

Tuner for musical instruments implemented with R2R Digital Analog Converter

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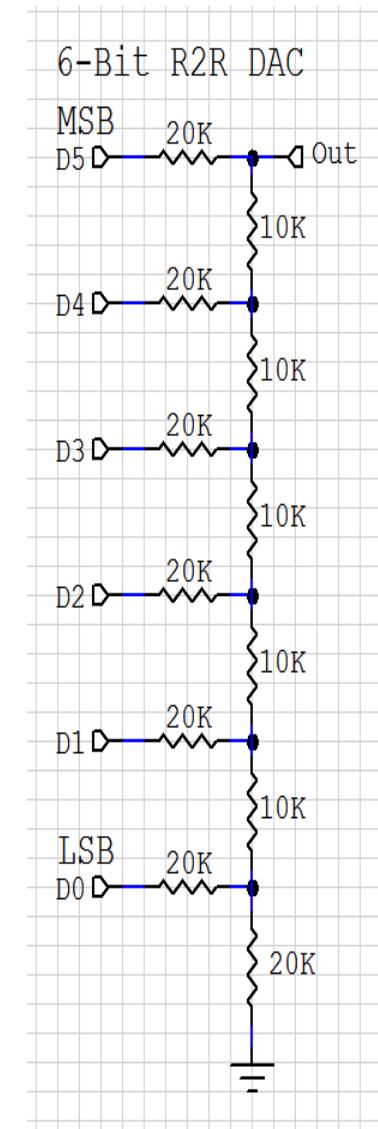
DAC – Digital Analog Converter

- Digital-analog converter made up of a resistive R2R network
- The launchpad microcontroller
MSP430G2553
 - => Tuning device for musical instruments.

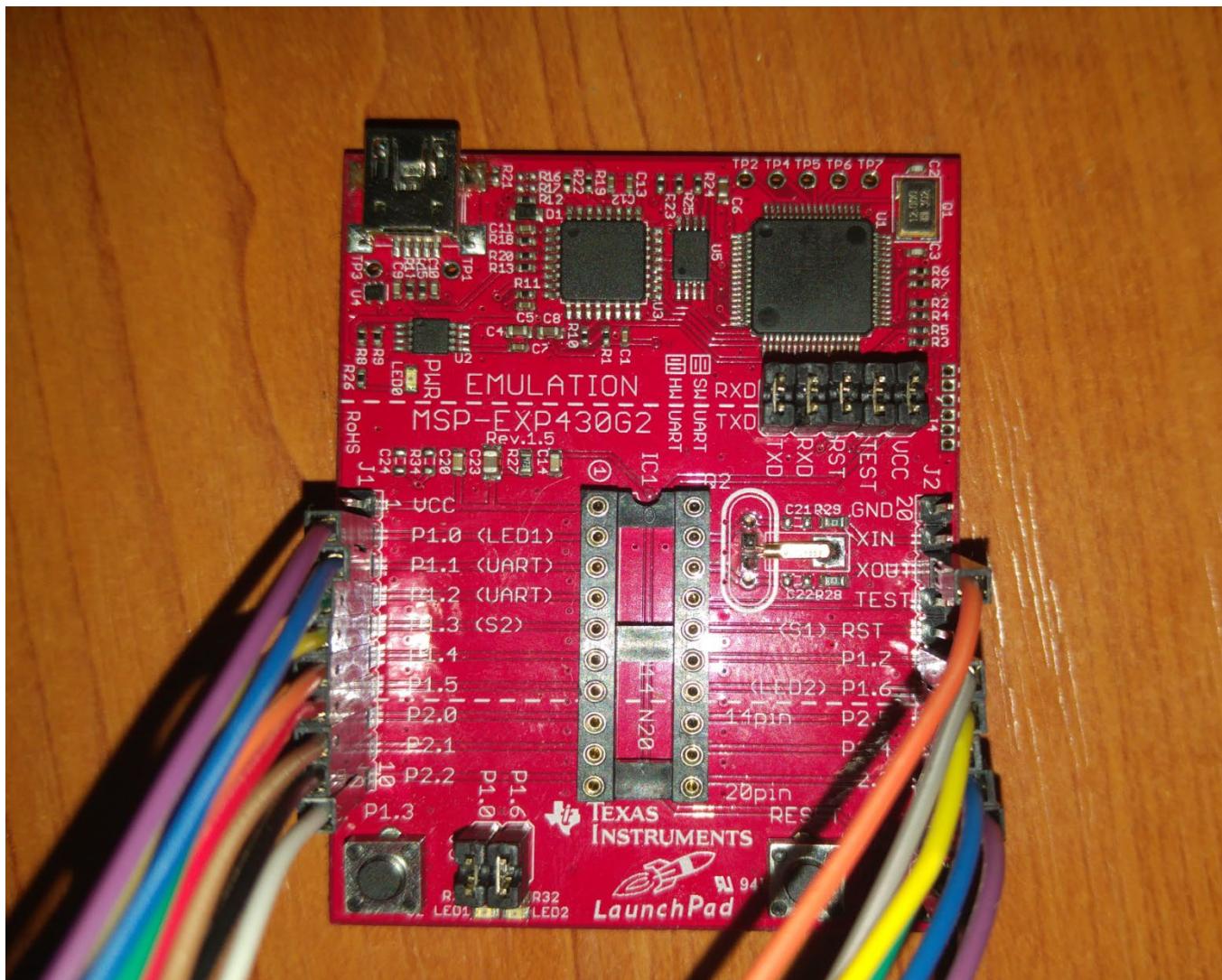
The DAC converter receives a 6-bit digital signal that it transforms into a single analog signal.

