

SimuSurveyX installation and operation

<http://simusurveyx.caece.net>

- I. This document describes how to install and operate SimuSurveyX on Microsoft Windows 7/10.
- II. Environment:
 1. Graphics card:

Since SimuSurveyX is developed with Microsoft XNA. Due to XNA is built on DirectX, there are some requirements on the graphics acceleration. There is no problem for computers with standard graphic card, but it may not be work properly on computers that use integrated chip set.
 2. Xbox controller:

Alrough SimuSurveyX can be operated with Xbox and keyboard. Xbox controller is highly recommended since it offer a large range of sensitivities. Keyboard is only used for roughly demo usage.
- III. Installation
 1. Download and install Microsoft Visual Studio 2008 Redistributable.
<http://www.microsoft.com/downloads/en/details.aspx?FamilyID=9b2da534-3e03-4391-8a4d-074b9f2bc1bf&displaylang=en>
*. you also can install Microsoft Visual Studio 2008 Express or Microsoft Visual Studio 2008 instead.
 2. Download and install .Net Framework 3.5 SP1.
<http://www.microsoft.com/downloads/en/details.aspx?FamilyID=ab99342f-5d1a-413d-8319-81da479ab0d7&displayLang=en>
 3. Download and install Microsoft XNA Framework Redistributable 3.1.
<http://www.microsoft.com/downloads/details.aspx?FamilyID=80782277-d584-42d2-8024-893fcd9d3e82&displaylang=en>
p.s. you can also set up the full version of Microsoft XNA 3.1.
 4. Download and install SimuSurveyX.
<http://simusurveyx.caece.net>
p.s. if there is still problem with executing SimuSurveyX, try installing the newest version DirectX.
<http://www.microsoft.com/downloads/details.aspx?FamilyID=2DA43D38-D B71-4C1B-BC6A-9B6652CD92A3&displaylang=en>
- IV. Operations (using Xbox controller)

The followings shows how to operate using Xbox controller.



1. Menu selection

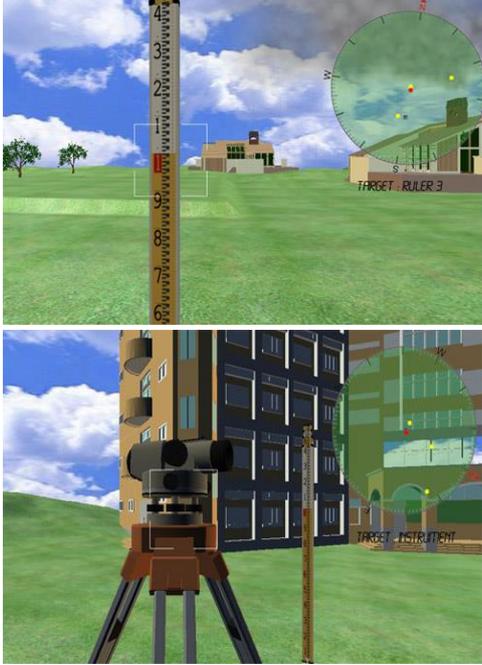
Menus include the Scenes menu and the Settings menu.

Screens	Operations
<p>Scenes menu :</p>  <p>Settings menu</p> 	<ol style="list-style-type: none"> Up/ down/ left/ right: use analog thumbstick(L) or directinal pad stick Selection: press Button A

2. First-person navigation mode

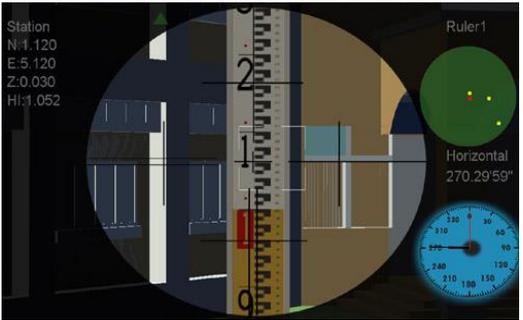
After entering the surveying scene, you can change the view angle, move yourself, or move objects include instruments, level rods, range poles. You also can elongate or shorten level rods. Before you can start moving or changing the objects , you first need to approach the object and see a

highlighted frame appeared. If you fly into the instrument, you can see the zoomed view with readings and rotate the instrument.

