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Influence of poor Architectural design of old government public buildings on Coronavirus spreading risks in Egypt

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Abstract:

During the outbreak of the COVID-19 virus, field observations showed that several government administrative buildings in old Egyptian cities had design flaws that made them more likely to spread airborne viruses like the COVID-19 virus.

The deficiencies in the architectural design of the administrative buildings led to an intersection of the main movement paths between users, as well as a lack of reception space to guide visitors and several other problems that consequently led to severe crowding inside those buildings, which certainly harms the healthy performance of these buildings.

Our governmental buildings are not built with disease prevention in mind. With the development of the health and epidemiological situation, scientists, researchers, engineers, innovators, and architects united in developing adaptive reuse solutions to deal with the risks of the spread of the virus in already existing buildings. Architects used these ideas to devise ways to deal with the epidemic, such as new designs or ways to make existing buildings healthier by using architectural ideas and new technologies. In Egypt, governmental buildings are often placed in areas that need to be commensurate with the population density to whom those buildings provide government service; Old government buildings often have poor designs due to a lack of architectural design.

Architects and architecture students need to understand better the impact of the decisions they make during the design process on how effective architecture is in achieving a healthy building that can prevent the spread of viruses, particularly in government buildings.

The architecture of these administrative buildings in old Egyptian cities shows that architectural decisions cause most design flaws, affecting the spreading of viruses. This study aims to understand better the design flaws in government buildings that contributed to increased congestion and unhealthy spaces, increasing the risks of spreading the virus. By observing and analyzing these problems, architects and architecture students can develop several recommendations to develop architectural solutions for them.

Key Words:
Healthy buildings, Governmental buildings, airborne viruses, design flaws.

Introduction

Egypt, like other countries, was infected with the Coronavirus. During the epidemic waves, large portions of Egypt had designated areas where the disease was actively killing people. Throughout the bouncy waves of an epidemic, the population experiences a high infection rate, resulting in widespread disease and mortality (1). The World Health Organization issued recommendations to protect against the spread of the virus. These recommendations included a commitment to wearing medical masks, paying attention to sterilizing hands and tools, and social distancing (2).

However, the health care system in Egypt shares many of the same flaws as the health care systems in other developing countries. In these countries, the general population's lack of health awareness contributes to various significant health problems.

The issue of low levels of health awareness is particularly severe among people with lower levels of education and young people in general. In addition, this problem is made worse because the population is growing, the economy is expanding, there is widespread poverty, and the government is not interested in promoting health awareness by educating the public (3). Population density has been linked to pandemics, and studies have focused on the relationships between energy and form, morphology and density in urban environments. Architecture and urbanism should pursue operational objectives to prevent pandemics, maintain physical health, preserve mental health, and address environmental concerns. (4). The importance of health awareness was evident in Egypt after the spread of the Coronavirus epidemic, especially in public government buildings. Egypt is one of the countries with an old administrative system that still needs to depend on Internet technology and remote service provision. During the Corona period, the government system could not close government buildings continuously and contented itself with placing self-sterilization gates and posters containing instructions for wearing masks, social distancing, and the rest of the Ministry of Health's instructions to limit the spread of the virus. However, in a society dominated by health randomness with buildings not designed to confront health crises and epidemics, it was impossible to control the seriousness of those buildings in contributing to the spread of the epidemic, the deficiencies in the architectural design of public government buildings in dealing with the pandemic were revealed.

Architectural design, quality of materials and finishes, quality of building uses, site selection and management personnel culture play a role in how well these buildings perform their functions. Moreover, because of the recent emergence of epidemics, the necessity arose for architects,

health engineers, specialized engineers, and city planners to collaborate to arrive at the concept of healthy buildings, which contributes to limiting the spread of the epidemic (5).

Previously in developing countries, research into virus-resistant architecture was sparse. After the coronavirus pandemic, researchers became interested in viruses and making connections between them and architectural design (6). Medical professionals in Egypt almost exclusively carried out interest in studies and research on virus resistance because this field falls more within the competence of health experts where the studies and research were conducted (7). Nowadays, Egypt is one of the countries that contributed to the most recent scientific research and publications on this topic, which was done relatively recently. Research has shown that architects must have a medical background to understand the terminology used in research reports, articles and related publications, understand the nature of viruses and airborne diseases, and generate appropriate ideas while dealing with them.

Without a doubt, buildings can prevent the spread of viruses with the assistance of architects and suitable architectural design (8). This study focuses on the following:

1- The architect's function and how his work can either contribute to or detract from the healthy performance of buildings and the spread of airborne viruses like Covid-19, particularly buildings used for administrative and governmental purposes in Egypt.

2- Clarifying the main flaws in architectural design in a group of public government buildings by examining and analyzing.

1- The function of architecture design in preventing the spread of viruses

"Urban planning, architecture and public health were partners in the historic efforts to prevent epidemics" (9)

WHO recommends preventing the spread of COVID-19 by getting vaccinated and following local vaccination guidelines, maintaining a distance of 1 meter from others, even if the surrounding environment appears healthy, avoiding crowds and wearing a suitable mask in poorly ventilated areas. Many published articles discussed the importance of natural ventilation and planting in maintaining a healthy environment that limits the spread of viruses. It also showed that copper and metal surfaces kill airborne viruses, and other proposed scientifically proven methods or those others that scientists are still searching about their validity and usefulness (10).

As it is human nature to survive and preserve the human race, researchers, engineers, innovators, scientists, and architects were able to integrate their efforts to reach a set of ideas and applications that contributed to confronting the war against this lethal virus, the most important of which will be presented in this research. Architects incorporate coronavirus anti-spreading guidelines into various architectural design concepts for both new and existing buildings to ensure that these guidelines are followed, including government administrative buildings, which are the focus of this study.

"As an architect, you design for the present, with an awareness of the past, for a future which is essentially unknown" Norman Foster. Living spaces (homes, workplaces, apartments, public spaces, hotels, etc.) should serve human needs and provide a safe space for self-isolation (11).

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The world health organization classifies administrative buildings as medium-risk environments due to the large volume of people present and the difficulty of maintaining a safe distance of at least one meter between workers, this may apply to those whose jobs require frequent interaction with each other (1).

Hence, the architect's role appeared in taking all precautions in designing government administrative buildings so that there is no possibility of crowding users in a way that makes it difficult for the process of social separation. Likewise, the architect must create a healthy internal environment that reduces infection rates with the virus, achieve spaces that enjoy ventilation and natural lighting, and not ignore the plant element in the interior design. Using furniture elements and internal materials suitable for dealing with viruses and introducing modern technology methods to eliminate viruses and reduce infection rates through an innovative architectural design. As shown in figure 1

