THEMATIC STRAND

Dichotomy of Technology and Humanity

Technological Interpretations to Humanity (TIH): A Development Approach of Education System to Make a Techno based Sustainable Social, Economic & Environmental Phenomenon of a Sustainable and Human Friendly Architecture.

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Abstract From last some decades, professionals from different disciplines have been discussing about sustainable smart living in social, economic and environmental design concepts through architecture as well as urban studies from both academic and professional perspectives. The vast growing of population of the world needs rethinking of sustainable and smart design from a single house to urban level. Due to the needs of the people and for future generation it needs to incorporate different disciplines together to build a smarter world. Innovations of technologies are now fulfilling the needs of the people. A proper sustainable building design now came out from not only the pencil of a designer on his desk rather than it needs the involvements of different disciplines. Architects and designers should rethink of using the technologies from other fields applying them to their designs to make the building and the city more sustainable regarding not only for social aspects but also for the economic growth of the society as well as environmental factors. This paper aims to develop a phenomenon of Architectural education system that will suggest why architects should work with other disciplinary professionals during their design process and how those interdisciplinary theories can explore the intersection between design, technology and nature discourses. The author will show how architects can play a vast role to the social equity, satisfactions, well-being of humanity, quality of life, energy efficiency, recycling, economic lifecycle of the inhabitancies at home, environmental purification through their design process. Building or City should behave like both "a Tree and a Machine" to be "Sustainable and Smart." The author will present this behaviour through a research by design from his own research at Department of Architecture, Technical University Munich, Germany at the end.

Keywords*: Sustainability, Sustainable Architecture, Architecture, Interdisciplinary Interpretation, Sustainable Design, Future Architecture, Generative Architecture, Living Architecture, Smart City, Techno city.*

INTRODUCTION

With around 7 billion population and growing very rapidly by the years of the world, it is needed to create more living spaces like a single house to several cities around the globe. Development in each field like industry, construction, education, health, entertainment also makes human life style more interesting and dynamic. People are now very concerned about to fulfill their all facilities in short time with best qualities. Different technological interpretations make human life-style easier than before. Every person can play his/her role even if he or she is disable to

a single house to city level development by taking the advantages of technology. Building design not only in small scale but also vast urban scale now concerning about all age groups of people; children to very old. It is the fact that building and its environment, climate, culture, energy, recycling and more or less artificial intelligence are now a day's apprehension of building design. Building should behave like human for human; it should have intelligence to acknowledge the human behaviors to fulfill the needs of human of all age groups.

Rising life expectancy and/or declining birth rate are causing population ageing. It is most advanced in the highly developed countries, and it is less developed countries that are experiencing the dramatic change. The speed of population ageing is anticipated to increase in coming decades, this emphasize on the study whether elderly will be able to live the extra years of the life in good or poor health, and what technology development can offer and facilitate in this regard. Demographic change studies, dealing with elderly population growth, reveal a relatively rapid increase and it is expected that in the next half century the proportion of elderly people will increase from 7% in 2000 to 16% in 2050[1].

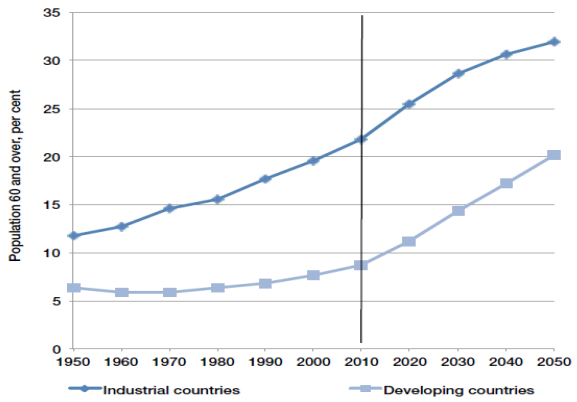


Figure 1: Ageing is accelerating worldwide
Source: UN World Population Prospects: (2010 Revision)

Almost every country faces difficulties to planning and constructing the cities within the needs of the vast population growth; specially undeveloped and developed countries, due to the lack of proper planning, time limitations beyond the population growth, big budgets, and a vast lacking of construction technologies. Almost every country is using conventional city planning systems with different zones like, residential, industrial, educational, parks, forests, playground, etc. But these buildings have different designs and planning as well as construction process due to heights, sizes etc. Due to the differences between the earth condition, climate, topography, construction material, technology and culture all the countries have different construction systems and building design systems. Now, the housing industries, construction industries are using advantages of technologies for only Single Building Manufacturing system. Mass customization techno based Manufacturing system can reduce lots of times, labors, money, energy, etc. regarding to the conventional way of construction [2].