Screens	Operations
<p>First-person movement</p> 	<ol style="list-style-type: none"> 1. Move forward/ backward/ leftward/ rightward: Analog thumbstick(L) 2. Angle of looking up/ down: Analog thumbstick(R) 3. Elongating or shortening Rods/ poles: When approaching an object, a white frame will be shown on the screen. Use analog thumbstick(R) to elongate or shorten the item directly. Under this mode, Use Directinal pad stick for tilt. 4. Moving object: When approaching an object and the white frame appears, press button X to pick up or put down an object. Objects which can be moved include instruments, level rods, range poles, level pads. 5. The radarscope is on the upper right corner of the screen. Yellow dots indicate the location of level rods or range poles. Red dot shows where the user is. Black dot shows where the instrument is.

3. Operation in the Telescope mode

In this mode you can pan/tilt/zoom, observe and get reading.

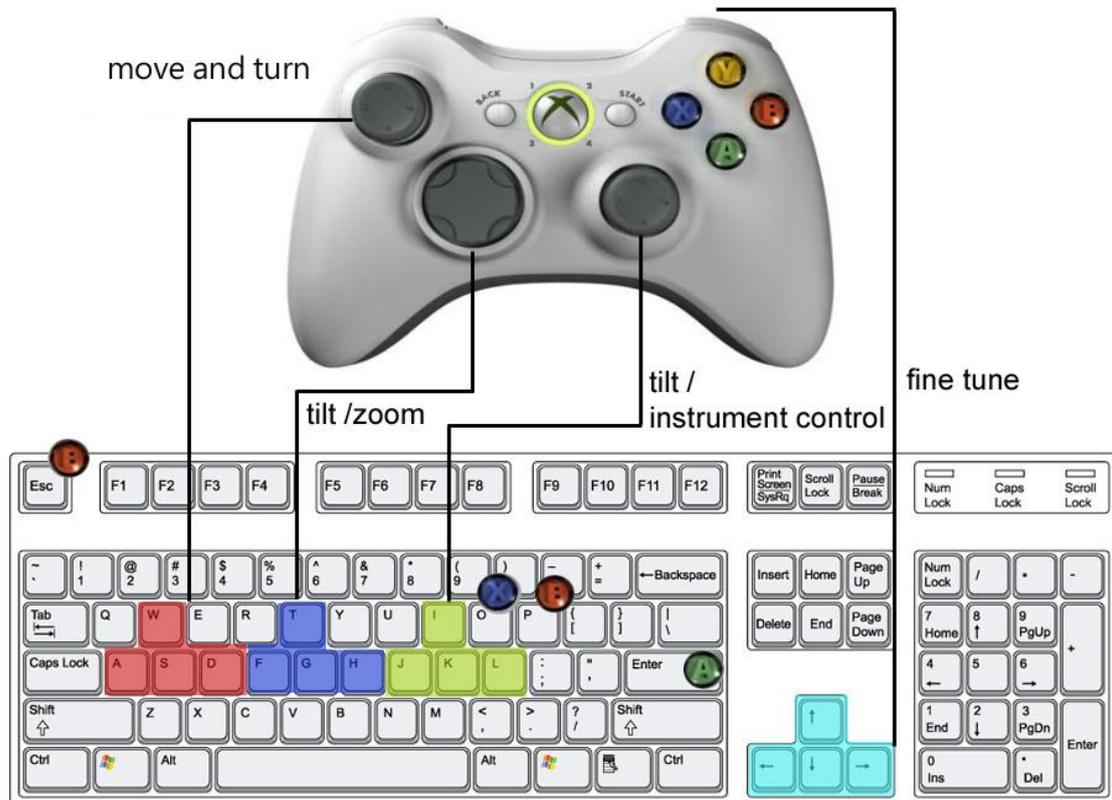
Screens	Operations
	<ol style="list-style-type: none"> 1. Get into Telescope mode: In the first-person navigation mode, aim the instrument and move toward it. The mode will change to the Telescope mode. 2. Turn left/right: Analog thumbstick(L) 3. Turn left or right precisely: Analog triggers 4. Zoom In/Out: Directinal pad stick 5. Zero the horizontal angle: Button A 6. Exit from Telescope mode: Button B 7. Direct/ Reverse mode: On the upper left of the screen will a green triangle appears to indicate direct mode, a red inverted triangle to indicate reverse mode.

4. Systematic Error setting

Image	Operation
	<ol style="list-style-type: none"> 1. In the first-person navigation mode, press button B and select OPTIONS\ ERROR SETTINGS 2. The default error setting is ON. Users can turn it off by selecting RESET 3-AXIS ERROR. 3. Distance error setting: The default setting is ON. The simulated error is between 0 to 7 mm for targets within 50m.

