Use of Tinkercad as part of programming in elementary school computer science classes

Ondrej Takáč[1], Robert Kanta[2] and Andrea Takáčová[3]

[1] J. Selye University
Bratislavská cesta 3322, 945 01 Komárno, Slovakia
takac.ondrej@gmail.com

[2] Základná škola – Alapiskola Jelenec
Školská 330, 951 73 Jelenec, Slovakia
kanta.robert@gmail.com

[3] Základná škola – Alapiskola Jelenec
Školská 330, 951 73 Jelenec, Slovakia
andrea.ada.takacova@gmail.com

ABSTRACT— ***The possibility of teaching programming in the form of blocks represents a great benefit and is becoming very widespread nowadays. Whether we are talking about children's programming languages, Lego MINDSTORMS or even Arduino programming. It is in connection with Arduino, especially for beginners who do not have sufficient knowledge, that it is appropriate to learn programming not directly on real hardware, but e.g. using the appropriate application. This will reduce the risk of damaging the Arduino by unwanted or inadequate intervention. Such an application is Autodesk Tinkercad. In our post, we will point out the possibility of facilitating learning the meaning of the ASCII table, using a practical example.***

Keywords— Arduino, Programing, Education, ASCII table, Tinkercad

1. INTRODUCTION

We encountered programming in the form of blocks in elementary schools in connection with educational kits with Lego MINDSTORMS robots. Relieving the negatives of classic programming and replacing it with a simpler, more acceptable form for students created space for the implementation of robotics in computer science classes. Failure caused by syntax or other programming errors is virtually non-existent. This brought the practice closer to modern education. [3][8] Thus, programming has an irreplaceable place in practical robotics, as in every field of informatics. Programming in an interesting way, which programming using blocks undoubtedly is, provides students with the opportunity to learn new knowledge in a playful way and helps to build a relationship with electronic and IT resources. It also significantly develops students' thinking and has a positive effect on their development. [4] The mentioned form reduces the disappointment of failure, as there is no risk of a syntax error in programming. It is also possible to apply programming in primary schools with great success. [2][11]

As a programming environment, we will use the Autodesk Tinkercad web environment, and as hardware, which includes a microprocessor for which we will create the program, we will choose the Arduino platform. Tinkercad is a free web application for 3D designs, electronics, programming and simulation. It also supports the Arduino board, has components and sensors. [8] Arduino was developed and is mainly used as an educational tool. [1] But it is also popularly used in practice as part of various applications in robotics, camera systems, sensor systems, UAVs, etc. It can also be used in a whole range of activities supported by microprocessors, e.g. in meteorology, agriculture, but also in the protection of cultural heritage. [5][6][7][9] And that is why we are of the opinion that it makes sense to deal with the programming of the Arduino platform.

The ASCII table represents an agreed system of encoding characters and numbers, and most current character sets are based on ASCII. [12] We will focus on understanding the ASCII principle in our article, where we will show its practical significance in combination with the Arduino platform.

2. METODOLOGY

After registering on www.tinkercad.com we can create a new project. Our goal will be to show, within one lesson, the use of an ASCII table on a simpler example, and on a more complex example, controlling the lighting of some LEDs using characters sent via the serial port. We will use the LCD display to display the received characters. The basic connection itself can be seen in fig. no. 1. The red LED only serves as a power-on signal.

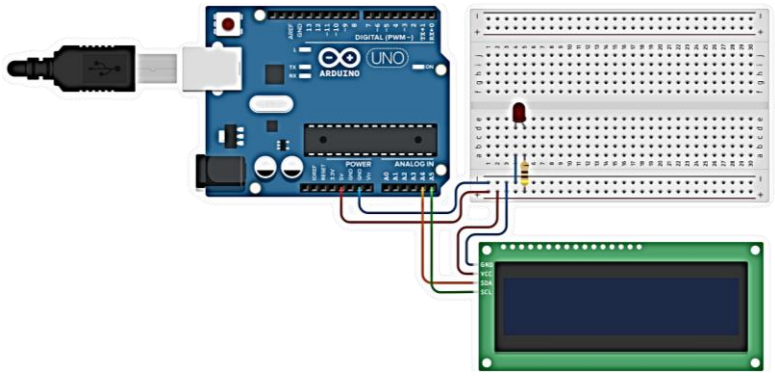

Figure 1: Connection of Arduino and LCD display

The serial port gives us a good option to communicate with the Arduino board via a USB cable. It is able to receive characters and text strings sent from Arduino, but also to send characters.

