Introduction

This DFRobot voice recognition module is built around an offline voice recognition chip, which can be directly used without an internet connection. It comes with 121 built-in fixed command words and supports the addition of 17 custom command words. Any sound could be trained as a command, such as whistling, snapping, or even cat meows, which brings great flexibility to interactive audio projects.
The module features a dual microphone design with better noise resistance and longer recognition distance, making it relatively accurate and reliable even in noisy environments. It comes with a built-in speaker and an external speaker interface for real-time voice feedback of recognition results. The module uses both I2C and UART communication methods and supports various 3.3V or 5V controllers, including Arduino UNO, Arduino Leonardo, Arduino MEGA, FireBeetle series, and more. This voice recognition module provides a reliable and flexible voice interaction solution for makers and electronics enthusiasts, and can be applied to any applications where voice control or interaction is desirable, such as all kinds of smart home appliances, toys, lamps, and robotics projects.

What is voice recognition?

Voice recognition is a computer technology that recognizes and converts speech signals into editable text or operational commands through analysis. It allows people to interact with computers by speaking without using a mouse, keyboard, or other input devices. Voice recognition technology has been widely used in applications such as voice assistants, smart homes, voice search, and voice recognition notebooks.

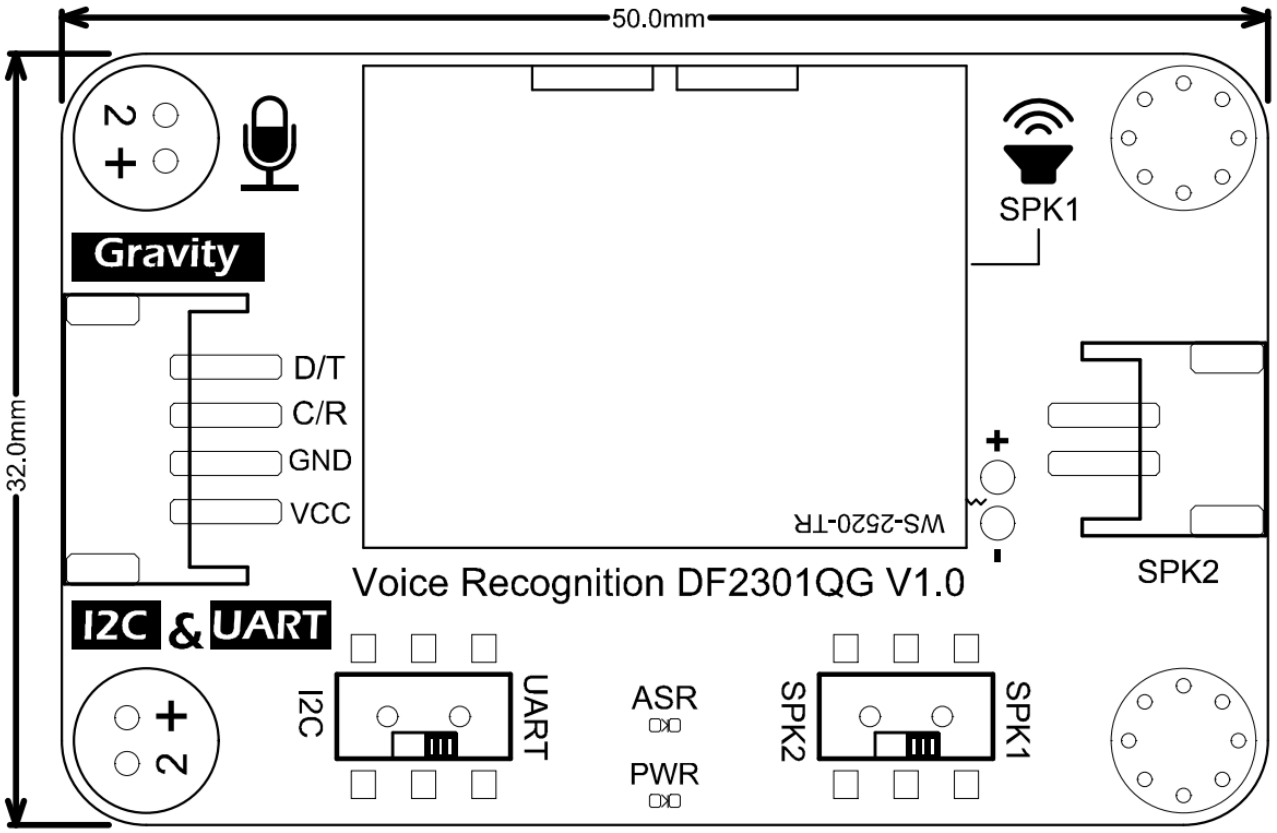
Features

- Self-learning function: Control the module to learn command words by the voice, and any audio can be used as a command.
- I2C and UART, with a Gravity interface
- Compatible with 3.3V/5V
- Built-in with 121 commonly used fixed command words
- The module has a built-in speaker and an interface for an external speaker, which can provide real-time voice feedback on recognition results
