

3D Crime Scene Reconstruction: Spatial Forensics Capture to Immersion

PROF SAVIOUR FORMOSA – TRAM NGUYEN

HUMS SYMPOSIUM – FORENSIC INTERDISCIPLINARITIES

21ST OCTOBER 2022

Scope – W6H

Capturing Reality

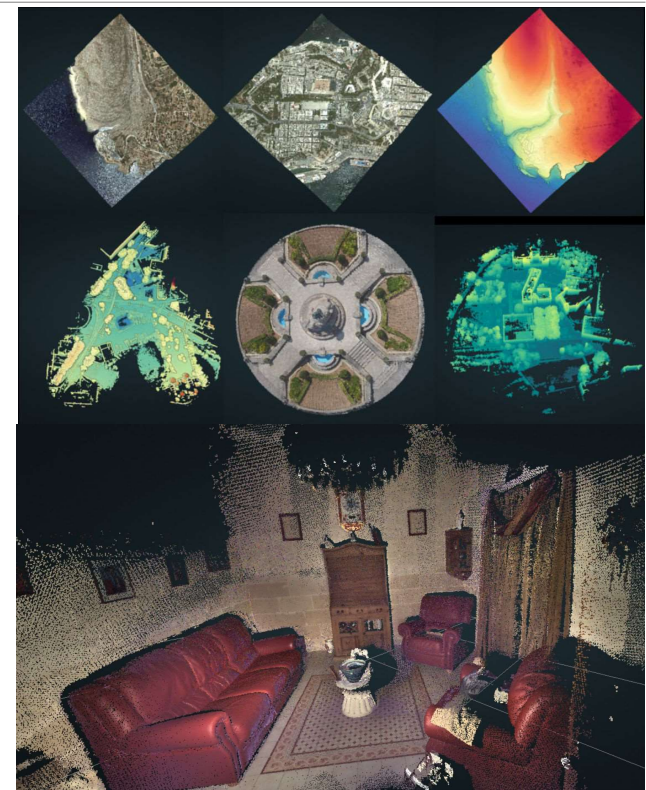
- What, Why, Where, When, Who, How... Why Not?...

Methods

- Photogrammetry
- Laser Capture

Limitations

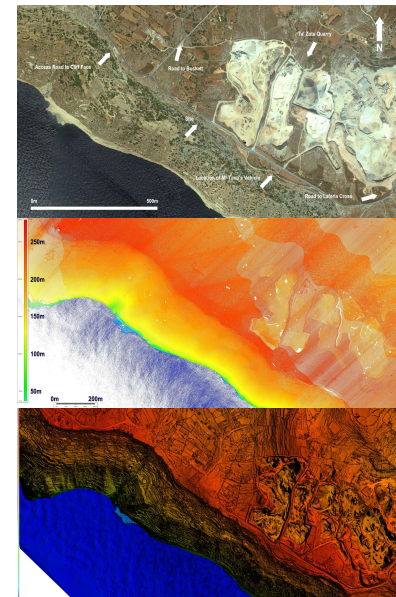
- Technological, methodological, human factors



The path we travel...

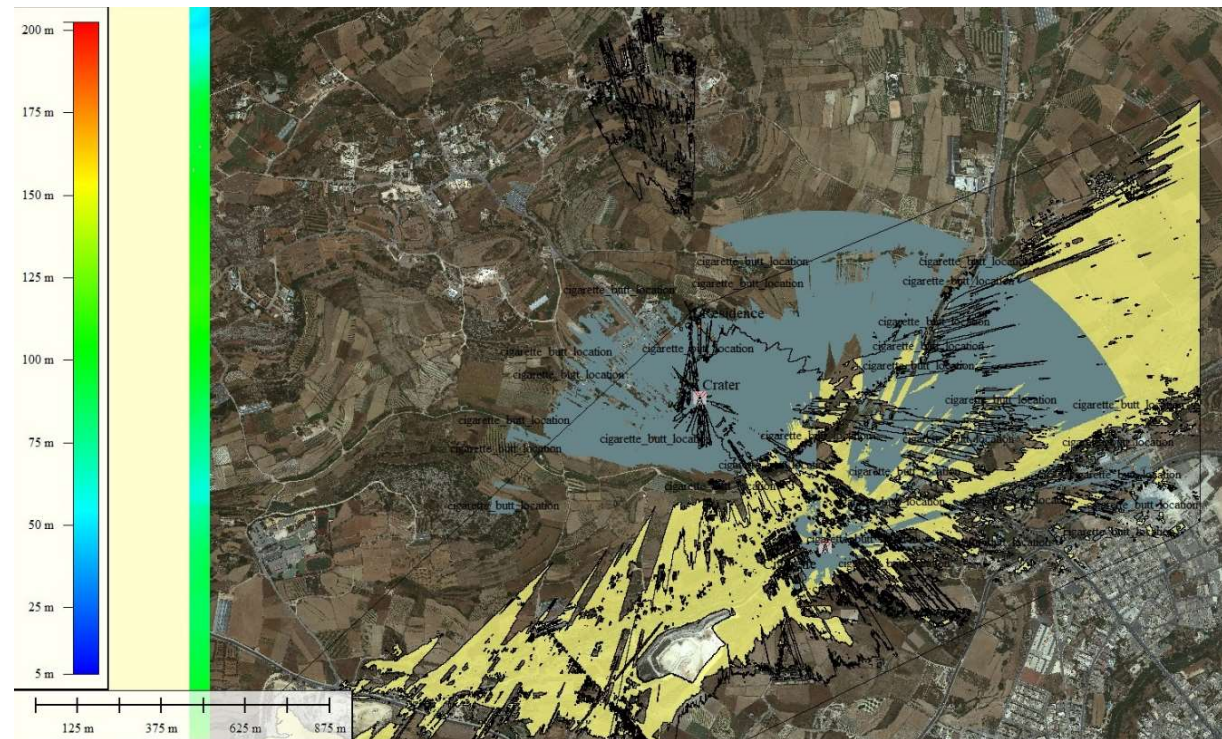
Building a Spatial Model: before we start investigating the scene

