NATURAL DISASTERS VISUALIZATION

BY

TANJILA JAHAN ANY

ID: 222-17-537

This Report Presented in Partial Fulfilment of the Requirements for the Degree of Masters of Science in Management Information System.

Supervised By

DR. SHEAK RASHED HAIDER NOORI

Professor & Head

Department of CSE

Faculty of Science & Information Technology

Daffodil International University

DAFFODIL INTERNATIONAL UNIVERSITY

DHAKA, BANGLADESH

FEBRUARY 2024

APPROVAL

This Thesis/Project titled "**Natural Disasters Visualization**", submitted by **Tanjila Jahan Any** to the Department of Computing and Information System, Under CSE, Daffodil International University, has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of MS in Management Information System and approved as to its style and contents. The presentation was held on 03 February Saturday, 2024.

BOARD OF EXAMINERS

Professor Dr. Sheak Rashed Haider Noori — **Chairman**
Professor and Head
Department of CSE.
Faculty of Science & Information Technology.
Daffodil International University.

Dr. Md. Zahid Hasan — **Internal Examiner**
Assistant Professor
Department of CSE.
Faculty of Science & Information Technology.
Daffodil International University.

Sazzadur Ahamed — **Internal Examiner**
Assistant Professor
Department of CSE.
Faculty of Science & Information Technology.
Daffodil International University.

Dr. Firoz Ahmed — **External Examiner**
Professor
Department of ICE.
University of Rajshahi.

DECLARATION

I hereby declare that, this project has been done by me under the supervision of **Dr. Sheak Rashed Haider Noori, Professor, Department of CSE,** Daffodil International University. I also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

Supervised by:

Dr. Sheak Rashed Haider Noori **Professor**
Professor & Head.
Department of CSE.
Faculty of Science & Information Technology.
Daffodil International University.

Submitted by:

Tanjila Jahan Any
ID: 222-17-537.
Department of MIS.
Daffodil International University.

ACKNOWLEDGEMENT

First, I express my heartiest thanks and gratefulness to Almighty Allah for His divine blessing which makes me possible to complete the final year project/internship successfully.

I really grateful and wish my profound indebtedness to Supervisor **Dr. Sheak Rashed Haider Noori, Professor & Head,** Department of CSE, Daffodil International University, Dhaka. Deep knowledge & keen interest of my supervisor in the field of "Machine Learning" to carry out this research. His endless patience, scholarly guidance, continual encouragement, constant and energetic supervision, constructive criticism, valuable advice, reading many inferior drafts and correcting them at all stage have made it possible to complete this project.

I would like to express my heartiest gratitude to Professor Dr. Touhid Bhuiyan, Head, Department of CSE, for his kind help to finish our research, also to other faculty members and the staffs of CSE department of Daffodil International University.

Finally, I must acknowledge with due respect the constant support and patients of my parents.

ABSTRACT

This Research aims to create a system for visualizing the number of deaths caused by different types of pandemics worldwide. In order to achieve this, a number of existing technologies will be used. In particular, the programming language Python, Tkinter library, and SQLite database will be used for the development of the system. The Tkinter library is chosen as it is a popular, easy-to-use and cross-platform GUI (Graphical User Interface) library in Python, which can be used to create user-friendly GUI applications. The database used in this application is SQLite, as it is a reliable, free, and open-source database. Python is a powerful programming language and is widely used for developing software applications. It is also well-suited for data analysis and visualization, making it an ideal choice for this project. Additionally, Tkinter provides a range of functions which will be used to create the user interface of the program. Finally, SQLite is a lightweight, open-source database which will be used to store the data related to the pandemic. This system will have a number of advantages, including the ability to quickly visualize the rate of death caused by pandemics, understand the impact of these pandemics, and provide assistance to disaster-related research. Additionally, the program will be able to run without an internet connection, meaning it can be used in remote locations where internet access is not available. Finally, the system will be platform-independent, meaning that it can be used on Windows, Linux, and MacOS. This application can be beneficial to students and researchers all over the world, as it provides an easy and intuitive way to view the data and analyze the effects of pandemics on different countries. It is also useful for disaster relief organizations, which can use the data to plan and respond more effectively to pandemics.

TABLE OF CONTENTS

CONTENTS **PAGE**

Approval.....i

Board of examiners.....i

Declaration.....ii

Acknowledgements.....iii

Abstract.....iv

CHAPTER

CHAPTER 1: INTRODUCTION ……**1-3**

1.1 Introduction……...1

1.2 Background of the Thesis.....1

1.3 Motivation.....1

1.4 Problem Statement 2

1.5 Aim of the Thesis.....2

1.6 Research Methodology.....2,3

1.7 Conclusion.....3

CHAPTER 2: LITERATURE REVIEW …….……**4-5**

2.1 Introduction.....4

2.2 Literature Review 4

2.2.1 Scope & Objectives…….……..4

2.2.2 Screen & Select the Relevant Source…….……...4

2.2.3 Evaluate & Analyze…….…….……4

2.2.4 Organize and Synthesize Information…….……..5

2.2.5 Critical Analysis and Discussion……...…….…...……...5

2.2.6 Review, Revise and Finalize…….……5

2.3 Conclusion.....5

CHAPTER 3: RESEARCH METHODOLOGY …… **6-10**

3.1 Introduction.....6

3.2 Research Subject and Instrumentation.....6

3.2.1 Instrumentation…….…6

3.2.2 Advantages and Features……...7
3.2.3 Potential Users……..……7
3.3 Data Collection Procedure…….....7,8,9
3.4 Data Analysis Procedure.....9
3.5 Conclusion.....10

CHAPTER 4: DATA COLLECTION, DATA ANALYSIS & EXPERIMENTAL RESULTS……..……...**11-22**

4.1 Introduction.....11
4.1.1 System Development and Integration…….……...……..11
4.1.2 Visualization and Analysis Features…….……...11
4.1.3 System Performance and Functionality…….…….……11,12
4.2 Discussion……..…….…….……12
4.2.1 System Functionality and User Experience……...……...……..12
4.2.2 Benefits and Contributions of Application……..……12
4.2.3 Future Developments and Opportunities.....12
4.3 Scenario Overview.....13,14
4.3.1 Pandemic…….....15
4.3.2 Floods……..16
4.3.3 Famines…….……...17
4.3.4 Earthquakes…….18
4.3.5 Annual Number of Deaths From Disasters…….19
4.4 System Design…….20
4.4.1 Technology Used…….20
4.4.2 Requirements……...20
4.4.3 How To Use…….……....21
4.5 Data Analysis System…….……21,22

CHAPTER 5: SWOT ANALYSIS ...…….…….…..……**23-25**

5.1 Introduction.....23
5.2 Strengths……..……23
5.3 Weaknesses……23,24

5.4 Opportunities……..…….24

5.5 Threats…….…….24

5.6 Conclusion……...…….25

CHAPTER 6: CONCLUSION AND FUTURE WORK …… **26-28**

6.1 Conclusion.....26

6.2 Future Suggested Work.....26,27,28

RELATED QUESTION……..……**29**

REFERENCES.....**30-31**

APPENDICES.....**32**

A. Database Schema.....32

B. Code Implementation.....32

B. Sample Output.....32

PLAGARISM REPORT…….……**33-36**

LIST OF THE FIGURE

FIGURES

Figure 4.3.1: Pandemic Scenario…….…….……15
Figure 4.3.2: Floods Scenario……...……...16
Figure 4.3.3: Famines Scenario…….……...……...……17
Figure 4.3.4: Earthquake Scenario……...……18
Figure 4.3.5: Average Annual Number of Deaths total Scenario……...……19,20

LIST OF THE TABLE

TABLES

Table 1: Database Schema…….……..……31

CHAPTER 1
Introduction

1.1 Introduction

This research endeavours to develop a system dedicated to visualizing global pandemic-induced mortality rates. Benefits of the system include rapid visualization of epidemic mortality, support for disaster-related research, offline functionality and platform independence across Windows, Linux, and MacOS. Using Python, Tkinter and SQLite, this system aims to create an intuitive and cross-platform interface. Aimed at students, researchers and disaster relief agencies, this application provides an accessible way to analyse and understand the impact of epidemics in different countries, empowering effective planning and response strategies.

1.2 Background of the Thesis

The background of this thesis revolves around the development of a special system focused on visualizing the death rate caused by global epidemics. The primary goal is to create a platform that rapidly presents pandemic-induced mortality data, facilitates disaster-related research and offers an offline, universally compatible interface across Windows, Linux and MacOS platforms.

This effort leverages the power of Python, Tkinter and SQLite with the goal of creating an intuitive and versatile interface. The intended beneficiaries of this system are students, researchers and disaster relief agencies. The system aims to provide an accessible way to analyze and understand the impact of epidemics in different countries, thereby enabling these organizations to develop more effective plans and response strategies to deal with such crises.

