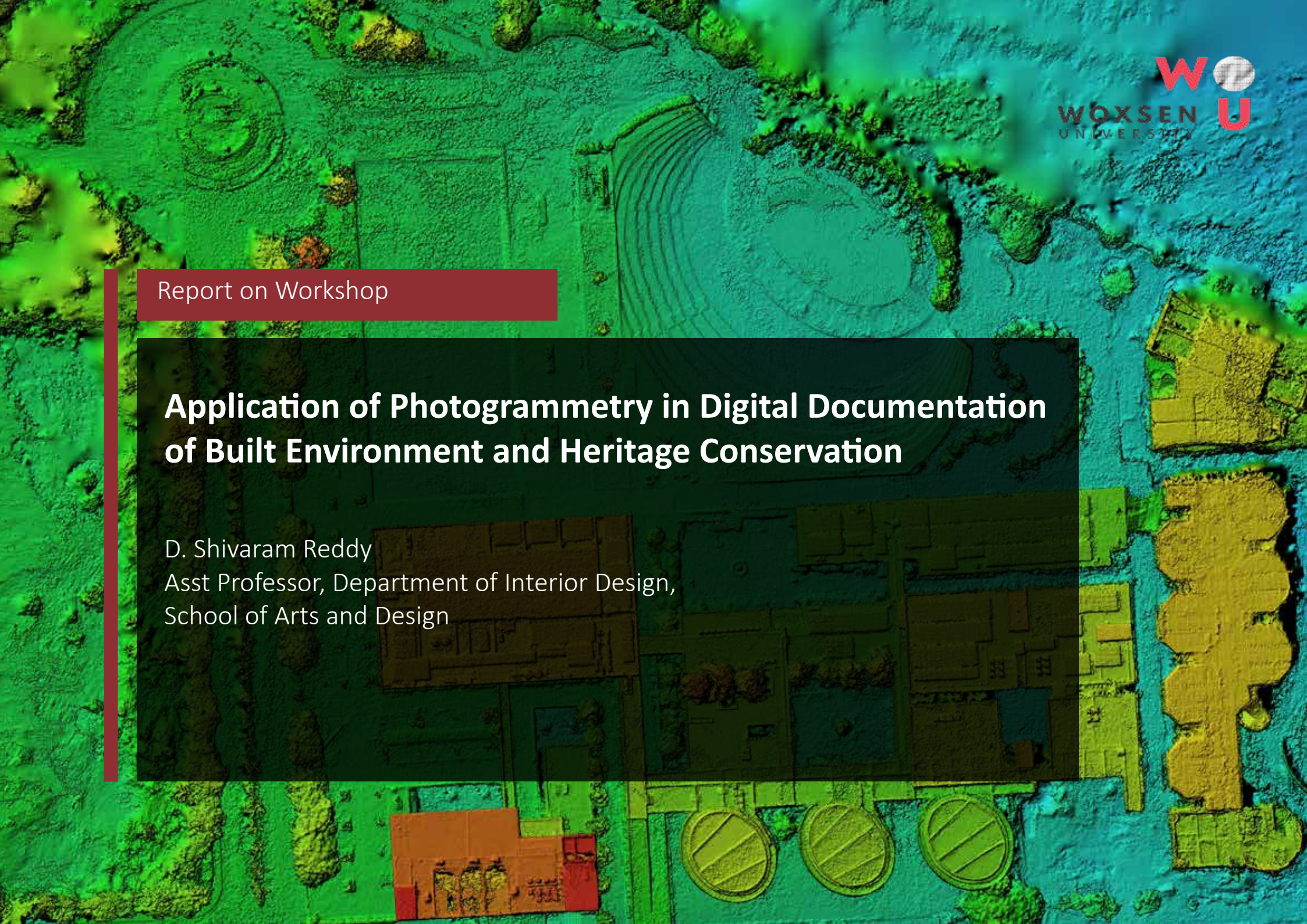


Report on Workshop

Application of Photogrammetry in Digital Documentation of Built Environment and Heritage Conservation

D. Shivaram Reddy
Asst Professor, Department of Interior Design,
School of Arts and Design

WOXSEN UNIVERSITY

Workshop on

Application of Photogrammetry in Digital Documentation of Built Environment and Heritage Conservation

Date
9th October to 13th October, 2023

Venue
Mondrian Hall, Woxsen University

Participants
Interior Design Students

Workshop Facilitator
Maniyarasan R
Practice & research in Cultural Heritage Documentation, Architecture, Photography and Photogrammetry

Workshop Organiser
Prof. D Shivaram Reddy
Assistant Professor, School of Arts and Design, Woxsen University

www.woxsen.edu.in

WOXSEN UNIVERSITY

Invitation for Display on

Application of Photogrammetry in Digital Documentation of Built Environment and Cultural Heritage

Organised by:
Department of Interior Design,
School of Arts & Design

Date:
19th October, 03:30 PM to 06:30 PM
Venue:
Gate way(in front of Rise), Woxsen University

www.woxsen.edu.in

Contents:

Workshop Overview:

Workshop on Digital Heritage & Documentation / Photography & Photogrammetry
5-day Workshop for Woxsen University, Hyderabad

Overview
Visual imaging, documentation and interpretation are the key tools in the process of Heritage conservation. The aim of this workshop is to demonstrate the benefits of documenting heritage via scientifically viable methods of photography. Understanding of scale, context, style, and elements among various other information, are a part of the process. The course will explore how digital technologies are used to present and curate heritage information; to develop your practical skills in 3D modeling, mapping, scale rectified imaging, virtual tours and related visualization technologies. The components of the workshop are structured with lecture sessions, hands-on training and field work exercises.

The workshop shall have the following components, but would not limited to.,

- Day 1. History of Photography & Imaging (Lectures, presentation & exercise)
  Understanding architecture & photography from the architectural photography history. Introduction to photographic aspects that shaped and evolved with the architectural practice. Introduction to the basics of photography and their techniques.
  Short Exercise for students in the afternoon and discussion.

- Day 2. Architectural photography (Lectures, presentation & exercise)
  Introduction to capture the built environment - interiors & exteriors. Understanding time and space. Introduction to Photogrammetry & Heritage documentation.
  Group exercises and review.

- Day 3. Photogrammetric demonstration at campus (or at a heritage site in Hyderabad). (Lectures, presentation & exercise)
  Understanding the methods of data capture, data processing and output presentation. Scale rectified imaging, orthophotos and photo-stitching.

- Day 4. Individual student projects.
  Data capture, data processing and reviews.

- Day 5. Project presentation, printing & final exhibition

Upon completion of the course the participants should be able to –
(i) develop critical understanding of Imaging in Architecture & technical Imaging in Heritage Conservation
(ii) have awareness and ability in photographic documentation
(iii) gain introduction to various methods of documenting heritage & built environment

Workshop Requirements
Every participant should have a camera (with manual control), a tripod, a laptop (with photo editing software), photoshop & metascape photoscan softwares (or their trial versions) installed. Projector and a space for projection. A2 Printing of the final work output.

