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IJIE

Journal homepage: http://penerbit.uthm.edu.my/ojs/index.php/ijie
ISSN : 2229-838X e-ISSN : 2600-7916

The International Journal of Integrated Engineering

Systematic Literature Review of Role of Applied Geomatics in Mapping and Tracking Corona Virus

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DOI: https://doi.org/10.30880/ijie.2020.12.08.024
Received 23 July 2020; Accepted 4 August 2020; Available online 31 August 2020

Abstract: This review paper focuses on the Role of Applied Geomatics in Mapping of dispersion Corona Virus and sheds the light on the important studies on the topic. It also sheds the light on the tracking Corona Virus literature. This review paper also sheds the light on the definition, conceptualization, and measurement of corona virus mapping and tracking. This review paper has also showed a number of studies that linked the relationship between applied geomatics and the mapping and tracking corona virus. Authors explores the literature about applied geomatics, mapping and tracking from 2009 to end 2019 in order to investigate how these two geomatics techniques were born, how they have developed, which are the shared features and how it plays an important role in corona virus the novel pandemic. This systematic review of current literature on applied geomatics and corona virus and provides insight into the initial and proposed framework of integrating geomatics to track and map the corona virus.

Keywords: Applied geomatics, corona virus (COVID-19), mapping, tracking

1. Introduction

Location information is an important data that benefit to the public sector, businesses, developers and academia. In Great Britain, the Ordnance Survey (OS) will deliver enhanced location information for Great Britain and transform the way users' access and work with geospatial data [24]. This process involves the role of Geomatics, where the Geomatics expert need to provide the infrastructure such as the network grid, reference system and delivery system that able to be understand and used by a nonprofessional [8] and [15]. It can be seen in daily usage of location information to support critical infrastructure and services for public sector and private sector, underpin decision-making, enable products and services, and drive growth in the Great Britain, which has been recognized globally as having the best location information country [5].

However, the location information needs a medium to represent the information such as plain paper or known as map. Today, the paper map has been transformed into digital medium and has been rebranded as Geospatial. The advantage of geospatial is not only mapped the location but it also capable for analyzing, monitoring and predicting [3].

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For instance, the usage of geospatial has been used for monitoring the spread of pandemic disease such as Ebola and covid-19 as published by John Hopkins University in the United State.

The uniqueness of geospatial is it can take any information either from addresses, telephone number, number of effected persons, satellite images or distance (just to name a few) and mapped the information onto the geospatial which later known as geospatial data [11]. Since, it able to take any kind of information as an input for the geospatial thus big data could be an issue. Hence, this paper systematically reviews the role of applied geomatic in mapping the dispersion of corona virus (Covid-19). Geomatic is a science, art and technology of gathering information about an object or phenomenon that combine measuring and mapping technique for enhancing the value of the information gather which includes Surveying and Mapping, Geographical Information Systems, Global Positioning Systems, Remote Sensing and others related field.

2. Method

An electronic database search was conducted, as well as grey literature databases, from inception to January 2020. Authors independently selected studies, extracted data and appraised methodological quality. If heterogeneous, data were analyses descriptively. Where studies were homogeneous, data were pooled through a meta-analysis. The literature divided into four topics. Starting with COVID-19, the novel pandemic, applied geomatics, followed by tracking and mapping studies.

3. Corona Virus - The Novel Pandemic

According to World Health Organization (WHO), on January 7, 2020, the 2019 novel coronavirus (2019-nCoV; later renamed severe acute respiratory syndrome coronavirus 2 [SARSCoV-2]) was confirmed as the cause of these reported cases, and the outbreak was subsequently named coronavirus disease (COVID-19). The WHO declared the outbreak a global health emergency on January 30, 2020. As of May 27th, 2020, a total of 5,698,421 confirmed cases and 352,475 deaths had been reported in more than 213 countries and territories [20]. The worldwide presence of the COVID-19 pandemic has disrupted the implementation of various activities in a country. Countries have to provide high provisions to prevent the spread of COVID-19. Various strategies have been put in place to address the epidemic, including banning mass rallies, shutting down educational institutions, stopping public transport services, 'locking' cities and executing movement control orders (MCO). However, some questions arise, how do we see their effectiveness? What medium is used? What kind of alerts are required?

