Co-funded by the
Erasmus+ Programme
of the European Union

VIRTUAL TECHNOLOGIES
@WESTERN BALKAN UNIVERSITIES

UNIVERSITETI I EVROPËS JUGLINDORE
УНИВЕРЗИТЕТ НА ЈУГОИСТОЧНА ЕВРОПА
SOUTH EAST EUROPEAN UNIVERSITY

Introduction to VR in Architecture

Assoc. Prof. Dr. Visar Shehu

South East European University

Co-funded by the
Erasmus+ Programme
of the European Union

Outline

- About us and our projects
- A crash course in Photogrammetry
- A review of tools that we can use
- Creating 3D models from real objects
- Scanning using LIDAR
- Modelling of large-scale object and areas

The NICS VR Laboratory

- In 2021 we established the NICS VR Laboratory
  - Supported by NATO SPS, MIT LL and Crisis Management Center
- Labs are equipped with:
  - VR / AR equipment
  - 3D Scanning devices
  - UAV (12+)
  - Infrared cameras
  - Microcomputers / Sensors
  - Powerful computers and servers

Co-funded by the Erasmus+ Programme of the European Union

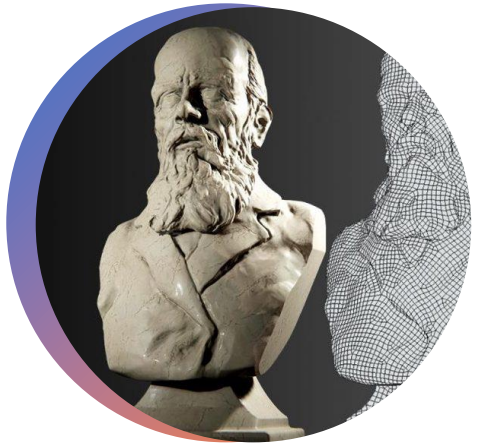
VIRTUAL TECHNOLOGIES @WESTERN BALKAN UNIVERSITIES

Co-funded by the
Erasmus+ Programme
of the European Union

VIRTUAL TECHNOLOGIES
@WESTERN BALKAN UNIVERSITIES

About the project

- The aim: to increase situational awareness during emergency situations
- Our applications:
  - **Photogrammetric 3D modelling of ruins after earthquakes**
  - **Accurate VR Enabled 3D buildings**
  - Augmented reality for mission planning
  - Intelligent solutions for first responders



The problem – how to scan real objects

- Multiple approaches:
  - Use 3D scanners
  - Use LIDAR enabled devices
  - Photogrammetry

3D Scanners

- Specialized devices
- Very accurate and fast (resolution of less than 1mm)
- Very expensive ($17,000+)
- Used in accurate 3D printing – parts, oral scanners, digital replication etc.

Co-funded by the
Erasmus+ Programme
of the European Union

Co-funded by the
Erasmus+ Programme
of the European Union

LiDAR enabled devices

- Light Detection and Ranging
- Uses lasers beams to map surfaces of objects
- Available in many implementations: handheld, drone mounted, smart phones etc.
- Ranging accuracy (<1cm – 15cm)

