Design and Development of Modular Isolation Unit for Pandemics

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Abstract

During the current pandemic- COVID-19, 'design' has emerged in homes and neighborhoods as a practical response to the global situation. From upcycled masks to drawing up boxes using chalk to ensure social distancing in queues, to contactless delivery of food and supplies, there is ingenuity happening at an individual level. Undoubtedly, there is a lot that this pandemic is teaching us in the aspects of architecture and design that we need to adopt and adapt to at home and public spaces. We may have to move away from communal setups or redesign it to more isolated individual units in a larger communal framework.

Due to infections that spread during pandemics, there is necessity for us designers to respond as it deals with human settlements. To curb the transmission of infection, we have come up with a solution of 'isolating the infected'. But, man is a social animal by nature. How do we ensure that we isolate the infection and the infected, contain them in a controlled environment, by providing daily necessities and treatment, with minimal or no human interaction, but keep them occupied to ensure their physical and psychological wellness.

Keywords: Covid 19, Framework, Transmission, Psychological

Introduction

Design of spaces originated as a primary defence system to defend oneself from natural forces like air, wind, rain, heat and the wildlife. Eventually we have elaborated the space into a shell to perform various activities. As the number of entities to save oneself from increased, many layers have been added on to space design.

From the late 19th century onwards, with the advancement in medical field, we have the antibiotics and immunizations for infectious diseases. Until then, the only way was to protect oneself from not getting infected. With the new diseases emerging, with no medicine and vaccines found yet, the only way to curb the transmission of these diseases is to return to medieval ways of taking shelter and prevent exposure to the disease. The spatial interpretation of the shelter may vary, but the response to the problem remains same- 'seeking space for disease control'. In other words, architecture or spatial design gets a medical purpose.

Relevance of Project

It is human instinct to distance from the danger, to put space between the danger and oneself. During the middle ages, in Venice, preventive measures were taken to stop the spread of plague- Ships arriving from areas affected by 'Black Death' were anchored for forty days for the crew to embark. In 1969, when Apollo 11 astronauts returned from the moon, NASA quarantined them in an Airstream trailer for 21 days as a precaution for bacteria or organisms that they may have brought back with them from the mission. The 1850 Cholera outbreak in London, led to a sanitary reform movement and created infrastructure for drinking water and sewage.

Pandemics have always forced the human race to push the boundaries of problem-solving to design scalable solutions. Quarantine is a temporary buffer of space in time. In a way, space becomes the medicine during pandemics. Isolating the infected and the infection from spreading is the key idea that drives the isolation facility.

Role of designers

All through the history, designing and inhabiting physical space has been primary defence against epidemics. The most famous modernist architect, Le Corbusier, had obsession for cleanliness in his designs. He viewed light and air as being medicinal. His most influential modernist house, Villa Savoye, features a hand-washing sink right near its entrance. (The Lasting Influence of Pandemics on Interior Design 2020) Traditional Indian houses also had the culture of washing hands and feet before entering the house.

With advancement of antiviral drugs, immunizations and antibiotics, the use of built environment for treating infectious diseases, epidemics waned. Although designing new ways to fight disease was effective in mitigating the spread of disease, it was seen as a blunt tool in comparison to medicine.

With the new epidemics like COVID-19 coming in, where the vaccines and drugs are still finding its way, space has come in as the first saviour in curbing the transmission of the disease in time. For many centuries, around the world, it has been believed that light and fresh air helps to cure diseases, hence, influencing architectural trends. Hence, designers become one of the first ones to respond to such pandemic situations.

Current Social Context

As laws are being passed to close up public spaces and gatherings, encouraging work from home and restricting movement of people, new windows are opening up with safety becoming the top priority in this current health crisis. Restaurants have begun to pack the cooked food and selling it as grocery boxes to people stuck at homes. No-contact delivery and real-time update of rider's temperature are few other measures taken. An endless series of webinars, panel discussions and meetings have spawned, spurring a number of creative responses to redesign online events. All courses, lectures, classes and meetings of institutions have moved to an online web-platform.

As the Covid-19 pandemic continues to spread, the future remains uncertain. Our lives have changed overnight in the last few months with overflowing hospitals, locked-down cities, work-from-home setups and closed educational institutions. Larger societal implications and how they shall manifest through design is the watch out for future.

