# Fingerprint Identification Module - YE-UL1701B -User Manual & Operation Guide



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# **1. Introduction**

This document is the operation manual of the "Fingerprint Evaluation Board (YE-UL1701B)". The following instructions are called YE-UL1701B. The contents of the document contain the YE-UL1701B introduction, specifications, communication protocols, operating instructions and usage examples in different environments. The operating examples in this manual also provide test tools and source code. The YE-UL1701B is a high-performance fingerprint identification module that provides product developers with the need to develop fingerprint identification requirements (application areas such as fingerprint locks, safes, industrial controls, licensing, finance, etc.). In addition, the YE-UL1701B can be used in development kits such as Arduino, Raspberry Pi, FPGA, ARM, pcDuino, etc. in microprocessor control boards with UART (Serial Port) interface. This document provides the user with a complete description of the steps to easily complete the operation.

# 1.1. Overview

- YE-UL1701B is a fingerprint identification sensor. The sensor consists of high-speed processor, high-performance fingerprint algorithm and FLASH chip.
- The sensor has stable performance and simple structure. The functions include fingerprint comparison, image scanning transmission, search, fingerprint storage and system unique internal code protection mechanism.
  - The fingerprint matching display program can register 24 fingerprints for comparison, and the comparison speed is fast and the correct rate is high, which can provide developers to develop various applications.
  - The system-specific XOM mechanism protects the code from "execution" and cannot be "read" to protect important intellectual property code.
- Functional characteristics: Independently complete fingerprint acquisition, fingerprint storage, fingerprint comparison (1:1) and fingerprint search (1: N) functions.
- Small size: The product size is small, and the built-in fingerprint algorithm chip board is convenient for installation.
- Low power consumption: Low power consumption and suitable for most applications.
- Simple application development: Developers can develop fingerprint-related products based on control instructions without the need for professional fingerprint identification knowledge.





YE-UL1701B Fingerprint Sensor

# **1.2.** Specification

• EVB Size : 53.3x17.8x1.6(mm)	• MCU: Nuvoton M2351, ARM-M0 Plus, 32-bit, 64 MHz
• Sensor Module : A172	• FAR : <0.001% (Security Level, 3)
• Active area : 176*176pixels	• FRR : <0.1% (Security Level, 3)
• Resolution : 508 Dpi	• Operating environment : -20 to +60°C / <rh 90%<="" td=""></rh>
• Sample rate : 40 frames/s	• Storage environment : -40 to +70°C / <rh 90%<="" td=""></rh>
• Matching mode : 1:1, 1:N	Communication interface : UART
• Matching time : < 0.3s	• Power : UART 3.3V or USB
• Enrollment time : < 0.2s	

# 1.3. Feature

- USB 2.0 full speed device
- LED and push buttons
- Fingerprint sensor
- Crypto acceleraor
- Emulating drivers
  - HID protocol
  - Storage class
  - Biometric class

# 1.4. Hardware Interface

The communication interface of the YE-UL1701B module is UART. The YE-UL1701B hardware description and wiring diagram are shown below. The oval red frame at the top left of the figure is the USB interface, the square red frame is the fingerprint sensor, the middle circular red frame is the reset button, the left and right rectangular red frame has the UART interface, and the UART pin is VCC (3.3V), GND, RX, and TX are defined as follows. Another 15 GPIOs are available for users (blue frame).

then the TE CETTOTE module communicates with user active, actimited of philis as fonows.			
Name	Туре	Description	
VCC	In	Power input (3.3V)	
GND		Signal ground. Connected to power ground	
RX	In	Data input.	
TX	Out	Data output.	



YE-UL1701B hardware description and wiring diagram

# 2. Protocol

The communication protocol between the YE-UL1701B and the connected control board. The control board (such as Arduino...) is the master (Master) and the YE-UL1701B is the slave (Slave). Slave are powered by UART and USB.



The channel used by this communication protocol is UART.

The initial transfer rate of the UART is 9600, N, 8, and 1. This setting can be changed by command.

For the contents of the communication protocol, please refer to the **YE-EVB Communication Protocol** document.

# **3.** Led light display instructions

The LED light of the YE-UL1701B shows the current working status.

After the YE-UL1701B is powered or reset, if the red LED and the green LED flash in turn, it means that the operation is in the connection mode. If the red LED or the green LED is blinking alone, it means that the work is in the standalone mode.

# **3.1.** Connection mode

After power supply or reset, if the red LED and the green LED flash in turn, it means that it is receiving the command status, and the master (Arduino or Raspberry PI) can command it to perform related functions.

The LED light display shows the following.

## The red and green LEDs flash in turn:

Indicates the status of the received command and waits for the command from the master.

