

Geospatial Dashboards for Mapping and Tracking of Novel Coronavirus Pandemic

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Abstract

In mid of December 2019, Wuhan sea food, China a new mysterious illness was reported lately called Coronavirus (COVID-19, The virus triggered a severe respiratory disease, rapidly speeded to many other states of China and around the world. COVID-19 is a new strain that had not been previously identified in humans. Hundreds of millions of people have been placed in some form of isolation. Governments announcing country wide lockdown while declaring the emergency to fight the sharp rise in coronavirus infection. The epidemic's consequences are devastating, currently around the globe more than three million confirm cases reported. Unfortunately, we are still counting the days, the cases and, most sadly of all, the deadly virus has taken more than three hundred thousand lives. The World Health Organization (WHO) officially has called Covid-19 a Pandemic. The previous viruses SARS-CoV, Avian Influenza, MERS-CoV and the Ebola, emerged the geographic information system , remote sensing applications , mapping and tracking techniques and social media platforms were provided an indispensable support for appropriate, accurate and timely response in the epidemic outbreak. The aim of the research is to critical review the development of geospatial dashboards which are using in real time monitoring and providing decision support in terms of visualization and integration of mapping in Covid-19 pandemic. This paper presents a comparison of Covid-19 geospatial dashboards and key technologies and applications use to fight with deadly virus.

Keywords

Coronavirus, Remote Sensing, Geographic information system, WHO, Geospatial dashboards,

1.Introduction

In mid of December 2019, Wuhan sea food, China a new mysterious illness was reported lately called Coronavirus (COVID-19, The virus triggered a severe respiratory disease, rapidly spread and affecting more than 210 countries and territories around the world. Compared to previous respiratory syndrome SARS-coV in 2002 & 2003 and Middle East respiratory syndrome (MERS) in 2012-2013, this new mysterious COVID-19 disease spreading very quick and reckless. The MERS had taken around two and half year to infect 1000 people, whereas SARS took around four months. The COVID-19 rapidly spreading. On Jan-30 the World Health Organization (WHO) officially has called COVID-19 a pandemic. As today, 16th September 2020, the deadly Covid-19 took more than 931,321 lives and more than 2.9 million infected cases reported in the span of December 2019 to September 16th, 2020(WHO, 2020).

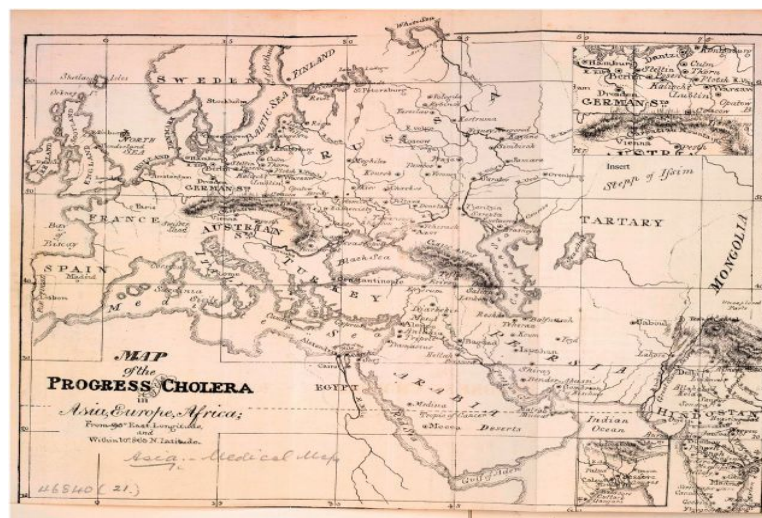
Coronavirus having a profound and severe impact on the world economy. Globally the COVID-19 shook the whole world and considering that the virus is more severe than the Great financial crisis 2007-2008. As it hit the business, financial institutions, international and domestic trades, and markets worldwide. Currently as of today 16th November 2020, the total number of confirmed cases is, 54,301,156, the death reported number is 1,316,994, reported to WHO.

The Geographic mapping and tracking dashboards provided an indispensable support when the previous viruses SARS-CoV, Avian Influenza, MERS-CoV and the deadly Ebola spread (Abid et al., 2020).

