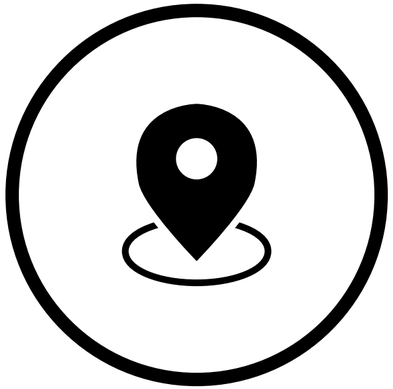
ANALYSIS OF CELLULAR NETWORK COVERAGE IN DIVERSE TERRAINS OF SRI LANKA

IN4720



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INTRODUCTION

This project leverages Geographic Information Systems (GIS) to analyze cellular network coverage in Sri Lanka. By integrating cellular tower data, population density information, and terrain data, the study aims to:

- Assess signal propagation and distribution considering geographical variations.
- Identify coverage gaps more accurately.
- Propose optimal locations for new cellular towers to enhance network services effectively.

OBJECTIVES

1. To use GIS tools to map the locations of existing cellular towers and analyze their coverage areas.
2. Integrate digital elevation models (DEMs) to study how the terrain affects signal strength and coverage.
3. To combine the tower coverage data with terrain information to locate areas with inadequate cellular coverage.
4. Suggest strategic locations for installing new towers to enhance coverage based on population density and signal propagation.
5. Analyze cellular coverage based on different technologies (like LTE, GSM, UMTS) by province in Sri Lanka.

DATA UTILIZATION

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- Cellular Tower Data
  - OpenCelliD: Global open database of cell tower locations and their technology types, including technology bands.
  - CellMapper: Crowd-sourced cellular tower and coverage mapping service.
  - OpenStreetMap: Represents physical features on the ground (e.g., roads, buildings) using tagged data structures.

- Terrain Data
  - NASA SRTM Digital Elevation Data
  - Google Terrain Hybrid

- Population Data
  - WorldPop: Open-access, detailed population distribution maps, essential for identifying population centers relative to cellular coverage areas.

- Administrative Areas
  - GADM: Provides maps and spatial data for countries and their sub-divisions..

QGIS ANALYSIS

- Data Collection: Combined cellular tower data from OpenCelliD, CellMapper, and OpenStreetMap. (Some random points were added in the Northern Part of Sri Lanka due to data limitations).
  - Assumed tower height = 70m (not included in the dataset).

- Signal Propagation:
  - Towers mapped on the Sri Lanka map.
  - Viewshed Analysis was performed to simulate signal propagation considering terrain.
  - Assumed signal radius = 5km per tower.

- Population Heat Map:
  - Created to analyze population density and overlay with signal coverage.

- Database Integration:
  - Integrated PostgreSQL with QGIS using the PostGIS plugin.
  - Saved processed data layers into the database for efficient management and analysis.

COLAB ANALYSIS

- Tower Analysis
  - Visualize tower locations, carrier distribution,and technology deployment.
  - Classification: By Carrier (Mobitel, Dialog, Airtel, Hutch) and Technology (4G, LTE, UMTS, GSM).
  - Classify towers by district boundaries

- Population Analysis:
  - Aggregate district-level population.
  - Visualize population density with heat maps.

- Signal Propagation Analysis:
  - Visualize signal propagation maps with terrain impact
  - Identify coverage gaps by integrating population and signal data.

- Timelapse Analysis:
  - Animated visualization of tower deployment over time

THANK YOU