DYNAMIC DASHBOARD FOR REAL TIME INSIGHTS ON COVID-19

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Abstract

The dashboard approach derives insights into dynamic data from Worldometer and derives various insights for the specific country and of the dynamic covid data which changes over time. The proposed system gives a dashboard which is an interactive and user-friendly visual tool for worldwide covid cases. The proposed system computes and derives insights as plots on Population Immunity, Recovery, and Risk with the population for the data by computing the probability on a statistical basis. The infection rates among the population based on countries are being compared by using plots and by statistics metrics. The countries and their level of risk of infection are being computed and visualized geographically. The level of recovery based on population and covid cases is analyzed and visualized in the dashboard. To visualize the behavior and trend nature of Covid-19, the proposed system follows a dashboard approach. The proposed system helps to identify the pattern, and trend of covid cases, and the nature of the spreading of the coronavirus geographically by the dashboard which could help WHO and health department officials in decision-making.

Keywords. COVID-19 dashboard, data visualization, Business Intelligence, recovery and risk with population, population Immunity.

1. INTRODUCTION

Covid 19 or Coronavirus is a pandemic and a communicable disease spreading globally and it is caused by the Severe Acute Respiratory Syndrome known as the SARS-CoV-2 virus. The first case was recorded in China, in a city named Wuhan, in November 2019. There was an exponential increase in the growth and spreading of the disease covid-19 worldwide. Several global countries had made statements of lockdown in the initial stages and drove vaccination to overcome this disease. This study shows the total active cases of covid 19, total deaths due to covid 19, and insights about immunity, and recovery in various countries and worldwide in a dashboard approach.

Dashboards help in decision-making and support behavior change. The user could derive insights about the virus and the growth and spreading nature of the virus globally in PowerBI. Based on the live covid data, the pattern, nature, and trend of the virus should be visualized as a dashboard approach and the insights should be analyzed for decision-making

by taking preventive measures in order with controlling the cases and reducing the deaths. Therefore, the proposed system gives the design and development of an online dashboard that visualizes the actual and live information about the COVID-19 and pattern of coronavirus in various countries using different methods. The dashboard updates dynamically based on real-time web data.

The use of the dashboard approach during the pandemic period was wide. The dashboards are used for interactive visualization in different geospatial regions. Dashboard analysis of covid 19 was the effective visual stimulation of trends and patterns of covid 19 worldwide and country-wise. The dashboard approach helps in aggregating various data from different countries and thereby helps in decision-making.

This paper focuses on visualizing the trend and nature of coronavirus globally through dashboards. The organization of the paper goes with the problem definition, briefing the existing problem in society and the need for the system for effective decision-making through visual tools, and a dashboard and it gives the objectives of the proposed system. The technology stack explains the process flow and describes statistical concepts used to derive insights from dynamic data. The module description picturizes the tools used for analysis and their overview. The results and discussion describe the dashboard approach and various charts used for real-time insights into global covid data. The future scope describes the possible future works that might be undertaken to benefit society and mankind. The conclusion part describes the decision-making in the healthcare domain through the dynamic dashboard.

2. LITERATURE REVIEW

A trend analysis of Google shows that the term “Covid-19 Dashboard” had been at its peak during March 2020. [1]

Kranthi Kumar Leela and Alphonse P.J.A analyzed the spreading and in-depth analysis of the diagnosis of COVID-19 disease which helps the clinical experts and research scientists to take necessary preventive measures for the pandemic.

Zhijun Ren [3] proposed the delivery of a standard Business Intelligence solution with the help of Microsoft Business Intelligence tool and he concluded that blending several technologies which include databases, connectors, business intelligence tools, and SharePoint servers leads to business intelligence solutions in an organization.

The author Guangzhi Zheng [4], in his work, had performed an exhaustive study of practical applications of business intelligence and realized the need for business intelligence to aid in decision-making in the healthcare domain.

Abel Brodeur, David Gray, Anik Islam, and Suraiya Bhuiyan’s studies show the economic and financial effects and disturbances of COVID-19.

Hector Florez and Sweta Singh [11] developed a dashboard and developed a mathematical model to project the cases and deaths evolved by country.

The existing research aims to derive useful clinical and health-related information in social media platforms like Twitter data using topic clustering and sentiment analysis to understand the public nature of covid-19.

