



PN532 NFC Reader Module



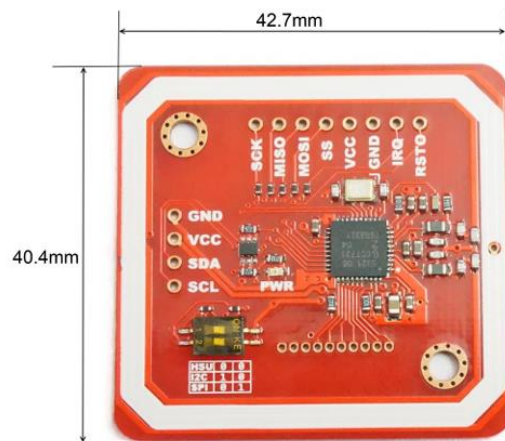
Description:

NFC is a popular technology in recent years. We often heard this word while smart phone company such as Samsung or HTC introduces their latest high-end phones. Almost all the high-end phones in the market support NFC.

Near field communication (NFC) is a set of standards for smartphones and similar devices to establish radio communication with each other by touching them together or bringing them into close proximity, usually no more than a few centimeters.

For electronics geeks, we also want to use NFC technology to make our own things. So we build this NFC RFID module. This module is built around NXP PN532. NXP PN532 is very popular in NFC area. And the company offers much technology document to help developers. We developed this module based on the official document. To make things easier, we also build library for this module.

We almost break out all the IO pins of NXP532 on this module. Users could easily connect and play. With our Arduino Sensor Shield, it is very easy to plug and play. However, if users want to use other interface such as UART or SPI, this module also makes it easy to connect those pins.



We have updated this module to version 3. Compared with V2, V3 have the following improvement:

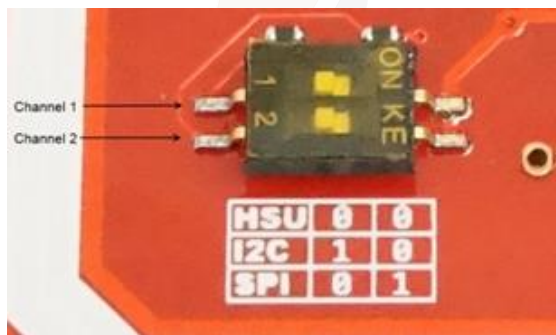
1. **Smaller:** the size now is as small as 42.7mm*40.4mm*4mm
2. **Easy to change mode:** with a small SMD toggle Switch, it becomes very easy to change among IIC, SPI and HSU modes
3. **Longer distance:** the reading distance becomes 5~7cm, compared with 4~6 cm of last version
4. **Add software to support NFC with Android Phone**

Features:

1. Support I2C, SPI and HSU (High Speed UART)
2. RFID reader/writer mode support
 - Mifare 1k, 4k, Ultralight, and DesFire cards
 - ISO/IEC 14443-4 cards such as CD97BX, CD light, DesFire, P5CN072 (SMX)
 - Innovision Jewel cards such as IRT5001 card
 - FeliCa cards such as RCS_860 and RCS_854
3. Plug and play, Arduino compatible
4. Built in PCB Antenna, with 5cm~7cm communication distance
5. On-board level shifter, Standard 5V TTL for I2C and UART, 3.3V TTL SPI
6. Work as RFID reader/writer
7. Work as 1443-A card or a virtual card

8. Support NFC with Android phone
9. Small size: 43mm*41mm*4mm
10. VCC: 3.3V~5V
11. I2C/UART: 3.3V~24V TTL
12. SPI: 3.3V TTL with 100 ohm resistors in series. It could be connected directly to 5V interface of microcontroller such as Arduino.

