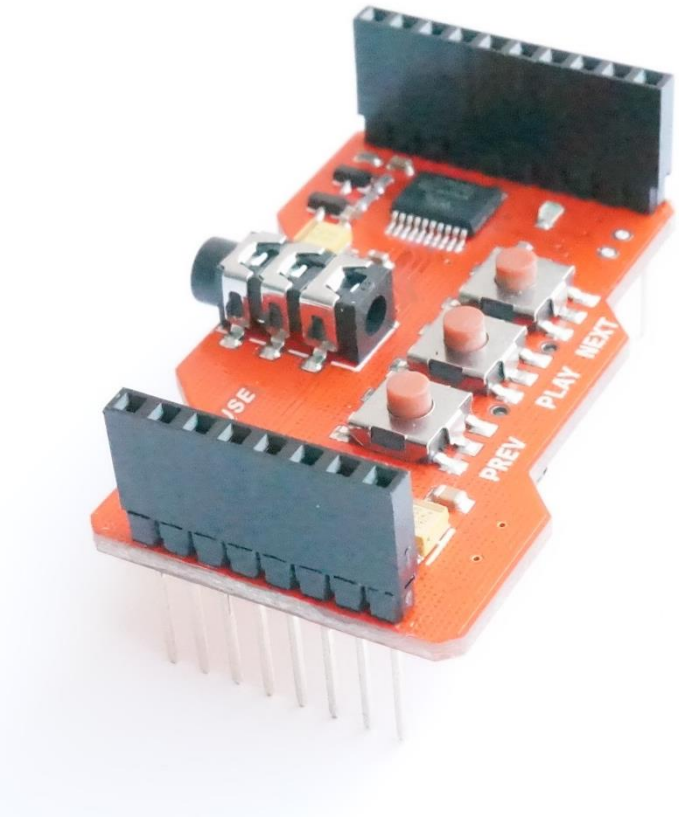
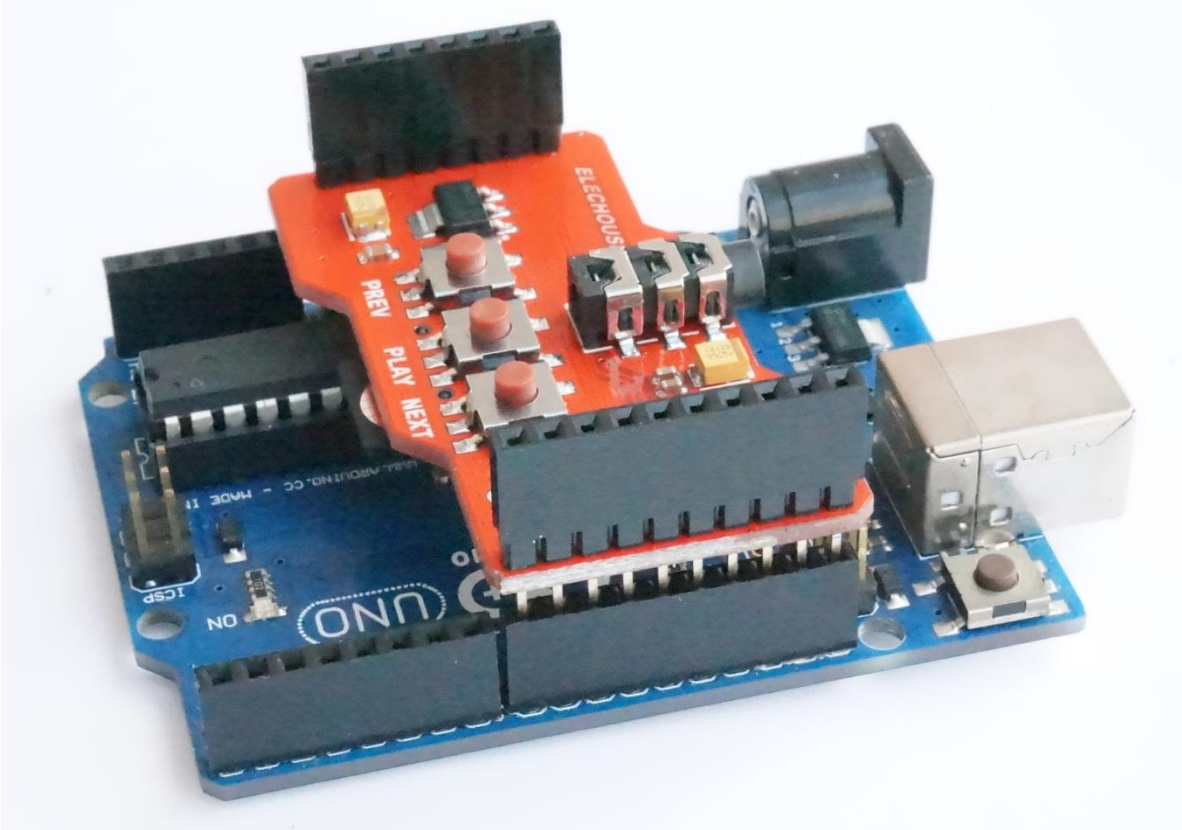
Wave shield V3.0



