

## A Review: How Space Technology can help in COVID-19 Pandemic (with Reference to Remote Sensing and GIS)

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### ABSTRACT

The corona virus (COVID-19) pandemic has virtually brought the world to its knees. Eventually, the spread of this highly infectious disease will be slowed down, but the world will never be the same as we knew it. Remote sensing and Geographical Information system (GIS) can play a powerful role in supporting experts as well as policymakers for formulating plans and policies on how to tackle this unprecedented calamity by mapping and analyzing the spread and effects of this disease around the globe.

**Keywords:** COVID-19: Coronavirus: Satellite Imagery: Remote Sensing: GIS

### INTRODUCTION

The use of space technology in daily life is no longer stuff of science fiction. Satellite Remote Sensing is the science of identifying earth's surface features and estimating their geo-biophysical properties using electromagnetic radiation as a medium of interaction from satellites, with the primary goal of geographical mapping, earthquake and flood monitoring, natural hazards and environment and resource surveying. In addition, remote sensing and GIS technology could be used in epidemic/pandemic mapping and prevention operations such as in fighting the current ongoing global crisis of Corona virus Pandemic which has affected millions of people and killed thousands till today within a short span of a few months.

#### Scope of RS and GIS

Satellite imageries can provide information, both at the macro and micro level, about the success of the global response to the stay at home and social distancing policies. Satellite imageries are providing information about the activities happening (or not happening) in major cities, tourist destinations, highways, industrial sites and places which are generally known to be crowded during normal days. Also, mapping and assessment of the availability and capacities of medical facilities and mortuaries could be done by using GIS software and its networking capabilities.

In this context, the further popularization of space-based assets among private and government agencies and the promotion of closer international cooperation in using civil space science and technology could make a significant contribution to addressing global public health emergencies.

Future moves and policies by government agencies about restricting the movement of the public, deployment of doctors or police, etc can be planned if information about the pattern and direction of spread of the disease can be mapped and predictions based on such information can be made available. Remote Sensing and GIS-based mapping can help in these matters to a great extent.

The advantages of GIS-based database creation of various parameters related to the COVID-19 pandemic are huge compared to conventional databases that deal with tables and statistical calculations, simply because GIS-based database and mapping have real-world spatial and temporal connotations that would be hard to come by in conventional methods. The temporal changes in the pandemic scenario on a global or local scale can easily be visualized through GIS-based techniques by creating spatial animations that will go a long way in understanding as well as predicting the spread and behavior of the infection in relation to population density, cultural diversity, economic strata, and various other parameters. Such spatial visualizations can help us in planning and coordinating logistics,

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surveying and countering the spread and also planning government legislations and policies that will help in preventing the spread as well as providing cure to the public (Figure 1).



**Figure 1:** Value of space Technology.

#### EARTH OR SPATIAL OBSERVATION

Broad assessment about the situation in a few states can be carried out by undertaking imagery interpretation. Such a situation would arise where intentional or otherwise stoppage to information flow is happening.

#### Case of wuhan hospital setup

A satellite image released by China Aerospace Science and Technology Corporation shows a verdant field in the Caidian District of Wuhan on October 29, 2019, before the area is turned into the city's first corona virus hospital to combat the deadly disease.

Another satellite image released by China Aerospace Science and Technology Corporation shows construction works in full swing for Huoshenshan or Fire God Hospital in Wuhan on January 30, 2020 - seven days after ground was broken for the project

To alleviate the pressure of hospital capacity overload, two temporary hospitals, namely the “Fire God Mountain” (Huoshenshan) and the “Thunder God Mountain” (Leishenshan) with an area of 25,000 and 30,000 square meters, respectively, were built in Wuhan and each completed in 10 days. During the construction process, the Chinese GaoFen satellites, a constellation of high-resolution optical observation satellites for the civilian program of the high-definition Earth observation system (HDEOS), recorded how the hospitals were constructed from scratch at remarkable speed.

In the meantime, other satellite sensors, including the Jilin-1 shipin-03, a commercial remote sensing satellite for high definition video; the Zhuhai-1 hyperspectral satellite; and the European Space Agency’s (ESA) Sentinel-1 satellite, perform well in aiding the evaluation of hospital construction.

