



“ Merging Aerial and Terrestrial Photos For 3D Photogrammetry Model Creation: A Case Study for Arraba Palace- Palestine ”

Prepared By:

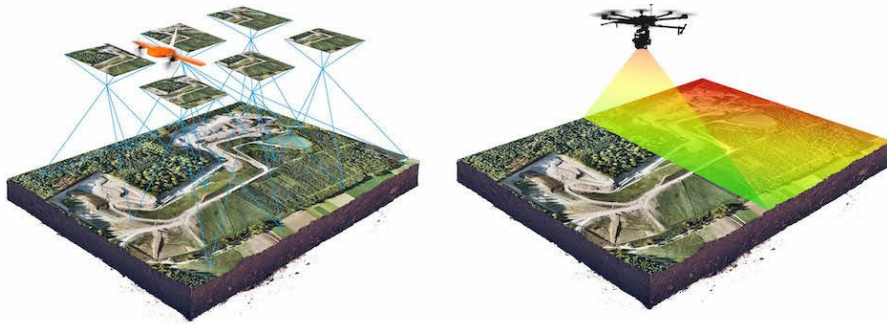
Zaid Qarmash

Zaid Sawalmeh

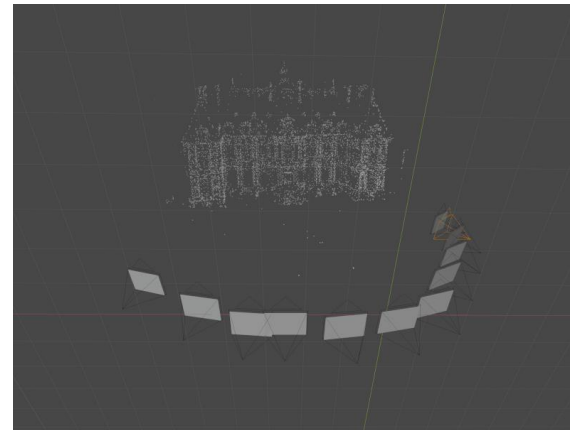
Murad Daqqah

Supervised By: Dr. Emmad Dawwas

Introduction

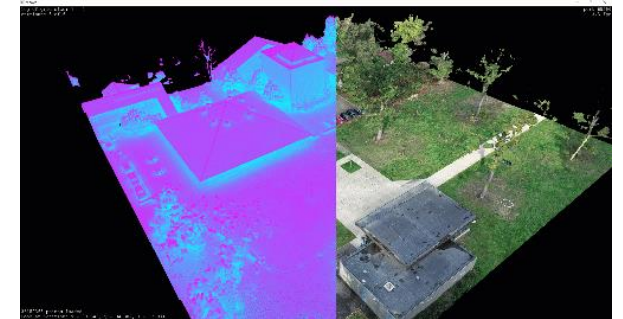


What is
Photogrammetry



Types of Photogrammetry:

- Terrestrial
- Aerial



What is
3D Model

Importance of 3D Modeling



- High accuracy
- Cost effective
- Risk mitigation
- Time Reduction
- Heritage preservation
- Maps creation
- Virtual Reality
- Machine Learning