- Equipped with power indicator (red) and recognition status indicator (blue)
- Dual microphones provide better noise resistance and longer recognition distance

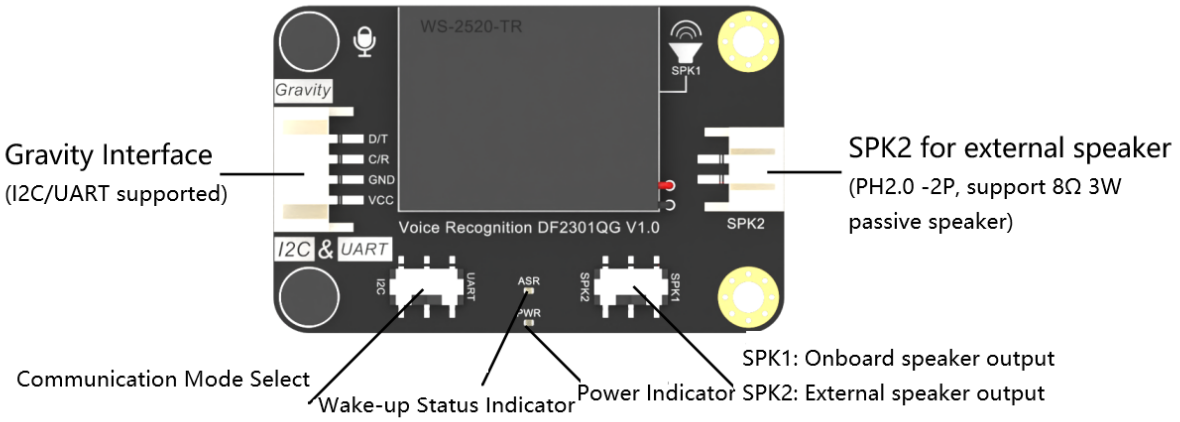
- Dual microphones provide better noise resistance and longer recognition distance
- Compatible with Arduino controllers: Arduino UNO, Arduino Leonardo, Arduino MEGA, FireBeetle series controllers, Raspberry Pi, ESP32

Specification

- Operating voltage: 3.3 - 5V
- Maximum operating current: ≤370 mA (5V)
- Communication method: I2C/UART
- I2C address: 0x64
- Fixed command words: 121
- Fixed wake-up words: 1
- User-defined command words: 17
- Learning wake-up words: 1
- Onboard microphone sensitivity: -28db
- Module size: 49 * 32 mm



Board Overview



Command Words

Wake-up word

Wake-up word refers to the word that switches a product from standby mode to working mode, which is the first point of contact between users and voice interactive products.

Learning wake-up word:

First, wake up the voice assistant with the default wake word, then say "Hello robot" and follow the prompts to learn the wake word (before learning a new wake word, delete the previous one, please refer to "Delete Wake-up Words and Command Words").

- Prompt: Learning now, be quiet, please say the wake word to be learned!
- The wake word to be learned: hello, there
- Prompt: Learning successful, please say it again!
- The wake-up word to be learned: hello, there
- Prompt: Learning successful, please say it again!
- The wake-up word to be learned: hello, there
- Prompt: Ok, learning completed!

You can now use the learned wake word to wake up the voice assistant!

Fixed command words:

Command words refer to the words that users use to give certain instructions to voice interactive products and communicate with them.

Learning command words:

Wake up the voice assistant with the wake word (default or already learned), then say "Learning command word" and follow the prompts to learn the command words (before learning a new command word, delete the previous one, please refer to "Delete Wake Words and Command Words").

