

# **ZKFinger SDK 5.0 Manual**

**ZKFinger SDK 5.0**  
**ZKSoftware Inc.**  
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# 1. ZKFinger Algorithm Description

ZKFinger algorithm is a kind of quick and accurate 1:1 and 1:N fingerprint identification algorithm, which is totally open to software developers and system integrators. If you use ZKFinger to identify fingerprints (2000-6000 pieces of fingerprints), you can complete the identification task easily within 1-5 seconds (the following tests require Pentium III 900MHz+ 128MB EMS memory) without categorizing fingerprints by names, PIN or any others in advance. ZKFinger algorithm has the following features:

- 1、 ZKFinger software development package can be quickly integrated to customers' systems, and can support any scanner device and fingerprint Sensor (Image quality  $\geq 300$ DPI) through open image process interface.
- 2、 By strainer mirrors and adequate valve values which are self-adaptive or can be easily matched, ZKFinger algorithm is able to weaken noise, increase the contrast degree of the bridge and vale, and even to capture whole or partial feature points from fingerprint of bad quality (fingerprint which is dirty, too dry or wet, broken, or with wounds, scars and marks) .
- 3、 ZKFinger algorithm identification supports the translation of fingerprints ( $\geq 35\%$  of the fingerprint size) and circumrotation for 360 degree. Special technology is used to realize speedy verification when the fingerprint is translated or rotated for 360 degree (the average speed is 3000 pieces/second). Even when the fingerprint has few feature points ( $\leq 10$  , normally fingerprint's feature points  $\geq 15$ ), this function can also be achieved.



- 4、 ZKFinger algorithm does not require global feature points (core point, triangular point), and identification can be completed by local feature points.
- 5、 Through classification algorithm (fingerprints are classified into five categories: arch category, left loop category, right loop category, tine arch category, and vortex category), ZKFinger use global feature ordering in advance, which accelerates the process of fingerprint verification remarkably.
- 6、 ZKFinger algorithm is quite concise: data only need 350K memory, so that they can easily be imported into embedded systems.

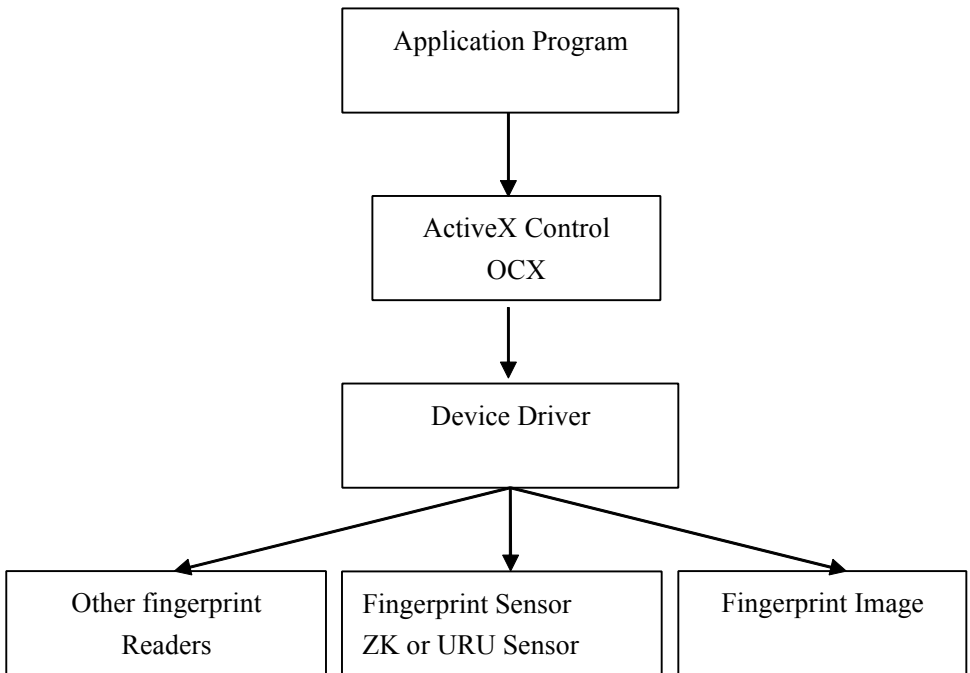
ZKFinger was used to test 2000 pieces of fingerprints collected from four Sensors (YLC, DFR200, U.are.U, and Authentec), every piece of fingerprint was verified with the other ones, and verification and test were carried out for altogether 4,000,000 times, and eventually the following test results were achieved:

|                            |                      |
|----------------------------|----------------------|
| Template size              | 310 or 1152 Byte     |
| Rotation                   | 0 – 360 degree       |
| FAR                        | $\leq 0.001\%$       |
| FRR                        | $\leq 2.0\%$         |
| Registration time          | 0.5 second           |
| Average verification speed | 2500 pieces/second   |
| Image quality              | $\geq 300\text{DPI}$ |

## 2. ZKFinger SDK Architect

ZKFinger SDK 5.0 Pro (Software Development Kit) mainly exists in the form of ActiveX, and users can develop application programs relative to fingerprint sensors by means of varied development languages (such as VC++, C++ Builder, Delphi, VB, Visual FoxPro, PB and so on).

### SDK Architecture:



### **3. Software Installation**

Before installing ZKFinger SDK, please make sure that your operation system and the configuration of your computer meet the requirements to run the software.

Before the installation, if your computer has been connected with a fingerprint Reader, you'd better pull it out.

1. Run setup.exe. Click Next button, and you can enter the following operation steps.
2. If it's windows 7 system, please install the patch in "Win7 Patch" folder.