To measure the Covid-19 pandemic information, different geospatial dashboards have been developed for different geospatial regions. These information come up with maps and visualization and gaining significant attention from individual to industry professional, government agencies and private personnel because of indispensable support and provides a geospatial nature of information as the Covid- 19 pandemic outbreak, we need as sustainable resilient environment by this geospatial dashboards were developed to support current decision systems. Right now, reportedly from WHO, as of 13th October, more than thirty-seven million confirmed cases have been reported with shockingly over one million deaths reported globally. Massive volume of geospatial data in terms of geospatial visualization are generated and used on daily basis to analyze the pandemic trends. Therefore, geospatial dashboards are using to support and visualize the geospatial data and mining spatiotemporal patterns. The geospatial dashboard tracks every country performance and supporting the sustainable goal by building resilient communities. As still we are counting the Covid-19 cases and it is expanding the geospatial data also generating rapidly and this has been produced a paradigm shift towards a Covid -19 pandemic research which has fostered the different types of geospatial dashboards. Every dashboard has different characteristics which are collaborated to the government agencies to monitor the Covid-19 situation.

The need of geographical mapping and tracking increasing with the passage of time(Graham et al., 2011). Maps have long been to moor viewers in space and time, getting the information of roads, hospitals, populations or even the disease case. Maps also tells stories of disease patterns, outbreak, and cost of care variations. The global disease is traced form its beginning in the 18th century and 19th century. The health and maps pioneer critiqued that the mapping relationship between place and health was in 1694 on plague containment in Italy. Later on the first-time map was introduced for the Cholera pandemic in 1819, a violent disease Cholera was reported in British army in sub-continent area and spread to middle east, Russia and trough Europe, The Lancet mapped was published in 1831 constructed the first map by identified fifteen different kinds of Cholera , spread to different location. The maps as communication tool in health disease gain significant importance from last couple of years and proving a timely support to understanding and tracking infectious diseases, such as yellow fever, cholera and the 1918 influenza pandemic and Ebola.

Figure 1: The 1831 map of cholera published in a Lancet article provides a convenient birth date for the birth of global health as a concept.



The application of geography and tracking system to health and epidemic have been cited by many authors and it has been found that the GIS and its application has contributed a lot to fight to the pandemic disease and other health

related issues. From 1694 to 2020 we have seen revolution in health geography through these dashboards and web-based tools. These tools protect human lives from deadly pandemics, by displaying the data from other sources. These tools and systems working together in this difficult time as the COVID-19 unfolds more than 200 countries and patients infected day by day.

The paper reviews and describes the unique kinds of geospatial dashboards and their application, the vital machineries, the design, and the visualization of dashboards. And find out the most reliable geospatial dashboards in terms of architecture approach, modeling the data and the visualization appearance in terms of geographical region, for monitoring and tracking the COVID-19 epidemics and the related incidents. These systems receiving the updated information in near-real-time, and how these dashboards can support and fight against the COVID-19 outbreak and epidemics.

2. Methodology

To understand the role and importance of geospatial dashboards in COVID-19 requires a systematic protocol for getting important information, knowledge, data and reviewing the online and published literature. The aim of the research is to critically review the development of geospatial dashboards which are used in real-time monitoring and providing decision support. A web-based content analysis is used to investigate the information of COVID-19 pandemic.

Therefore, different COVID-19 live dashboards, live websites such as World Health Organization (WHO) website, Johns Hopkins University, Worldometer and many other related to COVID-19 information websites have been selected for data gathering. The scope of this research was documentary; the source of information and the unit of analysis of the research were the reports of information of COVID-19 derived from websites and dashboards, occurred during the 2019-2020. This gives the following statistics of the dashboards, dashboard Name, Datasets, Scope, and purpose.

3. Literature Review on COVID-19 Dashboards

3.1 The World Health Organization COVID-19 Dashboard

The World Health Organization (WHO) is a specialized agency of the United Nations and responsible for international health issues. WHO has played a leading role in the several public health pandemics most notably Polio, Ebola and now the new pandemic COVID-19. The WHO composed of 194 countries member states across the globe. The WHO states its objectives, is the accomplishment of every single individual with the highest possible level of health. In the current devastating scenario, the WHO connected directly to its members and combating the Coronavirus through preparedness and response and providing Geospatial technology to its beneficiaries. The WHO unveiled its online web-based dashboard on 26th January 2020, for COVID-19. The dashboards cover the COVID-19 cases and total number of casualties of every effected country with accurate information by plotting the data on map.

The WHO dashboard is a detailed dashboard that provided other information related to COVID-19 like epidemic curve up front, reporting cases with actual deaths. WHO dashboard also reflected laboratory confirmed cases. Whereas the John Hopkins University dashboard had some interesting and unique differences with WHO dashboard. The John Hopkins University dashboard includes cases diagnosed with symptoms of chest x-rays. The WHO dashboard provides other disease information also, when we click the top right corner menu button the dashboard showing the disease such as fever, dengue, Ebola etc. The WHO dashboard updates the data daily by using the ARCGIS Geo Server. The WHO dashboard is very user friendly and easy to operate on mobile phones devices as well. The mobile phone user also getting the accurate information under simple operation.