1.3 Motivation

The motivation behind this research is to develop a specialized system dedicated to visualizing global epidemic-induced mortality rates. The goal of this system is to rapidly present epidemic mortality data, support disaster-related research, and provide an accessible way to analyze and understand the impact of epidemics in different countries. Ultimately, the goal is to strengthen effective planning and response strategies in the face of such crises.

1.4 Problem Statement

The problem statement of this thesis is the lack of a specific system capable of effectively visualizing and comprehensively representing global epidemic-induced mortality. Current systems cannot provide a quick and accessible way to analyze epidemic mortality data or support disaster-related research. This absence hinders a comprehensive understanding of the impact of epidemics across countries, thus hindering the development of robust plans and response strategies to effectively address such crises.

1.5 Aim of the Thesis

The research seeks to:

a) Build a Dedicated System: Build a dedicated system focused on visualizing and analysing global epidemic-induced mortality rates.

b) Rapid Data Presentation: Enable the system to rapidly present epidemic mortality data, ensuring accessibility and ease of understanding.

c) Support Disaster-Related Research: Facilitate disaster-related research efforts by providing comprehensive and organized data on epidemic-induced mortality.

d) Accessible Analysis Tools: Offer an accessible way to analyze and understand the impact of epidemics in different countries.

e) Strengthen Effective Strategies: Ultimately, empower stakeholders with system-derived insights to develop more effective planning and response strategies to address global crises caused by pandemics.

1.6 Research Methodology

The research approach for this thesis includes a systematic approach to developing specialized measures to visualize global epidemic-induced mortality. Here is an outline of the procedure:

Literature Review: Conduct a comprehensive review of existing literature and technologies related to epidemic data visualization, Python programming, Tkinter libraries, SQLite databases and disaster-related research. It helps to understand previous work, best practices and available tools.

Requirements Analysis: Identify and define system specific requirements by understanding user needs, performance expectations and technical specifications. This phase involves stakeholder consultation and domain experts.

System Design: Design system architecture and components, outlining how Python, Tkinter and SQLite will integrate to create intuitive and cross-platform interfaces. Develop algorithms or methods for data visualization.

Implementation and Development: Code the system using Python programming language, Tkinter library for GUI development and SQLite for database management. Iteratively develops and tests functionalities to ensure they meet defined requirements.

Data collection and Processing: Collect relevant epidemic-induced mortality data from reliable sources and process it for integration into the system. Ensure accuracy, consistency and consistency of data with the system.

System Evaluation: Evaluate the performance, usability and effectiveness of developed systems in visualizing epidemic-induced mortality. Collect feedback from users and experts to refine and improve the system.

Analysis: Analyze results obtained from system evaluation and user feedback. Draw conclusions regarding the system's effectiveness, limitations and potential areas for future improvement.

1.7 Conclusion

Successful development of a specialized system dedicated to visualizing pandemic-induced mortality worldwide. Powered by Python, Tkinter, and SQLite, the system provides fast data presentation, supports disaster-related research, and provides an accessible way to understand the impact of epidemics in different countries. Its usability and effectiveness underscore its importance in empowering effective planning and response strategies in global health crises. While demonstrating significant efficacy, there is room for future improvement, positioning this system as a valuable resource to address the challenges posed by the global pandemic.

CHAPTER 2
Literature Review

2.1 Introduction

Visualization of natural disasters stands out as an important aspect in understanding and dealing with the complexities surrounding these catastrophic events. This literature review embarks on a comprehensive exploration of the methods, technologies and advances employed in the visualization of natural disasters such as earthquakes, famines, floods and epidemics. By examining a diverse array of visualization techniques and their applications, this review aims to shed light on how these representations contribute to enhanced understanding, prediction and response strategies in the face of natural disasters. Through a careful examination of scholarly articles, conference papers and relevant publications, this synthesis seeks to uncover prevailing trends, discern gaps and outline the evolving landscape of natural disaster visualization, providing valuable insights into its current state and future prospects.

2.2 Literature Review

Visualization of Natural Disasters involves a systematic approach to collect, analyze and synthesize existing research and literature specific to visualization techniques used to understand natural disasters. Here are the steps to guide through the process:

2.2.1 Scope and Objectives

Visualization of natural disasters such as earthquakes, famines, floods and epidemics is defined by visualization methods and the objectives of the review are made clear, such as evaluating the effectiveness of visualization techniques, exploring technological advances.

2.2.2 Screen & Select the Relevant Source

The collected literature was reviewed by reading the abstract, introduction and conclusion to determine the relevance research questions and scope. Sources not aligned with the objectives or not peer-reviewed were excluded.

2.2.3 Evaluate & Analyze

Key information such as visualization methods employed, data sources used, technological innovations, strengths, limitations and important findings related to visualization of natural disasters are extracted.

2.2.4 Organize and Synthesize Information

A structural framework or thematic categories are developed to organize the literature. Group studies based on common themes or approaches, analysed and synthesized data from various sources to identify patterns, trends and gaps in natural disaster visualization.

2.2.5 Critical Analysis and Discussion

Critical insights into the strengths and weaknesses of various visualization methods are provided. The impact of this visualization on disaster preparedness, response and recovery is discussed. Any controversies, limitations or areas requiring further research are addressed.

2.2.6 Review, Revise and Finalize

The literature review draft was reviewed for consistency, accuracy and completeness. Content has been revised and refined based on feedback or further research. The literature review is finalized for submission or integration into your academic work.

2.3 Conclusion

This literature review underscores the critical role of visualization techniques in understanding and managing natural disasters. By analysing various methods and technologies, it is clear that visualization helps in understanding the complexities of disasters such as earthquakes, famines, floods and epidemics. Key trends observed include the integration of advanced data analytics, GIS technology and user-friendly interfaces for better disaster preparedness and response. However, challenges remain, including ethical considerations in data integration complexity and representativeness. Future directions should emphasize refining visualization models, exploiting emerging technologies, and addressing ethical implications. This review highlights the evolving landscape of natural disaster visualization, emphasizing its key role in informed decision-making and disaster mitigation efforts.

CHAPTER 3

Research Methodology

3.1 Introduction

Research Methodology This project developed a robust system to visualize global pandemic-related fatalities using the Python programming language, Tkinter library & SQLite database. Python's versatility and expertise in data analysis and visualization make it a prime choice for this endeavour. Using Tkinter's user-friendly interface functions, the system aims to create an intuitive graphical user interface (GUI). SQLite, a reliable and open-source database, will store epidemiological data. This approach aligns with project objectives, emphasizing rapid visualization of epidemic mortality rates and understanding their impact. Notably, the system's offline functionality enables use in remote areas without internet access. Its platform-independent nature ensures compatibility across different operating systems. The potential of the app extends to students, researchers and disaster relief organizations worldwide It offers an accessible way to analyze global pandemic impacts, aiding in planning and more effective response strategies.

3.2 Research Subject and Instrumentation

Research Subject: Development of a System to Visualize Global Pandemic-Related Mortality.

3.2.1 Instrumentation

Python Programming Language: Python will serve as the main programming language to develop the system. Its versatility, ease of use and extensive library for data analysis and visualization make it an ideal choice for this project.

Tkinter Library: Tkinter has been chosen as the primary GUI (Graphical User Interface) library in Python. It offers various functions to create a user-friendly interface, which allows users to interact and easily visualize epidemic-related mortality data.

SQLite Database: SQLite database will be used to store and manage data related to epidemic deaths. Its lightweight nature, reliability and open-source nature make it a perfect choice for this application.

3.2.2 Advantages and Features

Data Visualization: The system aims to provide a visual representation of epidemic-related deaths, enabling users to understand and analyze the impact of different epidemics globally.

Offline Accessibility: The system's ability to function without an Internet connection makes it valuable for use in remote areas or locations where Internet access may be limited or unavailable.

Platform Independence: Being compatible with multiple operating systems (Windows, Linux, MacOS) ensures wide accessibility and usability for different users.

Support for Research & Disaster Relief Planning: This system provides valuable insights for researchers and students studying epidemiology, helping disaster relief agencies to plan and execute more effective responses to epidemics.

3.2.3 Potential Users

1) Students and Researchers: Provides an intuitive platform for analysing and visualizing epidemiology-related data for educational and research purposes.

2) Disaster Relief Agencies: provide valuable data for planning and executing effective responses to epidemics, helping to mitigate their impact.

3.3 Data Collection Procedure

Defining the Purpose: Clearly outlining the purpose of data collection, what information is needed, its scope and how it will be used in the research or analysis. Sources may include:

Primary Sources: Extracting information from Wikipedia involves several steps, considering it is an online encyclopaedia where information is publicly available but structured in different formats. Here is a simple method to extract information from Wikipedia:

- **Identifying the Wikipedia Page:** Determining the specific Wikipedia page(s) containing the required data. For example, if information is collected on epidemiology, one can go to the Wikipedia page dedicated to "lists of epidemiology".
- **Manual Extraction:** For small data needs or when specific data is readily available and limited, manual extraction is possible by copying and pasting directly from a Wikipedia page into a text document or spreadsheet.