## The red LED and the green LED are ON (light) at the same time:

In the reminder state, it will enter the registration state after two or three seconds.

## The red LED flashes:

In the registration state, waiting for the fingerprint to press to register, if you register two fingerprints, each fingerprint needs to be pressed 3 times. After each successful pressing of the fingerprint, the green LED will light for two or three seconds.

### The green LED flashes:

In the input fingerprint state, wait for the fingerprint to press to scan the fingerprint image to compare with the registered fingerprint or upload the fingerprint image. If the fingerprint is compared, the green LED is on for two or three seconds when the comparison is successful, and the red LED is on for two or three seconds when the comparison fails. If the fingerprint image is uploaded, the red LED and the green LED alternately flash twice during image uploading.

# The red LED and the green LED flash twice in turn:

Indicates the fingerprint image upload status.

# 3.2. Standalone mode

After power or reset, if the red LED or the green LED is flashing alone, it means that it is working in standalone mode. The LED lights are described as follows.

# The red LED and the green LED are ON (light) at the same time:

In the reminder state, it will enter the registration state after two or three seconds.

### The red LED flashes:

In the registration state, waiting for the fingerprint to press to register, if you register two fingerprints, each fingerprint needs to be pressed 3 times. After each successful pressing of the fingerprint, the green LED will light for two or three seconds.

#### The green LED flashes:

In the comparison state, waiting for the fingerprint to press and compare with the registered fingerprint. If the comparison is successful, the green LED is on for two or three seconds, and if the comparison fails, the red LED is on for two or three seconds. If the continuous comparison fails 3 times, it will enter the reminder state.

# 4. Operation Example

Example of connection test environment in Arduino, Raspberry Pi and PC as follow.

# 4.1. Connection to Arduino

Example operation based on Arduino UNO.

#### 4.1.1. Hardware Installation

The cable line connection between YE-UL1701B and Arduino UNO is as follows.



Compare	Arduino	YE-UL1701B	
	3.3V	3.3V	
	GND	GND	
	GPIO10	RX	
	GPIO9	TX	

### 4.1.2. Arduino Source Code

The source code please refer to Fingerprint\_Demo.ino file.

#### 4.1.3. Arduino Command

After executing Fingerprint\_Demo.ino in the Arduino IDE, the following items will appear on the screen.

\_\_\_\_\_

- 1. Register Fingerprint
- 2. Compare Fingerprint
- 3. Query Fingerprint Image Information
- 4. Scan Fingerprint Image
- 5. Check Registered Fingerprint Number

#### 1) Register Fingerprint :

Register fingerprint (enter number 1), the user must register 24 fingerprints in the fingerprint sensing area, and each fingerprint registration must be pressed 3 times. When the fingerprint registration is completed and the number of registered fingerprints is less than 24, it means that the registration is interrupted after registering to N pieces. (When each press is successful, the light will turn green.). After successful execution, the response is as follows :

🤓 COM6 (Arduino/Genuino Uno)		63	- □	I X
				傳送
1.Register Fingerprint				^
2.Compare Fingerprint				
3.Fingerprint Information				
4.Scan Image				
5.Check Registered Number				
<r>0K</r>				
Fingerprint registration state.				
Input fingerprint #1 for capture #1.				
Move finger away from sensor.				
Input fingerprint #1 for capture #2.				
Move finger away from sensor.				
Input fingerprint #1 for capture #3.				
Move finger away from sensor.				
Input fingerprint #2 for capture #1.				
Move finger away from sensor.				
Input fingerprint #2 for capture #2.				
Move finger away from sensor.				
Input fingerprint #2 for capture #3.				
Move finger away from sensor.				
<r>FINISHED</r>				
1.Register Fingerprint				
2.Compare Fingerprint				
3.Fingerprint Information				
4.Scan Image				
5.Check Registered Number				
				~
🔽 自動捲動 🔄 Show timestamp	CR (carriage return) 🗸	9600 baud	~	Clear outpu

# 2) Compare Fingerprint :

Register fingerprint (enter number 2), When the user presses the fingerprint in the fingerprint sensing area, the matching error or the correct message will be displayed. After successful execution, the response is as follows :

💿 COM6 (Arduino/Genuino Uno)		1000		×
				傳送
1.Register Fingerprint				^
2.Compare Fingerprint				
3.Fingerprint Information				
4.Scan Image				
5.Check Registered Number				
<r>0K</r>				
Please input fingerprint to compare.				
Matched!				
<r>PASS_0</r>				
1.Register Fingerprint				
2.Compare Fingerprint				
3.Fingerprint Information				
4.Scan Image				
5.Check Registered Number				
				~
🔽 自動捲動 🔲 Show timestamp	CR (carriage return) 🗸	9600 baud	~ C	lear output

