A CREATION FOR PANDEMIC FIGHTING SYSTEM
FROM A CITY TO A SINGLE UNIT

PUBLIC HEALTH GROUP

INTRODUCTION

- **what is the Pandemic Fighting System (PFS) ?**
  I've tried to define this new term as :
  an integrated system that studies the causes of infection in specific space and proposing detailed solution for each cause by following the trip of the main carrier of infection in different scales of space aiming to decrease the possibilities of contagion and enhancing the quality of healthy spaces for the users.

- **How the PFS going to be applied in different scales from city to single unit.?**
  The pandemic fighting system will divide the prime city into 5 levels as per type of services (daily, weekly, periodically) in each level, based on this; it will study the common causes of contagion in each scale and find/create the proper solution that can be accommodated for a long term.

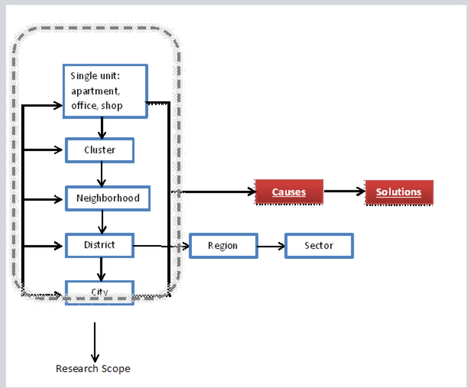
- **What is the purpose of creating a new building code such as the proposed PFS ?**
  One of the main purposes of creating PFS is to find a specific code for spaces to work securely and actively during the urgent /unplanned pandemics. COVID-19 was not the the first pandemic threating the human being , through the history there was many pandemics took a lives of millions , yet we don't have a sufficient system for quality and readiness of spaces to work in contingency.

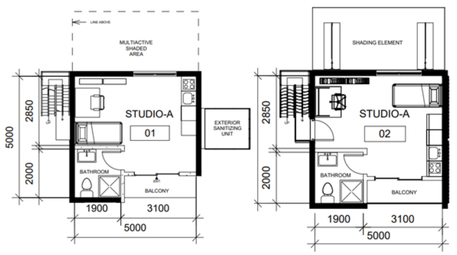
- **What are the potentials and solutions that this system will achieve?**
  By creating an integrated system including solutions for infection sequences, we can create a code to be applied for facilities readiness. This code system will accommodate all studies and solutions which proved its leverage to operate the spaces during pandemics.

METHODOLOGY

•The research will follow the trip of contagious virus through the different spaces from different scales starting from the single unit reaching to the scale of city with analyzing the causes of infection and solutions in these spaces for decreasing the possibilities of infection.

•The main principle for dividing the city into different levels from the single unit to the district, called "services hierarchy system".





ANALYSIS AND RESULTS

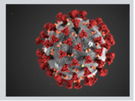
ANTI-CONTAGIOUS FINISHING;

•Many researches and scientific studies have been initiated to create material agent act as anti-microbial coating solution the same concept of antifungal /molds lining or anti-bacterial finishing. For what we are facing pandemic caused by SARS-CoV-2, antiviral surface coating is a promising finishing with futuristic high potentials that could eliminate the possibilities of transfer of microorganism to the human body and its subsequent spreads

•Literature survey shows that the nanoparticles (NPs) of various metals and metal oxides like Zinc Oxide nanoparticles (ZnONPs) 3, Cuprous Oxide nanoparticles (CuONPs) 4, Silver nanoparticles (AgNPs) 5, 6, Nano sized Copper (I) Iodide particles (CuINPs) 7, Gold nanoparticles on Silica nanoparticles (Au-SiO2NPs) 8 and also some Quaternary ammonium cations commonly called QUATs9 are very promising to inactivate the virus and are well proven.

•The main goal of the antiviral coating mechanism is to inactivate the spike glycoprote to resist the transmission of the virus from nonliving articles to living body cells by touch.

Nanoparticles (NPs) of various metals → Inactivate the spike glycoprotein to resist the transmission of the virus → Creating futuristic anti-microbial coating solution



SANITIZING SPRINKLER SYSTEM

•In this particular proposed method, I've tried to create a simulation for an existing system as the: firefighting sprinkler system, for our main purpose infection control.