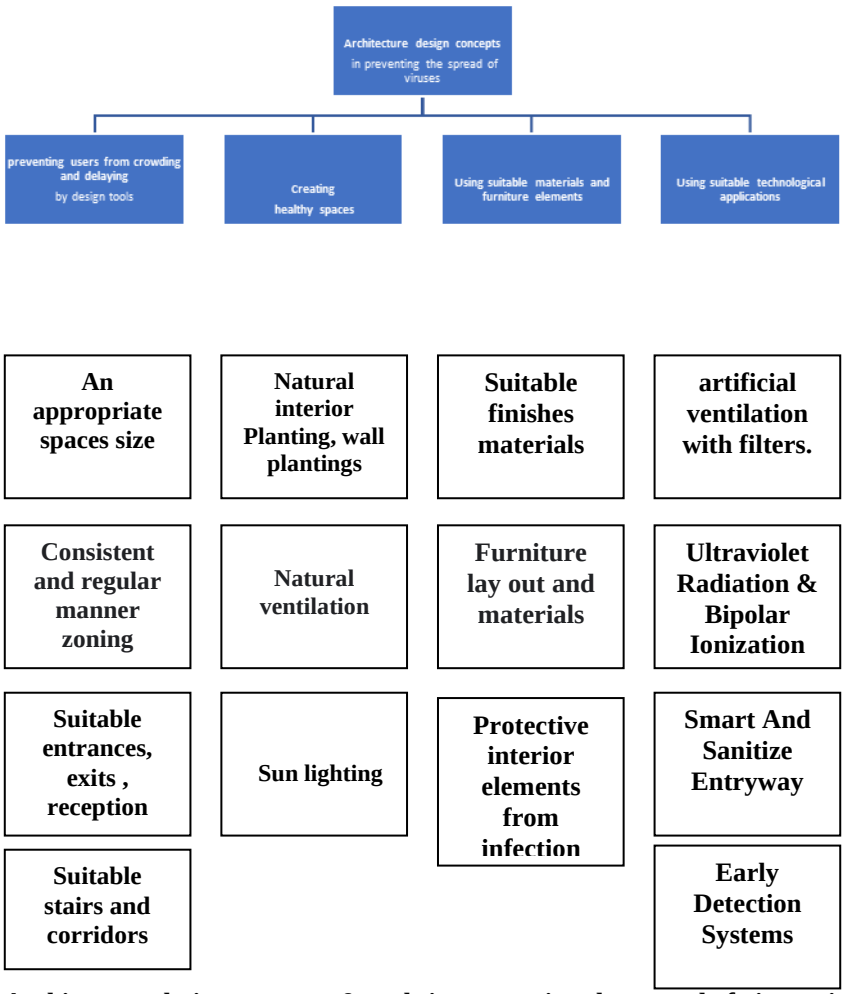

Figure 1: Architecture design concepts & tools in preventing the spread of viruses in public buildings

1-1: Preventing users from crowding and delaying.

Using science-informed designs to isolate people in public spaces and setting a guideline for planning and resilient design to ensure safe interior space is the only reliable solution to control the pandemic. Design proposals should encourage social distancing between occupants to adjust new space protocols by utilizing more partitions between departments and nearly eliminating open-plan spaces to allow safe circulation by having areas such as hallways, vestibules, and broader doorways(11).

Coworkers in open-plan offices, especially those with desks arranged in linear patterns, were also at risk of contracting and spreading COVID-19. Most of today's apartment and office buildings were constructed when "social distancing" had a narrower, more strictly inter-personal definition. In order to lessen the likelihood of an epidemic spreading throughout a community, many nations have enacted social distancing regulations, such as a minimum of 1.5 metres between individuals and a maximum of one person per 4 square metres of floor space. Signage on the floor and on seats and the removal of tables and chairs were used to enforce such spacing in indoor venues. Some authors have speculated that the spread of COVID-19 will spell the end of the open office plan. Ventilation should be extracted downward at the desk level or at the intersections and nodes of desk arrays to maintain privacy and efficiency in the workplace. Installing a series of floor ducts with multiple outlets or installing air pillars that collect in extraction ducts above the ceiling allows various office layouts to be accommodated. Using mid-floor grilles for subfloor extraction is another viable option (12).

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Architects should choose a suitable space size and zoning design according to a careful study of the number of users and the services required to be provided.

Figure 2: Preventing users from crowding and delaying

Care must also be taken not to cause any intersection in the horizontal and vertical movement paths and to coordinate movement within the space so that there is no delay in providing services because of a system disruption in the internal movement. The importance of the entrances to the building and their ability to accommodate and regulate the densities, with the presence of a reception to regulate the movement within the entire building, that any defect in the entrance area, especially in multi-service buildings, will directly lead to a disturbance in the entire movement within the building. Moreover, good organization and direct user entry to implement its goal quickly and accurately. As shown in figure 2

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1-2: Creating healthy spaces.

The worldwide lockdown has contributed to cleaner air in many countries. In order to maximize the benefits of airflow and its positive effect on human health—including the enhancement of feelings of happiness and comfort—natural ventilation has been relied on to improve the efficiency of the indoor environmental space. Mechanical heating and air conditioning account for a significant portion of a home's energy bill (HVAC) (11). The trend now is to increase ventilation and daylight. Keeping employees at ease is just as important as keeping them safe, which might give them more chances to connect with nature, even inside the office (13). Sunlight "UV" and natural ventilation are practical elements to sterilize and reduce infections in a confined space, killing indoor infectious agents that cause airborne transmissions (14).

Indoor plants can improve buildings' health by absorbing and catabolizing harmful environmental chemicals. This is one of the most environmentally friendly air-purification techniques, with minimum energy use and a low cost. Creating indoor portable green walls is another solution, using botanical biofilters and bioreactors to neutralize pollutants through active biofiltration (15).

Figure 3: Creating healthy spaces by planting, natural ventilation and natural lighting

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1-3: Using suitable materials and furniture elements.

Aerosols, copper (99% copper metallic plate), cardboard, stainless steel, and plastic were all tested by Cortes et al. (16)] to determine the best way to preserve the COVID-19 virus and determine how quickly it degrades. There was no sign of the SARS-CoV-2 virus after it had been on the copper surface for four hours. Antiviral and antibacterial ions in copper alloys can potentially eradicate pathogens at 99.9% in at least two hours. Protecting people in public spaces and large gatherings from the spread of respiratory viruses and copper surfaces could be used. Copper-based building materials and fixtures can help stop the spread of disease. Using copper alloys on high-contamination points like elevator buttons and door handles may help reduce the spread of germs. Copper is expensive and difficult to maintain, but stainless steel and plastics are widely used in many building applications due to their affordability and clean-looking surfaces. Plastics can be combined with copper, silver, and zinc to produce a substance with antimicrobial properties, which prevents the multiplying of viruses and eventually disappears. Silver nanocoating, gold, titanium, and carbon-based coatings can also potentially enable antiviral coatings(17).

Figure 4: Using suitable materials and furniture elements to provide antivirus protection

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Free-standing screens are one of the most adaptable and flexible solutions you can introduce into a workspace. Employers are advised to review the layout of their workplaces to ensure staff can work side-by-side or back-to-back and always at a 2-metre distance from each other. Anti-viral COVID screens are the recommended solution, and new suggested measures include 2-metre social distancing floor markings, staggered working hours and distanced outdoor meetings. Acrylic, plastic, Plexiglas desk dividers, and sneeze guard glass are also commonplace in the post-pandemic workplace (18).

1-4 : Engineering technological applications that contribute to limiting the spread of the COVID-19 virus.

In the wake of the COVID-19 pandemic, there have been changes in construction methods and building designs. The buildings we have now were not built or designed to prevent disease spread. Innovative approaches to overcome such a situation through adaptive reuse should be considered. These goals can be achieved in several ways, the most important of which is the achievement of appropriate artificial ventilation, the use of ultraviolet, ionizers and fogging spraying, and the use of Sensors to reduce touching (19).

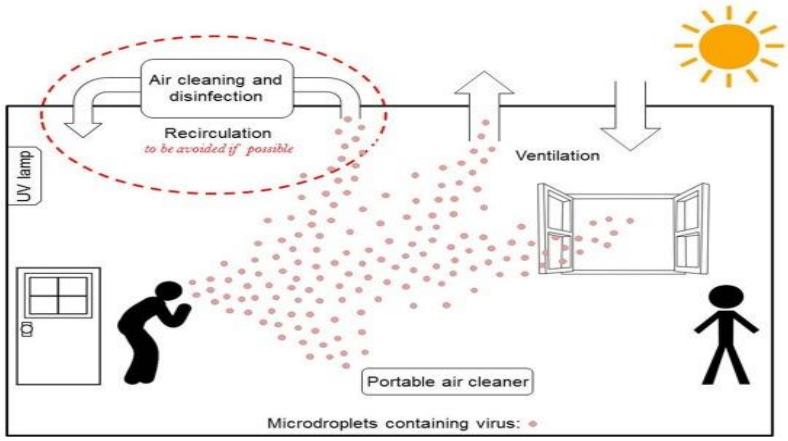

Figure 5: Engineering level controls to reduce the risks for airborne transmission (20).

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1-4-1: artificial ventilation with filters.

The central air filter could be upgraded to be more effective, portable HEPA filters could be made available, and the system's operating hours could be extended. HEPA filters can be modified with natural lytic enzymes to immobilise the pathogen on fibre media, making them an effective tool for preventing the spread of viruses in operating room air cleaners. Other products on the market, such as PM2.5 filters, photocatalytic oxidation (PCO) filters, and semi-absolute filters, can also improve filtration quality. Retrofitting these filters into HVAC systems can be challenging, but mobile, vertical air filtration units can help (21).

1-4-2 : Ultraviolet Radiation.

