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Application of GIS in COVID -19 Monitoring and Surveillance

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Abstract: COVID-19 is a virus part of corona virus family that causes a range of familiar disease from the common cold to SARS, COVID-19 is referred as novel corona virus because it is new to human. According to virus it spread from one person to other person through contact. So research public health practices and guidelines, one of the tool to our society can use to understand the disease is Geographic information systems (GIS) provide the utilization ,easy access and manipulation of geospatial information. The main advantage of GIS is mapping the many different locations of country and other facilities with human on a dashboard which helps in better monitoring and surveillance. Also, detailed studies are possible with respect to diseases forecasting, prediction of outbreaks, identification of disease cluster or hotspot and to evaluate different strategies to prevent the spread of infectious diseases.

Geospatial industries have come to rescue in a lot of crises and disasters by boosting relief and rehabilitation efforts. In the case of COVID -19 geospatial communities is proactive in tracking the spread of the virus. Constantly updating the number of people affected and providing real-time information company like ESRI, CSSE(JHU)which help to manage disaster mapping and helping agencies with data gathering it helps to transfer the data in dashboard , Apps, Information and data using the GIS technique GIS operations, mainly overlay analysis, buffer analysis, network analysis, statistical analysis, query, time series analysis, temporal cluster analysis, spatial-temporal analytic techniques to identify the catchment areas, vulnerable groups, health centers, movement of carriers etc.GIS provide ideal platform for the convergence of disease- specific information and their analyses in relation to population settlements, surrounding social and health services and the natural environment.
Keywords: Covid-19, GIS, Dashboard, Data, Surveillance

I. INTRODUCTION

A geographic information system (GIS) is a computerized information system in which user can capture, analyze, manage, present, retrieve, store, manipulate and share all types of spatial or geographic data. GIS is user friendly computer software which can show many different kinds of data on one map or dashboard and enables user to analyze and interpret data on different locations plotted on map to understand relationships, patterns, and trends.

GIS provide ideal platform for the convergence of disease-specific information and their analyses in relation to population settlements, surrounding social and health services and the natural environment and provide data which are highly suitable for analyzing data, revealing trends.

Surveillance is a mechanism applied to collect and interpret data on the health of human populations, to accurately describe their health status with respect to specific diseases of concern. In general, surveillance is aimed at demonstrating the absence of disease or infection, determining the occurrence or distribution of disease or infection, while also detecting as early as possible exotic or emerging diseases.

Human health surveillance is an essential tool to detect disease or infection, to monitor disease trends, to facilitate the control of disease or infection, to support claims for freedom from disease or infection, to provide data for use in risk analysis, for public health purposes, and to substantiate the rationale for sanitary measures. Human Disease Surveillance is a key for improving disease analysis, early warning and prevents the spread of diseases .Surveillance is used for the detection of new or exotic diseases while monitoring is aimed at detecting changes in established or endemic infection levels that may signal the recurrence of a disease outbreak.

Monitoring of the epidemiological patterns (Human, place, time) of diseases and pathogens within populations provides a vital system for the identification of changes in disease status within this population (whether this relates to all human worldwide, or those within a single country, region, cities or village). For this reason, most countries have systems that prevention is better than cure. Techniques such as human landscape monitoring, Spectrum monitoring tool, Hexagon dashboard and smart App

II. COVID-19

Corona or the covid – 19 is the very big pandemic the world has witnessed. The first human cases of COVID-19 were identified in Wuhan City, China in December 2019. It has killed thousands of people ,disrupted supply chains brought the global economy to a standstill and caused lockdown of entire cities all over the world airports and railway stations are empty, shuttered offices and work from home have become recurring feature due to this outbreak. Government and health ministry advisories and quarantine the infected, a lot of organizations are working on the ground to provide visualization of the affected areas along with real-time situational awareness. It can be prevented by frequent hand washing, covering the mouth and nose when sneezing and avoiding close contact with anyone showing symptoms of respiratory illness. The virus that causes COVID-19 is mainly transmitted through droplets generated when an infected person coughs, sneezes, or speaks it can spread by breathing in the virus if you are within 1 meter of a person who has COVID-19, or by touching a contaminated surface and then touching your eyes, nose or mouth before washing your hands. COVID-19 survives on surfaces COVID-19 may persist on surfaces for a few hours or up to several days. This may vary under different conditions (e.g. type of surface, temperature or humidity of the environment).
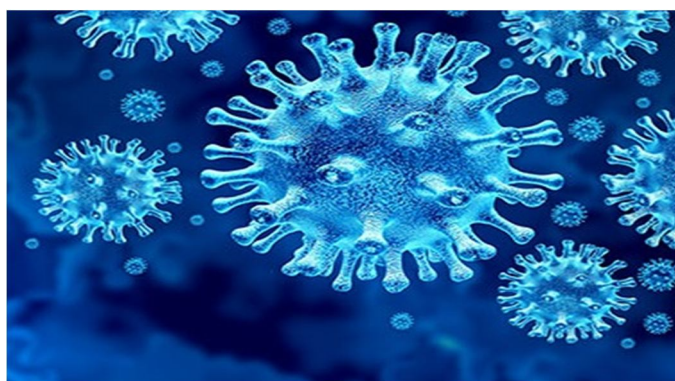
Structure of Covid - 19 virus

