Design and Development of Educational Computer Games:

Ultrasounds & Motion Sensors

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Abstract

Students of every age (from childhood to getting a master’s degree) always find it easier to learn materials when they are done in some entertaining form. Playing a game of sorts is more likely to involve a student actually learning rather than sitting in a lecture setting and seeing a professor lecture on the subject. The purpose of this paper is to explore different tests that can be done to advance students learning using gaming structures and specifically how different gaming systems were used in attempting to create a game that would teach medical students how to use a portable ultrasound and what the ending results of that are going to be. We hope to create a game on Unity that would allow people to better practice using a portable ultrasound rather than having to partake in an expensive alternative of taking lessons and scheduling times to use the expensive machines as practice.

Introduction

The purpose of this research is to find a suitable remote control system that can be used to assist in the training of people on a medical level. In this case, we are researching on how to use portable ultrasounds. By inserting lessons into a game setting the user should find it easier to learn as well as a lot cheaper. Having such a game would help with the high cost and long wait that portable ultrasounds currently have on ordering as well as the limited amount of people with efficient knowledge and the ability to teach that knowledge to others. This causes ultrasound teaching programs to take about 2 years until the student can become a licensed ultrasound technician.

The downfall for this study lies in the lacking of technology towards tracking extremely precise movements such as the entire movement of the hand and wrist and the angles of rotation that they are moving towards. These are critical and have to be down to a precise movement otherwise the training game would be useless and teach people improper methods that could allow them to miss serious conditions in their actual work, this could potentially lead to many people being harmed due to improper treatments and wrong medical diagnosis.

Background

- Portable Ultrasounds

Ultrasounds work by enabling a licensed technician to render a section of the body to “high-frequency sound waves producing pictures of the inside of the body” [2] as shown in the example of Figure 1 where a fracture can be seen through these waves of sound. Ultrasounds are commonly practiced on women during stages of pregnancy to check the status of the fetus because they do not use radiation like in x-rays which can cause serious damage to the unborn child as well as being able to examine body organs including but not limited to those show in Table 1 [2].

Images produced from ultrasounds allow doctors to see the “structure and movement” of internal organs even going so far as to show the “blood flowing through blood vessels” [2]. Portable ultrasounds are extremely useful when trying to see what is wrong with someone immediately due to inflammation, discomfort, infection or even hematuria, rather than having to take a patient to the hospital and prep them to undergo other methods of testing. With portable ultrasounds it is just swabbing a bit of gel and then scanning the person to identify immediate causes to problems as well as the status of a fetus inside of a pregnant
woman who is feeling pains that she shouldn’t be feeling. The accuracy of finding certain things such as fractures in human bones ahead of time is accurate with the ability to point out and locate many different types is shown in Table 2 [1] where the use of an ultrasound was found to be just as efficient as well as less damaging to the body as radiology.

My Research

- Wii

After working briefly with the Wii remote control sensors it was proven to be an un-useful system due to the lack of ability to track precise movements of the Wii remote. Slight jolting would move the control from one side of the screen to the other and was ultimately labeled as a mishap. If the movements could be tracked better such as entire arm movement and the angles at which body parts were moving during the testing it would have been a success.

- Xbox Kinect

Using the Xbox Kinect system on Unity as a tracking device was ultimately rejected. While the tracking was satisfactory and responded accordingly, the control itself did not track movements in the wrist with accuracy at all nor was it able to track rotations which are required for what the Ultrasound game is attempting to prove, that gaming systems can be used to help train and better students and practiced licensers of ultrasound technology. The main problem also lied in that when movements were made the system took a bit to move as well and it was always a general idea of where your hand might be as compared to the rest of your body.

- PS3 Move

The use of the PS3 Move has been proven to be difficult to start up, the first wall hit was the required expenses for getting all the materials, first the purchasing of the PS3 Move then finding out that the libraries required to connect the PS3 Move to a computer were only on Mac at the current time and getting that set up. Aside from that we needed to get a pro license of the Unity software to even work with the PS3 Move. We have the mac software but unfortunately it took quite some time until they came in, and after that we learned that while the PS3 move was very capable in tracking the rotation of your wrist and arms and such, it wasn’t that useful in tracking positioning and unless something can be done to fix that as of right now that has been concluded as not a solution as well.

- Android Phones

Due to recent advances in technology specifically in Android phones (as shown in Screenshot 1) [5], using an Android phone as a remote control for various things is becoming a common practice. Devices are being made that will “turn your phone into an easy-to-use, never-lost remote for your home entertainment center” as well as making it so you can actually control the flight of a “camera-equipped quadicopter” using your Android phone [4]. While using your Android phone as a remote control device for a game set up on a TV or your computer screen is likely to work, the cost of the technology to adapt the systems for a
remote tracking position, rotation, even going so far as the level of steadiness of holding the phone and making smooth motions with it, is going to be hefty. As well as expecting the intended users to have the knowledge to be able to connect their android phone to their system and set up all of the phone’s settings to match causes much unnecessary complication. Because of this unless a cheap, easy to understand system is developed the use of an Android phone is highly unlikely.

Conclusion

I spent the summer working with others in a lab room that attempted to find the best solution to developing a motion sensor. After various trials we are able to conclude that certain sensors were not advanced enough to work with the systems that we were attempting to use. The demo game itself was built in a 3D gaming software called Unity that allowed us to put together the pieces to simulate a 3D human body that we were then attempting to connect the motion sensors to in a way that would allow us to cut slices from the 3D body and formulate a picture with those slices that was similar to an ultrasound image. Unfortunately the program itself and the motion sensors were never on equal levels and there has not been enough time to find all the solutions although a lot of the possible solutions have been crossed off of the list leaving a smaller amount to get through until the final game can be perfected. Testing was done with the Wii Motion Sensors, Xbox Kinect, and PS3 Move that was concluded as being good attempts but not quite what we were looking for.

With further perfecting and development of this game system the benefits could be astounding and help perfect, shorten, and modernize years of training in ultrasounds. With that, much training could slowly be converted into certain gaming systems to shorten costs for having expertise instructors as well as allow a substantial increase in people being able to have the opportunity to get these licenses in their work choice. But until a solid solution is found to the motion sensor problem these are just possibilities that could happen as technology advances in the world as more and more people come together to solve and perfect the solution to these problems.

Sources