Type C ultraviolet (UV) rays can kill pathogens like bacteria and viruses. Germicidal ultraviolet (GUV) lighting is increasingly being incorporated into passive sanitising building designs to reduce the spread of disease. Researchers Vranay et al. [64] discovered that more than 90% of the SARS-CoV-2 virus produced by humans indoors could be inactivated by using germicidal sources to disinfect transported air. When purifying the air, the most efficient wavelength of ultraviolet light is 265 nm (22).

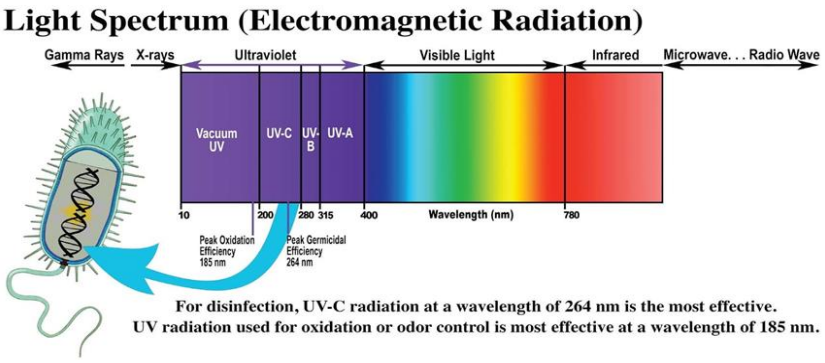

Figure 6: UV wavelength which destroy coronavirus.

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In order to lower the viral load in large buildings, UVGI technology employs a level of human-safeUV radiation. It's ideal for retrofitting older buildings because of its low cost and high capacity to protect. Mobile UVGI devices can be used to clean surfaces, indoor air, and corridors when no one is present. To avoid harming the locals, however, you must make sure that the area is shielded from UV light(23).

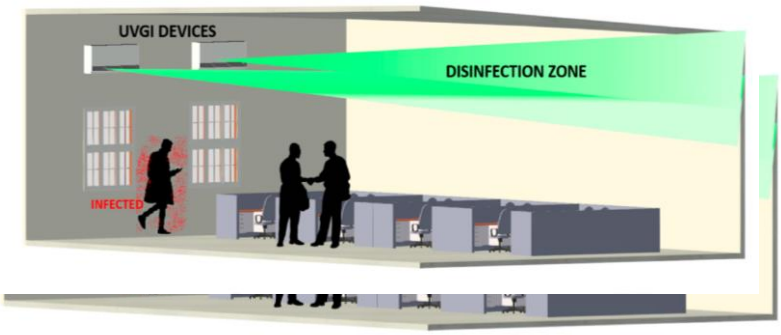

Figure 7: Potential application of ultraviolet germicidal irridatiom (UVGI) technology.

1-4-3: Bipolar Ionization.

By producing ions, needlepoint bipolar ionisation (NBPI) is used to purify the air. This method disperses negative and positive ions, eliminating airborne pathogens such as viruses, mould, and microorganisms. NBPI can provide many of the same advantages as UV radiation, odour control, and VOC reduction. It was discovered that approximately 84.2% of the virus could be inactivated within 10 minutes using NBPI(24).

1-4-5 sensors and smart tools .

The designers have been minimising human contact and practising social distancing by employing an intelligent vision. To meet the challenges posed by the second wave of the epidemic, they anticipate futuristic design solutions incorporating adaptive automated systems. Indoor air and passageways are some examples.

Biometric technology is becoming more mainstream and is used to identify and authenticate individuals, reducing the risk of exposure to germs and screening public health. It also facilitates social distancing, provides customers and users with contactless self-service experiences, and reduces operating costs. An intelligent biometric gate permits the rapid passage of people and unique needs in the metro, airport, and other transport installations. This intelligent biometric gate/automatic gate machine improves efficiency, lightens staff workload, and reduces administrative costs. It eliminates manual data entry and collection for the management of attendance and time, simplifying the process of access and controlling user passage.

The post-pandemic period has seen many changes and innovations in the indoor built environment, such as advanced sanitary features such as intelligent toilets and automatic cleaning faucets. Cleaning automation in bathrooms is a priority, and using cleaning robots and self-cleaning devices can lower infection threats to the janitorial staff. Biometrics technology can permit the rapid passage of people and unique needs in the metro, airport, and other transport installations. The innovative design of the radar sensor reduces the gate length.

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It integrates face and finger vein recognition and other technologies into the compact body, allowing passengers to pass through quickly without registering in advance. This machine improves efficiency, lightens staff workload, and reduces business operation costs.

Using AI and touchless technology would lessen the need for frequent, thorough cleaning. During a pandemic, buildings could use automation, voice control, and retina recognition powered by artificial intelligence to help stop the spread of disease. Furthermore, it has been reported that contact with contaminated surfaces accounts for the transmission of over 80% of infectious diseases (25). Therefore, it is desirable to employ more contactless methods of transportation, such as smartphone lifts, the elimination of handles, keys, automatic opening doors, etc. Some potential future uses for contactless systems include automated pathogen cleaning and remote temperature control.

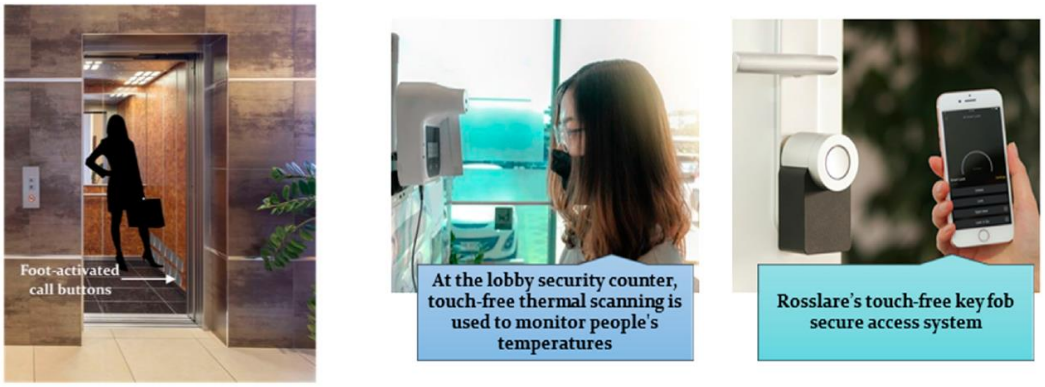

Figure 8: techniques examples used to reduce the environmental risks for airborne transmiss by technology.

Chicago's Fulton East Office Tower, the "First Post-Covid Building" (26), uses some of these cutting-edge innovations. One of the first commercial buildings built during the COVID-19 pandemic is a 12-story, 8361 m2 (90,000 ft2) office and retail complex in Chicago. With the first new installation of MAD Elevator Inc.'s Toe-To-Go (T2G) hands-free lift system worldwide, this building boasts several cutting-edge features, including touchless lifts with foot-activated call buttons.

Research Material and Methods

The pragmatic objectives of this study—bridging the gap between theory and practice and identifying areas where performance could be improved—make it an excellent illustration of applied research. Consequently, this study is predicated on a methodology shared by identifying the current state and diagnosing and classifying problems using the experimental research method. Utilization of Case Studies To collect data, a random sample of individuals was asked to complete a questionnaire. SPSS (Statistical Product for the Social Sciences) was utilized to analyze the questionnaire's results.

Criteria of selecting cases of study

Most of the high traffic governmental buildings at Zagazig city were chosen to be included in this research. Due to the legal status of these buildings, it is limited to take pictures or do a full survey of them. Instead, the researcher drew horizontal floors during a field visit instead of taking actual measurements. The selected buildings are the traffic department building, the civil registry building, the post office building, and the passport issuance building.

Criteria of selecting responders

Purposive sampling is a subset of non-probability sampling methods in which units are chosen for their desirable properties. Put another way, purposive sampling involves the deliberate selection of units. A total of 140 questionnaires were created, and the intended sample was chosen because to a lack of information among the general public about the selected buildings, as per the statistical guidelines for determining the size of the sample in procedural and experimental research.

