

CS661: Project Proposal Report

GROUP-9

Introduction

Global development and economic well-being are deeply intertwined with population dynamics. Variables such as population growth, urbanization, malnutrition rates, foreign direct investment (FDI), and currency depreciation shape a country's socio-economic trajectory. Although data on these variables is abundant, it remains underutilized due to fragmentation, complexity, and lack of accessible tools for meaningful exploration.

Our project aims to develop an interactive, web-based visual analytics platform that integrates global demographic, economic, and health indicators from trusted public datasets. The application will empower users to explore spatio-temporal trends, perform comparative analyses, and uncover correlations that influence poverty, malnutrition, foreign investment patterns, and currency decline — with a focus on both India and global regions. This application will be very helpful in becoming a decision support and awareness tool that addresses real global and national problems.

Data Sources

Our data comes from highly reliable and globally recognized sources:

- **UN World Population Prospects:** Historical and projected population metrics (1950–2100)
- **World Bank Open Data:** FDI inflows, urbanization %, GDP per capita, education, poverty
- **NFHS-5 (India):** Malnutrition, sanitation, literacy at state and district levels
- **Global Nutrition Report**
UNICEF: International stunting, wasting, anemia metrics
- **RBI**
FRED: INR/USD exchange rate, inflation, and macroeconomic indicators
- **GeoJSON/Shape Files:** Country and India district boundaries for mapping visualizations

All datasets are downloaded as CSVs and GeoJSON, preprocessed, and made suitable for interactive visualization.

Specific Tasks

We will complete the following key tasks:

- **Data Aggregation:** Download and organize data from 10+ sources including population, poverty, FDI, and health indicators.
- **Data Preprocessing:** Clean missing values, unify country codes, calculate derived features (e.g., risk score).
- **Visual Analytics Development:** Build rich, interactive visualizations for spatial and temporal analysis.
- **Correlation & Comparative Analysis:** Generate insights between population, literacy, FDI inflow, currency value, and malnutrition.

- **Web Application Integration:** Implement a dashboard with filters, maps, and data storytelling components.

Visualization Tasks

4.1 Population Density vs Poverty Index

Cause: High population density doesn't always equate to poverty — distribution is uneven and often misunderstood.

- Compare population density with Multidimensional Poverty Index (MPI) at global and regional levels.
- Filter by year and income group to analyze trends across time and economies.
- Identify mismatched regions (e.g., low-density high-poverty zones) for targeted development.
- Build an **interactive world map with focus-and-context mechanics** to highlight poverty-density mismatches.
- Use **choropleth maps**, **scatter plots**, and **bivariate grids** for intuitive comparison.

4.2 Malnutrition vs GDP, Literacy, Sanitation

Cause: Economic growth alone doesn't eliminate malnutrition — education and basic services are key drivers.

- Correlate malnutrition rates with GDP per capita, female literacy, and sanitation access.
- Highlight regions where malnutrition remains high despite economic progress.
- Segment by year, region, and child population density for granular insights.
- Use **bubble charts**, **stacked bar plots**, and **population pyramids** to visualize relationships.

4.3 Urbanization, Migration, Brain Drain

Cause: Rapid urbanization and limited opportunities drive internal migration and international brain drain.

- Analyze urbanization rates alongside net migration and emigration patterns.
- Identify countries/regions facing skill shortages due to brain drain.
- Compare migration push/pull factors such as education levels and unemployment.
- Use **flow maps**, **Sankey diagrams**, and **animated line charts** for dynamic storytelling.

4.4 INR Depreciation and Macroeconomic Indicators

Cause: Currency value is affected by macro factors like inflation, trade balance, and population pressure.

- Visualize INR/USD trends alongside GDP growth, inflation, and demographic changes.
- Compare India's currency trends with other South Asian economies.
- Explore how economic stress correlates with currency depreciation phases.
- Use **multi-line time series**, **correlation heatmaps**, and **area charts** for trend exploration.

4.5 Predictive Risk Mapping

Cause: Some Indian regions may face future risks in poverty or malnutrition due to current demographic trends.

- Create a composite risk score using child population growth, literacy, and sanitation access.
- Forecast 2030 risk zones across Indian states and districts.
- Display results as interactive heatmaps and filters for planning interventions.
- Use **choropleth layers**, **interactive dashboards**, and **range sliders** to support granular policy targeting.

Overall Solution

Our final product will be a web-based interactive dashboard that enables users to explore development-related metrics across geography and time. It will serve as a unified platform to visualize and analyze how population, literacy, urbanization, malnutrition, foreign investment, and currency trends interact and impact development. By making it web-based, the platform becomes easily accessible, device-independent, and scalable for real-time data updates and public use. It will help a wide range of users including policymakers, researchers, NGOs, economists, educators, and students by simplifying complex datasets into actionable insights. Ultimately, the tool will support more data-driven decisions in tackling poverty, malnutrition, economic inequality, and planning investment or public health interventions at both national and international levels.

Tech Stack

- **Frontend:** React.js, Plotly.js, D3.js
- **Backend:** Flask or FastAPI, Pandas
- **Database:** PostgreSQL or SQLite (for preprocessed and GeoJSON data)
- **Deployment:** Streamlit sharing / Render / GitHub Pages

Team Members & Responsibilities

Each member will contribute to specific project areas:

- **Data Processing, Cleaning & Analytics:** Chandra Vardhan Gottapu(230322),Vuppulam Prajwal(231179)
- **Backend Development:** Shaik Jameel Ur Rahaman (230951),Hemanth Kumar Ampili (230128)
- **Visualization Development:** Divyansh Singh Mertia(230385),Kantipudi Sri Aswin(230527),Dunna Mohith Varma (230392)
- **Frontend Development:** Kadari Meghana (230512),Majji Sharmila (230620)