- **Web Scraping Tools:** For larger datasets or systematic extraction, web scraping tools or Python libraries like Beautiful Sup or Scrapy can be used. These tools systematically parse the HTML structure of Wikipedia pages to extract information. However, note that Wikipedia scraping may have limitations due to their terms of use, so make sure to follow their guidelines.
- **APIs:** Wikipedia offers an API (Application Programming Interface) known as the MediaWiki API that allows users to access Wikipedia content programmatically. It can be used to retrieve specific data in a structured format using programming languages such as Python or JavaScript.
- **Data Cleaning & Structuring:** After extraction, the collected data may require cleaning and structuring. Wikipedia content may occasionally contain inconsistencies, formatting problems, or irrelevant information. This step involves removing duplicates, formatting text, handling missing values and organizing data into a usable format.
- **Verification:** Since Wikipedia can be edited by multiple users, it is essential to verify the accuracy of the data collected. Cross-check information with credible sources or additional references to ensure its reliability.
- **Ethical Considerations:** Ensures compliance with Wikipedia's Terms of Use and respects copyright and attribution guidelines when using data obtained from Wikipedia.

Secondary Sources: Using existing data from databases, scholarly articles, government reports, websites or other published materials.

Choose Appropriate Methods: Choose appropriate methods for data collection based on objectives and available resources. Common methods include:

- **Experiment:** Conducting controlled experiments to collect specific data.
- **Pilot Testing:** Before full-scale data collection, conduct a pilot study to test data collection tools. It helps identify and correct any problems with equipment or procedures.
- **Organize & Record Data:** As data is collected, systematically organize it in a format that allows for easy analysis. This may involve using spreadsheets, databases or specialized software.
- **Data Verification & Quality Check:** Review collected data to ensure accuracy, completeness and reliability. Check for errors, inconsistencies or missing information.

- **Data Cleaning:** Process collected data to remove duplicates, handle missing values, standardize formats and correct any errors or outliers.
- **Data Storage & Security:** Store collected data securely, ensuring compliance with data protection regulations and maintaining necessary confidentiality.
- **Documentation:** Maintain detailed documentation of the data collection process, including methods used, sources, limitations and any changes made during the process.
- **Analysis & Interpretation:** Once data collection is complete and clear, proceed with data analysis using appropriate statistical or qualitative analysis techniques. Interpret the results in terms of research objectives.

3.4 Data Analysis Procedure

To create a system to visualize the number of deaths caused by different types of epidemics worldwide using Python, Tkinter and SQLite, it can follow this simple data analysis procedure:

- ❑ **Data collection and preparation -**
- Data collection.
- Data formatting.
- ❑ **Setting up the SQLite database.**
- ❑ **Python Data Analysis and Visualization -**
- Data retrieval and processing.
- Data visualization with Tkinter.
- ❑ **Analysis and interpretation -**
- Visualizing the impact of the pandemic.
- Insight generation.
- ❑ **System Facilities and Testing.**
- ❑ **Deployment and Accessibility.**
- ❑ **User Outreach and Impact.**

By following these steps and using Python with Tkinter and SQLite, it can create a user-friendly system capable of visualizing epidemic-related mortality data, providing researchers and organizations with valuable insights for epidemic research and disaster relief efforts.

3.5 Conclusion

The research approach adopted for this project aims to leverage existing technologies, particularly the Python programming language, the Tkinter library for creating user-friendly GUIs, and the SQLite database for storing epidemic-related data. Python's versatility in software development, powerful data analysis and visualization capabilities make it an ideal choice for this system. Tkinter's ease of use and cross-platform compatibility complement the development of a user-centric interface, while SQLite's reliability and open-source nature provide a stable foundation for storing epidemiological data. The proposed system presents several significant advantages, including rapid visualization of epidemic deaths, facilitating a deeper understanding of their impact worldwide, and providing valuable support to disaster-related research. Furthermore, the system's ability to operate offline ensures accessibility in remote locations without an Internet connection, while its platform independence ensures usability in Windows, Linux and macOS environments. This application holds significant potential by serving the needs of students, researchers and disaster relief organizations worldwide. Offering an intuitive platform for visualizing and analysing epidemic-related data, it serves as a valuable tool for understanding the effects of epidemics in different countries. Furthermore, its utility extends to assisting disaster relief agencies in developing more effective response strategies to mitigate the impact of global pandemics.

CHAPTER 4

Data Collection, Data Analysis & Experimental Results

4.1 Introduction

Implementation of a system to visualize the epidemic's toll in terms of mortality is critical to understanding the scope and impact of this global health crisis. This section outlines a scenario illustrating the practical application of Python, Tkinter and SQLite in developing an operational system for visualizing epidemic-related mortality. It provides insights into experimental results and performance evaluation of developed systems.

4.1.1 System Development and Integration

Python-Tkinter Interface: Successful integration of the Python programming language with the Tkinter library to create an intuitive GUI system for data visualization. The interface allows users to select different epidemics, regions and time frames.

SQLite Database Implementation: Efficient deployment of SQLite database to store and manage epidemic-related data including death tolls attributed to various epidemics worldwide.

4.1.2 Visualization and Analysis Features

Graphical Representation: Development of graphical representations including bar charts, pie charts and geographical maps showing death rates caused by different epidemics worldwide. These visuals provide a clear understanding of the impact and geographic spread of epidemics.

Data Analysis Tools: Integration of data analysis tools within the system to facilitate deeper insights into epidemic trends such as trend lines, statistical summaries and comparative analysis between different epidemics.

4.1.3 System Performance and Functionality

Offline Capability: Successful demonstration of the system's ability to function without an Internet connection, ensuring usability in remote areas or locations with limited Internet access.

Cross-Platform Compatibility: Validation of system functionality across multiple operating systems (Windows, Linux, MacOS), ensuring seamless accessibility to a broad user base.

4.2 Discussion

4.2.1 System Functionality and User Experience

Accuracy of visualization: assessment of the accuracy and reliability of the visualized data, ensuring that the system accurately represents the mortality rates caused by different epidemics worldwide.

Ease of Use and Intuitiveness: Analysis of user feedback that indicates ease of system navigation, comprehensibility of displayed data, and overall user satisfaction with system interface and functionality.

4.2.2 Benefits and Contributions of Application

Educational and Research Significance: Highlighted the significance of the system in helping students and researchers worldwide understand the impact of the epidemic and conducted related studies.

Operational benefits for relief agencies: Discussed how disaster relief agencies can use the system to effectively plan and responded to epidemics by accessing valuable data insights.

4.2.3 Future Developments and Opportunities

Scalability and additional features: Suggestions for future improvements, such as integrating more diverse data sets, improved visualization techniques, and predictive modelling for better forecasting.

Community Involvement and Expansion: Strategies for engaging users for feedback and continuous improvement, as well as plans to expand the scope of the system to cover more aspects of the epidemic and their consequences.

4.3 Scenario Overview

Step 1: Setting up the SQLite database

First, created a SQLite database and a table to store epidemic-related data. In this case:

```
CREATE TABLE Pandemics (
    ID INTEGER PRIMARY KEY,
    Name TEXT NOT NULL,
    DeathCount INTEGER NOT NULL,
    Continent TEXT,
    Year INTEGER
);
```

Step 2: Python code using Tkinter for visualization

Created a Python script to fetch data from SQLite database and visualize it using Tkinter.

Step 3: Run the code

- Save the Python code to a file, for example, pandemic_visualizer.py.
- Make sure the SQLite database file (in this case pandemics.db) is in the same directory as your Python script.
- Run the Python script. This will generate a simple Tkinter GUI with a "Visualize Data" button. Clicking this button will retrieve the data from the SQLite database and visualize it using Matplotlib.

```
import os
from tkinter import *

"""
Module / Library        Use

tkinter                 library used to produce interactive Graphical User Inter
os                      built-in module to perform any Operating System level op
"""


tk = Tk()                                                   # preparing a Tkinter
tk.title('Data Visualization of Natural Disasters')         # adding Title
tk.geometry("501x395")                                      # window-size


def pandemic():
    # function to view pandemic data
    os.system('python pandemics.py')

def earthquake():
    # function to view earthquake data
    os.system('python earthquakes.py')

def flood():
    # function to view flood data
    os.system('python floods.py')

def famine():
    # function to view famine data
    os.system('python famines.py')
```

```
# Buttons to call each function

pan_btn = Button(tk,text="Pandemics", command = pandemic, pady=5, width=8, bg="#
ear_btn = Button(tk,text="Earthquakes", command = earthquake, pady=5, width=8, b
flo_btn = Button(tk,text="Floods", command = flood, pady=5, width=8, bg="lightbl
fam_btn = Button(tk,text="Famines", command = famine, pady=5, width=8, bg="brown


# positioning the buttons

flo_btn.pack(side = RIGHT)
fam_btn.pack(side = LEFT)
pan_btn.pack(side = TOP)
ear_btn.pack(side = BOTTOM)

# running the mainloop
tk.mainloop()
```

