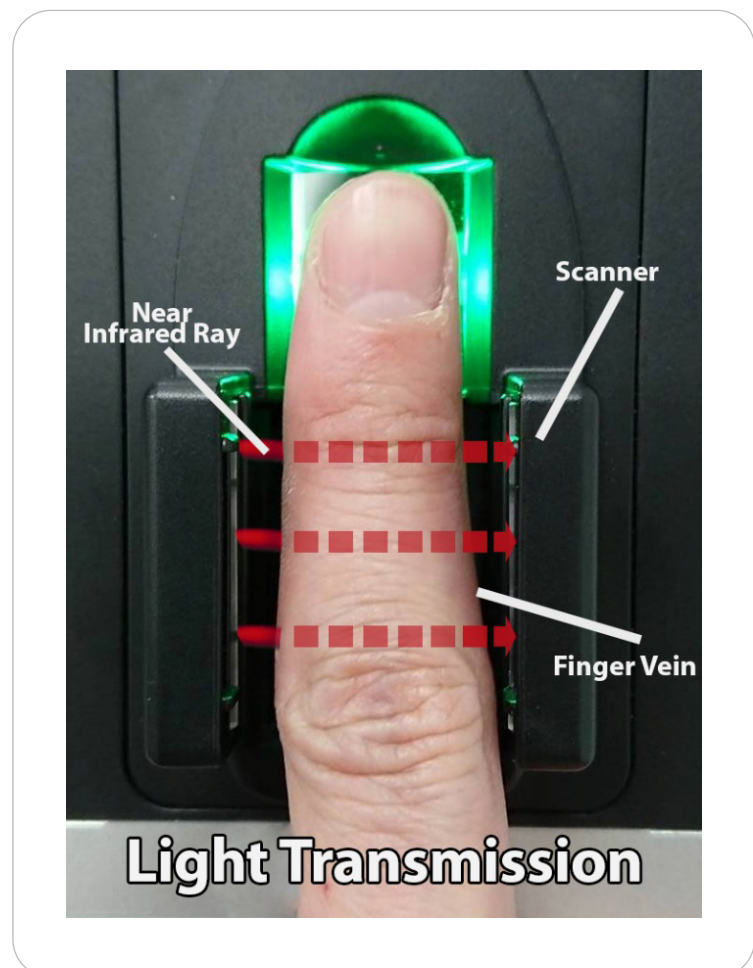
The light source and the image sensor are placed on the same side of the finger, and the image sensor captures the reflected light from the surface of the finger.

Light reflection method is mainly used by ZKTeco.



2. Light Transmission

The finger is placed between the image sensor and the light source, and the near-infrared light passes through the finger where it is captured by the image sensor.



Matching Process of Finger Vein Image

Offers one-stop point-to-point finger vein extraction methods based on in-depth learning method, and extract ridges of finger vein vessels and process the large offsets and rotations of finger position; Matching features of finger veins with complex matching algorithm.

