Face recognition module SB6000F

OCX User's Manual

(Rev 1.0)

Beijing Smackbio Technology Co., Ltd.

Table of Contents

1 Introduction

This manual describes about the design specification of SB6000F, Face Recognition + ID Card Time&Attendance machine and Access controller.

The aims of SB6000F

This is the complex personal authentication module which is combined with ID card and face recognition technology and it is a OEM module that composes T&A system or Access control system, in which the ID card number and face image data are transmitted from SB6000F sensor to the server through a LAN or USB and they are verified with the data enrolled in the database.
It uses ID card information and personal face information at a time, so it raises the exactness of the private authentication system.
And also it is flexible to the various system constructions by the combination with the computer through LAN or USB.
※If the fingerprint sensor is connected with the module instead of the camera, the user can compose the system with fingerprint authentication and ID card identification.

Technical features of SB6000F

1.1 SB6000F module is composed the sensor device and the soft ware (OCX).
1.2 The sensor device is composed a CCD camera to capture a f ace, a sensor circuit to read ID card and a interface circuit t o connect with the computer.
1.3 10M/100M LAN connector
1.4 USB2.0 interface
1.5 Notification of the authentication result by Wiegand output, a LED and the buzzer.
1.6 Enrollment and management function of the user.
1.7 Face enrollment by a camera and 1:1 verification.
1.8 Face image file enrollment and 1:1 verification.
1.9 ID card enrollment and verification.

2 Basic concept of SB6000F

The programmer who develops the Time & Attendance and access control system using SB6000F module is defined "Secondary Developer" in this document.
The user who has the authority to use the computer in which the program developed by the secondary developer is installed is defined "Manager" in this document.
The user who verifies using the program developed by the secondary developer is defined "User" in this document.

2.1 Requirements of SB6000F OEM module

2.1.1 System requirements

- 128M RAM, 1GHz CPU
- Microsoft Windows 2000/XP

2.1.2 Face image requirements

Posture

Use the front face (entire face).
Rotation of the head must be less than ±5 degrees fro m frontal in every direction - nodded up/down, rota ted left/right, tilted right/left.

Expression

Open both eyes, close mouth and expression should be natural. (Non-smiling)

Expression which must be prohibited

A smile where the inside of the mouth is exposed (jaw open).
The laugh which jaws is exposed. (Jaw is opened).
Rising up eyebrows.
Closing eyes.
Looking away from the camera.
Squinting

Frowning

Covering eyes by hair

Rim of glasses covering part of the eye

Face changes

Beard, moustache and the other changeable face features affect the quality of the face recognition.

If such changes are frequent for some individual persons, which changed face image (e.g. face with beard and clear face) must be enrolled into the database with the same ID.

Lighting

Lighting must be equally distributed on each side of the face and from top to bottom.

Specially, care must be taken to avoid "hot spots". These artifacts are typically caused when one, high intensity, focused light source is used for illumination.

Spectacles

There should be no lighting artifacts on spectacles. This can typically be achieved by increasing the angle between the lighting, subject and camera to 45 degrees or more.

If lighting reflections cannot be removed, then the spectacles themselves should be removed.

Spectacles have to be of clear glass and transparent so the eyes and irises are clearly visible.

Heavily tinted spectacles are not acceptable.

2.2 User classification(User's mode)

Users are divided into the following according to the combination method of the card and face recognition.

User A: Face + Card

User B: Only card

2.3 User enrollment

The user information saved in the database includes the card number, face features and user's mode.

A user has the only one ID in the database.

