Lab 6. Piano

Project realized and documented by: Petrescu Ioana, 10th grade D, specialization mathematics-informatics, "Constantin Cantacuzino" National Pedagogical College Targoviste

1. Introduction

This project involves creating a simple tone generation system with 8 buttons and a buzzer, similar to a piano. Each button is associated with a specific musical note, and by pressing the buttons, the buzzer emits corresponding tones.

Objectives:

- Demonstrate the use of a buzzer and buttons.
- Develop an efficient algorithm that associates each button with a musical note and controls the buzzer to play the appropriate tones when pressed.
- Understand the principles of buzzer operation and their application in robotics.
- To develop practical skills in programming microcontrollers to process sensory data.

2. Required components

- **Arduino Uno**

It is an ATmega328P based microcontroller board. It has 14 digital input/output pins (6 of which can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power socket, an ICSP connector and a reset button. It contains everything needed to support the microcontroller.

Electronic components used:

- **Breadboard**

It is a board used to connect electronic components such as wires, resistors, capacitors and coils to make various experiments and projects.

- **Pushbutton**

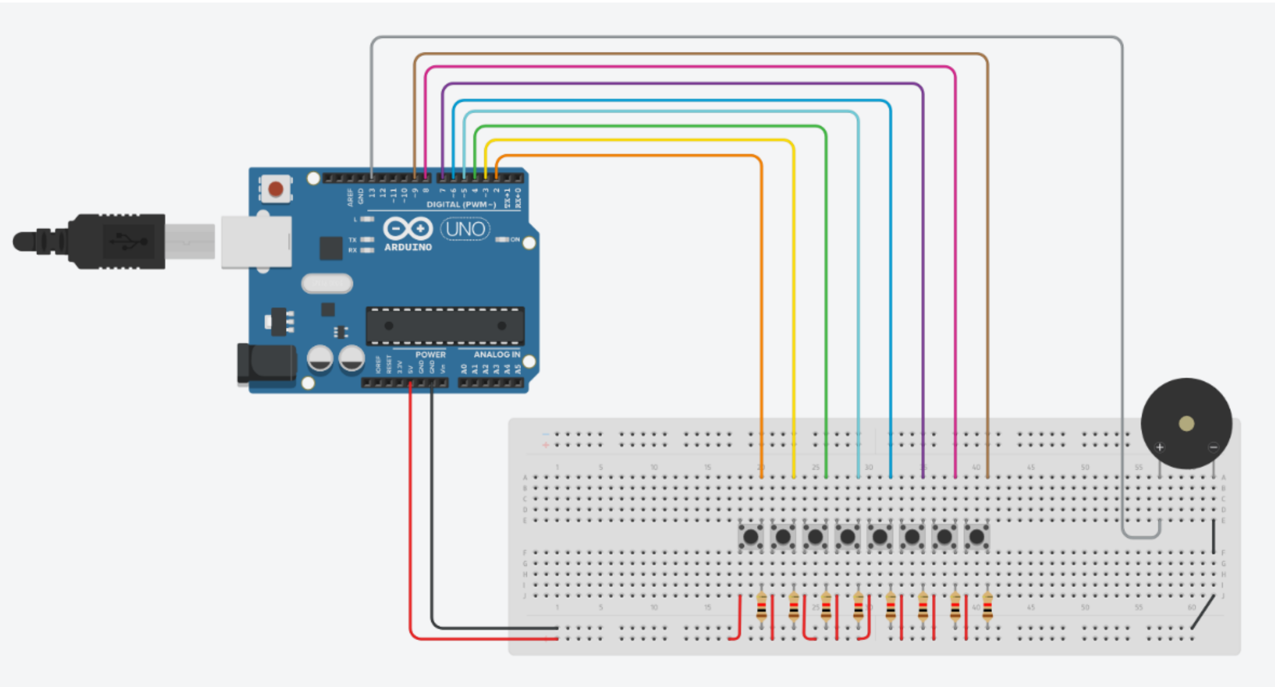
A simple switching mechanism used to control an aspect of a machine or process. Buttons are usually made of a hard material, usually plastic or metal. The surface is usually flat or molded to fit the human finger or hand so that it is easy to press or push.