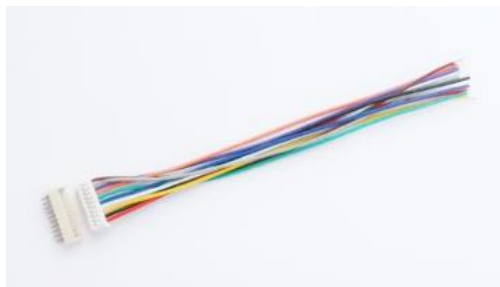
The I2C and HSU shares the same pins. The definition of IIC pins is printed at front and the HSU's is printed at the back. The HSU mode is configured as the default mode. But you could change the interface by setting the toggle switch.



The switch setting is shown as follows:

Working Interface	Channel 1	Channel 2
HSU	OFF	OFF
I2C	ON	OFF
SPI	OFF	ON

We break all the PN532 pins out. The 1.27mm connector hole contains those pins which might not be used for most users. If some developers need to connect those pins, we could supply connectors.

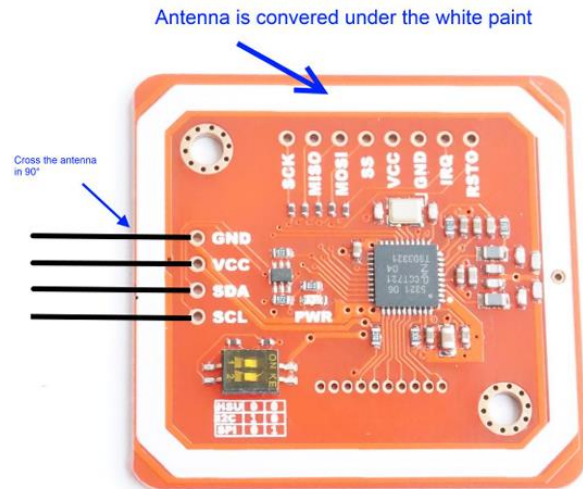


Hardware Installation:

1. Solder the connector

The bended male pins come with the NFC board.

Some users might need soldering other types of connectors or directly solder wires on it. Anyway, make sure the wires go across the antenna lines in 90 degree.



2. Connect with Arduino

If without the sensor shield, please connect as following:

Mode	PN532 Module	Arduino UNO	Arduino Leonardo	Arduino Mega (2560)	Arduino Due
Power	VCC	5V	5V	5V	5V
	GND	GND	GND	GND	GND
IIC/I2C Mode	SDA	A4/SDA	Pin 2 /SDA	Pin 20 /SDA	Pin 20 /SDA
	SCL	A5/SCL	Pin 3/SCL	Pin 21/SCL	Pin 21/SCL
HSU Mode	TXD	Pin 0	Could not present message in Serial Monitor on PC	Pin 0	Pin 19
	RXD	Pin 1		Pin 1	Pin 18
SPI Mode	SCK	Pin 13 or ICSP-3	ICSP-3	Pin 52 or ICSP-3	ICSP-3
	MISO	Pin 12 or ICSP-1	ICSP-1	Pin 50 or ICSP-1	ICSP-1
	MOSI	Pin 11 or ICSP-4	ICSP-4	Pin 51 or ICSP-4	ICSP-4
	SS	Pin 10	Pin 10	Pin 10	Pin 10

Note: SPI on Due is still in developing

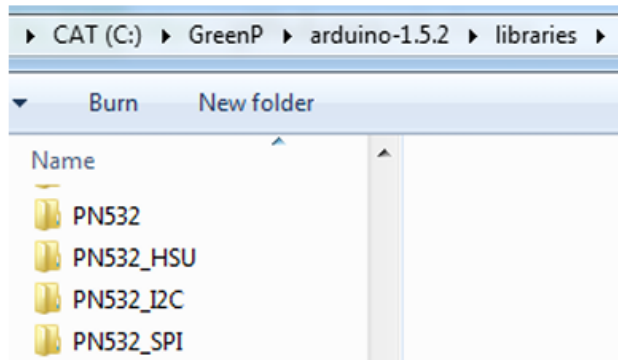
Arduino UNO only has one serial interface which is also connected to USB port to PC. In HSU mode, the serial monitor could not be used as message displaying windows.