Day 1

Introduction to Photography in Built Environment

Workflow

Measurable Imagery - Photogrammetry

▼

Preparation for Orthogonal Photography - Avoid perspective

▼

Divide the entire area into equal grids and arrange sequence

▼

Settings recommended:
Aperture: Above F8 - Control of light
ISO: Above 100 - Control of Light
Shutter speed: Fastest shutter - 1/25th Second speed
File type: RAW (Avoid Jpeg for more control)
GPS: ON (For stiching images in place)
Add copyright information

▼

Minimum overlap of 1/3rd or 1/4th of Image for better image stiching

▼

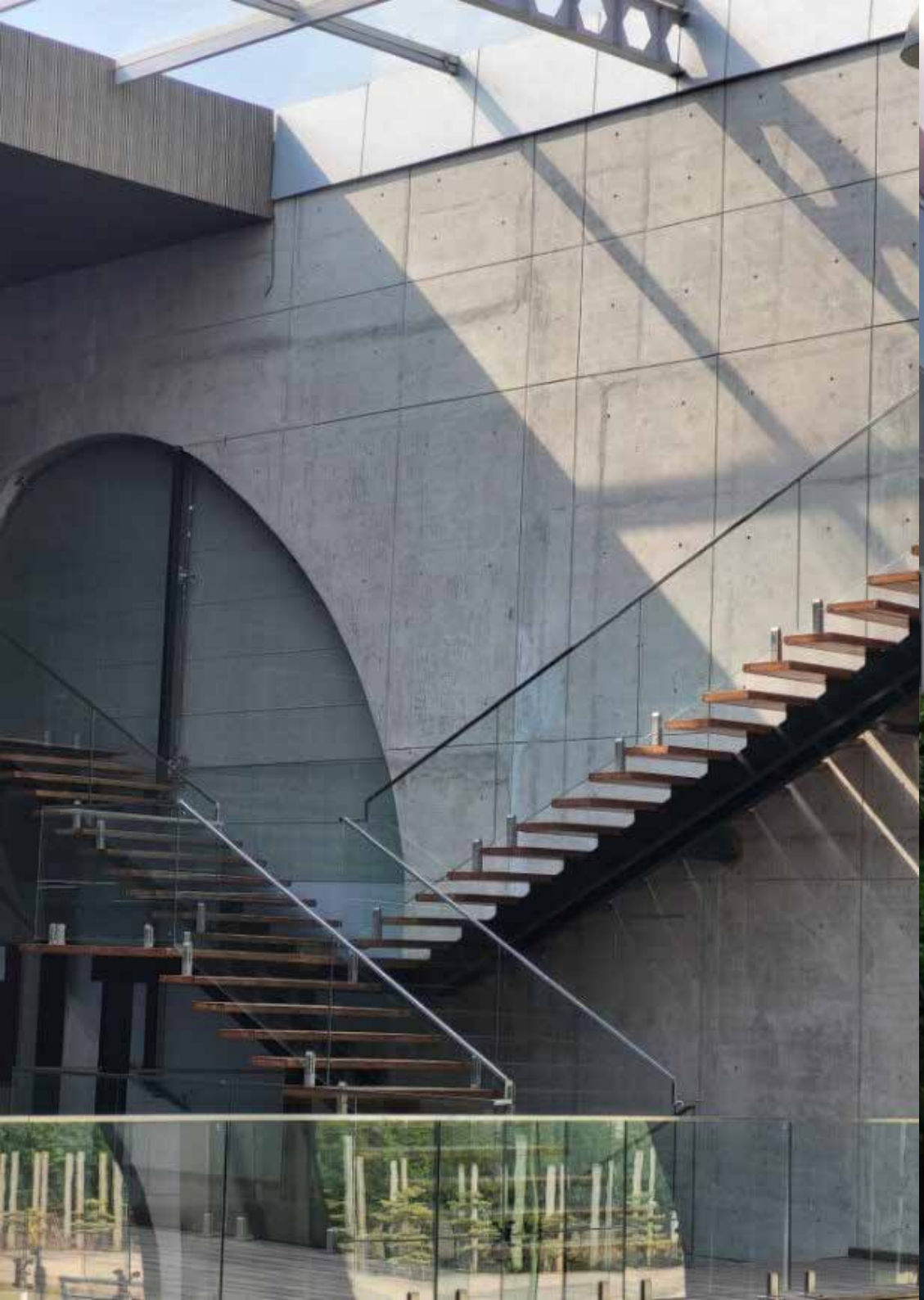
Equipment and softwares recommended:
LED Lights, Tripods, Stools
Photoshop, Lightroom for post processing - RAW to JPEG
Avoid changing Saturation, Brightness and contrast
(Ctrl+L/Ctrl+M: Highlights/Shadows)
White balance: Pick White

▼

Batch process the images - Auto from RAW to JPEG


Please
Use Hand Sanitizer
PLASTIC


45
45

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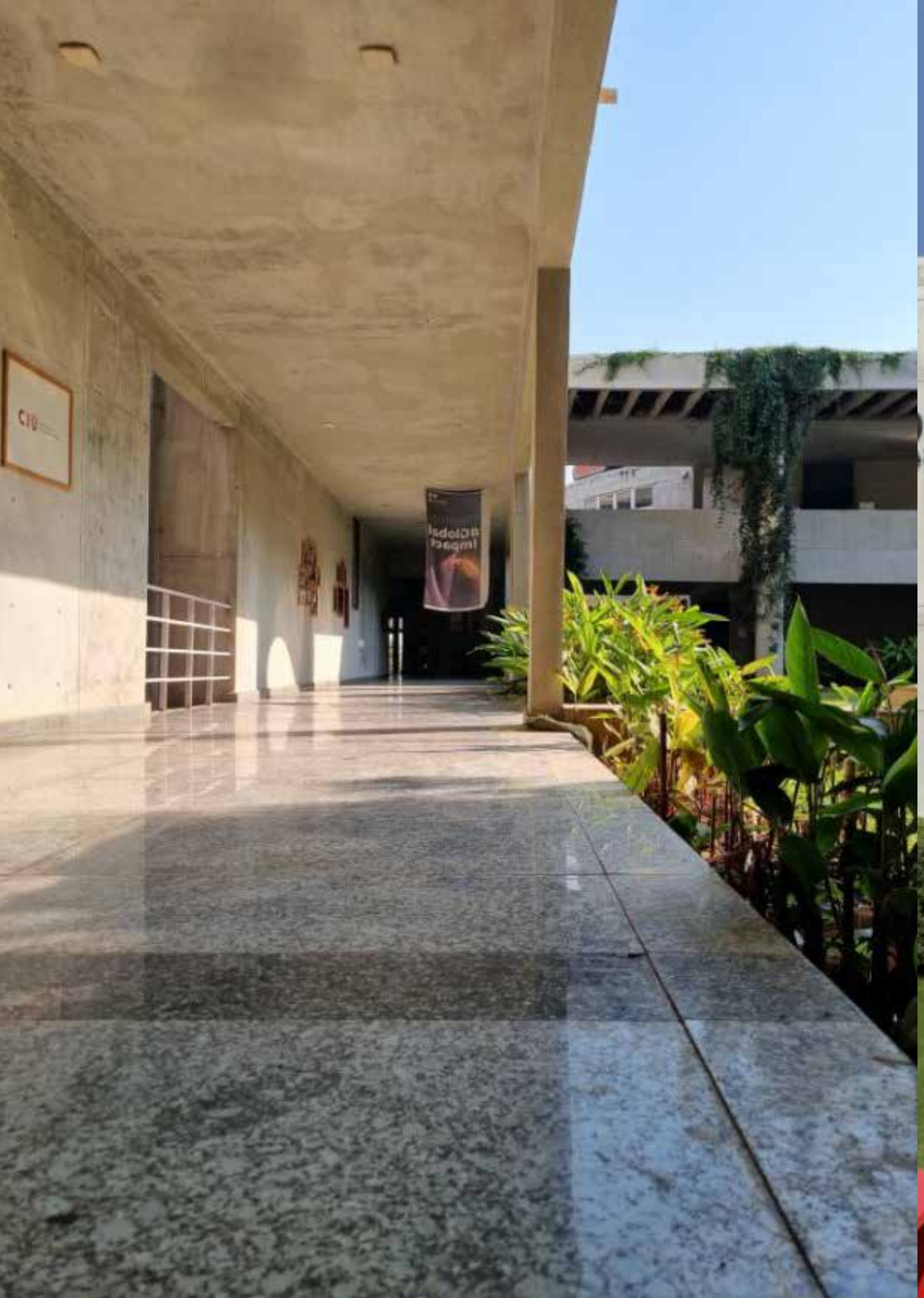