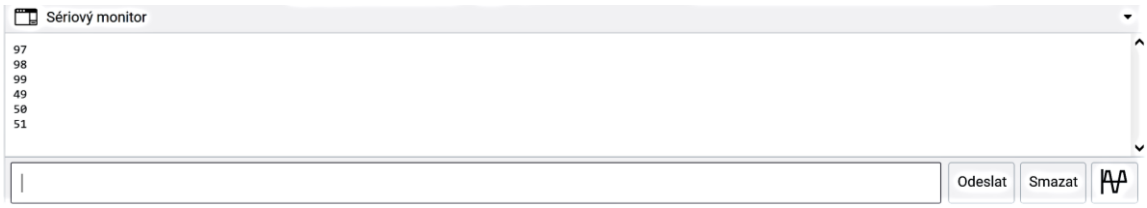

Figure 2: Serial port in Tinkercad

If we really wanted to build our design, Tinkercad gives us the opportunity to download the circuit diagram of our design and the list of necessary parts. This is another advantage, when we do not have to manually draw the wiring diagram in another software, but it is directly available on the Tinkercad website and is completely free.

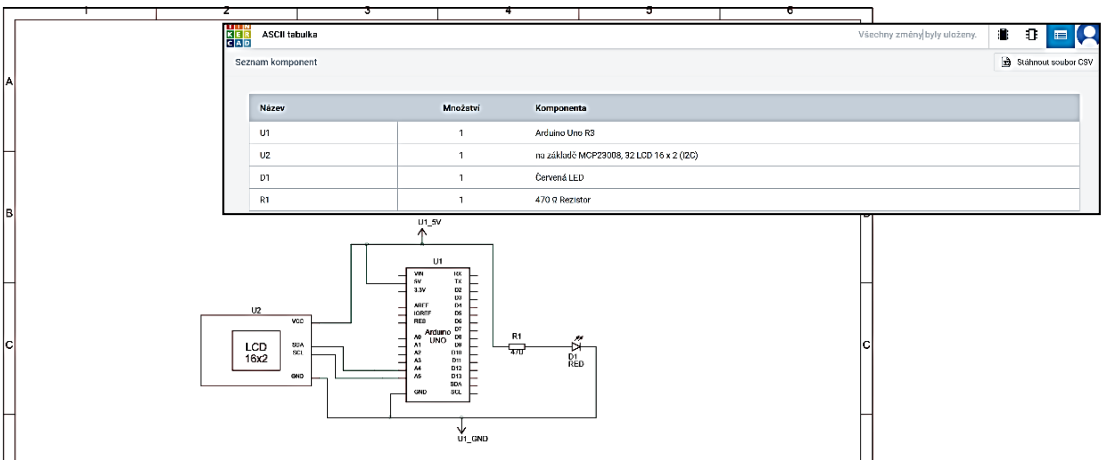

Figure 3: Automatic creation of the diagram according to the connection and the list of used parts

3. RESULTS

In the following picture we can see the operation of our program and we can also see the practical use of the ASCII table. For better readability, we have enlarged the program in the form of blocks. If we take a closer look at the program, we can notice that it is not a complex program, but basically the character that the Arduino receives on the serial port is simply sent back to the serial port and displayed on the LCD display. If we send the number 1 through the serum port, the number 49 will be printed, for the number 2 the number 50 will be printed, for the number 3 it will be printed 51 as we can see in the picture no. 4. Similarly for characters. For the lowercase letter "a" 97 is written, for "b" 98 and so on.