Additional Value

1

▶ The possibility of merging data from more than one source

3

▶ The best possible imaging plan to combine data from more than one source

2

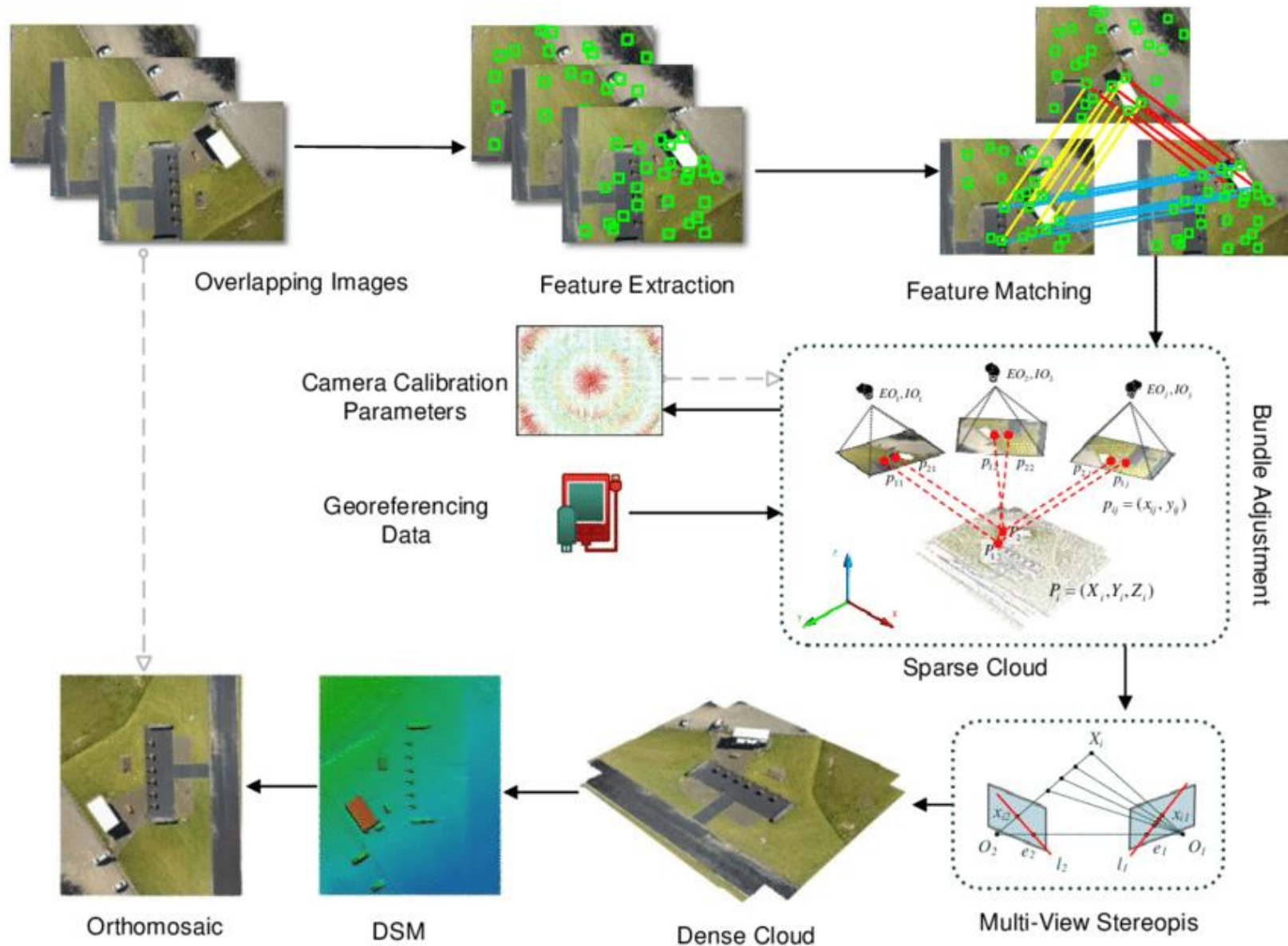
▶ Comparison with modeling programs

4

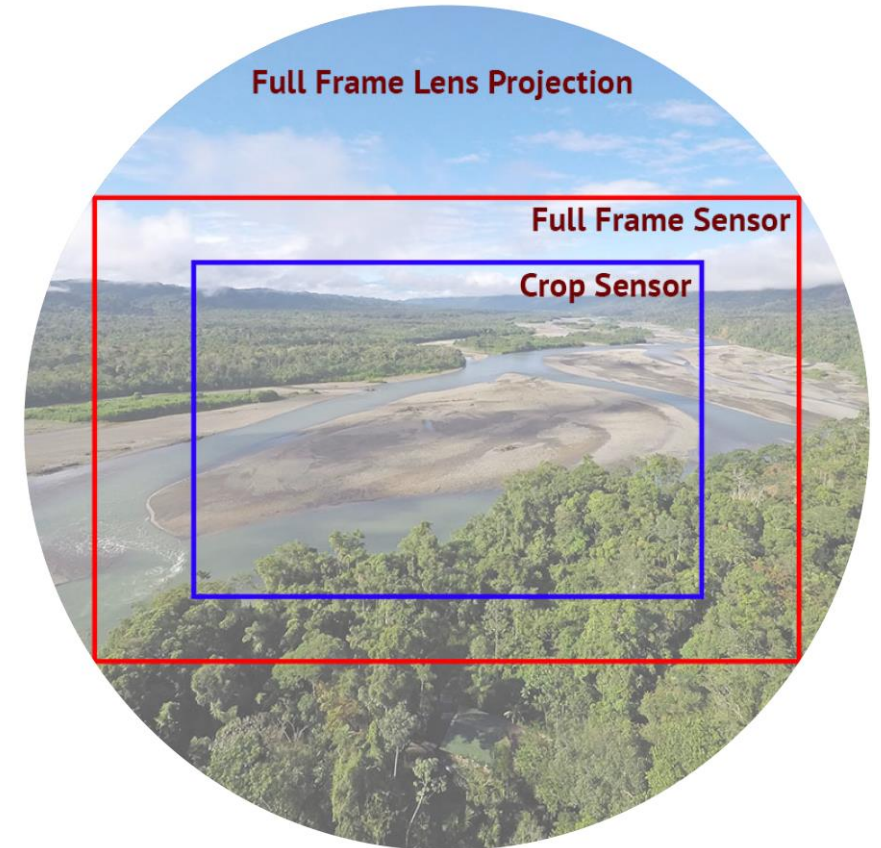
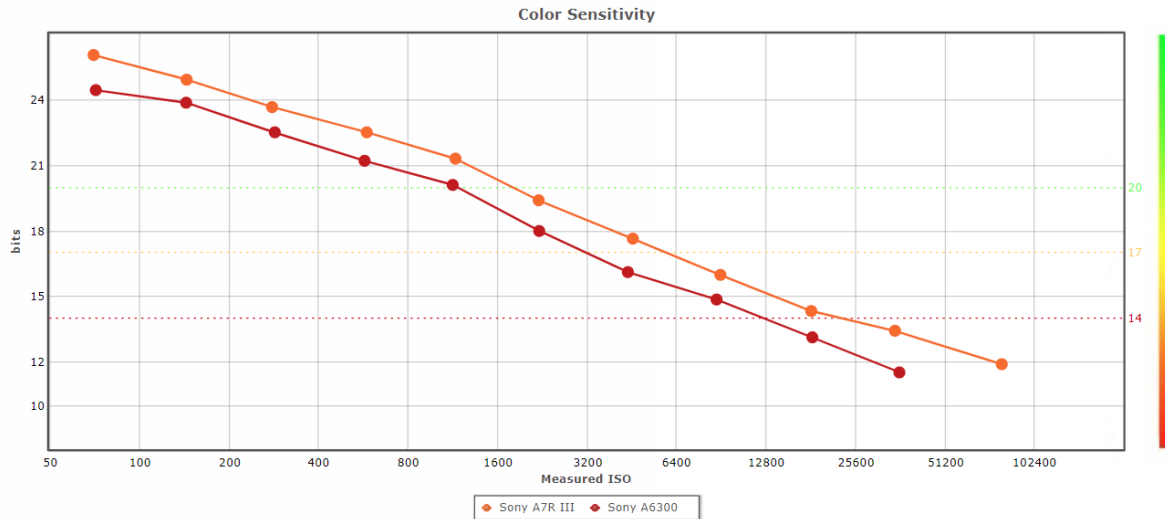
▶ The effect of the merging process on 3D models