Undoubtedly, there is a lot that this pandemic is teaching us in the aspects of architecture and design that we need to adopt and adapt to at home and public spaces. We may have to move away from communal setups or redesign it to more isolated individual units in a larger communal framework. Smart technology might take leap more than ever, with doors, lights, elevators, air conditioners working on motion or voice drivers to enable contact-less accessibility. Air filtering systems might see a boost.

Focus, Method and Methodology

The aim of the project is to design and develop a modular isolation facility which can be made, installed and put to use quickly- in less time. Literature case studies from books, journals, articles and blogs were carried out to get a deeper understanding of the user-infected, situation-infection and the space requirement- controlled environment. Ethnography

study by way of interaction with infected and health workers, questionnaire survey to collect feedback from prospective stake holders. The feedback was analysed to draw findings. The design strategies were set; brain stormed for conceptual ideas, explored concepts and compared the finalized concepts. The most efficient and relevant design has been chosen and detailed.

Design Strategies

With the background study and data collected, a framework has been set for the design of isolation unit. The concern, cause and corresponding design stance is defined as follows:
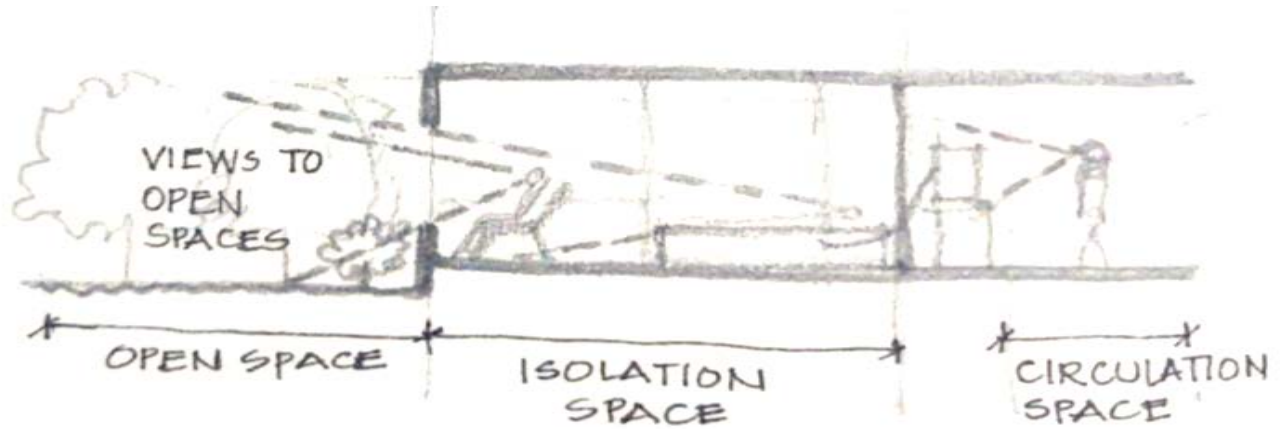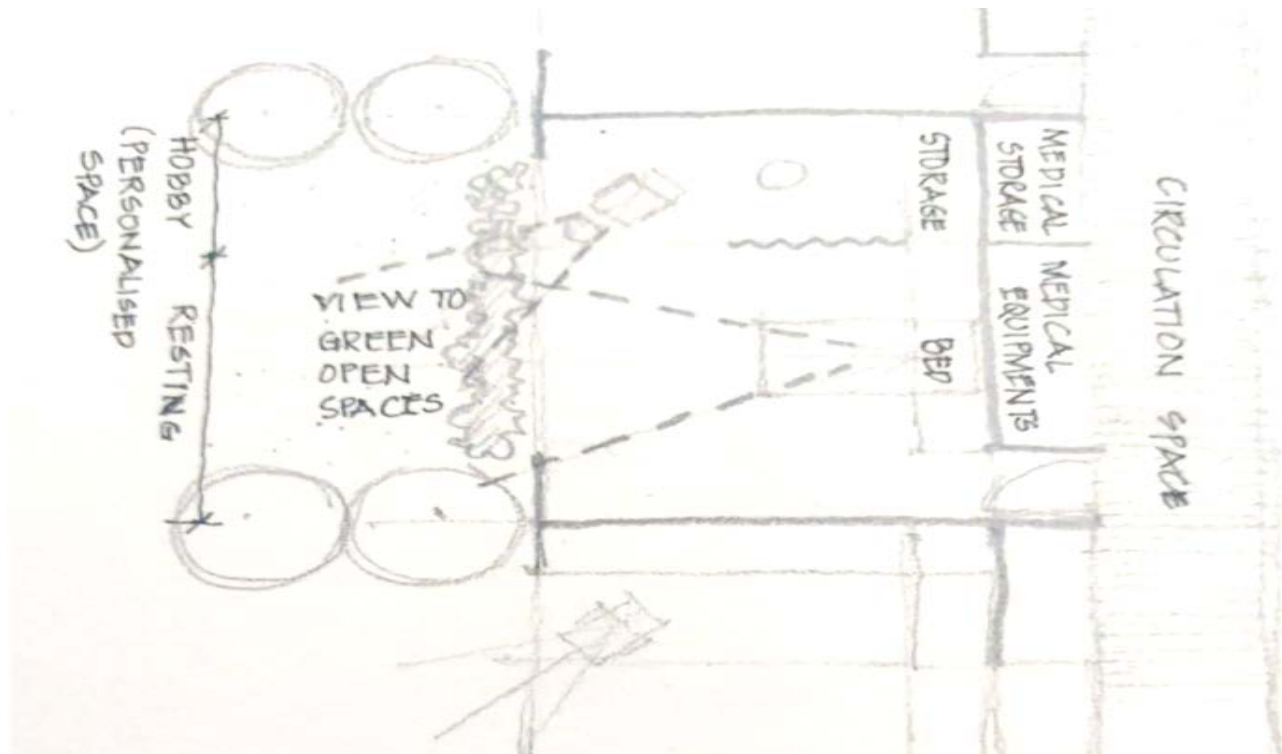