- Understanding the complex Maltese special constructs – from 2D to 3D
- Sourcing the data: PA basemap, SIntegraM LiDAR, In-situ capture
- Stepwise approaches: vector to raster to vector to raster to vector
- Capturing the scene – aerial, handheld, TLS, MLS, ALS, imagery, laser
- Outputs
 - LiDAR pointcloud
 - Digital Surface Model – Digital Terrain Model – Pointclouds - Meshes
 - Integrating models



How it all started...

2D GIS



Technologies...

Handheld Laser

Handheld Imagery

Terrestrial Mobile

Terrestrial Vehicular

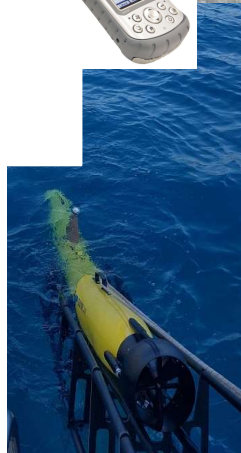
Aerial Imagery

Aerial Infrared

Aerial NDVI

Aerial Laser

Bathymetric Imagery



The Technologies

- MLS, ALS, TLS, drones, handheld scanners, Backpack Scanners, cameras, IR, RGB
- LiDAR, imagery
- Software: RiScan Pro, Metashape, Pix4D, Zephyr 3D, RiScanPro, RiProcessUnity, RealityCapture
- Integrating datasets
- Publishing online for user consumption
- Unity
- Immersion Tech



Preparing the process...

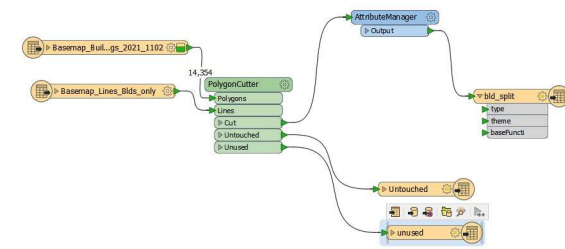
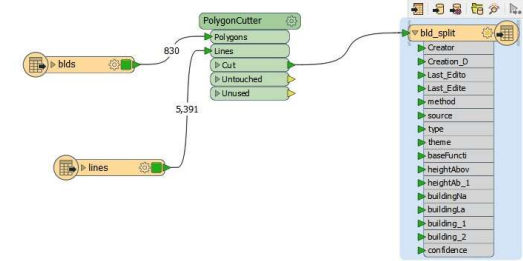
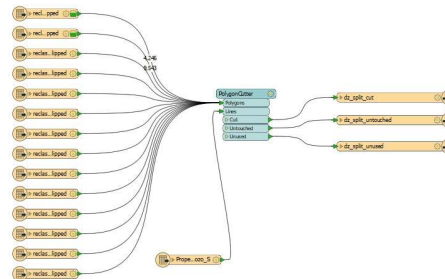
Imagery to