The card number is the secret number which is recorded i

n the card.
In principle, the unique number is recorded in every card.
The face features of the user can be enrolled in the datab ase using the several face images by SB6000F face recogn ition engine and thus it is possible to raise the rate of the recognition.
We recommend enrolling 3 face images at least.
For example, 3 face images can be selected in the type of front face, left rotated face and up tilted face.
The principle of the face enrollment is to enroll under the actual working environment, namely module's installation po sition.
The Secondary developer can organize the system as the f ollowing.
① Input the card number for users through SB6000Fand th en enroll the inputted card number in the database with the personal information (name, birthday, post, etc) and the us er's ID.
And also save the information that user's face is not enroll ed yet.
② Gives a card to a user and get him to go to the front o f the SB6000F sensor and enroll manually, or else the sec ondary developer can organize the automatic enrollment tha t the user is insensible of his enrollment.
If the user inputs the card through the sensor, then the sig nal of input is transmitted to the computer.
At this time, because the information which means that whether the corresponding face is enrolled or not is saved in the database, get him to enroll automatically or save his face image and after that time manager can decides whether to enroll or not.
Because it is possible that a user gives other his card, it is better that the manager verifies the face and then enroll.

3 SB6000F Outside structure

Figure 1 shows the outside structure of SB6000F.

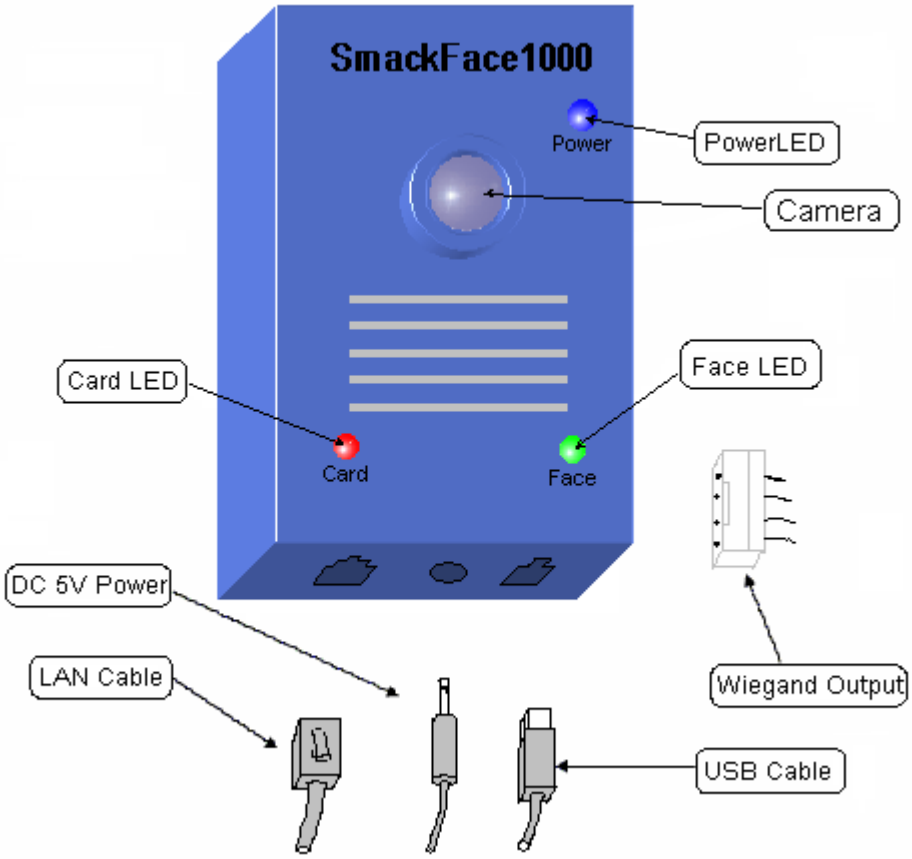

Figure 1. Outside structure of SB6000F

Power LED: This is the Blue LED and informs that the devic e is been enable to work.
It is on when it is connected.

Card LED: It is composed with two LEDs, Red and Green.
It informs the situation of reading card and identification. When it is connected with a computer and it is enable t hat card signal can be transmitted to the computer (Rea ding card state), the red LED flickers 0.5 second interva ls.

If a card signal is inputted, it would be transmitted to the computer and waits for response from the computer. During that time the red LED is off and the device dose not read the card.