#### **Comparison error (error fingerprint)**

<R>OK</R> Please input fingerprint to compare. Unmatched! <R>FAIL</R>

or

Correct (correct fingerprint) <R>OK</R> Please input fingerprint to compare. Matched! <R>PASS</R>

# 3) Query Fingerprint Image Information :

Register fingerprint (enter number 3), • After successful execution, the response is as follows :

💿 COM6 (Arduino/Genuino Uno)		<u>1000</u> 9		×
			傳	送
1.Register Fingerprint				^
2.Compare Fingerprint				
3.Fingerprint Information				
4.Scan Image				
5.Check Registered Number				
<r>\#=176,H=176</r>				
1.Register Fingerprint				
2.Compare Fingerprint				
3.Fingerprint Information				
4.Scan Image				
5.Check Registered Number				
				~
🗹 自動捲動 🔲 Show timestamp	CR (carriage return) 🗸	9600 baud 🔍	/ Clear o	output

#### 4) Scan Fingerprint Image:

Register fingerprint (enter number 4), The user must press the fingerprint in the fingerprint sensing area After successful execution, the response is as follows.

💿 COM6 (Arduino/Genuino Uno)				×	
[				傳送	1
1.Register Fingerprint					^
2.Compare Fingerprint					
3.Fingerprint Information					
4.Scan Image					
5.Check Registered Number					
<r>0K</r>					
Please input fingerprint to scan.					
Total Receive:3					
1.Register Fingerprint					
2.Compare Fingerprint					
3.Fingerprint Information					
4.Scan Image				- 1	
5.Check Registered Number					
					~
🗹 自動捲動 🔲 Show timestamp	CR (carriage return) $\!$	9600 baud $\sim$	C	lear outpu	at

(Note: Most of the built-in SRAM in Arduino is less than 30976 Bits (30KBytes), so all image data cannot be displayed. Users should confirm the hardware specifications used.)

#### 5) Check Registered Fingerprint Number :

Register fingerprint (enter number 5),

Slave responds with  $\langle R \rangle$  and  $\langle R \rangle$  to encapsulate the number, for example:

<R>0<R> Indicates no registration data.

<R>2<R> Indicates that there are 2 registration data.

💿 COM6 (Arduino/Genuino Uno)		<u>111</u>	
			傳送
1.Register Fingerprint			^
2.Compare Fingerprint			
3.Fingerprint Information			
4.Scan Image			
5.Check Registered Number			
<r>2</r>			
There are 2 registered fingerprints.			
1.Register Fingerprint			
2.Compare Fingerprint			
3.Fingerprint Information			
4.Scan Image			
5.Check Registered Number			
			~
🔽 自動捲動 🔲 Show timestamp	CR (carriage return) 🗸	9600 baud $\sim$	Clear output

# 4.2. Connection to Raspberry Pi

Example operation based on Raspberry Pi 3 B+.

## 4.2.1. Hardware Installation

The cable line connection between YE-UL1701B and Raspberry Pi is as follows.



Compare	Raspberry Pi	YE-UL1701B
Cable color: Red	3.3V	Vcc
Cable color: Black	GND	GND
Cable color: Blue	GPIO14	RX
Cable color: Green	GPIO15	TX

### 4.2.2. Raspberry Pi Source Code

Test version: Python 3.5.3 The source code please refer to Fingerprint Demo.py file.

# 4.2.3. Raspberry Pi Command

After executing Fingerprint\_Demo.py in the Python environment, the following items will appear on the screen.

3. Query Fingerprint Image Information

<sup>1.</sup> Register Fingerprint

<sup>2.</sup> Compare Fingerprint

4. Scan Fingerprint Image5. Check Registered Fingerprint Number0. EndPlease enter the function code:

## 1) Register Fingerprint :

Register fingerprint (enter number 1), the user must register 24 fingerprints in the fingerprint sensing area, and each fingerprint registration must be pressed 3 times. When the fingerprint registration is completed and the number of registered fingerprints is less than 24, it means that the registration is interrupted after registering to N pieces. (When each press is successful, the light will turn green.). After successful execution, the response is as follows :

<R>OK</R>

Fingerprint registration state. Input fingerprint #1 for capture #1. Move finger away from sensor. Input fingerprint #1 for capture #2. Move finger away from sensor. Input fingerprint #1 for capture #3. Move finger away from sensor. Input fingerprint #2 for capture #1. Move finger away from sensor. Input fingerprint #2 for capture #2. Move finger away from sensor. Input fingerprint #2 for capture #3. Move finger away from sensor. Input fingerprint #2 for capture #3. Move finger away from sensor. Input fingerprint #2 for capture #3. Move finger away from sensor. <R>FINISHED</R> Registration is complete