Video to

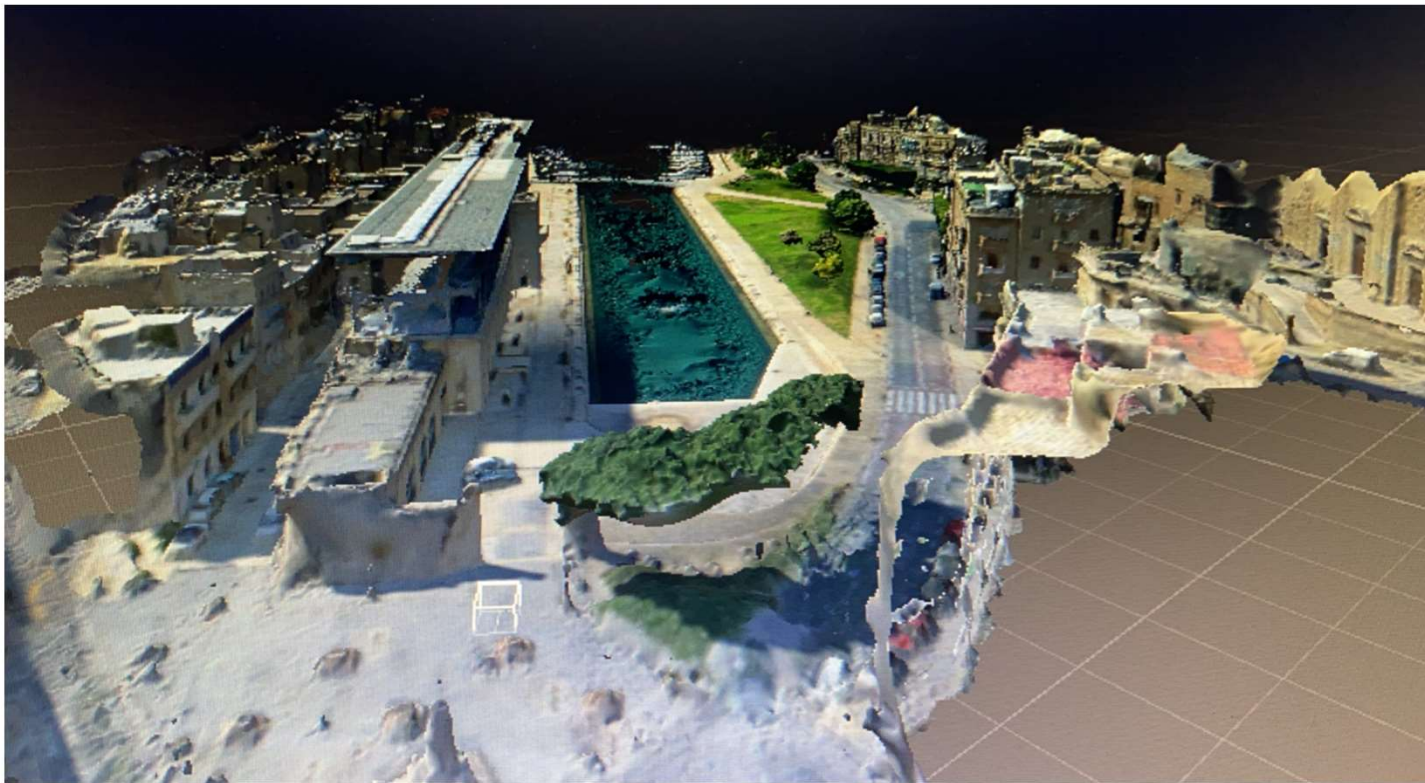
Pointcloud to

Mesh to

Web-enabled datasets that allow for measurements



The Spatial Information Systems Basis



How it all started...

A Siggiewi-Dingli Cases

- - IKE Camera for remote image and GPS capture
- - LiDAR 2012

A Spy Plane

- Single point photo run
- Cherry Picker capture

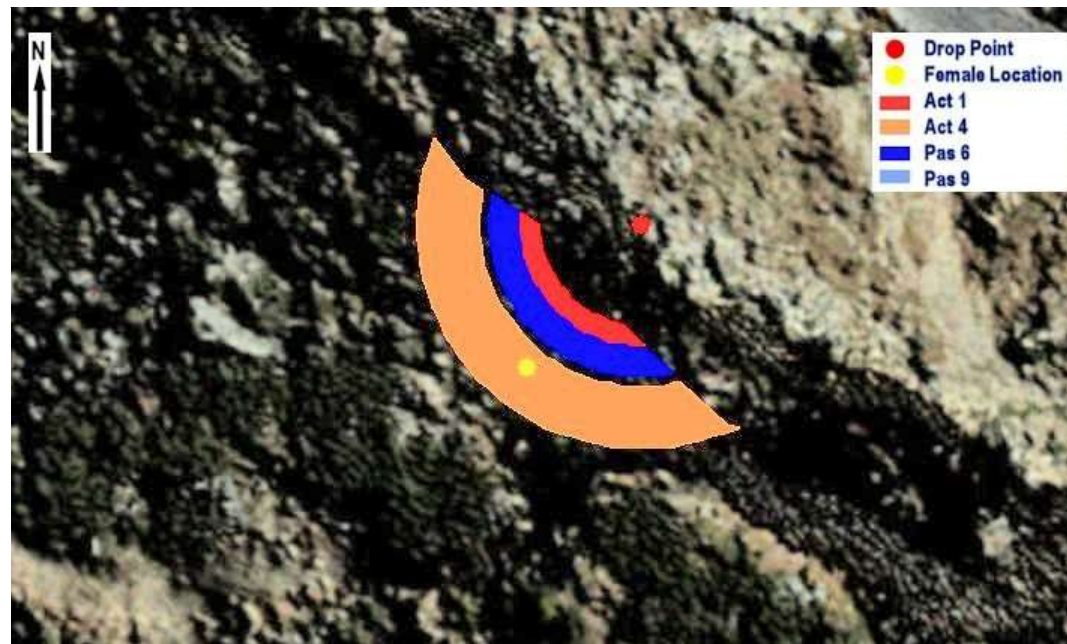
A Swieqi Homicide

- Handheld scanning
- 300+ photos



Cases...

Siggiewi-Dingli



How it all started...

A spate of car bombs

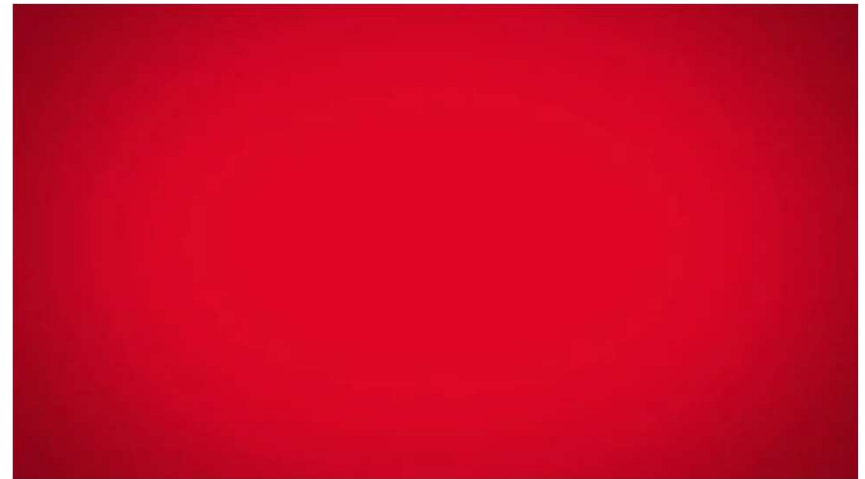
- - Qormi
- - Msida
- - Fgura
- - Bidnija

Other explosions/Fires

- Gharghur
dangerous structures
- Fireworks Factories
- Snack Factory

Tunneling in space

- Kalkara countermines case
- The Has-Saptan case



Source:

https://www.maltatoday.com.mt/news/court_and_police/73885/carbomb_qormi#.Y1FAQHZBy4Q

The court aspect...