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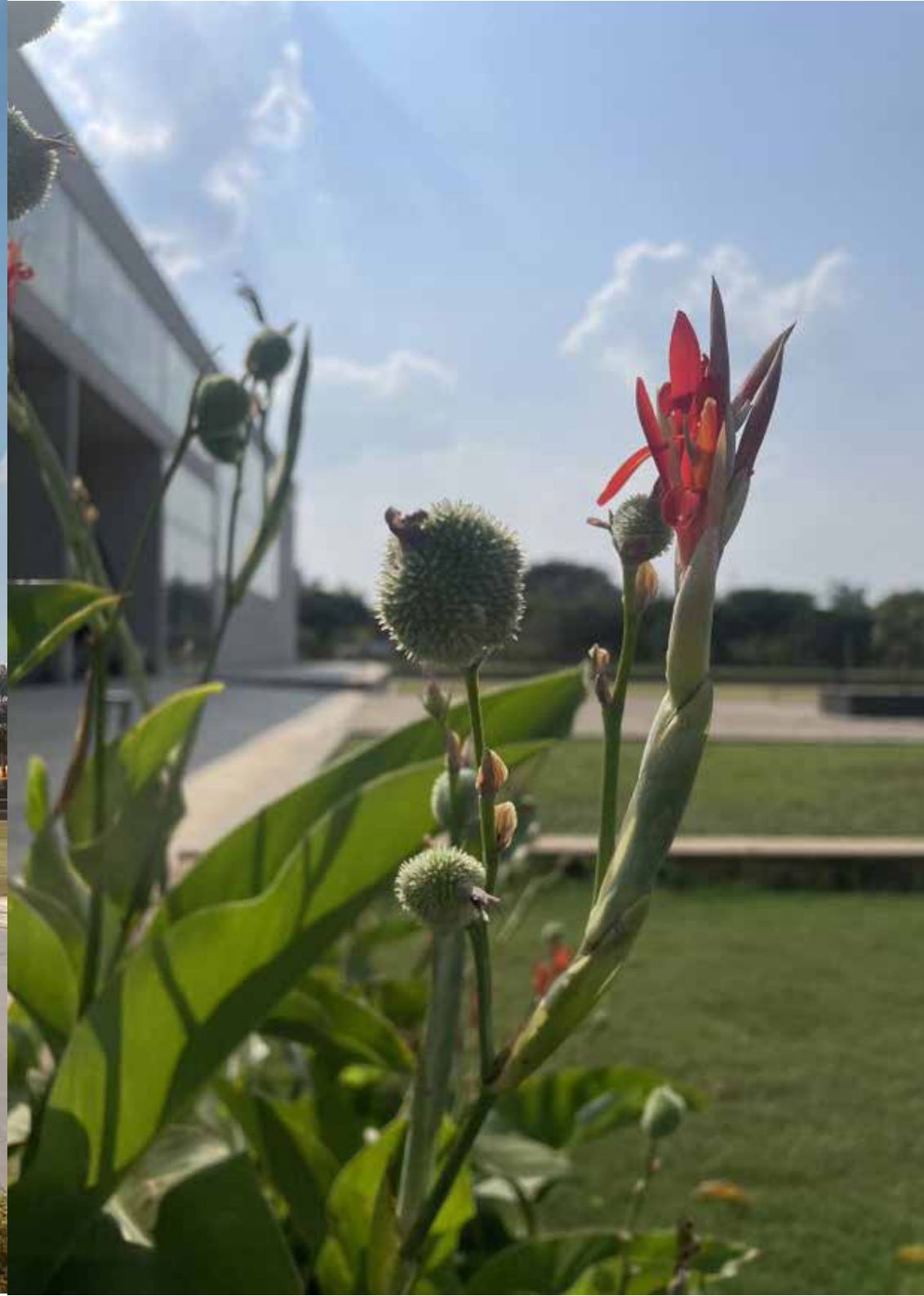
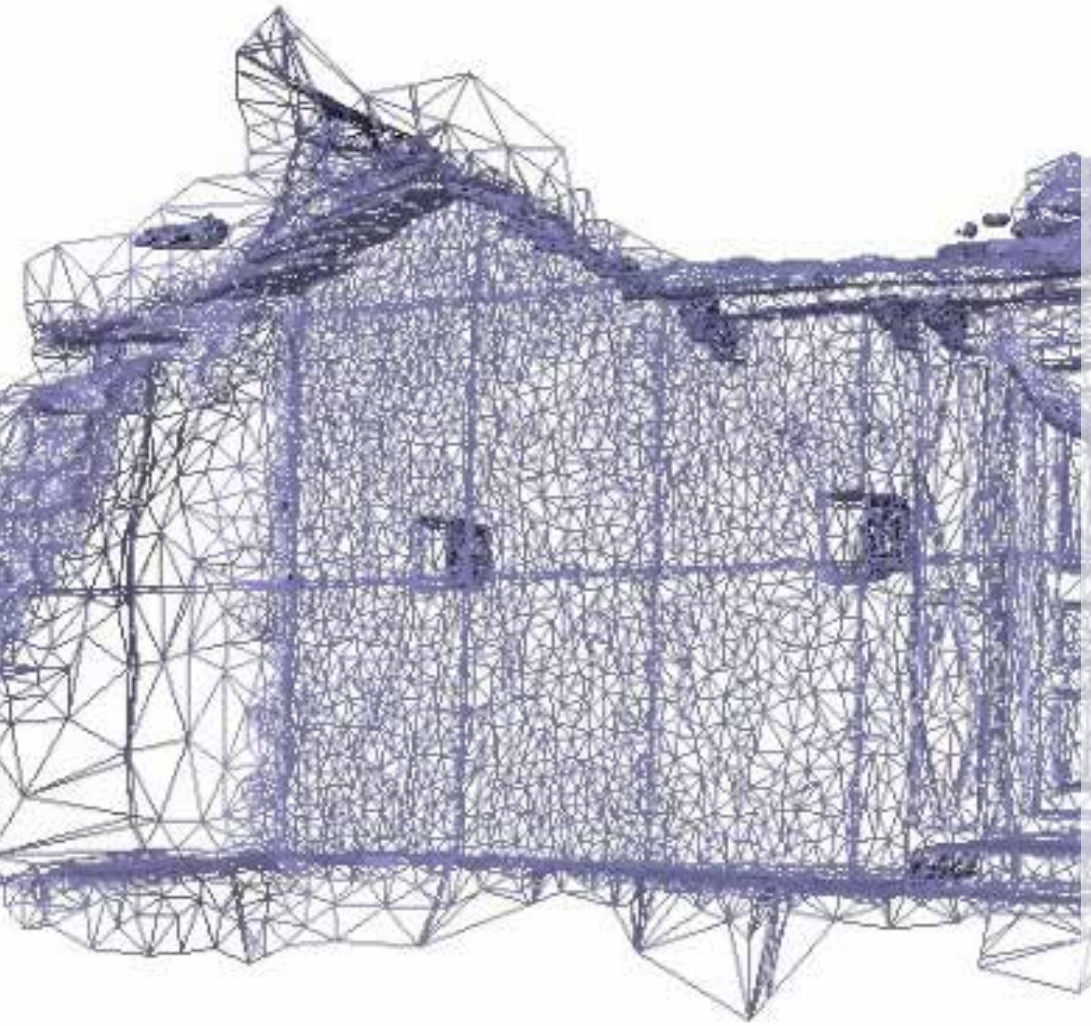