Sensors:

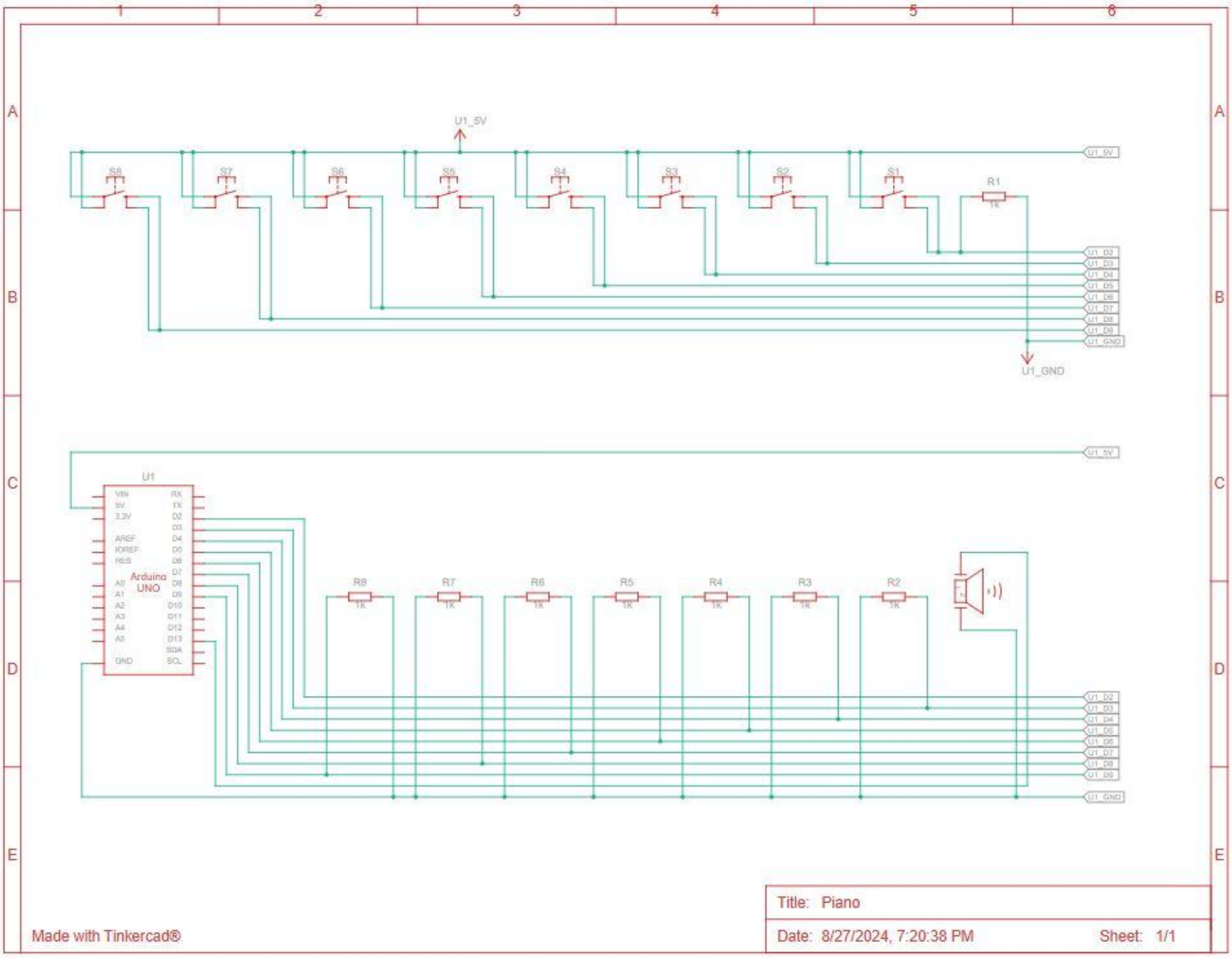
- **Piezo buzzer**

It is a simple electrical component designed to produce sound. It works by using piezoelectric materials that deform when an alternating voltage is applied across them. The voltage causes the material to vibrate rapidly, thus generating sound.