To meet the immense challenge posed by the pandemic, organizations across government, commercial, academic, faith-based, and non-profit sectors are contributing to the collection, analysis, and communication of health data like never before. New tools and resources to help understand and respond to the community spread of COVID-19 are being made available every day. Models that track the outbreak over time and space are enabling decision-makers and the public to design appropriate response strategies during this large and rapidly moving emergency Geo-scientists and technology professionals are contributing some of the most useful insights. Geospatial Information Systems (GIS), which are able to ingest and overlay geographically referenced data allow analysts to visualize and query disparate community health information [16]. For example, the ability to relate the number and location of COVID-19 cases with nearby hospitals is crucial for public health officials to design quarantine policies and prepare facilities, supplies, and the healthcare workforce. Careful monitoring of the number of respirators and available beds at hospitals and health facilities must be done continually as the locations of outbreaks change over time. Real-time mapping to support medical supply chain logistics is one of the most important capabilities currently needed to coordinate the shipment of supplies to communities in need [21]. Epidemiologists are increasingly able to model the genomic characteristics and spread of viruses and link that information to GIS as they study the evolution of pathogens. We are witnessing the dawn of a new era in health information modelling and visualization being powered by location-based technologies and geospatially intelligent systems that facilitate public awareness, increase scientists' understanding of viruses, and improve crisis preparedness and response outcomes. As the demand for geo-health systems increases, so too will the demand for data scientists and geospatial technology professionals who can manage their development to be interoperable, reliable, and secure.

4. Applied Geomatic

In determining the mapping of the virus corona, geomatics play a very important role to the universal human race. These pandemics are hard to be seen with the naked eye, and thus make them vulnerable to the society. Geomatic is a term derived from a combination of “geographical” (coordinated location on the Earth surface) and “mathematic” (calculation procedures). Geomatic is seems to be known as new tools for problem solving and decision making is various field. However, choosing the right geomatic method is still a challenge in most areas of study. It is mostly due to the complexity of the different applications and variables involved for task management [13].

Nowadays, data acquisition and generation of accurate and reliable geomatic products, was carried out with costly instrumentation, equipment and platforms requiring highly specialized work teams, with very rigid technical constraints that prolong the process of decision making [25]. Today, Geomatics science can provide modern techniques of acquisition, visualization, measurement and data management, useful for preservation, documentation and analysis in all its variety.

Geomatics is chosen as the 'next future tool' to help in metric documentation, preservation and management of both the parts, allowing a better knowledge from the early project phase to the realization one. Suitable geomatic techniques in this context can be: classical photogrammetry or computer vision approaches, laser scanning, for the acquisition step, GIS (Geographic Information System) and BIM (Building Information Modeling) for the subsequent steps (visualization, measurements and data management) [4].

Acquisition of spatial data is a key factor as it is the base for further calculations and analysis. However, it is necessary to bear in mind that the application field for water resources management is so wide that looking for the most suitable geospatial technique for each case study become essential. According to the Oxford dictionary definition of Geomatic: ''the mathematics of the Earth; the science of the collection, analysis, and interpretation of data, especially instrumental data, relating to the Earth's surface''[6].This definition emphasizes the fact that Geomatic is responsible for not only the data collection techniques and technologies, but also for the management of geospatial data by GIS (Geographical Information System) and SDI (spatial data infrastructure) [13].

Parameters to be measured and procedures that would allow assessing the centering capabilities of selected devices were defined taking into account both the specifics of devices and the available technical resources. It was also intended that the tests could be performed in such a way that neither angle nor distance measurements using surveying instruments were required [17].