The WHO online web-based dashboard/map provides the latest global numbers and numbers by country of COVID-19 cases daily. Globally, reportedly from WHO, as of 13th October, more than thirty-seven million confirmed cases have been reported with shockingly over one million deaths reported globally (WHO, 2020).

3.2 Johns Hopkins University COVID-19 Dashboard

When the disease spreading the information has also passed even more quickly. In this scenario the map-based dashboards are so crucial and valuable. Currently there are many dashboards of Coronavirus who are providing valuable information and accumulating over 160 million viewers.

The first dashboard published on 22 January 2020, in the response of COVID-19, The John Hopkins University online web dashboard. Currently this dashboard gathering more than 140 million viewers across the globe. The Johns Hopkins University dashboard providing COVID-19 information of different countries of actual cases reported, the deaths and the recovered patients from the deadly coronavirus. The John Hopkins University dashboard getting the geographical statistics from World Health Organization (WHO), Chinese Center for Disease Control and

Prevention (CCDC), ECDC (European Centre for Disease Prevention and Control) and other government health officials' institution.

The graphical representation of John Hopkins University dashboard provide virus detailed over time information of every country and giving comparison of susceptible area to other country red zones (Johns Hopkins University, 2020).

3.3 Covid 19 INDIA- Dashboard

In India, the first Covid-19 case was reported on 30th January, since then Indian government took quick action to stop the spread of covid-19. From day one the ministry of health India took initiative to launch the first covid-19 dashboard for India. India currently have the greatest number of cases in Asia and after the United States Indian has the second highest number of cases in terms of confirmed cases. As of today, 16th of November Indian has 8.85 Million confirmed cases with more than one hundred and thirty thousand deaths reported from the period January 30th, 2020 to November 16th, 2020. Ministry of health and family welfare is the main agency who leads the whole process in India and getting relevant information in terms of confirmed cases, deaths, total test count per day from other local authorities and compiling the data. Ministry of health launched the first Covid-19 dashboard in end of January and displaying the information on his website.

On the website of ministry of health the data is live for whole day, displaying the cases by active number of cases, discharged, change in cases from yesterday, total death count and change in death with mentioning the arrows. In Indian Covid-19 dashboard, they also providing the state wise status of Covid-19. They have news option as well and an awareness portion for latest updates (Government of India, 2020).

3.4 Newslab-Malaysia Online webpage-Covid-19 Dashboard

Newslab Malaysia map is the Malaysian based map providing information of the Covid-19 patients. The Newslab is focusing on the Malaysian Covid-19 perspective. In Malaysia, Covid-19 first case was registered on 3rd February 2020, as from very first day the Malaysian government launched the Newslab Malaysia map. The Newslab Malaysia online webpage providing data from whole Malaysia. It represents growth in number of cases, daily increase in cases and patient treatment.

The graphical representation showing cases by States and further explains each district Covid-19 cases. As of today 16th September 2020, the total cases are 10,031 are confirmed cases, 668 are under treatment and 9235 were discharge so far. 128 deaths are reported till today. The Newslab also providing the number of patients by cluster. The Ministry of health is the main data provider that connected with all the other agencies and plotting the map of Covid-19 (Malaysiakini, 2020).

3.5 Channel News Asia (CNA)- Covid-19 Dashboard

Channel News Asia is news network company. Based in Singapore and corresponds to major Asian cities. CAN televisions in viewed in more than twenty-nine territories and the users can also get the data online through social media platforms such as Facebook, Twitters, and Instagram etc. When the Covid-19 pandemic outbreak worldwide Singapore is one of the countries who have confirm cases after China. The first case of Covid-19 in Singapore was reported on 23rd January 2020. By late march and April of 2020, multiple cases were detected in Singapore and the government officer held senior level meeting in response of Covid-19 cases. Soon after the Channel news Asia developed a Covid-19 dashboard. The CAN dashboard connected with the Ministry of health Singapore and other health organization such as WHO to get the live data. Channel News Asia Novel Covid-19 map displaying the cases globally. In the top right side of the map the confirmed cases, reported deaths and the recovered cases was displayed. In the left side they have a list of countries with detailed number of Covid-19 cases (Channel News Asia, 2020).