Our project provides comprehensive experience and search on:

SfM

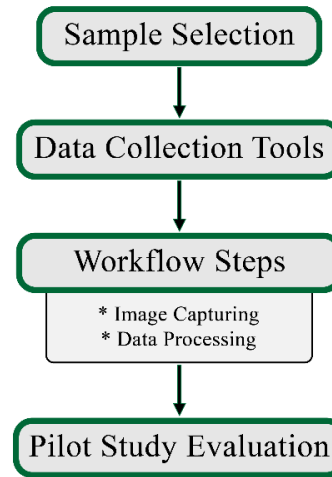


What do we gain from understanding SfM?

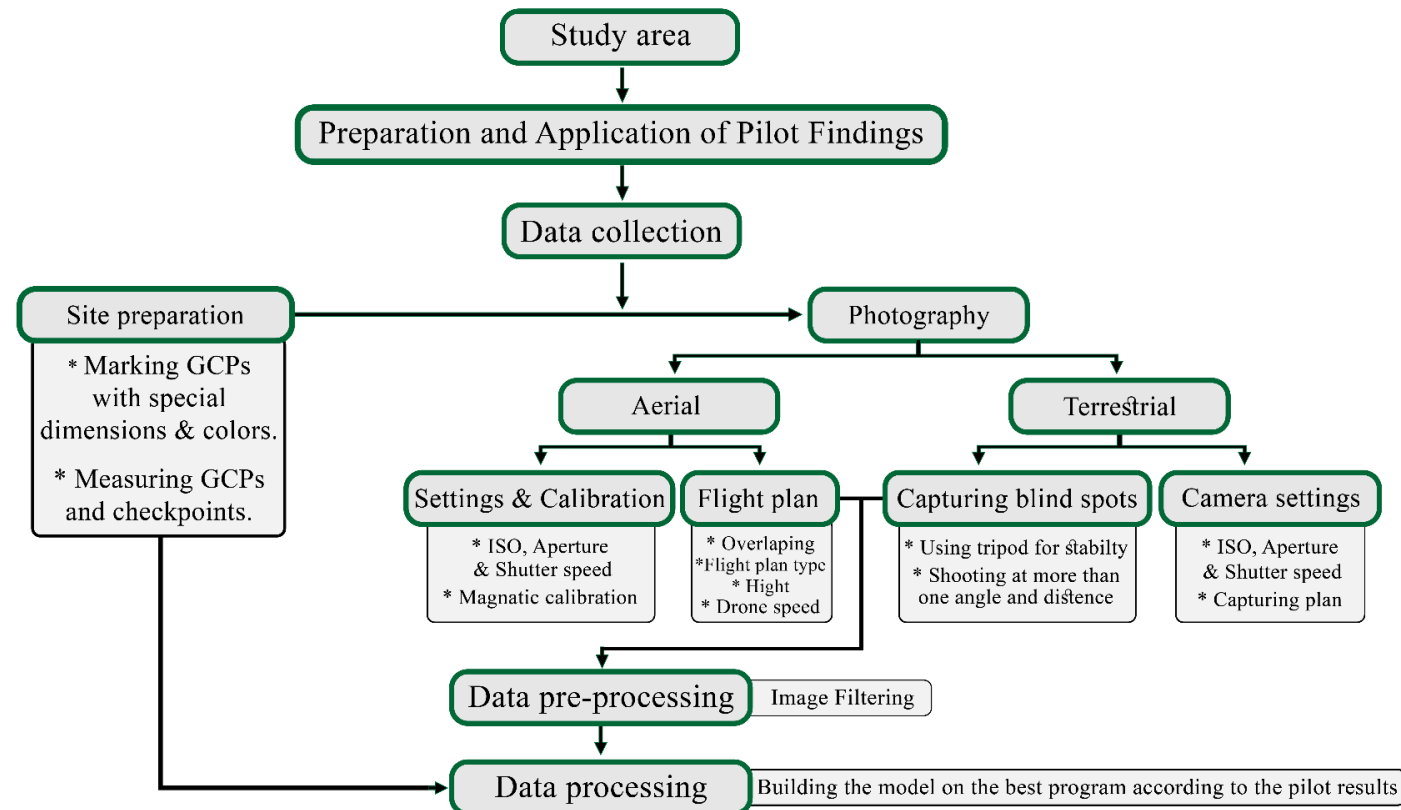


Methodology Flowchart

Phase 1: Pilot Study

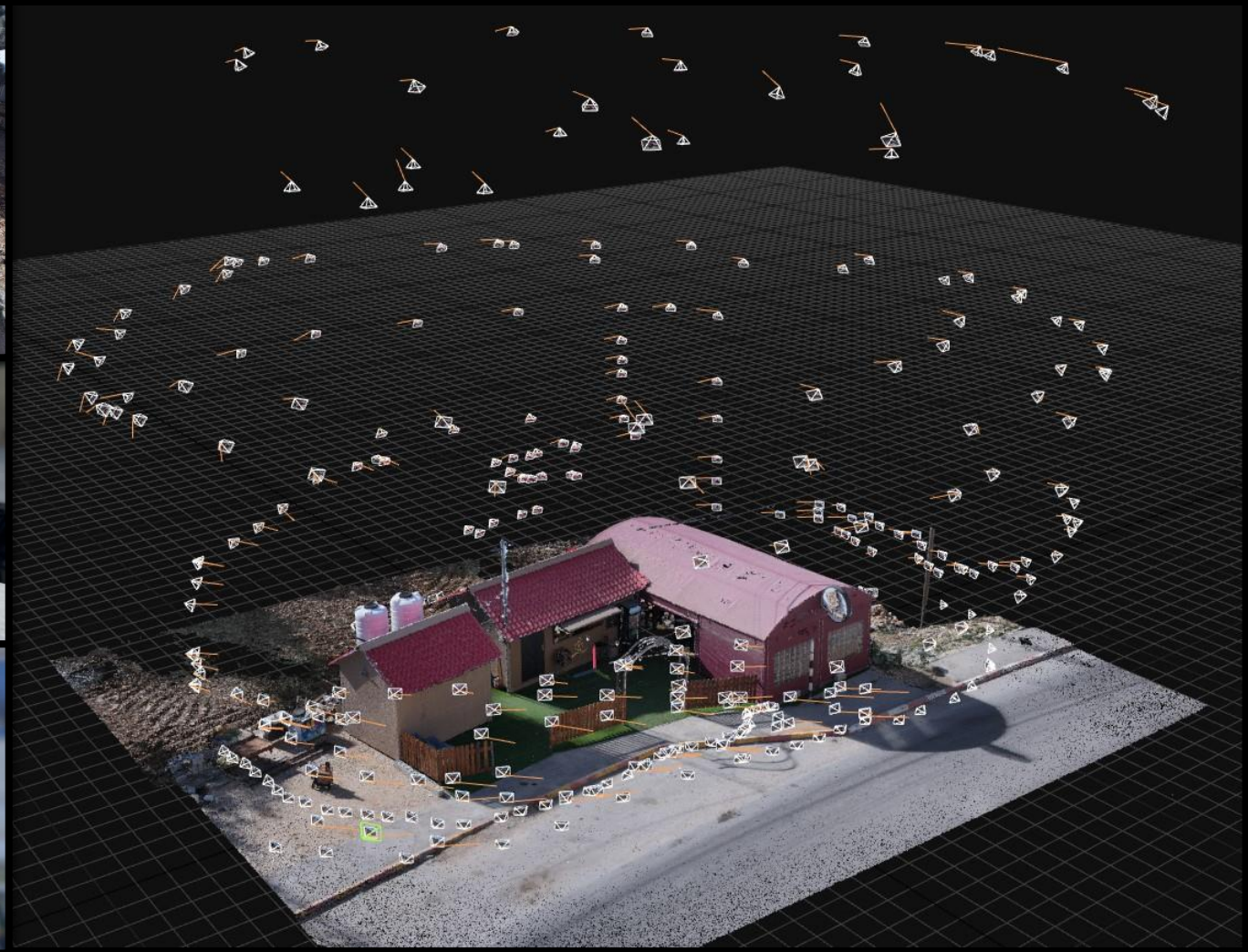
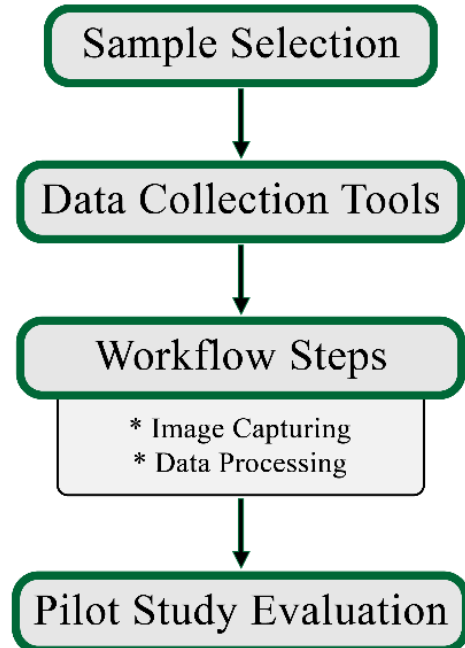