If the card number is not enrolled in the database, the re

d LED is on and the buzzer emits a sound of long whist ling for one second.
And then it goes over the reading card state.
If it is enrolled and the user is "User B", green LED is on and the buzzer emits a sound of short whistling thre e times for one second. And then it goes over the readi ng card state.
If it is enrolled and the user is "User A", green LED is on and the buzzer emits a sound of short whistling once for 150ms.

Face LED: It is composed with two color LEDs, the red LED and the green LED.

If the face recognition successes, the red LED is off, th e green LED is on and the buzzer emits a sound of sho rt whistling three times for one second.
After this, green LED is off and it goes over to the rea ding card state.
If it fails, the red LED is on for one second and buzzer emits a sound of long whistling for one second.
After this, the red LED is off and it goes over to the re ading card state.

LAN Cable: The sensor device can be connected with the co mputer through the cross cable with the RJ-45 socket.
The device can be also connected with the 10M/100M L AN.
It communicates with the computer using UDP protocol.
This device is not support DHCP protocol.
IP address can be changed by the command from the co mputer.
The changed IP address is saved in the flash memory o f the MCU.
The device understands the IP address of the server by the data from the server to the device.
When the device is connected with the computer throug h the LAN cable, USB cable should be not connected.
And DC 5V power must be supplied to the device when

it is connected through the LAN cable.

Supply cable: this is the cable to supply DC 5V (1.2A).

USB cable: The device contains the USB connector (B type).
The device can be connected with the computer by this.
The device supports USB 2.0.
In case of connecting through USB cable, it is not need to supply DC 5V.

Wiegand Output: The device can output the Wiegand signal according to the command from the server.
The access control can be done with this signal.

4 How to use SB6000F OCX

SB6000F OCX aims to provide the software interface for constructing Face recognition + ID card Time&Attendance system using SB6000F module.

4.1 Properties

4.1.1 SFBrightness

- Type of return value : LONG
- Range of return value : 0 ~ 255
- Default value :
- Read/Write property : Read/Write
- Meaning : brightness of camera

4.1.2 SFDatabaseDir

- Type of return value : String
- Range of return value :
- Default value :
- Read/Write property : Read/Write
- Meaning : ID card number, Directory name in which the face features database is saved.

4.1.3 SFCaptureMode

- Type of return value : Long
- Range of return value : 1 – 640*480,
  2 – 320*240
- Default value : 1
- Read/Write property : Read/Write
- Meaning : Mode of capturing

4.1.4 SFVerifyLevel

- Type of return value : LONG
- Range of return value : 1 ~ 5
- Default value : 2
- Read/Write property : Read/Write

- Meaning : Level of contrast intensity

4.1.5 SFEnrollCount

- Type of return value : LONG
- Range of value :
- Default value :
- Read/Write property : Read
- Meaning : Number of users in the database

4.1.6 SFCommMode

- Type of return value : LONG
- Range of value : 1 - LAN, 2 - USB
- Default value : 1
- Read/Write property : Read/Write
- Meaning : Communication mode (LAN/USB) with the device

4.1.7 SFMachineIPAddr

- Type of return value : String
- Range of value : IP address
- Default value : "192.10.3.2"
- Read/Write property : Read/Write
- Meaning : IP address when the device is connected through LAN.

4.1.8 SFImage

- Type of return value : LONG
- Range of value :
- Default value :
- Read/Write property : Read
- Meaning : Pointer of the buffer which contains the last face image. It is upgraded whenever CaptureImage, Display, ExtractFeatureFromDev methods are called or <card+face> verification is proceeded.

4.1.9 WorkingOrgMode

- Type of return value : LONG
- Range of value : 1- Default Mode, 0 - User Mode
- Default value : 1
- Read/Write property : Read/Write
- Meaning : Indicates that SB6000F monitors the attendance and leaving using the original mode or user mode.

4.2 Methods

4.2.1 InitSF

●Function : Initialize the device and OCX to use.
●Declaration : InitSF() as Long
●Parameters :
●Return value : If succeed, return 0. If fails, return -1.

4.2.2 UinitSF

●Function : Disconnect with the device.
●Declaration : UinitSF() as Long
●Parameters :
●Return value : If succeed, return 0. If fails, return -1.