## 4. ActiveX Control Reference

ZKFinger SDK 5.0 Pro is divided into two controls: 1:1 and 1:N. For these two, their interfaces are basically of the same property and method, and the methods for the two interfaces only differ in the verification related to 1:N. In our further description, we will try to display the two controls comprehensively, and their differences will be labeled and illuminated.

VB language expression is used here, and fingerprint template Variant variable show as one-dimension byte arrays.

### 4.1 Property

#### 4.1.1 Active as Boolean

##### ***Read only***

It indicates whether the fingerprint Reader set by currentSensorIndex has got ready or not.

#### 4.1.2 EngineValid as Boolean

##### ***Read only***

It indicates whether the fingerprint identification system is performing normally or not. If the function initEngine has been used, effective result will be returned.

#### 4.1.3 EnrollIndex As Long

##### ***Read only***

The sampling order number at fingerprint registration, that is, the effective times for successful fingerprint registration at present.

#### **4.1.4 EnrollCount As Long**

The times for sampling fingerprints at registration, whose value ranges is 1 or 3 or 4.

#### **4.1.5 FPEngineVersion AS String**

It indicates the version of fingerprint algorithm. It's "9" (ZKFinger 9.0) as default. You can set "10" (ZKFinger 10.0). You should set it before InitEngine.

#### **4.1.6 ImageHeight AS integer**

***Read only***

It indicates the height of the fingerprint image.

#### **4.1.7 ImageWidth AS integer**

***Read only***

It indicates the width of the fingerprint image.

#### **4.1.8 IsRegister As Boolean**

***Read only***

It indicates whether a fingerprint is being registered or not.

#### **4.1.9 OneToOneThreshold As Boolean**

Set the identification threshold value (1-100) for ZKFinger low-speed fingerprint verification—one-to-one, and the default value is 10. The larger of the value, the lower the FAR and the higher the FRR are.

**Note:** 1:1 control doesn't have this property.

#### **4.1.10 RegTplFileName As String**

Set to save the file name of the fingerprint registration template when the event OnEnrollToFile is taking place.

#### **4.1.11 SensorCount As Long**

##### ***Read only***

It indicates the number of fingerprint Readers which are connected to the computer, and if EngineValid is invalid, 0 is returned.

#### **4.1.12 SensorIndex AS Long**

Select the order number of the fingerprint head when multiple fingerprint Readers are connected. The serial number starts from 0, and if the number is smaller than 0, the fingerprint Reader will not work.

#### **4.1.13 SensorSN As String**

It indicates the serial number for hardware of the fingerprint Reader.

#### **4.1.14 TemplateLen As Long**

##### ***Read only***

It indicates the byte length of the fingerprint registration template.

**Note:** The template length is 1152 bytes for 1:N, and the template length is 310 bytes for 1:1.

#### **4.1.15 Threshold As Long**

Set the verification and identification threshold value (1-100) for the fingerprint identification system, and the default value is 10. The larger the value, the lower the FAR and the higher the FRR are.

### **4.1.16 VerTplFileName As String**

Set to save the file name of the fingerprint verification template when the event OnCaptureToFile is taking place.

### **4.1.17 LastQuality As Long**

#### ***Read only***

Lastest quality of fingerprint. You can get this property when event OnFeatureInfo triggered. When property LastQuality is less than LowestQuality, event OnFeatureInfo will return Insufficient feature points.

### **4.1.18 LowestQuality As Long**

Set allowed lowest quality of fingerprint. The default value is 60. When property LastQuality is less than LowestQuality, event OnFeatureInfo will return Insufficient feature points.

## **4.2 Method**

### **Methods for the Control Interfaces of 1:1 and 1:N**

#### **4.2.1 Sub BeginEnroll()**

Begin to register fingerprints, and the event OnEnroll will take place when the registration completes.

#### **4.2.2 Sub CancelEnroll()**

Cancel the current status of fingerprint registration, that is, the operation started from BeginEnroll will be cancelled by this function.

## **4.2.3 Function DongleIsExist As Boolean**

Examine whether Doggle is existing or not.

## **4.2.4 Function DongleSeed(Byval lp2 As Long, Byval p1, p2, p3, p4 As Integer) As Boolean**

Obtain four 16-digital integral (p1, p2, p3, p4) return values for the seed code lp2. Doggle can compute a seed code by interior algorithm, which results in four return codes. Seed code algorithm is not open, and by examining whether the return codes are of the expected value we can examine whether Doggle is existing or not.

## **4.2.5 Function DongleUserID As Long**

Read User ID in Doggle, and User ID will not repeat. Save it in specific location within Doggle.

**This function has been canceled, here in order to compatible with before, we keep up this function.**

## **4.2.6 Function DongleMemRead(Byval p1, p2 As Integer, buf) As Boolean**

Read the p2 bytes started from p1 located in Doggle memory to Variant variable buf (one-dimension byte array). There are altogether 24 bytes in the memory, located from 0 to 23.

**This function has been canceled, here in order to compatible with before, we keep up this function.**

## **4.2.7 Function DongleMemWrite(Byval p1, p2 As Integer, buf) As Boolean**

Write Variant variable buf (one-dimension byte array) to the p2 bytes started from p1 located in Doggle memory. There are altogether 24 bytes in the memory, located from 0 to 23.



**This function has been canceled, here in order to compatible with before, we keep up this function.**

#### **4.2.8 Function GetTemplate()**

Get the fingerprint template, which is obtained most recently.

#### **4.2.9 Function GetFingerImage(Byval AFingerImage) As Boolean**

Get the fingerprint image (BMP format), which is obtained most recently.