Figure 1: Spatial experience

Figure 2: Spatial experience

A. Stake holders: The isolation facilities can be categorised for various levels of patients categorised. The critical patients who need intensive care will require lot of medical equipments and hence the hospitals. So, the low level risk categories, patients who need isolation and much lesser monitoring are the target users under patients category.

B. Visual order: Any patient goes through the physical illness and the mental illness. The physical illness can be reduced by toning down the mental illness. Keeping the medical equipments away from sight of the infected, monitored by experts and hence creating visual access to the health care professionals helps to keep the isolation space clean from equipments, as illustrated in figure 4 and 5.

C. Inclusiveness: Isolation, as the name itself says, secludes the person from the rest of the community. It gives a negative emotion for humans- a social animal by nature. To avoid the psychological effects that it can have on the infected and to enhance the healing effect, it can be designed as a positive space where one gets time to spend with himself, to explore himself and enjoy the isolation, as illustrated in figure 1 and 2.

D. Personalisation: Each person needs his own personal space that he can personalise and hence feel his own, comfortable. So, the isolation space can have a niche for the patient to personalise and use for his own hobby, art and expression, as shown in figure 3 and 6.

Figure 3: Personas

E. Visual connections: Human culture revolves around nature; greens and blues are soothing to the mind and create pleasant atmosphere both visually and mentally. Hospitalisation often disconnects the person from the outdoors and gets more frustrating and claustrophobic. Hence, opening up spaces to visually pleasant outdoors, helps patient to connect to nature and creates pleasantness, as shown in figure 1.