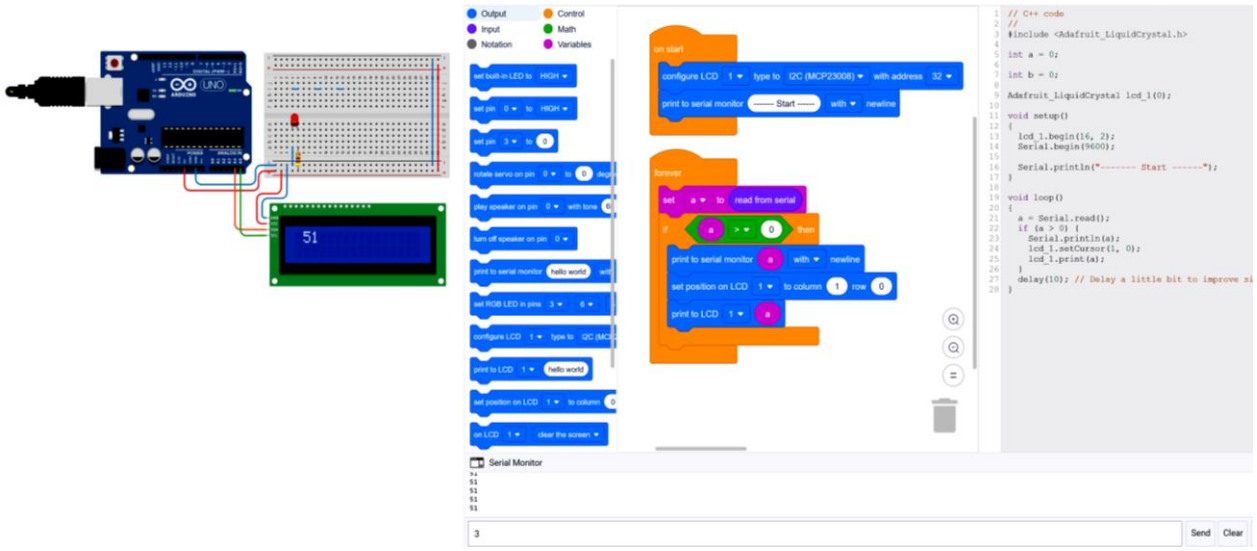

Figure 4: Write of the number 3 on the LCD display and created blocks

We could notice that we are working with two larger units when creating the program. The first unit - at the beginning we use it for initialization and input/output settings. In our case, we can see that in this unit we have set the use of the LCD display and we have written the start via the serial port. The processor processes the blocks in this unit only once. We have to mention that we connected the LCD display to the SDA and SCL pins to the numbers A4 and A5. These are connected to the processor pins for I2C. In the second unit - we have forever compiled the program itself, which will run in an endless cycle until the simulation is stopped or the device is turned off in the real case.

