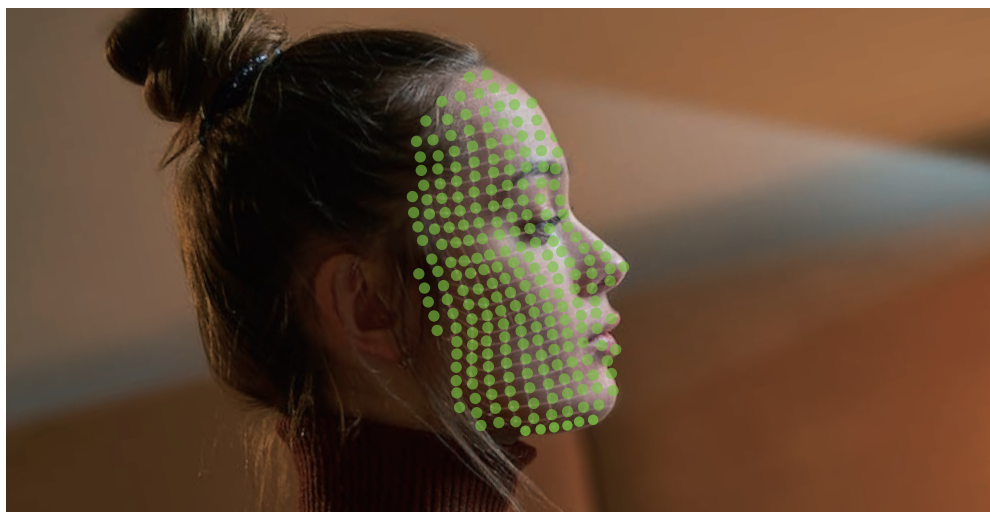
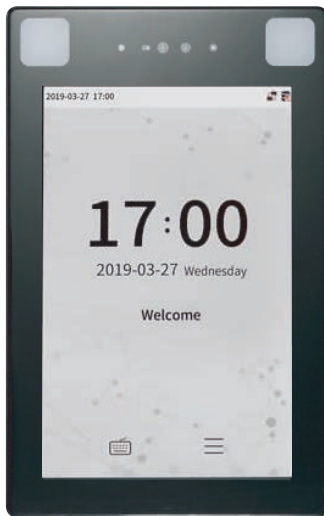


Introduction of 3D Structured Light Facial Recognition



ZKTeco applies the pioneering 3D surface imaging technique and develops its 3D Structured Facial Recognition, which proactively projects light to an object and observes light coding of the object's surface to calculate the disparity between the original projected patterns and the observed patterns deformed by the surface. The techniques enables higher accuracy of facial recognition, better performance in weak light source environment and ability to operate from shorter distance.





Introduction of 3D Structured Light Facial Recognition

With continuous development of high definition and high speed sensor, 3D surface imaging technology has achieved a new height in biometric technology. In particular, the 3D structured light surfacing imaging technology has been applied to the industry of access control.

ZKTeco combines its facial recognition technology with 3D structured light technique, which not only obtains vertical and horizontal details but also depth, significantly eliminating limitations on the perception and understanding of real objects.

What 3D structured light facial recognition is

3D structured light facial recognition is a cutting edge technology, it calculates the depth and surface information of the objects by projecting light patterns (generally in grids or horizontal bars) with a high speed camera system.

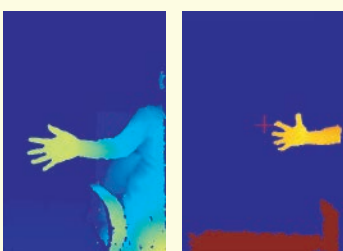
- Higher accuracy
- Better performance in weak light environment
- Highest performance in a short to med distance



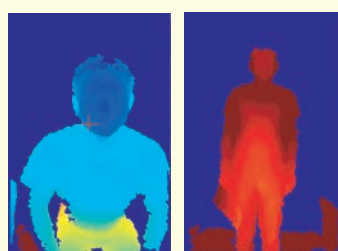
Core Algorithm with Independent Intellectual Rights

ZKTeco 3D Facial Recognition Algorithm reads and transforms 3D points of face including X, Y, and Z data, which offers higher level of security and verification preciseness, and is suitable for applications with high security demands like access control barriers.

It has achieved industry-top level according to both internal tests and clients' feedback.