The "incubation period" means the time between catching the virus and beginning to have symptoms of the disease. Most estimates of the incubation period for COVID-19 range from 1-14 days, most commonly around five days. Mask which covering face should be in good condition and Discard the mask in a closed bin immediately after use. Perform hand hygiene after touching or discarding the mask – Use alcohol-based hand rub or, if visibly soiled, wash your hands with soap and water. There is no vaccine and no specific antiviral medicine to prevent or treat COVID-2019.But traditional or home remedies may provide comfort.

III. GIS AND HEALTHCARE

GIS is being used to visualize disease foci, monitor newly infected or re-infected villages, and identify populations at risk, target cost-effective interventions, and monitor eradication efforts. The visual display of spatial phenomena provides a very effective descriptive analytical tool. Healthcare is a important subject for medical geography as modern world pressure to re evaluate health care system to accommodate current health care needs .GIS in public health planning and potential disease prevention, combining population distribution elevation, land cover, location and capacity of existing health services .GIS software such are ArcGIS and MapInfo provide the necessary tools that are appropriate to conduct the mapping. GIS serves as a common platform for convergence of multi-disease surveillance activities. Public health resources, specific diseases and other health events can be mapped in relation to their surrounding environment and existing health and social infrastructures. Such information when mapped together creates a powerful tool for monitoring and management of epidemics.

IV. DASHBOARD

A dashboard is a view of geographic information that helps you monitor events or activities. Dashboards are designed to display multiple visualizations that work together on a single screen. They offer a comprehensive and engaging view of your data to provide key insight for at-a-glance decision making. Like web maps and web layers, dashboards are part of the ArcGIS geo information model. They are items within your organization that can be identified by their icon .Main function of dashboard is1) See—in one view—all the data you need to be informed or make decisions. 2) Monitor the most important information about your day-to-day operations. 3) Ensure all your colleagues are focused on the same goal through viewing and using the same information. Some dashboards are operational in nature. They are designed to tell what is happening now and match the quickly changing nature of

incidents, events, and other activities. Some are more strategic and are ideal for executives and other senior managers interested in monitoring their organization's key performance indicators (KPIs) and metrics. Some are more analytical and are used to identify data trends or other interesting data characteristics. Last, some are simply informative and are used to tell a story with the data. Each type of dashboard is used by different teams and people within and outside of an organization. Example users include command chiefs, operations managers, senior executives, GIS managers, GIS analysts, and even community members. Dashboards are composed of elements, such as maps, lists, charts, gauges, and indicators, and occupy 100 percent of the application browser window. Effective dashboard should have following character 1) Draws your attention to where it's needed 2) Shows what's most important on a screen full of data 3) Provides its audience the ability to understand what's happening and respond quickly 4) Expresses performance measures clearly, accurately, directly, and without distraction. Dashboards can be designed for use in both unattended and attended scenarios. Unattended dashboards are often displayed on a large screen in environments such as operations centers, and provide a more passive user experience. In contrast, attended dashboards are generally viewed on desktop monitors or tablet devices and tend to offer a more interactive user experience. Once the dashboard is assembled, you share it with its intended audience. You can share dashboards publicly with everyone or with only people in your organization. You can promote your dashboard by providing a link to it or embedding it in another website. Dashboard that countries have created to monitor and tracking the COVID -19
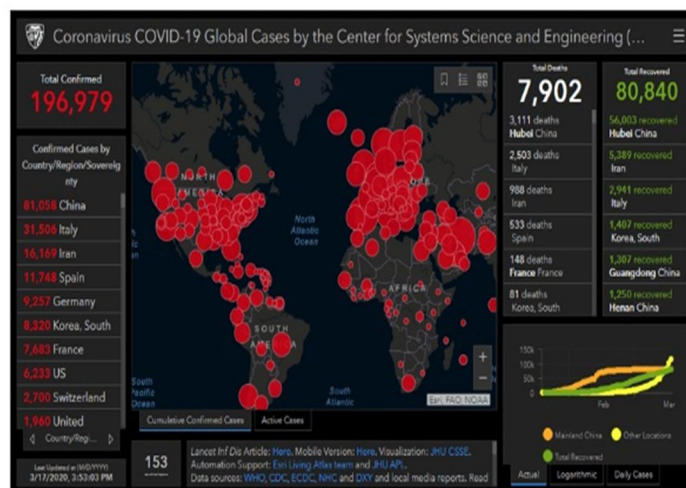
Dashboard Of COVID -19 Infected Locations

and to learn more about the spatial distribution of countries combining map and live data about the number of cases to understand where the disease is spreading .most rapidly global dashboard is maintain by ESRI and CSSE from JHU.They monitoring the global COVID -19 Hub.

