



**DEVELOPMENT OF AUGMENTED REALITY APPLICATIONS
FOR SCHOOL TEXTBOOKS****Kulishova Nonna,**

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The augmented reality (AR) is a new technology that integrates a virtual 3D model into the real world through tracking and positioning. This technology became an extremely effective tool in education: it allows successfully combining such advantages of printed textbooks and computer technologies as information capacity, mobility, visibility and animation capability [1–3]. A possible way of using the augmented reality in education is applications' development for physics studies. To develop models of different phenomena and effects, software tools based on physical modeling are used [4–6].

Considering visualization of the physical effects in the augmented reality, it is important to understand how a 3D model (where the effects applied to) and the application itself are gadget dependent. It is also important to consider possible limitations while developing AR applications for students or pupils.

When publishing such textbooks with AR applications, it is necessary to envisage the emergence of an appropriate technological chain, which includes operations related to the developing of the application virtual part. The augmented reality in this case will include 3D models of objects and processes use complex textures, special effects, animation for visualization [7, 8]. Another important part of the AR application



work is the stable tracking of virtual models to the labels placed on the textbook pages. As labels, the textbook pages could be chosen, but the quality of linking to them should be checked in advance, at the design stage. Then it will be possible, in case of instability of the tracking, to change the layout of the page or select another as a label [9].

All these factors lead to the fact that the scheme of the technological process of the textbook with the AR application pre-press should include the operations shown in Fig. 1.

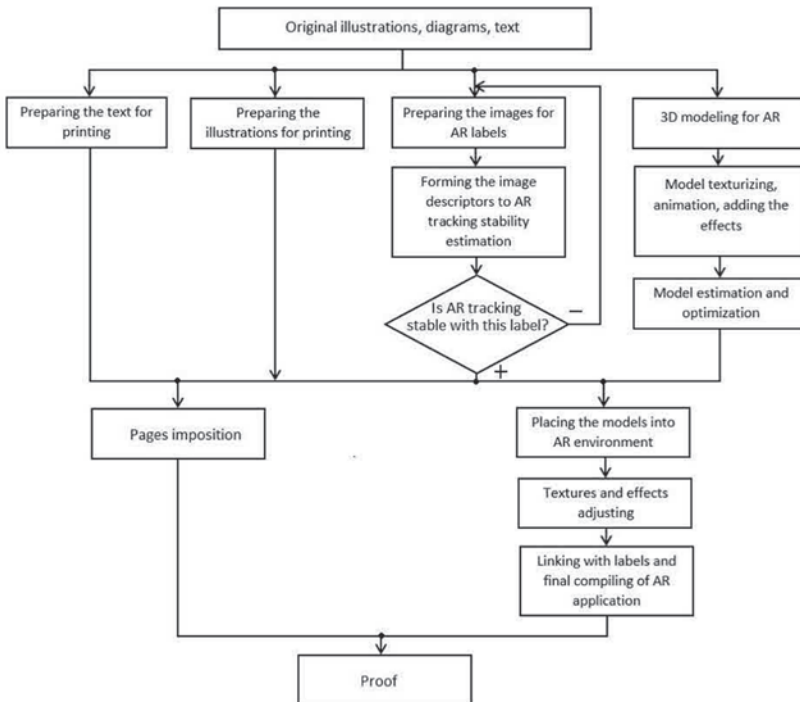


Fig. 1. Scheme of the process of AR application development

The already traditional prepress stages for text and illustrations are now accompanied by works on the creation, evaluation and optimization



of 3D models and labels for augmented reality. Labels should be placed on the proper pages before the imposition is made. After that, you adjust and optimize the properties of 3D models and virtual scenes, bind and compile AP applications. The final stage of this process is proof printing, in which not only test prints of the textbook pages are checked, but also the quality of the application itself and its work with the book.

References

1. Munoz-Cristobal J.A., Jorrián-Abellan I.M., Asensio-Perez J.I., Martínez-Mones A., Prieto L.P., Dimitriadis Y. Supporting Teacher Orchestration in Ubiquitous Learning Environments: A Study in Primary Education // *IEEE Trans. on Learning Technologies*. 2015. Vol. 8, No. 1. Pp. 83–97.
2. Santos M. E. C., Chen A., Taketomi T., Yamamoto G., Miyazaki J., Kato H. Augmented Reality Learning Experiences: Survey of Prototype Design and Evaluation // *IEEE Transactions on Learning Technologies*. 2014. Vol. 7, No. 1, January-March. Pp. 38–56.
3. Cieutat J.-M., Hugues O., Ghouaiel N. Active Learning based on the use of Augmented Reality Outline of Possible Applications: Serious Games, Scientific Experiments, Confronting Studies with Creation, Training for Carrying out Technical Skills // *International Journal of Computer Applications*. 2012. Vol. 46, No.20. Pp. 31–36.
4. Dünser An., Walker L., Horner H., Bentall D. Creating Interactive Physics Education Books with Augmented Reality // *OZCHI'12*, November 26–30. Melbourne, Victoria, Australia. 2012. Pp. 107 – 114.
5. Lee K. Augmented Reality in Education and Training // *TechTrends*. 2012. Vol. 56, Issue 2. Pp. 13–21.
6. Kauffmann H., Meyer B. Simulating Educational Physical Experiments in Augmented Reality // *Proceedings of ACM SIGGRAPH ASIA*. 2008. New York, NY, 8.
7. Kulishova N., Smiian K. Methods of Data Reduction for Augmented Reality Applications // *Полиграфические, мультимедийные и web-технологии*.



Т.І. Тез. Докл. 1-й Междунар. Науч.-техн. конф. (16–20 мая 2016). Харьков: ХНУРЭ. 2016. С. 134–135.

8. Kulishova N., Grankina V. Three-dimensional model of the optical effect for an augmented reality application // Полиграфические, мультимедийные и web-технологии. Т.1. Тез. Докл. 2-й Междунар. Науч.-техн. конф. (16–20 мая 2017). Харьков: ХНУРЭ. 2017. С.155–156.

9. Kulishova N., Suchkova, N. Impact of the Textbooks' Graphic Design on the Augmented Reality Applications Tracking Ability / In: Advances in Computer Science for Engineering and Education. 2019. Springer. Pp. 692–701.