Questionnaire Design

The status of use has been analysed using five categories. The first category focuses on the existence of architectural solutions to prevent congestion and delays among users. The second category is concerned with architectural solutions for creating healthy spaces. The third category emphasises using appropriate materials and furniture components. The fourth category focuses on engineering technology applications that limit the spread of the COVID-19 virus through architectural design. The final category provides an overview of the building's architectural design and its impact on reducing infection transmission risks.

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Data analysis

Analyse the means of various samples. The evaluation priorities were established by comparing the questionnaire's strengths and weaknesses to the indicators revealing the usage pattern, the questionnaire used to collect the data is provided below.

Please discuss the presence of each element or not in this government building :

Research question	Survey question	yes	no	probably
Preventing users from crowding and delaying by architecture design	The building spaces size is suitable for the size of the intensity of users and traffic.			
	The building spaces size is suitable for the number and quality of services provided by it.			
	The distribution of spaces in the building is regular in terms of the sequence of service provision			
	The locations of the vertical and horizontal connection elements are appropriate and easy to access and use			
	The locations of services for the public users and employee are appropriate and easy to access			
	The numbers and sizes of entrances are suitable for the density of users and the rate of use throughout the day and during peak times			
	There is a reception space and a guiding system such as a reception counter or electronic guidance so that users are directed to quickly and appropriately access the required service.			
	Numbers and widths of stairs and ramps suitable for the density of users and movement between floors			
	Corridor widths are suitable for the density of users and movement between spaces			
Creating healthy spaces by architecture design	Natural plants are used in indoor spaces to create a healthy environment and purify the air			
	Planted walls are used to increase the area of plants in the building to reach a healthy environment and purify the air			
	The sizes of windows and openings are suitable for natural ventilation of the spaces			
	The sizes of windows and openings are suitable for natural sunlight to enter the spaces			
	The smell in the building is good as evidence of healthy spaces as a result of the availability of plants, lighting and natural ventilation			
Using suitable materials and furniture elements	Most of the materials of the architectural elements that the user has to touch, intentionally or unintentionally, such as handrails, door handles, elevators, etc., are made of copper or stainless steel or metal.			
	Antibacterial and washable paints have been used			
	furniture elements are distributed in a way that helps social distancing occur when it is needed			
	The materials used in the furniture elements are			

	copper, stainless steel, or antibacterial metal materials			
	Furniture items that are used to protect employees from infection from public contact, such as splash proof glass panels, have been used			
	Furniture elements that organize the lines and regulate the entry and exit movement were used to obtain the service			
Integrating engineering technology applications that contribute to limiting the spread of the COVID-19 virus with architectural design	Smart systems and/or sensors were used in most aspects of the building to reduce the possibility of contact with surfaces			
	artificial ventilation systems are available and commensurate with the size of the spaces and the density of users			
	Filters that purify the air from viruses and bacteria may be used in artificial ventilation systems			
	Ultraviolet wave devices were used that eliminate viruses and bacteria			
	Bipolar Ionization devices were used that eliminate viruses and bacteria			
	Fogging and/or sterilizing devices were used to eliminate viruses and bacteria			
A general explanation about the architectural design of the building and its impact on reducing infection transmission risks	Can it be considered that this building is healthy and helps reduce the transmission of viruses, especially the Coronavirus?			
	Do you think that the architectural design of the buildings had a positive impact on the ability of the building to protect users from the transmission of infection during the pandemic?			
	Are the old government buildings in Egypt in ancient cities like this building capable of dealing with the Corona pandemic in the future?			
	Did you feel safe while entering the building during the pandemic?			

Table 1: Research questionnaire

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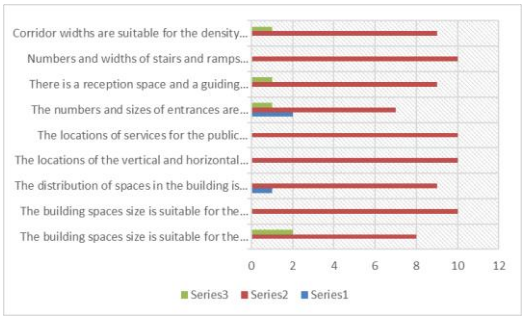
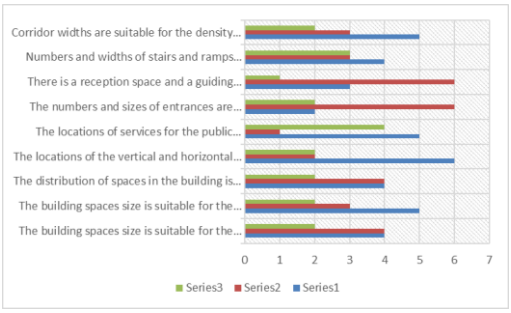
Results and discussion

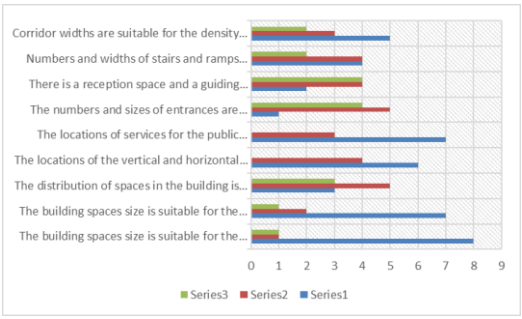
First Category: Preventing users from crowding and delaying by architecture design, the result of the questionnaire was as follows:



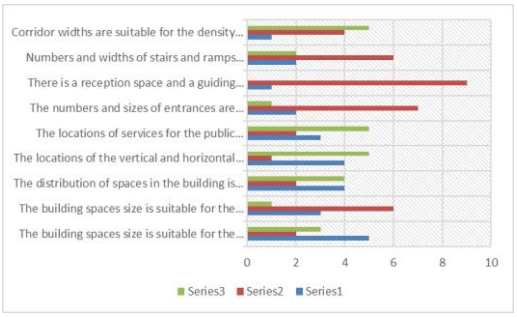
Passport issuance building



Citizen Services building



Traffic building



Post services building

Figure 9 -10- 11-12:

First Category results for selected buildings.

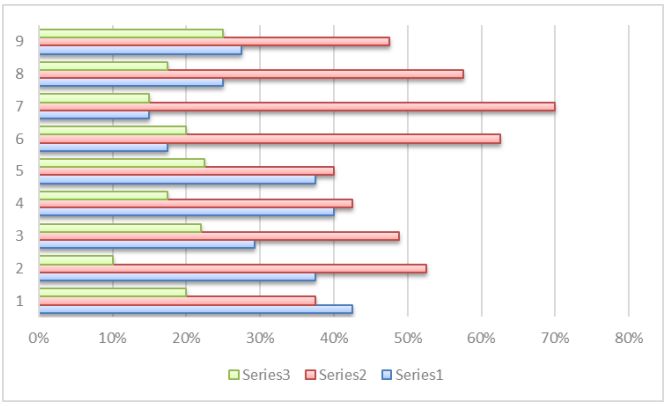


Figure 13: The average results for the first Category.

The results showed that no majority of architectural elements could be used to prevent crowding and make buildings able to deal with epidemics through social distancing and this appears in the following:

1- Lack of organization at the entrances and gates of Egyptian government buildings, which rely on security personnel and have a jumbled-up system, Additionally, the entrances are minor and do not correspond to the size and rates of building use per hour. Finally, the regulations for terminating some transactions in Egyptian government buildings require citizens to purchase the transaction form before entering, leading to severe crowding, as shown in figure 11.