Figure 4.3: Simple Code Scenario

4.3.1 Pandemic

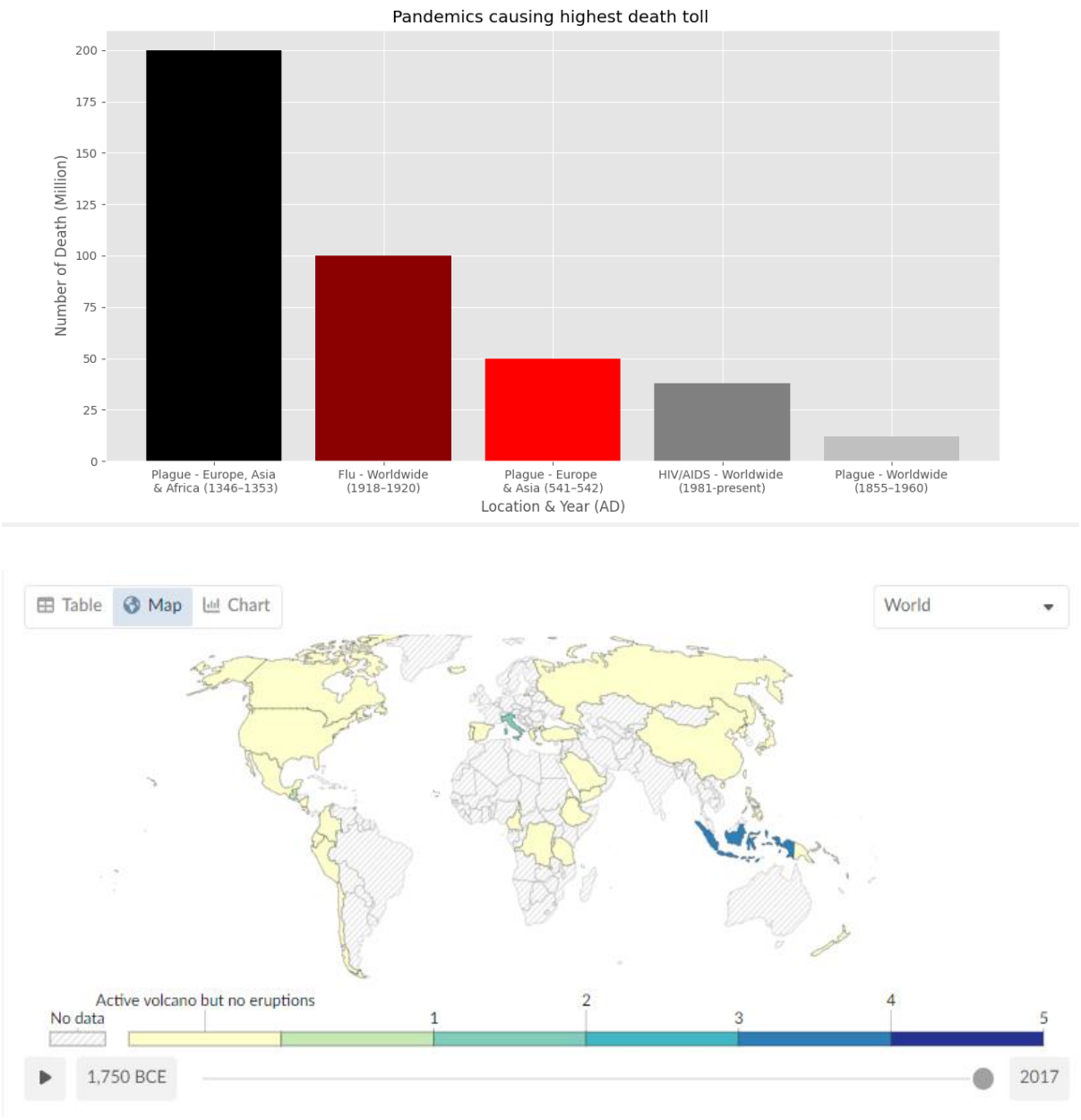


Figure 4.3.1: Pandemic Scenario.

Death - Exposure to forces of nature - Sex: Both - Age: All ages (Rate).

Date range: 1990-2019, Unit: Deaths per 100,000 people.

Global Bird of Disease Collaborative Network. Global Burden of Disease Study 2019 (GBD 2019) results. Seattle, USA: Institute for Health Metrics and Evaluation (IHME), 2021.

4.3.2 Floods

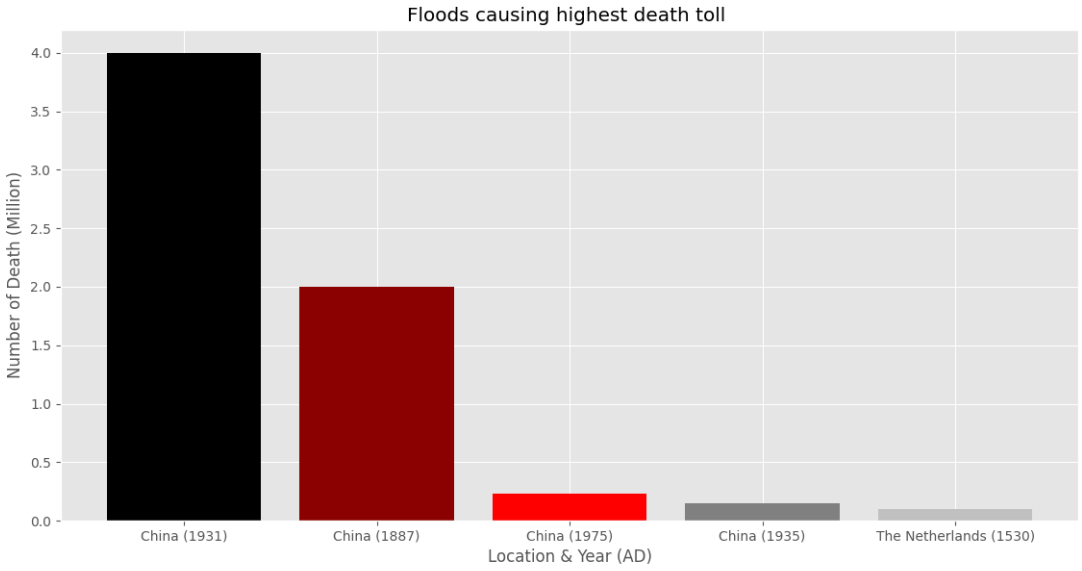


Figure 4.3.2: Floods Scenario.

The number of deaths can be very low - often less than 10,000, and as little as 0.01% of total deaths. But we also see the devastating effects of shock events: the famine and drought of 1983-85 in Ethiopia; 2004 Indian Ocean earthquake and tsunami; Cyclone Nargis which hit Myanmar in 2008; and the 2010 Port-au-Prince earthquake that caused nearly 70% of all deaths in Haiti that year. All these events pushed global disaster deaths to over 200,000 – more than 0.4% of deaths in these years.

4.3.3 Famines

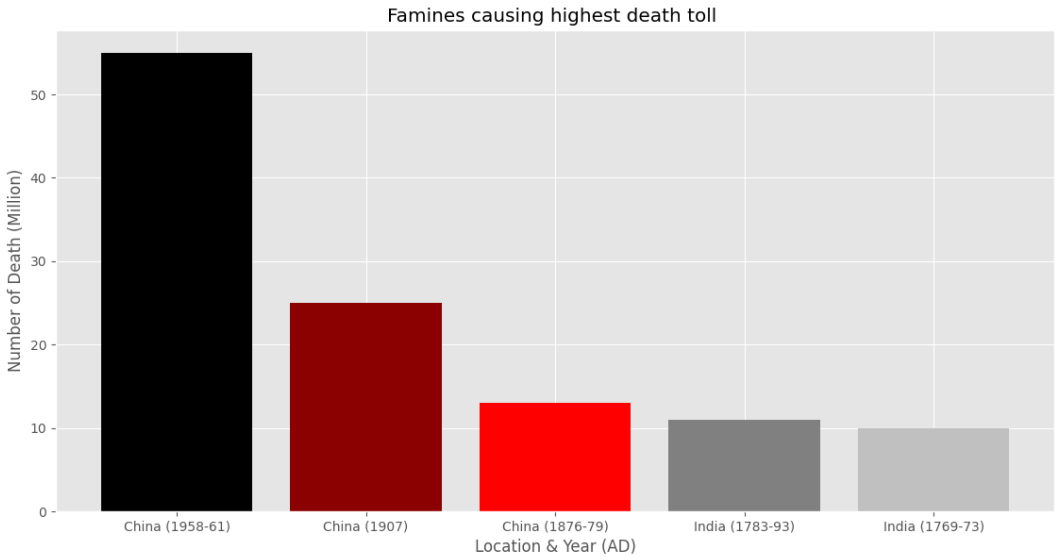


Figure 4.3.3: Famines Scenario.