5-finger depth image in 0.5m - 1.2 m



Full-perspective full-body depth from 0.5 - 1.2m

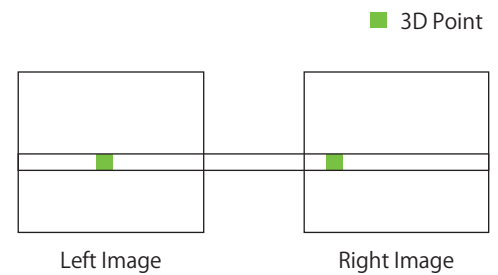


Example: depth image of 40cm

Principles of Binocular Vision

The 3D depth is calculated with the visual difference of the imaging by the duo-lens camera.

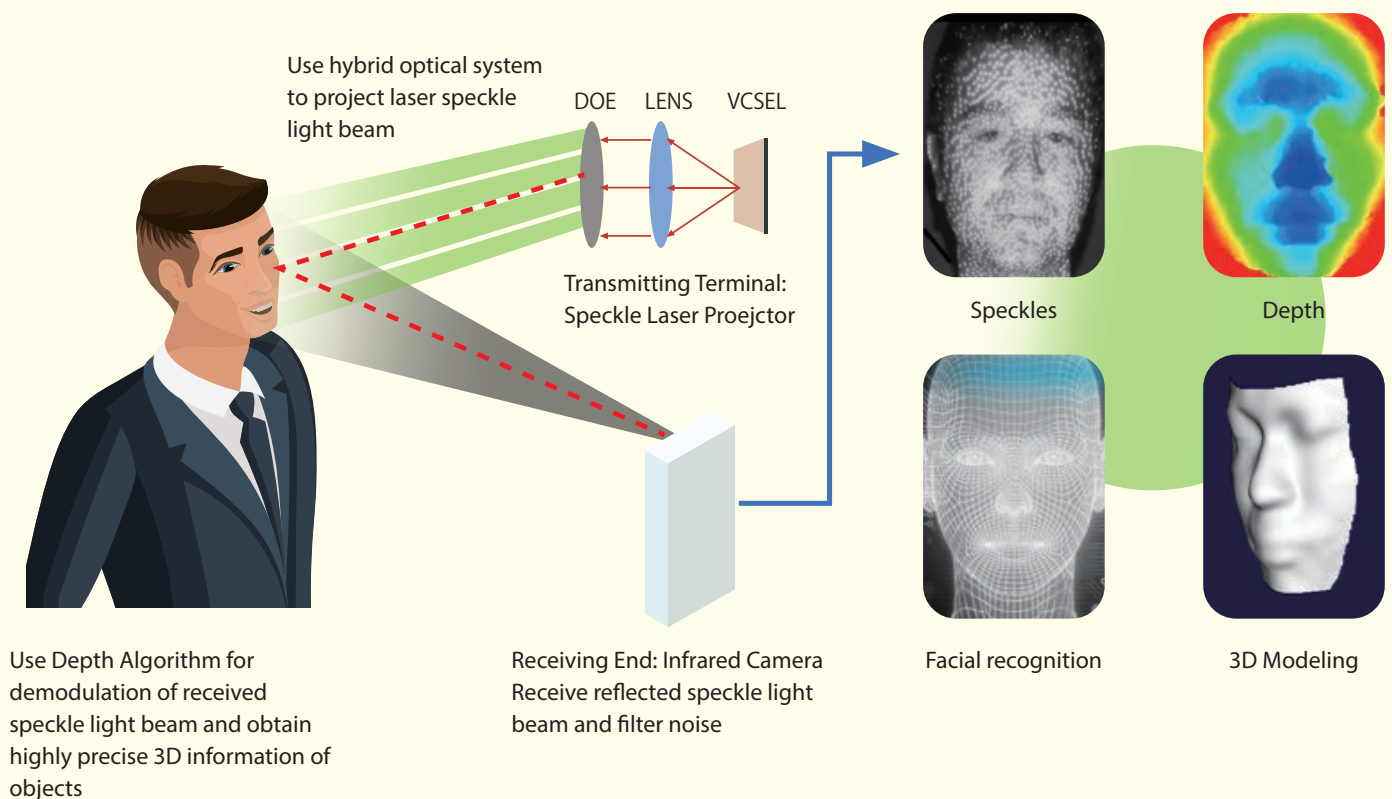
- It requires matching of the resolution difference of two images, as the duo-lens camera performs passive imaging, the changes of external light source environment have great influence.
- Low preciseness due to calculation with raw images.
- The binocular algorithm has huge computational amount and high requirement of processor. It demands high cost for high preciseness in embedded products.