#### **4.2.10 Function InitEngine() As Long**

Initialize the fingerprint identification system. Property such as SensorCount, SensorSN, EngineValid, ImageHeight and ImageWidth will not return accurate results only after this function has been called. Return values:

0 Initialization succeeded.

1 The loading of the fingerprint identification driver failed.

2 Fingerprint Sensor has not been connected.

3 The fingerprint Reader appointed by the property SensorIndex dose not exist (**Note:** Set the property SensorIndex before calling the function).

Method EndEngine can be used to release the fingerprint device system.

#### **4.2.11 Function VerFinger(byval regTemplate, verTemplate, AdoLearning As Boolean, byval AregFeatureChanged As Boolean) As Boolean**

Compare whether the feature templates for two pieces of fingerprints are matched or not. Here, regTemplate represents fingerprint registration feature templates, verTemplate expresses fingerprint verification feature templates which are collected on the spot, AdoLearning denotes whether to carry out fingerprint feature template learning updating or not, and AregFeatureChanged shows whether the registration template regTemplate has been changed or not. True will

be returned when the two pieces of fingerprints are matched, and False will be returned when not matched.

**Explanation:**

The fingerprint feature will vary to certain extent with the time, usually which will not pose an influence on the verification of fingerprints. While by fingerprint feature template learning updating, the system can obtain an integrated new template, so as to lower the FRR.

**4.2.12 Function VerFingerFromFile(regTemplateFile As String, verTemplateFile As String , AdoLearning As Boolean, byval AregFeatureChanged As Boolean) As Boolean**

Compare whether the feature templates for two pieces of fingerprints are matched or not. Here, regTemplate represents fingerprint registration feature templates, verTemplate expresses fingerprint verification feature templates which are collected on the spot, AdoLearning denotes whether to carry out fingerprint feature template learning updating or not, and AregFeatureChanged shows whether the registration template regTemplate has been changed or not. True will be returned when the two pieces of fingerprints are matched, and False will be returned when not matched.

**4.2.13 Function VerRegFingerFile(RegTemplateFile As String, verTemplate, AdoLearning As Boolean, byval AregFeatureChanged As Boolean) As Boolean**

Compare whether the feature templates for two pieces of fingerprints are matched or not. Here, regTemplate represents previous fingerprint registration feature templates in the file specified by FileName, verTemplate expresses fingerprint feature templates which are collected on the spot, AdoLearning denotes whether to carry out fingerprint feature template learning updating or not, and AregFeatureChanged shows whether the registration template regTemplate

has been changed or not. True will be returned when the two pieces of fingerprints are matched, and False will be returned when not matched.

#### **4.2.14 Sub PrintImageAt(HDC As OLE\_HANDLE, X As Long, Y As Long, aWidth As Long, aHeight As Long)**

At the location specified by (x,y), display the fingerprint image in accordance with the size specified by (aWidth, aHeight). HDC is the HDC for the window in which the fingerprint will be shown.

#### **4.2.15 Sub PrintImageEllipseAt(HDC As OLE\_HANDLE, X As Long, Y As Long, aWidth As Long, aHeight As Long, bkColor As OLE\_COLOR)**

At the location specified by (x,y), display the fingerprint image in accordance with the size specified by (aWidth, aHeight). HDC is the HDC for the window in which the fingerprint will be shown. Here the fingerprint image is surrounded by an ellipse.

#### **4.2.16 Sub SaveBitmap(FileName As String)**

Save the last fingerprint image to the bitmap file specified by FileName.

#### **4.2.17 Sub SaveJPG(FileName As String)**

Save the last fingerprint image as the Jpeg file that specified by FileName.

#### **4.2.18 Function SaveTemplate(FileName As String, Template) As Boolean**

Save the feature template for the Template fingerprint to the file specified by FileName.

**4.2.19 function EncodeTemplate(ASour, var ADest As String) As Boolean**

Transfer the Variant template ASour used by the control into the template string Adest, which is BASE64 formatted.

**4.2.20 function DecodeTemplate(const ASour As String, ADest) As Boolean**

Transfer the template string ASour which is BASE64 formatted into the Variant-typed template ASour used by the control.

The above-mentioned two methods are mainly used for saving database of templates. Variant-typed templates are saved in the manner of binary-formatted arrays, which are quite difficult for languages such as PB, VB, etc. Method EncodeTemplate can transfer Variant-typed codes into strings, and method DecodeTemplate can transfer string-typed codes into codes of Variant-typed. Here, we should pay attention that the template length will be increased after the template variable BASE64 code has been transferred into the string.

**4.2.21 function EncodeTemplate1(ASour) As String**

Transfer the Variant template ASour used by the control into the template string, which is BASE64 formatted.

**4.2.22 function DecodeTemplate1(const ASour As String) As Variant**

Transfer the template string ASour which is BASE64 formatted into the Variant-typed template used by the control.

**4.2.23 Sub BeginCapture()**

Set the current fingerprint device to begin to capture images, and method CancelCapture can be used to forbid the current device to capture images.

#### **4.2.24 Sub EndEngine()**

Release the fingerprint device initialized by method InitEngine, and method InitEngine can be utilized to re-initialize fingerprint device.

#### **4.2.25 function VerFingerFromStr(regTemplateStr As String, verTemplateStr As String, AdoLearning As Boolean, byval AregFeatureChanged As Boolean) As Boolean**

Compare whether the feature templates for two pieces of fingerprints are matched or not. Here, regTemplateStr(BASE64 formatted string) represents fingerprint registration feature templates, verTemplateStr(BASE64 formatted string) expresses fingerprint verification feature templates which are collected on the spot, AdoLearning denotes whether to carry out fingerprint feature template learning updating or not, and AregFeatureChanged shows whether the registration template regTemplate has been changed or not. True will be returned when the two pieces of fingerprints are matched, and False will be returned when not matched.

