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The contributions of the smart city in containing the epidemic crisis

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Abstract---The pandemic emergency (Coronavirus) uncovered the shortcoming of the metropolitan construction, of the metropolitan space and its socioeconomics, which is appeared in the ill-equipped foundation frameworks of the city. Where the conventional plan of public space has made imbalances, in the requirements of the metropolitan setting. The pandemic has supported interest in creating brilliant urban areas by exhibiting the numerous advantages of shrewd arrangements as far as distinguishing tainted people, foreseeing spread elements, lessening human-to-human contact, and empowering authorization and following of social removing and quarantine rules. As brilliant urban areas bear the weight of utilizing innovations to help city life during and after the Coronavirus pandemic. To address the more extensive wellbeing ramifications of shared metropolitan space. Especially thickly populated urban communities will quite often endure more from the side-effects of Coronavirus than rustic regions. The research problem emerged: in the lack of knowledge about the capabilities of smart cities in limiting and controlling the spread of epidemics and current and future infectious diseases. The aim of the research was: to reach an integrated set of smart technologies needed to enable cities to resist the spread of epidemics, as the research hypothesis was: Smart technologies contribute at the urban level to the city in detecting and controlling the epidemic by designing an effective response to recovery measures. The research methodology was: to follow a descriptive approach. Using case studies, this paper examines twelve key areas: 1) health care, 2) population, 3) education 4) energy, 5) governance, 6) technology, 7) transportation, 8) infrastructure, 9) living, 10) Mobility, 11) Economy, 12) Environment. The research found a set of indicators

for smart, flexible cities that are resistant to the epidemic, which contribute significantly to limiting and controlling the spread of epidemics in the urban environment, through four main axes: 1) planning, 2) absorption, 3) recovery, 4) adaptation.

Keywords---smart cities, resilient cities, smart technologies, disaster management, COVID-19.

Introduction

Well before the flare-up of the pandemic, there was a developing interest and critical advances in the utilization of savvy arrangements, empowered by data and correspondence innovation (ICT) and large information investigation, to upgrade the proficiency and viability of metropolitan activities and work on personal satisfaction (Chen et al., 2020). Unfurling in the midst of these fast turns of events, COVID-19 has given a decent chance to test the capacity of savvy answers for take care of major cultural issues. It has likewise given extra force to the improvement of brilliant urban areas, as proven by the expanded dependence on telecommuting, telemedicine, observing frameworks, and online business and schooling. Accordingly, it has been contended that COVID-19 is probably going to improve savvy city developments (Kunzmann, 2020).

Instances of utilizing shrewd advances to diminish human-to-human contact in the arrangement of administrations have likewise been accounted for. These incorporate China-based drives, like the utilization of robots for the independent conveyance of clinical and business supplies during lockdown (Chen et al., 2020), or clinical care supported by artificial intelligence and computerized tomography (CT) to protect health care workers from direct exposure to patient contact (Chen et al., 2020). These additionally given different advantages like superior productivity and speed. Shrewd arrangements have additionally been generally used to distinguish contaminated people and go to fitting control lengths. Contingent upon the social and political settings, three distinct ways to deal with these capacities can be recognized: 'innovation driven', 'human-driven' and 'joined' (Kummitha, 2020).

Kummitha (2020) in his examination shows that while the Chinese methodology is 'innovation driven', Western majority rules systems have taken on a 'human-driven' approach. In the innovation based approach, savvy advancements are utilized in a hierarchical way to contain the pandemic by restraining residents and controlling the free progression of data (Kummitha, 2020). For instance, China has conveyed a "variety coded order" program that has been empowered by cell phone applications to control populace development. The program works in light of the new wellbeing data recorded for the individual and their family members (Chen et al., 2020). Likewise, in India, a "Quarantine Watch" cell phone application has been acquainted with track adherence to self-quarantine rules.