# 2) Compare Fingerprint :

Register fingerprint (enter number 2), When the user presses the fingerprint in the fingerprint sensing area, the matching error or the correct message will be displayed. After successful execution, the response is as follows :

Comparison error (error fingerprint) <R>OK</R> Please input fingerprint to compare. Unmatched! <R>FAIL</R> or Correct (correct fingerprint) <R>OK</R> Please input fingerprint to compare. Matched! <R>PASS</R>

## 3) Query Fingerprint Image Information :

Register fingerprint (enter number 3), • After successful execution, the response is as follows :

<R>W=176, H=176</R>

### 4) Scan Fingerprint Image :

Register fingerprint (enter number 4), The user must press the fingerprint in the fingerprint sensing area After successful execution, the response is as follows.

Please input fingerprint to scan. Receiving data Total Bytes=30983 Data reception completed Please enter the storage path and file name, such as /home/pi/Finger/Image1.pgm, and the fingerprint image will be stored in the specified path.

### 5) Check Registered Fingerprint Number:

Register fingerprint (enter number 5), Slave responds with  $\langle R \rangle$  and  $\langle R \rangle$  to encapsulate the number, for example:

<R>0<R> Indicates no registration data.

<R>2<R> Indicates that there are 2 registration data.

# **4.3.** Connection to PC side

Note: In this test case, the user needs to have a USB to UART (or USB to TTL) line.

#### 4.3.1. Hardware installation

Connect the USB to UART (or USB to TTL) cable to the YE-UL1701B and PC. When the USB to UART cable is connected to the YE-UL1701B, the TX/RX pin of the YE-UL1701B needs to be exchanged.

YE-	PC side (USB to UART line)	Description
UL1701B		
VCC (3.3V)	VCC (3.3V)	Powered by USB.
TX	RX	Exchange docking
RX	TX	Exchange docking
GND	GND	

After power supply, the YE-UL1701B LED will flash in turn. For the LED display in the connected mode, please refer to the section: Led light display instructions.

#### **4.3.2.** Tool installation

The executable file name is BNQuickick.exe.

#### 4.3.3. Tool operation instruction



### The communication channel is UART for the present, USB will be included in the future.

### 4.3.4. Operation of Quickick Tool

#### [Startup]

The Quickick tool runs on Windows, just put the BNQuickick.exe, CxImage.exe and FreeImage.dll together at the same directory.

Please connect EVB UART to PC by a USB to TTL converter first, be careful that the VCC of UART must be 3.3V, the run BNQuickick.exe.

# [COM and Baudrate]

After Quickick is run, the first action is to find and set the baudrate of EVB, otherwise the communication of Quickick and EVB cannot be setup. It has COM and Baudare menu on Quickick as below:

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By New Quickick Utility Tool     —     □       COM     Baudrate     Query     Unlock	- 🗆 X About	N ByNew Quickick Utility Tool - □ × DM Baudrate Query Unlock Setting Abou BPS 9600 BPS 19200 BPS 38400 BPS 57600 ✓ BPS 115200	Baudrate     Query     Unlock     Setting     A       BPS 9600     BPS 19200     BPS 38400       BPS 57600     BPS 57600	- 🗆 X About
COM Baudrate Query Unlock Setting	About	DM       Baudrate       Query       Unlock       Setting       About         BPS 9600       BPS 19200       BPS 38400       BPS 57600       Image: Comparison of the set	COM Baudrate Query Unlock Setting A BPS 9600 BPS 19200 BPS 38400 BPS 57600	About
June (ac.) states of any		BPS 9600 BPS 19200 BPS 38400 BPS 57600 V BPS 115200	BPS 9600 BPS 19200 BPS 38400 BPS 57600	
PDC 0600		BPS 9000 BPS 19200 BPS 38400 BPS 57600 V BPS 115200	BPS 38400 BPS 57600	
BPS 9600		BPS 19200 BPS 38400 BPS 57600 V BPS 115200	BPS 19200 BPS 38400 BPS 57600	
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BPS 38400		BPS 57600 BPS 115200	BPS 57600	
BPS 57600		✓ BPS 115200	51051000	
BPS 115200			BPS 115200	
BPS 19200		BPS 38400 BPS 57600 BPS 115200	BPS 38400 BPS 57600	
BPS 38400		BPS 57600 BPS 115200	BPS 57600	
RDS 57600		✓ BPS 115200		
BPS 57600		✓ BPS 115200		
BPS 115200			BPS 115200	
BPS 115200			BPS 115200	
✓ BPS 115200			✓ BPS 115200	