The Covid-19 dashboard approach of the World Health Organization derives insights into the trends and patterns of the coronavirus and their peak during the covid waves but does not have information regarding the countries which were prone to the risk of coronavirus and their mode of recovery. The proposed system derives interactive and valuable insights based on the risk and recovery rates of various countries worldwide.

3. TECHNOLOGY STACK

3.1. ETL Operations

The live covid data is being extracted from the sources from the worldometer website. The data is extracted as a live table. The columns in the dataset have the live data as of the date (15.07.2022) of various attributes. The missing values and null values are being replaced with 0 in Power Query Editor. The extracted data is transformed based on their column values. The data type of the columns is transformed based on the data points in Power Query Editor. The transformed data is loaded in the PowerBI for dashboard generation.

3.2. Statistical Analysis

The statistical metrics such as population immunity, recovery rate, and risk with population measures are calculated from the data. The new parameters from the dataset are derived for visualizing the insights in the dashboard. Population immunity tells the extent to which the particular country is exposed and immune to the covid-19 disease. The parameter population immunity for various countries is derived by computing the probability of total deaths over total cases.

Population Immunity = 1 - (Total deaths / Total cases)

The recovery rate of the country shows the overall chances of surviving or recovering from the covid-19 of the overall country's population. The recovery rate of various countries is calculated by comparing the population immunity. The countries with population immunity greater than 0.95 are categorized as Strong Recovery countries. The rest of the countries with population immunity less than 0.95 are classified as Weak Recovery countries. These countries will be of less immunity in nature and will be in danger in the next wave of Covid hits a particular country.

if (Population Immunity (Countries) > 0.95), Strong Recovery

else, Weak Recovery

The parameter risk with population analyses the risk of rising cases to their peak in the population of the country. It is derived by comparing the total cases per 1 million population. If the overall corona cases per million population are greater than 5000 then the countries are categorized as High-Risk countries and the values between 1000 to 5000 are classified as Medium risk countries and the rest as low-risk countries.

if (Total Cases / 1M Population >= 5000), High Risk
Elif (Total Cases / 1M Population > 1000 && <5000), Medium Risk
else, Low Risk

4. MODULE DESCRIPTION

4.1. Data

The live covid-19 dataset from the web has daily information on the coronavirus containing the data fields of the globally affected cases, overall deaths, and active cases by a novel coronavirus. This is a time series value of real-time data, hence the data of the cases on a specific day is the cumulative value of the previous cases to date. The real-time data in the table from the webpage is updated daily after midnight GMT+0 (Greenwich Mean Time). The update in the live data is being reflected in the dashboard. The dashboard updates dynamically when the web data refreshes. The dashboard updates dynamically based on the live data. The real-time dynamic covid data about the cases of coronavirus infections were obtained from the Worldometer website (https://www.worldometers.info/coronavirus/). The worldometer website has the same live dataset size as on date in the web. The live data from the web is ingested into PowerBI as tables with the attributes.

4.2. Power Query Editor

Power Query Editor is used for performing ETL operations for loading the dynamic covid data in PowerBI through the on-premises gateway. Power Query Editor helps in transforming the data from the web, based on the attributes needed for ingesting or loading the data for dashboard generation.

4.3. On Premises Gateway

Power BI Gateways and Power BI Connectors help in creating interactive dashboards for the dynamic data and generating reports. Power BI Gateway is the component that helps in web scraping the data from various data sources with the help of connectors and protocols. [2] The different data sources may be data from cloud platforms, data from other databases, and data from the web. The real-time data from the worldometer website is ingested in the PowerBI by the on-premises gateway.

4.4. Power BI

Microsoft Power BI is a tool for business intelligence and data analytics, for decision making by the insights obtained from the interactive dashboards. Power BI supports publishing reports and dashboards and sharing with peers within the organization. The interactive and dynamic visualization charts for the live data such as area charts, stacked charts, treemap, bubble plot, cards, gauge charts, slicers, matrix, histogram, line chars, pie chart, doughnut chart, and geospatial map helps in better visualization and decision making through reports and dashboards. Map creation for visualizing countries is done by the choropleth option or by adding a vector layer in GIS maps.