Phase 2: Main Study



Methodology: Phase 1 (pilot study)

Phase 1: Pilot Study



Methodology: Phase 1 (pilot study evaluation)

Criteria	Agisoft Metashape	Reality Capture	ContextCapture	3Dsurvey
Number of aligned photos / 350 (calibrated)	342 of 350 photos	341 of 350 photos	342 of 350 photos	349 of 350 photos
Is the alignment completely correct?	No	Yes	Yes	No
Number of points in sparse point cloud	416563	1385485	77517	143561
Alignment time	05m 47s	4m 26s	9m 23s	37m 39s
Number of points in the dense point cloud	183749094	51744551	846 Million	23655364
Processing time to build dense point cloud	39h	37m 19s	22m 24s	2h 30m
Overall processing time	39h	49m 45s	31m	3h 07m
Distortion	High	Very low	Very low	High



Methodology: Phase 1 (pilot study evaluation)



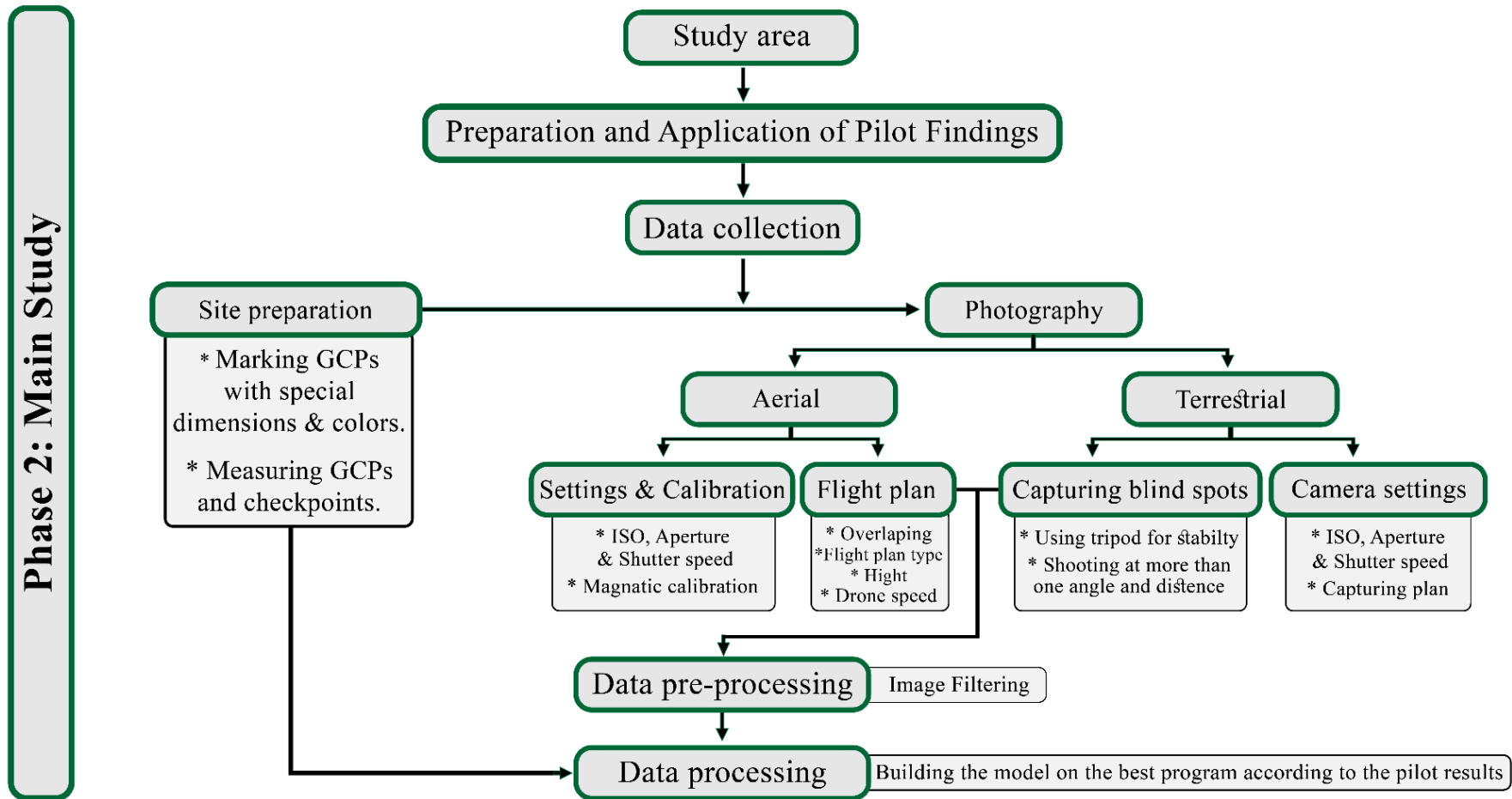
Methodology: Phase 1 (pilot study evaluation)