#### Case of Iran graves

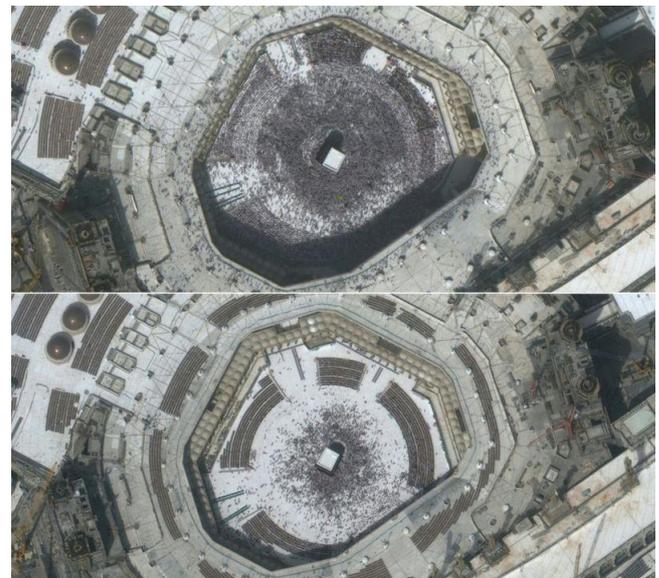
Few recent satellite imageries over the Middle East region have indicated about the digging of large numbers of graves in some parts of Iran. This demonstrates the growing numbers of COVID-19 fatalities in that country.

A detailed imagery interpretation also indicates the presence of a large pile of lime in some parts of Iran. Generally, lime gets used to managing odor and decay in human bodies. Experts are also known to be studying satellite imageries covering regions

like China and North Korea. All this could help to draw some inferences about the nature of disasters over there.

#### Case of mecca pilgrim

This combination of pictures shows a crowd at Mecca's Grand Mosque and the Kaaba on February 14, 2020 (top) and a much smaller group of visitors on March 3, 2020, a day before fears over the novel corona virus led to the suspension of Umrah pilgrimage.



**Figure 2:** Satellite image released by Maxar Technologies.

#### USE OF GIS TECHNOLOGY

GIS software's (proprietary or open-source) can be used for mapping country wise, region wise, block-wise or even local incidences of COVID-19 infections, identifying clusters and hotspots of such infections, locate hospitals, medicine shops, mortuaries, etc so that both the public as well as the government can be helped in fighting this disease. Such mapping can help in diverting traffic so that infection hotspots can be avoided by re-routing traffic through safer zones. Government officials and ministries can use such technology for formulating policies to combat and contain this epidemic by identifying hotspots and disease spread patterns or directions. Field workers, doctors, and the general public can greatly benefit from such technology that can provide information about nearby hospitals, medicine shops, clinics, emergency contact centers, etc through mobile internet-based apps.

Imagery from Earth-observation satellites is currently being used to create population density maps that are being combined with census data to identify demographics of vulnerable population groups such as the young or elderly.

In China, the HaiGe Smart Epidemic Prevention Management Platform was used to plan the routes of commuters to avoid highly-contagious COVID-19 areas. By connecting the databases of infected persons and local geographic information, the HaiGe software is capable of displaying the real-time cartography of disease locations and identifies hotspots with the use of a trajectory-tracking algorithm. After comparing the location of

the source of infection with the common route of employees' daily commute, and analyzing the density of people and vehicles at different times, the system re-plans a safer journey to work.

### Telemedicine

Telemedicine is one of the unique applications of Space Technology for societal benefit. This facility allows the doctors in smaller towns and villages (with patients seating next to them) with limited expertise to consult the super-specialists in real-time for medical advice. Today, with many states a significant amount of shortages in medical staff are visible, particularly when the hospitals are found to be overloaded with the patients. Hence, states should use this facility to the fullest of its potential, if the need arises.

ATS-1, satellite-based telemedicine has been successfully used in countries such as Australia, Albania, Canada, India, Italy, Romania, Russia, and Scotland. In 1996, ESA provided a satellite communication system to link Italian doctors with a field hospital in Sarajevo, Bosnia, enabling teleconsultation for both civilian and military patients.

### CONCLUSION

Due to the contagious nature of COVID-19, the use of satellite communication allows quarantined diagnosis without increasing the amount of face-to-face contact between patients and healthcare providers, a major step in reducing the risk of spreading the disease. Other technologies such as using robots to disinfect hospitals and autonomous drones to deliver medical supplies and meals, both of which are being assisted by high-accuracy satellite navigation, are preventing cross-infection and allowing countries to contain the coronavirus. AI (Artificial intelligence) is being used to process the large amounts of data that have been collected to expedite the development of a vaccine, with the large internet giants contributing their computing resources and expertise. Geographic Information Systems (GIS) helps to understand the scale of an emergency since critical information is made available in various layers. This allows better logistics planning, coordination and also

improves epidemiological surveillance. In addition, tracking of disease outbreak is possible without putting humans at risk

Satellites, GIS and drone are not the only tools in our fight against this global pandemic but can prove to be one of the more important ones that help in mapping, predicting and planning our moves and policies.

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