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Conceptualizing Student Housing Trough Trophic Design Around Universitas Sumatera Utara

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Abstract (English)

Universitas Sumatera Utara (USU) is a public university in Medan, North Sumatra. USU has many students from various cities. Most USU students come from out of town, so they need temporary residences in the form of student boarding houses. Several factors influence students' choice of boarding houses, such as location, price, facilities, comfort, and building visuals. Good accessibility concerns the location of student boarding houses close to campus and several public facilities and shopping areas. Visual buildings are in the form of beauty that can be felt by residents and attract attention. In addition, to overcome the problem of high temperatures, some designs that are suitable for local tropical climates are needed. With these considerations in mind, applying the trophic design concept emerged as an appropriate solution. Through qualitative descriptive methods, surveys, and case studies, student housing was conceptualized and designed, incorporating the principles of trophic design. The hope is that this approach can offer a comprehensive solution, providing comfortable, relaxing, and aesthetically pleasing student housing for students.

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Key Words
trophic, student housing

1. Introduction

USU is one of the universities in Indonesia that has many students who come from various cities [1]. Many students come from outside the city of Medan, so a temporary living area is needed for students [1]. There are several factors that influence students in choosing boarding houses. These are location, price, facilities, and comfort [2]. In addition, visuals are also one of the factors that affect student satisfaction [3]. The comfort aspect is very necessary in designing student boarding houses. The high temperature in Medan City causes discomfort. Therefore, a design that can overcome the problem is needed [4]. Indonesia is a country with a tropical climate. Tropical climate is a climate where heat is the main problem, so buildings are designed to cool the occupants throughout the year, with an average annual temperature of at least 20°C. According to Lippsmeier, the tropical climate in Indonesia has very high relative humidity (sometimes reaching 90%), considerable rainfall, and an average annual temperature of around 23°C, which can reach 38°C in summer [5]. The solution used is to apply the concept of tropical architecture to the building. Tropical architecture is a style of architecture that is customized to respond and adapt to the tropical climate. This style does not need to mimic the traditional forms often found in Indonesia as long as the building design is able to face the challenges of a tropical climate, such as intense sunlight, high temperatures, rainfall, and high humidity [6]. The location aspect is also something that needs to be considered in the design of student boarding houses [2]. A strategic location is a location that is close to the availability of a service, facility, or information that can be accessed by everyone [2]. Student boarding houses should be

designed in a location close to the campus. If the location of the boarding house is close to the campus, strategic, clean, comfortable, safe, and can save transportation costs and close to the necessary access (such as places to eat, photocopying, and minimarkets), it can increase student decisions in renting boarding rooms. The location around Dr Mansyur Street, Padang Bulan, is a strategic location for building student boarding houses. Completeness of facilities is also an important factor in the design of student boarding houses [2]. Some facilities and communal spaces are needed to support the comfort of residents. Communal space is a shared space where people gather and interact, play and exercise, and hold events/celebrations [7]. Facilities that help residents' lives can be in the form of mattresses, cabinets, study desks, private bathrooms, and additional facilities such as televisions, refrigerators, and air conditioners [2]. While communal spaces are in the form of parks, roads, drying places, cooking rooms, washing machines, and latrines [7]. The creation of communal spaces can increase social interaction, which is the key to meeting social needs and mantaining functional proximity.

Student boarding houses are a form of housing [8]. The difference with other types of housing is that boarding houses are temporary. Most boarders have other homes where their families are located. Because of this temporary nature, boarding houses have a different character from other types of housing. Student boarding houses often spring up around universities. [8]. Kost is an abbreviation of the Dutch phrase "in de kost" which means 'to eat in' or 'to live and eat in' a boarding house. The Big Indonesian Dictionary defines boarding as living in someone else's house, with or without food, by paying monthly [8]. There are several types of boarding houses, which are distinguished by their shape (Rooms in private homes and Co-operative houses), building height (1-3 floors), type of occupants (female, male, mixed), and horizontal circulation (single loaded, double loaded, centred). In addition, there are also types of boarding houses that are distinguished by price (Type A, Type B, and Type C) and needs (Exclusive Type and Loft Type) [9].