From the 6 bits we can remember:

- **MSB** (most significant bit)
- **LSB** (least significant bit)



Microcontroller programming



Boot sequence

Button
OK

Selection block of a Musical Instrument

Instrument
Guitar

Button

Back
Forward

Violin
Instrument

Button

Back
Forward

Trombone
Instrument

Button

Back
Forward

Button
OK

Back

Note Selection Block

Button
OK

Back

Button
OK

Back

Guitar notes

1. Mi
2. Si
3. Sol
4. Re
5. La
6. Mi jos

Button
OK

Back

Forward

Violin notes

1. Mi
2. Si
3. Sol
4. Re

Button
OK

Back

Trombone notes

1. Mi
2. Si

Button
OK

Back

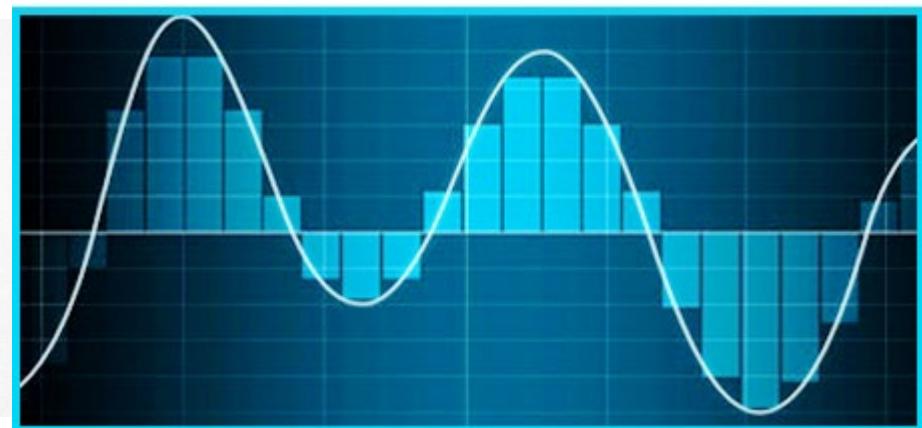
Sound signal generator
function

Sound signal generator
function

Sound signal generator
function

Signal processing

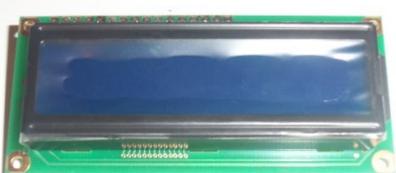
The signal is received at the output of the DAC by an operational amplifier (LM358) to filter it, then it is passed through an FTJ filter after which it is received by 2 amplifiers (LM358) arranged in antiphase for signal amplification.