TECHNOLOGICAL INTERPRETATION

Activities of Daily Livings (ADLs)

In developing countries, 75% of the elderly persons are living with their children/grandchildren. On contrary to this, there are only 27% elderly people in developed countries who live with their children. The elderly living alone need an independent living solution. Activities of daily living (ADLs) is a term used in healthcare to refer to daily self-care activities within an individual's place of residence, in outdoor environment, or both[3]. To fulfill the need of elderly and disabled people, the idea should be to design a smart living environment both in interior and exterior spaces with different techno based automated working space modules. The basic idea is to develop different automated modules based on daily activities of a person is placed in different locations of the Room. The room is divided in a simple grid both in ceiling and floor. These grids are used as the guiding rail for automatically movable Mod-

ules based on Activities and need of the person [4]. For designing such a flexible room or environment an architect should have the knowledge of different technologies such as programming, sensors, electronics, mechanics, etc. along with architectural education.

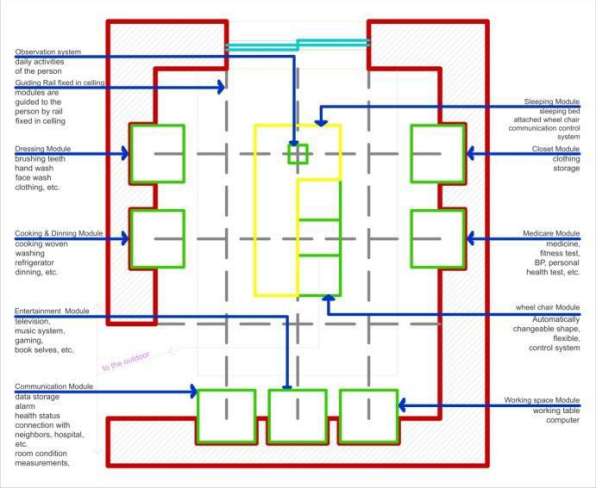


Figure 2: Design of an automated working space module based room for ADLs of elderly and disable persons.

Mass customization in different industries

Mass customization is the method of "effectively postponing the task of differentiating a product for a specific customer until the latest possible point in the supply network." (Chase, Jacobs & Aquilano 2006, p. 419).

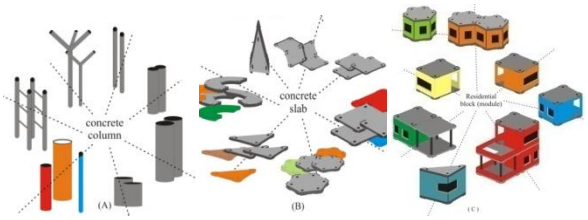


Figure 3: Mass customization of columns (A), slabs (B) and residential block (C). (MSc. Study: own concept).

Architects should learn the methods of mass customization in different industries to incorporate the technologies and methods to the building industry. The architectural education should have that concern to acknowledge the students about how to design a product for mass production and customization.

Construction Factories for building construction (construction & demolish systems): Automated On-Site Factories

A greater degree of automation and integration of robots at the construction site can be very beneficial in many ways, such as cost and time reduction or safety. Systems set up standardized and structured conditions at the construction site (converted and weather unaffected on site factories). Within this structured conditions a multitude of automated and robotic systems operate simultaneously and/or corporate. Single task Robots can be used as Sub-systems.

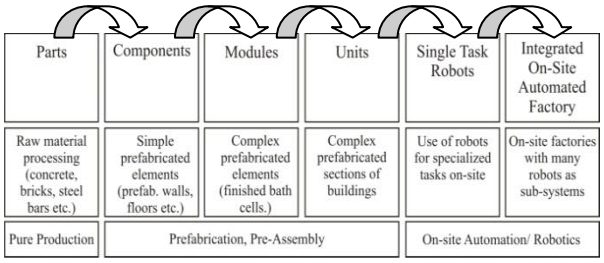


Figure 5: Sub-System Relation (class lecture of master course of Advanced Construction & Building Technology, Prof. Dr.-Ing. (Univ. of Tokyo) Thomas Bock)

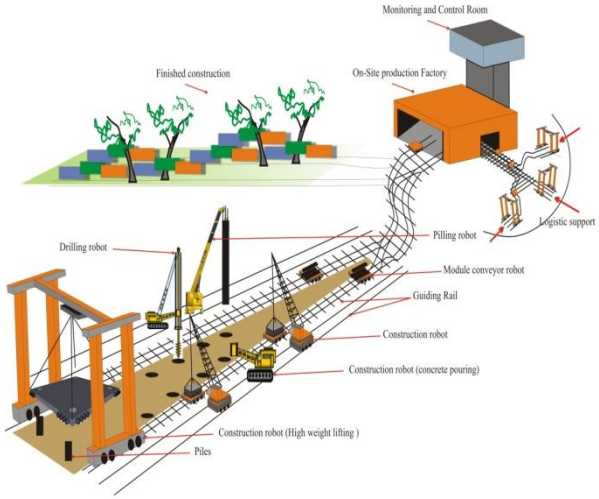


Figure 6: Automated Construction (On-site factory and construction). (MSc. study: own concept).