- Prompt: Learning now, be quiet, please learn the command word according to the prompt! Please say the first command to be learned!
- Example of command word to be learned: Turn on red light
- Prompt: Learning successful, please say it again!
- The command word to be learned: Turn on red light
- Prompt: Learning successful, please say it again!
- The command word to be learned: Turn on red light
- Prompt: OK, learned the first command successfully! Please say the second command to be learned!

... (Continue learning)

Or use "Exit learning" to exit the current learning state.

After learning, an ID will be generated, please refer to the "Command Word/Wake Word ID Table" below to control the program.

Delete Wake Words and Command Words:

Wake up the voice assistant with the wake word (default or already learned), then say "I want to delete" and follow the prompts to learn the command words.

- Prompt: Do you want to delete the learned wake word or command word?
- **Delete command word**: delete the learned command word.
- **Delete wake word**: delete the learned wake word.
- **Delete all**: delete all learned wake words and command words.
- **Exit deleting.**

Tutorial

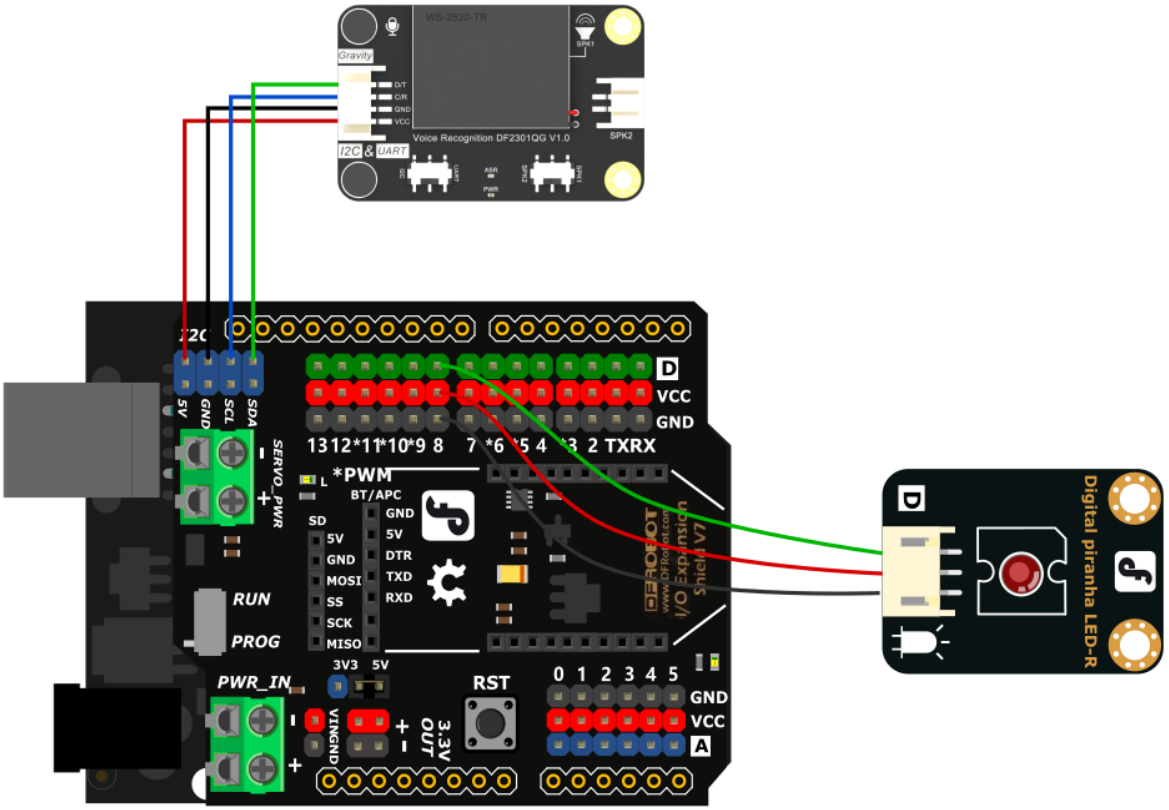
Requirements

- **Hardware**
  - DFRduino UNO R3 (https://www.dfrobot.com/product-838.html) (or similar) x 1
  - SEN0539 Gravity: Voice Recognition Module x I2C & UART
  - Gravity: Digital RED LED Light Module (https://www.dfrobot.com/product-

490.html)

- **Software**
  - Arduino IDE (https://www.arduino.cc/en/Main/Software)
  - Download and install the **DFRobot_DF2301Q Library** (https://github.com/DFRobot/DFRobot_MCP4725) (About how to install the library? (https://www.arduino.cc/en/Guide/Libraries#.UxU8mdzF9H0))

Connection Diagram - I2C



Sample Code

Please switch the communication mode switch to the I2C and download the required library file DFRobot_DF2301Q library for the code.