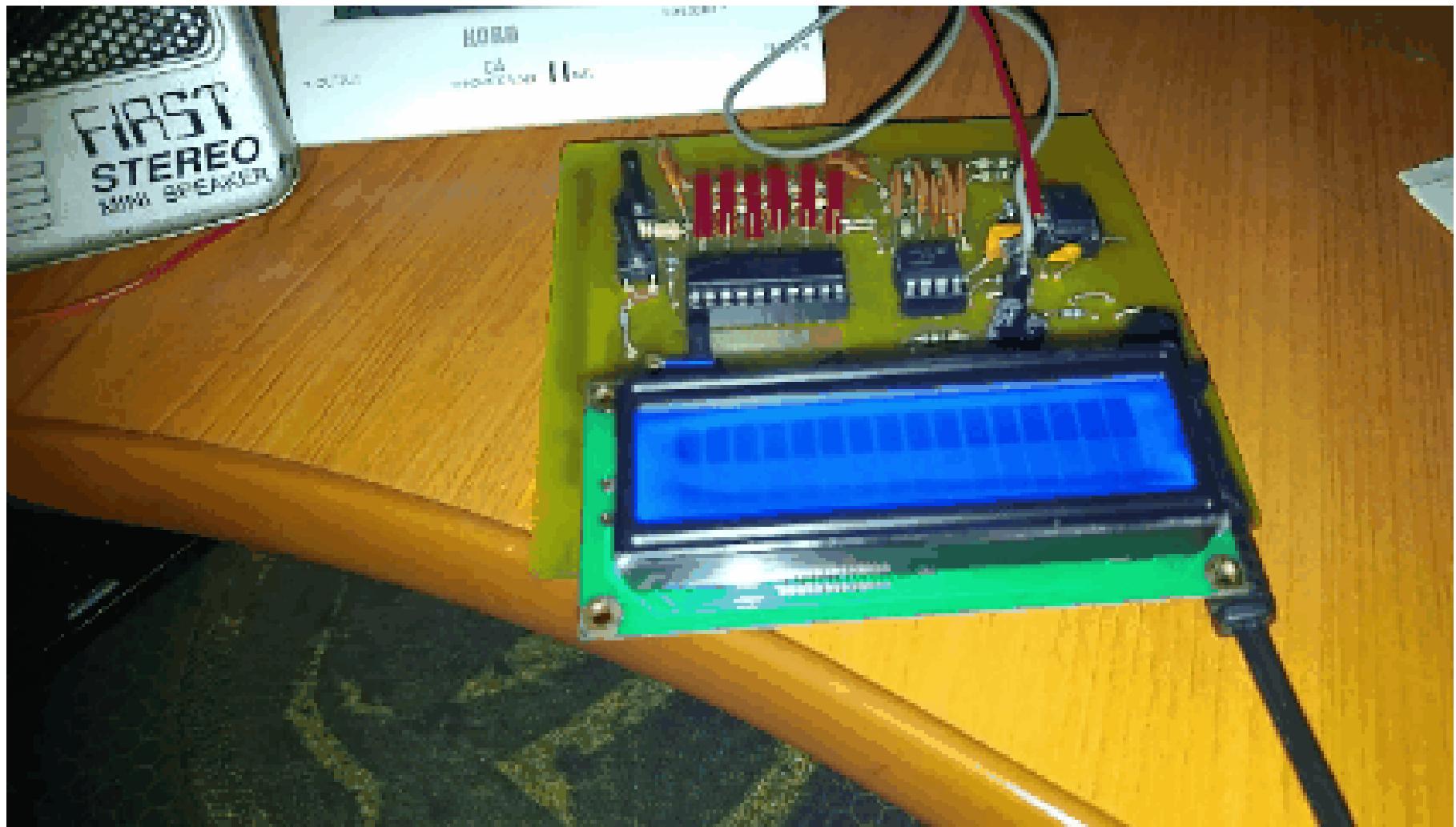
User interface



- For the user interface we used a 1602 LCD with which we can view the menu
- 3 buttons to navigate the menu
- 6 LEDs, one for each bit of the DAC, to show which bits are active at certain times.