There are several Automated On-Site factories of building construction such as, SMART – Shimzu, ABCS – Obayashi, Big Canopy – Obayashi, AMURAD – Kajima, T – Up, Taisei, NCC Komplett, System SKANSKA, etc. There have different construction machines used is different industries of which

the architects should have knowledge to incorporate them to their professional practice. The study of different construction system and the technologies should be the curriculum of architectural education.

Production line in different industries

Many products are manufactured and assembled on a production line. Before the introduction of computer control and robots production lines were operated by people. Each person would carry out a limited number of tasks or even just one task and the product would then be passed down the production line to the next person. This would continue until the product was completely assembled. Some modern production lines still operate in the same way whilst others rely on robots and computer control or a combination of people and machines. Architects must have the knowledge of production line of different industries so to apply them to the building design industry.

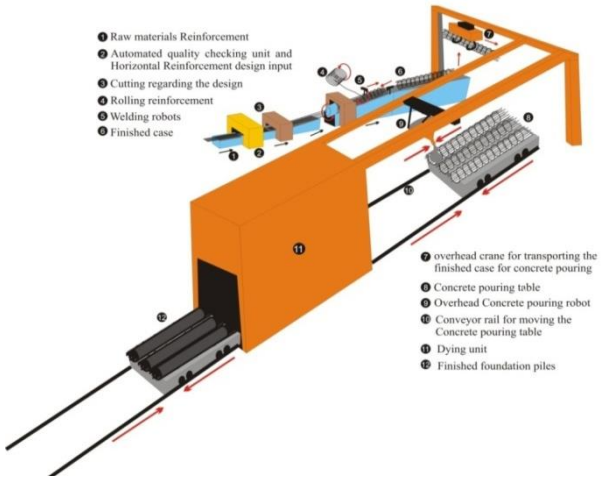


Figure 7: Production line construction process for foundation piles (MSc. Study: own concept).

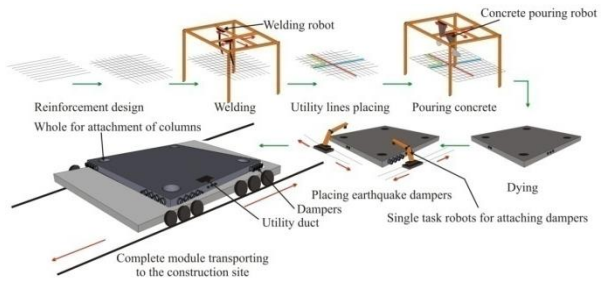


Figure 8: Production line construction process for load bearing slabs (MSc. Study: own concept).

Modular Architecture

Refers to the design of any system composed of separate components that can be connected together. The beauty of modular architecture is that we can replace or add any component (module) without affecting the rest of the system.

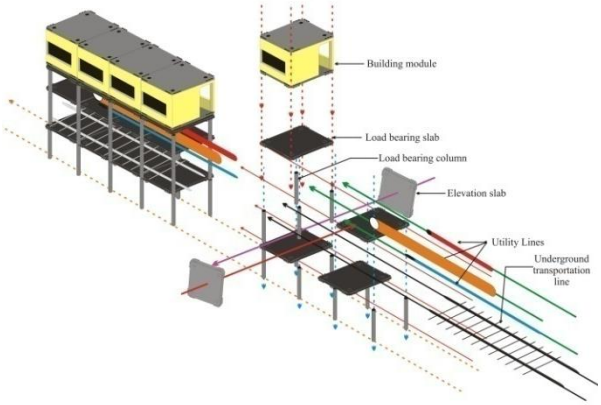


Figure 9: modularization and construction process of buildings. (MSc. Study: own concept).

Natural disaster protected technologies

To make a sustainable building architects should aware of different technologies for natural disaster protection. Architectural education system should be more concern about these technologies and their methods of use. There are Advanced Earthquake Resistance Technology- Passive and Active control systems, Hybrid control systems/ semi active control systems, Damping and Isolation-Tuned Mass Damper (TMD) & Active Mass Damper (AMD), Hybrid Mass Damper (HMD), Viscous Damping Wall (VDW), Active Damping Bridge (ADB), Air floating Floor System, Vibration Control Panel / Prefabricated Steel Panels, Rubber Damping Technology, Base Insulation System (BI), Damping systems in other industry; Oil industry-Slug Stop, Car industry-variable damping system (Porsche), Bridge- Fluid Damper (TJGZ-FD), High damping rubber bearings (HDR), Railway-Spherical Bearing (TJGZ-LX-Q), High Speed Railway- Pot Bearing.