Data reliability

Procedural documentation

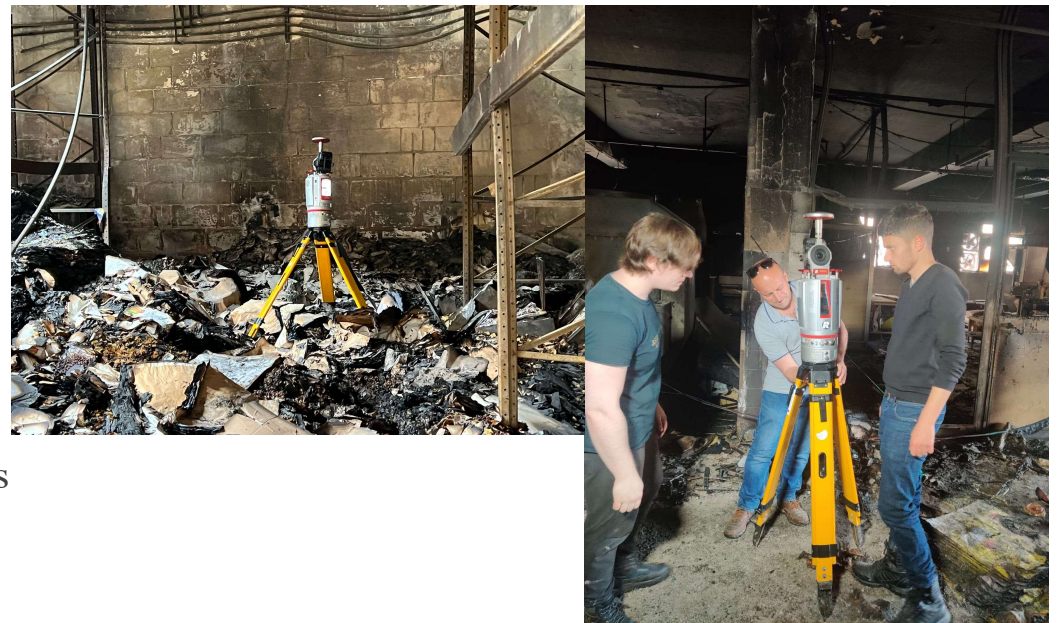
Lineages

Presentation of raw data

Presentation of reports

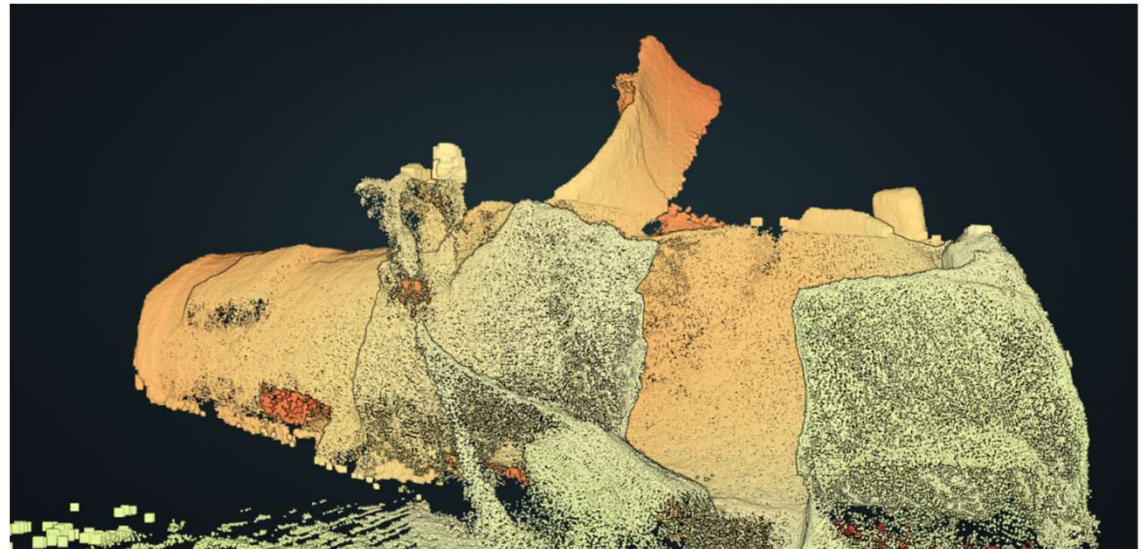
Visits by Magistrates during Compilation process

Expert witness in Court



Cases...

Explosions: Device recreation



Terrestrial Forensic Cases...