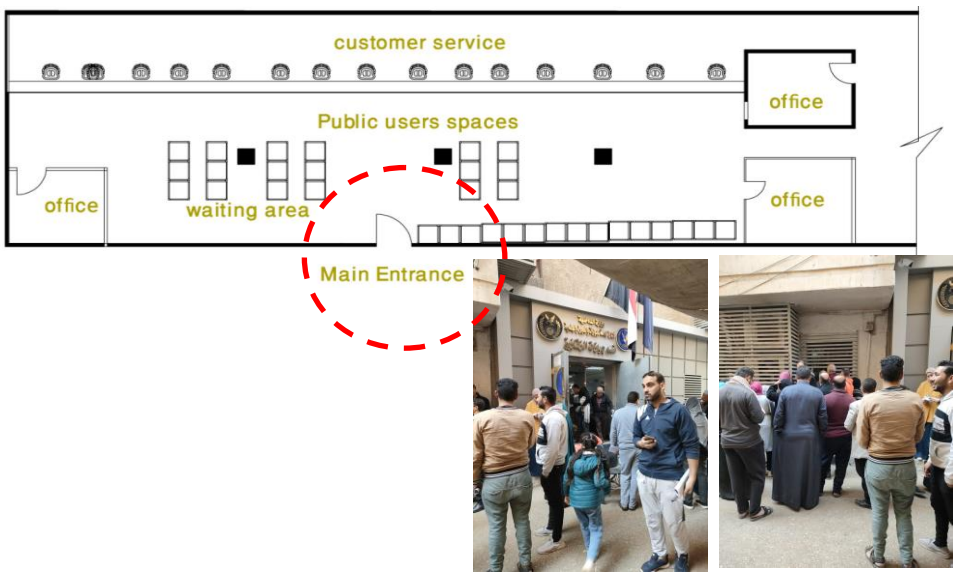


Figure 14: Passport issuance building Entrance

2- In the study cases, no space was designated for reception, and the reception space turned into a void. This contradicts the principles of architectural design, which state that the reception space should be critical in coordinating the rest of the building. This error significantly impacts the entire building because visitors must make unnecessary movements to reach their destination, resulting in many collisions and congestion.

3- The areas designated for waiting are not commensurate with the number of users, and the public spaces designated for serving citizens differ in the intensity of use, leading to a stampede and congestion. In the middle of the public space, there is no link between the user and the seating area, causing the visitor to be forced to stand next to the window in the hope of reaching an employee. Masks that cover the face are nearly impossible to make. As shown in figure 12.

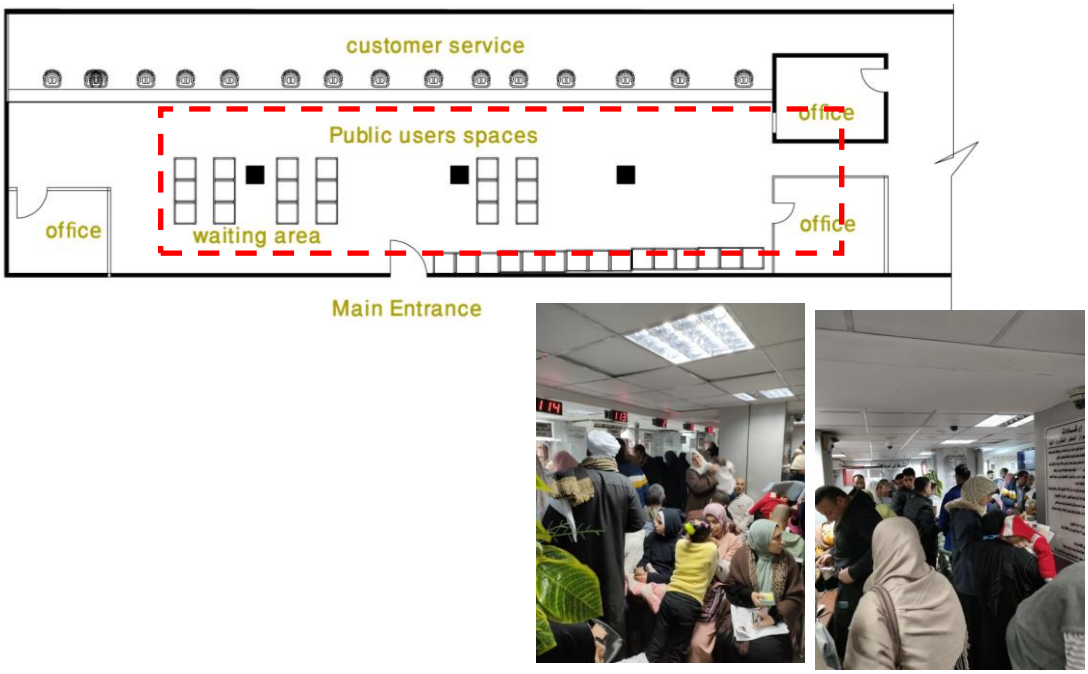


Figure 15: Passport issuance building reception hall

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4- Stairs do not conform to the design code for administrative buildings regarding width and number, resulting in a high risk of virus transmission. In other instances, the corridor transforms into a waiting hall and a service hall due to an incorrect architectural design for the horizontal plane. As shown in figure 15.

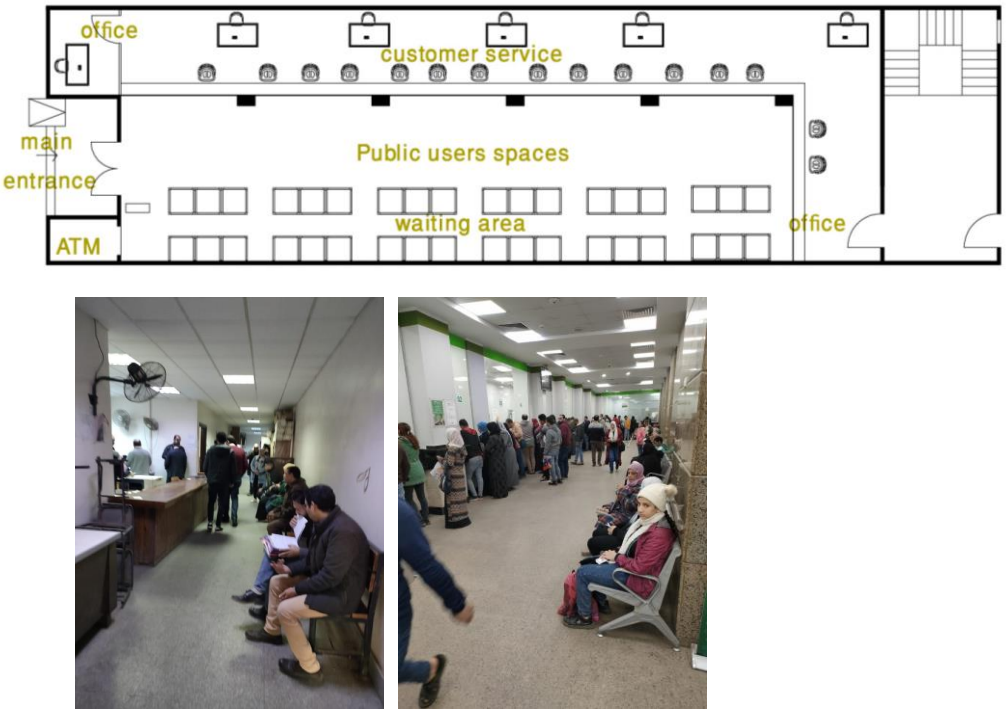
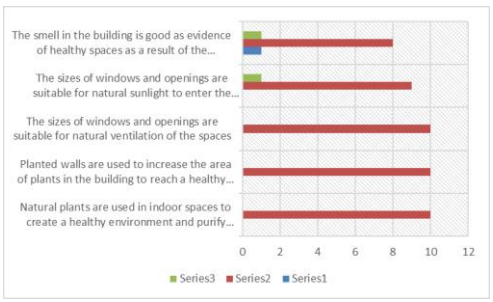
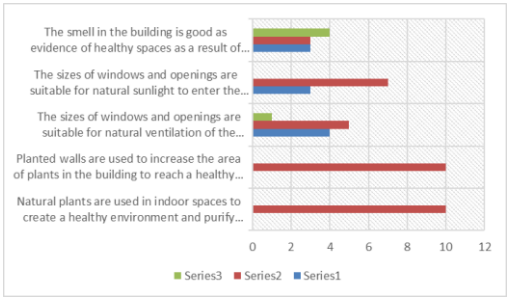


Figure 16: Post services building and reception hall

Second Category: Creating healthy spaces by architecture design, the result of the questionnaire was as follows:



Passport issuance building



Citizen Services building

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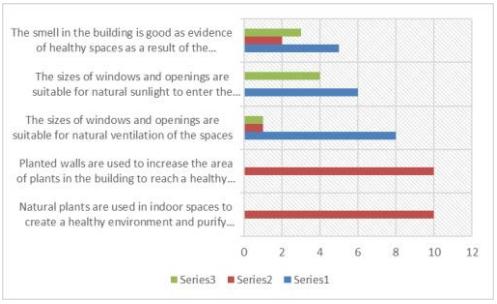

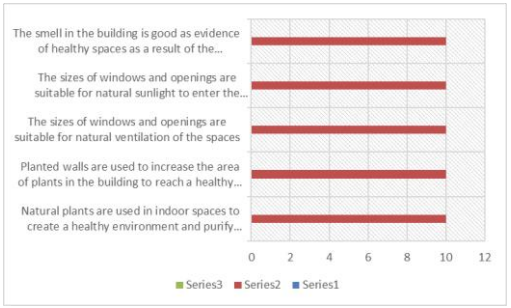

Traffic building post services building

Figure 17 -18-19 -20:

Second Category results for selected buildings.