•The basic principle of a sprinkler system: Piping networks fitted with closed nozzles. The nozzles open separately when heated by fire or hot flue gases. Extinguishing water is sprayed selectively on the source of the fire. Water is also sprayed on the surrounding area and therefore prevents the fire from spreading. For a better understanding, a simulation we can design for the principle of sanitizing instead of fire fighting for the high density /crowded indoor areas by creating the following comparison between both systems

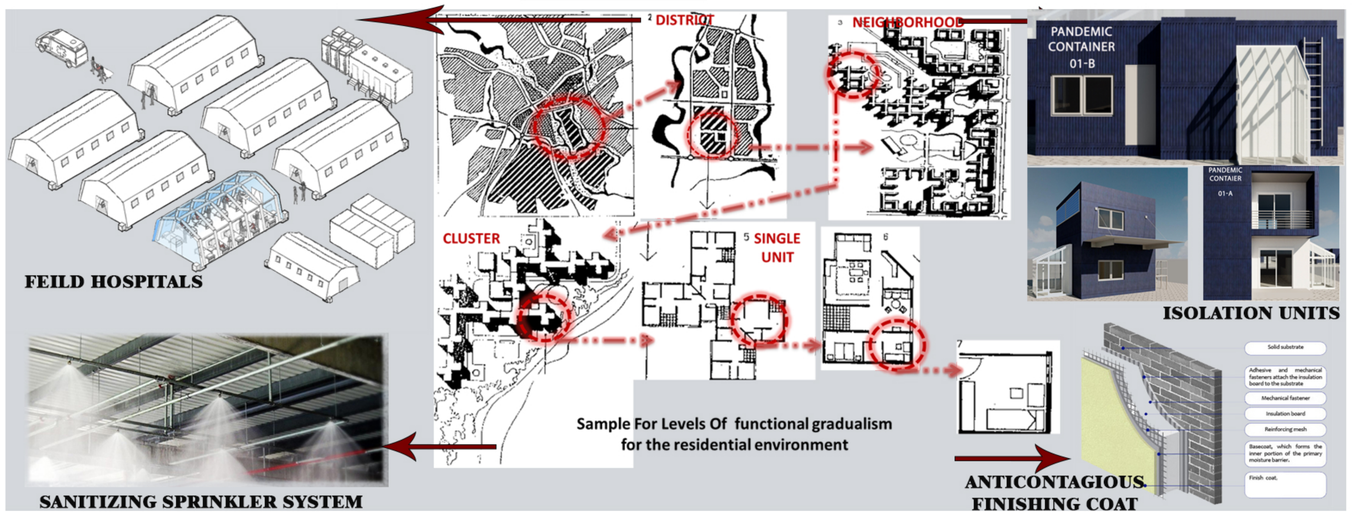
however we need a wide studies for he challenges of this system of sprinklers we may face regarding to the impacts of sterlizing gas towards the users health & interior items .

Sprinkler system	Fire Fighting	Sanitizing (Proposed)
Resistance to	Smoke	High User density
Resistance material	Pressurized Water	nonflammable sterilizing gas
Detection System	1)Smoke/heat detection 2)Alarm triggered 3)Sprinkler operated.	1)CO2 Level detection 2)Alarm triggered 3)Sprinkler operated.
Type of sensor	Smoke / Heat / Gas sensors	Gas Sensor (infrared/chemical)
Alarm connectivity	Connected (audible/visual alarms)	Connected (audible/visual alarms)
Principle of work	Detecting – alarming – evacuating-	Detecting – alarming – distancing – sanitizing.
Purpose of Resistance	Tackling (Detect – solve the problem)	Preventive against infection incidence (detect a possibility of problem-solve the possibility of the problem).
Time &spaces to be applied on.	-Applied for all facilities as mandatory	-At pandemic waves -In high density spaces
General code for applied areas	As per IS/NFPA standards and Codes	Measuring CO2 levels indirectly determines how many people are in a room, and Sanitizing can be adjusted accordingly. the initial equation we can assume depends on the following variables : - 1.50m (constant distance) - NO. of occupants (n) - Total area of space (A) - NO. of Required sprinklers (S) - Equivalent factor (E) : indicates to what each sprinkler cover CO2 level initiated by a certain number of occupants e.g.: 1 sprinkler covers 5 people so E = 5 S = (A/1.50 *n) / E

Single Unit Level

Single Unit Level

cluster level



•Moving to the level of neighborhood, by considering each neighborhood consisting of group of clusters, and each cluster consisting of group of different use of single units. Radius of service is ranging 400-500 meters (5-7 min. on foot). And thus the area and the population are calculated.