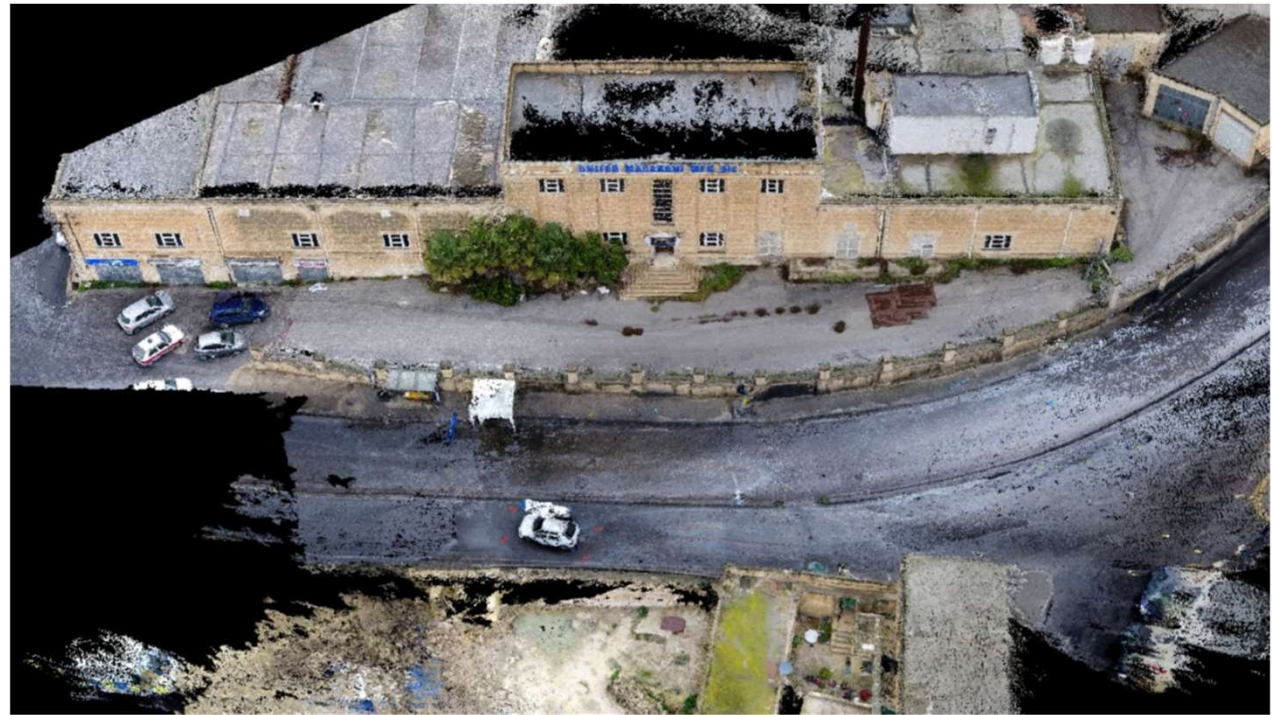


Terrestrial Forensic Cases...



Terrestrial Forensic Cases...

Explosions



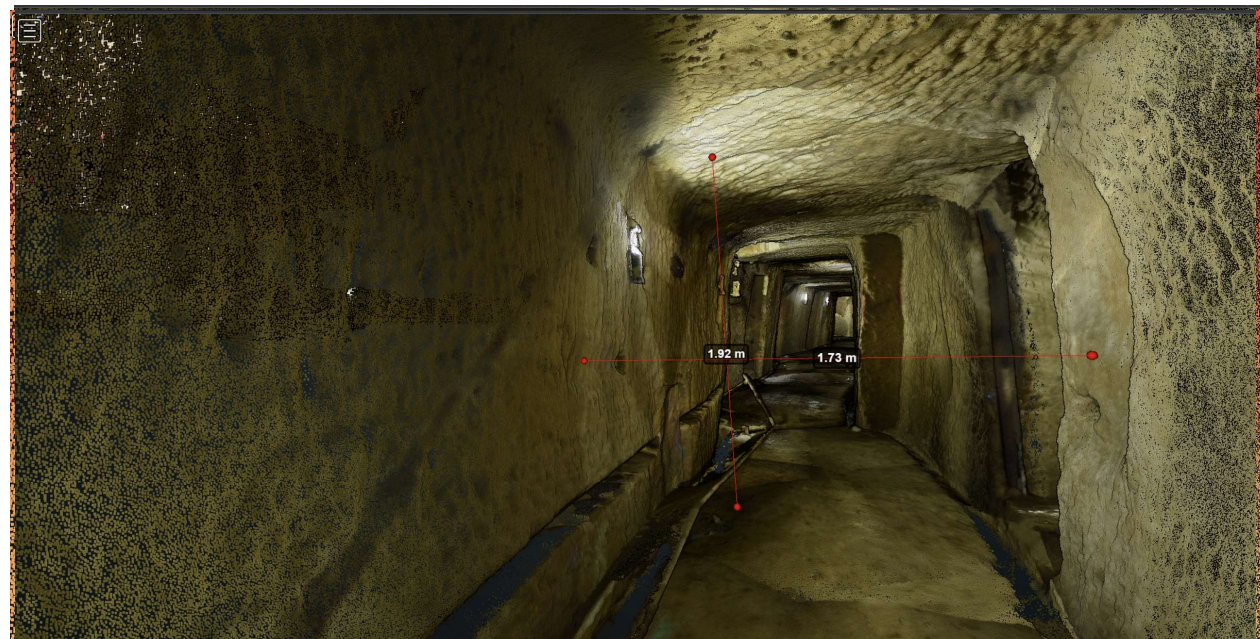
Terrestrial Forensic Cases...



Subterranean Forensic Cases...