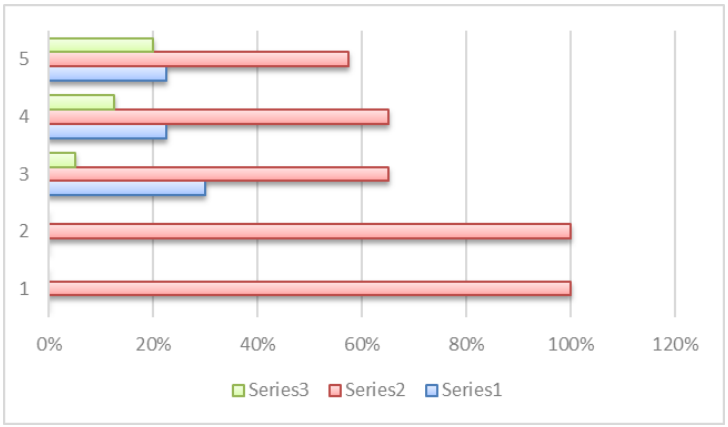

Figure 21: The average results for the Second Category.

The results showed that no majority of architectural elements could be used to Create healthy spaces by planting and natural ventilation, and this appears in the following:

1- The uncontrolled architectural design of most government buildings results in spaces that do not contain natural ventilation or natural ventilation with surfaces that need to be commensurate with the size of the spaces and the intensity of use.

2- The architect places all of the administrative spaces for employees and managers on the outer border of the site to take advantage of a good view and adequate ventilation. The fundamental administrative areas, stairwells and corridors are located in the centre of the horizontal plan, away from the exterior edge of the building.

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These spaces serve the citizens, giving them more importance than other office spaces. Due to the architectural design of the horizontal plane, the high-density service areas are transformed into unhealthy spaces, creating an environment favourable to the propagation of epidemics, viruses, and diseases. As shown in figure 16.

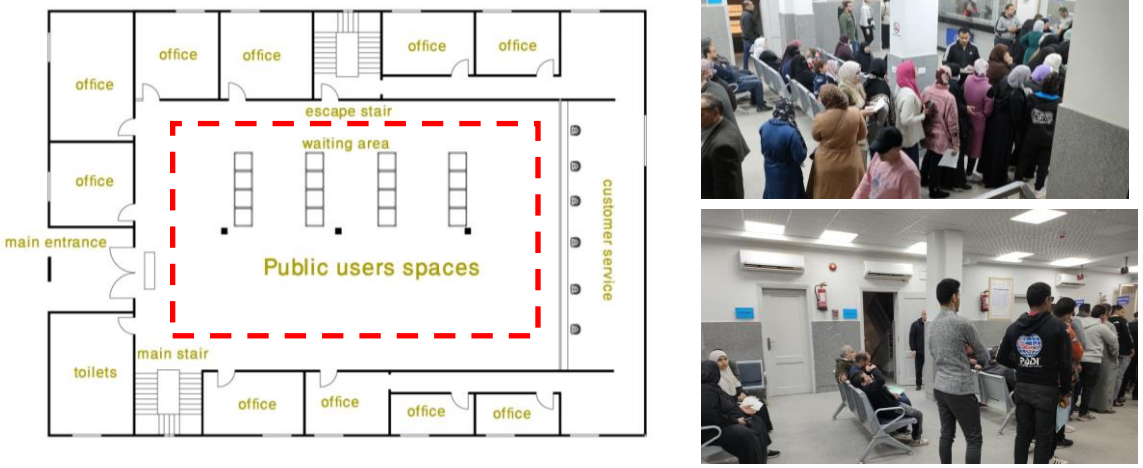
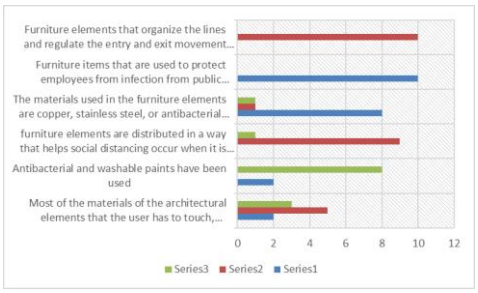
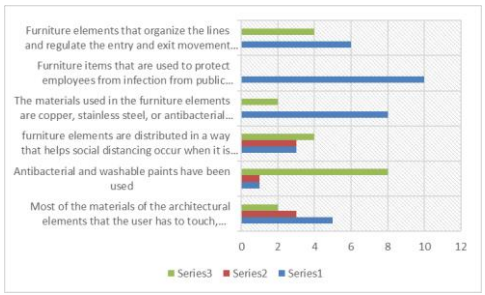


Figure 22: citizen services Building floor plan and reception hall.

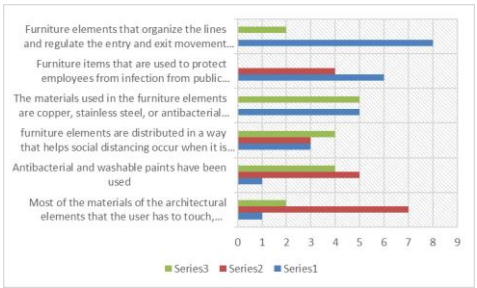
Third Category: Using suitable materials and furniture elements by architects, the result of the questionnaire was as follows:



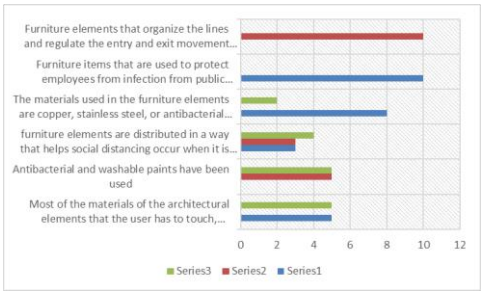
Passport issuance building



Citizen Services building



Traffic building



post services building

Figure 23-24-25-26:

Third Category results for selected buildings.

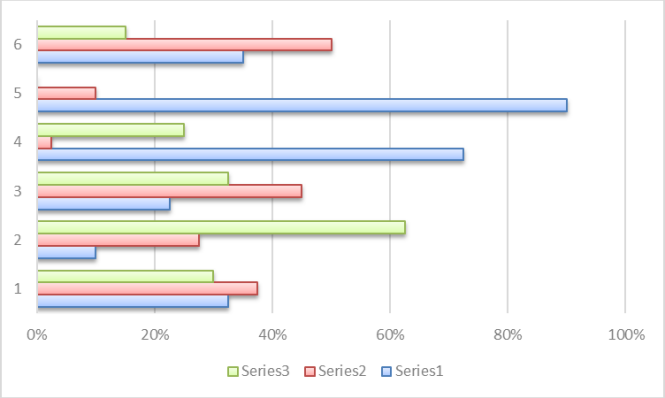


Figure 27: The average results for the third Category.

The results showed that there is a use in some buildings for stainless steel and marble materials in the interior design, which are materials that can be washed and disinfected. However, copper was not used, which is considered the best material for dealing with the virus, and we believe that the main reason for that is its high price.

Furnishing elements contributed to the accumulation of users waiting for services and reduced surface area in public spaces, while glass barriers were not used to protect employees from infection. This is concerning given that employees interact with hundreds of people daily, increasing the likelihood of becoming infected with droplets.