Interestingly, the human-driven approach zeroed in on controlling the scourge by illuminating and teaching residents and empowering two-way correspondence among residents and government. This was more normal in Western popular

governments (Kunzmann, 2020; Kummitha, 2020). Nonetheless, the innovation based approach has shown better progress in containing the spread of the infection, spreading advancements all over the place, forestalling the spread of falsehood, and planning the activities of various urban communities and entertainers (which is fundamental for accomplishing coordinated metropolitan administration. (Sharifi,et al,2020 ,p:8)

Smart Cities

The smart city is basically an idea, and there is still no reasonable and steady definition among specialists and the scholarly community. As a worked on understanding, a shrewd city is the place where conventional organizations and administrations become more adaptable, proficient and manageable with the utilization of data, computerized advances, and media communications to further develop city tasks to help its inhabitants. Shrewd urban communities are greener, more secure, quicker, and agreeable. The different parts of a shrewd city incorporate savvy framework, brilliant transportation, brilliant energy, savvy medical care, shrewd technology...etc. These parts make urban communities savvy and effective. Information and Communication Technology (ICT) is empowering the keys to changing customary urban areas into savvy urban areas. Two firmly related arising innovation systems, the Internet of Things (IoT) and Big Data (BD), are making brilliant urban communities productive and responsive. The innovation has developed to the point of permitting shrewd urban areas to arise. Be that as it may, there is a dire requirement for actual foundation, shrewd city, and advanced innovations to convert into better open administrations for inhabitants and better utilization of assets while diminishing ecological effects. (Mohanty,2016)

Savvy City: A city that "interfaces actual foundation, data innovation framework, and social framework. (Mohanty,2016) A savvy supportable city is an inventive city that utilizes information and Communication Technology (ICT) and different means to work on personal satisfaction, effectiveness of metropolitan tasks and administrations, and intensity, while guaranteeing that it fulfills the needs of current and people in the future concerning monetary, social and natural perspectives ITU-T Focus Group on Smart Sustainable Cities, "Shrewd economical urban areas: An investigation of definitions", Focus Group Technical Report, 2014. Any mix of various brilliant parts can make urban communities shrewd. A city needn't bother with every one of the parts to be named brilliant. The quantity of savvy parts relies upon the expense and accessible innovation. (Mohanty,2016)

Components of a smart city to reduce the risk of epidemics

Smart city innovation is basically isolated into three sections: a conversation of the purposes of shrewd innovation, brilliant medical care, and brilliant conveyance framework. Furthermore, the effect of these strategies to keep social separation, home seclusion, and the condition of lockdown. As well as discussing other innovative smart city technologies to significantly reduce the risks of COVID-19. (Shah S.2019. et al, p. 91885-91903)

The smart city to reduce the risk of epidemics consists of: 1) health care, 2) population 3) education 4) energy, 5) governance, 6) technology, 7) transportation, 8) infrastructure, 9) living, 10) mobility , 11) Economy, 12)Environment.

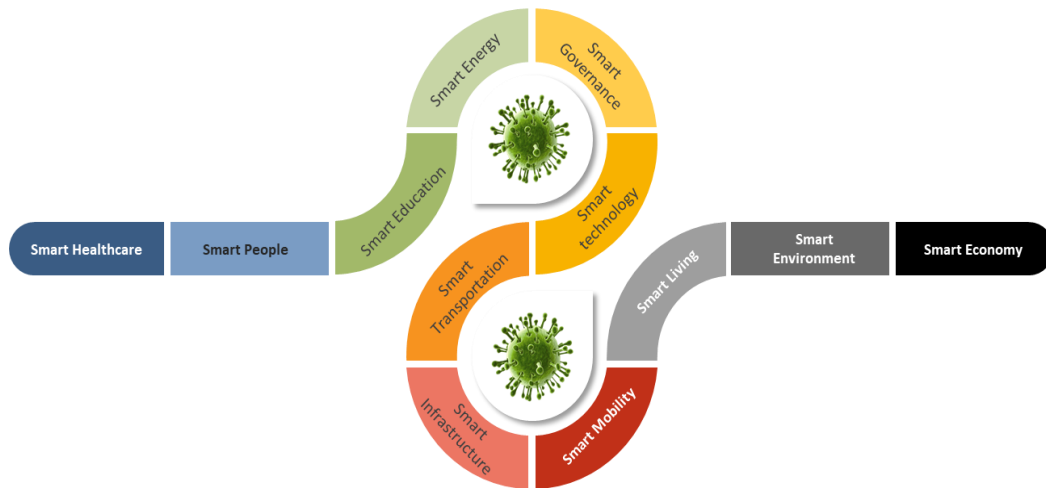


Figure 1. shows the components of smart cities to reduce the risk of epidemics.
Source: The researcher based on (Jaiswal, 2020, p: 84) & (Matthew, et al, 2016, p: 42.) & (Shah.. et al,2019, p. 91885–91903)