Introduction

We know that Ladyada designed an Arduino Wave Shield. It is a wonderful Arduino module. Arduino reads the .wave file in the SD card then send to DAC chip, while the sound is generated. But the problem is that, it is a little complicated to use this shied for beginners, pretty much code and, it involves file system.

So we are thinking about designing another shield, with a chip to do all the file system and audio decoding work. Arduino just need little code to control it. Also, it should be cheap.



Feature

- *Support TF/microSD card (Max 1GB, not SDHC)*
- *Support AD4 (6KHZ ~ 36KHZ) and WAV (6KHz～14KHz) format.*
- *Support 4 Bit ADCPM format files.*
- *Interfaces for earphone and speaker.*
- *16 Bit DAC / PWM audio output.*
- *Two line serial interface, control it only via 2 pins.*
- *Sleep current: 3uA*
- *Mono output*

This module can directly drive 0.5W 8 ohm speaker via PWM output. We also add socket for earphone via DAC output. No matter what your MCU is, you only need two wires to control this module. Code size is very small and very easy to be embedded into your project code.

How to use it

In this document we will show you how simple to use this module.

MicroSD card

MicroSD/TF card has to be less than 1G and should not be SDHC. Considering it might be hard to buy SD card less than 1G in the market, we will include a MicroSD/TF card along with this module if you choose the option.

Format the card to FAT system.