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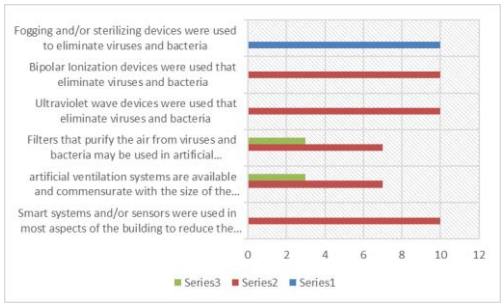
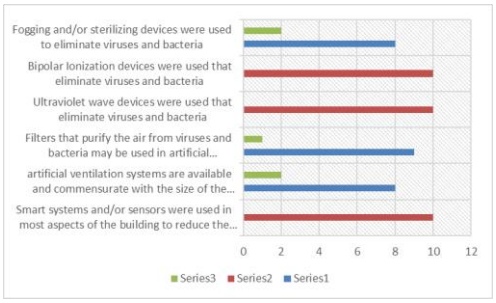
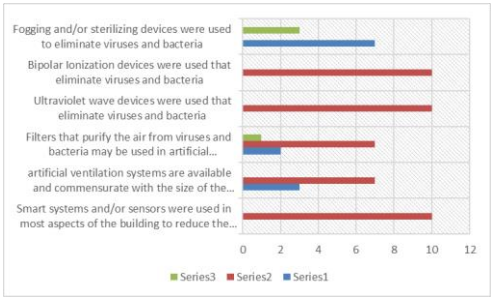
Fourth Category: Integrating engineering technology applications that contribute to limiting the spread of the COVID-19 virus with architectural design, the result of the questionnaire was as follows:



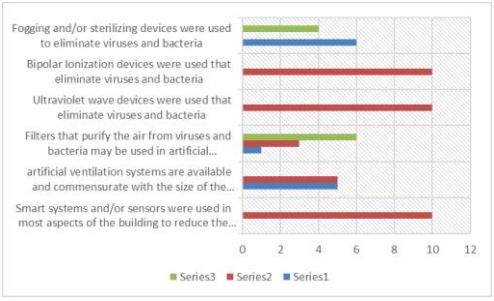
Passport issuance building



Citizen Services building



Traffic buildings



post services building

Figure 28 -29 – 30 - 31:

Fourth Category results for selected buildings.

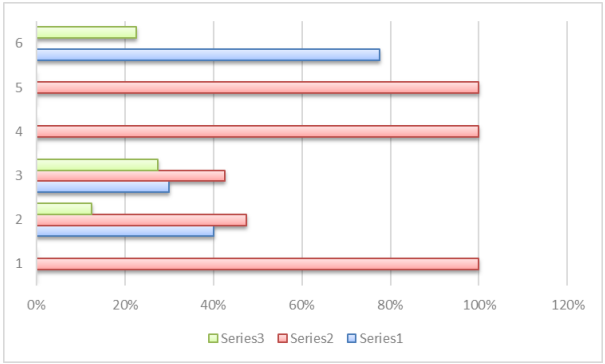


Figure 32: The average results for the fourth Category.

The results showed that some public government buildings put self-sterilization gates at the main entrances. Even though many of these gates do not work in real life and have no actual effect, the fact that they were installed was an essential indicator of the desire of the local administration in Egypt to develop a plan to try to reduce the spread of infection. However, after the visit and the audit, we did not notice that these efforts matched the recent studies that extensively used technology in buildings to reduce the risk of infection transmission. The industrial ventilation systems, the use of filters to purify the air, ultraviolet rays and ionizers, and sensors that help reduce the Surface and leaf contact ratio were nowhere to be found in the buildings that were the focus of the visit.

Figure 33: sterilization gates at Traffic building.

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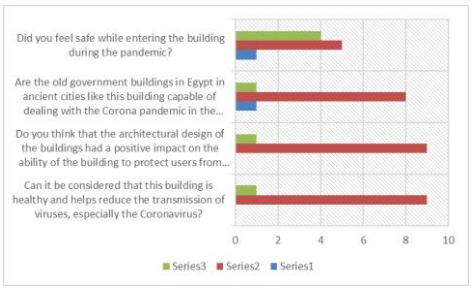
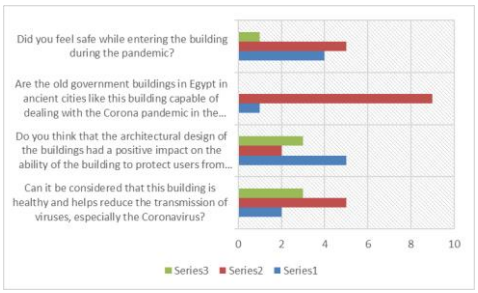
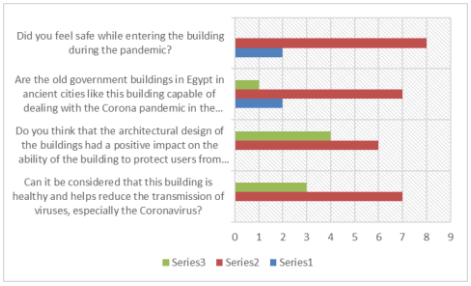
Fifth Category: A general explanation about the architectural design of the building and its impact on reducing infection transmission risks, the result of the questionnaire was as follows:



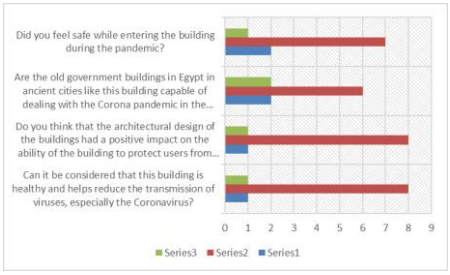
Passport issuance building



Citizen Services building



Traffic buildings



post services building

Figure 34-35-36-37:

Fifth Category results for selected buildings.

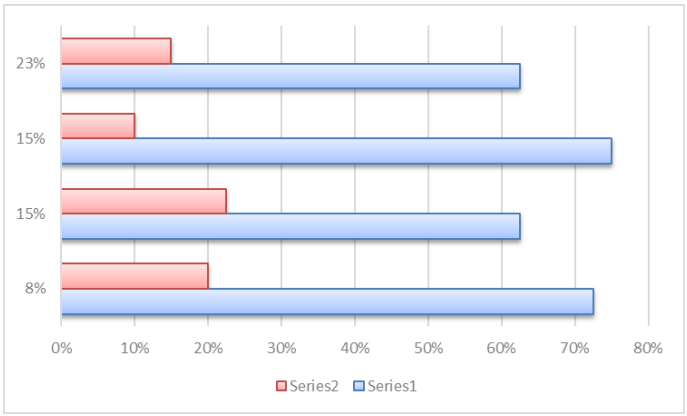


Figure 38: The average results for the fifth Category.

In the majority of old Egyptian cities, such as Cairo, Zagazig, Mansoura, Kafr El-Sheikh, and Alexandria, the poor quality of the design of government buildings, which deal daily with millions of citizens, is evident. Due to the lack of urban planning in the majority of these cities, government buildings were constructed in locations and on surfaces that could be more suitable for the number of residents that live there. With their service, the government service office is frequently located in a residential apartment in an old building or an old government building. It employs many employees and is filled with bureaucracy that increases the time it takes to implement the service for the citizen, resulting in much overcrowding as the citizen must visit the building multiple times to complete the requested service.

This paper's definitions of design flaws are intended for architects. The author believes that a verbal explanation supported by appropriate visuals will be more beneficial to an architect than a formulas list. When determining the criteria for the design of healthy buildings in Egypt, multiple factors must be considered. On the other hand, human life must be protected, even though construction is costly. In Egypt, there are no clear criteria comparable to building codes that architects can use when designing healthy buildings that reduce the transmission of viruses, particularly coronavirus. Only in the design of hospitals and other buildings under the control of the health ministry are there regulations governing the issuance of licences for the construction of healthy buildings.

CONCLUSION

During the architectural design phase of government buildings, resistance to the coronavirus and other viruses requires meticulous planning. Ultimately, the health system developed during the design process determines whether a building is healthy. Millions of Egyptians utilize government buildings daily, so they must be designed with health and safety in mind. When designing a new office building, anti-virus regulations must be considered. This factor also affects the factors that determine building costs. In light of Egypt's current economic climate and to meet the people's social and cultural needs, efforts to reduce building costs have centred on the relatively small portion of the budget devoted to maintaining a healthy environment. Most of this work is performed by individuals without technical training. The cost to the nation has been incalculable during the coronavirus pandemic years of 2018 and 2019. This study showed that the layout of a building significantly impacts how it affects people's health and that many of the flaws contribute to the spread of COVID-19 in government buildings. The secondary objective is to compile information regarding the nature of viral transmission phenomena, virus behaviour, and the most common cases of virus transmission in Egyptian government buildings due to design flaws, emphasizing sharing this information with architecture students.