Smart Cities and Disaster Management

The power of calamities (regular or man-made) has expanded in the beyond couple of many years. The International Federation of Red Cross and Red Crescent Societies, Global Disaster Report 2018, distinguished 3,751 cataclysmic events like quakes, floods, tidal waves, and so on, which happened over the most recent 10 years worldwide, causing all out harms adding up to 1,658 billion US dollars and influencing multiple billion individuals. Additionally, a sum of 118 man-made fiascos, for example, atomic implosions, primary disappointments, transportation mishaps, fear based oppressor acts, and so forth were accounted for in 2017 alone, bringing about in excess of 3000 passings. (SwissRe,2018)

Calamity the board as a bunch of coordinated processes that remembers the preparation and the executives of exercises for any of the periods of a catastrophe, like alleviation, salvage, reaction and recuperation. Calamity the executives exercises are carried out through participation with different concerned government and private area bodies. The primary goal of catastrophe the board is the incorporation of interrelated processes that can give compelling means to investigating, observing and additionally determining fiascos. To lessen the potential for losses and natural annihilation, catastrophe the board measures should be preventive and responsive. The fundamental elements of catastrophe the board are to set off early alerts, gather ongoing data, and precisely gauge harm (Hristidis.et al ,2010)

Disaster Management Systems

Customary fiasco the executives frameworks have become old since they are presently not adequate to oversee multi-source activities information and to store and dissect colossal measures of calamity information progressively. With the imperatives of exact and convenient navigation, fiasco and flexibility the board activities require a dependable and effective climate that incorporates different current advancements to upgrade its exhibition. Moreover, it is vital to have the option to connect any wellspring of data critical to the circumstance promptly for crisis responders, particularly during the commencement of an emergency reaction.

An imaginative and present day idea of climate in view of big data analytics (BDA) and IoT for calamity versatility in smart city framework has been proposed. The proposed idea of a disaster resilient smart city (DRSC) prompts cooperation among Internet of Things (IoT) and (BDA), where the Internet of Things can possibly give a structure to an unavoidable organization of interconnected savvy sensors and gadgets, and the (BDA) can possibly work with continuous handling of the IoT one next to the other. With other applicable information streams to uncover new data, examples and experiences for successful calamity the board. Another reference structure is acquainted with show the overall system of the proposed idea of (DRSC), determined to give a guide to future missions. A total five-layer engineering is gotten ready for the (DRSC) climate, which upholds a lot of The city is brilliant and tough notwithstanding catastrophes (Shah ,et al, 2019, p: 91888)

Smart cities resistant to the epidemic

By and large, the impacts coming about because of the spread of pestilences can't be controlled without an antibody, yet its impact can be diminished by utilizing a few cutting edge innovations. Shrewd urban communities: is one of the essential requirements to lessen this scourge. For its job in executing smart city innovation to diminish the gamble of pestilences, as brilliant city innovation is utilized to keep up with social removing, staying away from up close and personal connection and actual contact. It has been seen that area innovation is utilized to follow contaminated individuals. Advanced mechanics and robot innovations are utilized to act as clinical staff and are helpful for other fundamental administrations. It tends to be seen that shrewd medical services is one of the high level savvy city advancements, which is utilized to really focus on and treat the harmed with next to no contact. It has likewise been noticed that the brilliant conveyance framework is one of the contactless advances. It is utilized to convey fundamental things, including food, food, and meds, with practically no actual contact. The purposes of all the brilliant city innovations referenced above have been broadly examined to moderate the dangers of transmittable infections (scourges). (Jaiswal,2020,p:82)

