Experiment 5 - Audio Playback with Modulation

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1 Aim

To reproduce the audio signal on a speaker.

Different modulations in terms of amplitude and frequency using an 8-bit parallel DAC by using multiplication based on scaling of potentiometer input

Frequency modulation using multiplication of delay similarly.

2 Apparatus

1. Arduino Uno
2. DAC8000
3. LM386 Audio Amplifier
4. Breadboard
5. Connecting Wires
6. Resistors

3 Challenges Faced

1. Controlling Current in Components
   Placing resistors and capacitors appropriately in the path of current sensitive components such as LM386 to control the gain of the op-amp.

2. Playing Frequency
   Since the arduino has a limited memory it is difficult to play music on the device without using any external memory. Therefore the frequency was played directly by converting it into 8 bits and passing it to DAC0800.

3. Frequency Modulation
   Using arduino delay command to frequency modulate the output audio while interfacing with potentiometer for quantifying frequency.

4 Code Flowchart

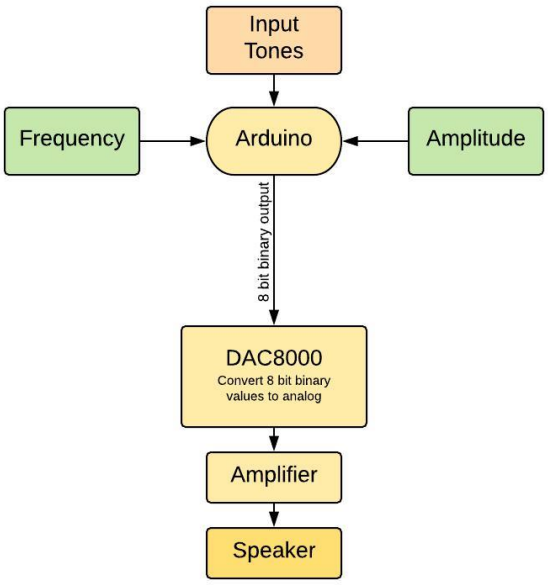

Figure 1: Flowchart.

5 Block and Circuit Diagram for Interfacing

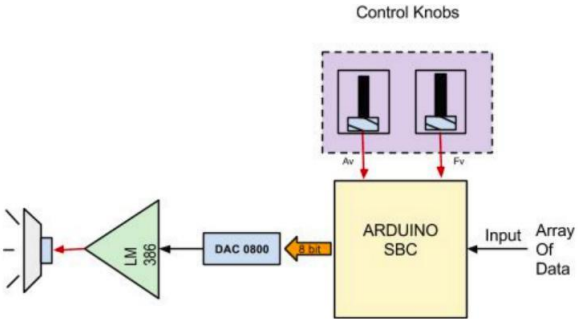

Figure 2: Block Diagram.

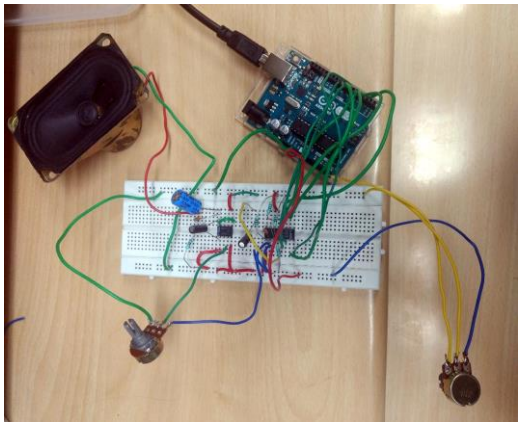

Figure 3: Circuit Diagram.

6 Conclusion and Results

In this experiment we studied and implemented an audio amplifier by feeding it an analog input through a 8 bit Digital to Analog Converter. We also implemented the functionality of Amplitude as well as Frequency Modulation on the same circuit by tweaking the arduino output. We used two potentiometers for controlling the output amplitude and frequency.

References

[1] "Arduino - Debounce", Arduino.cc, 2018. [Online]. Available: https://www.arduino.cc/en/Tutorial/Debounce. [Accessed: 09- Jan- 2018].

Appendix

Code

```
int PINS_OUT[] = {9, 8, 7, 6, 5, 4, 3, 2};
const int PIN_FREQUENCY = A3;
const int PIN_AMP = A5;
const int PIN_SPEAKER = 12;

void setup()
{
  Serial.begin(9600);
  pinMode(PIN_SPEAKER, OUTPUT);
  pinMode(PIN_FREQUENCY, INPUT);
  pinMode(PIN_AMP, INPUT);
  for (int i = 0; i<8; i++)
  {
    pinMode(PINS_OUT[i], OUTPUT);
  }
}

void applySignal(byte a)
{
  int i=0;
  byte b=128;
  for (;i<8;i++)
  {
    digitalWrite(PINS_OUT[i], ((a & b) > 0));
    b /= 2;
  }
}

byte MAX_AMP = 255;
int MAX_FREQ = 15500;
int amp, freq;
int flag = 1;
void loop()
{
  amp = analogRead(PIN_AMP);
  freq = analogRead(PIN_FREQUENCY);
  flag = 1;
  applySignal(byte(long(amp MAX_AMP) / 1024));
  delayMicroseconds(long(500000.0 1024.0 / (double(MAX_FREQ) double(freq))));
  flag = 0;
  applySignal(byte(long(amp MAX_AMP) / 1024));
  delayMicroseconds(long(500000.0 1024.0 / (double(MAX_FREQ) double(freq))));
}}
```