4.2.3 SearchEmptyID

●Function : Search a new ID to enroll in the database.
●Declaration : SearchEmptyID() as Long
●Parameters :
●Return value : ID value

4.2.4 SearchID

●Function : Search ID enrolled in the database and returns its card number if ID was enrolled.

●Declaration : SearchID(ID as Long) as Long
●Parameters : ID – User's ID to search
●Return value : If succeed, returns the card number.
If fails, return -1.

4.2.5 SearchCardNo

●Function : Search card number enrolled in the data base and returns its ID if card number was enrolled.
●Declaration : SearchCardNo(CardNo as Long) as Long
●Parameters : CardNo – Card number to search
●Return value : If succeed, returns the ID.
If fails, return -1.

4.2.6 Delete

●Function : Delete the ID and card number in the d atabase.
●Declaration : Delete(ID as Long, CardNo as Long) as Long
●Parameters : ID – User's ID enrolled in the database.
CardNo – Card number on the ID.
●Return value : If succeed, return 0.
If fails, return -1.

4.2.7 DeleteAll

●Function : Delete all data in the database.
●Declaration : DeleteAll() as Long
●Parameters :
●Return value : If succeed, return 0.
If fails. return -1.

4.2.8 RegisterItem

●Function : Enroll the card number in the database.
●Declaration : RegisterItem(ID as Long, name as String, CardNo as Long, mode as Long) as Long

●Parameters : ID – User's ID to enroll
name – User's name to enroll
CardNo – User's card number to enroll
Mode – User's verification mode.
Refer to GetUserType
●Return value : If success, return value is 0.
If fails, return value is less than -1.

4.2.9 GetUserType

●Function : Get the user's verification mode.
Verification mode has two types of <ID card + face> mode and <ID card> mode.
●Declaration : GetUserType(ID as Long) as Long
●Parameters : ID – User's ID enrolled in the database
●Return value : If return value is 1, <ID card> mode
If return value is 3, <ID card + face> mode.

4.2.10 GetUserName

●Function : Get user's name.
●Declaration : GetUserName(ID as Long) as String
●Parameters : ID – User's ID enrolled in the database
●Return value : User's name

4.2.11 ExtractFeatureFromDev

●Function : Capture face image from the device and extract its features.
●Declaration : ExtractFeature(Buffer as Long, Size as Long) as Long
●Parameters : Buffer – Pointer of buffer for features.
Its size must be more than 5848 bytes.
Size – Size of the buffer.
●Return value : If succeed, return value is 0.
If fails, return value is less than 0.

4.2.12 ExtractFeatureFromFile

●Function : Extract the features from a face image file.

●Declaration : ExtractFeatureFromFile(FileName as String, Buffer as Long, Size as Long) as Long

●Parameters : FileName – Image file path
Buffer – Pointer of buffer for features. Its size must be more than 5848 bytes.
Size – Size of the buffer

●Return value : If succeed, return value is 0.
If fails, return value is less than 0.

4.2.13 MergeFeatures

●Function : Merge the face features.

●Declaration : MergeFeatures(Features as Long, Num as Long, NewFeature as Long) as Long

●Parameters : Features – Pointer of the buffer for the features.
Num – The number of features to merge.
NewFeature – Pointer of the buffer for t he merged feature.

●Return value : If succeed, return value is 0.
If fails, return value is -1.

4.2.14 Enroll

●Function : Read the ID card from the device and e nroll the user on inputted ID with the in putted verification mode.
In the case of the <ID + face> verificat ion mode, also read the face image data from the device or a file and extract fe atures and enroll.

●Declaration : Enroll(ID as Long, name as String, mode as Long, FileName as String, bSave as Long) as Long

●Parameters : ID – User's ID to enroll
name – User's name to enroll. (max 20 bytes)
mode – Verification mod
FileName – Face image file path.
If this value is NULL, capture the face image from the device.
If it is not NULL, extract the features from the file.
In this case, it is valid when the mode is the <ID + Face> mode.
bSave – Decide whether image data will be saved as a file or not.
If it is TRUE, the Image data will be saved as the name with the ID in the database directory.