User interface



The menu

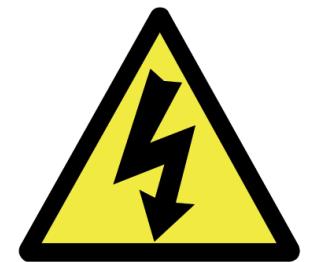
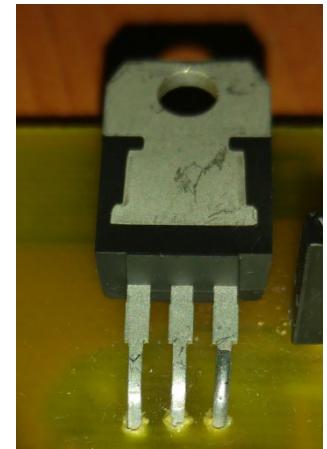
The menu is divided into several sequences:

- The first sequence is the welcome sequence
- The 2nd sequence contains the list of instruments that can be granted
- The 3rd sequence contains the available musical notes
- 4th, after selecting the desired note, the signal is generated and played on the speaker of the device

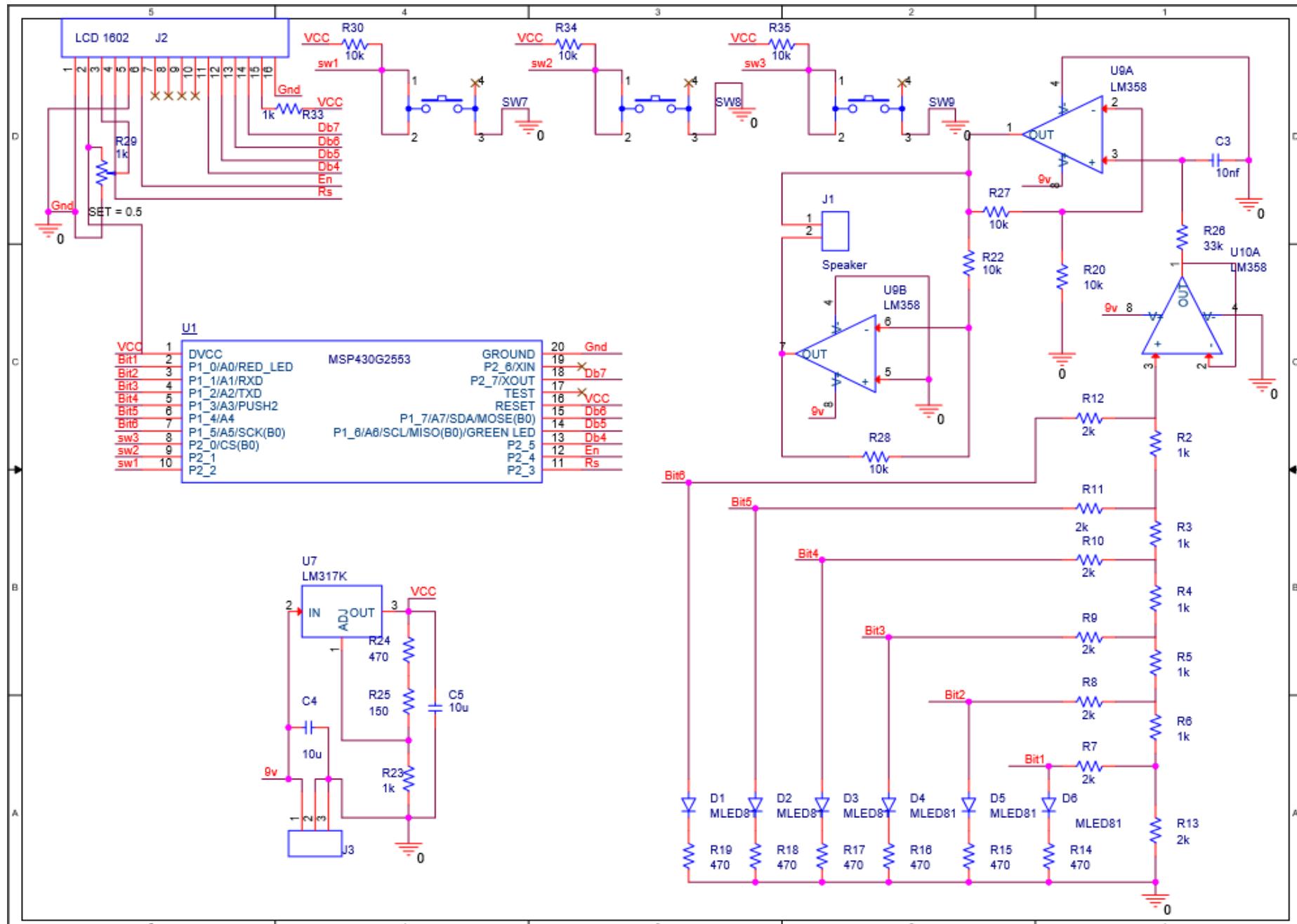


Electrical supply

- The device is powered by a 9V power supply.
- The LM317 voltage regulator that lowers the voltage from 9V to 3.3V