Day 2

Photostiching and Panaroma

Day 3

Documenting Woxsen University



Workflow

Agisoft Metashape - Add folder in Worksflow

▼

Right click to Estimate Image Quality - Eliminate less than 0.5

▼

Workflow - Align - Source, Estimated - Keypoint Limit -
Approx 20% of total Points with Tie Point limit - 0,
Reprocess - High

▼

Go to Model - Gradual Selection
Reconstruction Uncertainity - 10% points - Delete
Go to Model - Projection Accuracy -10% points - Delete

▼

Go to View - Optimise Camera
Workflow - Build Mesh - Run
Workflow - Build Texture - As it is - Remove: Enable ghosting filter
Workflow - Build Tile Model - (Perspective -5)

▼

Workflow - Build point cloud
OK - Point confidence
Tools - Point cloud - Filter by confidence

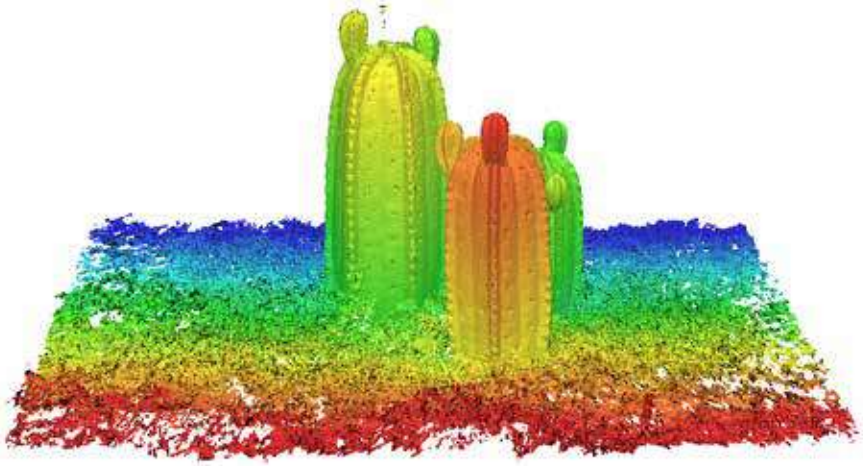
▼

Mesh lab - Sketch fab

▼

Export models to Obj - Integration with Visualisation

5



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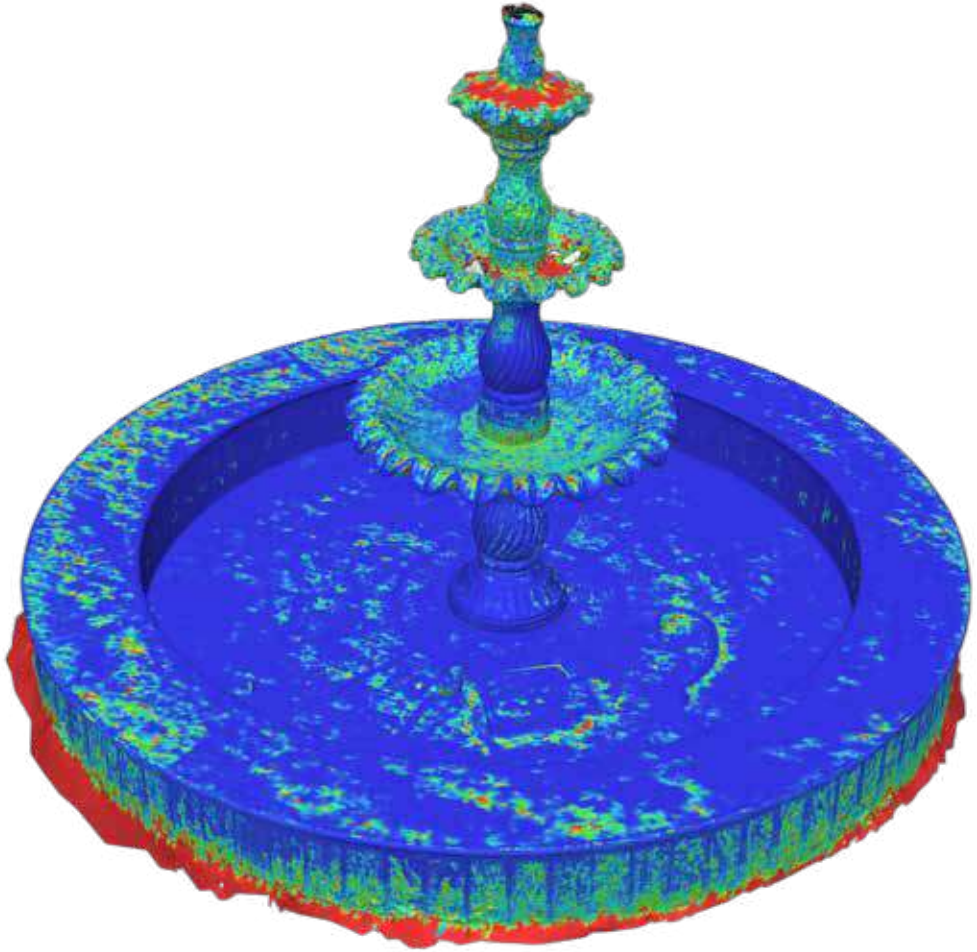
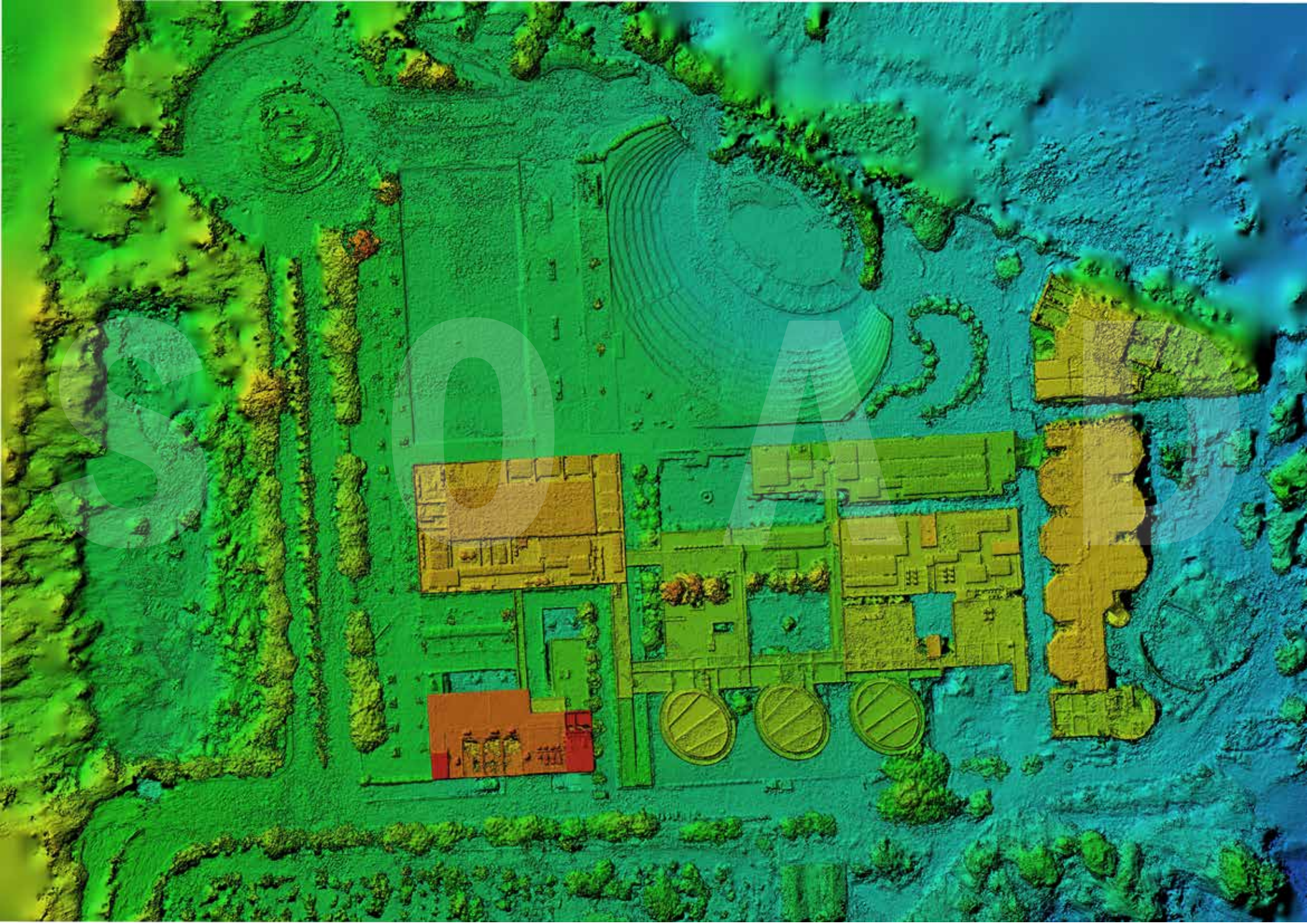
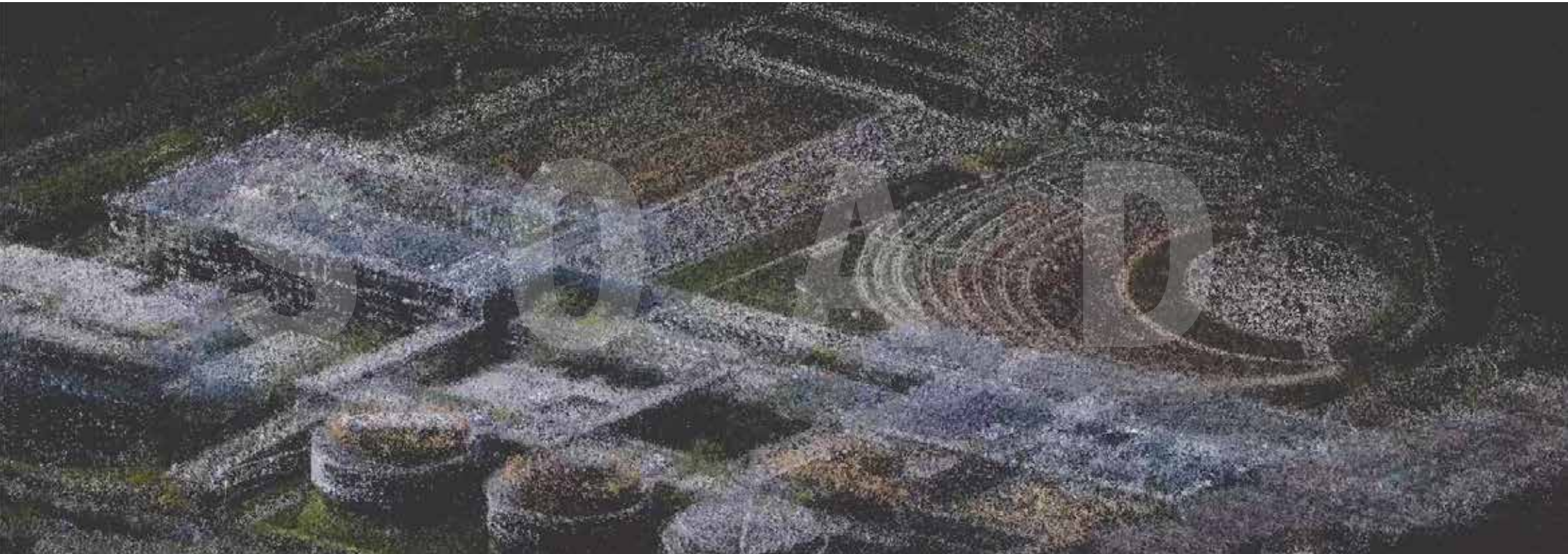