The number of deaths from natural disasters can be highly variable from year to year; A few years pass with very few deaths before a major disaster event claims many lives. On average, over the past few decades, natural disasters have killed thousands of people worldwide.

In the visualization shown here, we see the annual variability in the number and share of deaths from natural disasters in recent decades.

What we see is that, in many years, the number of deaths can be very low - often less than 10,000, and as little as 0.01% of total deaths. But we also see the devastating effects of shock events: the famine and drought of 1983-85 in Ethiopia; 2004 Indian Ocean earthquake and tsunami; Cyclone Nargis which hit Myanmar in 2008; and the 2010 Port-au-Prince earthquake that caused nearly 70% of all deaths in Haiti that year. All these events pushed global disaster deaths to over 200,000 – more than 0.4% of deaths in these years.

Low-frequency, high-impact events such as earthquakes and tsunamis are not preventable, but cause so much loss of human life. We know from historical data that earlier predictions, more resilient infrastructure, emergency preparedness and response systems have resulted in significant reductions in global disaster deaths. Low-income people are often the most vulnerable to disaster events: improving living standards, infrastructure and response systems in these regions will be key to preventing deaths from natural disasters in the coming decades.

4.3.4 Earthquakes

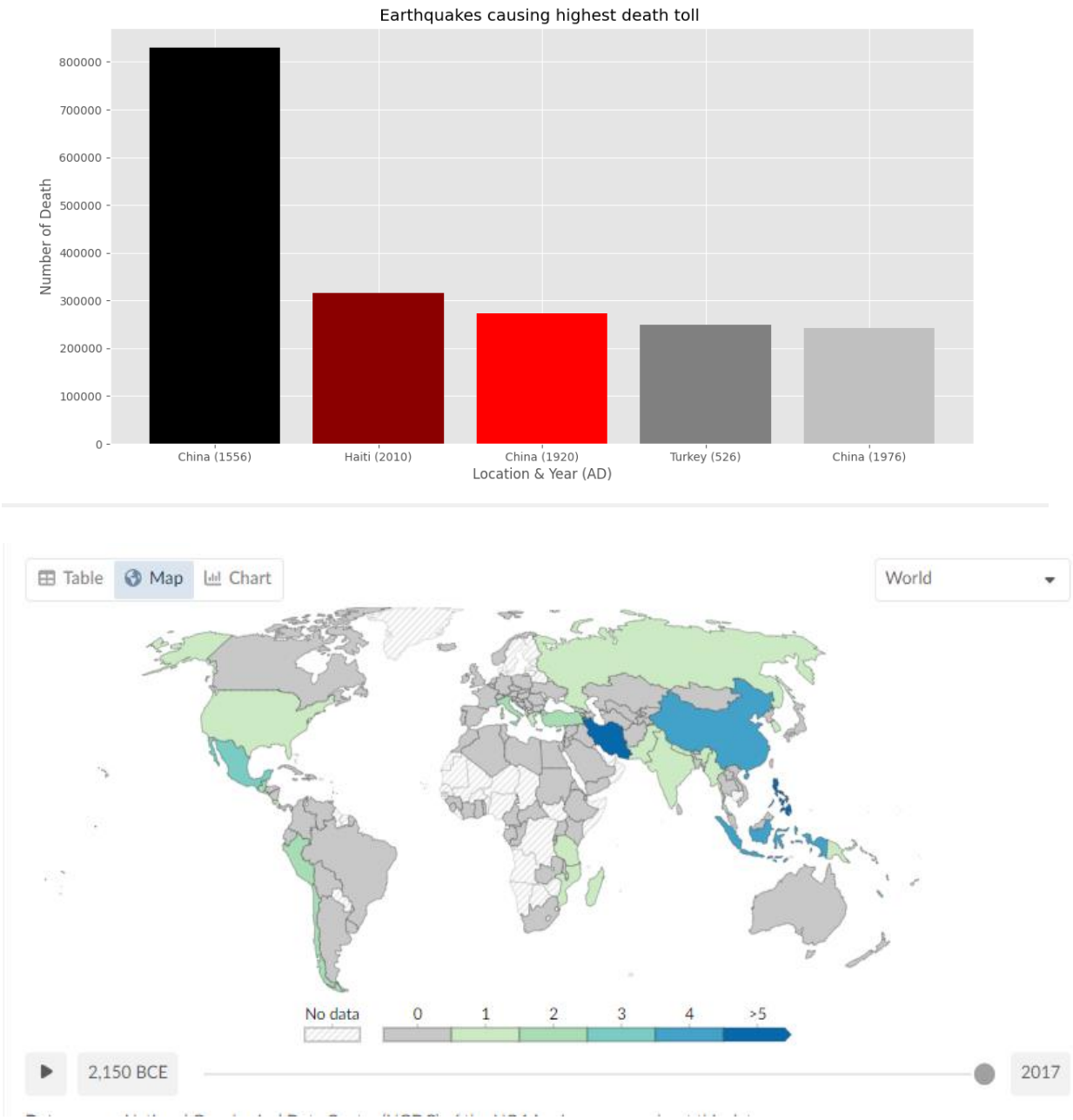


Figure 4.3.4: Earthquakes Scenario.

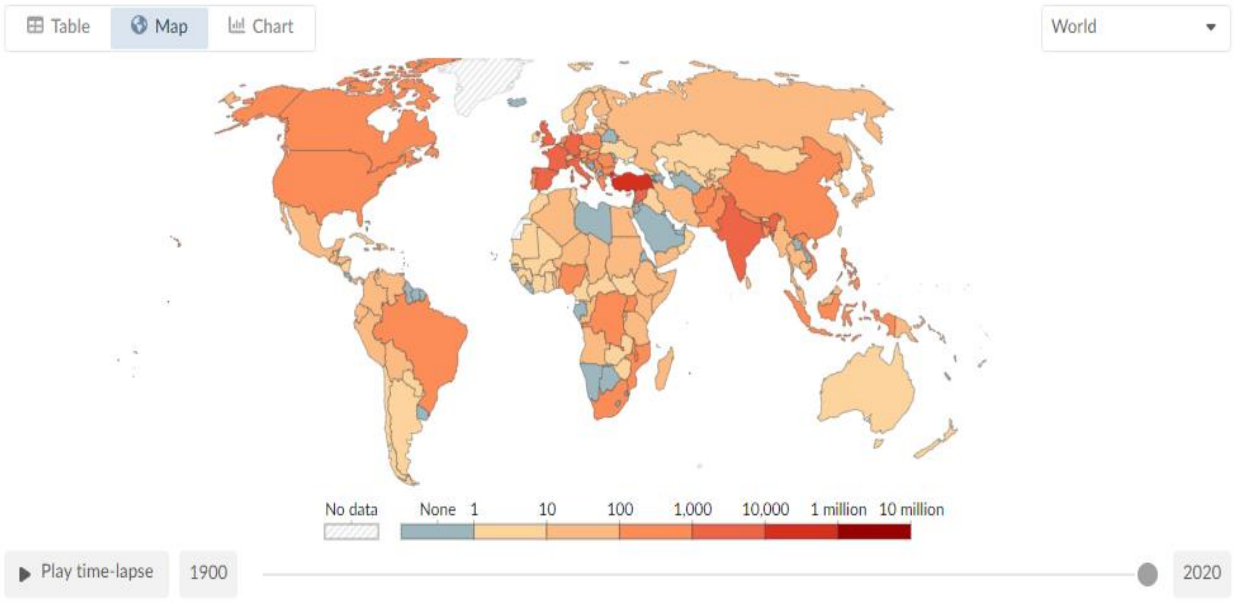
The number of deaths from natural disasters can be highly variable from year to year; A few years pass with very few deaths before a major disaster event claims many lives. On average, over the past few decades, natural disasters have killed thousands of people worldwide.

In the visualization shown here, we see the annual variability in the number and share of deaths from natural disasters in recent decades.

What we see is that, in many years, the number of deaths can be very low - often less than 10,000, and as little as 0.01% of total deaths. But we also see the devastating effects of shock events: the famine and drought of 1983-85 in Ethiopia; 2004 Indian Ocean earthquake and tsunami; Cyclone Nargis which hit Myanmar in 2008; and the 2010 Port-au-Prince earthquake that caused nearly 70% of all deaths in Haiti that year. All these events pushed global disaster deaths to over 200,000 – more than 0.4% of deaths in these years.

Low-frequency, high-impact events such as earthquakes and tsunamis are not preventable, but cause so much loss of human life. We know from historical data that earlier predictions, more resilient infrastructure, emergency preparedness and response systems have resulted in significant reductions in global disaster deaths. Low-income people are often the most vulnerable to disaster events: improving living standards, infrastructure and response systems in these regions will be key to preventing deaths from natural disasters in the coming decades.