5. RESULTS AND DISCUSSION

The goal of the dashboards in COVID-19 is to visualize the cases globally and to create awareness among individuals by analyzing the trend of coronavirus. Dashboards act as intelligent decision tools and guide in monitoring and guiding proper decisions promptly. The usage of intelligent dashboards ranges from monitoring the coronavirus and its infection and initiating preventive measures like social distancing and wearing masks and enforcing strict regulations in geographical areas or regions with high risk and low recovery from

covid-19. This dashboard was created on 15.07.2022. The results discussed were specific to the particular date. However, the dashboard updates daily, and the everyday results could be tracked and inferred for decision-making.

5.1. Risk level and Recovery level of countries towards Covid-19

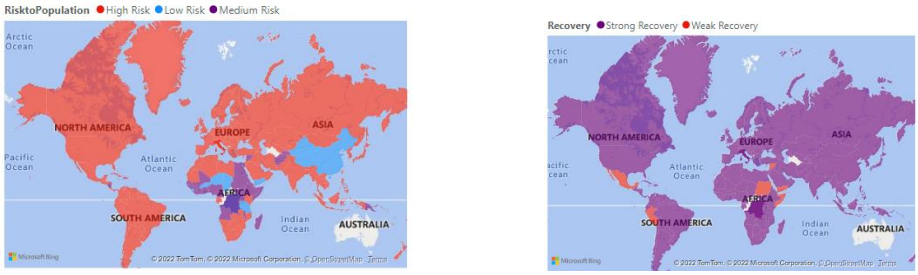

Figure 5.1 Filled map (Chloropleth) – (a) Risk to population (b) Recovery

Figure 5.1 (a) categorizes the countries based on risk with population. All the American, European and Asian countries were highly at risk with population. African countries such as Egypt, Ethiopia, Mali, Nigeria, Sudan, and Madagascar were at medium risk with population. The countries such as China, Tanzania, and Chad were at low risk of Covid-19. China being the first largest populated country, is at Low risk of infection at present. The decline in cases in China over days due to various reasons such as vaccination and following government protocols such as social distancing is the major reason for China being in low-risk countries.

Figure 5.1 (b) shows the recovery of countries. The lightly shaded regions show weak recovery from covid-19. Globally, many countries except a few show strong recovery from covid-19. This study says that even if another wave hits up due to mutations of coronavirus, the maximum number of countries have a high level of recovery even if they were at high risk to the population. The countries such as Mexico and Peru show low recovery and high risk with the population. These two countries should be targeted and necessary preventive measures should be initiated by the WHO to reduce the future impact due to covid-19.

5.2. Real-time Cumulative Active Covid-19 cases

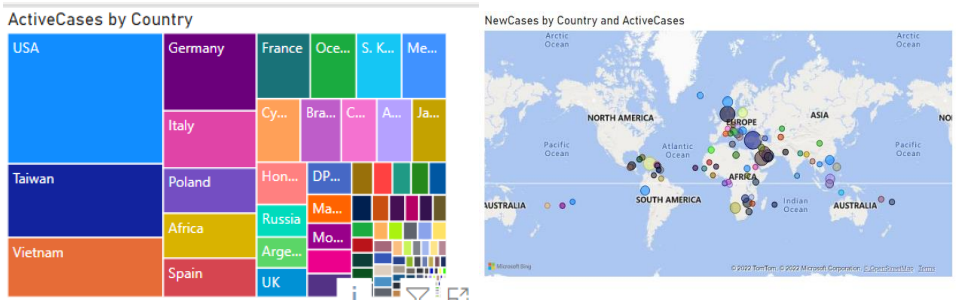

Figure 5.2 (a) Treemap - Active Cases by Country (b) New cases by Country

Figure 5.2 (a) shows the active cases of covid-19 on a particular day in all countries as a tree map. The larger rectangles show the countries with a greater number of covid-19 active

cases. The space inside each rectangle is allocated based on the value of the active covid-19 cases. Treemaps can be used to find the largest values of hierarchical data, and to show the pattern of distribution of data in the hierarchy. The USA, Taiwan, and Vietnam rank the top most active cases recorded. However, Taiwan records the second maximum daily covid cases, China is at a low level of risk of coronavirus.