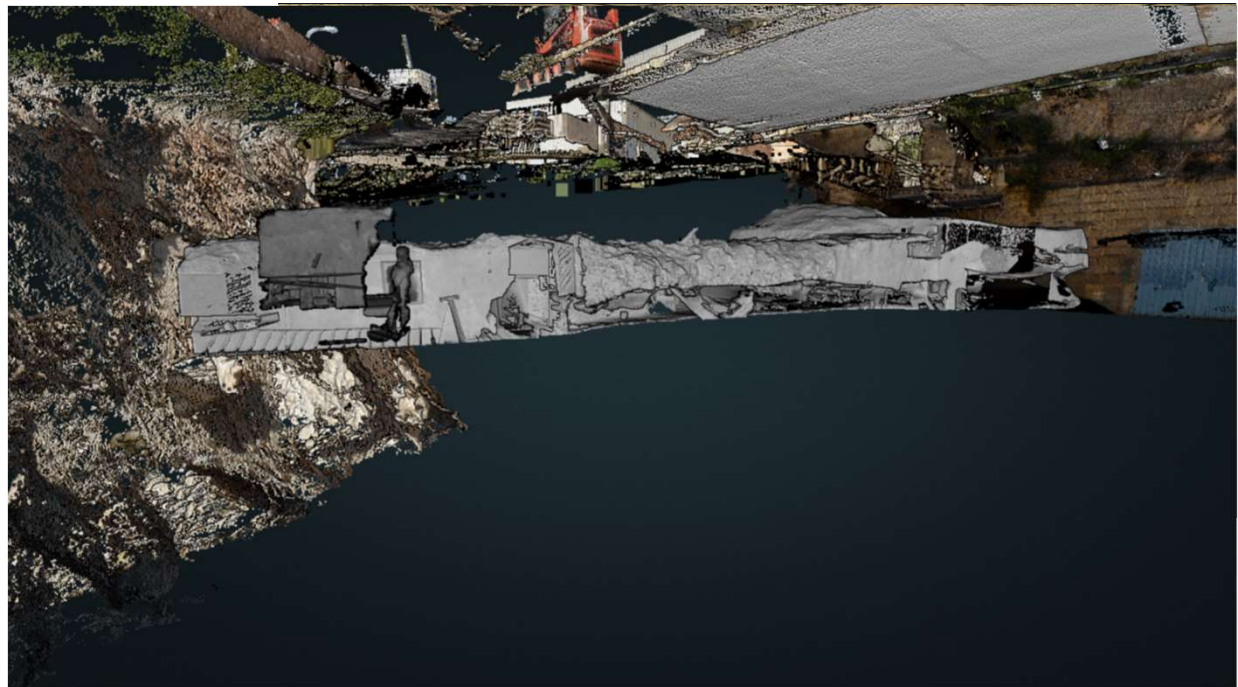


[Link to Model](#)



Preparing for the inevitable...

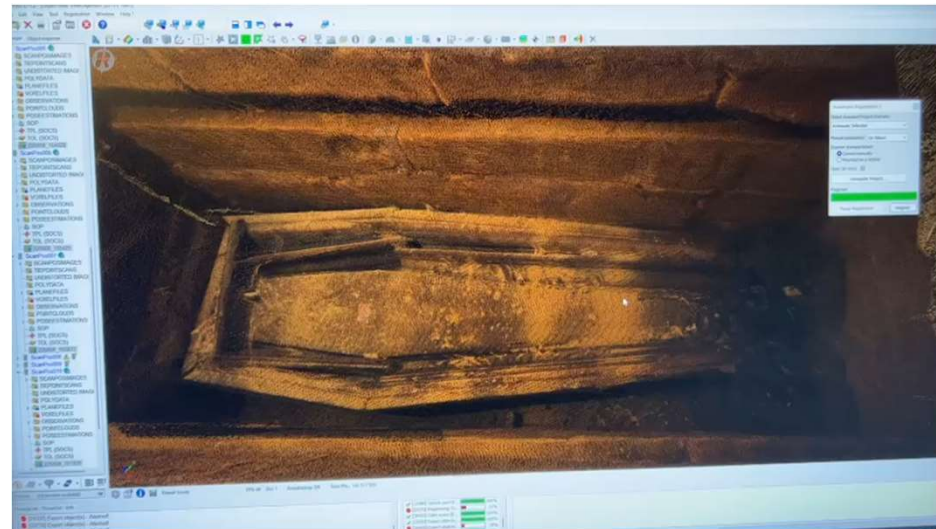
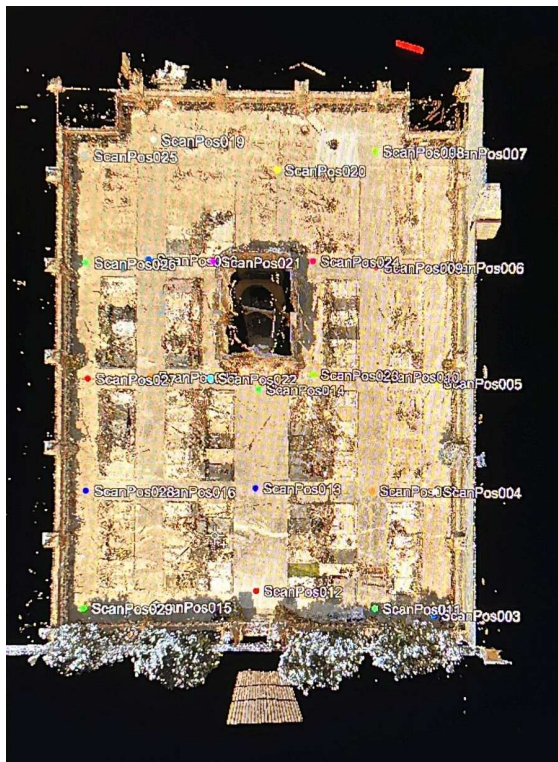
Lapsi



