Electronics came out as a new art medium during the 1960s. Naum Gabo and Marcel Duchamp were first who had used electric motors for kinetic sculptures. At the same time, Manfred Mohr understood the computer as a programmable machine and a flexible medium in aesthetic design. His art transformed from abstract expressionism to computer generated algorithmic geometry. However, digital media cannot be defined using conventional categories developed in analogue era. They have fundamentally different features based on algorithms.

Although painting, photography and sculpture still pull down a lot of creative persons; the video, audio, installation, performance and computations are attracting contemporary artists. As the size and price of electronic components dramatically dropped down in recent decades, embedded electronics and physical computing became very popular. Now the software is running not only on mainframe, desktop and laptop computers, as well as on a tablet PC or mobile phones. For instance, microcontrollers with sensors have been programmed to work as interactive systems facilitating the aesthetic process of perception and helping to visualize mathematical spaces. Artists are freely mixing media or they have used a medium in an unconventional way in their experiments and artistic practice. Such mixed reality supports the combination of digital media with other materials and became a great didactic part.

In this report, we summarized own experiences in embedded electronics, digital art and teaching. An attention is given to the hardware and software for a production of artistic artifacts. We built artistic systems on the basis of AVR microcontrollers and ARM microprocessors.

Arduino UNO R3 prototyping board has been used for initial electronic designs. The board was also attached to the 2.4 inch TFT LCD touch screen for the mini-visualizations. Embedded Attiny 85 and Pro Mini Atmega 168/328 microcontrollers were implemented to drive LEDs of different colors, RGB LEDs and addressable SMD3528 LED strips. To be mention, the Attiny 85 controller with 8 pins, 8Kb flash and 512b RAM was quite suitable for most projects. In case the HS-SR501 motion sensor or MQ2 smoke gas sensor in combination with numerous LEDs was involved,
the Pro Mini Atmega 168/328 controllers were preferable, because of multiple pins and larger memory (14/30Kb flash, 512b/1Kb EEPROM) that gave a possibility to perform algorithms imitating behavior patterns. Arduino Nano V3 having the mini-B USB port was very convenient to be fast reprogrammed from a laptop PC or in the serial connection with an ARM computer.

The Raspberry Pi 1 Model B single board microcomputer running Raspbian Wheezy OS was actively involved in early experiments and used for an embedded visualization in the combination with 4.0 inch TFT LCD display or for HDMI/PAL 720p video demonstrations. Based on AllWinner H3 SoC, the very successful board Orange Pi PC was applied to run Processing 3 programs in a combination with an HDMI video output. However, most part of abstract images has been generated in Python 2.7 environment and transferred to Arduino until now. Because the Mali driver is not included in the Armbian assembly 2.2.2017, the Loboris OrangePi-kernel 2015 was used to rotate 3D objects and to process a USB camera output. Both Raspberry Pi and Orange Pi demonstrated reliable serial connectivity with Arduino boards used as a bridge between Pi-microcomputers and sensors.

In conclusion, our artworks were being presented successfully in local art exhibitions. We showed that tiny electronic components can be enclosed in artworks. Embedded electronic systems can provide a real-time interaction with viewers. In general, microcomputers with adjusted peripherals can play a role of new visual media. Nevertheless, artists need more diversified sensors and actuators to meet their aesthetic goals.

References