Please find the com port from the Device Manager and try the baudrate from 9600 to 115200, reset EVB to see which baudrate can have startup message of EVB below:

BN ByNew Quickick Utility Too	Ľ	8 <del>7 -</del> 81	×
COM Baudrate Query Unio	ck Setting		About
+	.s running		
Execute non-secure code			
+	+ Sample Code		
+ System core clock = 6400000			
[ Enter Auto mode. ]			
Fingerprint registration sta	ite.		
input fingerprint #1 for cap	oture #1.		
115200,N,8,1	Set COM4 OK		/

When user see the above message, the communication between Quickick and EVB has been setup successfully, the left-bottom field displays the current baudrate and the middle-bottom field displays which com port it runs. After the communication has been setup successfully, now user can change the baudrate by click the baudrate item from Baudrate menu.

# [Query] # Device status

This is the first command to EVB, EVB will return it has password/fingerprint protection or not, and it is in locked or unlocked state.

BN ByNew Quick	ick Utility Tool		<u></u>	
COM Baudrate	Query Unlock Se	tting		About
<r>DS=37</r> The device ha The device ha The device is	Device status     Sensor size     Number of regi     Device FW version	istered fingerprint ion		
<r>DS=37</r>				
The device ha	s password prote	ection.		
The device ha	s fingerprint p	rotection.		
The device is	in unlocked sta	ate.		
<r>DS=37</r> The device ha The device ha The device is	s password prote s fingerprint p in unlocked sta	ection. rotection. ate.		
115200,N,8,1	S	et COM4 OK		//

The above example shows that there is password and fingerprint protection in device (EVB), and device is in unlocked state, so Unlock menu is grayed and Setting menu is enabled for user to do setting operation.

#### **# Sensor Size**

BN ByNew Quicki	ck Utility Tool		$\times$
COM Baudrate	Query Unlock Setting		About
The device had The device had The device is <r>W=176,H=17 The Sensor is List registrat [0]=0 [1]=0 [2 [5]=0 [6]=0 [2 [10]=0 [11]=0 [15]=0 [16]=0 [20]=0 [21]=0 <r>0</r> There are 0 reference had There are 0 reference had The sense had be an an</r>	Device status Sensor size Number of registered fingerprint Device FW version 176 pixels in width and 176 pixels in height. cion status: 2]=0 [3]=0 [4]=0 7]=0 [8]=0 [9]=0 [12]=0 [13]=0 [14]=0 [17]=0 [18]=0 [19]=0 [22]=0 [23]=0 egistered fingerprints.		
<r>W=176,H=170 The Sensor is</r>	< <pre>i 176 pixels in width and 176 pixels in height.</pre>		
9600,N,8,1	Set COM4 OK		//

To query the image dimension of fingerprint sensor. It will show how many pixels in width and height for the fingerprint sensor.

# **# Number of registered fingerprint**

BN ByNew Quickick Utility Tool	- 🗆 X
COM Baudrate Query Unlock Setting	Abou
<r>DS=33</r> The device has The device is The device is The device is The device of registered fingerprint Device FW version	
<pre><r>DS=33</r> The device has password protection. The device has fingerprint protection. The device is in locked state.</pre>	
List registration status: [0]=0 [1]=1 [2]=0 [3]=0 [4]=0 [5]=0 [6]=0 [7]=0 [8]=0 [9]=0 [10]=0 [11]=0 [12]=0 [13]=0 [14]=0 [15]=0 [16]=0 [17]=0 [18]=0 [19]=0 [20]=0 [21]=0 [22]=0 [23]=0 <r>1</r> There are 1 registered fingerprints.	
9600 N 8 1	

It will list all registered fingerprints as above. As the above example, it shows that there is only 1

registered fingerprint, and it is registered at index 1, which is the second position (it counts from index 0). The device can have 24 registered fingerprints at max.