Function Test:

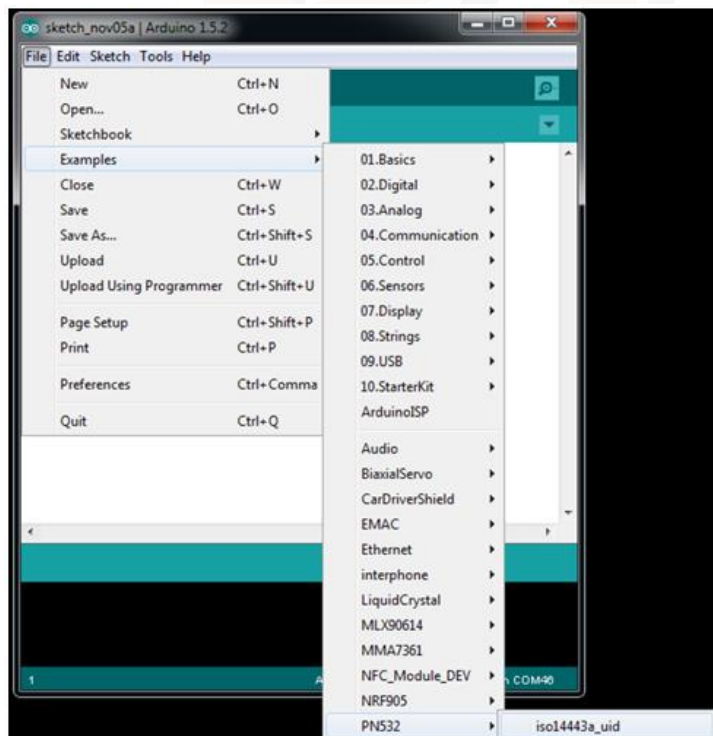
1. RFID Reader/Writer

Here we show how to read and write RFID card with this module.

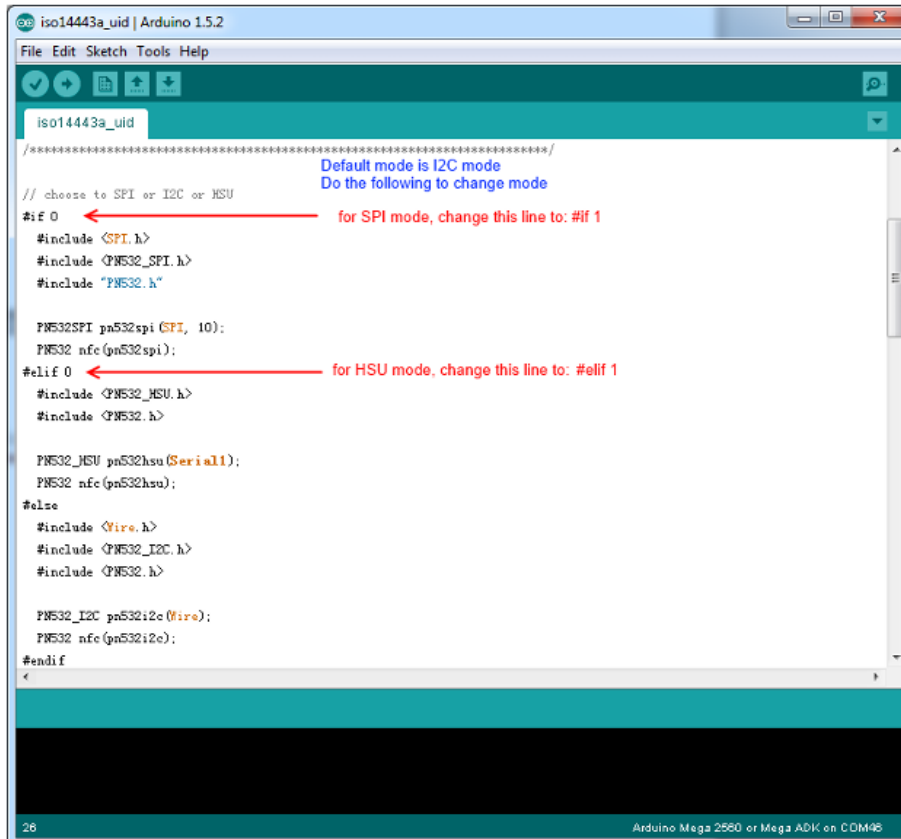
Download the library PN532 at our github page. You could find 4 folders in the library. Unzip the 4 folders at the library folder in Arduino IDE.



