CE331: Principles of GeoInformatics

Group Project Presentation

Group 9

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Introduction

The Surveying and Mapping of the WLE Building project aims to accurately document the layout, dimensions, and spatial features of the WLE (Weastern Lab Extension) building. This project involves comprehensive surveying techniques to create detailed maps and plans of the building's structure.

The maps can also be used for future renovation planning, safety assessments, and optimizing space utilization within the building.

Objectives

1. Establish a Closed Traverse: Set up control points in such a way that each control point has visibility to the previous and next points in the sequence.

2. Measure Side Lengths and Interior Angles: After establishing the traverse, measure the lengths of each side and the interior angles of the closed traverse.

3. Conduct Levelling Process: Use an auto level to carry out the levelling process across the region, ensuring accurate elevation measurements.

4. Determine Global Coordinates: Use GNSS to find the global coordinates for each control station.

5. Map Surrounding Features: Survey and record features like trees, buildings, fire hydrants, and lamps near the control points.

6. Create the Map with QGIS: Adjust the traverse using Bowditch's Rule, then compile and prepare the map of the area using QGIS software.

Methodology

Reconnaissance:

We began by surveying the area around the WLE building to identify optimal points with clear visibility to neighboring points. After careful selection, we marked six suitable locations with paint for easy identification and permanence during the survey

Levelling:

Using an auto level, we measured the elevation differences at the eight marked points, with a benchmark near the WLE building serving as our reference point.

Traversing and Angle Measurement:

We used a Total Station to measure distances and angles between control points, establishing a closed traverse. The local coordinates were calculated and adjusted using Bowditch's Rule to ensure accuracy in the site map

GNSS Coordinates:

We captured the global coordinates for 2 of the 8 control points using a GNSS receiver . These coordinates were refined through Similarity Transformation to align accurately with the global coordinate system.

Feature Mapping:

With the Total Station, we mapped features such as trees, buildings, skywalks, fountains, and roads, along with contour points. This allowed us to create a detailed map reflecting key features and elevation variations across the site..

MAPPING:

We exported the Total Station data into a CSV file and imported it into QGIS. We assigned colors and symbols to the features following Survey of India standards. Finally, we used QGIS's Print Composer to export the map for the final presentation.

Reconnaissance

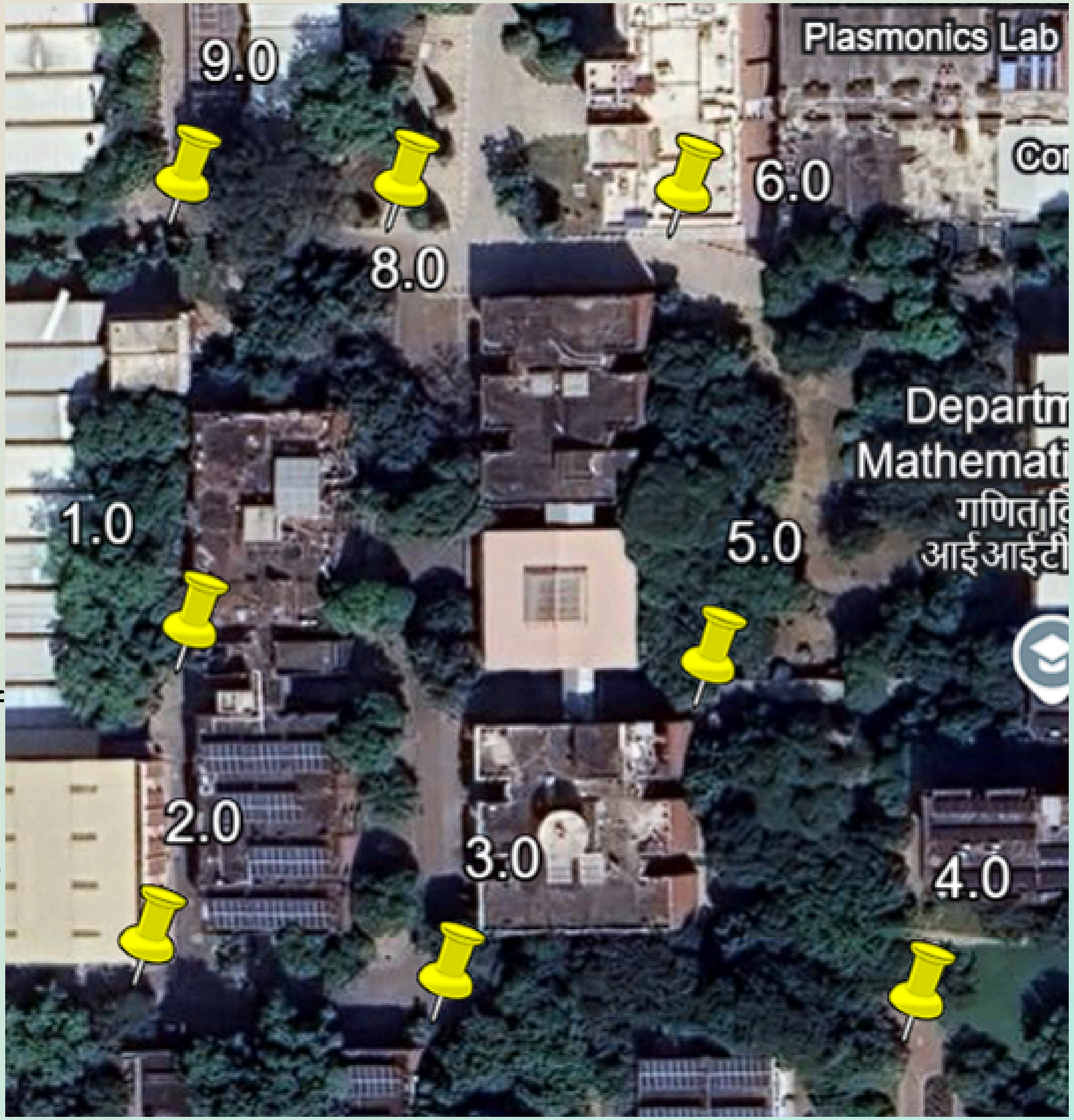
- Gaining Familiarity with the Area:
We begin by exploring the site to get a general feel of the landscape and environment.