Sustainability and Green Architecture

Sustainability, environmental awareness and green architecture are catch phrases that suddenly seem to have flooded the media. It has become fashionable to be green. This is good

for the earth, but the wary reader should also note that this is starting to become a selling point for many things which are far from being truly green. Unfortunately, green architecture is being treated more like a fashion trend. The difference is that fashion trends are set subjectively, whereas the practice of green architecture is scientific.

In green architecture, there are five primary principles that include the sub principles of this vast discipline. All topics related to green architecture fall under at least one of these.

Energy efficiency for reduced dependence on electricity for its basic needs with passive and active cooling, the maximum use of daylight and reduced need for energy-guzzling building systems. **Indoor air quality** for the physical well-being of the occupants is the primary concern of this principle. Its area of concern is the general atmosphere within a building. **Green materials** is directly concerned with the environment. After all, energy is not only measured by the electric meter that records power consumption. Green architecture also considers the use of material that will not waste energy in its production, transport and use in construction.

Green building systems This is a catch-all phrase that includes the various active design considerations that seek to monitor and reduce power consumption, water use, temperature, air quality, etc. Examples of green building systems are photovoltaic cells, solar water heaters, low-flush water closets and fixtures and water recycling systems. A good example of a green building sys-tem is a rainwater harvesting system. Rainwater is collected and stored. When needed, it is then pumped out for use. The rainwater can be used for flushing toilets and watering plants. **Good design**, in the context of green architecture, is designing buildings which are easy to use, easy to convert for other uses, safe to use for both of children and the elderly, etc. Good design can also have an influence on energy usage, repair and maintenance, and inevitably, on the property's value.

"Green is not only tree", "Green" is what?, What is Green Architecture?, How can we design a green building? What technologies we have for designing a green building? These should be included in our education curriculum. Building should behave like a tree as well as intelligent to cope up with different natural conditions. A proper educational guideline can help the students to know about how to create their building in that way.

Figure 10: Proposed green building design for RAJUK, Dhaka, Bangladesh (National competition)

Mobility

Mobility is a very big issue of today especially for children and elderly person. Architects can play a vast role to design mobility products as human friendly as techno based with different mobility base technologies like sensors, touch screen, speaker, light, GPS system, cell phone, etc. along with IT base system. For that, architects should have knowledge of these all technologies to play the role not just only as architect but also as a techno friendly person.

Figure 11: Techno based mobility product: Rotator/Wheel chair (own concept)

Ambient technology

Knowledge of different ambient technologies can help architects to design their building with artificial intelligent using of touch sensor, voice sensor, light sensor, noise sensor and more other sensors which can make the building environment more healthy and efficient for human.

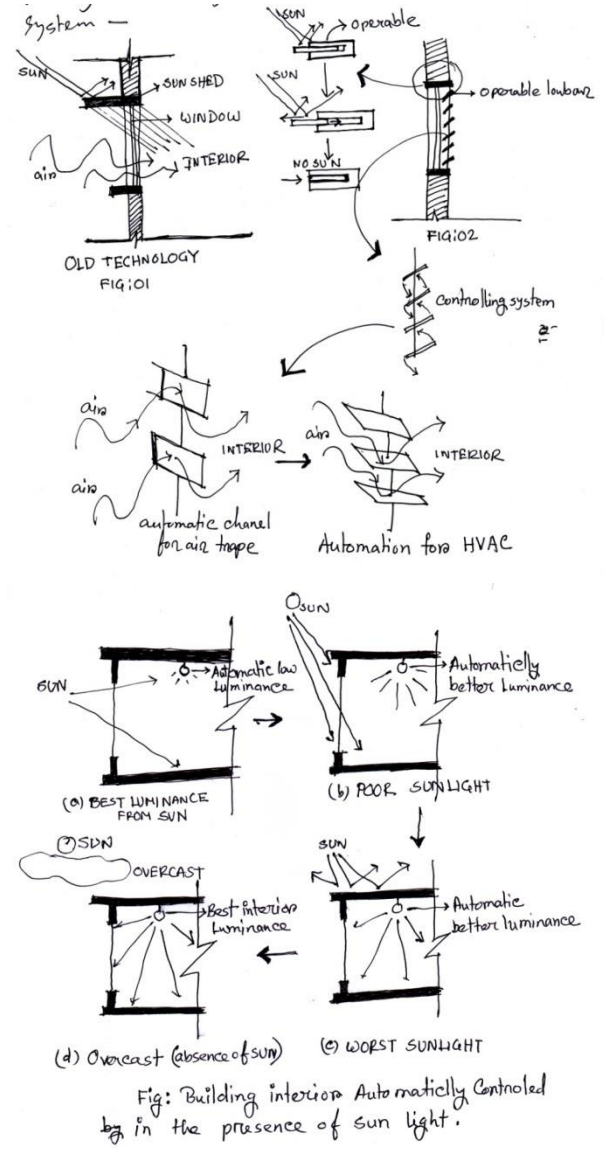


Figure 12: artificial intelligence to the building using different sensor systems. (own concept)

Architecture in extreme environment and industry

With the invent of technologies it is now possible to design buildings in different extreme environments like volcano, underwater, arctic zone, desert, etc. along with building on moon and Mars. Also it is now so pleasant to work in a heavy insecure industry building with 100% security with the advantages of technologies. Architectural education should have this guidance to know and use these technologies to the extreme environment and industries.