●Return value : If succeed, return value is more than 0.
If fails, return value is -1.

4.2.15 OffLineEnroll

●Function : Enroll with the ID, card number and verification mode.
In case of the <ID + Face> verification mode, read the image data from the file, extract the features and enroll.

●Declaration : OffLineEnroll(ID as Long, CardNo as Long, name as String, mode as Long, FileName as String, bSave as Long) as Long

●Parameters : ID – User's ID to enroll
CardNo – User's card number to enroll
name – User's name to enroll (max 20bytes)

mode – User's verification mode to use
FileName – The path of the face image file.
It is valid when mode value is 3, namely <ID + Face> mode.
bSave – Decide whether save the image data as a file or not.
If this value is TRUE, the Image data will be saved as the name with the ID in the database directory.

●Return value : If succeed, return value is more than 0.
If fails, return value is -1.

4.2.16 GetFeatureFromDB

●Function : Get the face features which is corresponding to the ID and card number from the database.

●Declaration : GetFeatureFromDB(ID as Long, CardNo as Long, Buffer as Long, Size as Long) as Long

●Parameters : ID – ID to get the features.
CardNo – Card number.
Buffer – Pointer of the buffer for the enrollment data.
Its size must be more than 5848 bytes.
Size – Size of the buffer.

●Return value : If succeed, return value is 0.
If fails, return value is less than 0.

4.2.17 SetFeatureToDB

●Function : Set the features on the ID and card number in the database.

●Declaration : SetFeatureFromDB(ID as Long, CardNo as Long,Buffer as Long, Size as Long) as Long

●Parameters : ID – User's ID to set

CardNo – Card number
Buffer – Pointer of the buffer for the features.
Size – Size of the buffer

●Return value : If succeed, return value is 0.
If fails, return value is less than 0.

4.2.18 Verify

●Function : Capture the image data from the device, extract the features and verify one to one with the features in the database.

●Declaration : Verify(ID as Long, CardNo as Long) as Long

●Parameters : ID – User's ID to verify
CardNo – Card number

●Return value : If succeed, return value is 1.
If fails, return value is 0.

4.2.19 VerifyFromFile

●Function : Extract the features from the face image file and verify one to one with the features in the database.

●Declaration : VerifyFromFile(ID as Long, CardNo as Long, FileName as String) as Long

●Parameters : ID – User's ID to verify.
CardNo – Card number
FileName – The face image file path

●Return value : If succeed, return value is 1.
If fails, return value is 0.

4.2.20 Match

●Function : Compare two features and decide whether they are same or not.

●Declaration : Match(Buffer1 as Long, Size1 as Long, Buffer2 as Long, Size2 as Long) as float

●Parameters : Buffer1 – Pointer of the buffer for feature 1.
Size1 – Size of Buffer1
Buffer2 – Pointer of the buffer for feature 2.
Size2 – Size of Buffer2
Buffer1 and Buffer2 must be more than 5848bytes.

●Return value : Similarity of the two features. Its value is from 0 to 1.

4.2.21 CaptureImage

●Function : Capture the face image data from the device and save into the buffer.

●Declaration : CaptureImage(Buffer as Long, Size as Long) as Long

●Parameters : Buffer – Pointer of the buffer for captured image
It takes 3 bytes (R, G, B) per a dot.
Size – Size of the Buffer

●Return value : If succeed, return value is 0.
If fails, return value is -1.

4.2.22 Display

●Function : Capture the face image from the device and display it.

●Declaration : Display(Long hDC, Long X0, Long Y0, Long Width, Long Height, Long bNew) as Long

●Parameters : hDC – Device context handle of the window to display the captured image.
X0 – X coordinate of the upper-left corner of the image.
Y0 – Y coordinate of the upper-left corner of the image.
Width – Width of the image.

Height – Height of the image.
bNew – Decide whether capture a new image from the device and display (value is 0) or display the last image saved (value is 1).

