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Water Risk Assessment for University Campus using GIS

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Abstract: This study presents a GIS-based methodology for terrain analysis and contour generation using freely available geospatial tools and satellite-derived elevation data. The project integrates elevation extraction from Google Earth, spatial data organization in Microsoft Excel, and surface modelling through Quick Grid software to generate accurate contour maps of the selected study area. Elevation values corresponding to geographic coordinates were collected using Google Earth, which utilizes Digital Elevation Model (DEM) datasets primarily derived from the Shuttle Radar Topography Mission (SRTM). The collected data were structured and processed to create an interpolated terrain surface, enabling visualization of elevation variation, slope characteristics, and drainage patterns. The study demonstrates that reliable contour mapping and basic terrain analysis can be achieved using low-cost and accessible GIS-based approaches without relying on advanced commercial software. The developed workflow provides an efficient framework for preliminary topographic analysis applicable to civil engineering planning, watershed assessment, and flood risk studies. The results highlight the potential of integrating satellite-based elevation datasets with simple GIS tools for academic research and practical geospatial applications.

Keywords: Geographical Information System (GIS),Digital Elevation Model(DEM),Water risk zones ,Spatial analysis, Geographic elevations ,Slope characteristics, Drainage patterns.

1.INTRODUCTION

This study presents a GIS-based methodology for terrain analysis and contour generation using freely available geospatial tools and satellite-derived elevation data. The project integrates elevation extraction from Google Earth, spatial data organization in Microsoft Excel, and surface modelling through QuickGrid software to generate accurate contour maps of the selected study area. Elevation values corresponding to geographic coordinates were collected using Google Earth, which utilizes Digital Elevation Model (DEM) datasets primarily derived from the Shuttle Radar Topography Mission (SRTM). The collected data were structured and processed to create an interpolated terrain surface, enabling visualization of elevation variation, slope characteristics, and drainage patterns. The study demonstrates that reliable contour mapping and basic terrain analysis can be achieved using low-cost and accessible GISbased approaches without relying on advanced commercial software. The developed workflow provides an efficient framework for preliminary topographic analysis applicable to civil engineering planning, watershed assessment, and flood risk studies. The results highlight the potential of integrating satellite-based elevation datasets with simple GIS tools for academic research and practical geospatial applications. The water-risk assessment of SARDAR BEANT SINGH STATE UNIVERSITY & NEARBY AREA is done to identify the higher and lower elevations.GIS provides a cost-effective, large-scale, and repeatable method to analyze the contours and elevations.GIS based software providing the best available Imagery. This study focuses on the area of university campus and its nearby areas using GIS.

2. LITERATURE REVIEW

i GIS technology has been widely applied in hydrological studies to analyze spatial data and identify waterlogging and flood-risk areas efficiently.

ii Contour and elevation analysis helps in understanding terrain slope and natural water flow direction, which are key factors influencing water accumulation.

iii Topographic survey data provides accurate ground coordinates and elevations, improving the reliability of contour mapping and terrain. modeling.

iv Digital Elevation Models (DEM) generated through GIS enable visualization of low-lying zones and assist in predicting runoff patterns.

v Soil characteristics, especially permeability and texture, play a significant role in

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determining infiltration capacity and water retention behavior.

vi Integration of Excel-based survey datasets with GIS software enhances data organization, validation, and spatial analysis accuracy.

vii Spatial analysis techniques such as overlay mapping and slope analysis are commonly used to classify areas based on waterlogging risk levels.

viii GIS-based water risk assessment supports sustainable campus and urban planning by helping design efficient drainage and water management systems.

3. STUDY AREA DESCRIPTION

FIG 1: LOCATION POINTS ON GOOGLE EARTH

a) Geographic Location of corner points

1. **UNI CORNER –** Latitude:~ 32°3'41.75"N , Longitude: ~75°26’28.15"E

2. **RANJIT BAGH Front Road –** Latitude:~ 32°3’49.65"N , Longitude: ~75°26’24.40"E

3. **SBI ATM –** Latitude:~ 32°3’44.11"N , Longitude: ~75°26’41.48"E

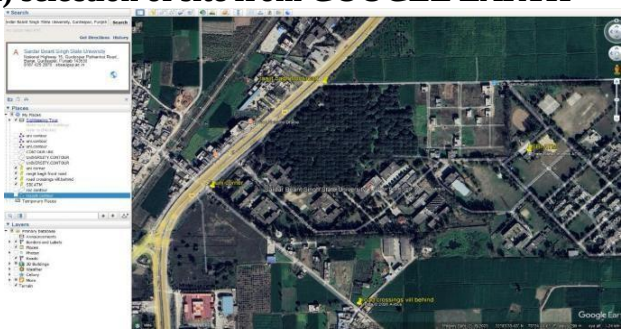
4. **ROAD CROSSING behind university –** Latitude:~ 32°3’32.43"N Longitude: ~75°26’26.85"E

b) Area Description

SARDAR BEANT SINGH STATE UNIVERSITY GURDASPUR, PUNJAB and its nearby area is the location of study. Its 4 points are marked in the map acc.to its location on GIS software .Its contours made using GIS and then the elevations are noted ,in this way the area which is prone to water risk is obtained .This data can be used to achieved good drainage .Also the soil testing is done which is mostly clay soil which has low permeability and leads to accumulation of water. The ground-based measurements can become difficulties due to obstacles thus GIS is used.