3. Circuit diagram



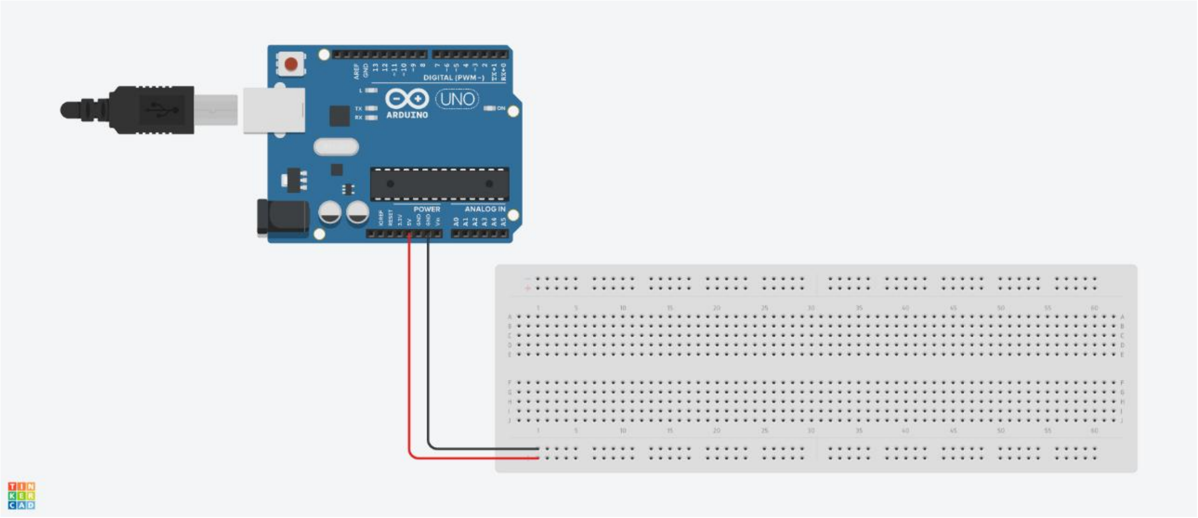
4. Wiring diagram



5. How it works

Connecting power:

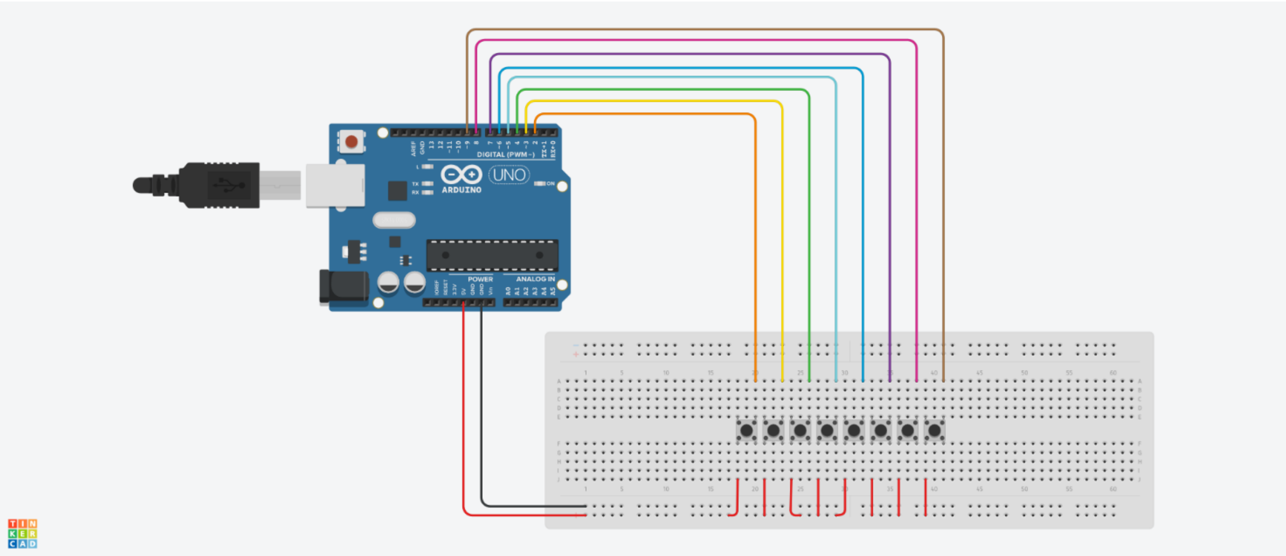
- Connect the 5V pin on the Arduino to the power (+) bar of the breadboard.
- Connect the GND (Ground) pin on the Arduino to the ground (-) bar of the breadboard



Connecting buttons:

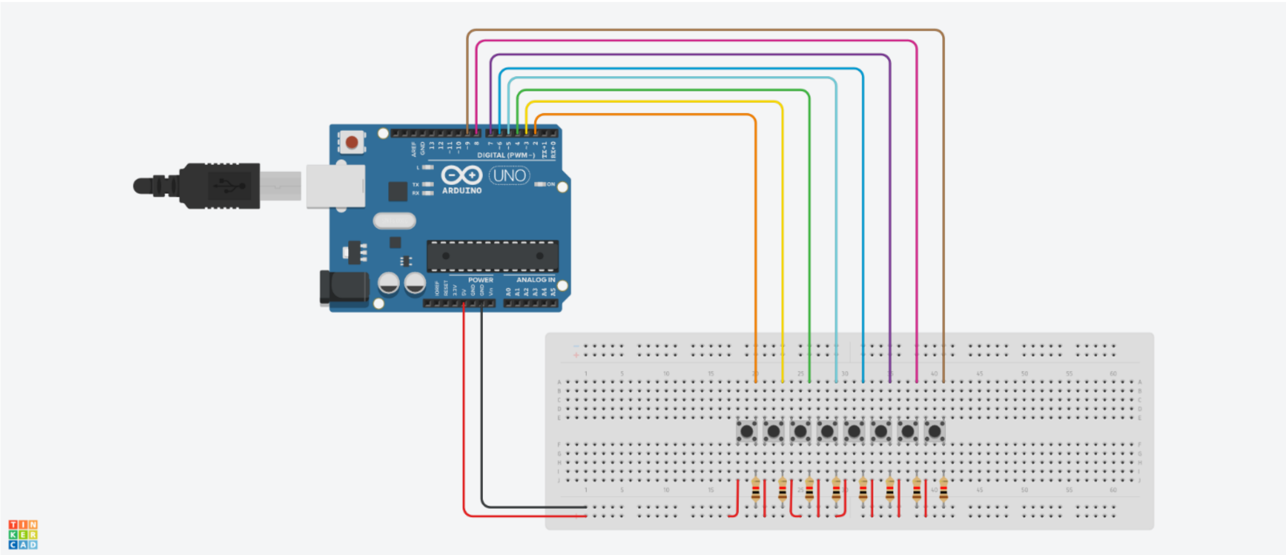
- Button 1 -> Digital pin 2 on the Arduino.
- Button 2 -> Digital pin 3 on the Arduino.
- Button 3 -> Digital pin 4 on the Arduino.
- Button 4 -> Digital pin 5 on the Arduino.
- Button 5 -> Digital pin 6 on the Arduino.
- Button 6 -> Digital pin 7 on the Arduino.
- Button 7 -> Digital pin 8 on the Arduino.
- Button 8 -> Digital pin 9 on the Arduino.

The other side of each button is connected to the positive rail of the breadboard.



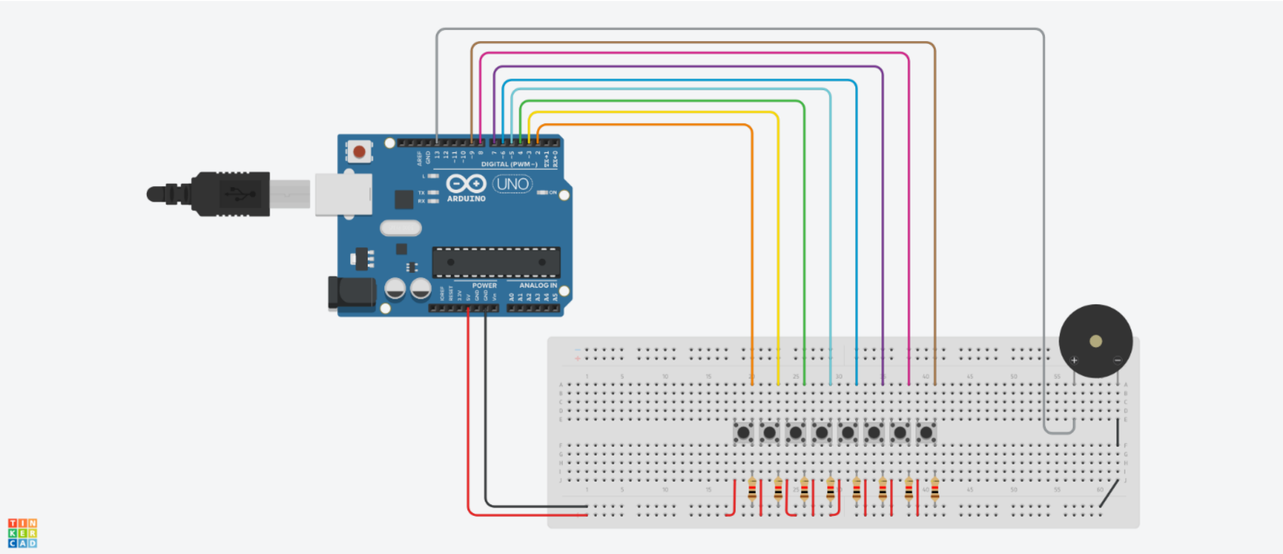
Connecting resistors:

Each button is connected to a resistor which is connected to ground (GND). These are used as pull-down resistors to ensure that the pin reads LOW when the button is not pressed.



Connecting the buzzer:

- The positive part (longer leg) of the piezo buzzer is connected to Digital Pin 13.
- The negative side (the shorter leg) of the piezo buzzer is connected to the ground bar (-) of the breadboard.



6. Programming

Software used: **Arduino IDE**

Code:

```
int btnl= 2;
int btn2= 3;
int btn3= 4;
int btn4= 5;
int btn5= 6;
int btn6= 7;
int btn7= 8;
int btn8= 9;
int buzzer= 13;

void setup()
{
  pinMode(btnl, INPUT);
  pinMode(btn2, INPUT);
  pinMode(btn3, INPUT);
  pinMode(btn4, INPUT);
  pinMode(btn5, INPUT);
  pinMode(btn6, INPUT);
  pinMode(btn7, INPUT);
  pinMode(btn8, INPUT);
  pinMode(buzzer, OUTPUT);
}
void loop()
{
  int bl= digitalRead(btnl);
```

```
  int b2= digitalRead(btn2);
  int b3= digitalRead(btn3);
  int b4= digitalRead(btn4);
  int b5= digitalRead(btn5);
  int b6= digitalRead(btn6);
  int b7= digitalRead(btn7);
  int b8= digitalRead(btn8);
  if (bl== l)
  {
    tone(buzzer, 388, 188);
  }
  if (b2== l)
  {
    tone(buzzer, 488, 188);
  }
  if (b3== l)
  {
    tone(buzzer, 500, 100);
  }
  if (b4== l)
  {
    tone(buzzer, 688, 188);
  }
  if (b5== l)
  {
    tone(buzzer, 708, 100);
  }
  if (b6== l)
  {
    tone(buzzer, 808, 100);
  }
  if (b7== l)
  {
    tone(buzzer, 988, 188);
  }
  if (b8== l)
  {
    tone(buzzer, 1888, 188)
  }
  delay(10);
}
```

7. Conclusions

This project demonstrates how we can create a simple tone generation system using a buzzer and 8 buttons, all controlled by an Arduino Uno R3 board. Through this project, we learned how to connect the electronics to a breadboard, make the necessary connections to power and control the buzzer and buttons, and write a simple program that allows the buzzer tone to be changed by pressing different buttons.

The project is a useful example of the use of microcontrollers for sound control and user interaction, providing a solid basis for the development of applications that require audio feedback or various sound signals. The success of this project may lead to the exploration of more complex ideas, such as customized alarm systems or electronic musical instruments.

8. Bibliographical references

Information:

- https://docs.arduino.cc/hardware/uno-rev3/
- https://www.sciencedirect.com/topics/engineering/breadboard
- https://en.wikipedia.org/wiki/Push-button
- https://uk.rs-online.com/web/content/discovery/ideas-and-advice/how-do-piezo-buzzers-work?srsltid=AfmBOorZWFPfkw3jUPq1Jgrfc-QD4lr0xf5EGCGUKJvdkA9TEu0FX4Qy

Images:

- https://ro.m.wikipedia.org/wiki/Fi%C8%99ier:Arduino_Uno_-_R3.jpg
- https://ro.farnell.com/multicomp/mc01000/breadboard-840-pin/dp/2503747
- https://www.sparkfun.com/products/9190
- https://www.pcboard.ca/minipiezo-buzzer
- https://www.tinkercad.com/dashboard