Principles of Structured Light

Depth is calculated with Speckle Images with special coding

- Actively projects speckle light spots to calculate depth, which is less affected by the external light source environment
- Higher preciseness with specially coded speckle images

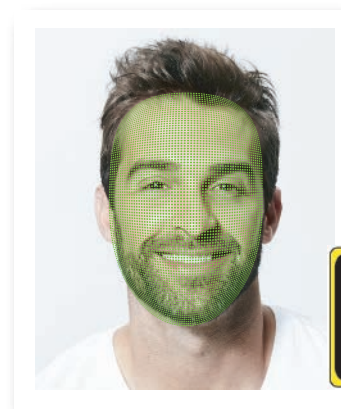
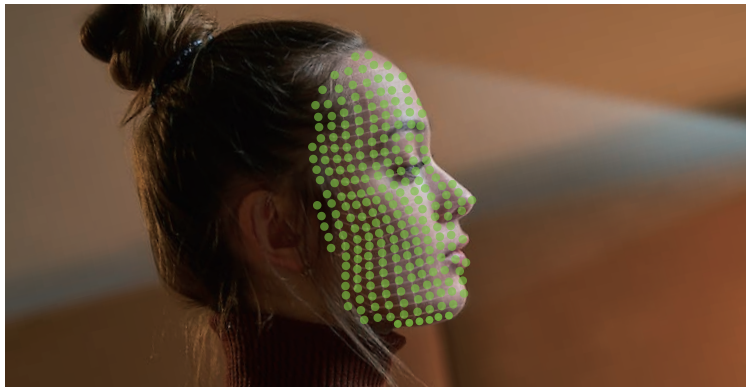


30,000 Laser Dots



30,000 Laser Dots

Generally, the more laser spots on facial detection, the more accurate of facial recognition detection is. While most of the facial recognitions provide 68 focus spots, ZKTeco's cutting edge Structured Light Technology provides 30,000 laser spots on face which are distributed around eyes, nose, mouth and jawline, enabling outstanding recognition adaptability for users and enterprises.



**CLASS 1
LASER PRODUCT**

Class 1

Laser information for ZKTeco's Products

ZKTeco Structured Light Recognition are classified as Class 1 laser product with a safe design, use and implementation of laser to minimize the risk of laser accidents, especially those involving eye injuries.

100% against all 2-dimensional spoof photo and video attacks

• New Height of Anti-Spoofing

With the applied structured light facial recognition, Anti-spoof function has been greatly enhanced and is able to 100% against fake faces, photos and video attacks, which is benefited from the power of structured light to conduct liveness detection by the 30,000-laser spot.

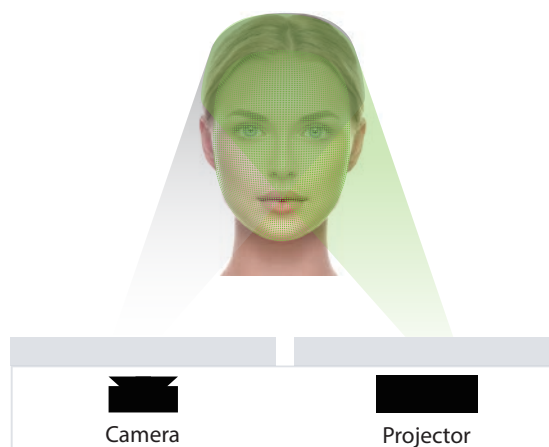
• Anti-Fake Photo and Video Attack

Anti-spoofing function effectively prevents intruders to access the locked areas of a building, as it is able to identify real human faces and photos, it denies unauthorized attempts of access by presenting fake photos and videos to cheat the system.



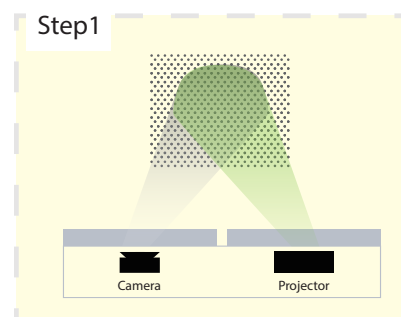
How 3D structured light facial recognition works

Structured light is an active 3D imaging technology, proactively projecting the light to an object. The camera is able to observe the light coding of the object's surface to calculate the disparity between the original projected patterns and the observed patterns deformed by the surface.