#### **4.2.26 function GetTemplateAsString() As String**

Get the fingerprint Verify or Register template, which is obtained most recently. It may be called on OnCapture , OnEnroll, OnCaptureToFile, OnEnrollToFile event. The return result is BASE64 formatted template string.

#### **4.2.27 function ControlSensor(ACode As Long; AValue As Long)As Long**

If ACode=11, control the green light, if it's 12, control the red light, if it's 13, control the beep.

If AValue=1, lights on, if it's 0, lights off.

#### **Explanation:**

Only support ZK4000 sensor and ZK8000 sensor currently.

## Method for 1:N Control Interface

### **4.2.28 Function AddRegTemplateToFPCacheDB(fpcHandle As Long, FPID As Long, pRegTemplate) As Long**

Add the fingerprint registration template pRegTemplate to the fingerprint sensor's high-speed buffer fpcHandle, and FPID is the label for adding registration template.

### **4.2.29 Function AddRegTemplateFileToFPCacheDB(fpcHandle As Long, FPID As Long, pRegTemplateFile As String) As Long**

Add the previous fingerprint registration feature template in the file specified by pRegTemplateFile to the fingerprint identification high-speed buffer fpcHandle, and FPID, which must be equal to or larger than 0, is the label for adding the registration template. If the return value is 1, it indicates a success, and 0 indicates a failure.

### **4.2.30 Function CreateFPCacheDB As Long**

Create the fingerprint identification high-speed buffer. As for 1:N identification, this function must be first called so as to obtain the fingerprint identification buffer handle.

#### **Explanation:**

ZKFinger 1:1 low-speed verification speed is rather slow (about 30ms for PII 233), so fingerprints of 1:1 genre added to the buffer by calling the function AddRegTemplateToFPCache can not be too many; otherwise, the verification speed will be impacted. By IsOneToOneTemplate, we can judge whether the fingerprint is of 1:1 type or not.

At the same time multiple buffers can be created for group comparison and others.

### **4.2.31 Sub FlushFPImages ()**

Delete buffer images in the current fingerprint device.

### **4.2.32 Sub FreeFPCacheDB( fpcHandle As Long)**

Release the fingerprint identification high-speed buffer. FpcHandle is the fingerprint identification buffer handle obtained by calling the function CreateFPCacheDB.

### **4.2.33 Function IdentificationFromFileInFPCacheDB (fpcHandle As Long, pVerTemplateFile As String, Byval Score As Long, Byval ProcessedFPNumber As Long) As Long**

Compare all the registration templates in the fingerprint identification high-speed buffer fpcHandle with the fingerprint verification template in the file pVerTemplateFile. Score represents the highest score among ProcessedFPNumber times of verification, and ProcessedFPNumber shows the times of verification. The fingerprint label will be returned if the identification is successful, and -1 is returned if failed.

#### **Note:**

During the process of identification, if the verification score is equal to or larger than the property Threshold, then it is considered that the verification is successful. In this case, no further verification will be carried out for the rest of fingerprint registration templates in the buffer, and this function returns the fingerprint label for the fingerprint registration template which is matched successfully;

If all the scores for the verification between all the fingerprint verification templates and all the fingerprint identification templates located in the fingerprint identification high-speed buffer, but meanwhile the highest score for the verification is equal to or larger than Score, then it is viewed that the verification is matched successfully. In this case, this function will return the label of the

fingerprint registration template which gets the highest verification score, whose recommended value is 9.

#### **4.2.34 Function IdentificationInFPCacheDB (fpcHandle As Long, pVerTemplate, Byval Score As Long, Byval ProcessedFPNumber As Long) As Long**

Compare all the registration templates in the fingerprint identification high-speed buffer fpcHandle with the fingerprint verification template pVerTemplate. Score represents the highest score among ProcessedFPNumber times of verification, and ProcessedFPNumber shows the times of verification. The fingerprint label will be returned if the identification is successful, and -1 is returned if failed.

##### **Note:**

During the process of identification, if the verification score is equal to or larger than the property Threshold, then it is considered that the verification is successful. In this case, no further verification will be carried out for the rest of fingerprint registration templates in the buffer, and this function returns the fingerprint label for the fingerprint registration template which is matched successfully;

If all the scores for the verification between all the fingerprint verification templates and all the fingerprint identification templates located in the fingerprint identification high-speed buffer, but meanwhile the highest score for the verification is equal to or larger than Score, then it is viewed that the verification is matched successfully. In this case, this function will return the label of the fingerprint registration template which gets the highest verification score, whose recommended value is 9.

#### **4.2.35 Function IsOneToOneTemplate (ATemplate) As Boolean**

Judge the current fingerprint feature template Atemplate is a ZKFinger 1:1



low-speed verification feature template.

#### **4.2.36 Function ModifyTemplate(byval Atemplate, AOneToOne As Boolean) As Boolean**

According AoneToOne modify the fingerprint feature template Atemplate to a ZKFinger 1:1 low-speed verification feature template or a high-speed verification feature template.

#### **4.2.37 Function RemoveRegTemplateFromFPCacheDB (fpcHandle As Long, FPID As Long) As Long**

Delete the fingerprint registration template which is labeled as FPID located in the fingerprint identification high-speed buffer fpcHandle. If the return value is 1, it indicates a success, and 0 represents a failure.

#### **4.2.38 Sub CancelCapture()**

Forbid the current fingerprint device to capture images, and the method BeginCapture can be used for the fingerprint device to begin to capture images.

#### **4.2.39 Function AddRegTemplateStrToFPCacheDB(fpcHandle As Long, FPID As Long, ARegTemplateStr As String) As Long**

Add the previous fingerprint registration feature template ARegTemplateStr which is BASE64 code string to the fingerprint identification high-speed buffer fpcHandle, and FPID, which must be equal to or larger than 0, is the label for adding the registration template. If the return value is 1, it indicates a success, and 0 indicates a failure.

