Audio Mixer Ordered Microcontroller

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Abstract *- In this paper is presented an audio mixer done with Digital Potentiometers ordered an ATmega 328 microcontroller. A function has been implemented whereby all signal sources to be brought to the same level by pressing a button. Also, the level can be adjusted separately for each channel.*

Keywords – Mixer, microcontroller, digital potentiometer, SPI (Serial Interface Peripheral), Auto Level.

1. INTRODUCTION

Sound mixer is a device that has at least two or more input signals (microphone, CD player, etc) and generates an output signal added. The mixer can adjust the level of each input and output signal is applied to an audio power amplifier or a recorder.

The most common uses are in radio television studios, recording studios, live music, karaoke, etc.

An operator must regulate levels of input sources continuously to keep output levels accordingly.

An audio mixer fitted with the auto-level work eases operator in case of spontaneous discussion or conference held during the shows or during television.

2. GENERAL PRESENTATION

Next will be presented an audio mixer with two inputs (see Figure 1), the number of channels can be extended later.

You can enter the mixer signals from different sources:

CD player, MP3 player

Microphones

- Transducer musical instruments

Microphones and transducers require amplification instruments. Two or more digital potentiometer will control the volume. Potentiometers control is performed by a microcontroller via SPI serial interface. The signals output from digital potentiometers are placed in a summing circuit. Finally, the mixed signals are applied to a power amplifier or recorder.

It will be used for each channel, two buttons comeback, with which it will increase and decrease the volume (UP / DOWN). A return button will activate the auto level.

2.1. Signal summation circuit

Since the analog input of a microcontroller only accept positive voltage (0 ÷ 5V) it is necessary as load voltage amplifier output to be half the supply voltage.

This was achieved by applying a voltage to the non-inverting terminal obtained from a resistive divisor consisting of two equal resistors R [1] .

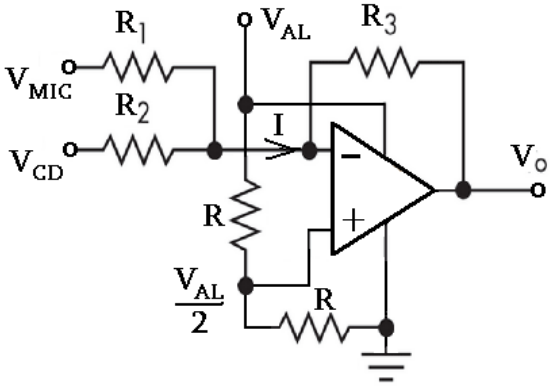

Fig. 2 . Signal summation circuit

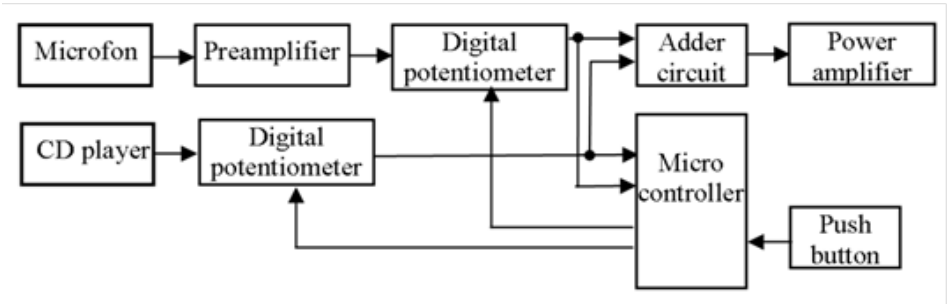

Fig. 1 Block diagram of the audio mixer

Output voltage circuit is given by 1:

$$V_O = \frac{V_{AL}}{2} - R_3 * I = \frac{V_{AL}}{2} - R_3 * \left(\frac{V_{MIC} - V_{AL}/2}{R_1} + \frac{V_{CD} - V_{AL}/2}{R_2} \right) \quad (1)$$

2.2 The microphone amplifier

For the experiments we used a type electrets microphone BCM6027 [2], which requires a gain of 100. In Figure 3 trackable microphone amplifier scheme [3].

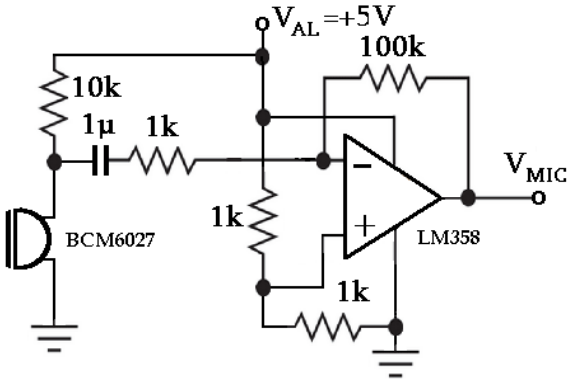

Fig. 3 The microphone amplifier

It is obvious that amplifier circuit has output voltage variation around VAL / 2. This offset is necessary because the digital potentiometer input voltages only accept positive voltage (0 ÷ 5V), [4].