3.6 Malaysia Covid-19- Outbreak Dashboard

Malaysia Covid-19, outbreak dashboard is developed by Non-Government organization with the support of Ministry of health Malaysia (Malaysia COVID-19- Dashboard, 2020). The outbreak dashboard is very detailed and specialized dashboard having different features, getting different visualization graphs on new cases per day, number of people tested per day, new recovered cases versus new cases, new deaths reported and the cases reported by states. There is unique feature in outbreak Malaysia dashboard is the details of every case reported with the actual date of the case reported along with the patient details such as gender, nationality, and age of the patient. Further the outbreak dashboard has facility is to guide citizen of Malaysian to know how the current situation by giving information through location of tracking map. When we click on the location tracking map a new window will open

to give us information about the places where we cannot go and avoid places where cases are reporting and the area are marked with red circle color. (Malaysia COVID-19- Dashboard, 2020)

3.7 Worldometer Covid-Dashboard

Worldometer is online private website and part of real time statistics project-based company was previously providing statistics on diverse topics such as population, economics, environment, society government health and energy projects. When the Covid-19 outbreak the worldometer launched his Covid-19 dashboard and providing a reliable data of coronavirus patients around the world,

The Worldometer statistics is trustable and based on real values using by Johon Hopkins, the Government of Pakistan, Government if United Kingdom, government of Thailand. Very renowned media big houses, The New York Times, the British broadcasting centers, The Financial times and may others.

Worldometer is considered as unique and dependable source in term of published books. Over 6000 journal articles and more than 10000 published books were votes for the best reference online data base and in used in American library Association (ALA). The ALA is one of the largest and oldest library association in the World.

The World meter team collect the large volume of data from different government agencies and process it regularly. The team of professional data analysis and researcher working fast to uploading the Covid-19 information as soon as official announcement made. The Worldometer dashboard is very user friendly, the graphical representation of data is unique and very easy to understand. More than 210 countries of data are uploaded on the dashboard and it is continuous updating. This Covid-19 dashboard showing data in term of total cases, total new cases, total deaths ad total new deaths per day, total recovered patients, and total active cases. It is also displaying the serious and critical patient of each countries under separate county heads(worldometer, 2020),

3.8 The Center for Coronavirus Information -ncov2019.live Dashboard

The ncov2019 dashboard is develop by a high schooler Washington State, USA, initially they develop only for United State of America and later they developed for the whole world. The data received from local government websites, hospitals, and health departments. The nco2019 dashboard displaying the world Covid-19 details by providing the world population data and details by per million for total number of confirmed cases, deaths and recovered cases.

Further in ncov live dashboard differentiate the Covid-19 cases by different continents, such as Asia, Europe, south America and South America and additional details by separate country information with total number of confirmed cases, cases actives, case per million according to the country population, changes case per day and the also giving information of the critical patient, deceased per million, total recovered cases and number of total test already being done. As per ncov.live more than nine hundred and ten million Covid-19 test has been done globally. Whereas, in Asia approximately four hundred and sixty million tests, In Europe two hundred and eight million test has been performed. As for as, in United States of America, the number of test count is more than one hundred and seventy million.

Table 1 Geospatial Dashboards for COVID-19
Source: The Researcher (2020)

S.no	Dashboard Name	Datasets	Scope	Purpose
1	World Health Organization (WHO) (COVID-19) Dashboard (https://covid19.who.int)	Official data from World Health Organization	Global	Visualization of daily counts Confirmed cases and deaths related to COVID-19, With time stamps using Esri ArcGIS Online service Exploratory data analysis using 3D graph to perform country-wise analysis using population, confirmed cases, Cumulative cases, deaths, and cumulative deaths Provides daily aggregate case and death count in CSV