#### **4.2.40 Function IdentificationFromStrInFPCacheDB (fpcHandle As Long, AVerTemplateStr As String, Byval Score As Long, Byval**

**ProcessedFPNumber As Long) As Long**

Compare all the registration templates in the fingerprint identification high-speed buffer `fpcHandle` with the verification template `AverTemplateStr`, which is BASE64 code formatted string. `Score` represents the highest score among `ProcessedFPNumber` times of verification, and `ProcessedFPNumber` shows the times of verification. The fingerprint label will be returned if the identification is successful, and `-1` is returned if failed.

**Note:**

During the process of identification, if the verification score is equal to or larger than the property `Threshold`, then it is considered that the verification is successful. In this case, no further verification will be carried out for the rest of fingerprint registration templates in the buffer, and this function returns the fingerprint label for the fingerprint registration template which is matched successfully;

If all the scores for the verification between all the fingerprint verification templates and all the fingerprint identification templates located in the fingerprint identification high-speed buffer, but meanwhile the highest score for the verification is equal to or larger than `Score`, then it is viewed that the verification is matched successfully. In this case, this function will return the label of the fingerprint registration template which gets the highest verification score, whose recommended value is 9.

**4.2.41 Sub SetAutoIdentifyPara(AutoIdentify As Boolean, fpcHandle As Long, Score As Long)**

Set the Internal Recognition Style `AutoIdentify`, fingerprint identification high-speed buffer `fpcHandle` and the `SCORE` which the same as the parameter `Score` of `IdentificationFromInFPCacheDB` method. Refer `OnCapture` event.

## **Methods for External Image File Interface**

### **4.2.42 Function AddBitmap(BitmapHandle As OLE\_HANDLE, ValidRectX1 As Long, ValidRectY1 As Long, ValidRectX2 As Long, ValidRectY2 As Long, DPI As Long) As Boolean**

Enroll or verify the user with bitmap specified by BitmapHandle. The parameters ValidRectX1, ValidRectY1, ValidRectX2 and ValidRectY2 specify the effective area of the image. If the specified area is invalid, the whole image is effective. DPI specifies the resolution of the image.

### **4.2.43 Function AddImageFile(FileName As String, DPI As Long) As Boolean**

Enroll or verify the user with fingerprint image (supports BMP or JPG format) specified by FileName. DPI specifies the resolution of the image.

Before using these two functions, if the image is used for fingerprint enrollment, use BeginEnroll first and then set EnrollCount. Otherwise, if the image is used for verification, use BeginCapturefirst and then set AddImageFile or AddBitmap, and the system will trigger OnEnroll or OnCapture event.

The two external image interfaces are not support in ZKFinger 5.0 Lite Version.

## **Methods for External Interface**

### **4.2.44 Function CreateFPCacheDBEx As Integer**

The function is similar to CreateFPCacheDB, except that it can create both 9.0 and 10.0 fingerprint identification high speed cache at the same time.

#### **4.2.45 Sub FreeFPCacheDBEx(fpcHandle As Long)**

The function is similar to FreeFPCacheDB, except that it can create both 9.0 and 10.0 fingerprint identification high speed cache at the same time.

#### **4.2.46 Function AddRegTemplateStrToFPCacheDBEx(fpcHandle As Integer, FPID As Integer, ARegTemplateStr As String, ARegTemplate10Str As String) As Long**

The function is similar to AddRegTemplateStrToFPCacheDB, except that it can create both 9.0 and 10.0 fingerprint identification high speed cache at the same time.

#### **4.2.47 Function AddRegTemplateToFPCacheDBEx (fpcHandle As Integer, FPID As Integer, pRegTemplate, pRegTemplate10) As Long**

The function is similar to AddRegTemplateStrToFPCacheDBEx, except that it uses Variant fingerprint template.

#### **4.2.48 Function AddRegTemplateFileToFPCacheDBEx (fpcHandle As Integer, FPID As Integer, pRegTemplateFile As String, pRegTemplateFile10 As String) As Long**

The function is similar to AddRegTemplateStrToFPCacheDBEx, except that it will upload the fingerprint template from the file.

#### **4.2.49 Function RemoveRegTemplateFromFPCacheDBEx(fpcHandle As Long, FPID As Long) As Long**

The function is similar to RemoveRegTemplateFromFPCacheDB, except that it will clear both 9.0 and 10.0 fingerprint template at the same time.

**4.2.50 Function GetTemplateEx(AFPEngineVersion As String) As Variant**

The function is similar to GetTemplate, except that it can import AFPEngineVersion parameter to get 9.0 or 10.0 fingerprint template.

If AFPEngineVersion is 9, get the 9.0 fingerprint template. If it's 10, get the 10.0 fingerprint template.

**4.2.51 Function GetTemplateAsStringEx(AFPEngineVersion As String) As String**

The function is similar to GetTemplateEx, except that the return template string is converted to BASE64 format.

**Methods for EM/Mifare Card****4.2.52 Function MF\_GET\_SNR(commHandle As Long, deviceAddress As Long, mode As Byte, rDM\_halt As Byte, ByRef snr As Byte, ByRef value As Byte) As Boolean**

Return a single or multiple cards of 1 byte, card number of 4 bytes.

commHandle: Communication serial port of handling, 0.

deviceAddress: 0.

mode: 0x26 mode control can only operate one card at once, 0x52 mode control can operate multiple cards at once.

API\_halt: Whether to need halt card, 00 means don't need and 01 means need.

snr: The returned single or multiple cards of 1 byte(snr[0] is error code when read card failed)

value: The returned card number of 4 bytes.

**Explanation:**

Only support ZK8000 sensor currently.

