



UNIVERSITY OF WEST ATTICA
Department of Surveying and
Geoinformatics Engineering

**NATIONAL TECHNICAL
UNIVERSITY OF ATHENS**
School of Rural and Surveying
Engineering



**Presented at the FIG e-Working Week 2021
21-25 June 2021 in Virtually in the Netherlands**

An interactive virtual environment for teaching total station surveying

Dimitris Anastasiou, Vangelis Zacharis, Vassilis Pagounis, Maria Tsakiri



eWORKING WEEK 2021 20-25 JUNE
SMART SURVEYORS FOR LAND
AND WATER MANAGEMENT
CHALLENGES IN A NEW REALITY

INTRODUCTION

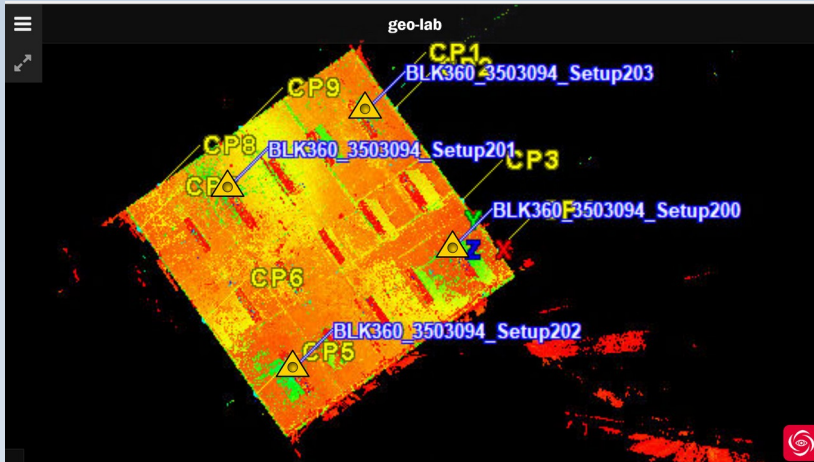
- ♦ Traditional teaching of surveying instrumentation is on a face-to-face basis.
- ♦ Recently, virtual education has become a challenge.
- ♦ E-learning tools supporting surveying engineering teaching started well before Covid19 era.
- ♦ There is a shortage of similar tools for topographic data collection using total station surveying.
- ♦ Certainly, there is still a gap between field surveying experience and virtual learning.
- ♦ The complexity to have complete hand-on experience in a virtual environment is still very challenging.

This paper describes the design, development, and initial evaluation of an interactive virtual environment with main objective being to enhance undergraduate students learning and revision of the concepts and practices for total station surveying.

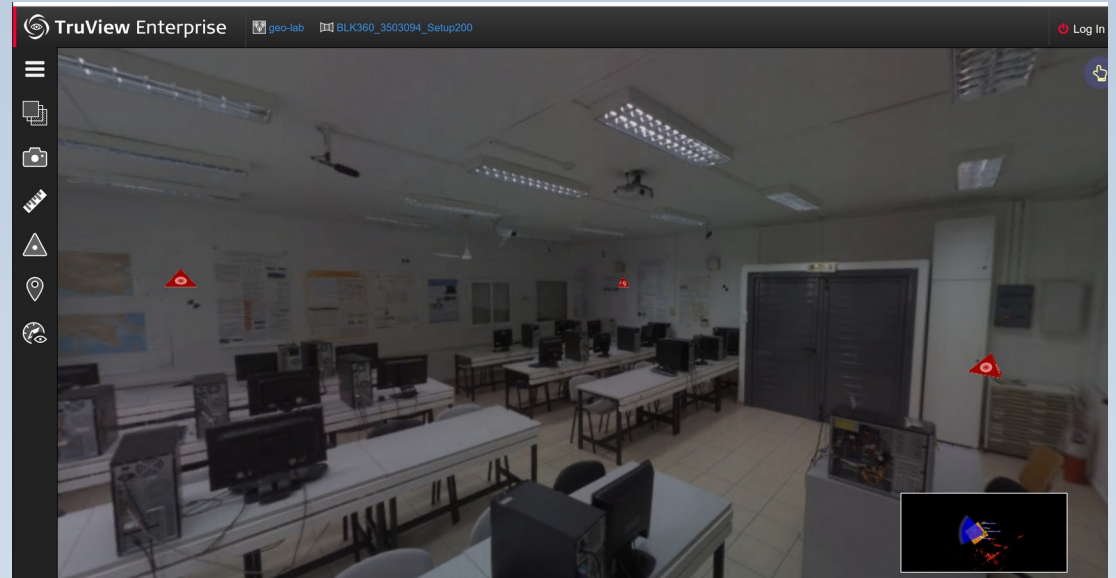


THE VIRTUAL ENVIRONMENT

Interactive virtual environment was based on 3D model created using TLS techniques.



