Keywords: game engine, engineering education, surveyor education, virtual equipment, XNA, XBox

Surveying technologies have become indispensable in modern life. They play important roles in the engineering. A typical surveying course includes outdoor fieldwork, which provides students with opportunities to familiarize themselves with the proper use of surveying instruments (Noëh, 1999). The major drawback of this method of education stems from the constraints imposed due to the availability of physical instruments. Since most schools cannot afford to provide one instrument for each student, students need to share the instrument and take turns practicing. This reduces students’ learning performance and motivation. Rainy or foggy weather may also impede the learning activities.

To overcome these drawbacks, several computer-based teaching aids have been developed specifically for improving the teaching in surveying courses. These teaching aids can assist instructors in explaining the concepts regarding the spatial relationship between the survey instrument and the targets. Based on the successful experiences learned from the aforementioned investigators, Lu et al. (2007) developed SimuSurvey, a computer-based surveyor-training tool which makes it possible to accurately simulate instrument manipulation.

The purpose of this research is the continued improvement of the usability and teaching effectiveness of SimuSurvey over previous efforts. By using the XNA gaming platform, we developed a new virtual surveying instrument named SimuSurvey X with improved visual effects and user interface. SimuSurvey X provides a virtual environment for survey training with various surveying instruments and accessories. The virtual instruments include leveling, theodolite and total station; the virtual accessories include level rulers and poles. SimuSurvey X provides five scenarios for surveying missions: leveling surveying, horizontal angle surveying, vertical angle surveying, traverse closed surveying and free mode surveying.

During the development, we focused not only on technical issues, but also considered creativity and aesthetics. We made use of user-centered design (UCD) methods in the implementation phase to help find problems regarding the user interface as early as possible. The resulting virtual training tools had to fully utilize the features and advantages of the gaming platform.

After the software implementation, we also prepared SimuSurvey X teaching material to accompanying the real instrument practices in surveying courses in vocational schools and universities. During the promotion activities, we conducted some user tests to collect user feedback, then analyzed the results to identify its usability and teaching effectiveness.

SimuSurvey X has achieved its first goal and released the beta version in December 2009. We have also started preparing teaching materials to accompany SimuSurvey X in the promotion activities beginning in February 2010. We will also analyze and evaluate the survey training effectiveness of
SimuSurvey X during those activities. Compared to the previous version, SimuSurvey X provides more vivid and realistic visual effects. The new user interface also increases the usability and makes it more accessible to users. The experience of the design of SimuSurvey X can be a reference for future development of survey training tools for engineering training courses. Through the improvement of survey training, more professional surveyors can be trained to a higher degree of skill, and thus advance the engineering industry.

Figure 1. Screenshots of SimuSurvey X

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References