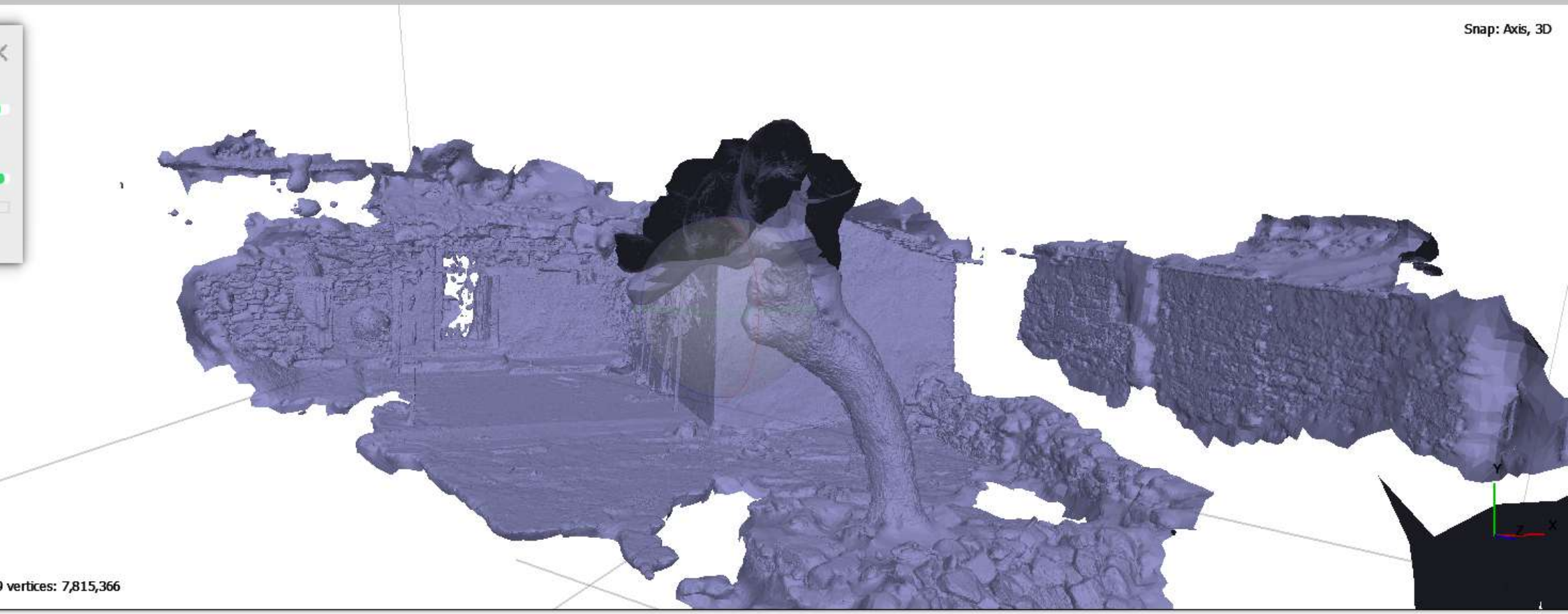




Day 4

Documenting Kamkole Village

Tools Help



Size	Aligned	Quality	Date & time	Make	Model	Focal length	F-stop	ISO	Shutter	35mm focal	Sensor
6000x4000		0.795326	2023:10:11 12:4...	Canon	Canon EOS 200...	24	F/13	200	1/59.9999		268.873
6000x4000		0.801529	2023:10:11 12:4...	Canon	Canon EOS 200...	24	F/13	200	1/59.9999		268.873
6000x4000		0.813955	2023:10:11 12:4...	Canon	Canon EOS 200...	24	F/13	200	1/59.9999		268.873
6000x4000		0.80905	2023:10:11 12:4...	Canon	Canon EOS 200...	24	F/13	200	1/59.9999		268.873
6000x4000		0.830241	2023:10:11 12:4...	Canon	Canon EOS 200...	24	F/13	200	1/59.9999		268.873
6000x4000		0.832096	2023:10:11 12:4...	Canon	Canon EOS 200...	24	F/13	200	1/59.9999		268.873
6000x4000		0.823181	2023:10:11 12:4...	Canon	Canon EOS 200...	24	F/13	200	1/59.9999		268.873

sional (29 days left)

Ortho Tools Help

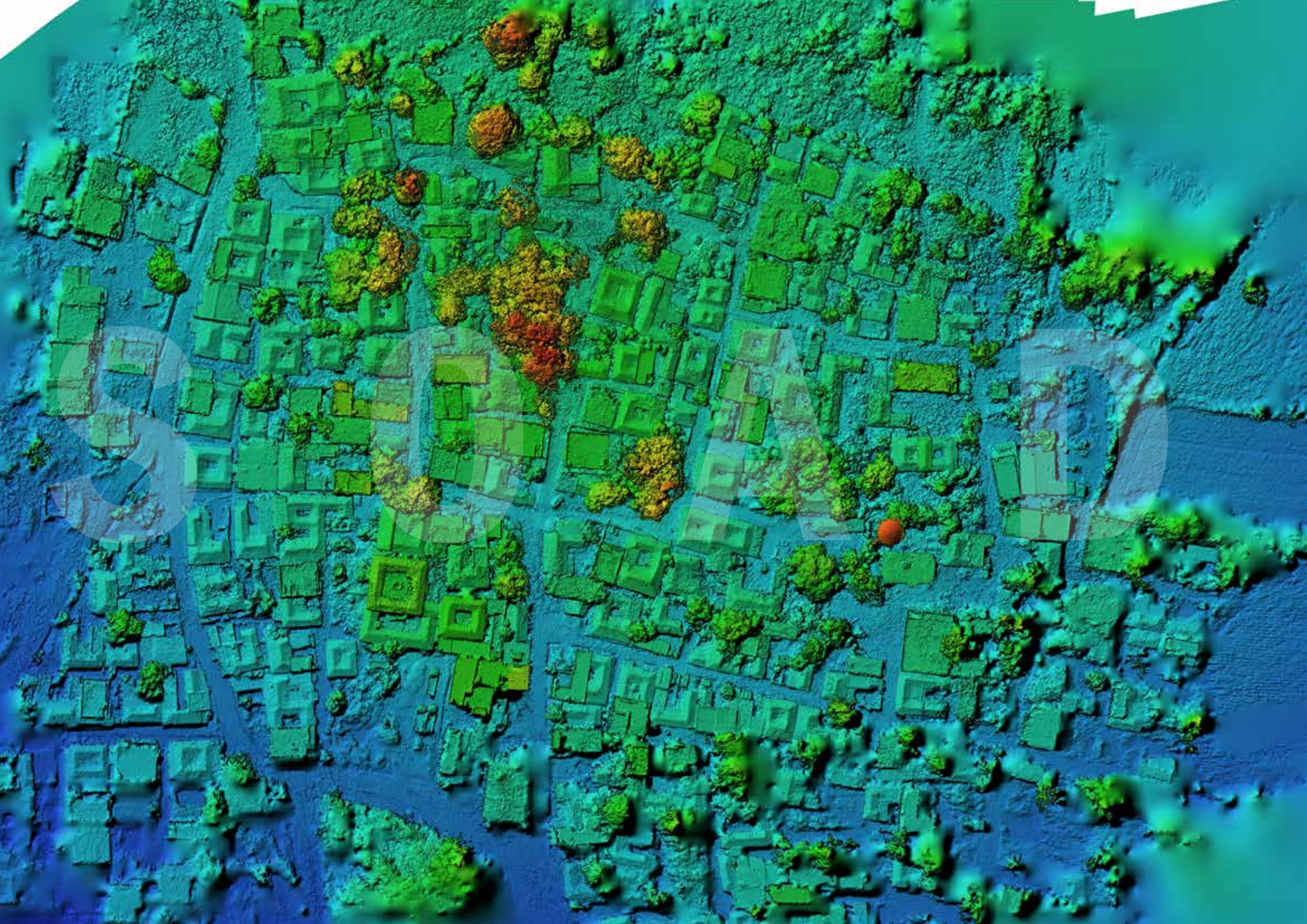
Ortho

ective 30°

Snap: Axis, 3D

15,499,119 vertices: 7,761,353

	Size	Aligned	Quality	Date & time	Make	Model	Focal length	F-stop	ISO	Shutter	35mm focal	Sensor
G_8450	6000x4000		0.795326	2023:10:11 12:4...	Canon	Canon EOS 200...	24	F/13	200	1/59.9999		268.873
G_8451	6000x4000		0.801529	2023:10:11 12:4...	Canon	Canon EOS 200...	24	F/13	200	1/59.9999		268.873
G_8452	6000x4000		0.813955	2023:10:11 12:4...	Canon	Canon EOS 200...	24	F/13	200	1/59.9999		268.873
G_8453	6000x4000		0.80905	2023:10:11 12:4...	Canon	Canon EOS 200...	24	F/13	200	1/59.9999		268.873
G_8454	6000x4000		0.830241	2023:10:11 12:4...	Canon	Canon EOS 200...	24	F/13	200	1/59.9999		268.873
G_8455	6000x4000		0.832096	2023:10:11 12:4...	Canon	Canon EOS 200...	24	F/13	200	1/59.9999		268.873
G_8456	6000x4000		0.823181	2023:10:11 12:4...	Canon	Canon EOS 200...	24	F/13	200	1/59.9999		268.873



Ortho Tools Help

Ortho

ective 30°

Snap

1,552,155 vertices: 778,051

s

	Size	Aligned	Quality	Date & time	Make	Model	Focal length	F-stop	ISO	Shutter	35mm focal	Sensor X r
3	3992x2992	✓	0.81184	2023:10:11 10:5...	DJI	FC220	4.7	F/2.2	100	1/1150	26	
9	3992x2992	✓	0.811837	2023:10:11 10:5...	DJI	FC220	4.7	F/2.2	100	1/1500	26	

Day 5

Processing of Data & Preparation for Display

PHOTOGRAMMETRY

WOXSEN UNIVERSITY

BRIEF:
this photogrammetry workshop introduced us to the fascinating world of photogrammetry. Photogrammetry is a technique used to create 3D models and measurements from 2D images, making it a valuable tool in various fields such as surveying, archaeology, architecture, engineering, geology, and interiors.
It can be used in interiors formodelling, virtual tours and for measurements. It can also be used for architectural documentation and representation

LEARNING OUTCOME:
•introduction to photogrammetry
•equipment and software
•data aquisition
•image processing
•uses of photogrammetry
•principles
•application of photgrammetry

PROCESS:
•image aquisition
•data collection
•data processing
•photogrammetric processing
•mesh generation
•texture mapping
•point cloud processing
•export and analysis

ELEVATION OF A HOUSE IN KAMKOLE

GUIDED BY:
PROF. MANIYARASAN R
PROF. SHIVARAM REDDY

M MONIKA RAO
21WU0301028
INTERIOR DESIGN SEM V

PHOTOGRAMMETRY
WORKSHOP

WOXSEN UNIVERSITY
SCHOOL OF ARTS & DESIGN

BRIEF

Our goal for this photogrammetry module is to obtain accurate 3D models of existing spaces in various segments.
It enabled us to thoroughly investigate and analyze the spatial layout, including dimensions, angles, and proportions.