Medicare

Innovation in Medicare product sector is helping people to live long a healthy life with controlled environment and interior furniture. To design a healthy environment in both interior and exterior spaces students of architecture should know the technologies of Medicare products to incorporate to their design.

Example Research Project

Architects can play a vast role to the social equity, satisfactions, well-being of humanity, quality of life, energy efficiency, recycling, economic lifecycle of the inhabitancies at home, environmental purification through their design process. Building or City should behave like both “a Tree and a Machine” to be “Sustainable and Smart.” Here the author will present this behaviour through a research by design from his own research at Department of Architecture, Technical University Munich, Germany at the end.

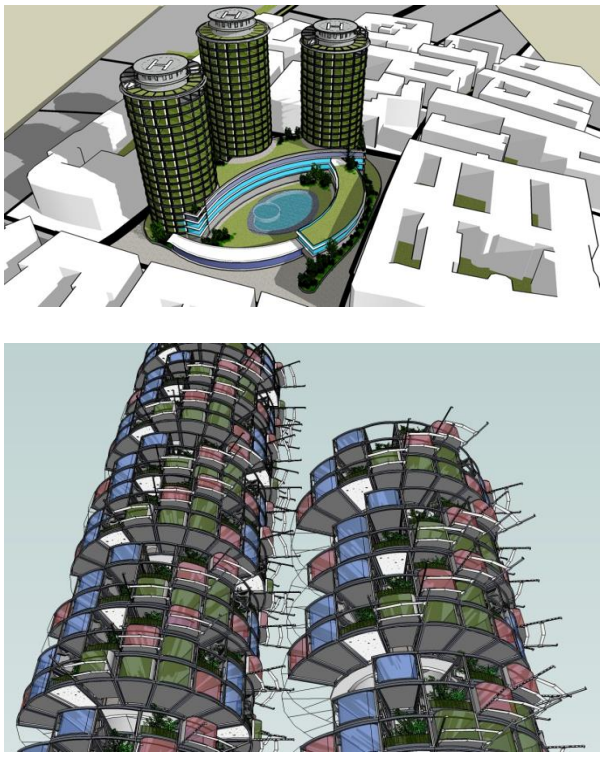
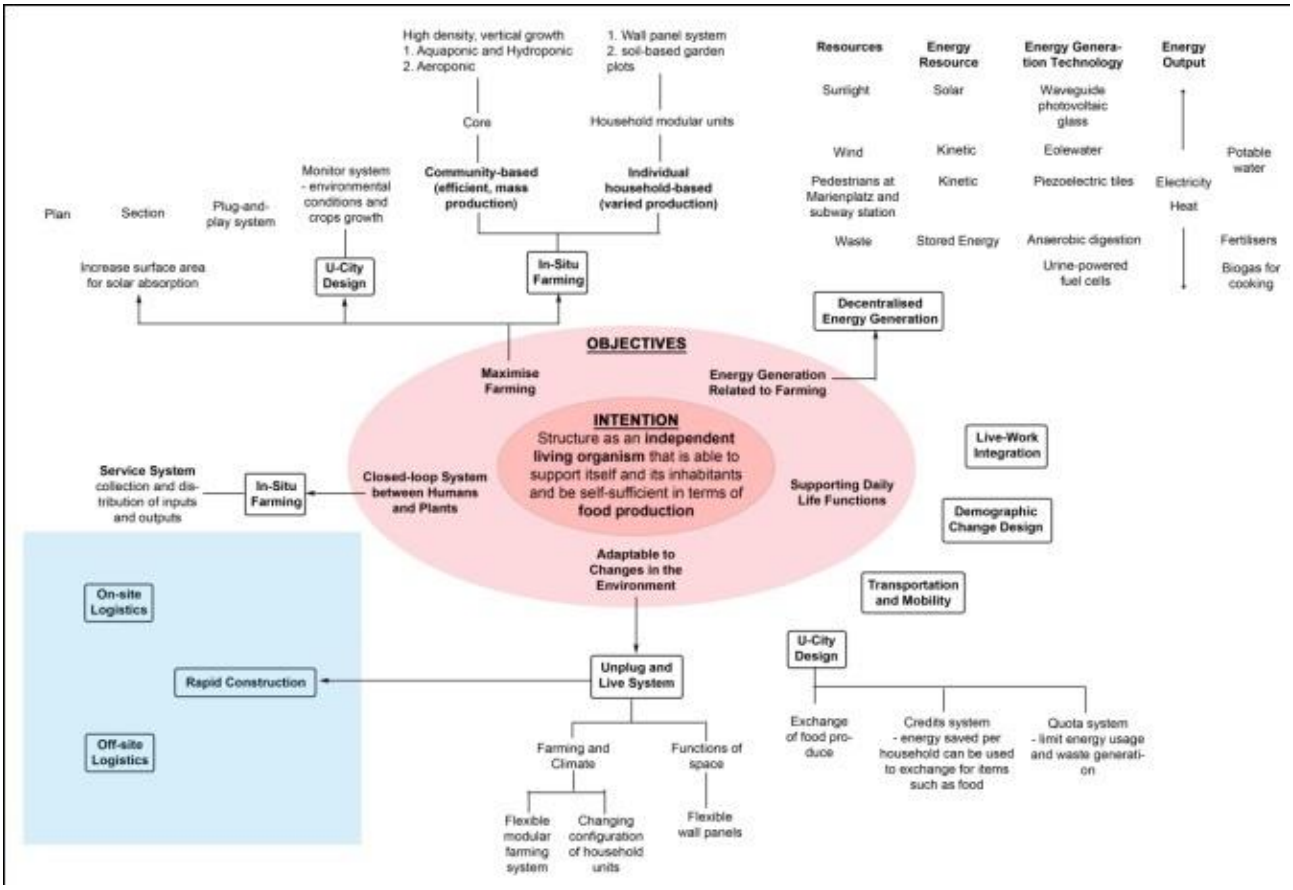