Start Arduino IDE and choose the example:



Modify the code to choose the right mode:



```

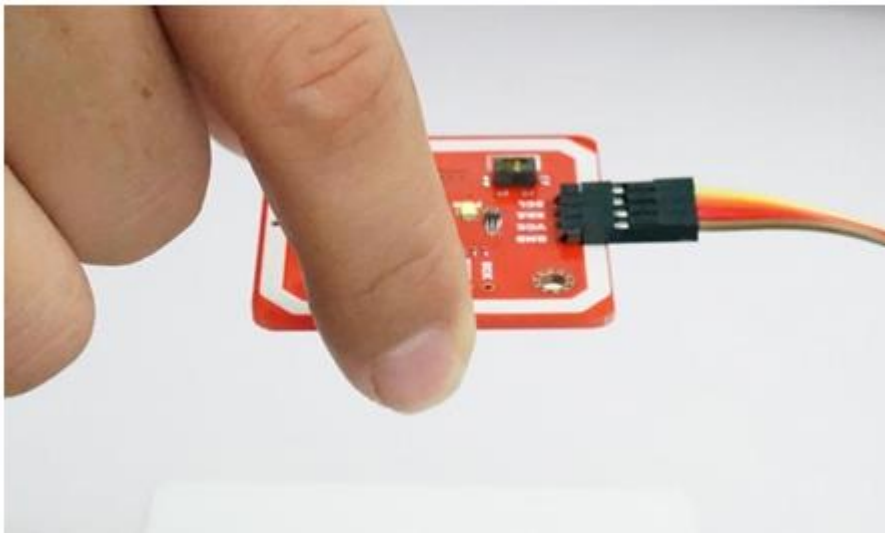
iso14443a_uid | Arduino 1.5.2
File Edit Sketch Tools Help
iso14443a_uid
/*****
// choose to SPI or I2C or HSU
// Default mode is I2C mode
// Do the following to change mode
#if 0 // for SPI mode, change this line to: #if 1
#include <SPI.h>
#include <PN532_SPI.h>
#include "PN532.h"

PN532SPI pn532spi(SPI, 10);
PN532 nfc(pn532spi);
#elif 0 // for HSU mode, change this line to: #elif 1
#include <PN532_HSU.h>
#include <PN532.h>

PN532_HSU pn532hsu(Serial1);
PN532 nfc(pn532hsu);
#else
#include <Wire.h>
#include <PN532_I2C.h>
#include <PN532.h>

PN532_I2C pn532i2c(Wire);
PN532 nfc(pn532i2c);
#endif
<
28 Arduino Mega 2560 or Mega ADK on COM48
  