The geomatic methodologies have an important role in the archaeological and architectural investigation of a building, mainly providing a significant amount of geometrical data with high accuracy (3D models, plans, sections) but also producing graphical output with metric content (orthophotos, virtual scans) and converted into GIS ready layer attributed with the lab analyses [8]. Geographic information systems (GIS) are widely used by governments in enterprise or clustered environments for the presentation of geo-spatial analyses and visualizations. It has been defined as, 'an organized collection of specific computer hardware, software, geographic data and personnel designed to efficiently capture, store, update, manipulate, analyze and display all forms of geographically referenced information (e.g., raster/vector) that can be drawn from different sources [12].

There are a growing number of collaborative geomatics applications under development or in use by social service agencies, libraries and archives, local economic and community development agencies, recreational and tourism services, conservation authorities, and municipal and regional governments in Malaysia especially in tracking and mapping the Corona Virus. The combined use of geomatics technologies (laser scanners, GPS positioning, digital photogrammetry, remote sensing, GPR) allows on the one hand to investigate objects and artefacts, providing metric, form, and location information; and on the other, to catalogue information and make it accessible to the community. Indeed, the digitalization and reconstruction tools of 3D models can be the answer to the limits related to communicability in the archaeological sector. Precision, detail, and very accurate photo-realistic reconstructions are particularly useful for virtual and augmented reality applications, integrating them in the devices used on a daily basis [1]. This represents a substantial advance in current practices, as the collaborative geomatics system under development is relatively inexpensive to apply and deploy, and user friendly thus minimizing the need for technical expertise and programming [2].

5. Tracking and Mapping

In order dealing with the integrated geomatic system, it deals with tracking the coordinated components required and mapping it on manipulated medium. Another example is a GPS navigation device that calculates its location relative to the road in order to show the driver directions to a destination and the location is presented via mobile and computer devices. However, this is a challenging task as determining the placement can demand a lot of computational power and memory depending on the approach and the required information [18].

Tracking is an important task that is used for several applications, such as navigation assistance and augmented reality. Thus, several tracking techniques proposed lately take into consideration the benefits and limitations of handheld devices. Therefore, the goal of this work is to applications to be executed on such devices. Systematic mapping is a method to review, classify, and structure papers related to provide an overview of a specific research field [18].

In the form of tracking the Corona Virus allocations, tracking for mobile devices means that an off-the-shelf cell phone or tablet extracts location information from the environment and then processes it locally or remotely or even real-time in order to compute the device's position related to the world, which will be used by an application or a service on the device itself. Thus, this study collects and analyses works published in scientific [18] and [22].

Furthermore, frameworks, such as adaptive capacity are emerging to help communities address change brought on by resource development and to build resilience based on the location of the subjects. Resilience refers to the ability of a social ecological system to tolerate stresses owing to change where a social ecological system refers, 'a bio geophysical unit and its associated social actors and institutions. Social ecological systems are complex and adaptive and delimited

by spatial or functional boundaries surrounding particular ecosystems and their problem context'. The development of adaptive capacity is critical to building resilience to change. In this Corona Virus context, adaptive capacity refers to the 'aspect of resilience that reflects learning, flexibility to experiment and adopt the virus carrier locations, and development of generalized response to broad classes of challenges' [12].

Tectonic Geodesy Application (TGA) proposed that a developed seismic hazard evaluating system, which can map focal mechanism solutions, Global Positioning System (GPS) deformation fields, and geological tectonic backgrounds [10].