- Identifying Potential Obstacles:
By observing the site, we identify possible barriers or challenges that could impact our survey, such as natural terrain variations or man-made structures.

- Strategic Planning of Control Points:
We carefully select locations for control points, ensuring optimal coverage of the entire area and clear visibility between points to maximize accuracy.

Observing the area's topography and notable landmarks helps us develop a detailed understanding of the site's layout, aiding in survey planning and mapping.

- Reconnaissance involves a blend of visual examination, preliminary measurements, and selecting routes for carrying equipment. Additionally, we note significant natural and man-made features.



Google Earth snapshot showing CPs

Levelling

						BS		Fs						
Station	Point	BS	FS	HI	RL	US	LS	US	LS	d1	d2	commulative	correction	corrected
Benchmark		1.017		129.426	128.409	1.061	0.967			9.4				
	1		1.301		128.125			1.34	1.26		8	17.4	0.001044636	128.1239554
		1.16		129.285		1.26	1.06			20				
	2		1.295		127.99			1.392	1.198		19.4	56.8	0.003410076	127.9865899
		1.295		129.285		1.397	1.209			18.8				
	3		1		127.998			1.382	1.198		18.4	94	0.005643435	127.9923566
		1.273		129.271		1.248	1.128			12				
	4		1.231		128.04			1.387	1.078		30.9	136.9	0.008219003	128.031781
		1.25		129.29		1.365	1.112			25.3				
	5		1.19		128.1			1.312	1.065		24.7	186.9	0.01122083	128.0887792
		1.324		129.424		1.461	1.187			27.4				
	6		1.231		128.193			1.389	1.04		34.9	249.2	0.014961107	128.1780389
		1.342		129.535		1.429	1.262			16.7				
	8		1.301		128.234			1.394	1.21		18.4	284.3	0.017068389	128.2169316
		1.333		129.567		1.394	1.272			12.2				
	9		1.357		128.21			1.429	1.281		14.8	311.3	0.018689376	128.1913106
		1.221		129.431		1.349	1.09			25.9				
	1		1.283		128.148			1.425	1.14		28.5	365.7	0.021955364	128.1260446
		1.301		129.449		1.34	1.26			8				
Benchmark			1.017		128.432			1.061	0.967		9.4	383.1	0.023	128.409
		12.516	12.493								total=	383.1		
		sum(Bs)-sum(fs)=23mm			misclosure =23mm									

Total setup = 8 Square root(8)=2.82 c = misclosure/2.82 = 8.133 mm

c is less than 10mm and hence quality of work is acurate.