Figure 13: Proposed building for Marinhop, Munich, Germany (Research Project)

The building is an innovative proposal that attempts to merge residential and commercial activities in one space, aiming on the direction of achieving a healthy lifestyle, not only for the people, but also for the environment. Ten parameters were considered on the design process of the project, but mainly three keywords (that included some of these parameters were vital in the development of the concep: Health, Flexibility and Technology.



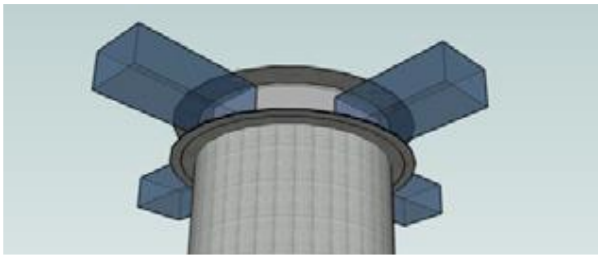
Health for Environment

To address the issue of health of the environment (sustainability), we incorporate the term Sustainable Efficiency in terms of electrical energy and water. Our approach to this matter comes from two perspectives, production and consumption. Even though it is important to obtain energy and drinkable water in a way that generates the least damaging impact to the environment, it is smart to say that by improving or refining our consumption, less energy and water is needed, therefore the environmental impact is reduced.

Health for People

The building will have common areas with facilities that encourage the practice of a healthy lifestyle, separated on private areas (for residents and members only) and public areas (for public costumers in general). Different topics related to health will be a dressed, such as sports, relaxation, nutrition, medicine, education and information. Some specific examples of these facilities: **Private Areas:** Swimming Pool, Jacuzzi, Turkish Bath, Sauna, Golf, Gym, Squash Court, Micro Football Court, Basketball Court, Gazebo, Sightseeing Terrace. **Public Areas:** Restarants, Sport Articles Stores, Organic Supermarket, Offices for doctor, massages, alternative medicine, Climbing Wall, Indoor Skydiving, Auditorium, Gym, etc.

Water Production



Air2Water machines will be installed on the top floor of each tower. They will extract water from the air, store it on a tank located on top and it will be distributed by hydrostatical pressure to the rest of the building.

Energy Production

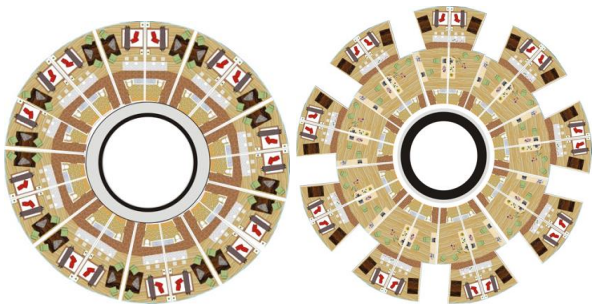
A decentralized energy production system is implemented, based on wind and solar technologies. Three main components are identified. The first one is the horizontal wind tu bines located in between the stories of the building. The second one is the translucent solar panels that serve at the same time as windows on the apartments. The third component is the zeppelin rotor system that is flying over the building, producing energy from wind while proudly acting as a very visible advertisement.

Consumption

All the electronics, water taps, toilets will be last generation low consumption devices. Also the integrated facility management system (as part of the main BIM platform) will allow the occupants to keep a control over time of this and other details of their apartment and consumption.