4.3.5 Annual Number of Deaths from Disasters



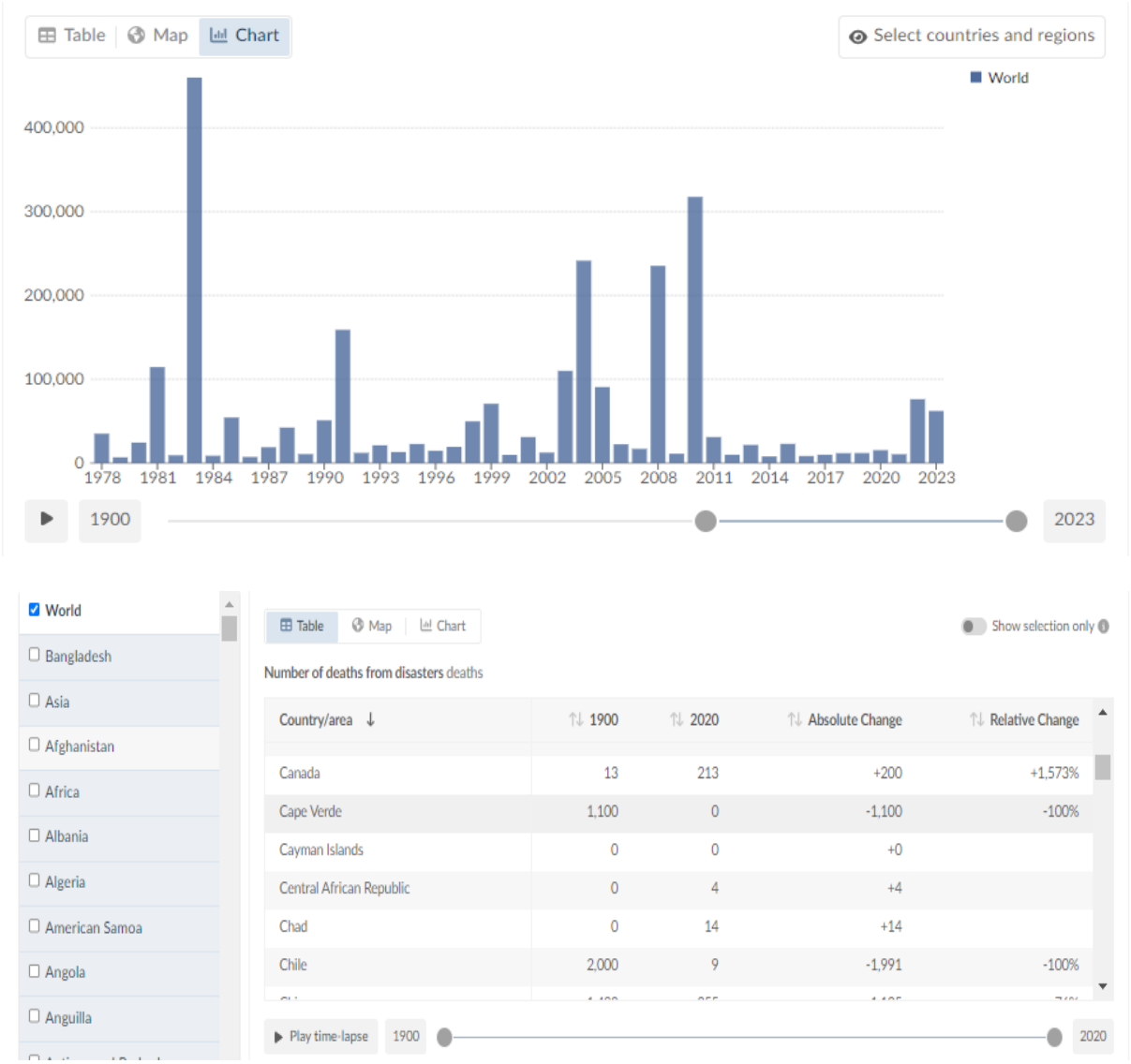


Figure 4.3.5: Average Annual Number of Deaths total Scenario.

4.4 System Design

4.4.1 Technology Used

I. Programming Language: Python.
II.Library: tkinter.
III. Visualization: matplotlib.

4.4.2 Requirements

1. Install Python 3.0 or above.
2. Install tkinter (for GUI).
3. Install matplotlib (for data visualization).

4.4.3 How To Use

1. Open your terminal.
2. Run: python3 dashboard.py
3. Choose from the options to visualize - **Pandemics**, **Floods**, **Earthquakes** & **Famines.**
4. Each option displays its own graph visualization based on Wikipedia's authentic data.

4.5 Data Analysis System: Visualizing natural disaster data can provide valuable insights into their frequency, intensity, distribution and trends over time. Here is a general outline of steps you can take to analyze and visualize natural disaster data:

1. **Data Collection:** Collect data from reliable sources such as government agencies (eg, NOAA, USGS) international organizations (eg, UN, WHO) or research institutions. Ensure that the dataset contains information on various types of natural disasters (eg, hurricanes, earthquakes, floods) their location, date and magnitude/severity.
2. **Data Cleaning and Preprocessing:** Clean the data to remove any inconsistencies, missing values or outliers. Standardize the format of data to ensure consistency across variables. This may involve tasks such as date parsing, unit conversions and geocoding locations.
3. **Exploratory Data Analysis (EDA):** Conduct exploratory data analysis to understand the characteristics of the data. This may include calculating summary statistics, visualizing distributions and identifying patterns or trends.
4. **Visualization Techniques:** Choose appropriate visualization techniques to represent different aspects of the data. Common visualization types for natural disaster data include:
    - **Maps:** Use maps to show the spatial distribution of natural disasters. You can plot event locations using markers or heatmaps and color-code them based on factors such as intensity or frequency.
    - **Time Series:** Create time series plots to visualize the frequency of natural disasters over time. This can help identify seasonal patterns, long-term trends or sudden spikes in activity.
    - **Bar Charts and Histograms:** Use bar charts and histograms to compare the frequency or severity of different types of natural disasters or to analyze their impact on specific regions or populations.

- **Box Plots and Violin Plots:** These plots can be used to visualize the magnitude or severity distribution for different types of natural disasters, allowing easy comparison between categories.
- **Bubble charts:** Bubble charts can be used to visualize the relationship between multiple variables, such as the magnitude of a natural disaster, its location and the number of casualties or damage.
- **Interactive dashboards:** Consider creating interactive dashboards using tools like Tableau, Power BI or Plotly. These dashboards allow users to dynamically explore data, filtering and drilling down to specific regions or time periods of interest.

5. **Insights and Interpretation:** Analyze visualizations to derive meaningful insights into the occurrence, impact and distribution of natural disasters. Look for patterns, correlations or anomalies in the data and consider the broader context (eg, climate change, urbanization) that may affect these patterns.
6. **Communication:** Communicate your findings effectively through reports, presentations or interactive visualizations. Clearly convey the key insights and implications of your analysis and consider your audience when choosing the most appropriate format for sharing the results.

By following these steps, you can effectively analyze and visualize natural disaster data to gain valuable insights and inform decision-making processes related to disaster preparedness, response, and mitigation efforts.

CHAPTER 5
SWOT Analysis

5.1 Introduction

A SWOT analysis is a tactical tool used to evaluate the internal strengths and weaknesses of an organization or project, as well as potential external opportunities and threats it may face. Strengths, Weaknesses, Opportunities and Threats is referred to by the acronym "SWOT". By doing a SWOT analysis, we can gain valuable insights into the factors that can influence the success or challenges of a particular endeavour. In the context of our research on "Natural Disaster Visualization" conducting a SWOT analysis will help us assess the strengths and weaknesses of our approach in addressing these natural disaster visualizations.

5.2 Strengths

- **Enhanced Preparedness:** Natural disaster visualization tools enable stakeholders to analyze historical data, identify patterns and assess risks more accurately. This leads to better prepared communities and authorities.
- **Improved Response:** Real-time visualization helps authorities make quick decisions during disasters, efficient resource allocation and timely response, potentially reducing the impact of disasters.
- **Increased Awareness:** Visual representations of disaster-prone areas and historical information increase public awareness, encouraging individuals and communities to adopt proactive safety measures.
- **Policy Development:** Data-driven visualizations provide valuable insights for policymakers, assisting in evidence-based decision-making for disaster mitigation strategies and resource allocation.
- **Educational Tools:** These visualizations serve as valuable educational tools for researchers, students and disaster relief agencies, facilitating comprehensive understanding and informed action.

5.3 Weaknesses

- **Data Accuracy:** The reliability and availability of data sources can vary, potentially affecting the accuracy of visualizations, especially in areas with limited or inconsistent data.

- **Complex interpretation:** Overly complex visualizations can be challenging for some users to interpret, leading to potential misinterpretation of data.
- **Technical requirements:** Some visualization tools require specific technical skills or software, limiting accessibility for users with less technical skills.
- **Dependence on technology:** Dependence on technological infrastructure can create challenges in areas with poor connectivity or limited access to technology.