#### **4.2.53 Function MF\_GetSerNum(commHandle As Long, deviceAddress As Long, ByRef buffer As Byte) As Boolean**

Read the reader address of 1 byte and the reader serial number of 8 bytes.

commHandle: Communication serial port of handling, 0.

deviceAddress: 0.

buffer: The reader-writer address of buffer[0], the 8 bytes reader-writer serial number of buffer[1...8].

##### **Explanation:**

Only support ZK8000 sensor currently.

#### **4.2.54 Function MF\_SetSerNum(commHandle As Long, deviceAddress As Long, ByRef newValue As Byte, ByRef buffer As Byte) As Boolean**

Set the 8 bytes reader-writer serial number.

commHandle: Communication serial port of handling, 0.

deviceAddress: 0.

newValue: The reader-writer serial number of 8 bytes.

buffer: The returned error code when operate failed.

##### **Explanation:**

Only support ZK8000 sensor currently.

#### **4.2.55 Function MF\_GetVersionNum(commHandle As Long, deviceAddress As Long, ByRef versionNum As Byte) As Boolean**

Read the version number of reader.

commHandle: Communication serial port of handling, 0.

deviceAddress: 0.

versionNum: The version number of reader-writer, versionNum[0] is error

code when operate failed.

**Explanation:**

Only support ZK8000 sensor currently.

**4.2.56 Function MF\_PCDRead(commHandle As Long, deviceAddress As Long, mode As Byte, blkIndex As Byte, blkNum As Byte, ByRef key As Byte, ByRef buffer As Byte) As Boolean**

Read the data of card.

commHandle: Communication serial port of handling, 0.

deviceAddress: 0.

Mode: 0(keyA+single card) 1(keyA+multi cards) 2(keyB+single card)  
3(keyB+multi cards).

blkIndex: block index.

blkNum: number of block.

key: 6 bytes key, return 4 bytes of card number when read successful.

buffer: buffer[0] is error code when read failed, while it's the read data when read successful.

**Explanation:**

Only support ZK8000 sensor currently.

**Error code:**

0x80: Parameters set successful.

0x81: Parameters set failed.

0x82: Communication timeout.

0x83: Card doesn't exist.

0x84: Data error of receiving card.

0x87: Unknown error.

0x85: Parameter or command format input error.

0x8A: error when initialize the card.

0x8B: The error serial number got in preventing conflict.

0x8C: Password authentication failed.

0x90: Card doesn't support this command.

0x91: Command format error.

0x92: The FLAG parameter in command doesn't support the OPTION mode.

0x93: The BLOCK to be operated doesn't exist.

0x94: The object to be operated has been locked, and it can't be modified.

0x95: The lock operation failed.

0x96: The write operation failed.

#### **4.2.57 Function MF\_PCDWrite(commHandle As Long, deviceAddress As Long, mode As Byte, blkIndex As Byte, blkNum As Byte, ByRef key As Byte, ByRef buffer As Byte) As Boolean**

Write the data to card.

commHandle: Communication serial port of handling, 0.

deviceAddress: 0.

mode: 0(keyA+single card) 1(keyA+multi cards) 2(keyB+single card) 3(keyB+multi cards).

blkIndex: block index.

blkNum: number of block.

key: 6 bytes key, return 4 bytes of card number when read successful.

buffer: The data to be written, buffer[0] is error code when read failed(Reference 4.2.56).

#### **Explanation:**

Only support ZK8000 sensor currently.



## 4.3 Events

### 4.3.1 OnCapture(ActionResult AS Boolean, ATemplate)

When the AutoIdentify (set by SetAutoIdentifyPara method) value set to False, Capture the fingerprint verification template ATemplate for verification. ActionResult =true indicates that the fingerprint template is obtained successfully, and False represents a failure.

When the AutoIdentify (set by SetAutoIdentifyPara method) value set to True, the ATemplate is fingerprint identification result. The result is one-dimension array, please refer the following definition:

- ATemplate[0] ID value, ID value is -1 if failed
- ATemplate[1] return one-to-many recognition score
- ATemplate[2] the processed fingerprint number for 1:N
- ATemplate[3] the processed fingerprint number for 1:1

### 4.3.2 OnCaptureToFile(ActionResult AS Boolean)

Obtain the fingerprint verification template for verification, and the template is saved in a file, whose name is set by the property VerTplFileName. ActionResult =true indicates that the fingerprint template is obtained successfully, and False represents a failure.

### 4.3.3 OnEnroll(ActionResult AS Boolean, ATemplate)

Call this event when the user fingerprint registration completes. ActionResult =true indicates that the registration is successful, and the fingerprint feature template can be captured by using pTemplate property; False represents a failure.

### 4.3.4 OnEnrollToFile(ActionResult AS Boolean)

Call this event when the user fingerprint registration completes. ActionResult

=true indicates that the registration is successful, and the fingerprint feature template is saved in a file, whose name is set as the property RegTplFileName; False represents a failure.

### **4.3.5 OnFeatureInfo(AQuality As Long)**

Obtain the fingerprint's initial feature. Quality represents the quality of this fingerprint's feature, and it may have the following values:

- 0: Good fingerprint feature
- 1: Insufficient feature points
- 2: Other reasons resulting in the incapability to capture the fingerprint feature.

### **4.3.6 OnImageReceived(byval AImageValid As Boolean)**

Call this event if the device receives the fingerprint image, or the fingerprint image is added by AddImageFile and AddBitmap. AimageValid indicates whether to extract a template or not. If it is set as False, the system will not extract templates after it has captured the fingerprint image.