2	Johns Hopkins University, COVID-19 (https://coronavirus.jhu.edu/map.html)	Data from World Health Organization, European Centre for Disease Prevention and Control (ECDC), World Meters, BNO News, US CDC, 1Point3Arces, COVID Tracking Project and DXY	Global	Dashboard for visualizing Real-time mapping of COVID- 19 With graphs on confirmed and daily cases Critical trend analysis on new cases per day, mortality and fatality analysis in population, timeline of outbreak, etc.
3	COVID19INDIA, (https://www.covid19india.org)	Chief Minister Office, Health Minister, Official Press Trust of India, State Press bulletins, PBI and ANI reports	India	Provides API on corona dashboards to visualize Cases at district and state level, hotspots, Treatment centers, testing labs, quarantine centres, Containment zones, lockdown issues, hunger relief, hunter and night shelters
4	NewsLab Malaysia, (https://newsLab.malaysiakini.com/covid-19/en)	Malaysian Government official data, Daily news, Ministry of health Malaysia, All states agencies	Malaysia	The Ministry of health Malaysia is the main data provider that connected with all the other agencies and plotting the map of COVID-19. Critical analysis of state wise cases, Graphical representation of cases, patient in treatment, active cases, Cases by district, key announcement, Cluster by cases, positive and negative cases.
5	Channel News Asia, (https://infographics.channelnewsasia.com/covid-19/map.html)	Singapore Ministry of health data, World Health Organization, Daily News bulletin, Official television	Global	Mapping of Daily cases reported deaths and discharge patients, Visualization of data representation through different graphs. Links with Singapore health ministry, official news channels and newspaper. Provides latest breaking news of cases reported. Three column table depicting the place, Confirmed cases and reported deaths.
6	Malaysia COVID-19- Dashboard	Malaysia/	Malaysia	Geospatial Dashboard for

	(https://www.outbreak.my/)	International Date from States local agencies, Ministry of health is the main source of data		visualizing real-time mapping of COVID-19 Outbreak.MY Provide details on the number of confirmed cases, deaths Stats for outbreaks in Malaysia & the world by visualization. Data representation by Gender Age Group: Admitted Hospital Details Provided by MOH Imported Local Resident/Non-resident Hospitalized /Discharged/Deceased: Confirmation Date: Age Case no:
7	Worldometer dashboard	World Health Organization, U.S. Centers for Disease Control and Prevention (CDC), National Health Commission (NHC) of the People's Republic of China, Australian Government Department of Health, Early Transmissibility Assessment of a Novel Coronavirus in Wuhan, China, Transmissibility of 2019-nCoV , Imperial College London , UK Government, Johns Hopkins CSSE, the Government of Thailand, the Government of Vietnam, the Government of Pakistan, Financial Times, The New York Times,	Global	Worldometer manually analyzes, validates, and aggregates data from thousands of sources in real time Provides global COVID-19 live statistics for a wide audience of caring people around the world. Worldometer statistics based on real values using More than 210 countries of data are uploaded on the dashboard and it is continuous updating. This Covid-19 dashboard showing data in term of total cases, Total new cases, Total deaths and total new deaths Per day Total recovered patients, and total active cases. It is also displaying the serious and critical patient of each countries under separate county heads

		Business Insider, BBC, and many others.		
8	The Center for Coronavirus Information -ncov2019. live Dashboard	WHO, Ministry of Health United State, Local Government Health department Websites,	Global	Covid-19 global details by providing the world population data, details by per million for total number of confirmed cases, deaths and recovered cases. No of cases by different continents, such as Asia, Europe, south America and South America and additional details by separate country information with total number of confirmed cases, cases actives, case per million according to the country population, changes case per day and the also giving information of the critical patient, deceased per million, total recovered cases and number of total test.

4. Challenges and Future Directions

The geospatial dashboards are heavily depending on the development of technology as these dashboards are interdisciplinary and seeking attention from interdisciplinary fields, such as medicines, aviation, geographical and remote sensing techniques, urban planning from resilient communities. We are on the verge of 4th industry revolution, by integrating and combining spatial dashboards with artificial intelligence and big data would give and open more avenues on decision support and research on visualization.

5. Conclusion

The innovative Spatial technologies, web-based tools, monitoring and providing a real time data, tracking, and mapping with improved data are playing a vital role in critical decision making (Abid et al., 2020). Increasing disaster resilience involves a focus on the strength and sustainability of a community's lifelines, as well as strengthening the relations between people, services, systems, and structures that support the community to function (Sulaiman et al., 2019). Mapping dashboards as discussed above giving live and update information have been extremely popular in sharing and understanding the spread of coronavirus. In the situation of lockdown these dashboards giving accurate data from all over the world in a single web address. Interaction through online map-based dashboards offers friendly information to people around the world eager to protect themselves and their families. These dashboards enhance data transparency and helps government authorities disseminate information. The dashboard depicts the future trends and providing a timely information to fight this pandemic. Certainly, the dashboards are providing indispensable support and creating awareness in panic condition. These are the powerful tools providing a new capability to under crisis situation, not only for Covid-19, but the mapping dashboards techniques are also familiar even to young children who have become accustomed to the Google Map and similar services. We must believe that how Covid -19 mapping dashboards can support the entire process of deadly disease outbreak.

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