Photogrammetry converts 2D images into 3D models, aiding interior designers in design validation, testing concepts, and selecting materials. It helps in reduces errors, improves workflow, and contributes to cost savings, speeding up the design process.

Pink House, Kamkole

I visited Kamkole and explored the streets and houses while walking. This pink house was very attractive to me so I decided to capture it.

Capturing each nook and corner of the house externally at different heights and angles, Climbing a parapet wall and taking a few shots from the top was all worth it.

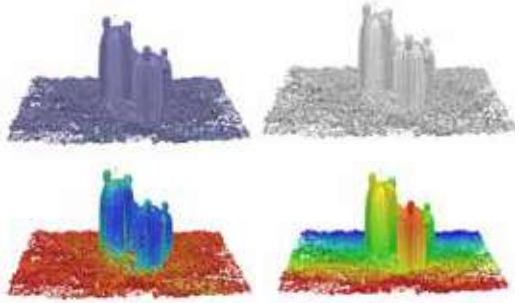
A total of 346 images helped to achieve the below model.

On the whole, this workshop was a wonderful experience and I thoroughly enjoyed the process of capturing the photographs.

Cactus, Near Admin Block

After taking multiple pictures of the cactus in different angles and at different heights, I achieved this 3D model of it with help of 110 pictures.

Agisoft Metashape Professional was used to create this 3D Model.



RAJ ARYAN SHARMA
21WU0301027

PHOTOGRAMMETRY

Brief

Dive your entire class into a exciting 5-day Photogrammetry Workshop. This interactive experience will enable each student to delve into the art and science of 3D modeling using photogrammetry. From initial idea to finalization, participants will grasp the skills to capture, process, and interpret 3D data from images. This workshop presents an exciting opportunity for students to work together and cultivate practical skills that go beyond the confines of the classroom. Guided by proficient instructors, the workshop ensures a comprehensive understanding of photogrammetry, catering to both beginners and those seeking to enhance their expertise

Learning outcome

Master Photogrammetry Techniques
Hands-On Experience
Collaborative Skills
Holistic Understanding
Problem-Solving Skills
Application Beyond the Classroom
Expert Guidance
New Perspectives in Mapping and Modeling
Confidence in Photogrammetric Project

Execution of building

Initially capturing pictures by overlapping the images.
images captured must be straight, 45 degrees, low angle through which every detailed information of the object is captured.
Edit the whole set of images by adjusting temperature, exposure, whites and blacks. necessary changes should be made.
Upload the images in meta and quality check, in which the less than 0.5 must be disabled. Align the images, remove the points and optimize it.
Build the mesh, build the texture, build the point cloud, build the ortho mosaic.

GAUTHAM BUDDHA

FROG RAJA

GEYA SATYA SRI.M
21WU0301036

PHOTOGRAMMETRY

BRIEF

Photogrametry is the process of obtaining orthographic images. It gives detailed information of the picture, which helps you attain complete accuracy. They are mostly used in heritage restoration and conservation.

PROCESS

Photogramettry process starts with capturing multiple proper photos of a place or an object. Later those clicked raw images are processed in photoshop and is saved as jpeg. images. Those jpeg images are imprted into metashape and is analysed.images with lower quality and noice are removed from the model.Then the process of building mesh, texture, tiled model, point cloud and orthomossaic in the software to build a 3d model and a orthographic image with those images.

OUTCOME

This process allowed us to learn how a live site or object can be converted into 3D and details of the picture can be obtained. This will help us in rebuilding the existing project and restoration of the heritage sites.

Prakalpa A
21WU0301030

PHOTOGRAMMETRY

It was a 5 days workshop. On the first day, we got an introduction to photogrammetry and a task that required us to shoot 5 clear photos constantly without deleting any of them.On the second day, we learned how to use Photoshop to stitch panorama photos together.

On the third day, we went to the nearby town of Kamkol to do a photogrammetry exercise and later we learnt how to use the Metashape software .

Brief:

Photogrammetry is widely used in land surveying, topographic mapping, and cartography.Documenting and analyzing archaeological sites and artifacts. Creating 3D models for construction planning, infrastructure assessment, and quality control.Digitizing historical sites, monuments, and artifacts for preservation and study.

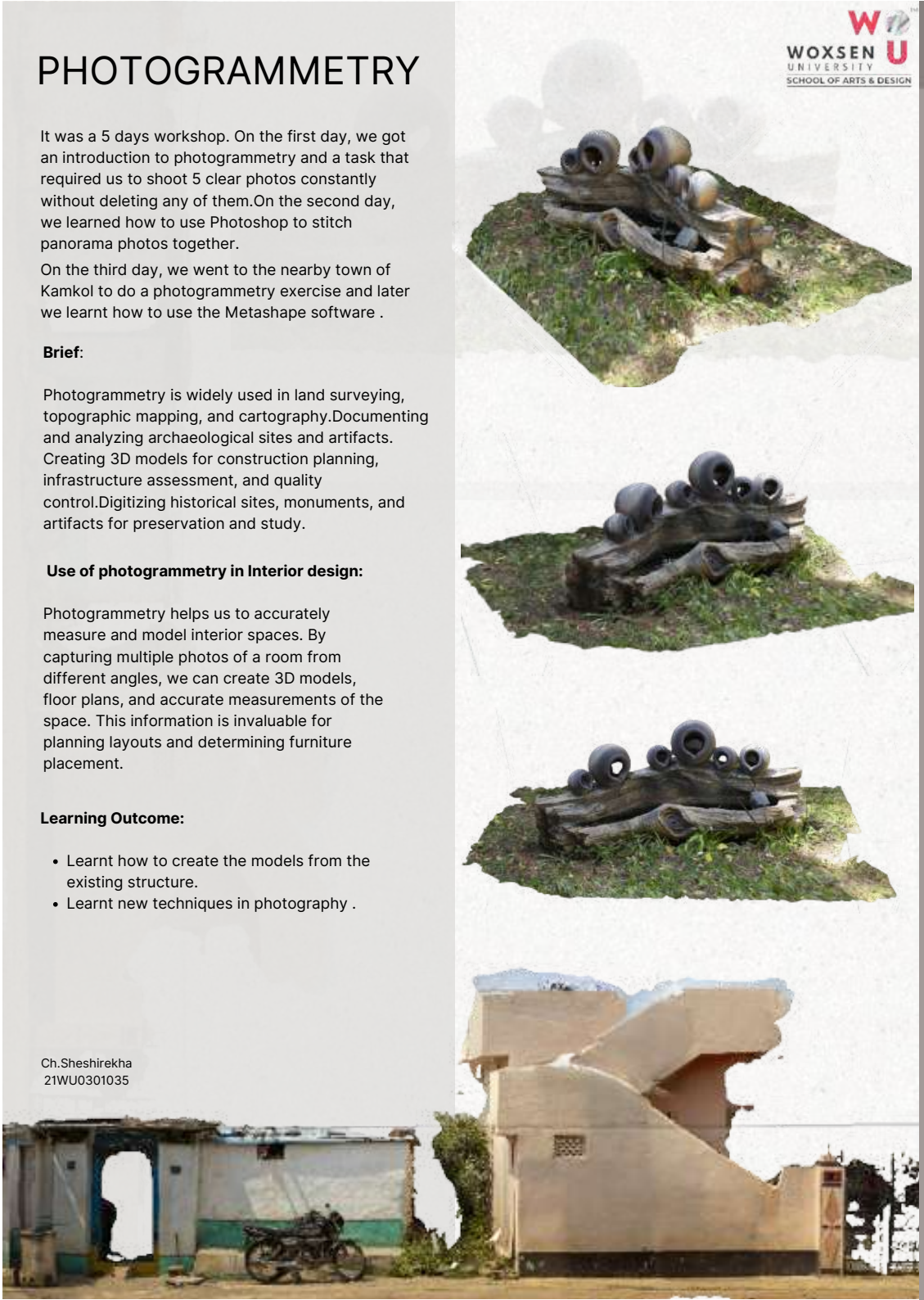
Use of photogrammetry in Interior design:

Photogrammetry helps us to accurately measure and model interior spaces. By capturing multiple photos of a room from different angles, we can create 3D models, floor plans, and accurate measurements of the space. This information is invaluable for planning layouts and determining furniture placement.

Learning Outcome:

- Learnt how to create the models from the existing structure.
- Learnt new techniques in photography .

Ch.Sheshirekha
21WU0301035



PHOTOGRAMMETRY

BRIEF :
This workshop taught us the value of photography and how it can have an impact on a larger scale. We then took pictures and turned them into 3D models to better understand space.

LEARNING OUTCOME :
This workshop helped us understand how photogrammetry can enhance spatial understanding.
It helped us understand the camera systems, the digital image processing, its applications that include various fields like archaeology, environmental monitoring and surveying.

PHOTOGRAMMETRY IN INTERIOR:
Visualizing design concepts:
Photogrammetric models can be used to create realistic renderings of interior spaces,.

Documenting existing conditions:
Photogrammetric models can be used to document the existing conditions of a space before renovation, which can be helpful for insurance purposes or for tracking changes over time.

Planning renovations:
Photogrammetric models can be used to create accurate measurements of interior spaces, which can be helpful for planning renovations.

Guided by :
Prof. Maniyarasan R
Prof. Shivaram reddy

Aarushi Ringangaonkar
21WUO301040

PROCESS:

PHOTOGRAMMETRY

Photogrammetry is a technique that uses photographs to create accurate 3D models of objects, environments, or spaces. It involves capturing and analyzing multiple images to measure distances, shapes, and dimensions, making it valuable in fields such as architecture, engineering, and mapping.

BRIEF:

Beginning with an introduction to photogrammetry, this 5-day workshop, led by Dr. Maniyarasan, offers us as interior design students an invaluable learning experience. We've dived into the principles of photogrammetry and its application in interior design, focusing on camera operation, photography skills, image processing, and software proficiency. Throughout the workshop, we've discovered how photogrammetry can enhance our interior design projects, from creating 3D models to advanced applications like historical preservation and cost estimation. By the end of the workshop, we were equipped with practical skills and insights to elevate our interior design capabilities.architecture, engineering, and

Workshop Overview:

Duration: 5 days
Instructor: Maniyarasan sir
Focus: Photogrammetry in Interior Design
Day 1: Introduction to Photogrammetry
Day 2: Camera Operation and Photography Skills
Day 3: Site visit to kamkole & introduction to software
Day 4: 3D Modeling and Design Applications
Day 5: Advanced Applications and Future Trends

Learning outcomes:

Understanding of Photogrammetry Principle : The mathematics involved in reconstructing 3D spaces from 2D images.

Camera Operation and Photography Skills: Learnt how to operate cameras effectively and capture high-quality images.

Image Processing: Learnt how to stitch images into panoramas and understanding the importance of enhancing image quality.

3D Modeling: Learnt how to create 3D models from a set of photographs.

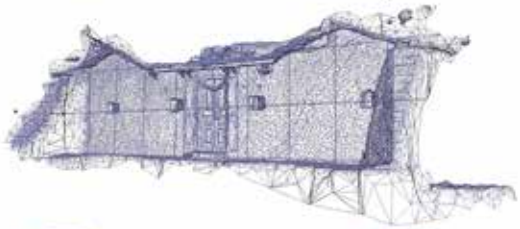
Learning Software : Software tools, such as Agisoft Metashape.

Accuracy and Precision: Ensuring that the details are faithfully represented.

Space Planning and Design: Learnt how to create 3D models of spaces and use them for designing layouts, selecting furniture, and planning interior elements effectively.

Collaboration: Prepared to collaborate effectively with other professionals in the architecture and construction industry by sharing photogrammetric data and facilitating communication.

Historical Preservation
Visualization and Presentation
Project Documentation
Quality Control



NATURE SENSE

PHOTOGRAMMETRY

BRIEF

In context of the photogrammetry module, our primary object entailed the careful selection of an object or spatial environment subsequently, we obtained a series of photographs of the chosen subject, which we later transformed into 3D models using Meta-shape.

The essence of photogrammetry lies in the acquisition of high-quality photographs, captured sequentially for subsequent processing and integration within specialized software. This process ultimately yields a 3D model with a myriad of practical applications.

IMAGE PROCESSING

MESH GENERATION

TEXTURE MAPPING

THE PROCESS OF PHOTOGRAMMETRY INVOLVES THE FOLLOWING KEY STEPS:

Subject Selection
Identify and choose the object or environment you wish to capture in 3D.

Data Acquisition
Systematically capture multiple photographs of the subject from various angles. These images should overlap to ensure comprehensive coverage.

Camera Calibration
Calibrate the camera settings, such as focal length and sensor size, to ensure accurate measurements.

Image Processing
Import the acquired photographs into photogrammetry software, which will identify common points between the images and establish correspondences.

Triangulation/ Align
The software employs a technique known as triangulation to calculate the 3D coordinates of the common points by analyzing the parallax in the overlapping images.

Mesh Generation
These points are then connected to form a polygonal mesh, creating the overall shape of the 3D model.

Texture Mapping
The original photographs are applied to the mesh, creating a visually realistic 3D model with textures.

Point Cloud Generation
The software creates a dense cloud of 3D points that represent the surface of the subject.

Quality Assessment
Verify the accuracy and quality of the 3D model, making adjustments as necessary.

Export and Application
The final 3D model can be exported for various applications, including 3D visualization, virtual reality, 3D printing, and more.

The photogrammetry process has been an enlightening and rewarding experience. It presents interior designers with a treasure trove of advantages. From ensuring precise spatial planning to enhancing client visualization, this technology fundamentally transforms the way we approach interior design projects. Its potential for greater accuracy, efficiency, and client satisfaction, photogrammetry has become an indispensable tool in the modern interior designer's arsenal, opening up new dimensions of creativity and excellence in the field.

Guided by : Prof. Maniyarasan R and Asst.Prof. Shivaram	**Project by** : Tasmiyakhanam P	**Interior Design**	**2021 - 2025**


NATURE SENSE
PHOTOGRAMMETRY
BRIEF
OUTCOME

Closing Session