Tropical architecture is a work of architecture designed to transform the uncomfortable tropical climate outside into a more comfortable climate inside the building. This comfort level is measured based on the achievement of thermal comfort in the building. Climatic factors in the tropics that affect thermal comfort include (a) air temperature, (b) solar radiation, (c) air humidity, and (d) wind speed [10]. Tropical architecture has characteristics such as adaptation to the tropical climate, using tritisan, using weather-resistant materials, energy efficient, providing comfort and health, and some principles and elements are in accordance with the tropical climate. The use of wide partisan aims to reduce tampers from rainfall and high wind speeds in tropical climates. In addition, the trellis serves to block direct sunlight from entering the room so that the residence remains cool without reducing the quality of lighting [11]. Furthermore, buildings with tropical architecture applications use weather-resistant materials that reduce the risk of damage caused by extreme climatic conditions [12]. In addition, applying tropical architecture in buildings can create an energy-efficient environment where tropical architecture can reduce dependence on air conditioning and artificial lighting by

efficiently utilizing sunlight and wind. Building designs that maximize natural lighting and air circulation also help reduce energy consumption [12]. To reduce the use of air conditioning, air ventilation should be considered in the design. Good cross-ventilation can create a cool atmosphere in buildings [13].

2. Method

The research methodology used in this journal is a descriptive qualitative method, case study and survey. The survey was conducted by distributing questionnaires to students who have lived in student boarding houses to find out what needs and factors are important in the design of boarding houses. The case study method collects information about existing student boarding houses. In addition, a literature study was conducted on applying the concept of metaphor architecture to increase understanding of the theme.

3. Result and Discussion

3. 1. Location

Three alternative locations can be used as land to build student boarding houses. Location 1 is on Dr Mansyur Street, location 2 is on Abdul Hakim Street, and location 3 is on Sehat Street (Figure 1). The selection of the location to be used will be adjusted to the GBCI (Green Building Council Indonesia) standard regarding community accessibility.

Figure 1. Lokasi 1, Dr. Mansyur Street, Lokasi 2, Abdul Hakim Street, Lokasi 3, Sehat Street (left to right)

Based on the GBCI standard,to support community accessibility, site selection must fulfill 7 accesses from 19 existing facility categories [14]. There are 2 locations that meet the standards, namely location 1 and location 3, and the location that meets the most accessibility is location 1,therefore,the location chosen is location 1 (Table 1).

Table 1. Site Selection Based on GBCI Community Accessibility [14]

No.	Jenis Fasilitas (maks. 1.500m dari lokasi)	Lokasi 1	Lokasi 2	Lokasi 3
1.	Bank	√	X	√

2.	Public Garden	√	X	√
3.	Public Parking (outside the lot)	X	X	X
4.	Stalls/Grocery Stores	√	X	X
5.	Multipurpose Building	X	X	X
6.	Security/Police Post	X	X	X
7.	Place of Worship	√	√	√
8.	Sports Field	√	√	√
9.	Daycare Center	X	X	X
10.	Pharmacy	√	√	√
11.	Restaurant/Canteen	√	√	√
12.	General Photocopies	√	√	√
13.	Health Facilities	√	√	X
14.	Post Office	√	X	√
15.	Fire Station	X	X	X
16.	Public Transportation Terminal/Station	√	X	√
17.	Library	√	X	X
18.	Government Office	X	X	X
19.	Market	√	X	X
		Fulfilled 13 points	Fulfilled 6 points	Fulfilled 9 points

The site on Dr. Mansyur Street has a land area of approximately 2 hectares. The site is located in the k-2/commercial, R2 and SPU zones (Figure 2) [15]. At this location, the type of zoning is in accordance with the function of the building to be built. Student boarding houses are included in commercial activities.