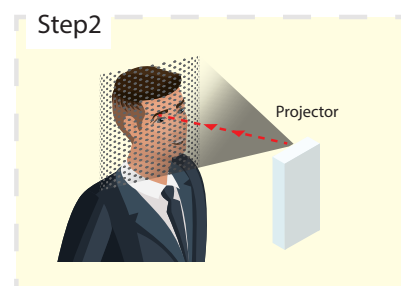
• Step1

3D Structured Light Module applies specific Laser Dot Distribution Structure.



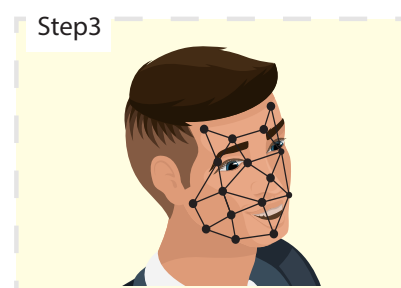
• Step2

Able to project up light pattern with up to several ten thousands infrared lights spots.



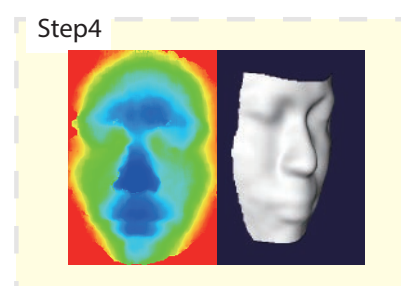
• Step3

Through IR Camera, the deformation of face light spot image and standard light spot image is captured, and depth image is calculated.



• Step4

With Depth Image it is able to be projected in 3D for instant restructuring, and with RGB camera it is able to perfectly restore face details for highly precise liveness detection.





Advantage of using 3D structured light

At present, there are three prevalent 3D imaging technologies, which are binocular stereo vision, ToF (Time of Flight) and structured light. Considering the highest efficiency of light projection, ZKTeco has applied of the 3D structured light technology.

- **Higher accuracy**

Taking advantage of using 3D structured light technology, it consistently achieves higher accuracy than TOF (time of flight) and Stereo Vision by learning the depth of image and comparison with facial features.

- **Better performance in weak light environment**

As an active technique of 3D structured light, it works well in conditions of lacking light, compared with Time of Flight method

- **Highest performance in a short to med distance**

Structured light camera is able to capture an object up to 4 meters, which is suitable for access control that requires a high accuracy of facial recognition in short to medium range.

Technology	3D Structured Light	Binocular stereo vision	ToF
Technique	Active	Passive	Active
Working distance	0.5m - 1.2m	≤2m	0.4-5m
Accuracy	High	Low	Mid
Power consumption	Medium	High	Medium
Application environment	Indoor	Environment where features can be detected	Indoor and outdoor
Software processing requirement	Medium	High	Low
Applications	Facial Recognition	Ranging, 3D reconstruction	VR, AR, autonomous vehicle

ZKTeco Products Applications

ZKTeco's touchless biometric solution is a good fit for this situation that is preventing people or patients from touching the door handle. The solution has been widely used in many practical scenarios, including hospitals, educational institutes, factories, construction sites, shopping malls, IT parks, public transportation, banks, business organizations, small to medium enterprises, government organizations and so on.



Hospitals



Educational Institutes



Factories



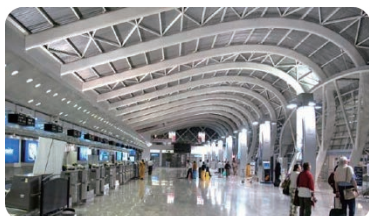
Construction Sites



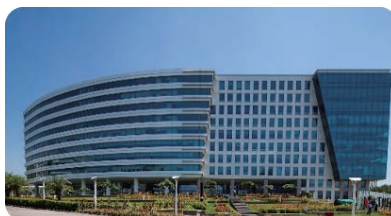
Shopping Malls



IT Parks



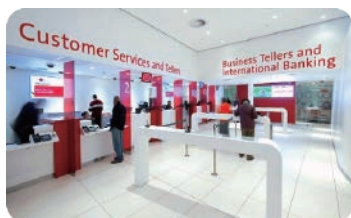
Public Transportation



Business Organizations



Small to Medium Enterprises



Banks



Government Organizations

