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Research Article

Should an already Virtual Model be modelled?

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Abstract – Three-dimensional models are made by creating digital objects that contain spatial depth and detail. These models are used in a wide range of fields, including computer graphics, game development, architecture, product design, animation and many others. There are many types of modelling as a process. We can talk about manual modelling, script-based modelling or even modelling with three-dimensional modelling programs. However, as a result of digitization, in most cases we usually use the term model to refer to a three-dimensional virtual copy of a real object. This paper, however, deals with an extreme case where a virtual model is already given, which we try to recreate using a traditional photo-based technique with the Pix4D modelling software. The method used is to maximize the overlap between the images that make up the object to be modelled, so we needed to find a virtual model that could be accessed from all perspectives during the image creation process. For this purpose, we used the PokémonGO game database developed by Niantic, which makes virtual models of characters of different shapes available. Our results suggest that traditional methods of image collection are not the most useful for virtual models that are already virtual by default. For comparison, we have modelled a real object in our paper. The reports obtained by the modelling software show that although we used the same device to capture a series of images of both the real monument and the virtual model, the images of the virtual model used the camera system of our device in a different way. The results clearly show that the general photography method is adequate for real object modelling, while it produces incomplete results for the virtual model. Based on the method studied, however, it cannot be generalized that re-modelling virtual models is impractical, and we therefore propose to investigate other types of methods in the future.

Keywords – Modeling, Methods, 3D, Pix4D, PokémonGO

I. INTRODUCTION

Creating three-dimensional (3D) models is an important part of digital design and computer graphics. 3D modelling is the process of creating three-dimensional objects that can be realistic, but often designers tend to get disconnected from reality.

Three-dimensional modelling is used in many areas of life. Such models allow designers and engineers to anticipate and visualize the end result before the actual physical implementation. For example, architects can use 3D models to design buildings to get an overview of spatial layout, building appearance and functionality. This can help identify design flaws and make projects more efficient.

In the film industry, 3D models are widely used to create visual effects, virtual locations and characters. Digital animation, computer-generated

effects and 3D modelled characters create stunning and realistic visuals in films. The development of 3D animated films dates back to the previous millennium [1]. In addition, the use of 3D models allows filmmakers to pre-planned complex scenes and precisely control special effects.

3D models can also be used in industrial design and product development [2]. For example, car manufacturers create 3D models for vehicle design and testing, where shapes, ergonomics and technical details can be predicted. These models allow product designers and engineers to easily communicate and share information about the products they are designing.

3D models can be very useful for modelling and preserving cultural heritage [3, 4]. Cultural heritage can be buildings, sculptures, archaeological artefacts or even entire cities. 3D modelling enables the digital representation of these objects, which can help us to better understand and document cultural heritage. Such monuments are usually composed of a sequence of images of the real object, which can be collected using simple manual or even more sophisticated technology, such as drone imagery, depending on the size of the object [5, 6].

One of the most up-and-coming areas is the games industry. Game designers are creating detailed 3D models of characters, objects and game worlds that give players a more realistic and exciting gaming experience. 3D models allow characters to be animated and interactive elements to be added to the game space. This is completely platform-independent, as they are becoming more common not only in computer or console-based games, but also in mobile applications. And if used appropriately, games can be used not only in the entertainment industry, but also as a motivational tool and experiential educational tool [7, 8, 9].

Last but not least, 3D models also have many potential uses in healthcare and can help doctors, researchers and patients alike. One of its most innovative branches is the modelling and printing of 3D prostheses. 3D models allow researchers to study the anatomy and pathology of diseases. This enables better understanding of disease and the development of new treatments. 3D printing and bio-printing can also help in the field of tissue engineering, for example to reproduce organs or tissues. 3D printing enables the creation of unique and customized implants and prostheses [10, 11, 12].

This article considers an extreme case of the modelling process. The question we are trying to answer is whether it is worthwhile to subject an already virtual model to a modelling process, using the virtual model as a basis rather than the real object. Our aim is to re-model existing virtual models using a general photo-based modelling process. To achieve the virtual models, we used the game industry. We chose PokémonGO, a mobile application with an extensive database of 3D models. Our goal was to investigate whether the 3D models provided by the game could be extracted using a photo-based modelling procedure to create a new 3D model.

II. Materials and Method

The modeling photos were taken with an iPhone SE 2020. In collecting the images that make up the model, we tried to walk around the object we wanted to model, in our case the virtual model by default, and take a sufficient number and quality of images from each perspective.