V. RECORDING AND REPORTING

GIS can be used to produce maps of disease incidence, prevalence, and mortality, region, or national levels. The information is more easily understood when visualized on a map. Because information on diseases often tends to be aggregated (from information on each individual herd to municipality or county level) the information loses some of its value. Another way to describe the incidences of diseases in a defined area can be to create density maps by using the density function. The density function creates a grid with a defined cell size and gives each cell in the area a density value of the location. To adjust for the underlying population, a density map of the whole population at risk is created with the same cell size. The density maps are then divided to provide a map that shows the incidence of the particular disease in each area unit at the time unit chosen. This function can further provide maps which show the spread of the disease by displaying the maps as a movie. The GIS can also be incorporated in a real time outbreak notification.GIS is the better tool for study and application of the Global Early Warning System (GLEWS) that formally brings together human and veterinary public health systems to demonstrate vector-environment relationships and potentially forecast the risk of disease outbreaks or epidemics.

VI. ESRI ARCGIS AND JOHNS HOPKINS

Esri developed a new dashboard that keeping the track of number of cases in the world interactive dashboard monitor and map the impact of covid -19 on real time the spread of covid 19 including infectious cases and emerging pattern among population /geographics.Dashboard is being used as national disaster management.In case of an outbreak of an infectious disease, GIS can provide an excellent tool for identifying the at risk within a specified area of the outbreak. It has been used to strengthen data collection, management, and analysis, develop early warning systems, plan and monitor response programs, and communicate large volumes of complex information the maps can assist the health care officals to plan their work in the current situation, and for the authorities in how to handle a potential outbreak. CDC'S (Centre for disease control and prevention) plays great role

VII. PLANNING AND ANALYSIS

Data collection about affected people in the location .regional boundary and global boundaries are monitored by public health agencies use map to tracks the movement of infected peoples.It is important to understand patterns of movement of infected people may have come in contact so monitor them to avoid spread of virus. Dashboard designed in GIS technology

To provide real time update in the map describe state and national wise corona cases click on the icon to see the number of cases in particular location for example click the America