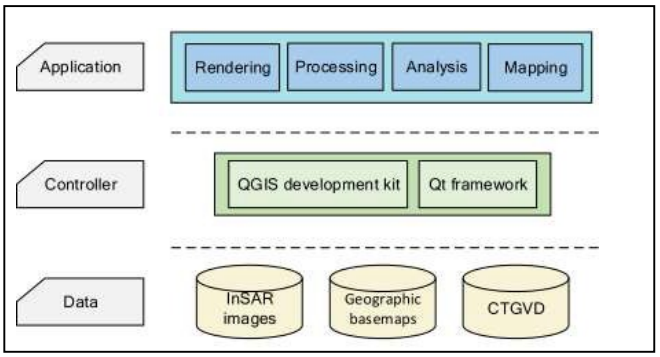

Fig. 1 - The architecture diagram of TGA

So, the system can be adapted into the proposed framework of integrating geomatic to track and map the corona virus. The integration of geomatic knowledge in tracking and mapping the corona virus that can be utilized by the frontlines to collect the information and manage the patients' information as in Figure 2.

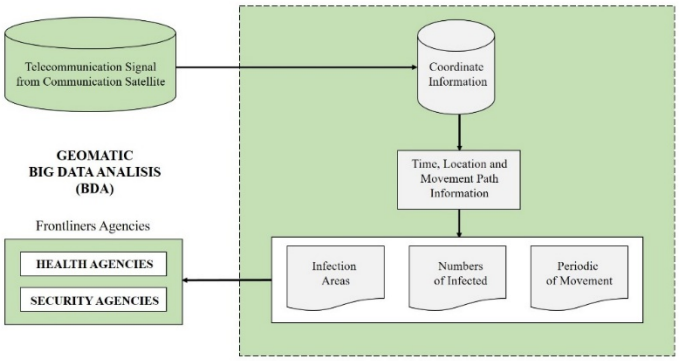

Fig. 2 - The framework of big data analysis for mapping and tracking the spreading diseases

Based from the framework, the main concern of geomatic field involve in determining the location and movement of the patients is using the coordinate from the mobile device. Since, Survey and Mapping Department of Malaysia (JUPEM) is the main agency dealing with developing the base map and accurate positioning and surveying; hence it is suggested that JUPEM use the coordinate of the corona virus patient and map it on the base map. Based on the GIS analysis of history data and real time information's, the information of current periodical movement and location can be obtained. The output from the suggested framework would be the infected areas, the numbers of infected as well as the periodic of patient's movement. The information would be importantly useful to the frontlines such as health agencies and security agencies that may help to plan for the best solution to overcome the virus spread.

6. Discussion and Conclusion

Based from the literature analysis, the integration of geomatic in determining the location of corona virus is applicable for coordinated tracking. It is suggested that the approach furnishes intuitively track the corona virus patients and carriers mapping result and the mapping would be beneficial to detect hot spots of the virus, abnormal activities [22] and so on, and encourage efficient management of the virus. However, the lack of sufficient or identified funding to develop these tracking and mapping plans is a serious impediment to the whole community-based health awareness. In terms of the long-term sustainability of the collaborative geomatics system, applications and data must be continuously accessible by the relevant communities in perpetuity [12].

The last dimension of adaptive capacity is the ability of a community to create opportunities for innovation. Innovation in social systems can be defined as an initiative, product, and process or program that profoundly changes the basic routines, resource and authority flows or beliefs of any social system. The collaborative geomatics system can allow for the development of a spatial database. Communities would not only be better prepared to address the associated impacts of corona virus, but be in a better position to influence policy decisions and take more of a leadership role in the planning and development of the solution to overcome the spreaders of the diseases [12].

Mobile devices, such as phones and tablets, are becoming increasingly popular in the world. Moreover, the research shows that approximately a third of the world's population owns a handheld device. This scenario favors the creation of numerous types of applications since such devices create several opportunities that are only possible when the user can be mobile [18] and [25]. However, the new paradigms of geomatic science, result of the progress achieved in the last three decades, provide the scientific and engineering community of a set of reduced cost and even low-cost techniques and methodologies. This, directly impacts on more efficient use of economic resources affecting at public administrations and private corporations [25].

Acknowledgement

We would also like to show our gratitude to the Universiti Tun Hussien Onn, Universiti Teknologi Malaysia and Department of Survey and Mapping Malaysia (JUPEM) for sharing their pearls of wisdom with us during the course of this research.

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