The complete electronic diagram



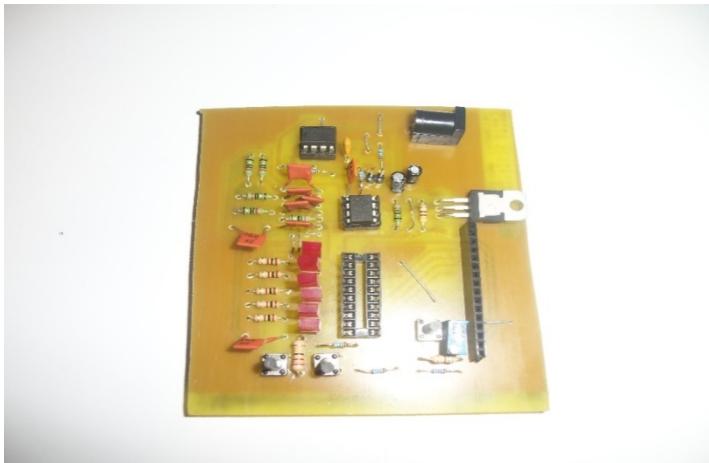
Used equipment and parts

For the realization of this project we used the following equipment and tools:

- Oscilloscope
- Digital multimeter;
- Soldering station;
- Tuner;
- Computer for IC;
- Pliers.