#### **# Device FW version**

BN ByNew Quickick Utility	Tool	- 🗆 🗙
COM Baudrate Query	Unlock Setting	About
[10]=0 [11]=0 De [15]=0 [16]=0 Ser [20]=0 [21]=0 Nu <r>0&lt;∕R&gt; There are 0 r ✓ De</r>	vice status Isor size mber of registered fingerprint vice FW version	
<r>W=176,H=176</r> The Sensor is 176 pi	xels in width and 176 pixels in	height.
List registration st	atus:	
[0]=0 [1]=0 [2]=0 [3 [5]=0 [6]=0 [7]=0 [8	]=0 [4]=0 ]=0 [9]=0	
[10]=0 [11]=0 [12]=0	[13]=0 [14]=0	
[15]=0 [16]=0 [17]=0	[18]=0 [19]=0	
[20]=0 [21]=0 [22]=0	[23]=0	
<r>0</r>		
inere are U register	ea lingerprints.	
<r>0103</r>		
9600,N,8,1	Set COM4 OK	

It shows the device FW version. As the above example, the FW version is 0103, which means version 1.03

# [Unlock]

BN ByNew Quickick Utility	Tool	- 🗆 🗙
COM Baudrate Query	Unlock Setting	About
Execute non-secure	By Password By Fingerprint	
Quickick No:	nsecure Sample Code	
Secured FW version This system can reg [ Enter Auto mode.	is 0103 ister 24 fingerprints at most. ]	
<pre>Please input finger; [ Exit Auto mode. ] <r>DS=33</r></pre>	print to compare.	
The device has pass The device has fing The device is in lo	word protection. erprint protection. cked state.	
9600,N,8,1	Set COM4 OK	//

When the device is in locked state, it needs to unlock it by password or fingerprint in order to do some setting to the device. There can be only 1 password be kept in device, but it can have 24

registered fingerprints at max. If user select fingerprint to unlock, it must be any of the registered fingerprint to unlock device.

#### **#By Password**

BN ByNew Quickick Utility	Tool		X
COM Baudrate Query	Unlock Setting		About
Execute non-secure of Unlock By Passw	ord	×	
+   + Input Pas System c	sword:		
Secured OK	CANCEL		
[ Enter Auto mode. ] Please input fingery [ Exit Auto mode. ]	) print to compare.		
<r>DS=33</r> The device has pass The device has finge The device is in loc	ord protection. erprint protection. sked state.		
9600,N,8,1	Set COM4 OK		

It popup a message box for user to input password, after comparison, it will respond "Fail" or "Pass".

## **#By Fingerprint**

BN ByNew Quickick Utility Tool			$\times$
COM Baudrate Query Unloc	k Setting		About
Execute non-secure code			
+Quickick Nonsecu:	re Sample Code		
System core clock = 64000 Un	lock By Fingerprint X		
Secured FW version is This system can regist [ Enter Auto mode ]	Ready to input fingerprint to compare?		
Please input fingerpri			
[ Exit Auto mode. ]	是(Y) 否(N)		
<r>DS=33</r>			
The device has password p	protection.		
The device has fingerprin	nt protection.		
The device is in locked :	state.		
9600,N,8,1	Set COM4 OK		 //

It will popup a message box to notify user be ready to input his fingerprint, after press "Y", it will instruct user to enroll his fingerprint to compare.

BN ByNew Quickick Utility Tool	1_0	×
COM Baudrate Query Unlock Setting		About
++ System core clock = 64000000		
Secured FW version is 0103 This system can register 24 fingerprints at most.		
[ Enter Auto mode. ] Please input fingerprint to com [ Exit Auto mode. ] PASS		
<r>DS=33</r> The device has password protect The device has fingerprint prot 確定 The device is in looked state		
<pre><r>OK</r> Please input fingerprint to compare.</pre>		
Match! Welcome back. <r>PASS_0</r>		 
9600,N,8,1 Set COM4 OK		/

If the fingerprint is matched with any registered fingerprint, it will respond "PASS" as above, and on the screen, it will also show which registered fingerprint is matched. For the above example, it shows "PASS\_0", so it matches with the first registered fingerprint (count from index 0). After user press "CONFIRM" to the above PASS message box, the device gets into unlocked state, and the Setting menu will be enabled.

#### [Setting]

After device is unlocked, user could do all the setting items below:

COM Baudrate Query Unlock	Setting		About.
	Password	>	
System core clock = 640000	Register All Fingerprints		
Secured FW version is 0104	Clear All Registered Fingerprints		
This system can register 2	Compare Fingerprint (1:N)		
[ Enter Auto mode. ]	Register One Fingerprint		
Please input fingerprint t	Clear One Registered Fingerprint		
[ Exit Auto mode. ]	Compare Fingerprint (1:1)		
<pre>(R&gt;DS=32</pre>	Scan Fingerprint Image		
The device has no password	Set UART String		
The device has fingerprint The device is in locked st	User Secured Key	>	
	Set Unlock GPIO State	>	
Please input fingerprint t	Set TimeOut		
fatched!	Lock		
(R>PASS_0			

### # Password

It has 3 sub-functions:

- Get Password

To get the current password saved in device.

- Set Password

To set a new password to the device, the previous one will be overwritten.

- Clear Password

To clear the current password saved in device.

