3D Modeling Solutions in the Cloud

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Abstract – The article presents cloud solutions for 3D modeling, which can be used in technology education to create and visualize technical objects, when working on the design and solution of various technical and creative tasks. You offer SketchUp Free and Autodesk Tinkercad software solutions with an intuitive and easy to use interface.

I. INTRODUCTION

Cloud Computing's main idea is for users to access powerful computing and disk resources without being interested in the physical location of these resources, their support and management [1]. The integration of cloud technologies into technological education is conditioned by public needs and expectations for the modernization of the learning process [2]. In the classroom of the future, students will have an electronic device that will provide access to homework and other learning resources in the cloud. there will be no heavy textbooks, all materials will be available as long as there is an Internet connection. This innovation will give students and teachers great freedom, and they will be able to work on their projects from school, home and anywhere else. One of the problems of modern pedagogy is the declining interest of students to study and gain knowledge. For this reason, it is necessary to establish a mechanism for forming students' motivation in order to be able to purposefully influence it, in which teachers will be able to effectively manage the learning process [3]. One option to increase students' motivation to learn is the skillful use of cloud technologies in their learning.

II. CLOUD SOLUTIONS TO CREATE 3D MODELS

SketchUp *Free and Autodesk Tinkercad cloud solutions* provide just as many lye tools as desktop applications. Important advantages of cloud solutions is that created 3D models can also be viewed and edited over mobile devices, do not require the purchase of software, and created models are stored in the cloud.

SketchUp Free SketchUp Free's cloud solution is a powerful tool for 3D network modeling, which is free. An Internet connection and a Google Account are required to work with this solution. SketchUp's core 3D modeler works directly in the web browser. For storage of created models, 10 GB is provided in trimble connect cloud storage. SketchUp Viewer's app can view 3D models on your mobile device. Created models can be imported into SKP, JPG, PNG file types, and display SKP, PNG, STL file types. The 3D gallery allows access to user-generated and manufacturer-made models.

SketchUp Free is located at: https://www.sketchup.com/plans-and-pricing/sketchup-free.

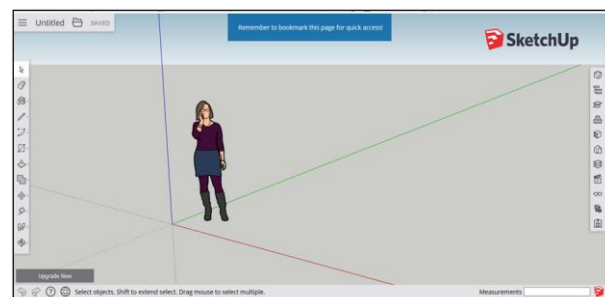The working screen of SketchUp Free is shown in (Figure 1).

Figure 1 The working screen of SketchUp Free

To create models with Google Sketch Up, you need to draw edges and faces using a few simple tools. It will take you almost no time to study them. With the Push / Pull tool you can turn any board into a 3D shape. In addition, the software works with Google Earth, which allows you to deploy scaled aerial photos directly from there or use SketchUp to create models that can be seen in Google Earth.
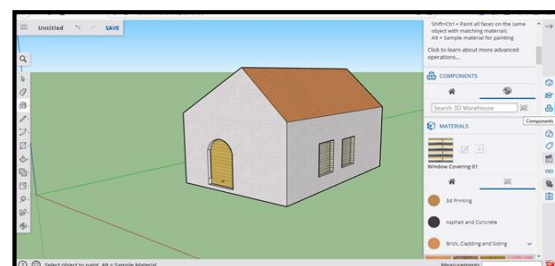
Figure 2 shows a 3D model of a house with a SketchUp**.**

Figure 2 shows a 3D model of a house

SketchUp for Schools

SketchUp for Schools is a free version of SketchUp available to any primary or secondary school signed up with G Suite for Education. With SketchUp for Schools, students around the world have access to free and intuitive 3D modeling tools that enable creative expression and skill development from a young age [4].

Autodesk Tinkercad

The Autodesk Tinkercad cloud solution has a very simple interface. The site, located at: https://www.tinkercad.com/, has completely free training in the basics of working in this 3D editor.

In order to use the functions of the editor, site registration is required. The service is ideal for simple projects with the ability to organize subsequent 3D printing.

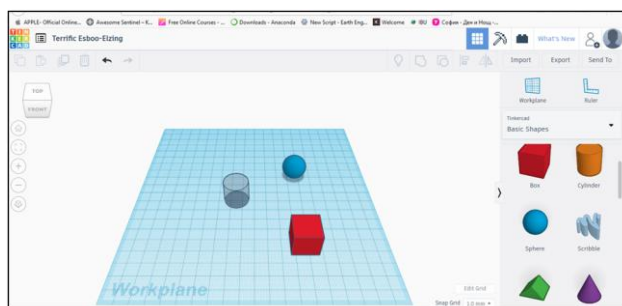The Autodesk Tinkercad work screen is shown in figure 3.

Figure 3. The working screen of Autodesk Tinkercad

Autodesk Tinkercad has a library of ready-made elements, which helps to quickly create 3D models. An online textbook is available. All tools are free. Autodesk Tinkercad has an electronic circuit modeling environment that includes the following modules:

• Editor for electronic circuits.

• Emulator for operation of the main electronic components.

• Emulator for the Arduino controller.

• Sketch editor.

• Debugging and project simulation system using Arduino.

Figure 4 shows an electrical circuit, which includes: voltage source, electric switch, wires and consumer.
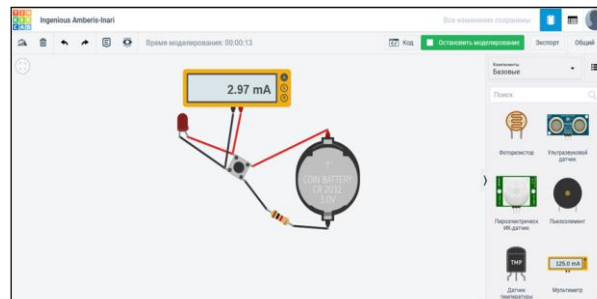

Figure 4. Electronic circuits

CONCLUSION

Cloud technologies are evolving and very soon all aspects of our lives, including education, will be affected. Cloud technologies provide new opportunities for the realization of pedagogical goals and change the educational environment and ways of communication between teacher and students, leading to an increase in their motivation to learn.The application of cloud technologies in the educational environment allows to ensure mobility, accessibility and timeliness of the created 3D models. Cloud technologies for 3D modeling can be a useful tool in education that stimulates creative thinking of students, activates the process of learning new concepts and generating ideas. Mastering and using cloud solutions to create 3D models is a challenge for both teachers and students.

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[4] https://help.sketchup.com/en/sketchup-schools/sketchup-schools

[5] https://www.tinkercad.com/