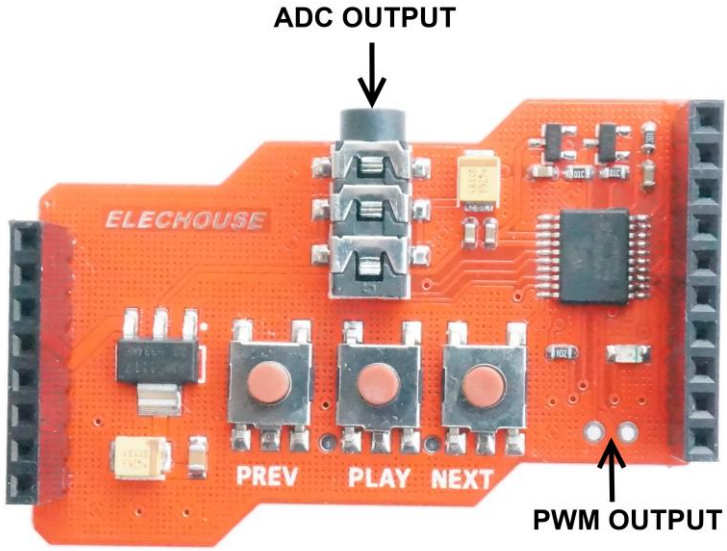
File

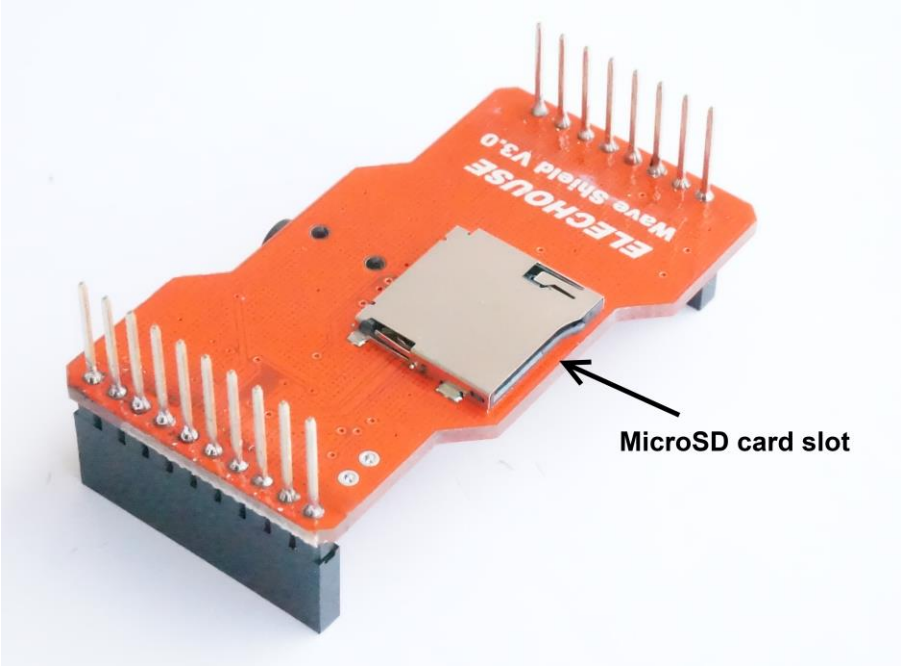
This module could play AD4 and WAV file. You can convert MP3 file to AD4 or WAV. To create AD4 files, download this software. In the package contains instruction showing how to use it. To create WAV file, you can refer to this document. We also supply audio sample.

Load voice files to root directory of SD card, and rename the files in this way: for WAV format voice, name in hex 0000.wav, 0001.wav, 0002.wav……; for ad4 format voice, name in hex 0000.ad4, 0001.ad4, 0002.ad4……. This module can play max 512 files.

Connection

Just plug in this module in Arduino. It is compatible with all Arduino series. There are two audio output interfaces on this module: PWM OUTPUT and ADC OUTPUT.





You could connect a 0.5W 8ohm speaker via PWM output interface.

Software

Those pins of this shield are connected with Arduino.

Arduino Pins	Input/Output	Description	Example code
Pin 8	Output	CLOCK Pin	Please refer to the section below: Two-line Protocol and Command
Pin 9	Output	DATA Pin	
Pin 10	Output	RESET, set HIGH to be effective	

Pin 11	Output	Play previous track	pinMode(11, OUTPUT);
			digitalWrite(11, LOW);
			delay(100);
			digitalWrite(11, HIGH);

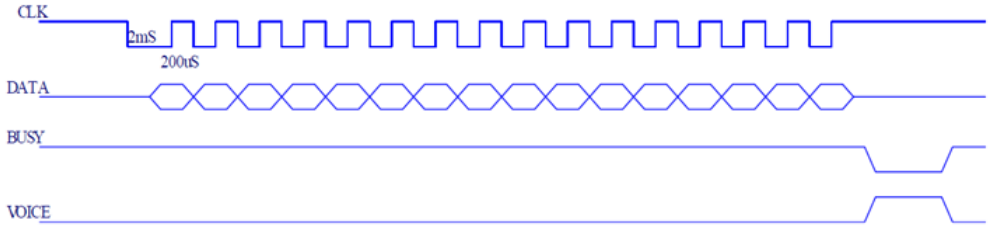
Pin 12	Output	Pause/Play	pinMode(12, OUTPUT);
			digitalWrite(12, LOW);
			delay(100);
			digitalWrite(12, HIGH);

Pin 13	Output	Play next track	pinMode(13, OUTPUT);
			digitalWrite(13, LOW);
			delay(100);
			digitalWrite(13, HIGH);

SDA	Input	HIGH if the audio is playing
		SDA is：
		Arduino UNO: AD4
		Arduino Leonardo: D2
			pinMode(SDA, INPUT);
			If (digitalRead(13)==HIGH)
			Serial.print("Playing");//add processing code

Two-line Protocol and Command

Arduino sends command via two pins: CLK (Arduino A5) and DAT (Arduino A4). The communication protocol is like I2C, but not standard I2C.