F. Context: The isolation cell designed in a shipping container shall be placed in a green context like public parks, mini-forest (cultivated), lake and river banks, etc. To ensure nature views for quicker healing, as shown in figure 2.
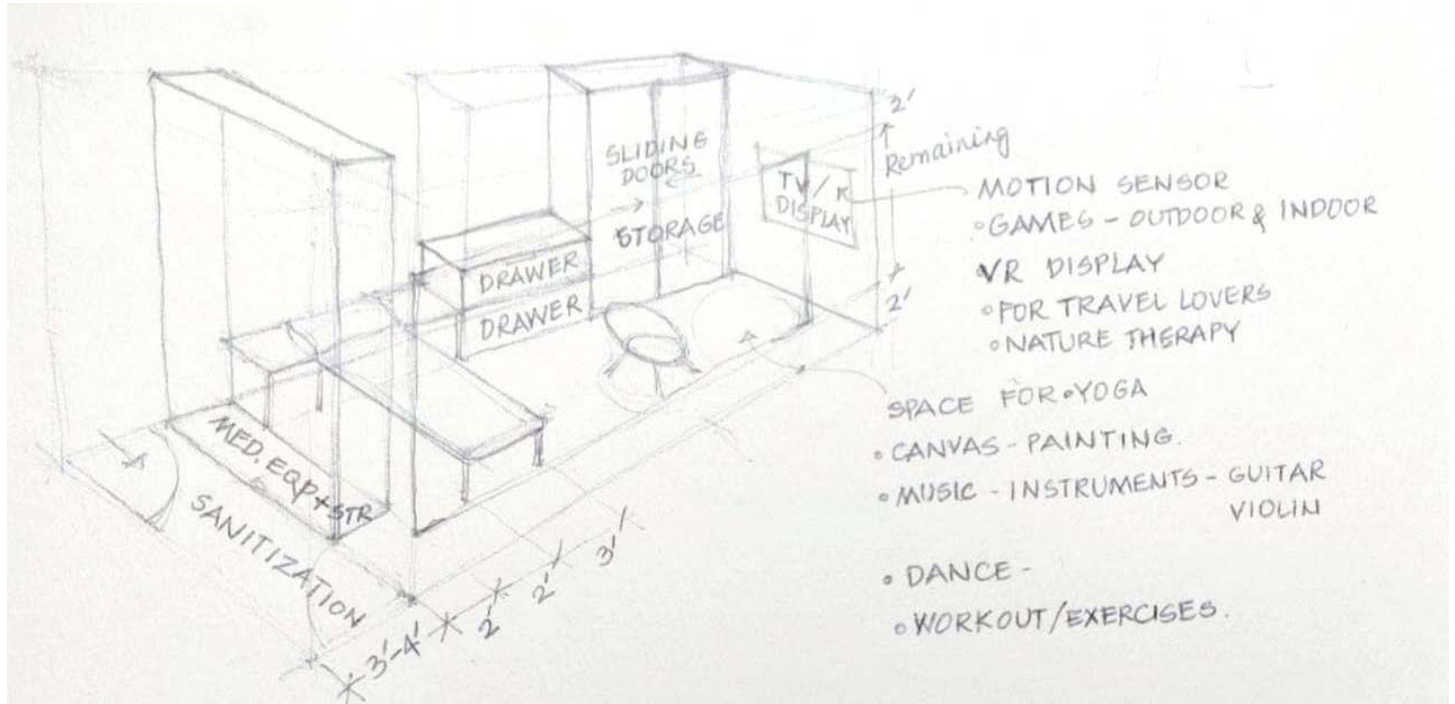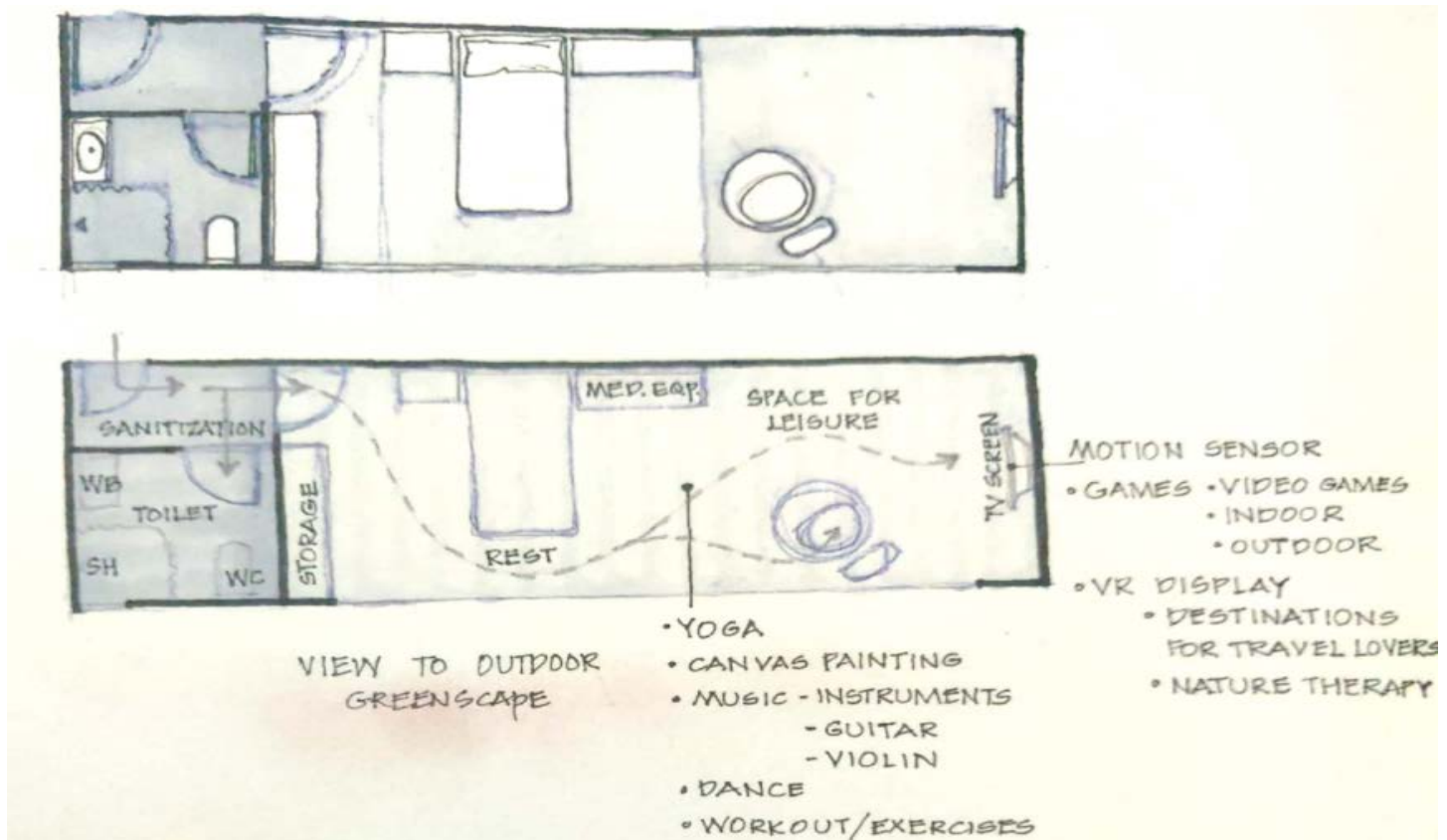
Figure 4: Conceptual ideas