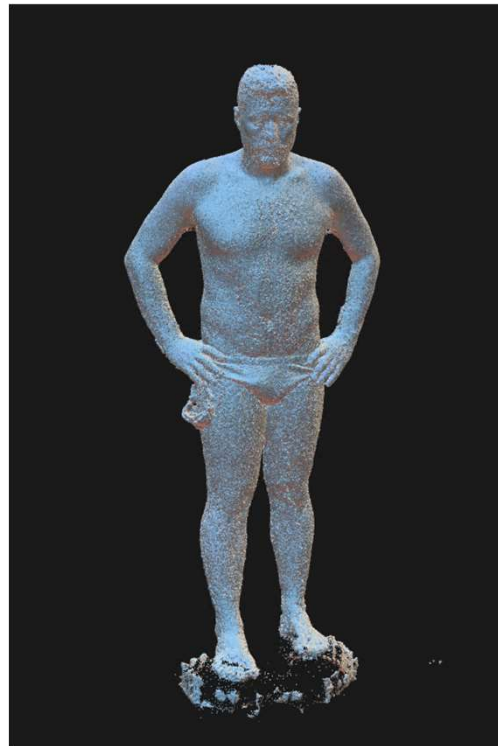
Strange requests...



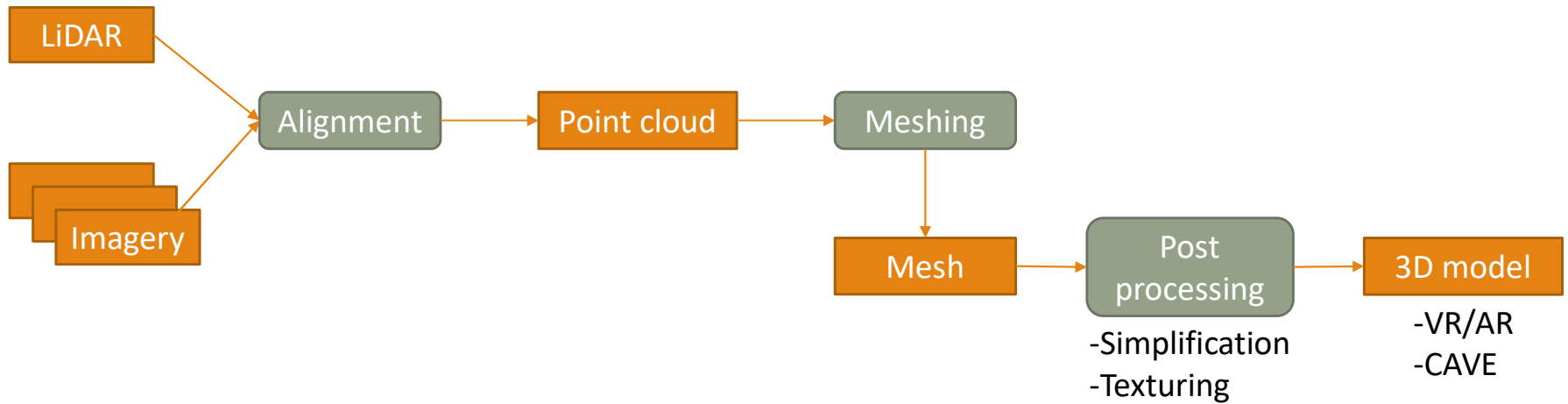
Strange requests...



Strange requests...



Creating 3D models



The student aspect...