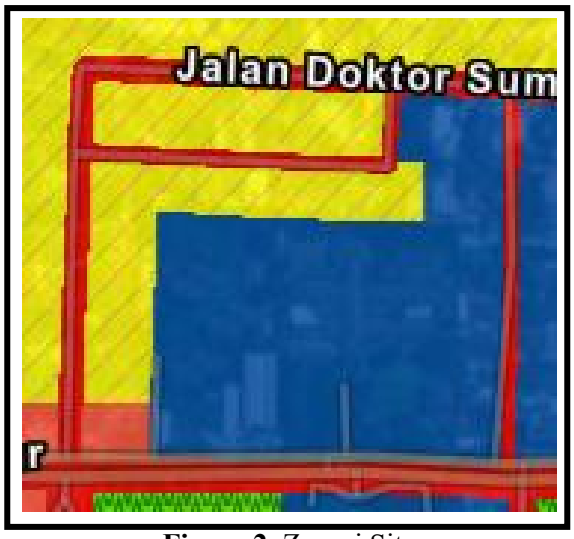

Figure 2. Zonasi Site

The site location is in an area where there is an intensity of space utilization: 70% KDB

X 20,000 = 14,000 m2;KLB 10; 20% KDH X 20,000 = 4,000 m2; and a maximum building height of 15 floors or 60 m high (Table 2 [16].

Table 2. Intensity of Space Utilization

	Maximum KDB	Maximum KLB	MinimumKDH	Maximum Building Height	Description
Commercial	70%	10	20%	15 floors / 60 m	Fit for purpose building requirements For City Centers and SPKs in the RTRW, a maximum KLB of 21 applies as long as the building requirements are feasible.

3. 2. User Space and Activity

There are spaces that must be met when designing. These spaces are needed because of the activities carried out by its users (Table 3).

Table 3. User Space and Activity

No.	Ruang	Kegiatan	Karakteristik Pengguna
Fungsi Utama			
1.	Boarding Room Ensuite Bathroom	Sleeping/resting, studying, bathing, toileting, washing.	Residents
2.	Lobby	Information area, reception.	Manager
Support Function			
1.	Kitchen	Cooking, washing dishes.	Residents
No.	**Ruang**	**Kegiatan**	**Karakteristik Pengguna**
2.	Living Room	Relax, chat, and receive guests.	Residents
3.	Viewing Room	Watching, relaxing.	Residents
4.	Dining Room	Eat, drink.	Residents
5.	Drying Room	Drying clothes.	Residents
6.	Laundry Room	Washing clothes.	Residents
7.	Ironing Room	Ironing clothes.	Residents
8.	Copy Room	Photocopy, scan, print.	Residents
9.	Balcony	Relax.	Residents
10.	Security Post	Keeping watch, chatting.	Residents

11.	Janitor	Placement of cleaning equipment.	Residents
12.	ATM Center	Deposit money, withdraw cash.	Residents
13.	Men's Restroom	Dispose of water.	Residents and manager
14.	Ladies Restroom	Dispose of water.	Residents and manager
15.	Waiting Room	Relaxing, waiting.	Residents
16.	Warehouse	Storing used furniture/furniture stock, storing other items.	Manager

3. 3. Programming of Space

In the calculation of space requirements that have been carried out,the design of student boarding houses requires a space of 21,827.15 m2 (Table 4).

Table 4. Programming of Space

ZONE	SPACE TYPE	CAPACITY		SPACE STANDARD		SPACE AREA	CIRCULATION	SUBTOTAL AREA	SOURCE
		people	amount	size	unit				
Room Unit	Bedroom	1	1	7,5	m2	7,5	30%	9,75	Apartment Setup
	Bathroom	1	1	3	m2	3	30%	3,9	Apartment Setup
	Balcony	1	1	1,5	m2	1,5	30%	1,95	Assumption
	TOTAL AREA OF ROOM UNIT = 15,6 X 408 UNITS							6.364,8	
General Support	Lobby	10	4	2	m2/person	80	30%	104	DATEK
ZONE	**SPACE TYPE**	**CAPACITY**		**SPACE STANDARD**		**SPACE AREA**	**CIRCULATION**	**SUBTOTAL AREA**	**SOURCE**
		people	amount	size	unit				
	Receptionist	2	4	1,5	m2/person	12	30%	15,6	DATEK
	Waiting Room	10	4	5	m2/person	200	30%	260	DATEK
	Elevator Lobby	10	2	2,25	m2/person	45	20%	54	TS
	User	4	6	1,5	m2/per	36	20%	43,2	TS