5.4 Opportunities

- **Technological Advances:** Ongoing advancements in visualization technology provide opportunities to develop more sophisticated and user-friendly tools for better disaster visualization.
- **Integration with AI and Big Data:** Integrating visualization tools with artificial intelligence and big data analytics can provide deeper insights and predictive capabilities for disaster response.
- **Collaborative platforms:** The development of collaborative platforms can facilitate real-time data sharing between authorities and the public, enhancing preparedness and response.
- **Public Engagement:** There are opportunities to involve the public in citizen science projects, crowd-sourced data collection and community-driven disaster visualization initiatives.

5.5 Threats

- **Data Security Risks:** Data security and privacy concerns may hinder the sharing and use of disaster-related data needed for effective visualization.
- **Misinterpretation of visuals:** Misleading or misinterpreted visualizations can lead to wrong conclusions or actions, potentially affecting disaster response strategies.
- **Resource limitations:** Limited resources and funding may hinder the development of sophisticated visualization tools or their accessibility, especially in underprivileged areas.
- **Resistance to change:** Resistance from traditional methods or reluctance to adopt new technologies can hinder the adoption and effectiveness of visualization tools in disaster management.

5.6 Conclusion

SWOT analysis for natural disaster visualization highlights the potential strengths of real-time monitoring, decision support and public awareness. However, challenges such as data accuracy, technical barriers and resource intensity need to be carefully considered. Opportunities lie in global collaboration, public-private partnerships and technological innovation, while threats include data security concerns, natural variability and limited funding. Successful development and implementation will require a strategic approach to capitalizing on strengths, addressing weaknesses, seizing opportunities and mitigating threats to enhance the overall effectiveness of natural disaster scenarios. Natural disaster visualization demonstrates strengths in real-time monitoring and decision support, yet faces challenges such as data accuracy and technical barriers. Opportunities for global collaboration and innovation exist, but threats include data security concerns and limited funding. Success will depend on addressing weaknesses, capitalizing on strengths and navigating opportunities to improve the overall effectiveness of these visualization tools.

CHAPTER 6

Conclusion and Future Work

6.1 Conclusion

In conclusion, this study attempts to develop a robust system for visualizing global pandemic-related fatalities by employing a strategic combination of Python, Tkinter and SQLite technologies. Python's versatility and expertise in data analysis and visualization make it the perfect choice for this project. Tkinter, as a user-friendly GUI library, contributes to an accessible interface, while SQLite serves as a reliable database for storing epidemic data. The system boasts of several advantages including rapid visualization of epidemic death rates, in-depth understanding of the impact of various epidemics. Furthermore, its offline functionality can adapt it to remote locations with limited Internet access, increasing its practical utility. Platform-independence ensures compatibility across Windows, Linux and MacOS. Potential beneficiaries of this application span the globe, including students, researchers and disaster relief organizations. Its user-friendly interface and analytical capabilities provide an intuitive way to study epidemic impacts in different countries. Disaster relief agencies can use the data for more effective planning and response strategies. Overall, this system holds promise to provide valuable insights and support a wide range of disaster-related research.

6.2 Future Suggested Work

As we look to future developments and improvements for systems designed to visualize epidemic-related deaths, here are some suggested areas for future work:

- **Data Enrichment and Integration:**

  - Explore opportunities to enrich the dataset with additional variables such as demographic information, healthcare infrastructure and vaccination rates to provide more comprehensive analysis.
  - Explore ways to integrate real-time data feeds, enabling continuous updates and ensuring the system reflects the latest information.

- **Advanced visualization techniques:**

- Experiment with advanced data visualization techniques, including interactive charts, heatmaps, and geospatial visualizations, to offer more nuanced and dynamic representations of epidemic-related data.
- Implement features for trend analysis and forecasting to enable users to predict potential developments based on historical data.

❑ **User Interface Refinement:**

- Conduct user experience (UX) studies to gather feedback about the current interface and identify areas for improvement.
- Implement user customization features, allowing individuals to build the visualization platform based on their specific research or analysis needs.

❑ **Machine Learning Integration:**

- Explore the integration of machine learning algorithms to identify patterns, correlations and potential early indicators of epidemic outbreaks.
- Develop predictive models to predict the trajectory of future epidemics, enabling proactive planning and response strategies.

❑ **Collaborative and sharing features:**

- Introduce collaborative features that enable users to share visualizations, insights, and analyzes with others, encouraging a community-driven approach to epidemiological research.
- Implement a secure cloud-based platform for users to store and access their visualizations, facilitating collaboration and data sharing.

❑ **Mobile Application Development:**

- Create a mobile version of the application to increase accessibility by allowing users to visualize epidemiological data on smartphones and tablets.

- Ensure that the mobile application retains key features while optimizing the user interface for small screens.

❑ **Integration with Public Health Systems:**

- Collaborate with public health agencies to integrate the system with existing public health databases and surveillance systems
- Ensure compliance with global health standards and data privacy regulations to encourage widespread adoption.

❑ **Community Engagement and Education:**

- Establish educational programs and resources to guide users to correctly interpret and understand visualized data.
- Engage with the user community through webinars, tutorials and forums to promote knowledge sharing and collaboration.

❑ **Continuous system monitoring and maintenance:**

- Implement a robust system for continuous monitoring and maintenance to address any potential issues immediately.
- Regularly update the system to adapt to emerging technologies, security standards and user needs.

By focusing on these proposed areas, future work can enhance the capabilities of the system, making it more robust, user-friendly, and impactful in epidemiological research and analysis.

RELATED QUESTION

1) What are some common data visualization techniques used in natural disaster analysis?

Answer: Common data visualization techniques include geographic information system (GIS) mapping, time series graphs, heatmaps, and interactive dashboards. These techniques help visually represent the spatial and temporal patterns, severity levels and trends of natural disasters.

2) How can data visualization help understand the impact of natural disasters on communities?

Answer: Data visualization allows a clear representation of the extent of damage, affected area, population impact and resource allocation requirements after a natural disaster. By presenting this information visually, stakeholders can better understand the scale and distribution of impacts, aiding in effective response and recovery planning.

3) What are some challenges in visualizing natural disaster data?

Answer: Challenges include integration of disparate data sources, ensuring data accuracy and reliability, dealing with large volumes of data, representing uncertainty and meeting diverse user needs. Additionally, communicating complex information in an understandable manner poses a challenge in data visualization for natural disasters.

4) How can data visualization contribute to disaster preparedness efforts?

Answer: Data visualization helps identify high-risk areas, vulnerable populations and potential hazards, enabling proactive planning and mitigation strategies. By visually stimulating various disaster scenarios and their potential impacts, stakeholders can better understand potential consequences and develop stronger preparedness measures.

5) What role does real-time visualization play in disaster response?

Answer: Real-time visualization provides decision makers with up-to-date information on disaster events, including event progress, cumulative impact and resource allocation needs. It allows for timely and informed decision-making, facilitates efficient coordination of response efforts and allocation of resources where they are most needed.

REFERENCES

[1] S. F. William Wresch, "*NATURAL DISASTERS DATA EXPLORER*", Journal of Global Information Management, Vol. 19(3), Pp. 30-44, 2024.

[2] M. A. I. H. E. Mohammad Anisur Rahman, "*ANTICIPATING NATURAL DISASTER IMPACTS USING DATA*," Vol. 5(1), Pp. 1-22, 2023.

[3] C. S. Yan Tian, "*NATURAL DISASTERS - BASIC EDA AND VISUALIZATION*", Vol. 10. Ch 001, 2007.

[4] S. G. C. Ranganathan, "*DATA VISUALISATIONS*," Key Dimensions of Natural Disasters Web Sites, Vol. 39(6), Pp. 457-465, 2002.

[5] D. Zanzalari, "*DATA VISUALIZATION DESIGNED TO RAISE AWARENESS REGARDING THE VARIOUS TYPES OF NATURAL DISASTERS*", 2022.

[6] M. Mutha, "*VISUALIZATION OF SOCIAL MEDIA DATA IN DISASTER RECOVERY*," Pp. 118-125, 2020.

[7] E. G. Vladimir Velikorossov, "*VISUALIZATION-BASED MONITORING IN EARLY WARNING SYSTEMS WITH WIRELESS SENSOR NETWORKS*," 2021.

[8] P. D. P. R. P. Anurag Mishra, "*PRINCIPLES FOR DATA MANAGEMENT, VISUALIZATION, AND COMMUNICATION TO IMPROVE DISASTER RESPONSE MANAGEMENT: LESSONS FROM THE HURRICANE MARIA RESPONSE MISSION*," Pp. 429-452, 2023.

[9] D. B. Mvv, "*NATURAL DISASTER DATA BOOK: AN ANALYTICAL OVERVIEW*," 2022.