GIS

3d GIS

Clouds

Sweethome 3d

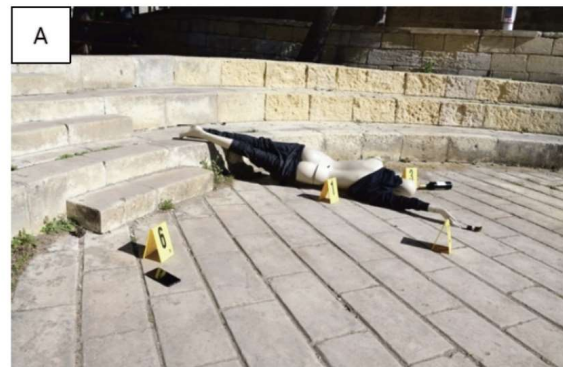
Potree

Laspublish

Zak Grech

The traffic dilemma - crash site

www.cloudisle.org



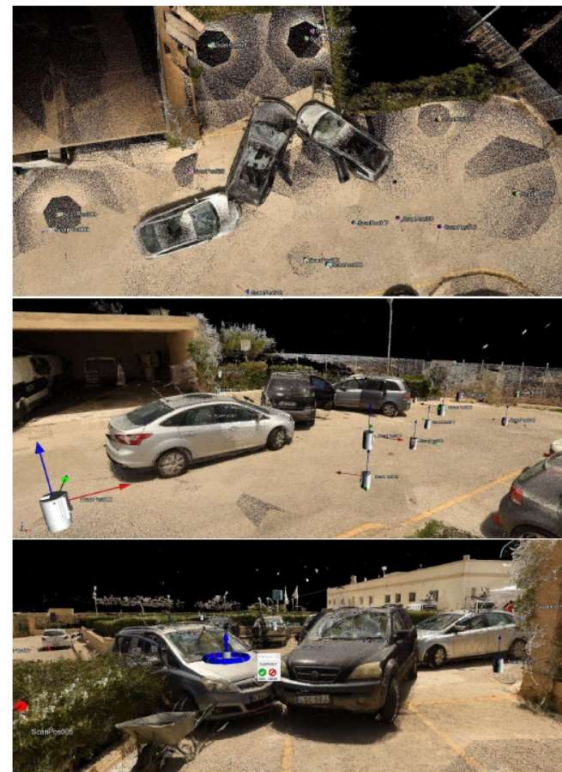
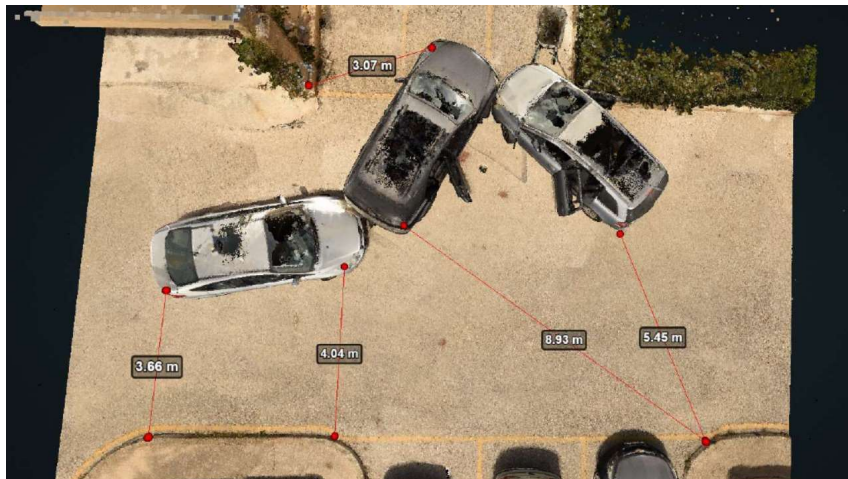
Viewing the outputs...



Only for ANDROID



Crash Test



Crash Test



Presenting in the Immersion Lab...

VR

Oculus Rift



Presenting in the Immersion Lab...

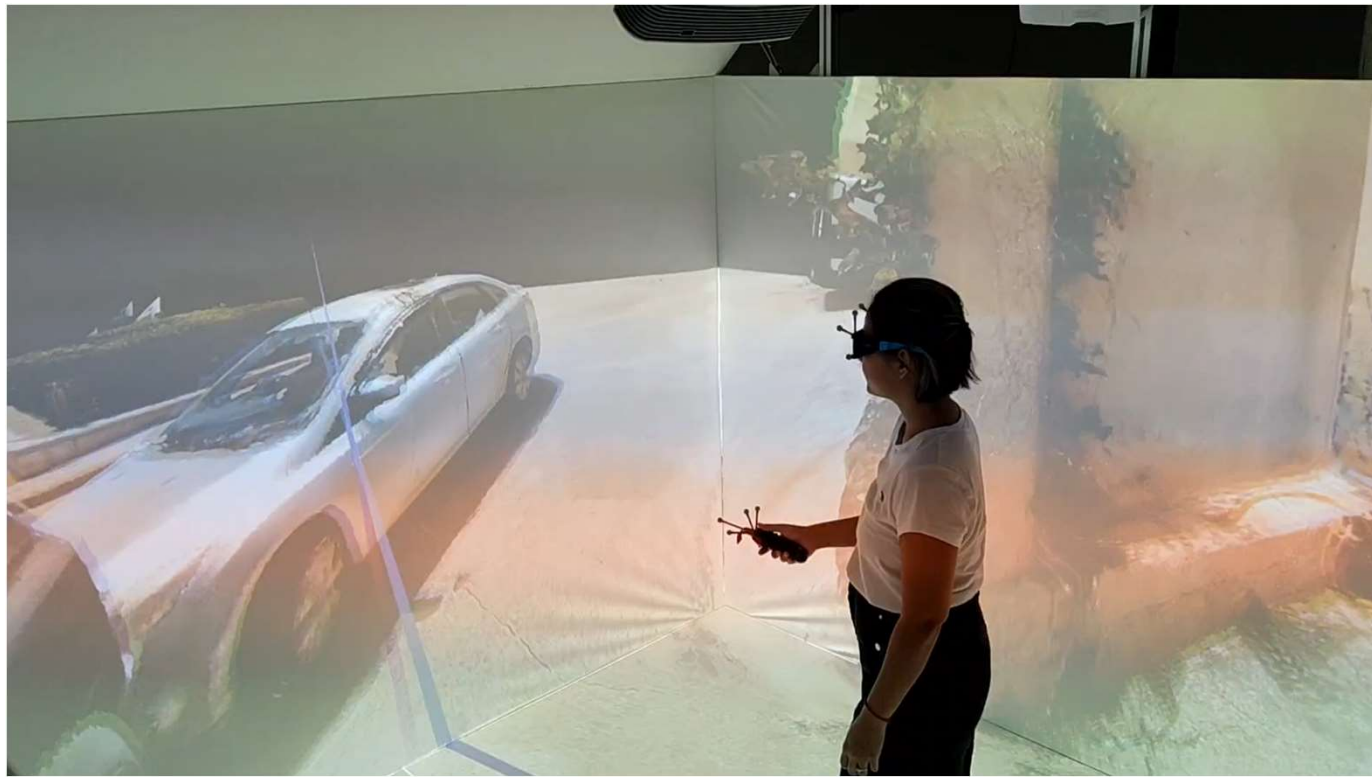
AR

MagicLeap



Presenting in the Immersion Lab...

CAVE



The Immersion Experience...

Record for posterity

Record for witness recollection

In-situ *Access* reduction

Visualisation during investigation

Visualisation projection in the courtroom



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