Smart city technologies to reduce the risk of epidemics

Smart city technologies are one of the most important artificial intelligence techniques that can be used in smart city management, which contribute

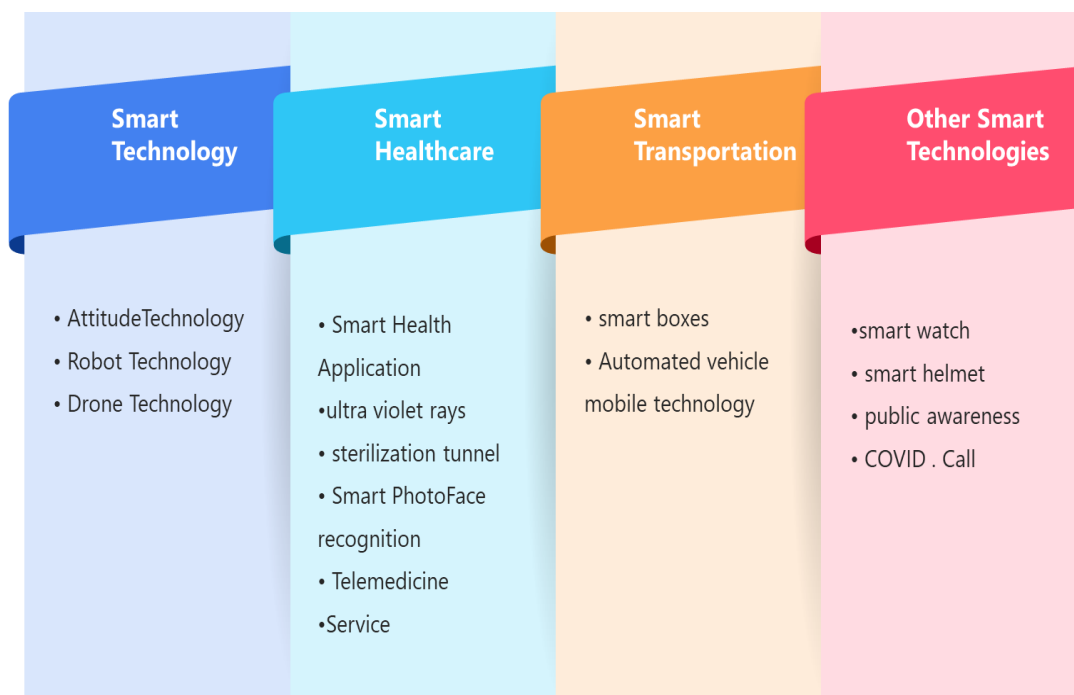
significantly to controlling the spread of epidemics within cities ,since the rise of the pandemic, general society and private areas all over the planet have involved computerized reasoning as quite possibly the best apparatus to face the "Coronavirus" scourge; In the medical services area specifically, man-made brainpower has been utilized widely because of the squeezing difficulties presented by the infection, especially in the field of diagnostics and medication and immunization improvement.(Davenp,et al ,2019)

Because of the earnestness of the "Coronavirus" episode, most nations have gone to physical separating lengths and requested that their residents stay in their homes however much as could reasonably be expected, regardless of this, administration offices, organizations and establishments had the option to actuate the method for distant correspondence utilizing man-made consciousness instruments, to keep up with movement. Financial efficiency and labor force efficiency, while giving satisfactory degrees of medical care, training, and other fundamental administrations simultaneously.(Ting,et al ,2020)

The experience of the "Coronavirus" pandemic has demonstrated that robots can play out the important undertakings of answering emergencies in circumstances that are thought of as dangerous for people, like the emergency of this plague. To shield individuals from openness to this infection, robots have been customized to meander the roads and appeal to occupants to keep actual separations and follow security safeguards in numerous urban communities around the world.(PwC,2016)

There are numerous regions where computerized reasoning is being utilized actually to battle the pestilence, As displayed in the table:

Table 1. Different types of smart city technologies to reduce the risk of epidemics, source: the researcher based on (Jaiswal, 2020, p: 84)