V. Operations (using keyboard)

The mapping of Xbox 360 controller and keyboard



VI. Scenes

The design of the scenes introduced below refers class C certified technician testing for surveying in Taiwan, includes leveling, horizontal angle measuring, vertical angle measuring, and closed traversing. Users can move points in the scene (like A, B, P) and level pads to different places to practice surveying.

1. Direct leveling with level



Preparations:

Choose a scene with fluctuant terrain. Nail a wooden peg on both point A and B firmly. The distance between A and B should be about 120m. Suppose the elevation of the top of the peg at point A is 30m, measure the elevation of the top of the peg at point D to mm and note it down.

Exam question:

Suppose the elevation of the top of the peg at point A is 30m. Set a turning point(TP1) between point A and B. Examinees set level between point A and TP1, TP1 and point B, measure the elevations between each points and note them down. Reverse measurement must be done after direct measurement, the turning point(TP2) during reverse measurement can't be the same on with the one in direct measurement(TP1). Examinees calculate the absolute value of the difference between adjustments of direct and reverse measurement according to their measuring results, and use the average difference between elevation of direct and reverse measurement to find the average elevation of top of the peg at point B.

2. Horizontal angle measuring



Preparation:

Select a square, set P, A, and B 3 points on it. Both point A and B are about 60 m away from point P. Nail wooden pegs at A, B and nails on the pegs. Set up sign beside the points. Nail nails on the peg at point P to be a standard to adjust instruments. Set theodolite at point P, tripods and reflectors at point A and B. Set the reflector at point A as backsight direction and the one at point B as foresight direction. Use single angle method to observe horizontal angle $\angle APB$ for one set and note down the average horizontal angle of each point you observed.

Exam question:

After examinees done the setting of theodolite at point P, set the reflector at point A as backsight direction (the beginning reading of direct mode is set by testing committees). Use single angle method to observe horizontal angle $\angle APB$ for one set, read reading to second and calculate $\angle APB$.

3. Vertical angle measuring



Preparation:

- (1) Nail three pegs at points A, B, C on an open ground. The distance between point A and B is about 50 m, and about 40 m between point B and C. Nail a nail on each peg. The top of the nail at point A and B is about 1 cm high away from the top of the peg, the one at point C is about 2.5 cm away. Set signs beside the points.
- (2) Set a tripod and a reflector at point A, measure I_a , height of the reflector, for calculating.
- (3) Set a level rod at point C.
- (4) Measure the plane coordinate and elevation of point C from point B to be a basis of grading.

Conditions:

- (1) Plane coordinates and elevations of two known points A and B as below.

Point	Ordinate (N)	Abiscissa(E)	Elevation(H)	Height of reflector (I_a)
A	800.000m	760.000m	50.000m	1.6000m
B	760.000m	800.000m	x	x

- (2) To set the condition, examinees need to use distance measurement with vertical staff to measure the plane coordinate and elevation of C, so it's necessary to set theodolite at point B and observe data below.
 - a. Aim the reflector at point A and read the readings of zenith angle in direct and reversed mode.
 - b. Aim the horizontal crosshairs of the theodolite to C. Read the readings of zenith angle at 2 m and 3 m on the level rod.
 - c. Aim the reflector at point A and the nail at point C. Observe horizontal $\angle APC$.

Exam question:

- (1) Practice: Read the readings of zenith angles of point A, C and horizontal angle $\angle APC$ from point B.
- (2) Calculation: Calculate plane coordinate and elevation of point C according to examinee's result.

4. Measuring and calculating of closed traverse



Preparation:

(1) Nail 4 points A, B, C, D on an open ground. Each of them is 30 – 50 m away from each other, forming a closed quadrilateral. Nail nails on the top of the pegs. To make observation easier with theodolite, make the top of the nails about 0.5 cm away from the top of the pegs.

(2) With scenes of different sizes, set some other questions with different coordinates and angles like this. Set different signs to distinguish them.

Conditions:

(1) Given coordinate of point A and azimuth of ϕ_{AB} .

(2) The observed results of horizontal angles $\angle A$, $\angle B$ and distance between point A, B and A, D is given by the authority which is in charge of the skill test. While doing traverse computation, use the same precision to count them into adjustment and be corrected.

(3) Examinees set theodolite at point C and D, then finish traverse computation.

Exam question:

(1) Observation: Set theodolite at point C, D to observe $\angle C$ and $\angle D$ for one set. Measure the distance between point B, C and C, D once each in both direct and reverse measurements. Note down the results.

(2) Calculation: According to the results from observation and given values, calculate angle misclosure, coordinate misclosure, and ratio of misclosure. Finish traverse computation and write the answer into answer sheet.