2.3 Digital Potentiometer

The MCP41010 [4] single-channel digital potentiometer features 8-bit resolution (256 wiper steps), and an industry-standard SPI™ serial interface. The wiper position varies linearly and is controlled via the SPI interface. The MCP41010 has a resistance value of 10 kohm. Voltage Range for potentiometer is 0÷VDD [4].

Connect digital potentiometer to microcontroller is as shown in Figure 4.

For the experiment were MCP41010 use features two circuits, one for volume control of the microphone, the other volume CD player.

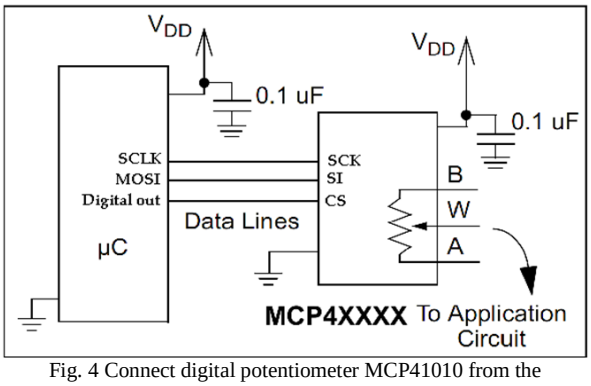

Fig. 4 Connect digital potentiometer MCP41010 from the microcontroller [4]

2.4 Microcontroller ATmega 328

It used an Arduino Uno platform development [5].

Arduino is an open-source physical computing platform based on a simple i/o board and a development environment that implements the Processing/Wiring language. Arduino can be used to develop stand-alone interactive objects or can be connected to software on your computer. Arduino Uno is a microcontroller board based on the ATmega328P], [6]. . It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button.

Peripheral Features

- –Two 8-bit Timer/Counters with Separate Pre-scaler and Compare Mode
- –One 16-bit Timer/Counter with Separate Pre-scaler,
- –Real Time Counter with Separate Oscillator
- –Six PWM Channels
- –6-channel 10-bit ADC in PDIP Package
- –Programmable Serial USART
- –Master/Slave SPI Serial Interface
- –Byte-oriented 2-wire Serial Interface I^2C
- –On-chip Analog Comparator
- –Interrupt and Wake-up on Pin Change..

3. DEVICE'S DESCRIPTION

Figure 5 shows the experimental setup can be traced to the wiring diagram in Figure 6.

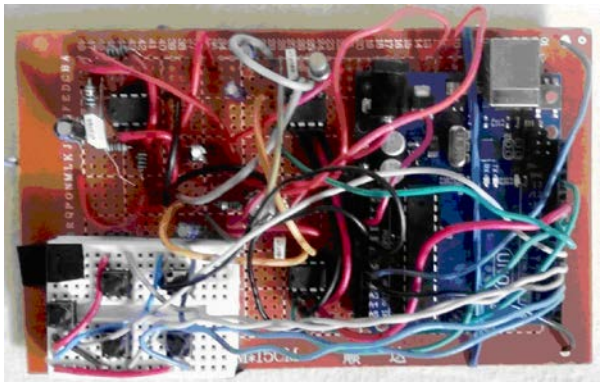

Fig. 5 Experimental installation

Principle of operation

Digitally controlled mixer is designed around a microcontroller ATMEGA 328 implemented a development platform Arduino Uno.

They used two digital potentiometers type MCP 41010, which regulates the signal from a microphone and a CD player. The signal from the CD is inserted directly into one of the potentiometers, the output of the potentiometer is connected to the analog input of the microcontroller A1. Electret microphone type is used and it is amplified signal provided by an LM358 operational amplifier.

As the circuit is powered from a single power supply is necessary to maintain output voltage to ½ of Val = 2,5v.Acesta non-inverting input is accomplished by connecting a resistive divider consisting of two equal resistors (1k) connected to 5V.

The signal from the output of the amplifier is taken from the 2nd digital potentiometer and applied to analog input A0.

Also the two outputs of digital potentiometers are placed in an adder, made the second of LM358 operational amplifier available.

4. PROGRAMMING

His use features Arduino programming environment IDE (Integrated Development Environment) which allows editing C code [8][9].

Volume control is achieved with four push button. Two buttons are used to increase the volume and two for volume decrease. Buttons impulses are taken by the microcontroller. Follow the volume control, conducted by microcontroller based on impulses received from buttons.