Figure 5: Design Concept

Figure 6: Design Concept

Design -Key Features

a. Structure: The isolation unit is built in a 20' high-cube shipping container; readily available, hence quickly built. The unit is placed in common spaces over-looking scenic views like parks, lakes, reserved areas, etc. Visual connectedness to open spaces from resting space and leisure space is ensured, as in figure 7 and 8.

b. Spaces: A user-defined space for leisure, to accommodate variety of users and their hobbies as per interests; virtual reality set-up to experience places, games and sports from the room itself.

c. Interaction: Interactive service unit beside bed for supply of food and medicines, disposal of waste, display of medical readings without entering the space physically.

d. Sanitization: Sanitization space/ante as a buffer at the entrance of the room. Minimal surfaces to ensure sanitization after every user vacate; all surfaces are made of water resistant materials. Controlled air environment with air filtration system above false ceiling.

e. Energy services: Solar cells on roof to generate energy consumed by the unit- self-sufficient isolation units. All plumbing services for toilet and sanitization space is housed below the container.

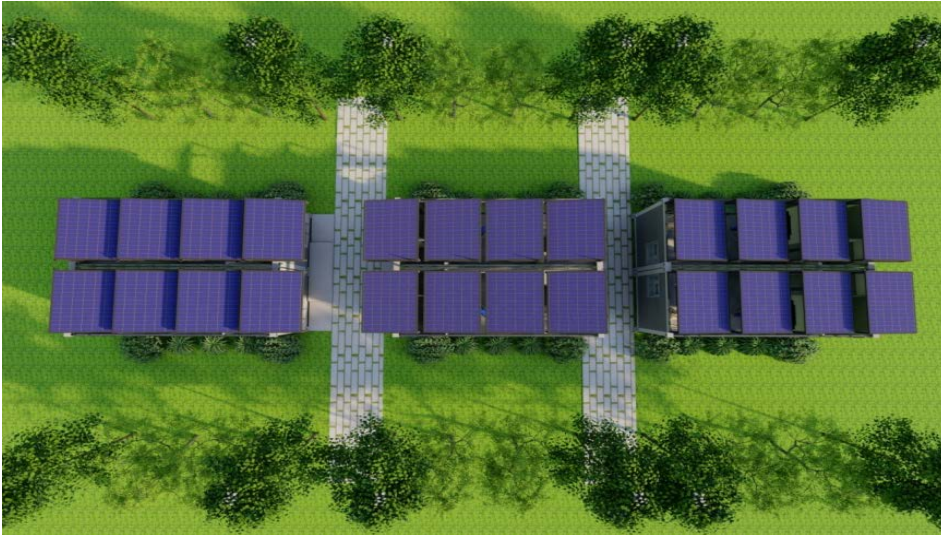f. Segregation: Distinct separate paths for infected and health workers.

Figure 7: Exterior view- isolation units cluster in open green space

Figure 8: Exterior view- path for patients

Spatial Experience

The user experience from each space has been detailed and explained in detail below:

A. Resting space: As shown in the figure 9, there is a view to pleasant open space. Air-out vent for exhaust in the false ceiling above the patient zone; air-filtration system within the false ceiling. Medical equipments for examination in the cabinet beside; food and medicine supply from cabinet (shelf above), accessible from both inside and outside the container; trash disposal from cabinet (shelf below), accessible from both sides of the container.

Leisure space: Activity space for hobby in leisure time, as isolation gives lot of time for oneself. User can bring his required materials to use during leisure- artist easel-board, canvas, paints, books to read, musical instruments, yoga mat for yoga, etc. There is a storage cupboard for storing them, clothes and other belongings, as shown in figure 10.

Figure 9: Interior view- resting space

Figure 10: Interior view- motion sensored games

B. Virtual Reality screen: Virtual reality wall to offer spatial experience for travel lovers; motion sensored games, both indoor and outdoor games, as seen in figure 10.

C. Sanitizing the spaces: All wall surfaces are cladded with water resistant cement fibre board for smooth surface and quick drain off. Other furniture in the room like wardrobe, shelf, etc is made of water resistant, pre laminated boards for sanitization purpose. Filtered air inlet at room entrance from the ceiling.

D. Energy: As shown in figure 11 and 12, solar panels are installed on roof to generate electricity to run the isolation cell energy-efficiently and self-sufficiently; as the isolation cell runs on mechanical ventilation, lot of energy is consumed. All windows are of fixed glass to ensure there is no leakage of infected air.
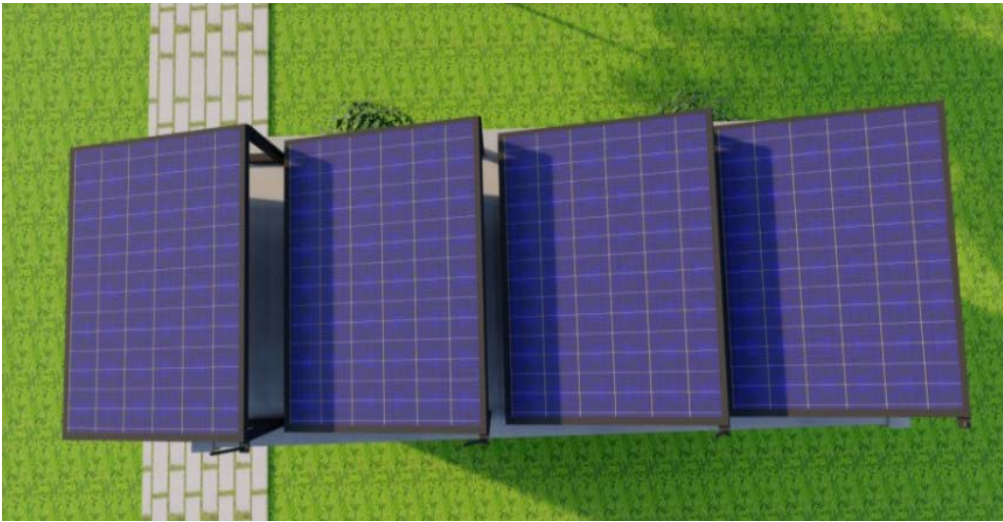
Figure 11: Top view- solar panels to tap energy