## **# Register All Fingerprints**

To register fingerprint, it can register 24 fingerprints at max. User needs to enroll his fingerprint one by one to replace the previous registered one from beginning, each registration needs 3 enrolls. User follows the instructions on screen to enroll fingerprint.

User can stop this process by press Reset button on EVB at any time. For example, after register 3 fingerprints, user can press Reset button to make device only have 3 registered fingerprints.

### # Clear All Registered Fingerprint

To clear all the registered fingerprint.

### # Compare Fingerprint (1:N)

Input fingerprint to compare with all the registered fingerprint. User follow the instruction to enroll his fingerprint. It will display compare result on screen.

### **# Register One Fingerprint**

To register only one fingerprint, it will popup a message box for user to input the index of fingerprint to register. The index is from 0 to 23.

BN ByNew Quickick Utility	Tool		
COM Baudrate Query	Unlock Setting		About.
+ System core clock =	64000000		
Secured FW Fingerprint I	ndex	×	]
This system [ Enter Aut Please inpu [ Exit Auto (R)DS=33(/F	0 for the first fingerprint CANCEL		
The device has passw The device has finge The device is in loc	ord protection. erprint protection. eked state.		
<r>OK</r> Please input fingerp Match! Welcome back. <r>PASS_0</r>	orint to compare.		
9600,N,8,1	Set COM4 OK		

After registration, the original registered fingerprint with the same index is overwritten.

#### # Clear One Registered Fingerprint

To clear some registered fingerprint, it will popup a message box for user to input the index of fingerprint to clear. The index is from 0 to 23

#### # Compare Fingerprint (1:1)

Input fingerprint to compare with a specified registered fingerprint, it will popup a message box for user to input the index of fingerprint to compare. The index is from 0 to 23..

#### **# Scan Fingerprint Image**

To scan a fingerprint image to host. User follows the instruction on screen, the scanned image will be saved to a file, FpImage.pgm.

BIN BYINEW QUICKICK UT		37 <del>-</del> 33	~
COM Baudrate Query	Unlock Setting		About
The device has passwor	rd protection.		
The device has finger	print protection.		
The device is in locke	ed state.		
Please input fingerpri	int to compare.		
Matched!			
Please input fingerpri	int to compare.		
Mismatch!	200 A		
Please input fingerpri	int to scan.		
Fingerprint image has	been captured.		
Please move away finge	er from sensor.		
Start to send image da	ata to host		
10 10 10 10 10 10	20174 (10090472-201		
[ Fingerprint image is	s saved to FpImage.pgm ]		
115200 N 8 1	Set COM4 OK		

If CxImage.exe and FreeImage.dll are at the same folder with BNQuickick,exe, it will display the scanned image automatically as below.



#### # Set UART String

It is to set the output string from device UART when compare fingerprint. User can define the output string for match and mismatch:

BN ByNew Quickick Utility Tool		100		$\times$
COM Baudrate Query Unlock	Setting			About
Start to cond incode data to how Set UART String [ Fin Pleas Finge String for fingetprin Pleas Match : Pass! Welco Start Mismatch: Fail! Try . [ Fin Pleas OK Finge Please move away finger from se Start to send image data to how [ Fingerprint image is saved to Please input fingerprint to com Pass! Welcome back. Please input fingerprint to com Fail! Try again.	<pre>t comparison. ome back. again.  CANCEL nsor. t FpImage.pgm ] pare. pare.</pre>		×	
115200,N,8,1 Set 0	COM4 OK			

And then all the fingerprint comparison, the output message will be the setting of UART string as the above example.

#### **# User Secured Key**

User keep his secured data in secured area, user secured data can be password of an e-mail account, safe box password, or any other important thing. Here it supports functions of Get Key/Set Key/Clear Key/List All Key/Clear All Key.

BN ByNew Quickick Utility Tool			
COM Baudrate Query Unlock	Setting		About
Start to send image data to ho:	Password	>	
[Fingerprint image is saved to Please input fingerprint to so Fingerprint image has been cap Please move away finger from so Start to send image data to hos	Register Fingerprint Clear Registered Fingerprint Compare Fingerprint Scan Fingerprint Image		
[ Fingerprint image is saved to	Set UART String		
Please input fingerprint to sca	User Secured Key	>	Get Key
Fingerprint image has been cap Please move away finger from se	Set Unlock GPIO State	>	Set Key
Start to send image data to hos [ Fingerprint image is saved to	Set TimeOut Lock		Clear Key List All Key Clear All Key
Please input fingerprint to co Pass! Welcome back. Please input fingerprint to co Fail! Try again.	npare.		
115200,N,8,1 Set	COM4 OK		

Each secured data includes "ID" and "KEY", both are string format.