The routine schedule is as follows:

```
if (upM == LOW) {
  digitalPotWriteM(valM);
  valM++ ;
}
 if (dwM == LOW) {
  digitalPotWriteM(valM);
  valM--; } ;
 if (upB == LOW) {
  digitalPotWriteB(valB);
  valB++ ;}  ;
  if (dwB == LOW) {
  digitalPotWriteB(valB);
  valB--; } ;
```

For the numerical value which is sent digital potentiometer, were used two variables of type byte (0 ÷ 255) (VolM and VolB). Pressing these two variables can be increment or decrement (ValM++,ValM--) (Valb++,ValB--).

It was implemented and a function by pressing a button that makes the two sources of signal levels are equal (Auto Level).

```
if (aul == LOW ) {
 if (volM > volB ) {
   valB = valM;
  digitalPotWriteB(valM);
 }

 else {
   valM = valB;
   digitalPotWriteM(valB);
 };
}
```

The routine for controlling digital potentiometers is:

```
void digitalPotWriteM(byte value)
{
  // take the SS pin low to select the chip:
  digitalWrite(potM,LOW);
  SPI.transfer(B00010001); // Bitul de comanda
  SPI.transfer(value);     // Bitul de data
  // take the SS pin high to de-select the chip
  digitalWrite(potM,HIGH); }
 void digitalPotWriteB(byte value)
{
  // take the SS pin low to select the chip:
  digitalWrite(potB,LOW);
  SPI.transfer(B00010001); // Bitul de comanda
  SPI.transfer(value);     // Bitul de data
  // take the SS pin high to de-select the chip
  digitalWrite(potB,HIGH); }
```

Was used communication protocol SPI (Serial Interface Peripheral), [7].

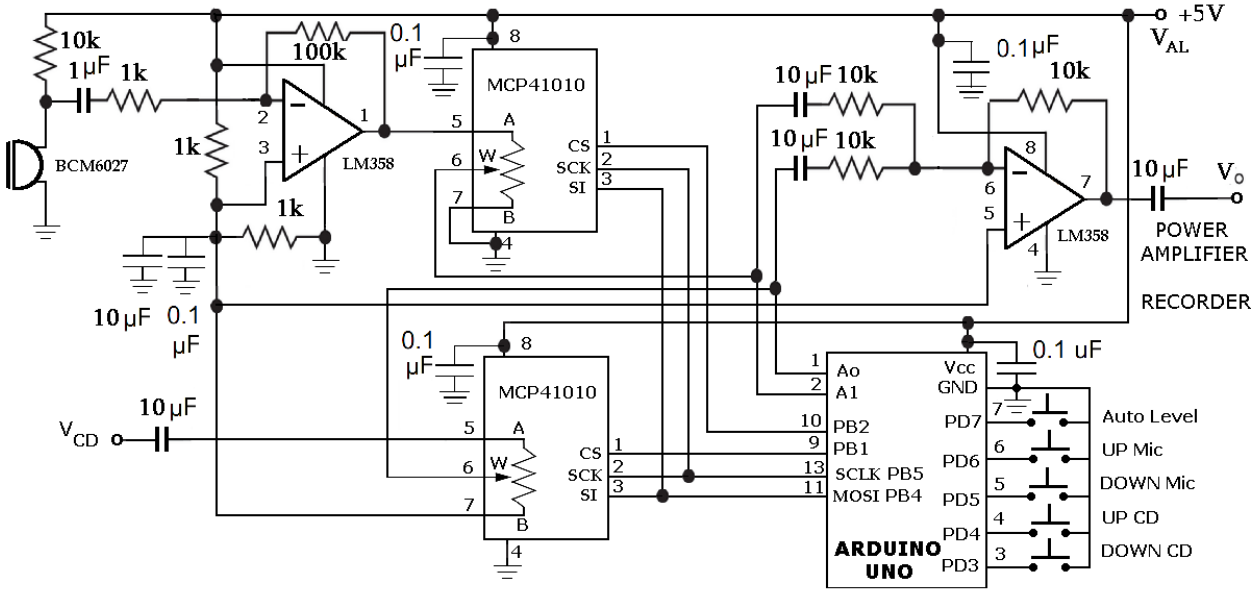

Fig. 6 ` Wiring plan, digitally controlled mixer

5. CONCLUSIONS

Digital potentiometers have the advantage that they are not subject to wear.

The digital volume control features such as equalization obtain signal sources automatically (Auto Level).

The program can impose an upper limit signals may not exceed a maximum level to avoid distortion.

The advantage of digital over analog potentiometers is that no predetermined operating curve. Depending on the order applied to them may have linear or logarithmic feature.

The number of input channels can be expanded up to 6 Arduino Uno, or 8 Arduino Nano.

The embodiment shown can be made of a reduced number of components and minimum cost.

Digitally controlled audio mixer presented in this paper can be greatly improved by making its remote control. Use a module for Arduino Ethernet or Wi-Fi module. Remote controls can be implemented through an application on the mobile phone or tablet, Android or IOS platform.

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