	Elevator				son				
	TOTAL AREA OF GENERAL SUPPORT = 476,8							476,8	
Communal Room 1	Kitchen	6	1	3	m2	18	30%	23,4	DATEK
	Dining Room	6	1	1,25	m2	7,5	30%	9,75	Apartment Setup
	Living Room	6	1	9	m2	9	30%	11,7	Apartment Setup
	TOTAL AREA OF COMMUNAL ROOM 1 = 44,85 X 20 UNITS							897	
Communal Room 2	Kitchen	8	1	3	m2	24	30%	31,2	DATEK
	Dining Room	8	1	1,25	m2	10	30%	13	Apartment Setup
	Living Room	8	1	9	m2	9	30%	11,7	Apartment Setup
	TOTAL AREA OF COMMUNAL ROOM 2 = 55,9 X 36 UNITS							2.012,4	
Public Space	Retail	-	16	20	m2/unit	320	30%	416	TS
	Toilet	10	4	2	m2/person	80	30%	104	ASM
	Emergency Stairs	-	6	18	m2/unit	108	20%	129,6	TS
	TOTAL AREA OF PUBLIC SPACE = 649,6							649,6	
Food Court	Stand	-	5	20	m2/unit	100	30%	130	TS
	Cashier	1	5	2	m2/person	10	30%	13	ASM
ZONE	**SPACE TYPE**	**CAPACITY**		**SPACE STANDARD**		**SPACE AREA**	**CIRCULATION**	**SUBTOTAL AREA**	**SOURCE**
		people	amount	size	unit				
	Dining Area	10	1	2	m2/person	20	30%	26	DATEK
	Sink Room	1	1	1,5	m2/person	1,5	30%	1,95	DATEK
	TOTAL AREA OF FOOD COURT = 170,95							170,95	

MEE	Generator Room	-	2	40	m2/unit	80	20%	96	DATEK
	Panel Room	2	14	1,5	m2/person	42	20%	50,4	ASM
	Pump Room	-	4	30	m2/unit	120	20%	144	DATEK
	Warehouse	-	4	35	m2/unit	140	20%	168	DATEK
	TOTAL AREA OF MEE = 458,4							458,4	
Security	Guard Post	2	4	3	m2/person	24	20%	28,8	SB
	Access Post	2	2	3	m2/person	12	20%	14,4	SB
	CCTV Room	-	2	30	m2/unit	60	20%	72	TS
	TOTAL AREA OF SECURITY = 115,2							115,2	
Parking	User	1	408	12,5	m2/unit	5.100	100%	10.200	DA, ASM
	Guest	1	20	12,5	m2/unit	250	100%	500	DA, ASM
	TOTAL AREA OF PARKING = 10.700							10.700	
GRAND TOTAL								21.827,15	

3. 4. Massing

There are two building masses where: the first mass is planned as a female boarding house, and the second mass is planned as a male boarding house. To reduce the intensity of sunlight hitting the side of the building, shading is done so as to create four towers (Figure 3).