Phase 1 (pilot study evaluation)



Methodology: Phase 2 (Main study)



Study Area



Methodology Phase 2 : (Data Collection Tools)



Canon EOS 1DX Mark 2



SP60 GPS



Mavic Air 2 Drone

Methodology Phase 2 : (Tools Settings)



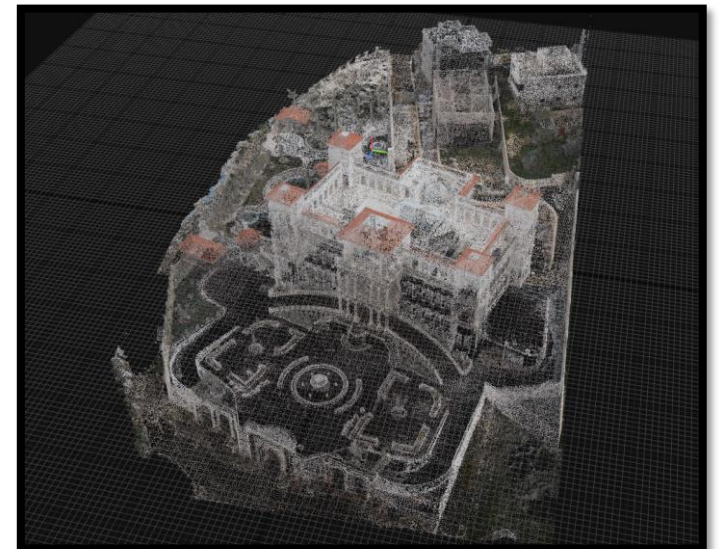
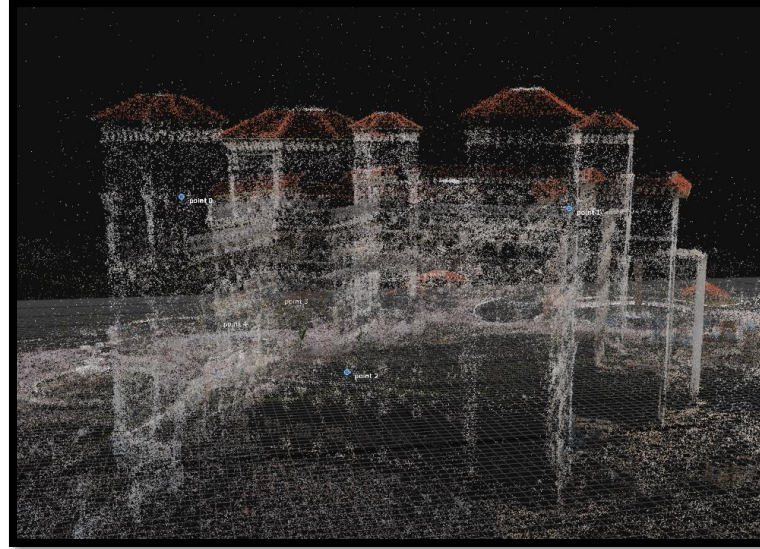
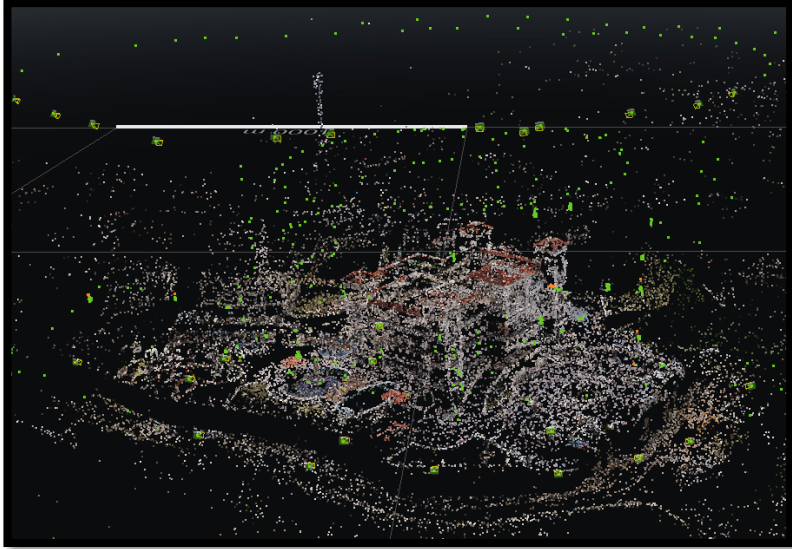
- ▶ *DJI Mavic Air 2:*
 $f = 4.5 \text{ mm}$
Aperture = $f/2.8$
Automatic shutter speed
ISO = 100
- ▶ *Canon EOS 1DX Mark 2:*
 $f = 24 \text{ mm}$
Aperture = $f/9$
Automatic shutter speed
ISO = 400