Flexibility

Human beings are flexible creatures by nature, capable of adapting to the surrounding environment. We owe our survival as a species to our movement and adaptation capacities. It is interesting to note the importance of flexibility in the design of architecture, not only on housing scale as in this project, but also expanding it to city scale. The design of the building allows it to adapt to different conditions. These varying conditions can arise from the changing environment or from the requirements of the inhabitants on a specific moment.

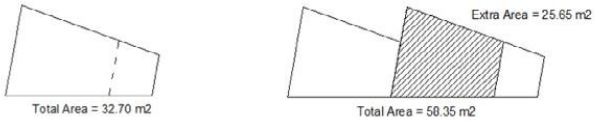


Adaptability to Weather Conditions

Let's say for example that it is a very sunny day, with exceptional weather conditions, so the building is capable of opening up in order to allow more sunlight and fresh air to come inside. In the opposite case, with cold temperature with rain or snow, the building is able to close itself so that the hard conditions of the outside do not affect the wellbeing of the people on the inside.

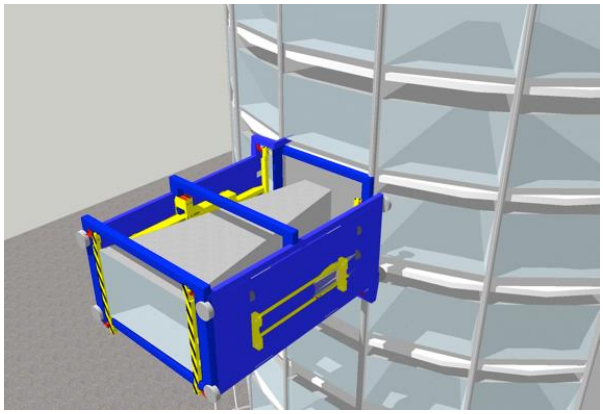
Expandable Apartment

Sometimes it is not the external but the internal conditions what requires a change. Imagine if, under specific conditions, you could increase the size of your apartment in almost an 80%. This project makes it possible. The following scenarios will give an idea of the advantages of this feature.



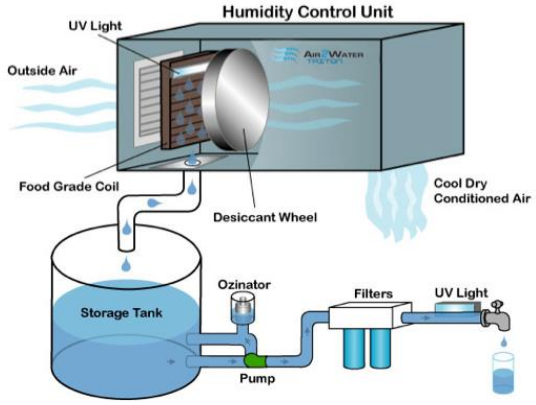
Exchangeable Apartment

A plug-in mechanism allows the apartment modules to be detached and transported by a Robot that moves along the façade of the building (MXBot). This allows people to replace their apartment if they want a new one, or maybe even transport it to another location where a partner building with a similar system is available.

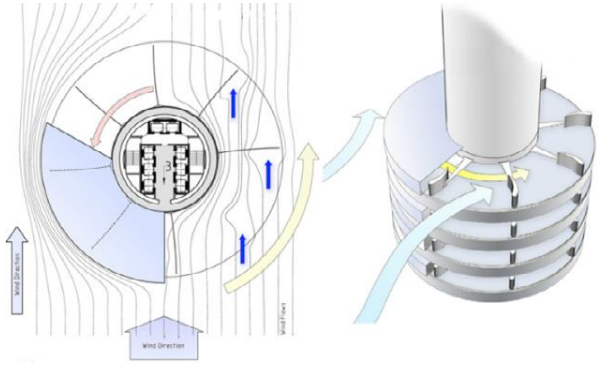


How is it Possible? >>> Technology

Energy and water; Air2Water Technology
Wind catcher is very popular in Iran especially in traditional Iranian house. Machines units that apply this technology are called Atmospheric Water Generators (AWG). They extract clean drinking water from the air. The unit first pulls air through an electrostatic filter removing 93% of all air borne particles. It collects water drops into a collection tray and immediately passes into Ultraviolet (UV) light, where the water stays in contact with UV rays killing germs and bacteria in the water. The water is then pumped through a sediment screen into a water pump and through a series of solid carbon block, UF or no waste R/O water filters. The water is then recirculated through UV or treated by ozonation. It is then circulated back into the dispensing tanks. Finally, the water is chilled or heated and dispensed to the consumer.

