3D Modeling for Kitchen Scene in a Hospital

Wen-Lung Tsai* and Xing-Ying Liu
Department of Information Management, Oriental Institute of Technology, New Taipei, Taiwan

*Corresponding author email: wlttsai@mail.oit.edu.tw

Abstract. This research focused on hospital diet management to explore the design of 3D models for kitchen scenes and the facilities of a hospital. Hospital diet management has standard operating procedures, but most people have never seen the kitchen environment within a hospital. Hence, the ongoing research highlights the foodservice procedure and makes a live-action film to complete 3D modeling and animated scenes within a hospital. This research applied the 3ds Max and other multimedia technologies in the medical and healthcare fields. The presentation of the virtualized scene and facilities is realistic and detailed. This research illustrates that the diet management process can be done quickly by 3D modeling and animation. It can also be applied to healthcare education and train new employees who need to understand the carrier’s details as soon as possible.

Keywords: 3D modeling; Virtual scene; Kitchen facilities; Hospital diet management.

1. Introduction
Most people know that hospitals have standard procedures to control meals, but they do not know the details of these procedures. This is why they do not trust the safety of meals completely. This research designs a 3D animated film of hospital diet management to give inpatients and their families a clear understanding of hospital diet management as a set of standard operating procedures following the Hazard Analysis and Critical Control Point (HACCP) system [1]. This study cooperated with the Dietary Department at Far Eastern Memorial Hospital (FEMH) to render vivid, virtualized scenes of the current FEMH dietary management, with the equipment, appliances, and worker behavior presented through 3ds Max and other software illustrating the actual sites and characters. This research provides two contributions. Through the animation design and production, the first is to allow patients to understand as quickly as possible the dietary management process to reduce their food safety concerns [2]. Second, the final results of this research can be utilized in medical education and practice [3], helping students or new employees quickly acquire knowledge about diet management [4].

2. Related Work
HACCP is a food safety control system that identifies important control points during processing raw materials. It impacts hygiene and safety through multiple procedures, such as monitoring and recording food processing and manufacturing, to be a basis for future improvement. Based on the HACCP principles, hazards are analyzed and controlled in detail. During the following steps, points in hazard analysis are implemented in the critical control protocol: food production, including raw materials, inspection and acceptance, manufacturing, processing and packaging, until the products are supplied to consumers. The content, which differs from traditional food hygiene management, is stated in Table 1. Currently, major hospitals use HACCP as a benchmark to ensure food safety and improve food hygiene.
Table 1. Comparison between traditional food hygiene management and HACCP [1].

| Compared items       | Traditional food hygiene management | HACCP system                                      |
|----------------------|-------------------------------------|--------------------------------------------------|
| Control focus        | Final product inspection            | Whole-process control                             |
| Cost                 | Substantial workforce cost on product inspection | Saving workforce, cost-effective use of resources |
| Safety inspection    | Foods already eaten when the results are available | Allowing control and prevention of poisoning caused by microbial pollution |
| System guidelines    | The same food hazard easily reproduced by repeating the process errors | Criterion is international mutual certification of food, which is more reliable |

HACCP, Hazard Analysis and Critical Control Point

3. Research Design

3D animation covers the control of geometric objects and coordinate systems composed of points, lines, and surfaces; material editing and chart let settings; and the construction of scenes and character models. 3ds Max features full functionality [5]. It can model dietary management and related characters and scenes close to reality and then add the material spheres to show the desired overall effect. In addition, the binding of skin onto the skeleton of the character can accurately drive the model, make the character move naturally, and allow a lifelike appearance after the generation of animation. After rendering, the animation of the overall meal-management process can be presented entirely in detail. The design process is shown in Figure 1.

![Design process flowchart](image-url)
The diet management scenes in this study were taken from FEMH and modeled as in Figures 2 and 3. The scene in Figure 2 mainly dealt with food ingredients. The scene in Figure 3 showed that the cooked food was prepared into a meal to be delivered to the patient, and the plate was cleaned after eating.

Figure 2. A corner of Scene (1).

Figure 3. A corner of Scene (2).

Role in the film: a dietary staff member, with reference to the actual clothing and work behavior and with the color and type of clothing adjusted based on the type of work. For example, the man should wear a blue jacket to enter the freezer (Figures 4 and 5).
4. Results and Discussion
The health education video designed in this research reverses the public’s perception of hospital diet management. The work content is simple cooking and the introduction of the entire production process, which allows understanding of the flow of food processing and the rules that should be observed in each area.

5. Conclusions
The 3D animated film enhances the viewer’s understanding. It is no longer merely a verbal or paper presentation but education and training material for new hospital employees, assisting them in familiarizing themselves with the environment and work much quicker. The realistic animated environment will bring fairly positive results and is possibly the first case of applying 3D animation in medical care.
Acknowledgments
The authors would like to express appreciation for the supports of Smart Living Lab at Oriental Institute of Technology and Far-Eastern Memorial Hospital in Taiwan.

References
[1] Vukman D Viličnik P Vahčič N Lasić D Niseteo T Krbavčič I P Marković K and Bituh M 2020 Design and evaluation of an HACCP gluten-free protocol in a children's hospital Food Control 2020 107527 https://doi.org/10.1016/j.foodcont.107527
[2] Schaumann D Breslav S Goldstein R Khan A Kalay and Y E 2017 Simulating use scenarios in hospitals using multi-agent narratives J Build Perform Simul 10 5–6 pp 636–652
[3] Baranowski T Ryan C Hoyos-Cespedes A Lu A S 2019 Nutrition education and dietary behavior change games: A scoping review Games Health J 8 3 pp 153–176
[4] Hatami T Noroozi A Tahmasebi R Rahbar A 2018 Effect of multimedia education on nutritional behaviour for colorectal cancer prevention An application of Health Belief Model Malays J Med Sci 25 6 p 110
[5] Chaudhary D G Gawali B W 2018 Design and modeling with Autodesk 3DS Max International Journal of Computer Science and Information Security 16 6 pp 68-85