*One of the Ground Control Points (GCPs) has been used
RTK method*

Methodology: Phase 2 (Data Collection)



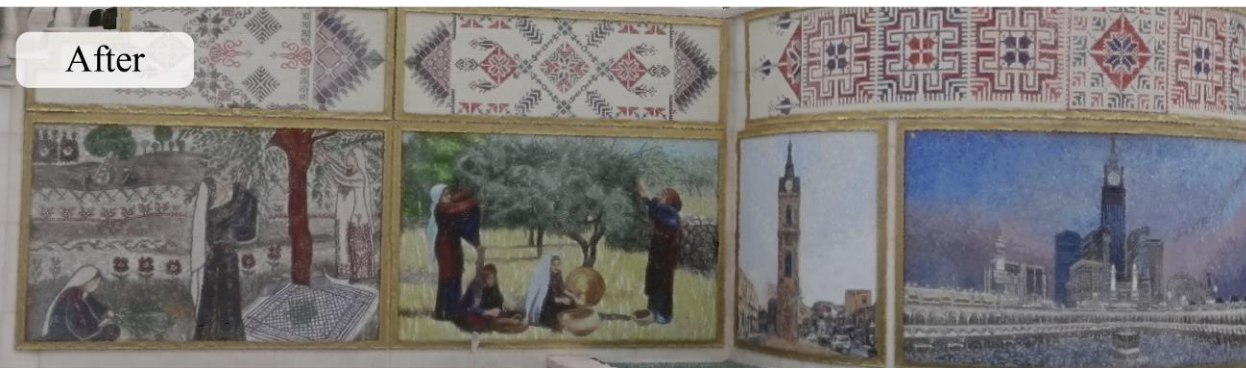
Methodology: Phase 2 (Data Processing)



Phase 2 : Main Study Results

Metric	Drone-Only Model	Merged Model
Number of photos	521	839
Number of alignment photos	520	775
Number of of points in spars point cloud	2 453 347 point	3 372 577 points
Alignment time	00h:01m:55s	00h:16m:31s
Triangle count	211.2 M	311.1 Million
Vertex count	105.9 M	156.0 Million
Overall processing time	05h:21m:27s	07h:48m:44s
Details	Weak in showing small details	Very good at small details
Distortion	In the blind spots	No distortion