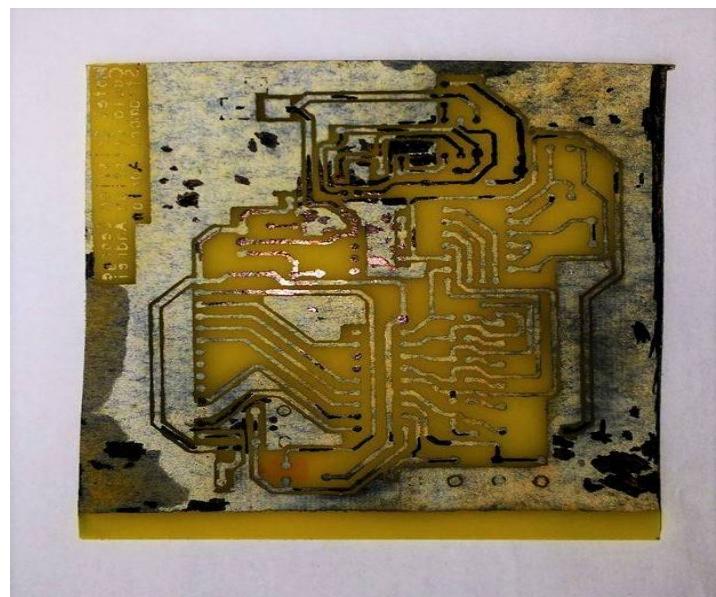
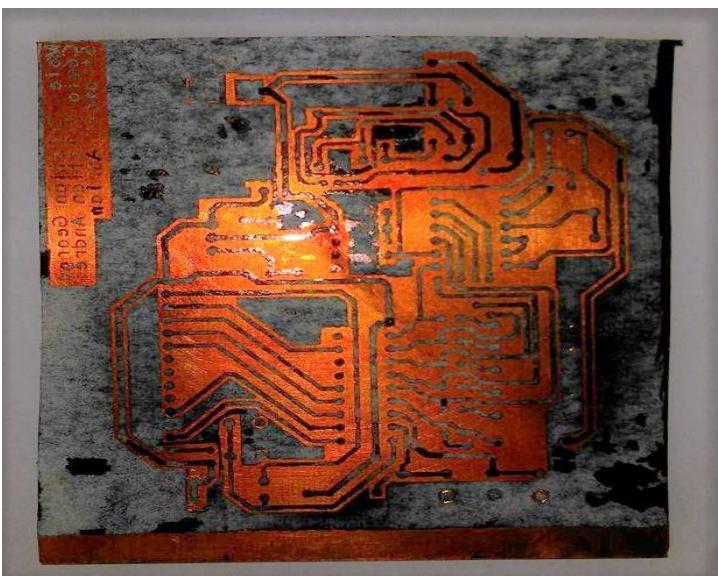
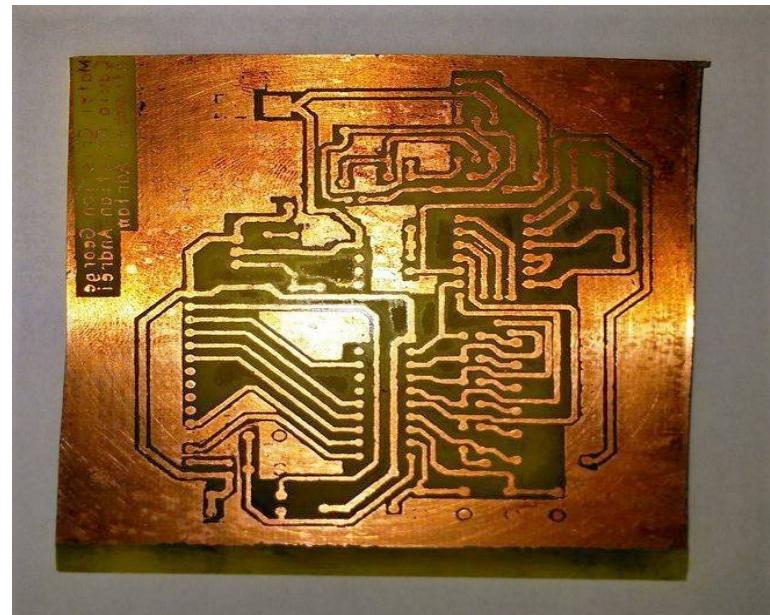
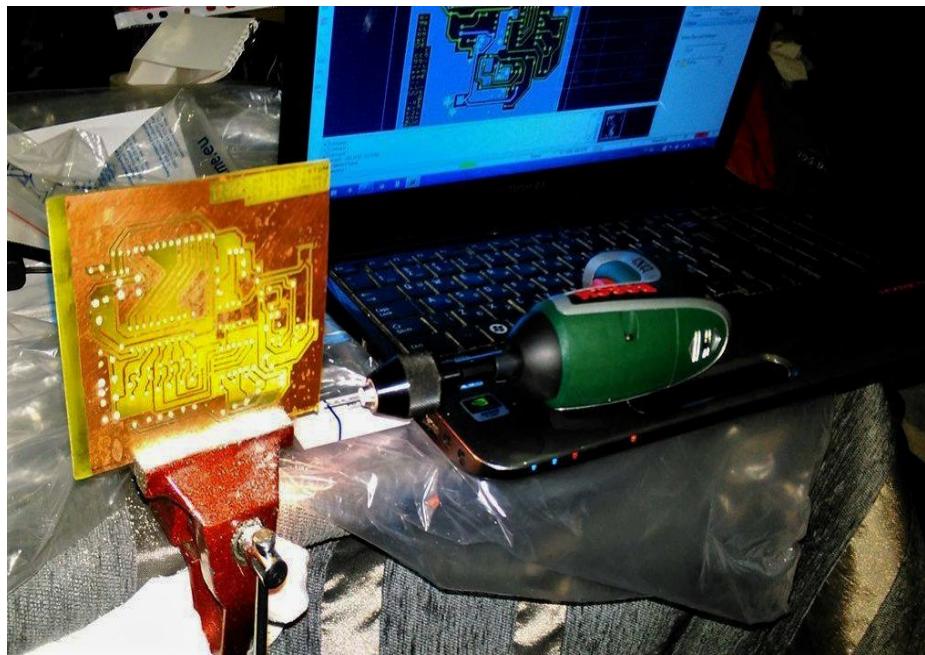