To model the virtual models, we used the game PokémonGO, developed by Niantic and released in 2016 [13]. We chose PokémonGO because it is a world-renowned application with a large number of users, and its database currently contains 810 different models, not including the different variants (shiny, shadow, etc.). The game also provides the option for the user to virtually place the Pokémon they catch in the world around them and walk around it from any perspective. This provided a suitable input for our research, as we were able to walk around the selected Pokémon and take detailed pictures of it.

Pix4D Mapper Pro was used to create the final model. The software was given the images as input and the modeling was done by the software.

In addition to the virtual model, we also modelled a real monument. Our results point to important differences in the properties of the images that make up the models which may influence the way in which future models of a similar type are created.

III. Results

In the following, we will present the results of our research, which show that the general modelling procedure of taking a photo around the object to be modelled is not the most appropriate for virtual models. Our results provide a detailed description of the tool used to take the images, the amount and

resolution of the images used, the amount of points detected by the software and a graphical representation of the results of the models produced.

Our results are presented in two models. A virtual model created from the PokémonGO database and a memorial. The results will be presented according to the following points:

- the amount of images that make up the model
- the number of images used in the calibration
- camera positions estimated by the software
- the number of overlaps detected by the software
- presentation of the completed 3D models

Results of the virtual model re-modelling available from the PokémonGO database

For the model, we chose the #25 Pokémon in the database and the most iconic character, Pikachu. A total of 44 images were captured for the model, a simplified montage of which is shown in Figure 1.

Fig. 1 PokémonGO's virtual model of Pokémon from different perspectives

After taking the pictures, we worked with the software. As we can see, the model available within the application is considered to be of good quality, but Pix4D could not treat these images as a sequence of images of a real object directly using the camera system. The camera positions estimated by the modelling software and the resulting model can be seen in the figures below.

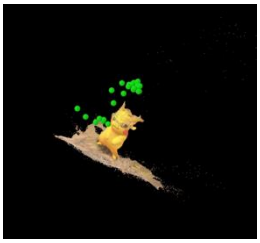

Fig. 2 Camera position calculated by Pix4D

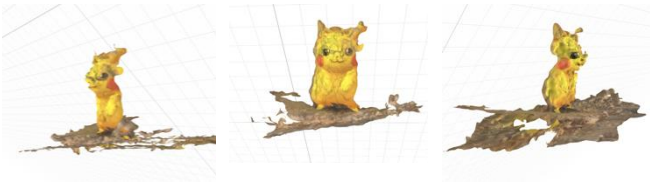

Fig. 3 The resulting model from different perspectives

Results of real object modelling

In this case, we photographed a real object, a stone monument, using the same device. We tried to work with similar parameters, so we were careful about the number of images and the camera position. Lighting conditions were not a relevant factor in this case, as our virtual model was not affected by any light. In this case it was irrelevant whether the ojbectum was exposed to natural or artificial light conditions.

42 images were taken of the stone object, the montage of which is similarly shown in Figure 4.

Fig. 4 Different perspectives of the object we want to model

The software produced results similar to our previous research. It was able to produce a 3D copy of the real object. The calculated camera positions and the resulting model are illustrated in Figures 5 and 6.

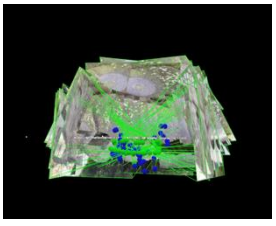

Fig. 5 Camera position calculated by Pix4D

Fig. 6 The resulting model from different perspectives

IV. DISCUSSION

From the report obtained by the modelling software, the following data were obtained.

Table 1. Differences between the two models

	Model Pikachu	**Model Stone**
Resolution	1380x2454	4032x3024
Geolocation	No	Yes
Full dataset	44	42
Calibrated dataset	23	42
Number of 2D Keypoints per Image (Median)	16224	64164
Number of 3D Points Observed (Sum)	45029	260088

These data suggest several things that may have influenced the final outcome. The resolution of the images processing the real object is different from the virtual model, where they were created with the same device. Examining the image files, we observed that the PokémonGO application, while displaying the background through the lenses, did not directly use the camera system to take the image, but instead took screenshots of the virtual model and the environment around it as detected through the lens. This has also caused that while the images of the cultural monument model have geolocation information, the images that build the Pikachu model do not. These features subsequently affected all other parameters. While the camera positions of the images that make up the real object are clearly visible in Figure 5, we can see that the green dots indicating the camera position in Figure 2 are much sparser and process the model almost only from one perspective. During the calibration process, the software was thus able to calculate fewer common points for the virtual model, which may account for the nearly 50% image loss from the total data range.