•The Ideal solution to control infection cases in the higher city levels is by Equal & fair urban distribution.

•This can be achieved by specifying a plot area in each neighborhood for Isolation units that will host the infected stable cases in which don't require intensive medical care and can be monitored from a dedicated infection medical center at the same neighborhood.

Isolation units features :

•the Isolation units (pandemic containers)were designed to be as residential spaces that suite with quarantine requirements through: sanitizing and social spaces, I designed two types of pandemic units :

• Studio-A: two stories each floor = 25sqm , capacity in each floor= 1 user.

•Studio- B :v one story of total space of 15 sq. , capacity = 2 users

• Materials: eroton steel (self-healing steel) with corrugated exterior walls.

•Characteristics: light units, flexible, affordable for law income societies, easy for shipping, fast erecting/removing.

Neighbor Hood Level

•**What is the PFS solution proposed for the unit of district?**

•After distributing the stable cases in each neighborhood inside the district to the isolation units , thus giving the opportunity for the main district hospital to receive the severe case and cases that need a medical involvement , however ,although this has been applied in many cities but still , hospitals are suffering from high pressure due to Complications of infection.

•By creating a field hospitals with fast erection structure in specified plot for each district , which will be prepared and designed to receive 40-50% of stable urgent cases depending on the medical report for each case , this will Helps to regulate adequate capacity for each treatment unit and increase the efficiency of Equal & fair urban

District Level

•By reaching to the last level in our scope, we need to calculate the gradual assumed effect of PFS in each level of city that we can elicit the overall result of PFS in minimizing the possibilities of infection risk.

Urban Level	The Minimum Assumed Percentage To Be Treated By PFS	Details & references
Cluster (Surface Control In Single Unit By Proposed Methods)	(3%)	Since the cluster consisting of group of single units ,As per studies of Infection prevalence ratio it showed a rate of Under the high prevalence rate scenario (5%) risks for single hand-to-surface contact followed by hand-to-face contact
Neighborhood (Isolation Units)	35 %	If self-isolation of symptomatic cases alone was included, our optimistic scenario resulted in a mean transmission **reduction** of 29% if self-isolation was within the household and 35% if self-isolation was outside the household.
District (field hospitals)	Depends on infection rate in each country as per it's policy E.g. : in UAE a rough estimated rate is 10 %	Dr – Oday Shahawneh –field hospital specialist doctor-interview .
City	The total assumed percentage we can estimate for PFS efficiency by calculating the total assumed percentages of city urban components can be roughly estimated as **50%-60%**	The rate will differs from a country to another based on the its different circumstances .

CITY Level

DISCUSSION

A design for Rehabilitation –post pandemic complications facilities

•The idea of this type of facilities is to provide a separate space to treat the cases who suffers from severe complications regarding to the infection treatment.

•After a survey I made with ICU doctor who was at the front line in dealing with covid-19 severe cases DR- ALAA MOH.

•Critical care Health care provider, she mentioned in her experience on the huge load of hospital capacity , that she has a case at ICU from the first wave of novel covid-19 pandemic at APRIL-2020 till now the case still suffering from the complications of the treatments although these cases shows a negative test result .

•Based on this these cases occupies a necessary beds for other severe cases waiting for its opportunities.

•These type of facilities can be classified at the city level to receive all post pandemic cases for rehabilitation.

CONCLUSION

-This research studies Infection causes in terms of space objects that considered as third agent of developing infection without neglecting the social distancing &personal sanitizing precautions.

-PFS system has strong potentials that can be applied to create a new building code for enhancing the health & life quality of spaces.

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