Merged point cloud from TLS data

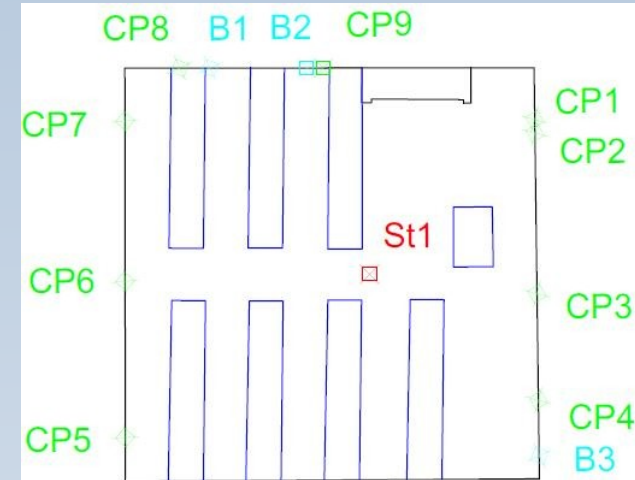


Snapshot of the lab with control points



PLAN OF THE LABORATORY

- ♦ A large number of control points as well as instruments set ups were measured in order to be used as targets.
- ♦ 13 points were implemented:
 - 9 control points (CP) | paper targets
 - 3 fixed points (B) | permanent forced centering base



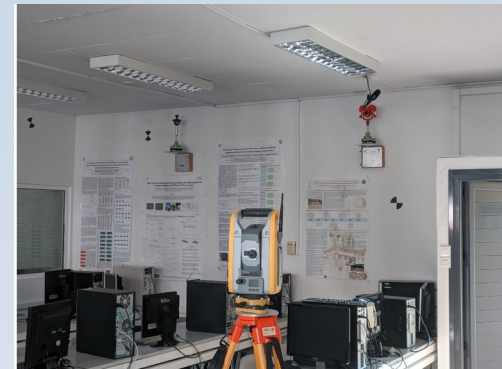
Robotic geodetic station

- ♦ TRIMBLE S6 DR300+

angles acc.: 3"

distance acc.: 3mm - 2ppm

- ♦ TSC2 controller
- ♦ MyMobiler
- ♦ TeamViewer (15.12.4)



MEASUREMENT TASKS

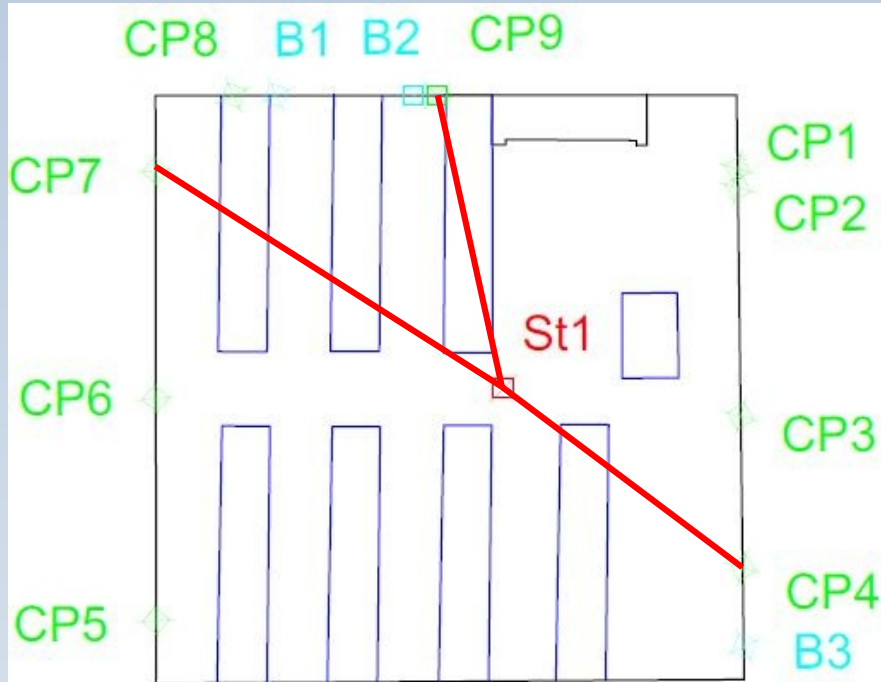
Learning outcomes:

- ♦ Instrument set-up ready for measurements.
- ♦ Comprehension of angle procedure.
- ♦ Understanding of horizontal and vertical angle computation.
- ♦ Profound understanding of the field data collection during topographic surveying.

Achieved via the following processes:

- ♦ Student expose to the virtual terrain topographic surveying with measurements of angle and distances.
- ♦ Exporting of the acquired data for processing and accuracy obtaining.
- ♦ Assessment of the learning outcomes.
- ♦ Feedback of the assessment results to the student.