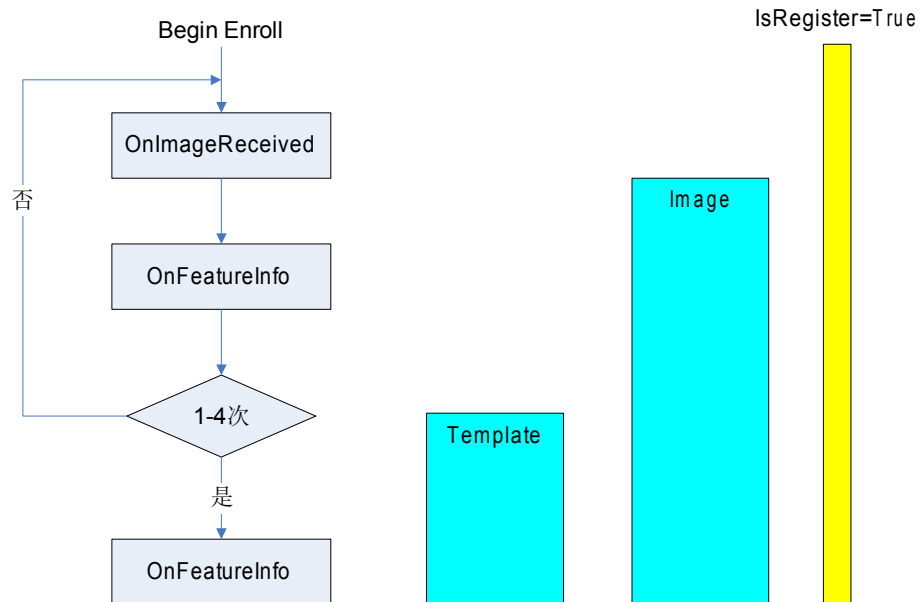
### **4.3.7 OnFingerTouching**

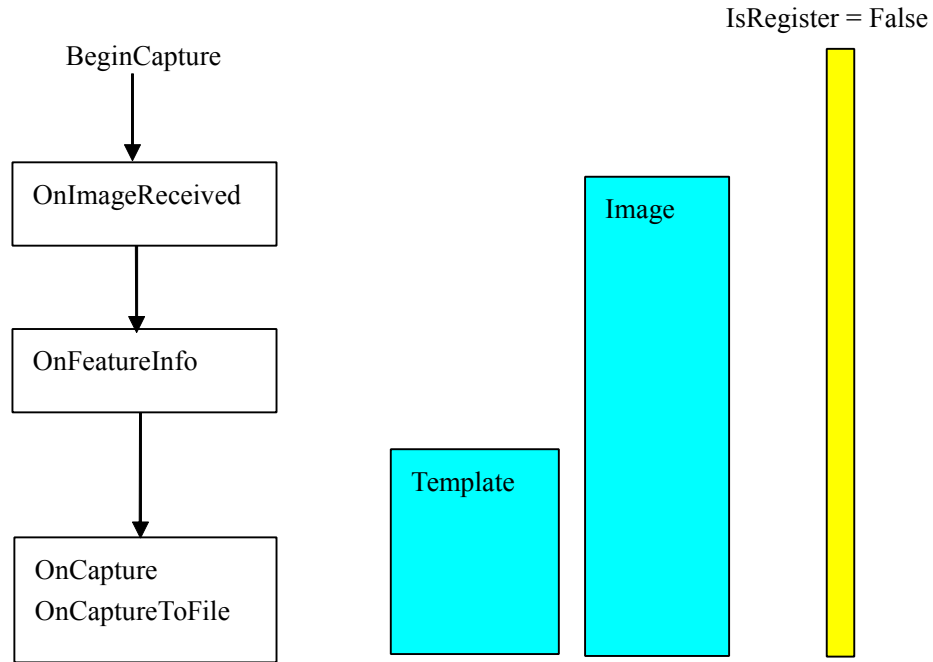
Call this event when press finger on sensor.

### **4.3.8 OnFingerLeaving**

Call this event when removed finger from sensor.

## 5. Task Flow Description





### Task Flow Description:

After the fingerprint Sensor has entered the working status, call `BeginEnroll` to enter fingerprint registration status, and call `BeginCapture` to enter fingerprint verification status. The working mode is based on event motivation, and events can be triggered in an order as shown in the above sketch graph.

It is usually needed to press the same finger for 1 to 4 times for fingerprint registration, and a fingerprint registration template will be obtained after the identification system integrates them. The times number needed for pressing the finger at registration is defined by the control property `EnrollCount`, and events `OnEnroll` and `OnEnrollToFile` will be triggered if the defined times number is arrived at.

At fingerprint verification, events `OnCapture` and `OnCaptureToFile` will be triggered after pressing the finger. At this moment, `VerFinger` or `IdentificationInFPCacheDB` can be called to carry out 1:1 or 1:N verification.

It should be paid attention to that event `OnFeatureInfo` will be triggered when a finger is being pressed for each time. If the fingerprint template of the finger which is being pressed is not qualified, this time the image captured is invalid, and the finger should be re-pressed.

## 6. Common Questions Description

### 6.1 The difference between 1:1 and 1:N Control

1 : 1 Control is mainly used for development projects which need 1:1 verification, and usually the currently-verified client's PIN should be entered in advance, and after that one or several templates he/she has registered are obtained for verification; while 1:N Control does not require entering the client's PIN, and this client can be identified by the client's fingerprint out of the registered fingerprint templates.

1:1 Control mainly aims to achieve a high pass rate and a relatively high accuracy rate; 1:N Control is principally designed to obtain a high verification speed and a relatively high accuracy rate.

1 : 1 Control's maximum template length is only 310 bytes, while that for 1:N Control is 1152 bytes. Because 1:N requires high-speed verification, and a remarkably low RAR, relatively more template feature information should be saved.

