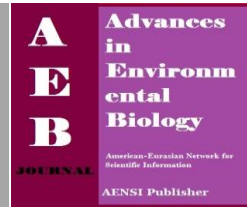




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## Augmented Reality Technology in Medical Studies

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### ABSTRACT

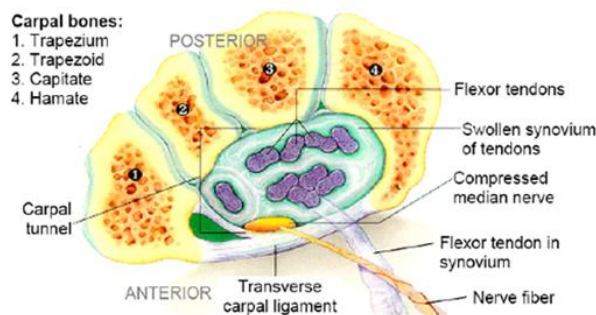
Understanding how the human nervous system works required a lot of detail studies. Usually, medical students learn from textbooks or real specimens which may not provide full understanding on how the human body operates. With advance in computer technology, especially augmented reality technology which can simulate virtual images on top of real space, medical students can see the body in action in every angle. In this research, we emphasize on implementing augmented reality to simulate median nerves and carpal tunnel on human wrists, which is the main cause of Carpal Tunnel Syndrome. Carpal Tunnel Syndrome (CTS), a disease in the office syndrome group, is the most popular disease found in new generation who use computers as a tool. Understanding how the median nerves and carpal tunnel operate will save time, save money and assist in finding ways to cure this disease.

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## INTRODUCTION

Carpel tunnel syndrome is a disease in the office syndrome group which is the most popular disease found in people using computers in everyday life such as office workers and programmers. Usually, people at the age between 16-24 years old who are working with computers for more than six hours per day without changing position have the tendency to acquire this disease. The risk could be very high up to 55%. Since the number of patients who have this disease increases every year, understanding the details about the nervous system which causes this problem would make it easier for medical treatment. In studying the human nervous systems, medical students learn from books, videos or real specimens. Books would only present two-dimensional views of the specimens (Figure 1). Videos may present three-dimensional views of the specimens but the students cannot interact with it. Learning from the real specimens is the best way to understand how the nervous systems work but it is inconvenient and costs a lot of money.

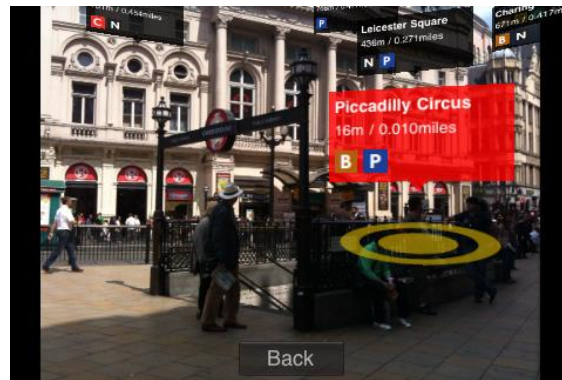


**Fig. 1:** Cross section of Carpal Tunnel (From Hitchcock and D. Silva (1995)).

Using the new technology such as 3-D computer graphics and Augmented Reality (AR) technology, may be the best solution for this problem. Augmented reality is the technique of creating virtual images on top of real space. The virtual images could be in the form of texts, pictures, videos or 3-D Graphic images. There are two types of augmented reality i.e. marker based AR and marker-less AR. The difference is that, the marker based AR uses a marker as a reference whereas the marker-less AR uses the GPS to locate and interact with AR

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resources (Figure 2). For marker based AR, virtual images could be rotated and translated in any directions upon moving the marker (Figure 3).



**Fig. 2:** Marker-less AR

(From <http://blogs.exeter.ac.uk/augmentedreality/blog/2010/09/19/what-is-augmented-reality>)



Physical real-world 'marker'

Marker transformed into 'augmented reality' when held in view of a webcam. Output as displayed on a computer screen.

**Fig. 3:** Marker based AR.

(From <http://blogs.exeter.ac.uk/augmentedreality/blog/2010/09/19/what-is-augmented-reality>)

## 2. Literature Review:

Augmented Reality has been used in medical fields for many years [1]. Richard *et al.* [2] used augmented reality to help special kids in learning. Using virtual objects, the special kids could improve abilities in decision making. Another approach of using AR in medicine is the treatment of patients with phobia problems. Botella *et al.* [3] used AR for treating patients with cockroach phobia. By using virtual cockroaches running around the patients, eventually the patient's phobia was eliminated. Until recently, due to the advancement of computer technology, the use of AR was extended to medical training especially in learning anatomical structures [4].

## 3. The Methodology and Model:

In this project, the topics covered six areas of medical training: Median Nerve, Anatomy, Pathophysiology, Symptom, Diagnosis and Treatment. 3D model of the specimens were made using Maya software. Augmented Reality were created using AR media program. The process of creating AR training was separated into 3 parts: pre-production, production and post-production.

1. Preproduction involved gathering informations up to creating storyboard. The storyboard covered all six topics for medical training. The details from the storyboard were then used to make animation (Figure 4).
2. Production consisted of 3D modelling, texture creation and animation. 3D model of the hands and all the nervous systems were designed and animated using Maya program (Figure 5).
3. Post production involved marker design and linking them with 3D model. Markers related to the models or animations were created and linked to the assigned models using AR media program (Figure 6).

