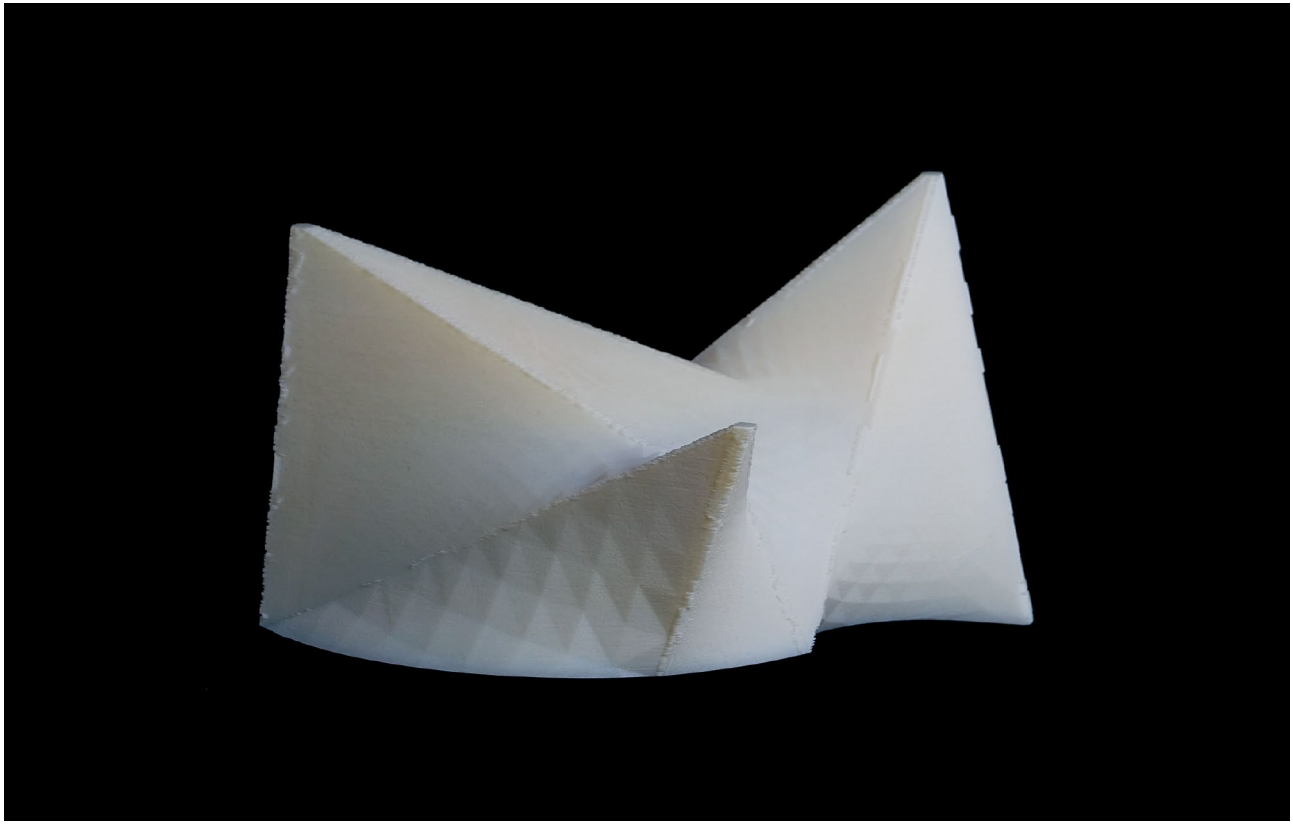
3D PRINTED MODEL AS AUGMENTED REALITY MARKER