### 6.2 Read-in and Read-out Fingerprint Templates in Database

In SDK fingerprint templates are saved and called by means of Variant variable. What is stored is one-dimension binary arrays, which can not be read-in and read-out by SQL sentences as for character strings. There are two solutions:

- 1、Method EncodeTemplate and method DecodeTemplate are able to make BASE64 code transfer between Variant variables and string variables. One point, which should be improved, is that after variables being transferred into strings, the template length will be increased by about 1/3.
- 2、Directly work on Variant variables. An example is shown as the following:  
Delphi, CB:

```

    procedure TFPPProcess.SaveFPData(AQuery: TADOQuery; AFingerID: Integer; AFPData:
OleVariant);
var
    pData: PChar;
begin
    with AQuery do begin
        Close;
        SQL.Clear;
        SQL.Add('SELECT * FROM zkFingerPrint WHERE FingerID = ' + IntToStr(AFingerID));
        Open;
        if IsEmpty then
            Append
        else
            Edit;
        FieldByName('FingerID').Value := AFingerID;
        //Save the fingerprint template
        with TBlobStream(CreateBlobStream(FieldByName('Template'), bmWrite)) do begin
            pData := VarArrayLock(AFPData);
            try
                Write(pData^, VarArrayHighBound(AFPData, 1) - VarArrayLowBound(AFPData, 1) + 1);

            finally
                VarArrayUnlock(AFPData);
            end;
            Free;
        end;
        Post;
        Close;
    end;
end;
end;
```

```

procedure TFPPProcess.GetFPData(AQuery: TADOQuery; AFingerID: Integer; var AFPData:
OleVariant);
var
    pData: PChar;
begin
    with AQuery do begin
        Close;
        SQL.Clear;
        SQL.Add('SELECT * FROM zkFingerPrint WHERE FingerID = ' + IntToStr(AFingerID));
        Open;
        //read-out data
        if not IsEmpty then
            with TBlobStream(CreateBlobStream(FieldByName('Template'), bmRead)) do begin
                AFPData := VarArrayCreate([0, Size + 1], varByte);
                pData := VarArrayLock(AFPData);
                try
                    Read(pData^, Size);
                finally
                    VarArrayUnlock(AFPData);
                end;
                Free;
            end;
        Close;
    end;
end;

```

For other languages, please refer to the technical discussion forum on [www.zksoftware.com](http://www.zksoftware.com).



## 6.3 Software Doggle and Authorized License Documentation

The running of SDK requires software Doggle and authorized license documentation. The difference between software Doggle and authorized license documentation is that software Doggle is independent of the fingerprint Sensor which is being used, while authorized license documentation corresponds to the fingerprint Sensor which is being used. That is, software Doggle can be used with all fingerprint Sensors, but authorized license documentation can only be used with the authorized fingerprint Sensor.

This item has been canceled in the 4.0 Version

## 6.4 The use of 1:N high-speed buffer

For 1:N verification, it is needed to categorize the templates to be verified; at the same time, in order to achieve higher speed, SDK needs to create memory first, and then add registered fingerprints to the memory. In fact, high-speed buffer is a kind of memory. In practice, firstly we need to create the buffer by the method `CreateFPCahceDB`, and then by methods such as, `AddRegTemplateToFPCahceDB`, `RemoveRegTemplateFromFPCacheDB` and so on, to add or delete fingerprint registration templates, and lastly free the memory by the method `FreeFPCacheDB`.

We can create multiple high-speed buffers at the same time so as to realize such functions as grouping query.

## 6.5 Using fingerprint images

In projects where 1:1 Control is used, quite often you are required to save fingerprint images, or to obtain plane fingerprint images directly from scanning. Thus, 1:1 Control SDK provides methods, which are capable of capturing fingerprint registration templates directly from plane fingerprint images, such as `AddImageFile`. But what should be paid attention to is that images should be captured correctly, and their resolution must not be less than 350DPI.

**Note:** SDK in Lite Version dose not provide these methods.

## 6.6 Setting fingerprint identification threshold

In 1:1 Control, the recommendation value for the property Threshold is 10. In this case, FAR is about 0.01%, and FRR ranges from 1.5% to 2%.

In 1:1 Control, the recommendation value for the property Threshold is 10. In this case, FAR is about 0.001%, FRR is about 3%, and the recommendation value for the property OneToOneThreshold is 10.

## 6.7 Solutions to low-quality fingerprint templates for 1:N identification

In 1:N Control, at fingerprint registration, the system will automatically label fingerprints by categories in terms of quality, and save them in templates. Templates of low quality are titled as ZKFinger 1:1 low-speed verification feature templates, and 1:1 in this term is a concept quite different from 1:1 in 1:1 Control, which should not be mixed up. Registration templates of high quality are labeled as ZKFinger high-speed verification feature templates.

In normal application environments, about 5% of the total fingerprint registration templates will be labeled as low-speed verification feature templates. The method `IsOneToOneTemplate` can be used to judge whether the template is a low-speed verification feature template, and the method `ModifyTemplate` can be used to modify grouping labels which distinguish templates of high quality from those of low quality forcefully.

ZKFinger 1:1 low-speed verification is quite slow (about 30ms for PII 233), thus not too many low-speed verification feature templates can be added to the high-speed buffer by the method `AddRegTemplateToFPCache`; otherwise the verification speed will be impacted.

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Zip Code: 100086

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Fax: 010-51518015

E-mail: [support@biometric.com.cn](mailto:support@biometric.com.cn)

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- 2、 The configuration of your computer (including the brand, computer type, CPU, EMS memory, disc driver, main board brand, and so on).
- 3、 Windows 95/98/NT4.0/2000/XP or any other environments
- 4、 any application programs you are using

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