Used equipment and parts

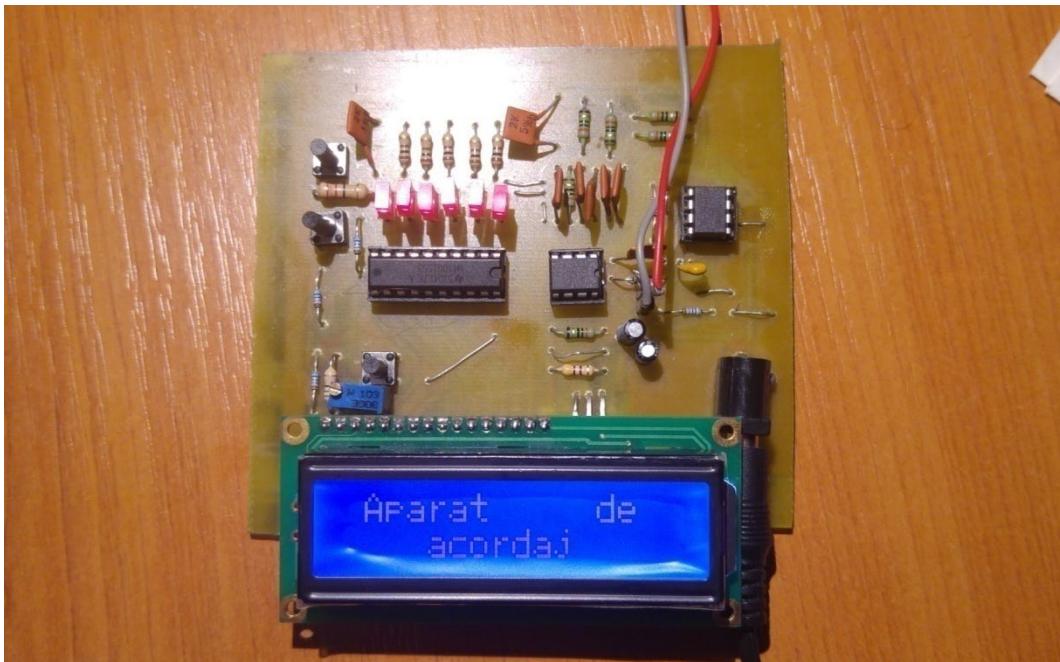
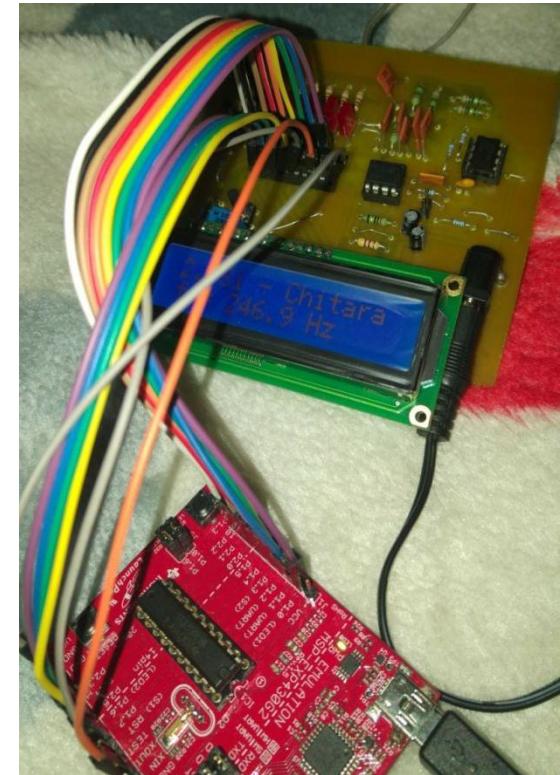
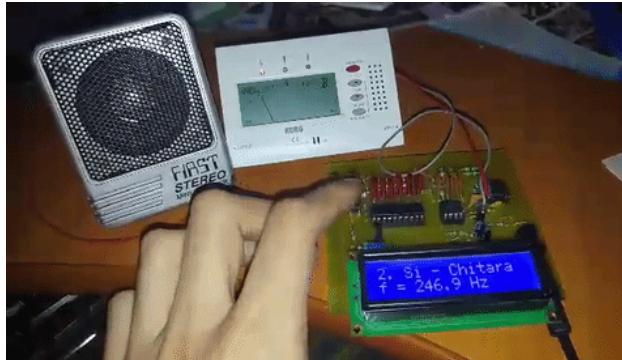