BN ByNew Quickick Util	ity Tool		$\times$
COM Baudrate Query	Unlock Setting	А	bout
Start to send image da [ Fingerprint image is Please input fingerpri	ata to host s saved to FpImage.pgm ] .nt to scan.		Ĩ
Fingerp Set Key By ID Please J Start to		×	
[Finger Input ID: Please : Fingerpi Input KEY: Please ;			
Start to [Fingerprint image is Please input fingerpri Pass! Welcome back. Please input fingerpri	CANCEL saved to FpImage.pgm ] .nt to compare. .nt to compare.		4
Fail! Try again.	Set COM4 OK		

- Get Key

User input ID to query its KEY.

- Set Key

User set a new secured data with its ID and KEY.

As an example, user can input an e-mail account as ID and its password as KEY.

- Clear Key

User input an ID to clear its secured data.

- List All Key

List all stored secured data on screen.

- Clear All Key

User clear all secured data.

#### **# Set Unlock GPIO State**

It can set GPIO state when device is in unlocked state, and it is the opposite state when device is in locked state. User can define the GPIO is "Don't care", Low or High when device is in unlocked state.

```
It supports some GPIOs of PA, PB and PC:
GPIO A: PA.6, PA.7, PA.13, PA.14
GPIO B: PB.7, PB.8, PB.9, PB.10, PB.11, PB.12, PB.15
```

BN ByNew Q	uickick Utility Tool				×
COM Baudr	ate Query Unlock	Setting			About
Ther are to <r>OK</r>	otal O stored key	7S.			
<r>KEY=<td>et Unlocked GPIO A Sta</td><td>ite</td><td></td><td>×</td><td></td></r>	et Unlocked GPIO A Sta	ite		×	
<r>OK</r> <r>KEY=<!--</td--><td>PA.6 C Don't Care</td><td></td><td>C High</td><td></td><td></td></r>	PA.6 C Don't Care		C High		
ID=123@gm	PA.7 C Don't Care	C Low	· High		
KEY=123gc	PA.13 (D+) C Don't Care	C Low	@ High		
Ther are <r>OK</r>	PA.14 (D-) C Don't Care	• Low	C High		
ID=123@gm	ОК		CANCEL	1	
KEY=123good	đ				
Ther are to <r>OK</r>	otal 1 stored key	7S .			
9600,N,8,1		Set COM	4 OK		

PA.13 and PA.14 are the D+ and D- signals of USB bus, here just take them as GPIO output pins.

OK				
Set Unlocked GPIO B S	tate		×	
- PB. 7				
C Don't Care		C High		
- PB. 8	oalat			
O Don't Care	C Low	High		
PB.9	6 T	C . III . 1		
Don't Care	(• Low	C High		
C Don't Care	C Low	High		
PB.11				
C Don't Care	• Low	C High		
-PB.12				
C Don't Care	C Low	• High		
PB.15	C. Terr	C High		
• Don t Care	C TOM	, high		

COM	Baudrate Query Unlock Se	etting		About
(R>K	EY=	<b>J</b>		
RSe	et Unlocked GPIO C State		×	
R	20.0			
(R)	C Don't Care C Low	• High		
ID: (E)	PC.3 C Don't Care @ Low	C High		
Γhe	PC.4 C Don't Care C Low	@ High		
R	PC.5 C Don't Care @ Low	C High		
ID: KEY	PC.6 O Don't Care O Low	• High		
The	PC.7 C Don't Care @ Low	○ High		
(R)	OK	CANCEL		
(R>0	K			

Please be noted that NOT all the GPIOs above can be set and work, please check the EVB board for the available GPIOs.

## **# Set Timeout**

It is to set timeout for unlocked state.

BN ByNew Quicki	ck Utility Tool		-	$\times$
COM Baudrate	Query Unlock Set	tting		About
Start to send image	age data to host			
Lock State Time	e Out		×	
Ple				
Fir Ple Timeout:	이		_	
Sta	0 for no time or at least !	eout (unit:second) 5.		
l F Ple OK Fir		CANCEL		
Please move away Start to send ima	finger from senso age data to host	or .		
[ Fingerprint im Please input fing	age is saved to Fp gerprint to compar	oImage.pgm ] re.		
Pass! Welcome bad	ok.			
Please input fin Fail! Try again.	gerprint to compar	re.		
115200,N,8,1	Set CO	M4 OK		/

When device is in unlocked state and timeout, it will go back to locked state.

## # Lock

Click this item will make device from unlocked state back to locked state immediately. The Setting menu will be grayed and Unlock menu be enabled again. User needs to unlock again before doing any Setting item.