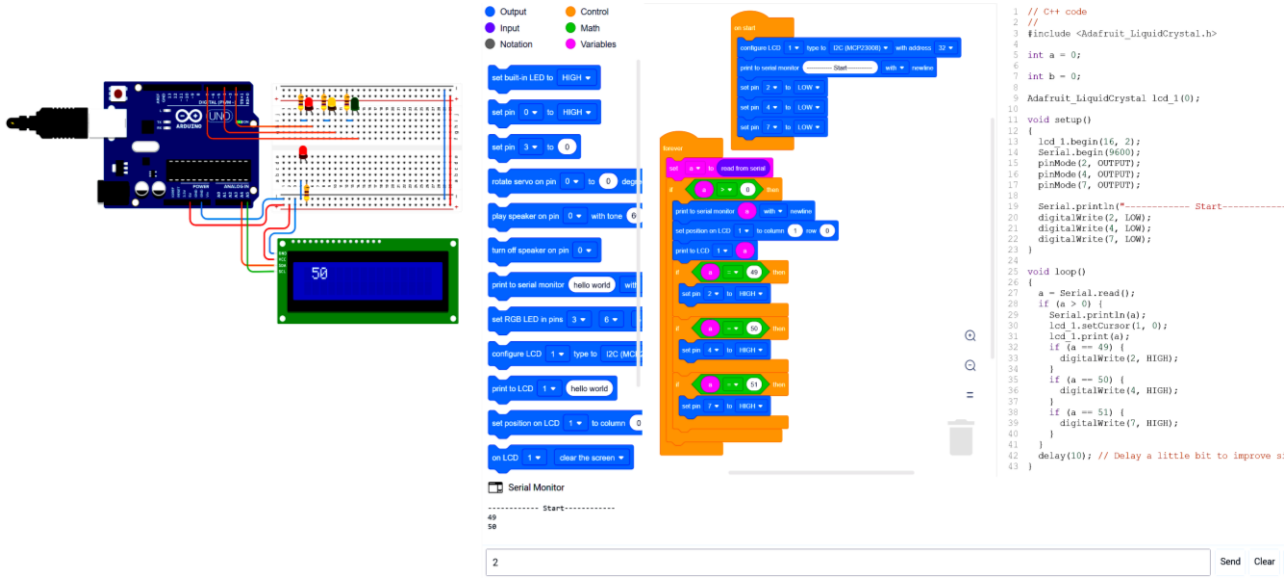

Figure 4: Write of the number 3 on the LCD display and created blocks

With this simple example, we pointed out that we really use the ASCII table in practice. In the next example, we will focus on the practical use of characters sent through the serial port. Now I know that when we send characters through the serial port, when we receive the character, we continue to work with its numerical value. When the number 49 (which is the number 1) is received, one LED turns on, when the number 50 the second LED and when the number 51 the third LED turns on. We see the solution in picture no. 5. A separate task is to complete the program so that the sign "x" turns off all the LEDs.

4. CONCLUSION

The use of the ASCII table is of great importance in computer science. Practically all areas of informatics build on it. We chose the Arduino platform as a way to demonstrate the use of the ASCII table, where we took advantage of the free Tinkercad online environment. We are of the opinion that in this form the students will understand its principle better than if they understood it verbally. It goes without saying that the use of the Tinkercad application reduces the need for deeper programming knowledge.

5. REFERENCES

[1] Arduino. (15. 10 2022). What is Arduino? Cit.: Arduino.cc: https://www.arduino.cc/en/Guide/Introduction
[2] CZAKÓOVÁ, K. 2021. Game-based programming in primary school informatics. In: INTED2021 Proceedings. IATED, 2021. p. 5627-5632.
[3] Stoffová, V., Takáč, O. (2013). ROBOTICKÉ STAVEBNICE V PRÍPRAVE UČITEĽOV INFORMAČNEJ VÝCHOVY. Trendy ve vzdělávání, 6(1), 315-322.
[4] Udvaros, J., Takáč, O. (2020) Developing Computational Thinking By Microcontrollers. In: ICERI2020 Proceedings. IATED, 2020. p. 6877-6882.
[5] Takáč, O., Tomášik, L., Hrubý, D., & Palková, Z. (2012). EXACT NAVIGATION OF SMALL AGRICULTURAL MOBILE ROBOTS WITH THE UTILIZATION OF LASER RAY. MANAGEMENT ECONOMIC ENGINEERING IN AGRICULTURE AND RURAL DEVELOPMENT, 12(1), 239-241p. Volume: 12 Issue: 1. ISSN: 2284-7995. WoS :000422176100048
[6] Takáč, O., Hrubý, D., & Cviklovič, V. (2011). POSSIBILITIES OF NAVIGATION OF MOBILE AGRICULTURAL ROBOTS ON THE PRINCIPLE OF THE GEOMETRICAL OBJETS DETECTIONS. MANAGEMENT ECONOMIC ENGINEERING IN AGRICULTURE AND RURAL DEVELOPMENT, 11(1), 206-208p. Volume: 11 Issue: 1. ISSN: 2284-7995. WoS :000422170400044
[7] Takáč, O., Végh, L. (2021) USAGE OF UAVS IN THE PROTECTION OF CULTURAL HERITAGE IN THE TEACHING OF COMPUTER SCIENCE. In: INTED2021 Proceedings. IATED, 2021. p. 9987-9992.
[8] Takáč, O. (2016). Výučba robotiky pomocou lego MINDSTORMS NXT. Edukacja-Technika-Informatyka, 7(1), 219-223.
[9] Tinkercad (15. 10 2022). Tinker. Dostupné na Internete: ttps://www.tinkercad.com
[10] Tusor, B., Takáč, O., Molnár, A., Gubo, Š., & Várkonyi Kóczi, A. (2020). Shape Recognition in Drone Images Using Simplified Fuzzy Indexing Tables. 2020 IEEE 18TH WORLD SYMPOSIUM ON APPLIED MACHINE INTELLIGENCE AND INFORMATICS (SAMI 2020) (s. 129-134). Herľany: SAMI 2020. ISBN: 978-1-7281-3149-8. WoS :000589772600025
[11] Végh, L., Takáč, O. (2021) Online Games to Introducing Computer Programming to Children. In: INTED2021 Proceedings. IATED, 2021. p. 10007-10015.
[12] XU, Xuemiao; ZHANG, Linling; WONG, Tien-Tsin. Structure-based ASCII art. In: ACM SIGGRAPH 2010 papers. 2010. p. 1-10.