MEASUREMENT TASKS

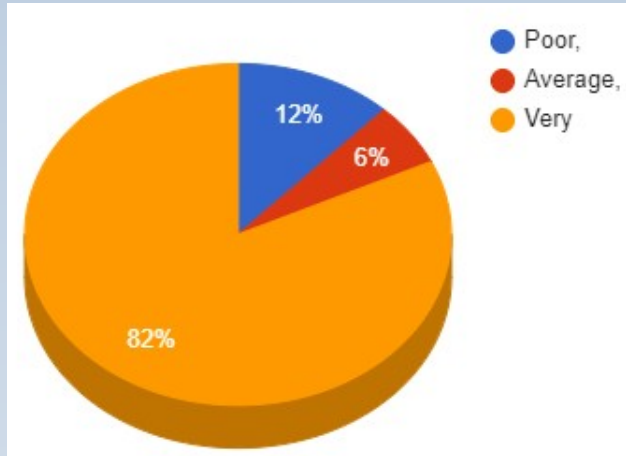


- 1) From position ST1 measure horizontal directions and vertical angles to the points CP4, CP7, CP9 in 4 periods.
- 2) Estimate the angles:
CP4-ST1-CP7, CP7-ST1-CP9, CP9-ST1-CP4.
- 3) Calculate the coordinates of the station ST1.
- 4) Calculate the horizontal coordinates and height of the base points B1, B2, B3.

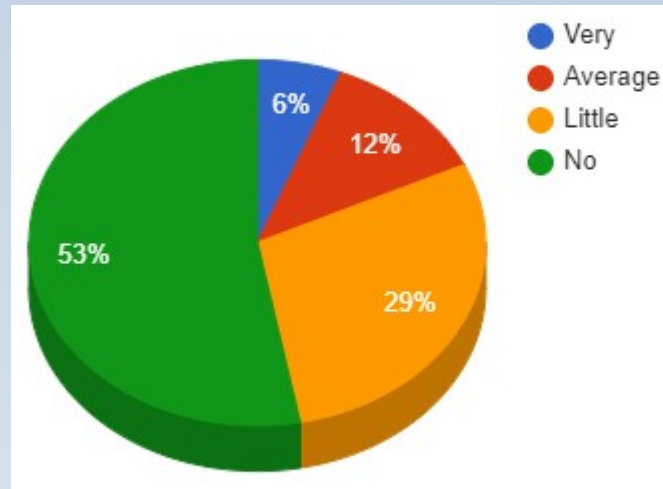


RESULTS

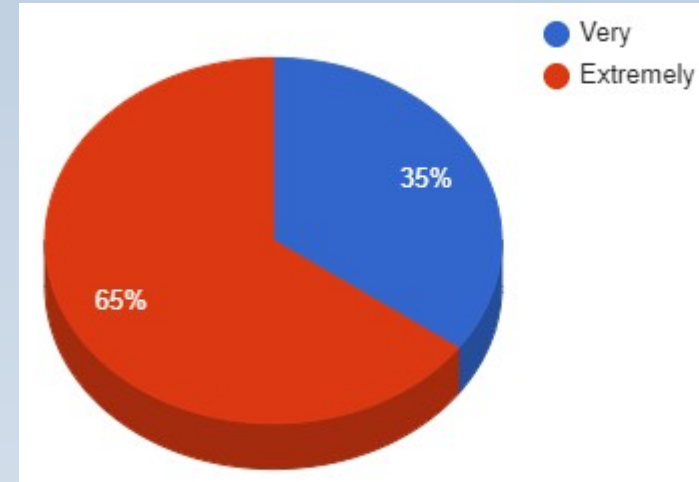
Assessment of the objectives



Difficulty of the experiment



Impact of 3D space in student's understanding



DISCUSSION & CONCLUSIONS

- ♦ For as long as pandemic continues and distance education, this tool may be used to a wide range of students for their training to total station data collection.
- ♦ This approach is not a stand-alone education tool but supplements the lectures.

Benefits

- ♦ Early semesters
students get acquainted with the main surveying instruments equipment and the primary observations of angles and distances.
- ♦ Later semesters
students can use virtual environments to enhance their skills and their knowledge by more complex tasks.



DISCUSSION & CONCLUSIONS

Advantages

- ♦ Enable students to understand surveying concepts.
- ♦ 3D model helps students to understand the space where the measurements take place.
- ♦ Students get familiar with 3D scanning techniques.

Disadvantages

- ♦ Infrastructure to support this activities.
- ♦ Development environment as for now contain only internal laboratory space.

In the future

- ♦ Environment has to be expanded to include physical landscape.
- ♦ In more complex environments students will have to take decisions.
- ♦ Other surveying techniques can be incorporated to allow f or more complex scenarios.



UNIVERSITY OF WEST ATTICA
Department of Surveying and
Geoinformatics Engineering

**NATIONAL TECHNICAL
UNIVERSITY OF ATHENS**
School of Rural and Surveying
Engineering



THANK YOU FOR YOUR ATTENTION

Dimitris Anastasiou, Vangelis Zacharis, Vassilis Pagounis, Maria Tsakiri

Dr. Dimitris Anastasiou
University of West Attica

dganastasiou@gmail.com // danastasiou@uniwa.gr
<https://www.linkedin.com/in/dganastasiou/>



eWORKING WEEK 2021 20-25 JUNE
SMART SURVEYORS FOR LAND
AND WATER MANAGEMENT
CHALLENGES IN A NEW REALITY