Send the file name to play the audio. If you need to play file 0005.AD4, send data 0x0005.

To control voice volume and others, send the following command:

CODE	FUNCTION	DESCRIPTION
FFF0H～FFF7H	VOICE VOLUME ADJUSTMENT	THE VOLUME CAN BE ADJUSTED DURING PLAY OR STAND BY STATUS. FFF0H IS MIN, FFF7H IS MAX, TOTAL 8 LEVEL .
FFFEH	PALY/PAUSE	PLAY/PAUSE THE VOICE IN THE ADDRESS
FFFFH	STOP	STOP TO PLAY THE VOICE

The default volume is the maximum. FFF0H is mute. Volume can be adjusted in play or stop status.

Example Code

Click here to download the sample code:

```
/*
              This code is show how Arduino Wave Module works with Arduino.
              Code is not optimized. Any improving work on it is encouraged.
 (C) Copyright 2011 elechouse.com
 */

int CLK = 8;
int DAT = 9;


void setup() {
   pinMode(CLK, OUTPUT);
   pinMode(DAT, OUTPUT);

   pinMode(11, OUTPUT);
   pinMode(12, OUTPUT);
   pinMode(13, OUTPUT);


}

void loop() {
 send(0x0000);//play file 0000
 Serial.println("Play 1");
 delay(10000);//delay 10 seconds


 send(0x0001);//play file 0001
 Serial.println("Play 2");
 delay(10000);//delay 10 seconds

 send(0x0002);//play file 0002
 Serial.println("Play 3");
 delay(10000);//delay 10 seconds

 send(0xfff0);//set voice volumn to 0 (turn off)
 delay(3000);

 send(0xfff4);//set voice volumn to 4
 delay(3000);

 send(0xfff7);//set voice volumn to 7
 delay(3000);

 send(0xfffe);// pause
 delay(5000);
 send(0xfffe);//play
 delay(5000);

/*
   //the following code is to play previous track
   digitalWrite(11, LOW);
   delay(100);
   digitalWrite(11, HIGH);


   //the following code is another way to pause and play
   digitalWrite(12, LOW);
   delay(100);
   digitalWrite(12, HIGH);

    //the following code is to play next track
   digitalWrite(11, LOW);
```

```
   delay(100);
   digitalWrite(11, HIGH);

*/
  while(1);
}

/*********************************************
The following function is used to send command to wave shield.
You don't have to change it.

Send the file name to play the audio.
If you need to play file 0005.AD4, write code: send(0x0005).
For more command code, please refer to the manual
*********************************************/
void send(int data)
{
  digitalWrite(CLK, LOW);
  delay(2);
  for (int i=15; i>=0; i--)
  {
    delayMicroseconds(50);
    if((data>>i)&0x0001 >0)
      {
        digitalWrite(DAT, HIGH);
        //Serial.print(1);
      }
    else
      {
        digitalWrite(DAT, LOW);
       // Serial.print(0);
      }
    delayMicroseconds(50);
    digitalWrite(CLK, HIGH);
    delayMicroseconds(50);

    if(i>0)
    digitalWrite(DAT, LOW);
    else
    digitalWrite(DAT, HIGH);
    delayMicroseconds(50);

    if(i>0)
    digitalWrite(CLK, LOW);
    else
    digitalWrite(CLK, HIGH);
  }

  delay(20);
}
```

Upload the code to Arduino and then press RESTE button (the black on) on the module. You can also try the red buttons. They are NEXT, Play/Pause and PREVIOUS.

Now you could enjoy your music.

Useful link

- *Buy Arduino Wave Module*
- *Buy speaker*
- *Sample audio file*
- *AD4 software*
- *How to format SD card*

- *How to convert audio file to WAV*
- *Test code*

Disclaimer and Revisions

The information in this document may change without notice.

Revision History

Rev.	Date	Author	Description
A	Dec. 16th, 2011	Wilson	Initial version
B	April 27th, 2012	Wilson	Corrected known defect of V1; Changed the testing code for Arduino;
C	Jan. 8th, 2014	Wilson	Upgrade to V3