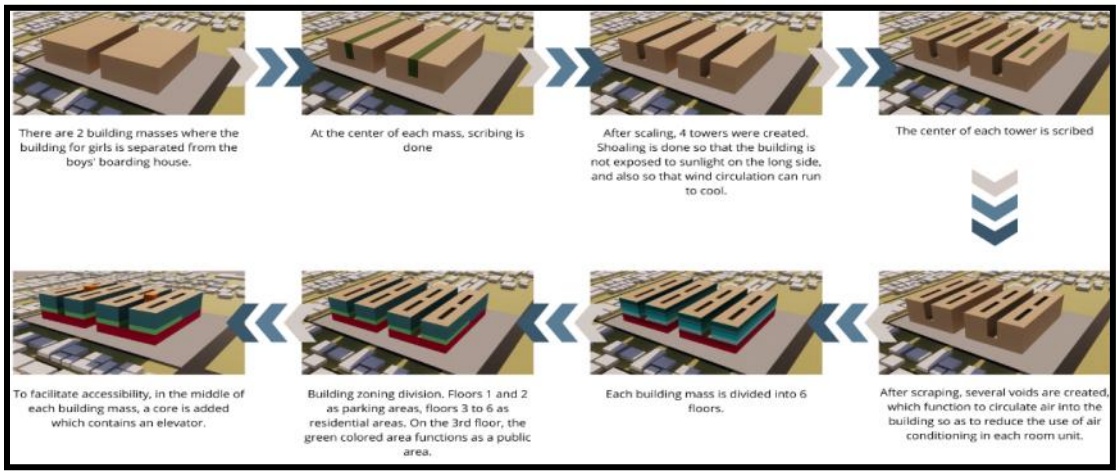

Figure 3. Massing

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3. 5. Zoning

The first and second floors of the building are used as parking areas. In addition to the parking area, there are also functional spaces such as the groundwater tank room, panel room, and sewage treatment plan room. Access from the 1st floor and 2nd floor can be reached using a vehicle, while to get to floors 3-6 requires the use of an elevator.

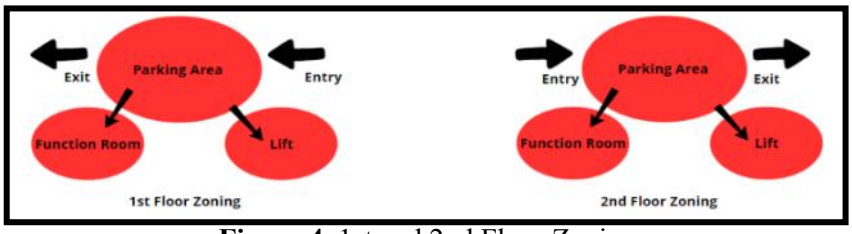

Figure 4. 1st and 2nd Floor Zoning

On the 3rd floor,there are public areas and private areas. The public area is a retail area with a lobby and waiting room. The private area is the living area/unit room. Each unit room is connected to a communal room. In the communal room there is a shared kitchen, living room and dining room (Figure 5).

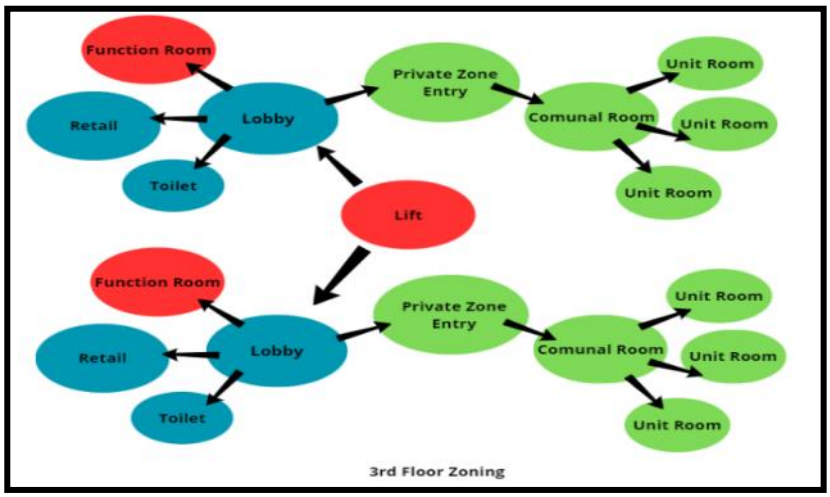

Figure 5. 3rd Floor Zoning

On the 4th to 6th floors there are special private areas. On these 3 floors there are only living areas/unit rooms and communal rooms. Access to these floors can only be by elevator with an access card (Figure 6).