```

Upload the code to Arduino and open Serial monitor. Put a card on it:



```

COM46
Hello!
Read Ack
0 0 FF 0 FF 0Read response
0 0 FF 6 FA D5 3 32 1 6 7 EB 0Found chip PN532
Firmware ver. 1.6
Read Ack
0 0 FF 0 FF 0Read response
0 0 FF 2 FE D5 33 F8 0SAMconfig
Read Ack
0 0 FF 0 FF 0Read response
0 0 FF 2 FE D5 15 16 0Waiting for an ISO14443A card
Read Ack
0 0 FF 0 FF 0Read response
0 0 FF C F4 D5 4B 1 1 0 4 8 4 9D 44 A3 46 4 0ATQA: 0x 45AK: 0x 8
Found a card!
UID Length: 4 bytes
UID Value: 0x9D 0x44 0xA3 0x46
Read Ack
0 0 FF 0 FF 0Read response
0 0 FF C F4 D5 4B 1 1 0 4 8 4 9D 44 A3 46 4 0ATQA: 0x 45AK: 0x 8
Found a card!
UID Length: 4 bytes
UID Value: 0x9D 0x44 0xA3 0x46
Read Ack
0 0 FF 0 FF 0Read response
0 0 FF C F4 D5 4B 1 1 0 4 8 4 9D 44 A3 46 4 0ATQA: 0x 45AK: 0x 8
Found a card!
UID Length: 4 bytes
UID Value: 0x9D 0x44 0xA3 0x46
Read Ack
0 0 FF 0 FF 0Read response
0 0 FF C F4 D5 4B 1 1 0 4 8 4 9D 44 A3 46 4 0ATQA: 0x 45AK: 0x 8
Found a card!
Autoscroll No line ending 115200 baud
  
```

You could also try other reading/writing example code in the library.



It also supports reading flexible tag. We tested flexible tags of Mifare 1 S50 and Ultralight. The reading distance is up to 5cm.

2. P2P NFC

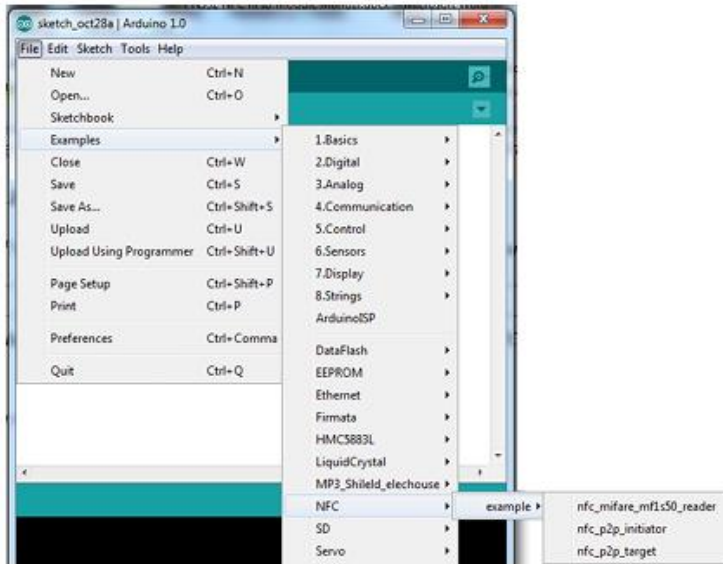
Currently we are still developing the software. The P2P NFC communication between two PN532 modules is only supported by I2C mode. Please download this library.

Note, while testing this library, please remove the libraries in the testing above (or other PN532 libraries) to other folders. Otherwise they might conflict.

Here we need two Arduino boards to test this function. Basically we will program one NFC module as Initiator, and the other as Target.

Please upload the following two examples to the two Arduino board:

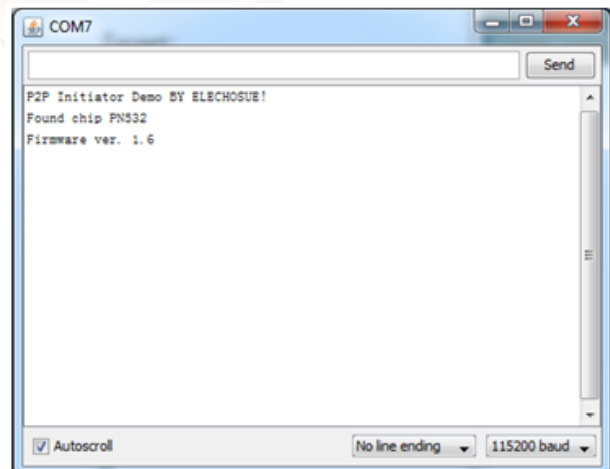
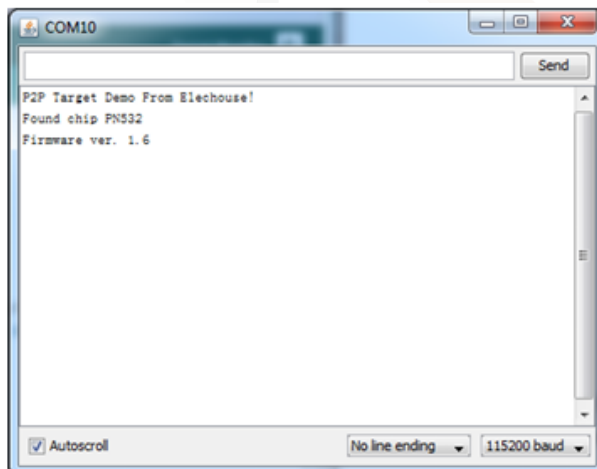
- a) NFC_p2p_initiator
- b) NFC_p2p_target