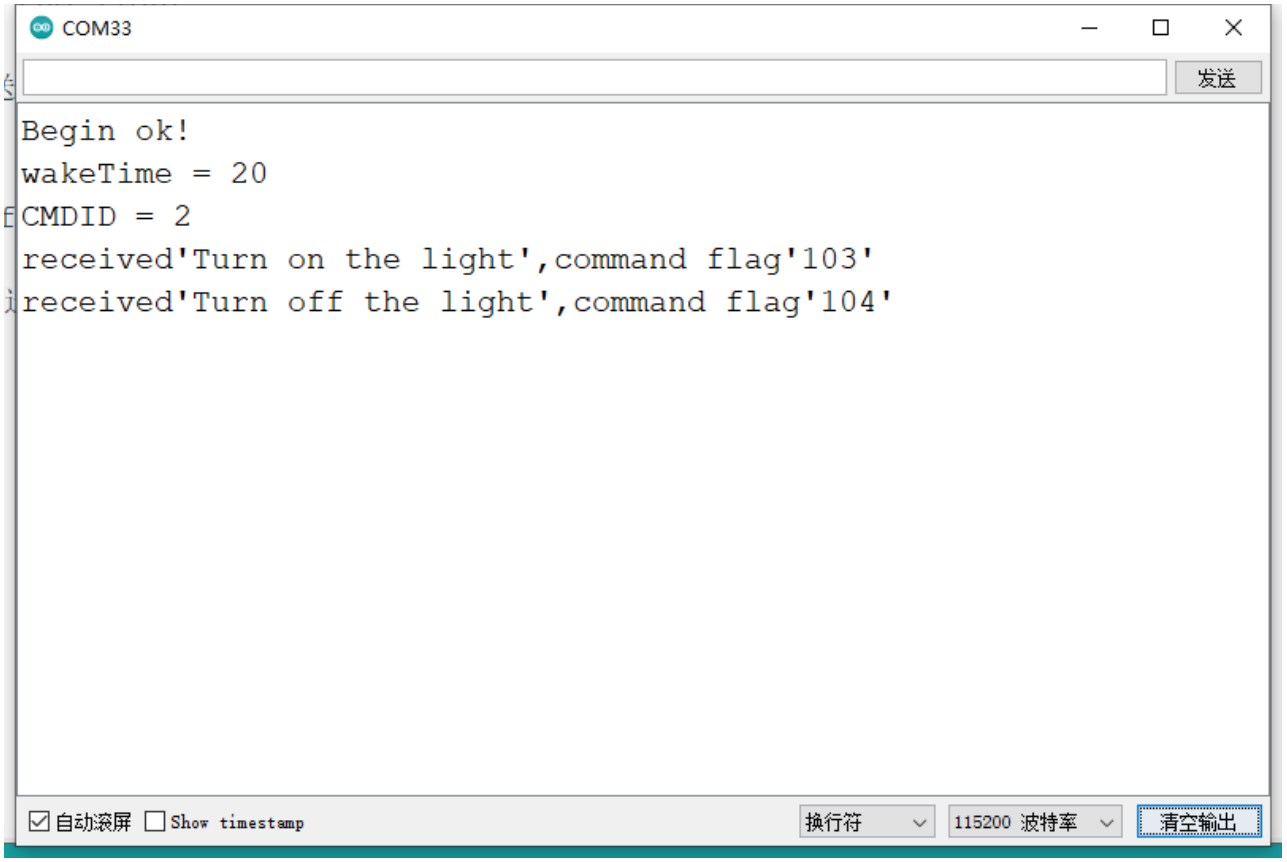
```
/*!
 * @file  i2c.ino
 * @brief Control the voice recognition module via I2C
 * @n  Get the recognized command ID and play the corresponding reply audio accordi
 * @n  Get and set the wake-up state duration
 * @copyright  Copyright (c) 2010 DFRobot Co.Ltd (http://www.dfrobot.com)
 * @licence  The MIT License (MIT)
 * @author  [qsjhyy](yihuan.huang@dfrobot.com)
 * @version  V1.0
 * @date  2022-04-02
 * @url  https://github.com/DFRobot/DFRobot_DF2301Q
 */
#include "DFRobot_DF2301Q.h"

#define Led 8

//I2C communication
DFRobot_DF2301Q_I2C asr;

void setup() {
  Serial.begin(115200);

  pinMode(Led, OUTPUT);    //Init LED pin to output mode
  digitalWrite(Led, LOW);  //Set LED pin to low

  // Init the sensor
  while (!(asr.begin())) {
    Serial.println("Communication with device failed, please check connection");
    delay(3000);
  }
  Serial.println("Begin ok!");

  /**
   * @brief Set voice volume
   * @param voc - Volume value(1~7)
   */
  asr.setVolume(4);

  /**
     @brief Set mute mode
     @param mode - Mute mode; set value 1: mute, 0: unmute
  */
  asr.setMuteMode(0);

  /**
     @brief Set wake-up duration
```

```
    @param wakeTime - Wake-up duration (0-255)
  */
  asr.setWakeTime(20);

  /**
    @brief Get wake-up duration
    @return The currently-set wake-up period
  */
  uint8_t wakeTime = 0;
  wakeTime = asr.getWakeTime();
  Serial.print("wakeTime = ");
  Serial.println(wakeTime);

  // asr.playByCMDID(1);   // Wake-up command

  /**
    @brief Play the corresponding reply audio according to the ID
    @param CMDID - command word ID
  */
  //asr.playByCMDID(23);  // Command word ID
}

void loop() {
  /**
    @brief Get the ID corresponding to the command word
    @return Return the obtained command word ID, returning 0 means no valid ID is
  */
  uint8_t CMDID = asr.getCMDID();
  switch (CMDID) {
    case 103:                                                    //If the command is
      digitalWrite(Led, HIGH);                                   //Turn on the LED
      Serial.println("received'Turn on the light',command flag'103'");  //Serial tr
      break;

    case 104:                                                    //If the command is
      digitalWrite(Led, LOW);                                    //Turn off the LED
      Serial.println("received'Turn off the light',command flag'104'");  //The seri
      break;

    default:
      if (CMDID != 0) {
        Serial.print("CMDID = ");  //Printing command ID
        Serial.println(CMDID);
      }
  }
  delay(300);
}
```

