

An improved simple flexible cryptosystem for 3D objects with texture maps and 2D images

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With the continued evolution of three dimensional (3D) object presentation and usage, the security of such objects has become an increasingly desirable research area. Previous efforts mostly concentrated on the encryption of point clouds, solid models, meshes, and 3D textured models. The (texture map) part of meshed 3D objects was overlooked by previous encryption techniques of 3D meshed objects in spite of its importance because they require preprocessing to be extracted. Therefore, this paper provides a system for the full encryption of 3D textured objects with their texture maps. It provides an improved system based on an existing flexible cryptosystem named Flexible cryptosystem based on Cellular Automata (FcCA). The FcCA system has two drawbacks. One drawback is shuffling plain data without changing their values, which yields the same histogram and nonstandard encryption ratios. The other drawback is the need for many generations to make the keyspace very large, which is unsuitable for the large size of textured object data. This work overcomes these drawbacks of FcCA and fully encrypts 3D textured objects with their texture maps. The improvements to FcCA include making intersect start points change with every generation and encrypting the values of plain data while shuffling them using cellular automata. At first, the plain 3D object is extracted to vertices, faces, and texture, in addition to its texture map. After that, extracted data are encrypted using the proposed *improved FcCA* (iFcCA) cryptosystem. Implementation and analysis of this new system showed its preponderance as it can encrypt and decrypt 3D textured objects better than FcCA and other existing methods. Moreover, it reduces the need for many generations of cellular automata, and consequently, reduces execution time. In addition, iFcCA has a very robust key, and it can resist different types of attacks.

Mizher, Manal A., Sulaimana, Riza, Abdallab, Ayman M., Mizher, Manar A., (2019), An improved simple flexible cryptosystem for 3D objects with texture maps and 2D images, Journal of Information Security and Applications.