Traversing

Label	Angle	Error	Angle	correction	corrected
1	0	0.012	188.816	-0.455	188.361
	188.804				
	359.988				
9	0	0.018	86.841	-0.209	86.632
	86.823				
	359.982				
8	0	-0.038	180.41	-0.435	179.975
	180.448				
	0.038				
6	0	0.003	94.757	-0.228	94.529
	94.749				
	359.997				
5	0	0.002	209.165	-0.503	208.662
	209.163				
	359.998				
4	0	0.007	57.133	-0.137	56.996
	57.126				
	359.993				
3	0	0.011	176.295	-0.425	175.87
	176.284				
	359.989				
2	0	0.007	89.191	-0.215	88.976
	89.184				
	359.993				
		summation=	1082.608	misclosure=	2.608

Angle	observed	correction	corrected	line	WCB	Length	dE	dN	correction in E	correction in N	corrected	corrected	final E	final N	point
													1000	2000	9
912	188.816	-0.455	188.361	91	0	55.116	0	55.116	0.562	0.573	0.562	55.689	1000.56	2055.69	1
123	89.191	-0.215	88.976	12	8.361	38.957	5.665	38.543	0.397	0.405	6.062	38.948	1006.62	2094.64	2
234	176.295	-0.425	175.87	23	277.337	37.996	-37.69	4.852	0.388	0.395	-37.297	5.247	969.327	2099.88	3
345	57.133	-0.137	56.996	34	273.207	59.395	-59.3	3.323	0.605	0.616	-58.697	3.939	910.63	2103.82	4
456	209.165	-0.503	208.662	45	150.203	49.368	24.532	-42.841	0.504	0.513	25.036	-42.328	935.666	2061.5	5
568	94.757	-0.228	94.529	56	178.865	59.102	1.171	-59.09	0.603	0.614	1.774	-58.476	937.44	2003.02	6
689	180.41	-0.435	179.975	68	93.396	34.892	34.831	-2.067	0.355	0.362	35.186	-1.705	972.626	2001.31	8
891	86.841	-0.209	86.632	89	93.371	27.142	27.095	-1.596	0.277	0.281	27.372	-1.315	999.998	2000	9
	1082.608					361.968	-3.693	-3.76			-0.002	-0.001			
error=	2.608														

Coordinate Transformation

Objective of Transformation

To align the local coordinates of control points within the WLE building to the global coordinate system, ensuring accuracy and consistency with external geographic data.

Selection of Reference Points

We chose two control points with known global coordinates as anchors, providing the basis for translating our local measurements into the global frame.

Local Coordinate Determination

Using traversing techniques, we measured the local coordinates for all eight control points within the building, building a precise local map.

Application of Transformation Code

With a transformation code provided by the TA, we converted the measured local coordinates into global coordinates, mapping each point with high precision.

Alignment with the Global Coordinate System

This transformation process allowed the building’s map to seamlessly align with the global coordinate system, enabling accurate integration with broader geographic datasets.

Global Coordinates of CP’s

Point Name	Northing	Easting	Point Name	Northing	Easting
1	2932732.599	423438.159	5	2932727.914	423503.68
2	2932693.226	423432.753	6	2932786.833	423500.836
3	2932688.617	423470.441	8	2932787.921	423465.336
4	2932685.705	423529.682	9	2932788.748	423437.718

N

SCALE 1:1000

0 50 100 m

WLE Area

Monday Group 9

Legends

- Control Points
- Street light
- Tree
- Structure lab boundary
- Road
- Concrete road
- WLE
- Electrical dept. buildings
- Two-Wheeler stand
- Ground
- Contours

Learnings

1. **Importance of Geodetic Control:** Establishing accurate control points is crucial, as it significantly impacts the precision of the entire survey. This step helped us understand how even minor errors in the control network can propagate through the survey.
2. **Equipment Proficiency:** Gained practical experience with Total Stations and Auto Levels, enhancing our technical skills in operating these instruments for field data collection. This was essential for understanding how to collect reliable and consistent data under varying field conditions.
3. **Data Processing with QGIS:** Learned to process raw survey data in QGIS, including steps like importing, cleaning, and layering the data. This also involved skills in spatial analysis, transforming raw data into informative and accessible visual formats.

4 . **Understanding Surveying Fundamentals:** Overall, this project deepened our understanding of surveying principles, emphasizing the importance of accuracy, attention to detail, and the role of modern technology in enhancing traditional survey techniques.

Conclusions

This surveying project has provided valuable insights into the principles and practicalities of modern surveying techniques. By following systematic surveying and mapping procedures, we successfully created an accurate map of the designated area. Establishing precise geodetic control points and collecting detailed topographic data allowed us to construct a reliable spatial model, emphasizing the importance of accuracy and precision in civil engineering and geospatial analysis.

Through the project, we gained hands-on experience with advanced surveying equipment, such as Total Stations and Auto Levels, and learned the essentials of data processing and visualization in QGIS. These skills have strengthened our technical proficiency and our ability to address real-world surveying challenges, preparing us for future work in geospatial and infrastructure projects.

Thank You