●Return value : If succeed, return value is 0.
If fails, return value is -1.

4.2.23 IsFaceImage

●Function : Capture the image data from the device and decide whether it is a face image or not.
●Declaration : IsFaceImage(Buffer as Long, Size as Long) as Long
●Parameters : Buffer – Pointer of the buffer for the captured image.
Size – Size of the Buffer
●Return value : If succeed, return value is 0.
If fails, return value is -1.

4.2.24 IsFaceImageFile

●Function : Decide whether a file is the face image file or not.
●Declaration : IsFaceImageFile(FileName as String) as Long
●Parameters : FileName – Image file name.
●Return value : If succeed, return value is 0.
If fails, return value is -1.

4.2.25 SaveImage

●Function : Save the image saved in SFImage as the type of "BMP".
●Declaration : SaveImage(FileName as String) as Long
●Parameters : FileName – File name to save image.
●Return value : If succeed, return value is 0.

If fails, return value is -1.

4.2.26 BuzzerOn

●Function : Switch On/Off the buzzer of the device.
●Declaration : BuzzerOn(On as Long) as Long
●Parameters : On – If value is 0, switch off the buzzer. Or else switch on it.
●Return value : If succeed, return value is 0.
If fails, return value is -1.

4.2.27 LEDCardGreenOn

●Function : Switch On/Off the green LED of the card verification LED of the device.
●Declaration : LEDCardGreenOn(On as Long) as Long
●Parameters : On – If value is 0, switch off the LED. Or else switch off.
●Return value : If succeed, return value is 0.
If fails, return value is -1.

4.2.28 LEDCardRedOn

●Function : Switch on/off the red LED of the card verification LED of the device.
●Declaration : LEDCardRedOn(On as Long) as Long
●Parameters : On – If value is 0, switch off. Or else switch on.
●Return value : If succeed, return value is 0.
If fails, return value is -1.

4.2.29 LEDFaceGreenOn

●Function : Switch on/off the green LED of the face recognition LED of the device.
●Declaration : LEDFaceGreenOn(On as Long) as Long
●Parameters : On – If value is 0, switch off. Or else switch on.
●Return value : If succeed, return value is 0.

If fails, return value is -1.

4.2.30 LEDFaceRedOn

●Function : Switch on/off the red LED of the face recognition LED of the device.
●Declaration : LEDFaceRedOn(On as Long) as Long
●Parameters : On – If value is 0, switch off.
Or else switch on.
●Return value : If succeed, return value is 0.
If fails, return value is -1.

4.2.31 GetLogCount

●Function : Get the count of the log data in the database.
●Declaration : GetLogCount() as Long
●Parameters :
●Return value : If succeed, return value is the count.
If fails, return value is -1.

4.2.32 GetLogInfo

●Function : Get a log data in the database.
●Declaration : GetLogInfo(no as Long, pLogInfo as Long) as Long
●Parameters : no – Log data number to get.
pLogInfo – Pointer of the buffer for the log data.
●Return value : The log data number

Log data type is the following.
Type LOGITEM

Id As Long	'User's ID of the log data
CardNo As Long	'User's Card number
mode As Long	'Verification mode
vYear As Long	'Year
vMonth As Long	'Month

```
    vDate As Long          'Date
    vHour As Long          'Hour
    vMin As Long           'Minute
    vSec As Long           'Second
    sim As Single          'Similarity of the verification
    wTime As Long          'Response time (ms)
    Ok As Long             'Verification result
                           (success-1, fail-0)
    tryCount As Long       'Number of verification
                           attempt
End Type
```

4.3 Events

4.3.1 OnReceiveCardSign

●Function : Informs the card number when read the card from the device.
●Declaration : OnReceiveCardSign(CardNo as Long)
●Parameters : CardNo – Card number read

4.3.2 OnVerifyOk

●Function : Informs the verification result after the verification.
●Declaration : OnVerifyOk(ID as Long)
●Parameters : ID – Verified ID
If value is 0,it means verification failure.
If value is more than 0, it means the verified ID.