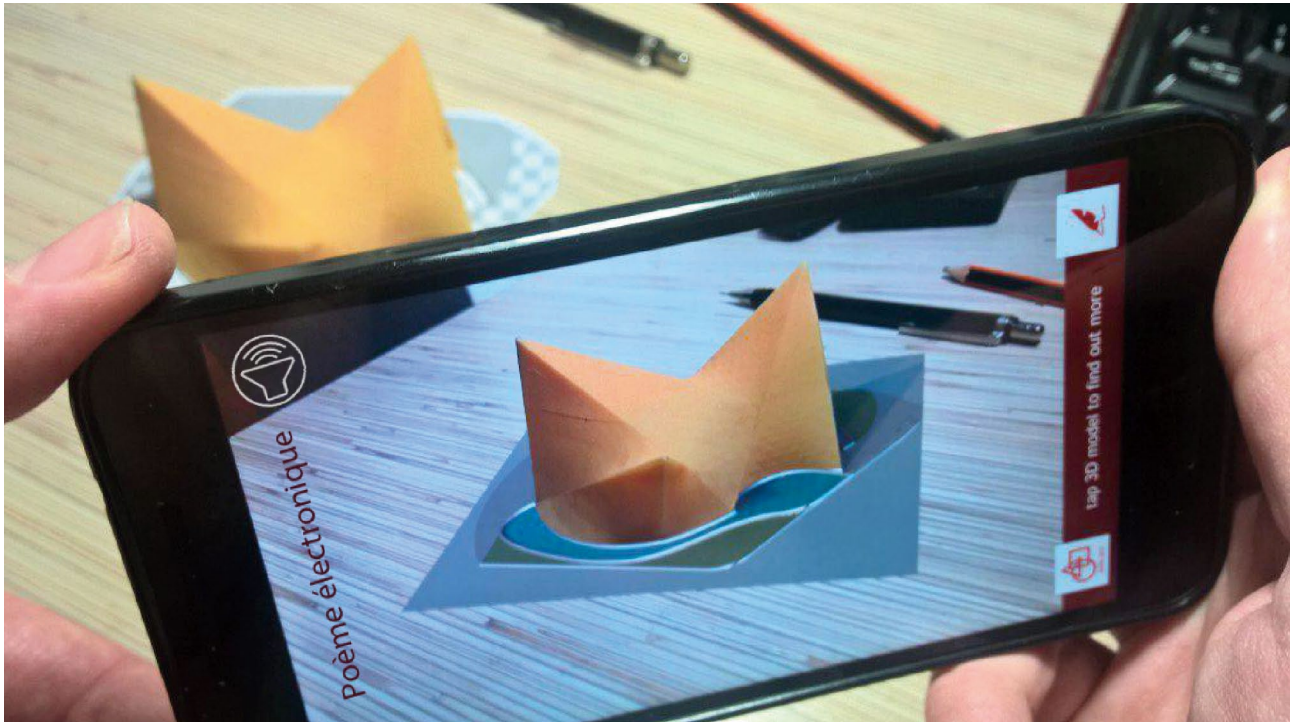
Petar Pejic, Sakan Srdjan, Sonja Krasic



Petar Pejic, Sakan Srdjan, Sonja Krasic “3D PRINTED MODEL AS AUGMENTED REALITY MARKER” 2017, Material: VeroWhite, Size: 198W x 107D x 138H (mm)

Virtual 3D model of the complex architectural object, which contain 9 hyperbolic paraboloid is created. 3D model is printed and used as a marker for visual Augmented Reality tracking. For purposes of this research, we develop android application based on Augmented Reality technology, which provide additional information on the top of printed 3D model in the form of virtual 3D geometry, sound and links to additional web resources.

Keywords: Complex Geometric surfaces, Architecture, Augmented Reality



1 Abstract

In this research, we create a virtual 3D model of the complex architectural object, which contain 9 hyperbolic paraboloid. 3D model is printed and used as a marker for visual Augmented Reality tracking. For purposes of this research, we develop android application based on Augmented Reality technology, which provide additional information in the form of virtual 3D geometry, sound and links to web resources.

2 Model idea

3D printing, also known as additive manufacturing, has become an established technology in many industry sectors for the fabrication of three-dimensional (3D) objects [1]. Some complex geometric shapes of architectural objects, such as buildings made of hyperbolic paraboloids are really hard to produce. The traditional construction method assumes use of complex temporary supporting structures, which usually cost more than the rest of the building [2].

The main inspiration for 3D model was The Philips Pavilion

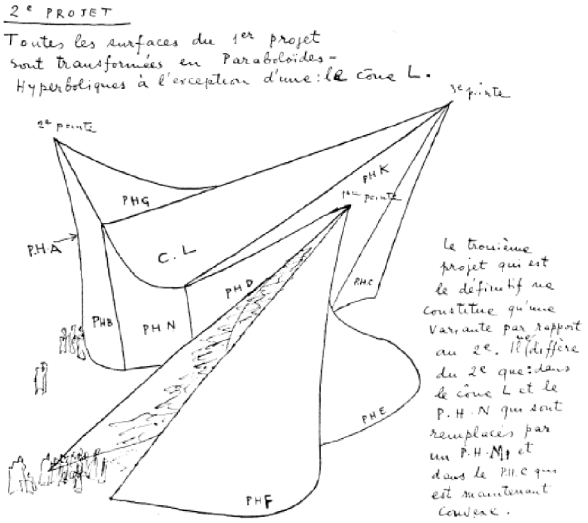


Figure 1: Original sketch of Philips Pavilion

designed for Expo '58 in Brussels by the office of Le Corbusier (Figure 1). The pavilion was designed to house a multimedia spectacle that celebrated technological progress. It is a cluster of nine hyperbolic paraboloids in which music, Edgar Varèse's Poème électronique, was spatialized by sound projectionists using telephone dials [3].

3 3D model production process

A 3D model is created on the basis of existing sketch and images [4] using SketchUp [5] software package. A structure is created from 9 Hyperbolic paraboloids. Some are only parts, created by cutting them with ground horizontal plane (Figure 2).