Flexibility and Smart City Solutions

Flexibility is a multi-meaning idea that can have various definitions starting with one discipline then onto the next (Hosseini,et al.2016). Whereas, features such as durability, shock resistance and minimal disturbance are emphasized. Resilient systems are expected to be well adapted to undergo shocks without significant functional loss, and to be able to quickly return to equilibrium points (Sharifi,et al.2016). In this manner, these frameworks involve "planning (pre-disaster), absorption (during disaster), and recovery (post-disaster)". Different regions, for example, those connected with social and natural viewpoints and cycles have a more unique way to deal with flexibility (instead of a static way to deal with designing strength), and they focus closer on the capacity to "adjust (for example live with chances) after disturbances (. Sharifi,et al.2021,p:2)

Like 'adaptability', there is still no all inclusive meaning of knowledge . While (Söderström ,et al .2020) brilliant drives were at first determined by(ICT)-empowered advances and their mix with actual foundation, it is presently perceived that non-actual aspects and parts (like individuals, associations, information economy, and so on) are likewise significant and firmly connected with rawness. Framework (Angelidou,et al,2015). In any case, information and innovation are the foundations of savvy arrangements (Söderström ,et al .2020), and since more consideration has been given to the mechanical aspects in the writing, the innovative components of the shrewd city got more accentuation in this review. Shrewd arrangements and innovations are assorted and can incorporate man-made brainpower, AI, blockchain, IoT, drones, independent vehicles, cutting edge correspondence organizations like" 5G, virtual reality (VR),

augmented reality (AR), 3D printing, distributed computing, and enormous information examination, among others" (Schoitsch,2020).

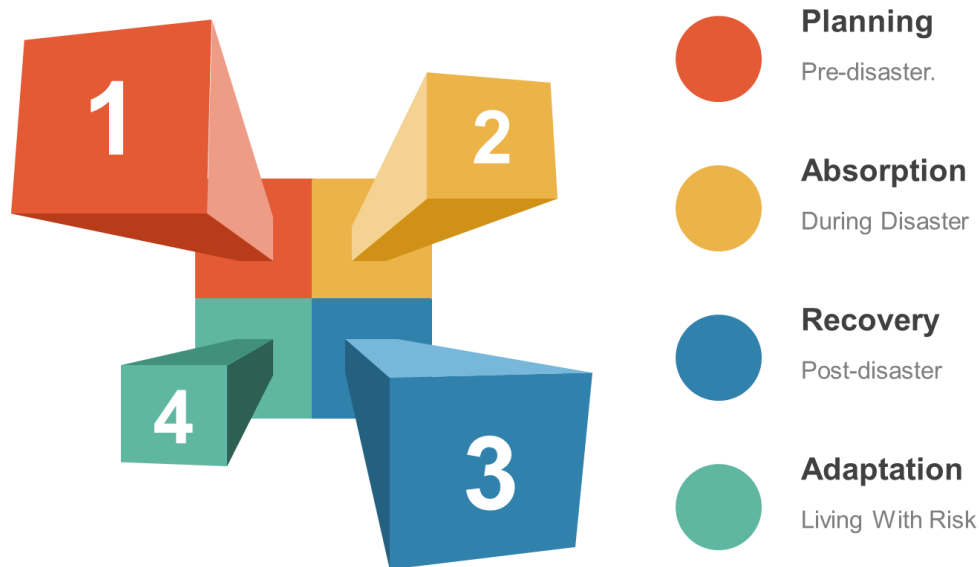


Figure 2. Flexible smart city hubs, source: researcher

Smart city indicators to reduce the risk of epidemics

Smart city framework fills in as a basic variable in upgrading the capacity to get ready for and plan for a pandemic by working with incorporated administration and giving chances to anticipate designs connected with a scourge. As far as limit, brilliant arrangements work with better execution of preventive measures through cutting edge observing techniques and additionally by permitting contactless arrangement of administrations. We audit issues connected with the commitments of brilliant arrangements and advancements :

Planning

Planning and giving framework to savvy urban areas

- Past interest in shrewd framework that can be diverted to battle pestilences
- Accessibility of framework alongside coordinated calamity the board designs and serious authority improves readiness.
Work with cooperative and incorporated arranging and the board
- Information and data trade stages can work with coordinated effort
- Metropolitan observatories and incorporated order and control focuses add to coordinated administration and work with interoperability
- Utilizing savvy advances to anticipate and recognize problem areas
- Adds to the early identification of the infection, which can prompt opportune activity