V. CONCLUSION

Digitalization is the process of transforming analogue information, systems and processes into digital form. The digitalization of the world around us is an increasingly common trend, usually in the form of 3D models. However, our article has examined a case where we have used an already digital model as a basis for a new model. Our research has shown that if we use methods similar to those used to model real-life objects, we may run into problems and the results will not be acceptable. This case, however, does not generalize to other methods, which is why further experiments should be pursued in the future.

REFERENCES

[1] G. P. Shalini, and P. Rajesh, *Learning Computer Graphics: From 3D Models to Animated Movies on Your PC*, Springer New York, NY. 1998. https://doi.org/10.1007/978-1-4613-8503-5

[2] A. Petruccioli, F. Gherardini, and F. Leali, *Assessment of close-range photogrammetry for the low cost development of 3D models of car bodywork components*. Int J Interact Des Manuf 16, 703–713, 2022. https://doi.org/10.1007/s12008-022-00865-6

[3] S. Gubo, T. Kmet, A. Molnar A, and O. Takac, *A Multi-Range Approach for Cultural Heritage Survey: A Case Study of a Medieval Church in Slovakia*. In: 2020 IEEE 18th World Symposium on Applied Machine Intelligence and Informatics (SAMI). 2020 doi:10.1109/SAMI48414.2020.9108724

[4] O. Takáč, and L. Végh, *Usage of UAVS in the Protection of Cultural Heritage in the Teaching of Computer Science*. In: INTED2021 Proceedings. 15th International Technology, Education and Development Conference. IATED; 8-9 March, 2021. doi:10.21125/inted.2021.2084

[5] L. Radácsi, M. Gubán, L. Szabó, and J. Udvaros, *A Path Planning Model for Stock Inventory Using a Drone*. Mathematics. 10(16):2899, 2022. https://doi.org/10.3390/math10162899

[6] M. Gubán, and J. Udvaros, *A Path Planning Model with a Genetic Algorithm for Stock Inventory Using a Swarm of Drones*. Drones. 6(11):364, 2022. https://doi.org/10.3390/drones6110364

[7] L. Végh, and O. Takáč, *Online Games to Introducing Computer Programming to Children*. In: INTED2021 Proceedings. 15th International Technology, Education and Development Conference. IATED; 8-9 March, 2021. doi:10.21125/inted.2021.2091

[8] L. Végh, and O. Takáč, *Mobile Coding Games to Learn the Basics of Computer Programming*. In: EDULEARN21 Proceedings. 13th International Conference on Education and New Learning Technologies. IATED; 5-6 July, 2021. doi:10.21125/edulearn.2021.1590

[9] K. Czakóová, *Developing algorithmic thinking by educational computer games*. In. Proceedings of the 16th International Scientific Conference: "eLearning and

Software for Education: eLearning sustainment for never-ending learning. Volume 1, DOI: 10.12753/2066-026X-20-003, 2020/1, p. 26-33. Bucharest: "CAROL I" National Defence University Editura, Universitara, 2020. ISSN 2066-026X, ISSN-L 2066-026X, ISSN CD 2343 – 7669.

[10] E. J. Hurst, *3D Printing in Healthcare: Emerging Applications*, Journal of Hospital Librarianship, 16:3, 255-267, 2016. DOI: 10.1080/15323269.2016.1188042

[11] K. Ransikabum, C. Yingviwatanapong, R. Leksomboon, T. Wajanavisit and N. Bijaphala, *Additive Manufacturing - based Healthcare 3D Model for Education: Literature Review and A Feasibility Study*. Research, Invention, and Innovation Congress (RI2C), Bangkok, Thailand, pp. 1-6, 2019. doi: 10.1109/RI2C48728.2019.8999943.

[12] H. Dodziuk, *Applications of 3D printing in healthcare*. Kardiochirurgia i Torakochirurgia Polska/Polish Journal of Thoracic and Cardiovascular Surgery, 13(3), 283-293, 2016. https://doi.org/10.5114/kitp.2016.62625

[13] (2023) Niantic website. [Online]. Available: https://nianticlabs.com