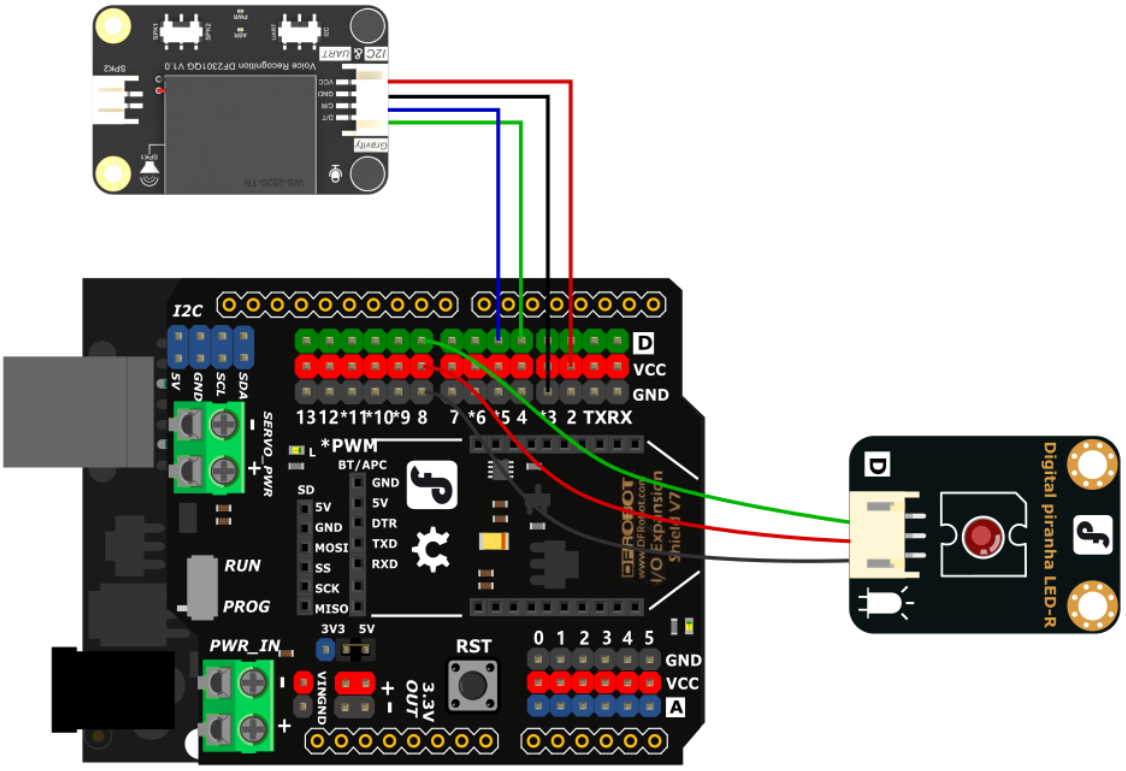
Expected Results

Use a fixed or learned wake-up word to activate the speech recognition module, then

Use a fixed or learned wake up word to activate the speech recognition module, then speak out "Turn on the light" or "Turn off the light" to control the illumination module.



Connection Diagram - UART



Sample Code

Please switch the communication mode switch to the UART and download the required library file DFRobot_DF2301Q library for the code.