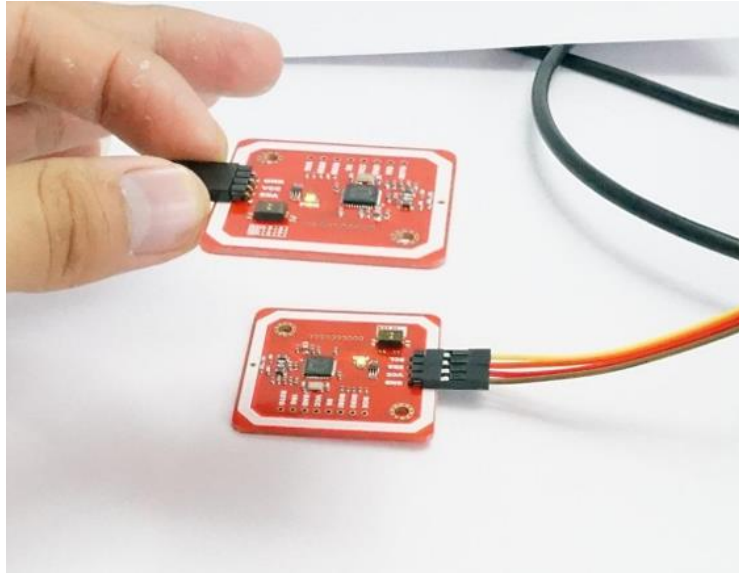
After uploading the sketches, open the Serial Monitor. Please note that Arduino IDE doesn't support opening 2 Serial Monitors. So you need another Serial Tool. Here we have 2 versions of Arduino IDE installed in my PC: Arduino 0022 and Arduino 1.0. We open the two and could have two Serial Monitor working. Note the baud rate is 115200.

Target:

Initiator:



Then put one module above the other:



Finally we get:

Target:

```

COM10
-----
P2P Target Demo From Elechouse!
Found chip PN532
Firmware ver. 1.6
Initiator is sensed.
Data Received: Hi, this message comes from NFC INITIATOR.

Initiator is sensed.
Data Received: Hi, this message comes from NFC INITIATOR.

Initiator is sensed.
Data Received: Hi, this message comes from NFC INITIATOR.

Initiator is sensed.
Data Received: Hi, this message comes from NFC INITIATOR.

Initiator is sensed.
Data Received: Hi, this message comes from NFC INITIATOR.
    
```

Initiator:

```

COM7
-----
P2P Initiator Demo BY ELBCHOSUE!
Found chip PN532
Firmware ver. 1.6
Target is sensed.
Data Received: Hi, This message comes from NFC TARGET.

Target is sensed.
Data Received: Hi, This message comes from NFC TARGET.

Target is sensed.
Data Received: Hi, This message comes from NFC TARGET.

Target is sensed.
Data Received: Hi, This message comes from NFC TARGET.

Target is sensed.
Data Received: Hi, This message comes from NFC TARGET.
    
```