Stages of the Project

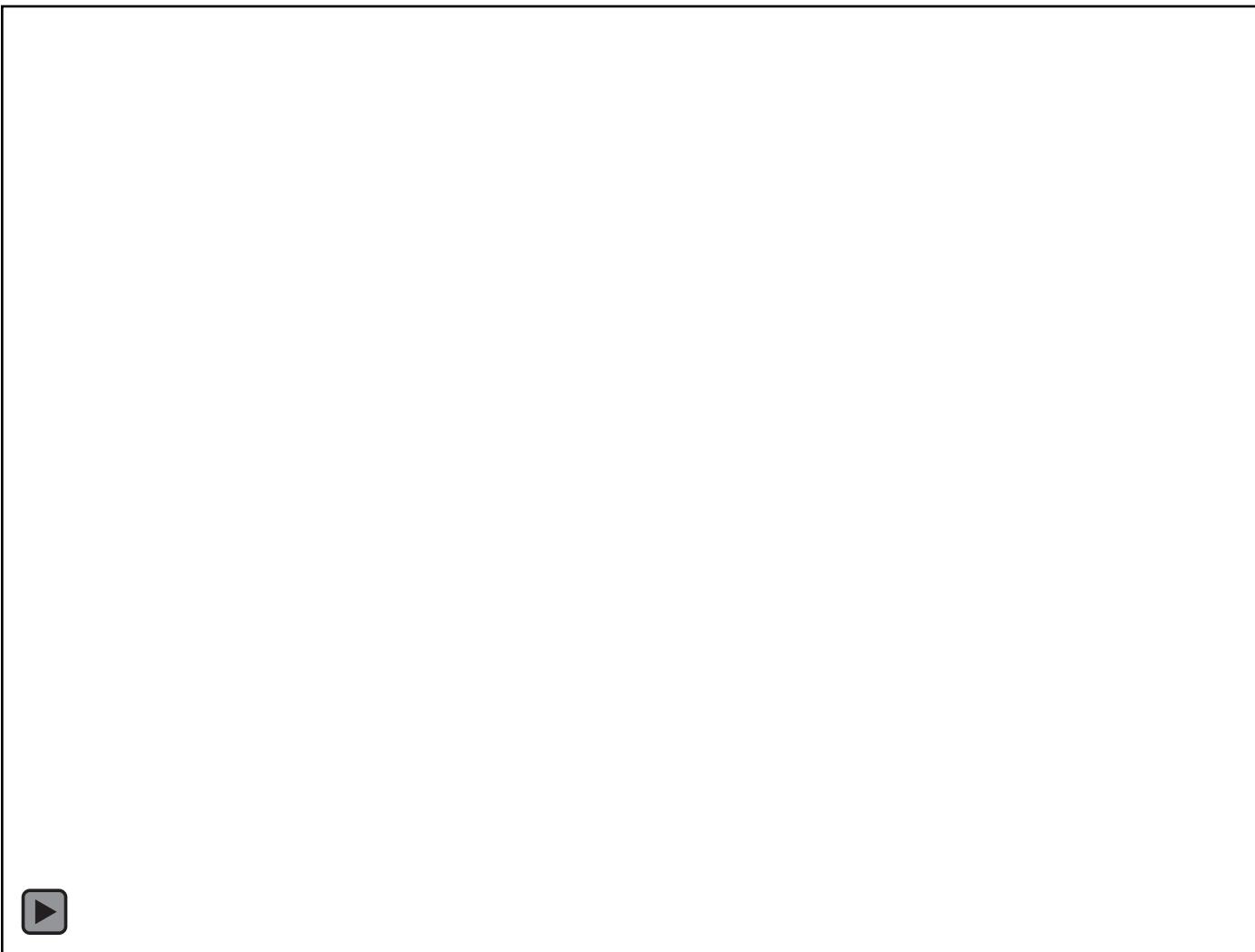
1. Schematic in Orcad Capture CIS
 2. Simulation in Pspice
 3. Realization of printed wiring diagram in PCB Editor
 4. Realization of the printed wiring using the Press Pill method
 5. Checking the continuity and correctness of the circuit
 6. PCB board drilling
 7. Making the necessary bindings (strap)
 8. Drilling the plate according to Drill Drawing/Drill Legend
 9. Bonding of components and connectors
 10. Microcontroller programming
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The final product



Demo operation





Thank you for your
attention

We are waiting for your questions!