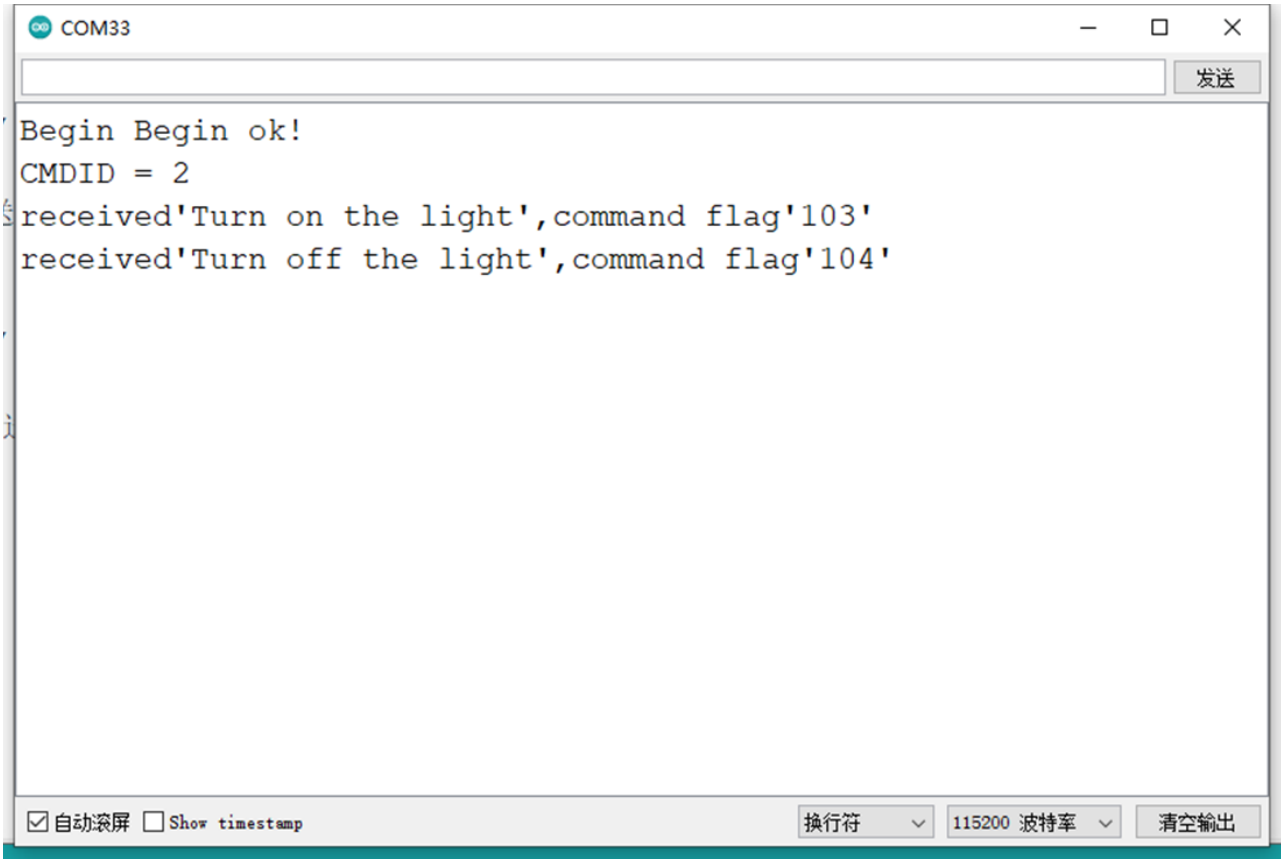
```
/*!
 * @file uart.ino
 * @brief   Control the voice recognition module via UART
 * @n  Get the recognized command ID and play the corresponding reply audio accordi
 * @n  Set the wake-up state duration, set mute mode, set volume, enter the wake-up
 * @copyright  Copyright (c) 2010 DFRobot Co.Ltd (http://www.dfrobot.com)
 * @licence  The MIT License (MIT)
 * @author  [qsjhyy](yihuan.huang@dfrobot.com)
 * @version  V1.0
 * @date  2022-04-02
 * @url  https://github.com/DFRobot/DFRobot_DF2301Q
 */
#include "DFRobot_DF2301Q.h"

#define Led 8

/**
   @brief DFRobot_URM13_RTU constructor
   @param serial - serial ports for communication, supporting hard and soft serial
   @param rx - UART The pin for receiving data
   @param tx - UART The pin for transmitting data
*/
#if (defined(ARDUINO_AVR_UNO) || defined(ESP8266))  // Use software serial
SoftwareSerial softSerial(/*rx =*/4, /*tx =*/5);
DFRobot_DF2301Q_UART asr(/*softSerial =*/&softSerial);
#elif defined(ESP32)  // Use the hardware serial with remappable pin: Serial1
DFRobot_DF2301Q_UART asr(/*hardSerial =*/&Serial1, /*rx =*/D3, /*tx =*/D2);
#else                 // Use hardware serial: Serial1
DFRobot_DF2301Q_UART asr(/*hardSerial =*/&Serial1);
#endif

void setup() {
  Serial.begin(115200);

  pinMode(Led, OUTPUT);    //Init LED pin to output mode
  digitalWrite(Led, LOW);  //Set LED pin to low

  // Init the sensor
  while (!(asr.begin())) {
    Serial.println("Communication with device failed, please check connection");
    delay(3000);
  }
  Serial.println("Begin ok!");

  /**
     @brief Reset module
```

```
  */
  // asr.resetModule();

  /**
     @brief Set commands of the module
     @param setType - Set type
     @n       DF2301Q_UART_MSG_CMD_SET_VOLUME: Set volume, the set value range 1-7