Figure 5.2 (b) shows the daily new cases of covid-19. Each bubble in the geographic map represents a data point of a country. The size of the bubble represents the number of new cases and active cases in a country. The horizontal position on the x-axis in a bubble chart represents the new cases recorded in a country. The vertical position y-axis in a bubble chart represents the cumulative sum of active cases in the country.

5.3. Real-time rise of covid-19 cases

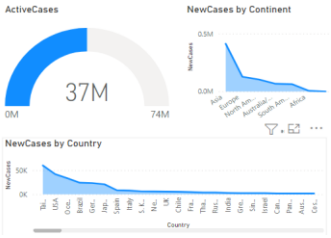

Figure 5.3 Gauge Chart - Active Cases

Area Chart - New cases by continent, New cases by country

Figure 5.3 shows the gauge chart which is an indicator for detecting the rise in cases globally and it acts as a decision tool to suggest preventive measures like imposing lockdown if the indicator level crosses the limit. The area chart shows the rise in new cases in countries by continent. It gives the magnitude of change of covid-19 cases across different regions. The Asian and European countries register the maximum number of new covid cases daily. The Asian and European countries such as China, Italy, Germany, Spain, Nepal, and France record the maximum number of new cases. Though they have an increased number of new cases, their level of risk to coronavirus and their mode of recovery rate is optimum. Hence, even if there were a rise in new cases the immune nature of the population helps to overcome the situation without any emergency in those countries.

5.4. Dashboard for decision making

Figure 5.4 (a) Slicer - Risk and Recovery (b) Dashboard - Active Cases

Figure 5.4 (a) shows the dashboard with a slicer containing the values of Risk and Recovery features calculated based on probability and statistical measures. The countries of Mexico and Peru were at high risk of covid-19 with a weak recovery rate from the disease. The World Health Organization should identify such countries periodically and suggest measures to improve the recovery and risk rate. The suggested measures may be of following and regulating the protocols like social distancing and increasing vaccinations. Figure 5.4 (b) shows the dashboard containing the slicer showing the range of cumulative active cases of Covid-19 globally. The slider value could be adjusted to see the varying number of active cases given the input range, which displays the countries of that particular range of active covid cases in various countries in the dashboard.

6. CONCLUSION

The COVID-19 dashboard enables analysis of COVID-19's behavior and pattern. With the use of a dashboard, it is possible to see which nations have been most negatively affected by the coronavirus. Decision-making in the healthcare sector is aided by knowledge of the nations with a high risk of coronavirus infection based on their population and rate of recovery. By analyzing and identifying the countries that are at risk and the countries based on recovery rate, the dashboards assist in decision-making. The produced dashboards can be accessible over the web, for as through a website or shared link inside the organization, or via mobile applications like Power Apps and Mobile Power BI. Government leaders and healthcare domain specialists worldwide could make decisions based on the Covid-19 dashboard.

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Biographies

Dr. A. Kannammal is currently working as a Professor and Head of the Department of Decision and Computing Sciences, Coimbatore Institute of Technology, Coimbatore, India. She completed her Ph.D. in Computing Science from VIT University in 2007 and her MCA from IGNOU in 2001. She has completed research projects funded by the All India Council for Technical Education, Department of Science and Technology, and Indo-US Science and Technology Forum, with research grants of close to 50 lakhs. She is currently serving as the Research Consultant for an industry research project jointly funded by the Indian and Sweden Governments, under Indo-Sweden India Sweden Collaborative Industrial Research & Development Programme. A member of many professional bodies like IETE, ISTE, CSI, IARCS, and IACSIT, she is serving as a reviewer for many journals like IEEE Transactions on Cloud Computing, International Journal of E-Commerce Research and Applications, Elsevier Publications, and many conferences. She is an Editorial Board Member (Editor) of a few international journals.

R.R. Venketesz is a final year integrated M.Sc Decision and Computing Science student from Coimbatore Institute of Technology, Coimbatore. His initial career in the Geo Data Science industry pushed him to go further in discovering more things about it. He has done a project for PUDA (Punjab Urban Development Authority) under the guidance of Dr. Ramji who was a former research scientist in DRDO, Integrated Test Range. He completed Rashtrabhasha Praveen from DBHPS in 2014 and currently he is pursuing a B.A Hindi (Hons) from IGNOU. He is motivated to join a group of seasoned and experienced professionals in the industry.

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