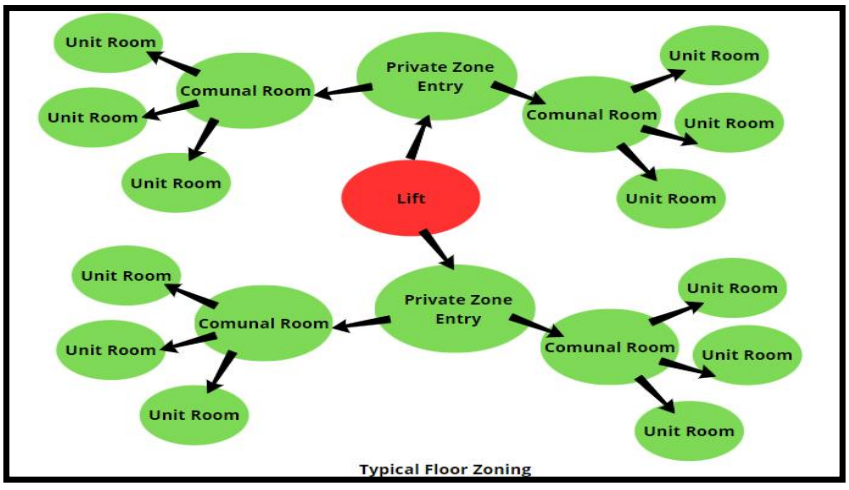

Figure 6. 4th-6th Floor Zoning

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For site zoning, the entrance to the site can be accessed via Dr Mansyur Street. The mass of the building is slightly indented into the site. In the front area, there is a gathering point in case of disaster (Figure 7).

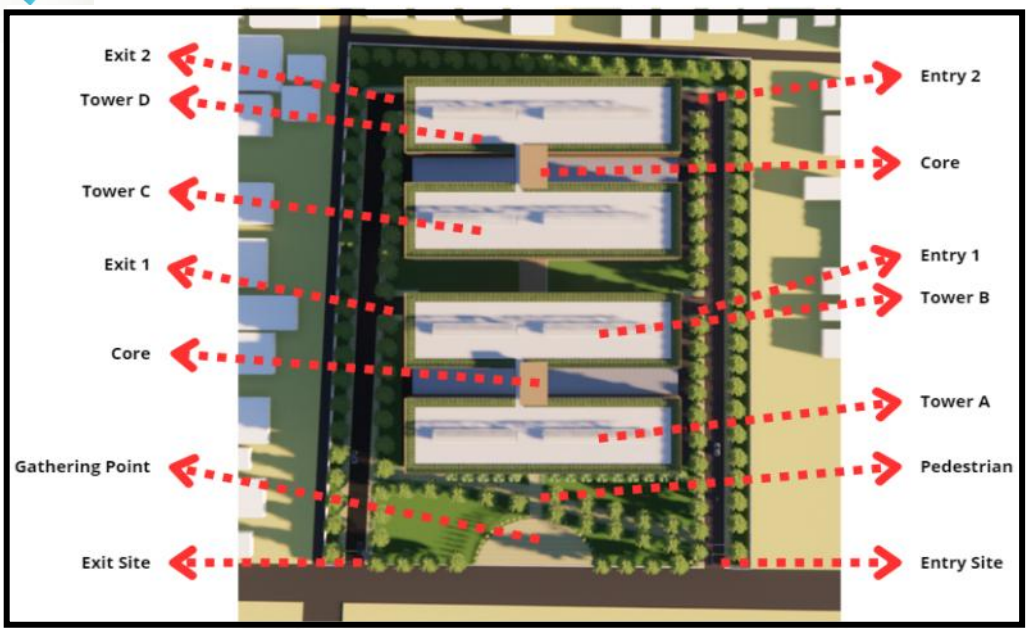

Figure 7. Site Zoning

3. 6. Theme Implementation

3. 6. 1. Building Orientation

Due to the elongated side of the land in the East and West directions, a solution is needed so that the building is not exposed to direct sunlight on the longest side of the building. The solution is to divide the building into four towers (Figure 8). In addition to avoiding direct sun exposure, this is also done so that wind circulation occurs and the area becomes cooler.

Figure 8. Building Orientation

3. 6. 2. Use of Secondary Skin

The use of secondary skin reduces direct sunlight exposure and also adds aesthetics to the building. In addition, because the secondary skin is placed on the balcony, security is created for the occupants of the boarding unit (Figure 9).