     @n       DF2301Q_UART_MSG_CMD_SET_ENTERWAKEUP: Enter wake-up state; set value
     @n       DF2301Q_UART_MSG_CMD_SET_MUTE Mute mode; set value 1: mute, 0: unmute
     @n       DF2301Q_UART_MSG_CMD_SET_WAKE_TIME ; Wake-up duration; the set value
     @param setValue - Set value, refer to the set type above for the range
  */
  asr.settingCMD(DF2301Q_UART_MSG_CMD_SET_MUTE, 0);
  asr.settingCMD(DF2301Q_UART_MSG_CMD_SET_VOLUME, 7);
  asr.settingCMD(DF2301Q_UART_MSG_CMD_SET_WAKE_TIME, 20);
  //asr.settingCMD(DF2301Q_UART_MSG_CMD_SET_ENTERWAKEUP, 0);

  /**
     @brief Play the corresponding reply audio according to the command word ID
     @param CMDID - Command word ID
  */
  asr.playByCMDID(23);
}

void loop() {
  /**
     @brief  Get the ID corresponding to the command word
     @return Return the obtained command word ID, returning 0 means no valid ID is
  */
  uint8_t CMDID = asr.getCMDID();
  switch (CMDID) {
    case 103:                                                    //If the command is
      digitalWrite(Led, HIGH);                                   //Turn on the LED
      Serial.println("received'Turn on the light',command flag'103'");  //Serial tr
      break;

    case 104:                                                    //If the command is
      digitalWrite(Led, LOW);                                    //Turn off the LED
      Serial.println("received'Turn off the light',command flag'104'");  //The seri
      break;

    default:
      if (CMDID != 0) {
        Serial.print("CMDID = ");  //Print command ID
        Serial.println(CMDID);
      }
  }
  delay(300);
}
```

Expected Result

Expected Result

Use a fixed or learned wake-up word to activate the speech recognition module, then speak out "Turn on the light" or "Turn off the light" to control the illumination module.