Created 3D model is exported as *STL file and printed using Ultra 3SP printer [6] (Figure 3).

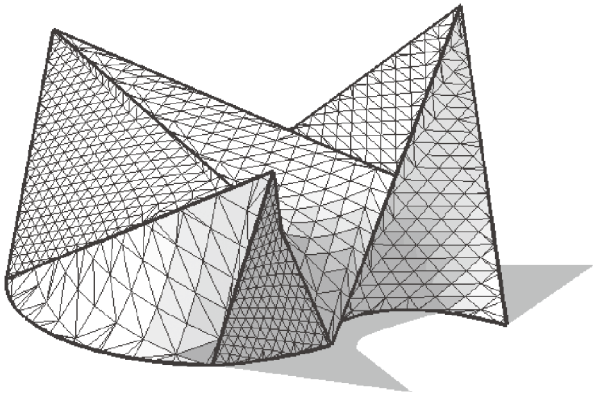


Figure 2: SketchUp – 3D model

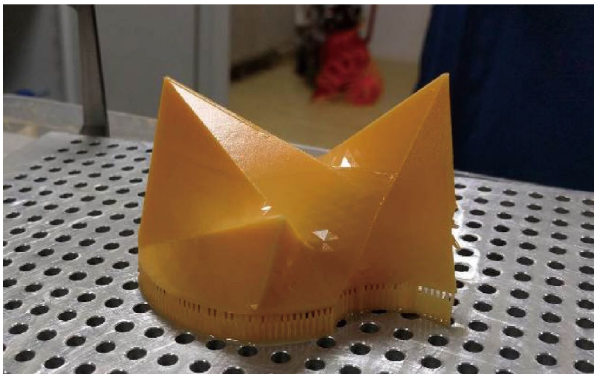


Figure 3: Printed 3D model

4 Augmented Reality

For purposes of this research android based Augmented Reality, mobile application is developed [7], [8]. The application uses previously printed 3D model as a marker in order to connect and display virtual data inside real surroundings.

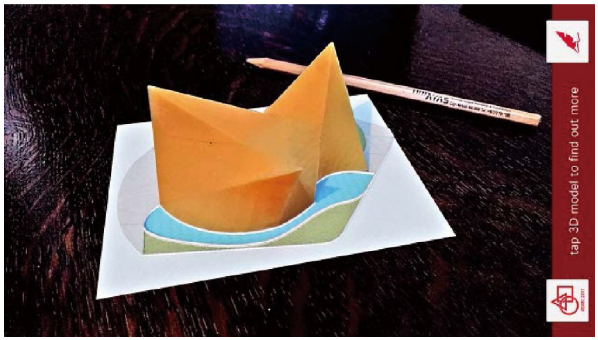


Figure 4: Mobile application screenshot

After starting the application, the device camera records real surrounding, while the application is searching for predefined 3D model. When the application detects and recognise 3D model, on the device display and speakers additional information is provided.

Detection of 3D model by application activates the original song “Poème électronique”, composed by Edgard Varèse and performed inside the Philips Pavilion.

On the basis of pictures from World’s Fair - Expo ’58 held in Brussels virtual 3D model of the building surrounding is created and presented in same scale as printed 3D model. Moving the marker will cause a joint move of both the marker and the additional digital content on the device display (Figure 4).

Taping on printed 3D model inside application provide additional information about the Philips Pavilion available on the web. While buttons at bottom of the screen provides links to ADMC 2017 conference and additional information about authors.

References

[1] Teizer, J., Blickle, A., King, T., Leitzbach, O. and Guenther, D., Large Scale 3D Printing of Complex Geometric Shapes in Construction, 33rd International Symposium on Automation and Robotics in Construction (ISARC 2016), 2016.

[2] Veljković M., Krasić S., Pejić P.: Use of the torus in the design of modern architectural structures, The 5th International Scientific Conference on Geometry and Graphics, moNGeometrija 2016., June 23-26, 2016, Belgrade, Serbia, pp.445-453, 2016.

[3] https://en.wikipedia.org/wiki/Philips_Pavilion

[4] http://www.cirma.unito.it

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

[6] https://envisiontec.com/3d-printers/industrial- 3d-printers/ultra-3sp/

[7] Pejić P., Krasić S., Veljković M., Sakan S., Rizov T.: Augmented and Virtual Reality application in traditional architectural project presentation - case study of “MH Petra” house, FME Transactions, Volume 45, No 2, pp. 227-231,2017.

[8] Pejić P., Krasić S., Petković D., Veljković M.: Application of augmented reality in façade redesign presentation, Journal of industrial Design and Engineering Graphics, number 10, ICEGD 2015, SORGING, Romania, ISSN 1843-3766, pp.45-49, 2015.