## 4. Result:

The AR training system for Carpal Tunnel Syndrome (Figure 7.) was set up and evaluated by medical staff and 5<sup>th</sup> year medical students at Praboromarajchanok Institute for Health, Nakorn si Thammarat. Evaluations were done by interviewing the staffs, focused group discussions and handing out questionnaires. The results revealed that in using AR training program, student could understand better than studying from books. The 3D

models which could be seen in any angle is the same as learning from the real specimens. The staffs also mentioned that this system could replace learning from patient models which would also save cost. From the questionnaires used for the pretests and posttests, we have found that students tend to understand much better about how the position of the wrist have some effect to median nerves.

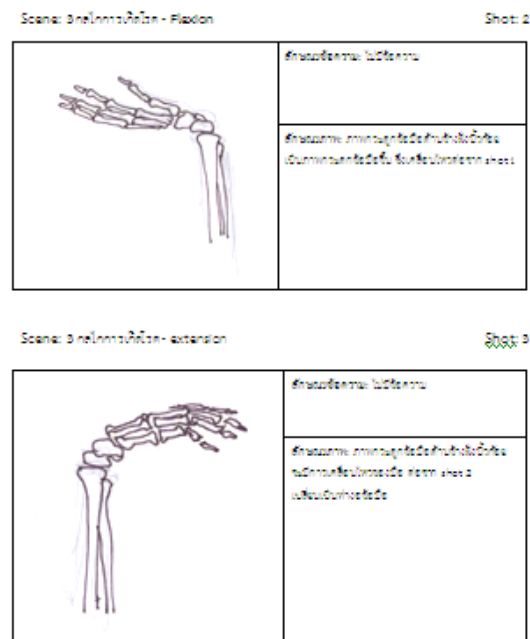


Fig. 4: Storyboard for medical training.

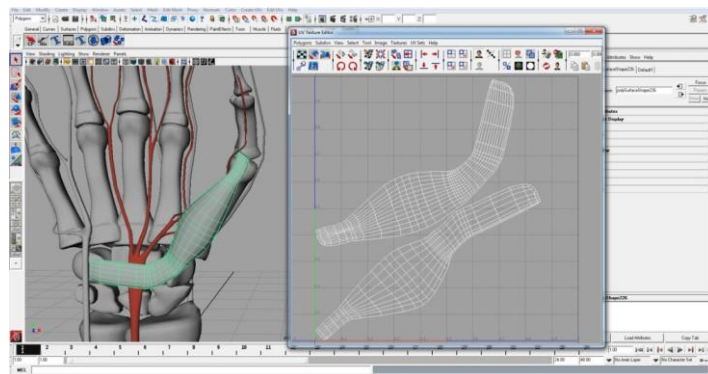


Fig. 5: 3D Model of specimen using Maya Program.

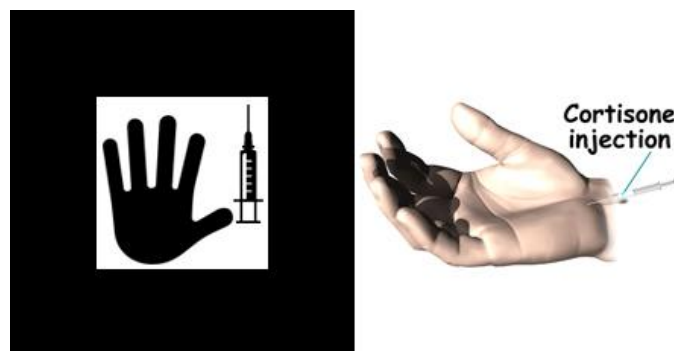
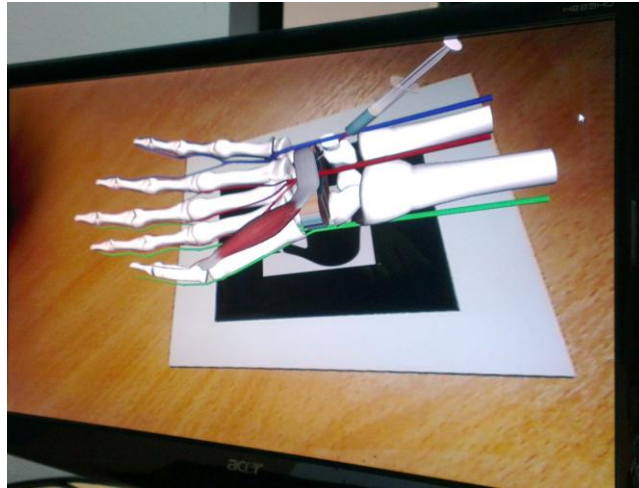


Fig. 6: Marker linked to corresponding model.



**Fig. 7:** The AR training system for Carpal Tunnel Syndrome.

*5. Summary and Conclusions:*

From this research, it is confirmed that Augmented Reality application for Carpal Tunnel Syndrome Learning can replace books and learning from real specimens. Medical students can study with the system at any time and as many times as they prefer. The system will assist students in understanding the 3D perspectives that resemble real specimens and the effects to the nervous systems which occur from moving the muscles in the wrong position. Besides that, the system can save costs by replacing patient models and real specimens.

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