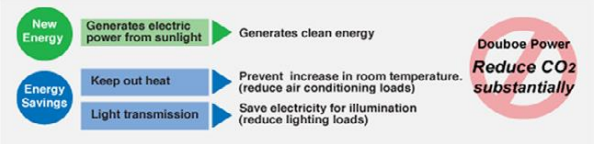


Horizontal Wind Turbines
With the inspiration of the Rotating Tower by David Fisher in Dubai, we want to implement a series of rotator wind turbines. This system must be located underneath every level of the building. Wind is guided to the direction of the blades making them rotate around the axis of the core of the building. A wind shield is installed to avoid wind to slow down the rotation by impacting the blades in the wrong direction.



The system is estimated to have a peak production rate of 12'000.000 W with 80 turbines under the best conditions of wind and exposure. This means that around 75 kWh can be produced by every turbine on an average day.

Solar Energy – TSS (Taiyo See-through Solar) Energy is produced from sunlight by utilizing Transparent Photovoltaic Glass used as the windows of the apartments. It applies a dual function concept of New Energy (Electric power generation) and Energy Savings greatly reduce overall energy costs helping to make the building an environmentally friendly facility.



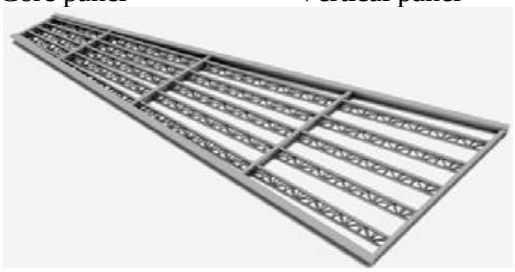
It provides a space that distributes daylight comfortably. It changes the sun rays into delicately diffused light by transmitting light moderately, and reduces intrusion of heat from the sun all this while maintaining exterior views. Multifunctional, effective, comfortable see through glass.

Tower construction
Construction
The main structure of each one of the three towers is going to be constructed on ground level starting with the top story (roof), where all the prefabricated elements will be installed. Then the building will be pushed up and the next level will be built. This process will be repeated until total completion of the tower. Modules will be plugged on the higher levels in the meantime by parallel processing. Also parallel will be performed the simple installation of modules for the commercial ring located on the lower levels. The energy required for powering the construction period will be provided ecologically by Magenn Technology. All the prefabricated elements were designed in a way that their size is appropriate to be carried by tram and truck.
Overall Performance: 185㎡/hour, 4440 ㎡/day
Modular Elements
These are the prefabricated elements that are used for the construction of the building. They are modular so that the construction

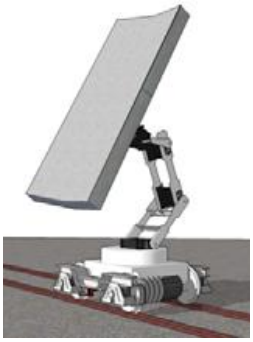
process can be a repetitive execution of the same process over and over again.

Core panel

Vertical panel



Horizontal panel

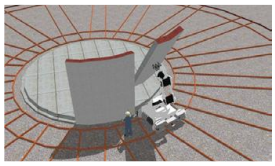


CPBot (Core Panel Robot) VPBot (Vertical Panel Robot)

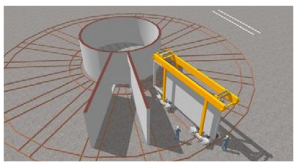
Building Components

The building is structurally composed mainly by three elements: Core, Metallic Cages and Pluggable Modules. They are all mainly a metallic structure covered with a lightweight esthetical material (not defined).

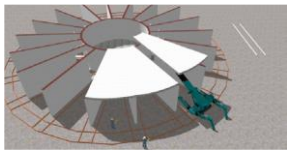
Construction Process



Step 01



Step02



Step 03

Step04

CONCLUSION

From all of these study it is easily can say that innovation of technologies and their proper use can help the living of human more healthy and sustainable. Architects are much related to the living style of human because they are directly involved with their living environment; their homes. In our education system of architecture there must have the scope of gathering these different industrial technologies. The main aspect of the architectural education is to be a designer but with the knowledge of technologies we can be a better designer. In this era of globalization the world is going faster and faster day by day. In case of time, cost, efficiency, tolerance, quantity, quality now a day's people wants the best. Thousands of technologies are fulfilling their needs in short time with best efficiency as great quality. The architectural education of Bangladesh is mainly based on Design on the basis of the creativity of students. But after completing five years of education most of the students have the lacking of knowledge of technologies which can make a building more sustainable. It is not so efficient to incorporate different technologies to the building after the building has been constructed than to incorporate them at the early stage of the design. For the social equity, satisfactions, well-being of humanity, quality of life, mobility, Medicare, energy efficiency, recycling, economic lifecycle of the inhabitancies at home, environmental purification through their space and build-

ing and obviously for a “Smart and Sustainable” building environment the education system of architecture should be upgraded with the curriculum of technological interpretation.

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