[10] D. M. S. Begam, "*DATA VISUALIZATION*," Vol. 12, Pp. 214-225, 2019.

[11] G. Q. S. D. S. Alessandro Silva De Oliveira, "*NATIONAL SDG DATA PRESENTATION*," Vol. 2, Pp. 5-22, 2023.

[12] B. A. Amresh Kumar, "*REVIEW OF VISUALIZATION TECHNIQUES FOR LANDSLIDE AND FLOOD DISASTER DATA*," Vol. 45(3), P. 1281, 2023.

[13] T. S. D. Tuneklao Sinhaseni, "*THE 16 DEADLIEST STORMS OF THE LAST CENTURY*," Vol. 10(5), Pp. 50-69, 2017.

[14] V. K. S. S. Vipin Kumar, "*PAST PANDEMICS THAT RAVAGED EUROPE*," 2015.

[15] F. R. K. Noura Al-Jahwari, "*TOP 10 DEADLIEST NATURAL DISASTERS*," Vol. 6(2), Pp. 64-73, 2018.

[16] F. A. Q. Zaid Ahmad Ansari, "*THE WORLD'S WORST NATURAL DISASTERS*," Vol. 11(4), Pp. 57-64, 2018.

[17] Ö. Ö. Süzer, "*1900 GALVESTON HURRICANE*," Vol. 15, P. 155, 2022.

[18] A. G. C. Monika Kukar-Kinney, "*NATURAL DISASTERS,"* The Determinants of Disasters, Pp. 70-88, 2024.

[19] A. T. G. R. G. H. Atika Qazi, "*1931 CHINA FLOODS*," Vol. 75, Pp. 450-460, 2017.

[20] Y. M. Ginting, "*1976 TANGSHAN EARTHQUAKE*," International Journal of Data and Network Science, P. 325, 2023.

[21] V. K. S. S. Vipin Kumar, "*LIST OF NATURAL DISASTERS BY DEATH TOLL,"* 2022.

[22] D. B. Mvv, "*HISTORICAL ANALYSIS AND PREDICTION OF THE MAGNITUDE AND SCALE OF NATURAL DISASTERS GLOBALLY*," 2021.

[23] D. Zanzalari, "*NATURAL DISASTER DATA BOOK 2022: AN ANALYTICAL OVERVIEW*," 2018.

APPENDICES

A. Database Schema

This section presents the detailed schema of the SQLite database used for storing pandemic-related data, including the table structure, field names, data types, and primary key.

Field	Data Type	Description
ID	INTEGER	Primary Key
Name	TEXT	Name of the Pandemic
DeathCount	INTEGER	Number of Deaths
Continent	TEXT	Continent of Occurrence
Year	INTEGER	Year of the Pandemic

Figure: Pandemic Table Schema.

B. Code Implementation

This appendix contains snippets of the Python code utilized for various aspects of the project, including database setup, Tkinter GUI creation, data retrieval and data visualization using Matplotlib.

C. Sample Output

1. Tkinter GUI Interface.

2. Pandemic Mortality Visualization.

NATURAL DISASTERS VISUALIZATION

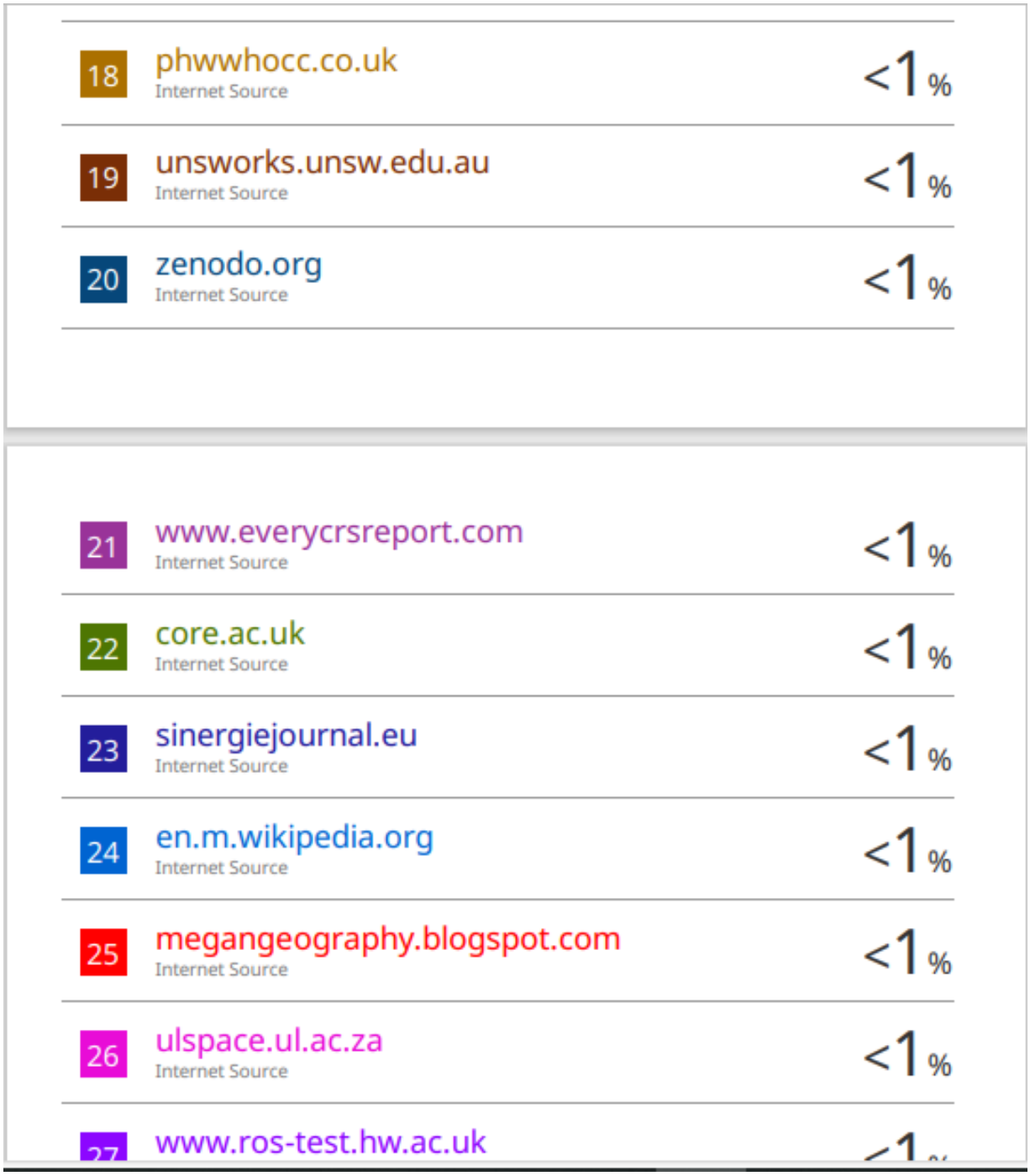
ORIGINALITY REPORT

16%	14%	4%	12%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	dspace.daffodilvarsity.edu.bd:8080 Internet Source	8%
2	Submitted to Daffodil International University Student Paper	2%
3	Submitted to British School of Commerce - Colombo Student Paper	1%
4	Submitted to University of Sydney Student Paper	<1%
5	www.mdpi.com Internet Source	<1%
6	playground.citethisforme.com Internet Source	<1%
7	safetylit.org Internet Source	<1%
8	Submitted to Brigham Young University Student Paper	<1%

9	www.eea.europa.eu Internet Source	<1 %
10	Submitted to Delhi Metropolitan Education Student Paper	<1 %
11	Submitted to Colorado Technical University Online Student Paper	<1 %
12	ruor.uottawa.ca Internet Source	<1 %
13	Submitted to University of Warwick Student Paper	<1 %
14	Submitted to Victoria University Student Paper	<1 %
15	www.citethisforme.com Internet Source	<1 %
16	Submitted to American InterContinental University Student Paper	<1 %
17	ijeecs.iaescore.com Internet Source	<1 %


18 phwwhocc.co.uk Internet Source <1%
19 unsworks.unsw.edu.au Internet Source <1%
20 zenodo.org Internet Source <1%
21 www.everycrsreport.com Internet Source <1%
22 core.ac.uk Internet Source <1%
23 sinergiejournal.eu Internet Source <1%
24 en.m.wikipedia.org Internet Source <1%
25 megangeography.blogspot.com Internet Source <1%
26 ulspace.ul.ac.za Internet Source <1%
27 www.ros-test.hw.ac.uk

22	core.ac.uk Internet Source	<1 %
23	sinergiejournal.eu Internet Source	<1 %
24	en.m.wikipedia.org Internet Source	<1 %
25	megangeography.blogspot.com Internet Source	<1 %
26	ulspace.ul.ac.za Internet Source	<1 %
27	www.ros-test.hw.ac.uk Internet Source	<1 %

Exclude quotes	Off	Exclude matches	Off
Exclude bibliography	Off		