It indicates the status other location in the world as country, region and sovereignty the dashboard contain the last updated time, and month date and year to avoid the confusion .it has cumulative, confirmed cases and active cases as red point in the map. It has the another two major results which are total number of death and total number of recovered patients details in dashboard by using tools they displayed results in graph and charts format for statically display and divides that into four
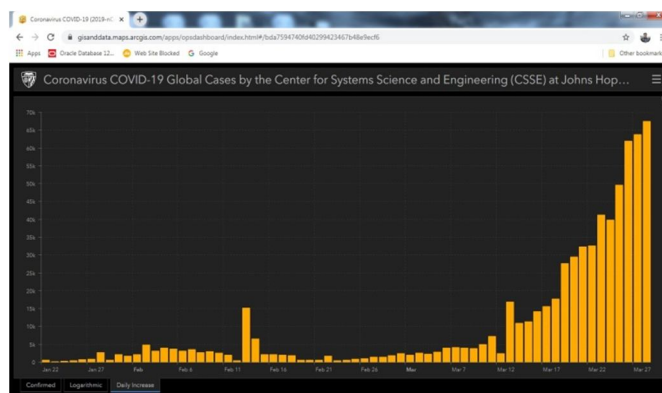
1) Confirmed 2) logarithmic 3) daily increase 4) pie chart it has day to day update and the analysis is used for government and public to aware about the status of deadly diseases.
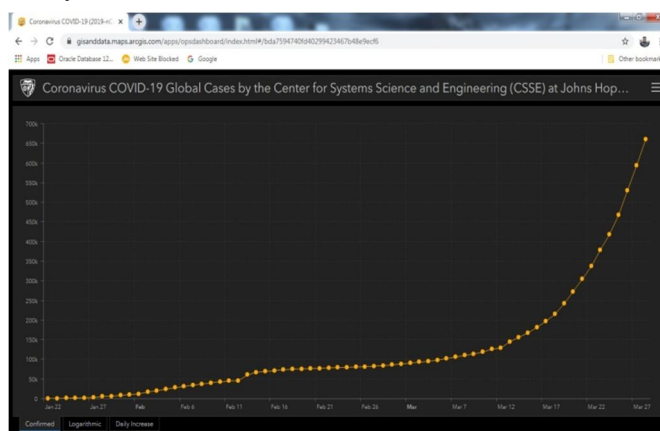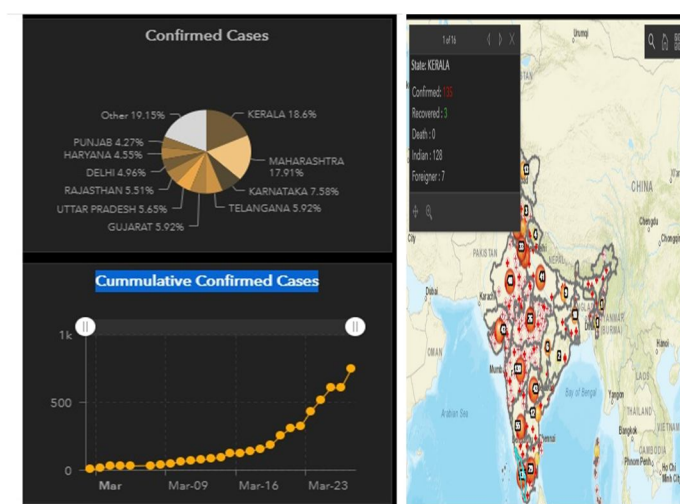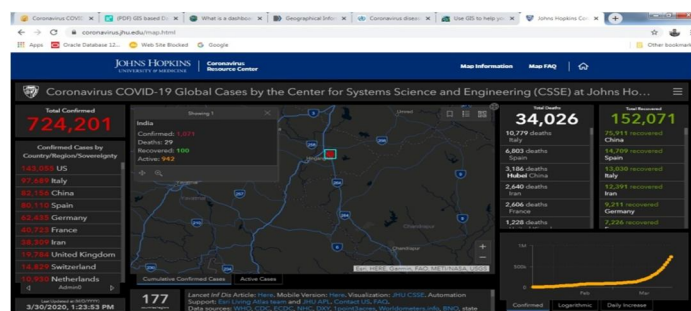

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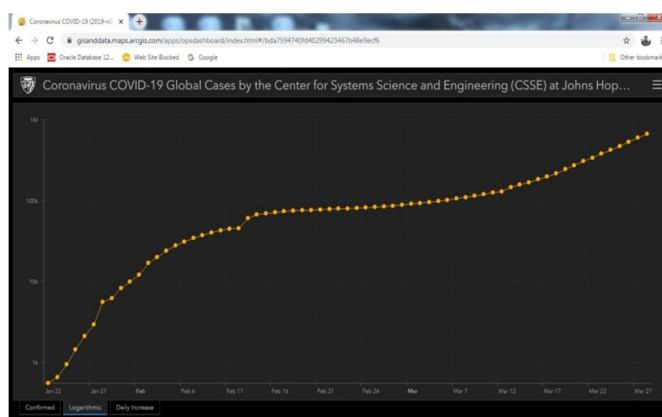
Logarithmic

Daily Increase

Pie Chart

JHU Dashboard For India

VIII. FUTURE ENCHANCEMENT AND CONCLUSION

Spatial factors like distance to the source of outbreak, population density and climate conditions, vegetation and landscape, all of which have been defined as risk factors for the spread of the disease. GIS technology has many features which make it ideal for use in disease control, including the ability to store information relating to demographic and causal factors and disease incidence on a geographical background, and a variety of spatial analysis functions. In the planning of eradication of diseases, GIS has the possibility to perform superimpose analysis to find high or low risk areas for diseases which depend on geographical features or conditions related to the geography Health care is a important subject for medical geography as modern world pressure to re evaluate health care system to accommodate current health care needs .GIS in public healthy planning and potential disease prevention combining population distribution elevation,landcover,location and capacity of existing health services GIS software

such as ArcGIS and Mapinfo provide the necessary tools that are appropriate for mapping . GIS has great impact in biomedical field and GIS plays a vital role in health care field and its main focus is to advancement in disease control, health outcome risk factors and relationship between them. Health organization can now visualize ,analyze, interpret and display malfunctions ,geo-location data through the use of GIS tools mapping application and big data. There are number of fake dashboard that look virtually identical to the real ones below that are designed to infect your computer with malicious files. The most perfect dashboard are johns Hopkins and WHO dashboards .There is number of apps,dashboard and maps out there data with reputably sourced data to avoid spreading of misinformation about the corona virus through internet where map includes cover of whole world so as this is swiftly becoming everyone problem. To that end, here are the ones that will help you track the virus based on the most-up-to date information.

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