4. DATA COLLECTION

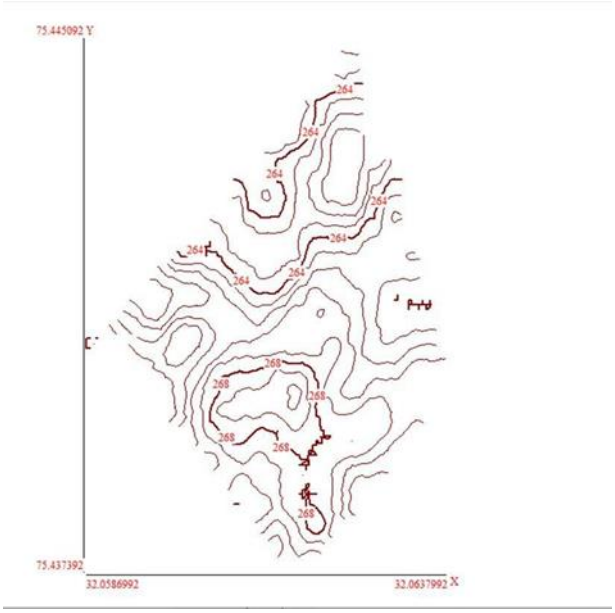
a) selection of site from GOOGLE EARTH



b) Extraction of EXCEL DATA from GPS VISUALIZER

Latitude	Longitude	Elevation
32.06172	75.43745	265.8
32.06175	75.43749	265.7
32.0618	75.43754	265.7
32.06183	75.43756	265.8
32.06186	75.4376	265.9
32.06189	75.43764	266.1
32.06192	75.43766	266.2
32.06193	75.4377	266.4
32.06196	75.43776	266.8
32.06197	75.43779	267
32.06198	75.43782	267.1
32.062	75.43785	267.3
32.06202	75.43788	267.4
32.06205	75.4379	267.4
32.06207	75.43793	267.4
32.06211	75.43795	267.3
32.06214	75.43796	267.1
32.06217	75.43799	267.1

c) QUICKGRID CONTOUR MAP OF LOCATION



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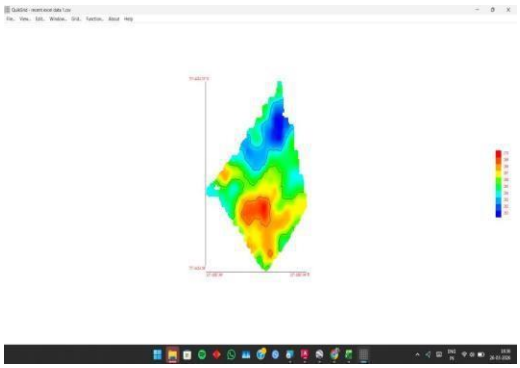
5. METHODOLOGY

The survey methodology adopted in this study was based on a GIS-assisted virtual data collection approach using satellite-derived elevation information. The study area was first identified and geo-referenced using Google Earth, where multiple location points were selected systematically to ensure uniform spatial coverage. Geographic coordinates (latitude and longitude) along with corresponding elevation values were extracted for each observation point using the terrain elevation tool available in Google Earth. The collected data were compiled and organized in Microsoft Excel to create a structured spatial database suitable for further processing. The dataset was then imported into QuickGrid software, where interpolation techniques were applied to generate a continuous terrain surface model. Based on the interpolated surface, contour lines representing equal elevation intervals were produced for terrain analysis. This methodology enabled efficient identification of elevation variations, slope characteristics, and low-lying zones potentially susceptible to water stagnation, while minimizing the need for conventional field surveying methods.

a) Coloured Contour Map of the site:



b) Software used:

Primary Source: Shuttle Radar Topography Mission (SRTM). This is the main satellite that was indirectly used.
Data Type-Digital Elevation Model

I. GOOGLE EARTH PRO
II. QUICKGRID
III. MICROSOFT EXCEL
IV. AUTOCAD

6. WATER RISK ZONES Identified On The Site

Comparison of location points of origional site and the contour map extracted .