As a developing nation, Egypt may need more economic resources. As is the case in numerous other fields, the professional status of architects and the quality of the buildings they design differ from those of the developed world. In this country, contractors frequently mass-produced official buildings with little input from architects. Numerous architects are fine selling their designs and names to the highest bidder.

Even when an architect is hired to design a building from scratch, the project owner, whose top priority is profiting maximization at any cost, can significantly impact the design. However, no self-respecting member of the architectural community can use any of those above as an excuse for not knowing what they are talking about. For us citizens, the day government buildings are safe, sound, and healthy is the day of reckoning for all those who labour in the building trades, from owners to designers to builders to finishers. The spread of a virus should be more concerned with a structure's aesthetic value and the number of awards its architect may have won. The building's guiding principles become irrelevant in the event of a pandemic.

Healthy designs are crucial factors that must be considered when constructing national offices. Architects must understand viruses' transmission dynamics and behaviour to design a healthy architecture that can withstand epidemics. Designing buildings that can withstand the spread of viruses is an instance in which knowledge alone is decisive. Professional architects have a moral and legal obligation to educate themselves.

To conclude, initiating the practice of constructing virus-resistant, healthy government buildings in Egypt will require substantial effort. It is impossible to anticipate a sudden improvement in construction quality given all the factors and politics involved in the industry. Getting there takes a lot of effort and motivation, and it is easy to feel discouraged. However, it is crucial to remember that human lives are at stake if we do not attempt to learn more.

References:-

1- "Egypt COVID - Coronavirus Statistics - Worldometer." Egypt COVID - Coronavirus Statistics - Worldometer, www.worldometers.info/coronavirus/country/egypt. Accessed 1 Jan. 2023.

2- "Coronavirus Disease (COVID-19) – World Health Organization." Coronavirus Disease (COVID-19), 19 Dec. 2022, www.who.int/emergencies/diseases/novel-coronavirus-2019.

3- Overview of the Health System in Egypt, chapter2, https://dhsprogram.com/pubs/pdf/SPA5/02chapter02.pdf. Accessed 25 nov. 2022.

4- Fezi, B. A. (2020, March 1). HEALTH ENGAGED ARCHITECTURE IN THE CONTEXT OF COVID-19. Journal of Green Building, 15(2), 185–212. https://doi.org/10.3992/1943-4618.15.2.185

5- D'Alessandro, Daniela., et al. (2020). COVID-19 and Living Spaces challenge. Well-being and Public Health recommendations for a healthy, safe, and sustainable housing. Acta bio-medica: Atenei Parmensis. 10.23750/abm.v91i9-S.10115.

6- "Building Design for Preventing COVID-19 Pandemic." Building Design for Preventing COVID-19 Pandemic | Encyclopedia MDPI, encyclopedia.pub/entry/23087. Accessed 19 nov. 2023.

7- Abou-ElWafa., et al. (2021). Self-reported COVID-19 among physicians: An Egyptian online study during the pandemic. F1000Research, 10. https://doi.org/10.12688/f1000research.53931.1

8- https://www.inss.org.il/publication/egypt-coronavirus-test/. www.inss.org.il/publication/egypt-coronavirus-test. Accessed 9 Jan. 2023.

9- Pongsakornrungsilp, P., Pongsakornrungsilp, S., Jansom, A., & Chinchanachokchai, S. (2022, September 10). Rethinking Sustainable Tourism Management: Learning from the COVID-19 Pandemic to Co-Create Future of Krabi Tourism, Thailand. Sustainability, 14(18), 11375. https://doi.org/10.3390/su141811375

10- https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public

11- Zaher, N. (2020, December 21). Design solutions for interior architecture post coronavirus. Journal of Art & Architecture Research Studies - JAARS, 1(2). https://doi.org/10.47436/jaarsfa.v1i2.71

12- Spennemann, D. H. R. (2022, July 8). Designing for COVID-2x: Reflecting on Future-Proofing Human Habitation for the Inevitable Next Pandemic. Buildings, 12(7), 976. https://doi.org/10.3390/buildings12070976

13- Raouf SEDKY, R. (2020, June 1). The influence of human movement on the formation of adaptive architecture. International Journal of Architectural Engineering and Urban Research, 3(1), 58–66. https://doi.org/10.21608/ijaeur.2020.219314

14- ietz, L., Horve, P., Coil, D., Fretz, M., ..., & Wymelenberg, K. (2020). 2019 Novel Coronavirus (COVID-19) Pandemic: Built Environment Considerations To Reduce Transmission. Retrieved from American Society for Microbiology: https://msystems.asm.org/content/5/2/e00245-20

15- Susanto, A.D.;Winardi,W.; Hidayat, M.;Wirawan, A. The use of indoor plant as an alternative strategy to improve indoor air quality in Indonesia. Rev. Environ. Health 2021, 36, 95–99.

16- Cortes, A.A.; Zuñiga, J.M. The use of copper to help prevent transmission of SARS-coronavirus and influenza viruses. A general review. Diagn. Microbiol. Infect. Dis. 2020, 98, 115176.

17- Shirvanimoghaddam, K.; Akbari, M.K.; Yadav, R.; Al-Tamimi, A.K.; Naebe, M. Fight against COVID-19: The case of antiviral surfaces. APL Mater. 2021, 9, 031112.

18- https://penkethgroup.com/knowledge-centre/covid-secure-workplace-safety-sneeze-guard-glass-protection-screens/

19- Navaratnam, S., Nguyen, K., Selvaranjan, K., Zhang, G., Mendis, P., & Aye, L. (2022, January 12). Designing Post COVID-19 Buildings: Approaches for Achieving Healthy Buildings. Buildings, 12(1), 74. https://doi.org/10.3390/buildings12010074

20- Morawska, L., Tang, J. W., Bahnfleth, W., Bluyssen, P. M., Boerstra, A., Buonanno, G., Cao, J., Dancer, S., Floto, A., Franchimon, F., Haworth, C., Hogeling, J., Isaxon, C., Jimenez, J. L., Kurnitski, J., Li, Y., Loomans, M., Marks, G., Marr, L. C., . . . Yao, M. (2020, September). How can airborne transmission of COVID-19 indoors be minimised? Environment International, 142, 105832. https://doi.org/10.1016/j.envint.2020.105832

21- Lipinski, T.; Ahmad, D.; Serey, N.; Jouhara, H. Review of ventilation strategies to reduce the risk of disease transmission in high occupancy buildings. Int. J. Thermofluids 2020, 7–8, 100045
22- Kumar, A.; Sagdeo, A.; Sagdeo, P.R. Possibility of using ultraviolet radiation for disinfecting the novel COVID-19. Photodiagnosis Photodyn. Ther. 2021, 34, 102234.
23- Megahed, N.A.; Ghoneim, E.M. Indoor air quality: Rethinking rules of building design strategies in post-pandemic architecture. Environ. Res. 2021, 193, 110471.
24- Zeng, Y.; Manwatkar, P.; Laguerre, A.; Beke, M.; Kang, I.; Ali, A.S.; Farmer, D.K.; Gall, E.T.; Heidarinejad, M.; Stephens, B. Evaluating a commercially available in-duct bipolar ionization device for pollutant removal and potential byproduct formation. Build. Environ. 2021, 195, 107750.
25- Zhang, N.; Wang, P.; Miao, T.; Chan, P.-T.; Jia, W.; Zhao, P.; Su, B.; Chen, X.; Li, Y. Real human surface touch behavior based quantitative analysis on infection spread via fomite route in an office. Build. Environ. 2021, 191, 107578. [CrossRef] 37.
26- Dorfman, P. This Chicago Office Tower Claims to Be the First Post-COVID Building. Available online: https://blog.bluebeam. com/post-covid-office-building-fulton-east/ (accessed on 8 August 2022).

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