Demonstration

1

Use IPAD Lidar to scan an area

2

Import the object in Blender

3

Clean up the object

Co-funded by the Erasmus+ Programme of the European Union

VIRTUAL TECHNOLOGIES @WESTERN BALKAN UNIVERSITIES

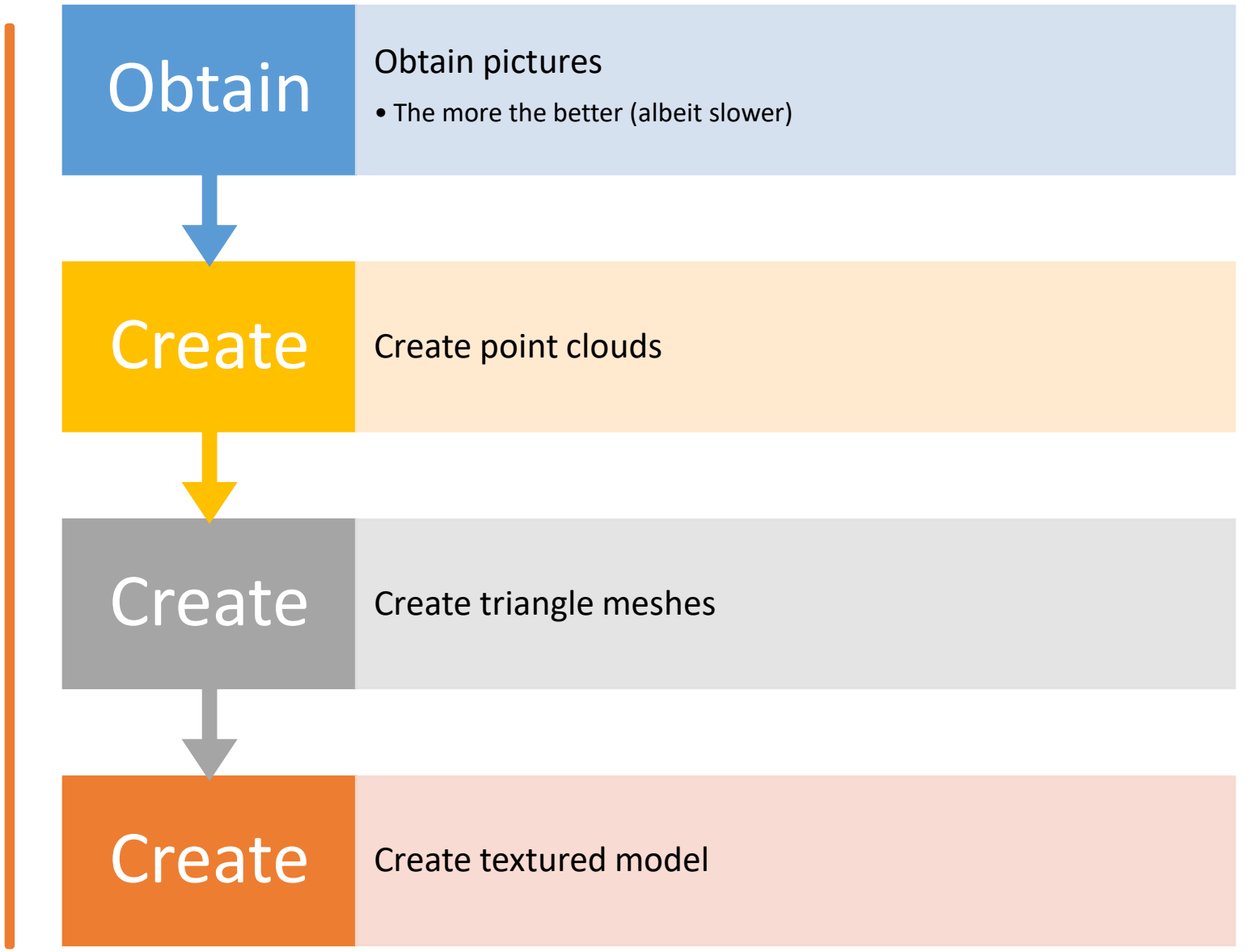
Co-funded by the
Erasmus+ Programme
of the European Union

Enter photogrammetry

- The science of making measurements using pictures
- Allows for generation of 3D models from images
- Used in
  - 3D map generation
  - 3D models from real objects
- Benefits – inexpensive, accurate (up to around 5cm)
- Drawbacks – slow, very data intensive process

Co-funded by the
Erasmus+ Programme
of the European Union

The process



Co-funded by the
Erasmus+ Programme
of the European Union

Obtaining the pictures

- Any camera would do
  - Fixed focus is preferred
  - No zoom
  - Overcast weather
  - Mechanical shutter
  - ISO level: 100 – 250
  - Overlapping photos
- Pictures should be taken in a spiral fashion around the object
  - Manual or using software
  - Central position 360
  - Lower position 360
  - Upper position 360
- It is good to cleanup photos (remove background)
  - Easier to do if the background is the same for all images (rotate object)

Drone Planning Software

- Allows to set the path of the drone
- Specify plan and configure how pictures will be taken
- We use Pix4D Capture
  - Not all drones are supported
- In SEEU we use Inspire2 and Phantom4 drones

Aerial photogrammetry

- Using regular cameras in drones we are able to generate 3D models of buildings or 3D maps of areas
- These models do not have high accuracy but allow us to
  - Quickly determine the 3D shape of structures
  - Determine the accessibility towards a region / structure
  - Also allow us capturing the 3D shape of irregular structure (important for collapsed buildings)
- These approaches are helpful during earthquakes or floods
  - The 3D structure of objects is altered (e.g., collapsed budlings)
  - Roads can be blocked from rubble
- The time to generate these models is quite short: in less than 30 minutes we can have a basic model