Determining models can assist with recognizing possible areas of interest and configuration designated measures and arrangements

Absorption

Preventive measures to control the spread of the infection

- Broad checking and testing utilizing shrewd innovations forestall or defer the spread of sickness by giving successful and precise location techniques
- Endlessly observing frameworks can be utilized to guarantee consistence with social separating rules
- Adds to the battle against the pandemic by diminishing the need to contact surfaces/objects or actual contact between people
- Follow tainted people
- Recognizing methods of contamination by following the development examples of tainted people
- Guarantee that quarantine rules are really applied
- Work with straightforward correspondence and forestall the spread of phony news
Work with straightforward correspondence
- Adds to controlling the spread of falsehood
- Bringing issues to light and working with social connections

Recovery

Offering help to exhausted representatives

- Incomplete mechanization of diagnostics, treatment and different advances
- Lessening medical clinic visits through the advancement of telemedicine
- Diminished holding up times and extra wellbeing costs
Give elective means to guarantee the progression of fundamental capacities
- Limiting production network disturbances
- Add to the recuperation of various areas through remote work, e-learning, and so forth.

Adaptation

speed up the progress towards digitalization

- Give extra catalyst and reinforce the case for shrewd city improvement developments
- Give open doors to sensible execution of groundbreaking brilliant city drives
Mainstreaming practices like teleworking and telemedicine that can lessen openness to comparable future occasions
Giving illustrations to further develop city tasks
- Furnishing examples on the most proficient method to manage arising cultural requests
- Invigorating groundbreaking arrangements

- Convey co-advantages, for example, further developed productivity and decreased air contamination that add to long haul strength

Conclusions

Within its general axis, the research dealt with the most important smart city technologies that contribute to limiting the spread of epidemics and the most important intellectual concepts related to the topic. The research reached the final conclusions:

1. The pandemic has demonstrated the importance of digital transformation, which significantly reduces traffic and pollution, and if we apply remote work through the digital city strategy as a means to achieve physical distancing, and to help employees and citizens achieve a balance between work and life, this will make our cities consume less highway spaces. And parking lots. In this case, we can restore these spaces to use as safe walking and cycling networks because they will encourage people to ride their bikes to work and give more space to pedestrians.
2. Accessibility, infrastructure, land use and natural environmental factors are important factors for the city's resilience in the face of epidemic outbreaks.
3. The importance of the economic aspect in the urban context of smart cities is necessary for its active role in providing the necessary capabilities and flexibility to address epidemics
4. The environment contributes greatly to reducing the spread of epidemics by controlling the sources of pollution, water and sewage by using smart information technologies that contribute to identifying possible danger areas. Where the epidemiological crisis contributed to reducing the levels of CO2 in the atmosphere as a result of the downtime of factories and reducing the use of cars during the epidemiological crisis.
5. The technology of communications, tracking and positioning has provided great solutions in the ability of the population to move and walk in the streets without using known preventive measures.
6. The contribution of digital technology to supporting the health sector through smart capabilities in identifying injuries and telemedicine.
7. The smart lifestyle and the smart person are important axes in dealing with the course of the crisis, by motivating citizens to use smart solutions as a lifestyle.
8. Smart e-learning led to the creation of a set of technologies for scientific communication as a future solution that will continue even after the epidemic crisis.

Recommendations

1. Local governments must transform their cities into smart cities and choose a transformation strategy that helps achieve this goal.
2. Educating citizens to use smart technologies in daily life in order to reach a smarter society.
3. The importance of enhancing adaptation and functional diversity of smart buildings and smart urban spaces as tools to mitigate the effects of epidemics.
4. Activating and promoting high smart communication and the integrated link between the natural environment and the built environment.

5. Emphasis on employing smart technologies in disaster management and applying the concept of learning from past experiences.
6. The need to follow a consistent approach to dealing with future epidemics through stages: planning, absorption, recovery and adaptation.

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