Phase 2 : Main Study Results



Before



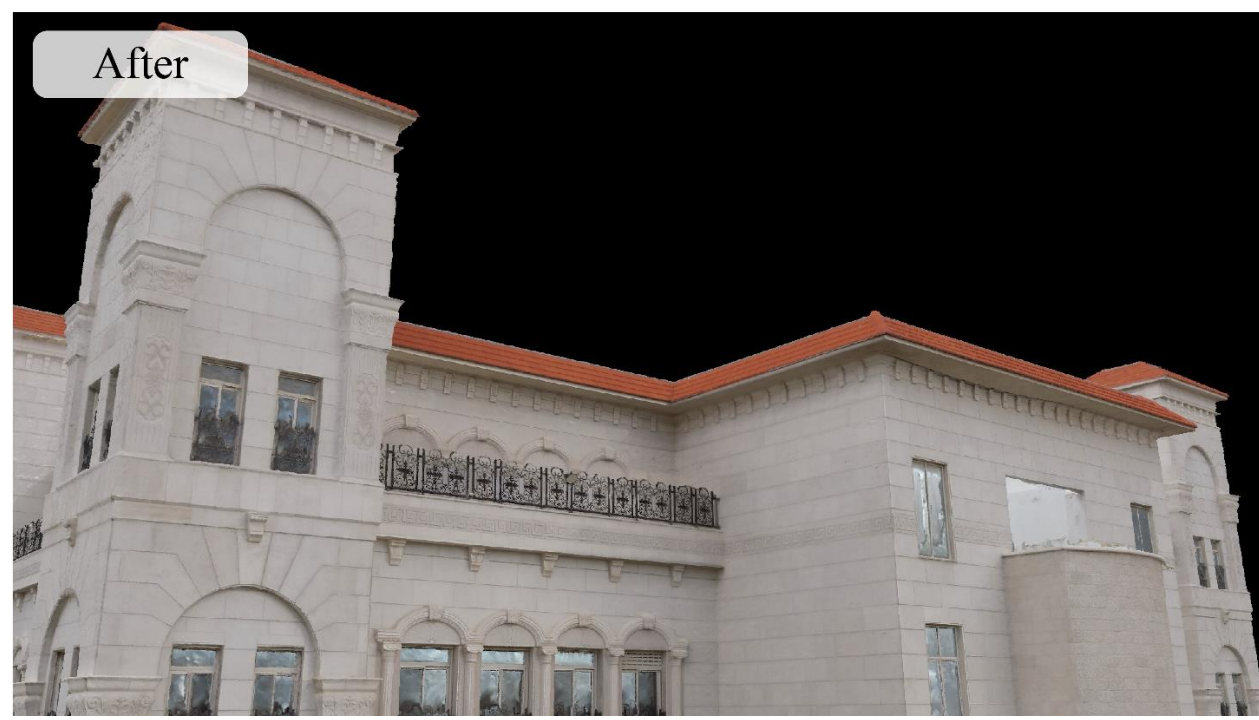
Before



After



After



Phase 2 : Main Study Results





Limitations and Challenges

Military Jamming



Limitations and Challenges

Interference



Limitations and Challenges

Manual photography



Limitations and Challenges

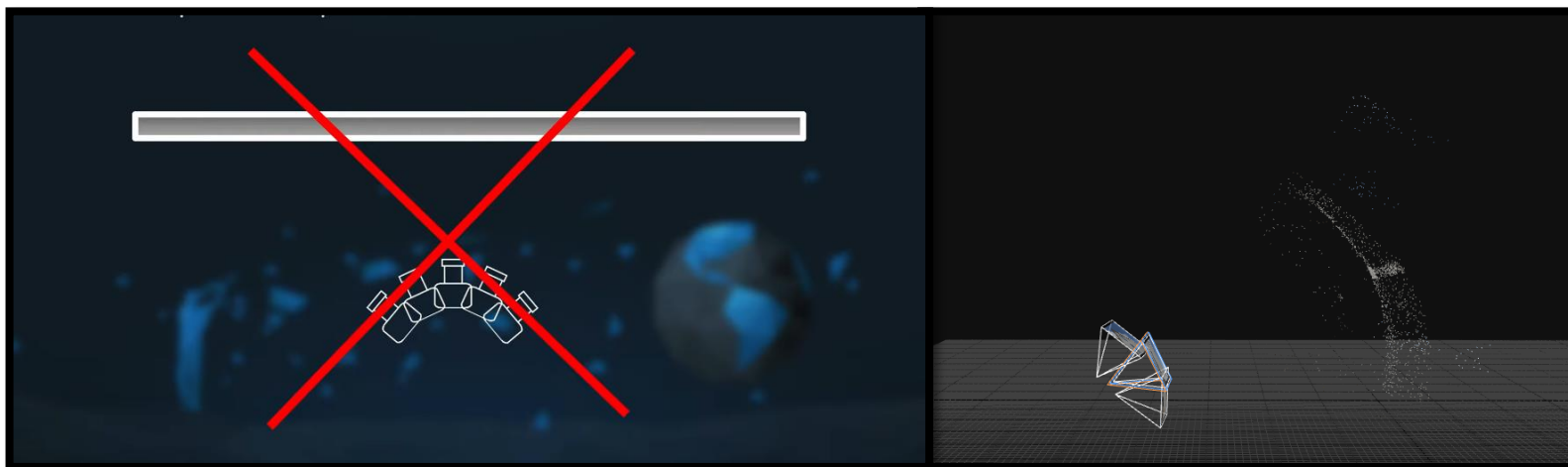
- ▶ Lack of advanced tools.
- ▶ Difficulty of roads and transportation.
- ▶ Unsteady weather conditions.

Conclusion

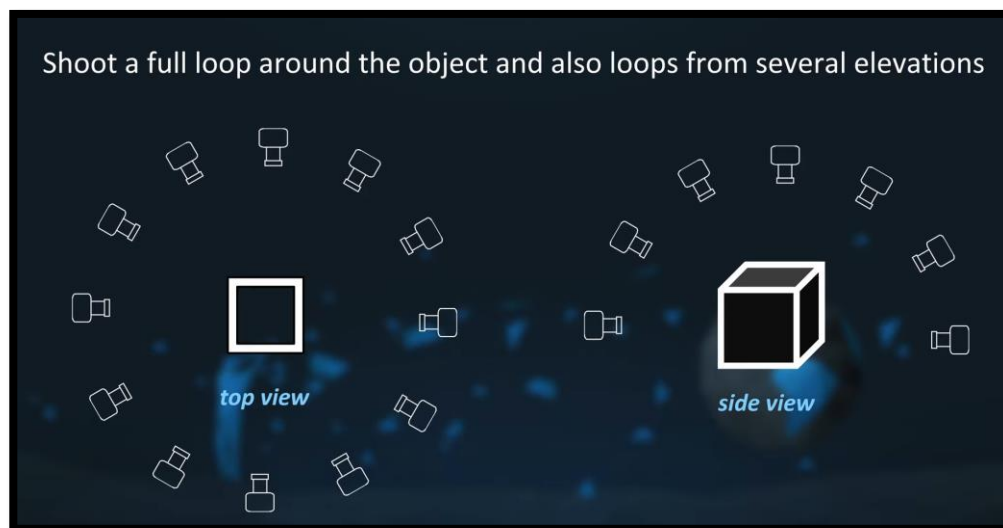
- ▶ *Combining aerial and ground photography creates better 3D models for documenting and preserving important sites.*
- ▶ *Drones are fast and cost-effective for collecting data, making them useful in modern photography and mapping.*

Recommendation

Avoid panoramic photography



Shoot a full loop around the object and also loops from several elevations



Recommendation

It is preferable to shoot on a cloudy day



Recommendation

Avoid automatic shutter speeds if the weather is cloudy



Recommendation



Agisoft
Metashape



ContextCapture



CapturingReality



3Dsurvey

Thanks