Figure 9. Facade of Building

3. 6. 3. Use of Eaves

The use of terraces is done to reduce exposure to direct sunlight and rainwater from entering the room.

3. 6. 4. Visual Connection with Nature

Simulated nature is designed in buildings in the form of procurement of vines and ornamental plants that function to reduce the temperature in the room that makes residents comfortable.

3. 6. 5. Air Circulation

The cool concept is a natural airflow concept that relies on the air conditioning system in the room. The concept of ventilation uses cross ventilation, where air entering from outside is captured into the building. The incoming air will circulate and carry heat out of the building [17]. Good air circulation is needed to reduce the use of air conditioning. Therefore, in this building, voids are made in each tower. These voids exist from the 3rd floor to the roof floor of the 88 88 89 90 91 92 93 94 95 Report: jurnal IJAU lagi en Report was generated on Wednesday, Jul 10, 2024, 01:56 PM Page 37 of 50 building. This allows air to enter the building. For good circulation, each unit is provided with a balcony so that air exchange can occur (Figure 10).

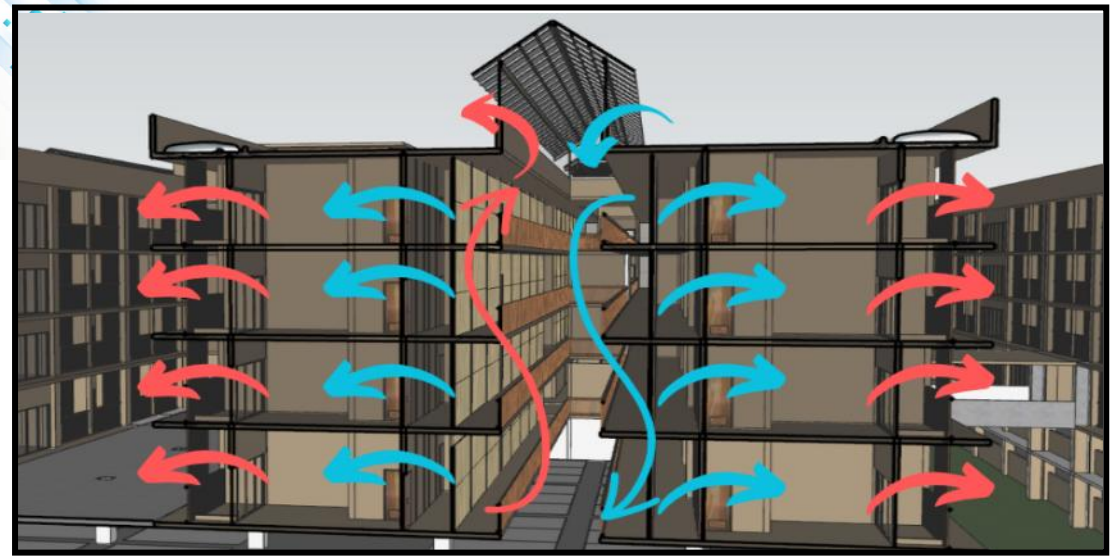

Figure 10. Air Circulation

4. Conclusion

The design of this student boarding house aims to provide temporary living accommodations for students of the University of North Sumatra who come from outside the city of Medan. There are several aspects that influence students in choosing boarding houses. These aspects are location, comfort, price, facilities and building aesthetics. The comfort aspect needs to be considered, especially thermal comfort. The high temperature in Medan can cause discomfort. Therefore, the application of tropical architecture is expected to create coolness and reduce energy use. This student boarding building can also be a study area for students. In addition, due to the addition of other commercial functions, such as retail, this boarding building can be visited by guests who want to visit or just gather together and study together. Public activities can be carried out in public areas as well. There are other facilities provided such as sports facilities, laundry, salon and game center. The design of this student boarding house is expected to provide comfort to its users and foster the desire to teach students. In addition, it can also provide visual comfort from the design that has been designed through a combination of colours and building facade design (Figure 11).

Figure 11. Building Perspective

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6. Conflict of Interest

The authors state that this manuscript has no conflicts of interest and has not received any external funding.

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