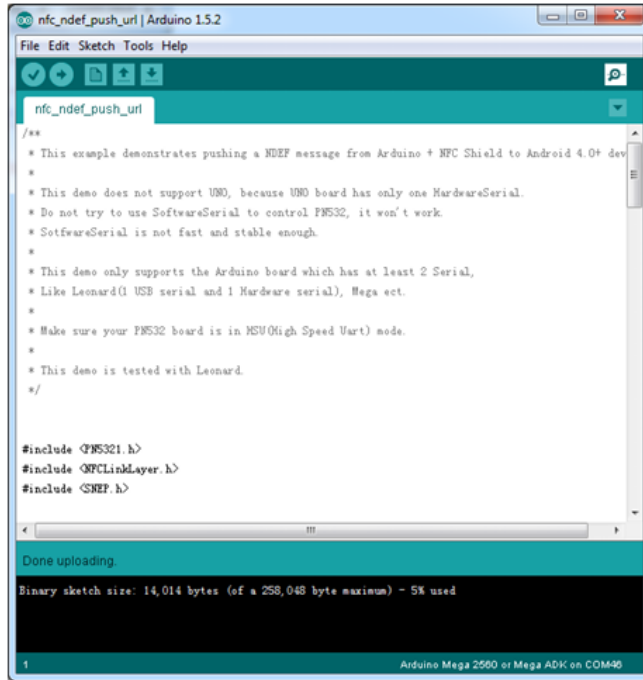
3. NFC with Android phone

Download the library of NFC_Module_DEV from our github page.

Note, while testing this library, please remove the libraries in the testing above (or other PN532 libraries) to other folders. Otherwise they might conflict.

Currently this library only supports HSU mode. We are still working on more modes. If you want to use SPI mode, you could try NFC_Shield_DEV. Just connect Arduino with our PN532 module through SPI interface in the way shown in the table above.

Open the example in Arduino Due:



```

nfc_ndef_push_url | Arduino 1.5.2
File Edit Sketch Tools Help
nfc_ndef_push_url
/**
 * This example demonstrates pushing a NDEF message from Arduino + NFC Shield to Android 4.0+ dev
 *
 * This demo does not support UNO, because UNO board has only one HardwareSerial.
 * Do not try to use SoftwareSerial to control PN532, it won't work.
 * SoftwareSerial is not fast and stable enough.
 *
 * This demo only supports the Arduino board which has at least 2 Serial,
 * Like Leonardo(1 USB serial and 1 Hardware serial), Mega ect.
 *
 * Make sure your PN532 board is in HSU(High Speed Vart) mode.
 *
 * This demo is tested with Leonardo.
 */

#include <PN5321.h>
#include <MFCLinkLayer.h>
#include <SKEP.h>

Done uploading.
Binary sketch size: 14,014 bytes (of a 258,048 byte maximum) ~ 5% used
1 Arduino Mega 2560 or Mega ADK on COM46
  
```

Upload the code to Arduino, and open Serial Monitor:

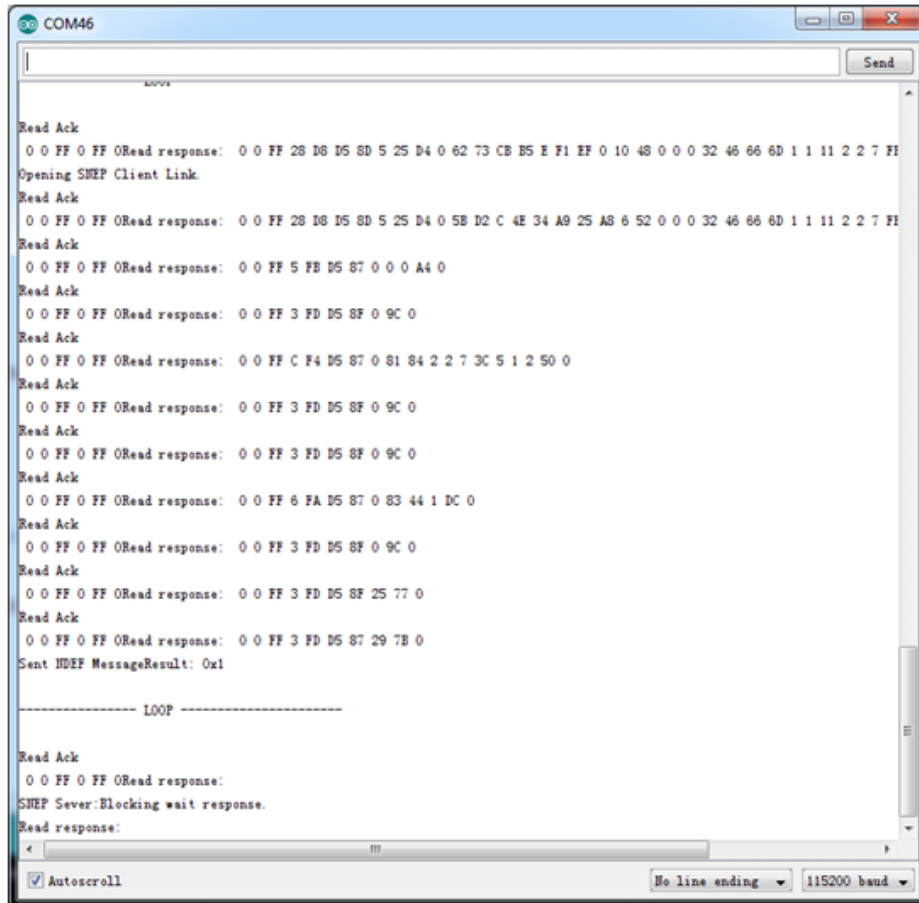
Put a NFC-support phone on the module (the following phone is Nexus 4):



On Android phone, if you have set the default browser, it will start the browser and visit our website: www.elechouse.com

If it doesn't start the browser, please open the browser and try again. Here we tested HTC one and Google Nexus 4. They all work very well. Different NFC phones might have different NFC ICs. If your phone doesn't work with it, try to google information to check if your phone NFC chip is compatible with PN532.

On Serial Monitor you could get the following result:



```

COM46
Read Ack
00 FF 00 FF ORead response: 00 FF 28 D8 D5 8D 5 25 D4 0 62 73 CB B5 E F1 EF 0 10 48 0 0 0 32 46 66 6D 1 1 11 2 2 7 FF
Opening SHEF Client Link.
Read Ack
00 FF 00 FF ORead response: 00 FF 28 D8 D5 8D 5 25 D4 0 5B D2 C 4E 34 A9 25 AB 6 52 0 0 0 32 46 66 6D 1 1 11 2 2 7 FF
Read Ack
00 FF 00 FF ORead response: 00 FF 5 FB D5 87 0 0 0 A4 0
Read Ack
00 FF 00 FF ORead response: 00 FF 3 FD D5 8F 0 9C 0
Read Ack
00 FF 00 FF ORead response: 00 FF C F4 D5 87 0 81 84 2 2 7 3C 5 1 2 50 0
Read Ack
00 FF 00 FF ORead response: 00 FF 3 FD D5 8F 0 9C 0
Read Ack
00 FF 00 FF ORead response: 00 FF 3 FD D5 8F 0 9C 0
Read Ack
00 FF 00 FF ORead response: 00 FF 6 FA D5 87 0 83 44 1 DC 0
Read Ack
00 FF 00 FF ORead response: 00 FF 3 FD D5 8F 0 9C 0
Read Ack
00 FF 00 FF ORead response: 00 FF 3 FD D5 8F 25 77 0
Read Ack
00 FF 00 FF ORead response: 00 FF 3 FD D5 87 29 7B 0
Sent NDEF MessageResult: 0x1

----- LOOP -----

Read Ack
00 FF 00 FF ORead response:
SHEF Sever:Blocking wait response.
Read response:
Autoscroll No line ending 115200 baud
  
```