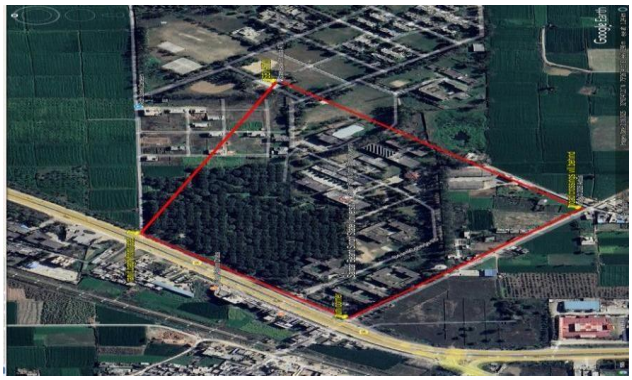


FIG: ORIGIONAL SITE LOCATION

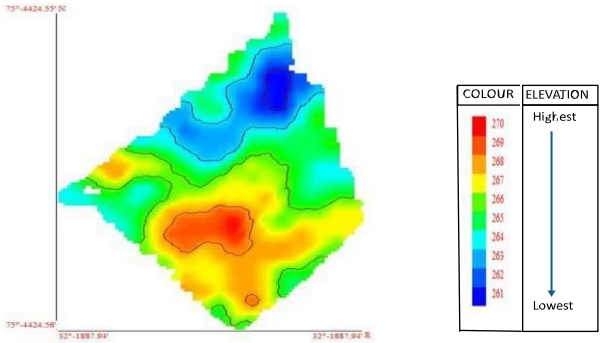


FIG: COLOURED CONTOUR MAP of the Location

The map shows the following data :

i The map showing the elevations from 261 to 270 representing the lower and higher elevations respectively.
ii The water risk prone areas are representing by dark blue (261) to skyblue colour (264). This is done by observing the soil type and can be used for good drainage.
iii It represents the higher elevations from (269) to (270) indicated by orange and red colour respectively.
iv The proper sofware and excel data is used to get the desired details.

7. CONCLUSION

This study demonstrates the effectiveness of a GIS-based approach for terrain analysis and contour generation using freely available geospatial resources and software tools. Elevation data extracted through Google Earth, supported by satellite-derived Digital Elevation Models primarily obtained from the Shuttle Radar Topography Mission, were successfully organized and processed to develop contour maps using QuickGrid. The generated contours provided a clear representation of terrain variation, enabling identification of higher and lower elevation zones, slope characteristics, and natural drainage patterns. The analysis proved useful in locating low-lying areas susceptible to

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water stagnation and potential flooding during rainfall events. The study confirms that reliable preliminary topographic assessment can be achieved through an accessible, low-cost GIS workflow without extensive field surveys. This methodology can support applications in drainage planning, watershed management, and civil engineering decision-making, highlighting the practical value of integrating satellite based elevation data with GIS techniques for sustainable land and water resource analysis.

8. RESULTS

i Elevation data of the study area were successfully extracted using Google Earth based on geographic coordinates.

ii A structured spatial dataset containing latitude, longitude, and elevation values was created using Excel for further analysis.

iii Interpolation of elevation points in QuickGrid generated a continuous terrain surface model of the study area.Contour maps were produced effectively, representing lines of equal elevation and overall terrain morphology.

iv Higher and lower elevation zones were clearly identified from contour patterns.Slope characteristics and natural drainage directions were interpreted using contour spacing and elevation variation.

v Low-lying regions susceptible to water stagnation during rainfall events were identified through terrain analysis.

vi The results confirmed that DEM data derived primarily from the Shuttle Radar Topography Mission can be effectively used for preliminary topographic and hydrological assessment.

9. REFERENCES

i. T. G. Farr et al., “The Shuttle Radar Topography Mission,” Reviews of Geophysics, vol. 45, no. 2, 2007.

ii. NASA Jet Propulsion Laboratory, “Shuttle Radar Topography Mission (SRTM) Overview,” NASA Earth Observatory, 2000.

iii. K. El-Ashmawy, “Investigation of the Accuracy of Google Earth Elevation Data,” Artificial Satellites, vol. 51, no. 3, pp. 89–97, 2016.

iv. P. S. Hiremath and B. G. Kodge, “Generating Contour Lines Using Different Elevation Data File Formats,” International Journal of Computer Science Issues, 2011.

v. S. Dawn, V. Saxena, and B. D. Sharma, “DEM Registration and Error Analysis Using ASCII Values,” 2014.

vi. C. Okolie and J. Smit, “A Systematic Review and Meta-Analysis of Digital Elevation Model Fusion,” 2022.

vii. P. A. Longley, M. F. Goodchild, D. J. Maguire, and D. W. Rhind, Geographic Information Systems and Science, 4th ed. Wiley, 2015.