Command Words/Wake-up Words & ID Table

Wake-up words	ID
Wake-up words for learning	1
Hello robot	2

Commands for learning	ID	Commands for learning	ID	Commands for learning	ID
The first custom command	5	The second custom command	6	The third custom command	7
The fourth custom command	8	The fifth custom command	9	The sixth custom command	10
The seventh custom command	11	The eighth custom command	12	The ninth custom command	13
The tenth custom command	14	The eleventh custom command	15	The twelfth custom command	16

The thirteenth custom command	17	The fourteenth custom command	18	The fifteenth custom command	19

Commands for learning	ID	Commands for learning	ID	Commands for learning	ID
The sixteenth custom command	20	The seventeenth custom command	21		

Fixed Command Words	ID	Fixed Command Words	ID	Fixed Command Words	ID
Go forward	22	Retreat	23	Park a car	24
Turn left ninety degrees	25	Turn left forty-five degrees	26	Turn left thirty degrees	27
Turn right forty-five degrees	29	Turn right thirty degrees	30	Shift down a gear	31
Line tracking mode	32	Light tracking mode	33	Bluetooth mode	34
Obstacle avoidance mode	35	Face recognition	36	Object tracking	37
Object recognition	38	Line tracking	39	Color recognition	40
Tag recognition	41	Object sorting	42	Qr code recognition	43
General settings	44	Clear screen	45	Learn once	46
Forget	47	Load model	48	Save model	49
Take photos and save them	50	Save and return	51	Display number zero	52
Display number one	53	Display number two	54	Display number three	55
Display number four	56	Display number five	57	Display number six	58
Display number seven	59	Display number eight	60	Display number nine	61

Display smiley face	62	Display crying face	63	Display heart	64

Fixed Command Words	ID	Fixed Command Words	ID	Fixed Command Words	ID
Turn off dot matrix	65	Read current posture	66	Read ambient light	67
Read compass	68	Read temperature	69	Read acceleration	70
Reading sound intensity	71	Calibrate electronic gyroscope	72	Turn on the camera	73
Turn off the camera	74	Turn on the fan	75	Turn off the fan	76
Turn fan speed to gear one	77	Turn fan speed to gear two	78	Turn fan speed to gear three	79
Start oscillating	80	Stop oscillating	81	Reset	82
Set servo to ten degrees	83	Set servo to thirty degrees	84	Set servo to forty-five degrees	85
Set servo to sixty degrees	86	Set servo to ninety degrees	87	Turn on the buzzer	88
Turn off the buzzer	89	Turn on the speaker	90	Turn off the speaker	91
Play music	92	Stop playing	93	The last track	94
The next track	95	Repeat this track	96	Volume up	97
Volume down	98	Change volume to maximum	99	Change volume to minimum	100
Change volume to medium	101	Play poem	102	Turn on the light	103
Turn off the light	104	Brighten the light	105	Dim the light	106
Adjust brightness to maximum	107	Adjust brightness to minimum	108	Increase color temperature	109
Decrease color temperature	110	Adjust color temperature to maximum	111	Adjust color temperature to minimum	112

Daylight mode	113	Moonlight mode	114	Color mode	115
Set to red	116	Set to orange	117	Set to yellow	118

Fixed Command Words	**ID**	**Fixed Command Words**	**ID**	**Fixed Command Words**	**ID**
Set to green	119	Set to cyan	120	Set to blue	121
Set to purple	122	Set to white	123	Turn on ac	124
Turn off ac	125	Increase temperature	126	Decrease temperature	127
Cool mode	128	Heat mode	129	Auto mode	130
Dry mode	131	Fan mode	132	Enable blowing up & down	133
Disable blowing up & down	134	Enable blowing right & left	135	Disable blowing right & left	136
Open the window	137	Close the window	138	Open curtain	139
Close curtain	140	Open the door	141	Close the door	142

Learning-related commands	**ID**	**Learning-related commands**	**ID**	**Learning-related commands**	**ID**
Learning wake word	200	Learning command word	201	Re-learn	202
Exit learning	203	I want to delete	204	Delete wake word	205
Delete command word	206	Exit deleting	207	Delete all	208