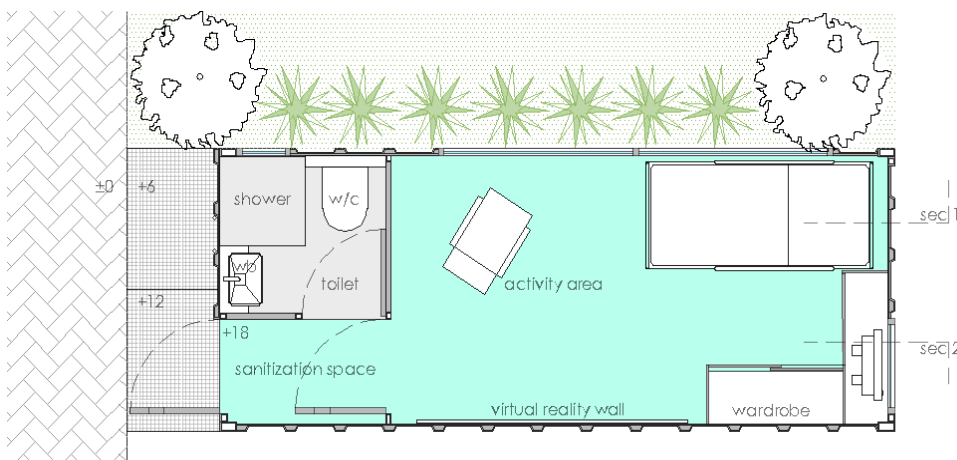Figure 12: Exterior view- open green space

Figure 13: spatial plan to understand the interactions

E. Functioning and Maintenance: As illustrated in figure 15, medical readings are displayed on monitor, visible from outside for health workers to check regularly. Services for the patient is kept on one side, on a separate path exclusively, as shown in figure 14, including food and medicine supply, trash collection and medical status tracking. Plumbing services for toilet and sanitization space is from below the container.

F. Inclusiveness: The units are placed in a huge open space to form a cluster, as shown in figure 11. It helps to have good control to over look on the patients and the patients also have visual connection to the common open spaces to feel the community space. The feeling of 'isolation' can be reduced to a great extent.

Figure 14: Exterior view- path for health workers- maintenance

Figure 15: Exterior view

Conclusion

This project revealed to design minimal space for a person yet focus on the impact of physical space on the mental state of user. It pushed to explore materials that can be cleaned often and quick, a space that has minimum furniture yet allowed the user to make the maximum usage of space in his own ways.

This project was an eye opener that to keep one engaged and productive, it is the 'luxury of space' and not luxurious space that is required. It is pleasantness seen, pleasantness felt and pleasantness transferred to the mind. The project sensitised to be sensitive to the user and live in the space while designing, looking around the space in the mind, for colours, materials, aesthetics, performing functions in the mind that are carried out in the space which gives more scope to design a user-friendly interactive space.

Lastly, understanding re-using the existing- with shipping containers, being conscious to consuming energy for a controlled environment- solar energy tapping, using existing natural spaces for context than creating one- public parks, lakes, reserves were explored and learnt 'to adapt and adopt' more than create, as a need for the hour.

Future Work

This project has addressed majorly the current pandemic of covid. However, in future there may be a different situation for the isolation and the requirements may change. In the given situation and given time, the given proposal may hold good. Yet, other situation needs to be thought of, if adaptable.

The project has addressed the adults as the user group; children and old people have not been the target users. A new-normal to stay protected from infections has come. There can be a new get-away space called the "isolation cell" where one gets to take break from their daily routine and spend more quality time with oneself for self-satisfaction, contemplation, relaxation, etc.

The project also opens an avenue for private spaces that can be put in different contexts like resorts, retreats, rehabilitation centres, nature cure centres and so on. Privacy itself is a luxury in today's highly dense context.

Acknowledgement

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