The generating process of alternatives of contemporary facades forms for Houses

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Abstract

The architects follow the trend of the architectural style used to design the facades of the buildings. The similarity in the design principles and elements in the designing of the facades are the most common problems in the contemporary era because of the difficulties that architects faced to add their creativity to the design without matching with the other architects to represent the speciality of the designer. The study was conducted to figure out the mechanism of generating new models of the facades' form related to selected designers, which can provide alternative models from the basic façade. The facades of contemporary houses are the focus of the study. the methodology applied visual analysis of the selected façade sample to identify the principles, relationship, elements, mass and v oid, and colour. The results of analysis used to create a data set for artificial intelligence applications to generate new models of facades. The facades frame (width – length), depth, floors number, and t he offside of the façade are the main variable to generate the new models artificially. The results identified the algorithmic process of generating new models linked to original design depending on the principles (symmetry, balance, transformation), the colour results show that in the contemporary design three colours usually used in the design in the ratio of (3-3-1), which one colour is in contrast with others. The ratio of mass to void is (3-1). The vertical and horizontal lines are used in the balance ratio.

1. Introduction

In the current era, designers faced various requirements related to the functions, styles, context, and trends of the design market, in which the client has a role in affecting the design, especially the design of the façade in the contemporary era. The trend of architectural style is rapidly updated following the international trend and the desire for improvement and change. Moreover, the emergence of construction and finishing materials enforced the designers to update their design trend, which was obviously reflected in the façade formation system. Various studies highlighted the problem of negative similarity and visual deformation of the urban image because of the fluctuation of the trend (Abdullrazaq & Abbas, 2008).

The improvement in design thinking is reflected in the formation of the façade, especially after using the technology in the design process and new construction materials and methods, which enhance the ability to implement any design to be existed. Ali (2009) highlighted that the problem of the improvement and variety of the formation system of the façade in Baghdad referred to the unclear effects of the formation system of the façade (Ali, 2009). Therefore, in one street, three or more of houses' façades are included similarity for more than 70%, which may belong to the same designers of the construction company (figure 1).

The problem statements of the current study determined after the pilot study done by observing the houses façade in the three different quarter in the Nineveh Governorate to highlight the main problems that enhanced the similarity issue.

Figure 1. Various façade form design by different designers in Nineveh (Source: architect Ashraf Alhafody, Architect Amer Azawi)

The aim of the study is to figure out the mechanism of generating new models of the facades' form related to selected designers, which can provide alternative models from the basic façade. The mechanism is to assist the designer to generate models of the façade form depending on the designer style and trend to reflect the speciality of the designer on the facades design.

The similarity in the faced form link with the form characteristics, elements, relationship, and material, which affect the exterior of the buildings. The façade elements are mostly common between the buildings, but the differences in the manage the relationships and location in the façade. Opening elements is normally framed or designed with walls of

the facades. Moreover, columns, masses, vertical and horizontal elements such as open r oof or balcony are the main elements of the facades (Wadah, 2005). The principles of design have a role in the similarity and creating trend for the designer, which harmony, contrast, unity, balance, and axiality are mostly used in the designing process in the contemporary ear (Abdulqader et al., 2015).

Amer and G aber (2018) discussed that the visual deformation in the city related to the multi-themes of the facades design related in the same period. The design of the façades should follow the trend and the style or context of the street and any modification or adding strange elements or materials (Amer & Gaber, 2018). However, facades formation depends on the structure of the form of the buildings. Moreover, the additional envelop covered the original façade of the building has a role in the similarity i n addition to the new construction material(Çıkış, 2007). Architects responded to the environmental requirements by adding elements and pr inciples of design to the facades to achieve the comfortability of the users (Pastore & Andersen, 2022), which is another affected factor in the formation of the façade.

The from, space, and or der in the designing of the architectural facades was highlighted by Ching (2014), which identified the principles, relationship, and finishing of the buildings to create better architecture. The balance, harmony, and scale are most used and ef fective principles that can be us ed to create a suitable façade for suitable functions (Ching, 2014). The vertical, horizontal, and surfaces are the main physical facades elements. Moreover, pure and irregular shapes can be i ncluded in the design process of the facades to create levels and extended of the buildings. While mass and s pace, solid and void are also physical elements of the façade created by the another physical element (Gunce et al., 2019).

In conclusion, the similarity in the design of the facades can be i n positive or negative impact on t he buildings and image of the city. Trend of façade design depends on physical elements, principles, and r elationships, which the specialty of the architect can emphasis due the way of dealing with these three factors. Moreover, the colours and materials relations have a role in the matching process of the facades formation.

2. Research Methodology

The research methodology applied formal analysis method to random selected samples of houses facades. The visual analysis method is widely applied in architectural studies (Gunce et al., 2019), which can be applied using Auto analysis programing or manually by the researchers and t he two way are depend on t he data set that should be provided. Therefore, visual observation using checklist sheet used to record the analysis of selected cases (table 1).

The variables and values arranged in the checklist (table 1) contained four parts. The first part is general information about the selected sample. The second part related to the main shapes that used in the forming the facades, while the third part is to observe the relationships and

design principles applied in the selected sample. The last part is related to the materials and colours and t he way of applying them in the façade. The analysis of the sample is to the façade wall and excluding the fences.

Table 1. The variables and v alues as a checklist form.

1	Sample Information			
Sample image		code		
Designer		Construction year		
Area of Facade		Number of facades		
2	Shapes and elements			
Vertical				
Horizontal				
Pure shape				
Irregular shape				
Surfaces				
Columns				
Mass ratio				
Void ratio				
3	Principle and relationships			
Balance				
Unity				
Scaling				
Axiality				
Hierarchy				
Proportion				
Continuity				
Overlap				
Tangency				
Adjustment				
4	Finishing treatments			
Colour theme				
Colours relation				
Ratio of materials to colour				
Ration of dark theme				
Ration of light theme				
location of dark theme				
Location of light theme				

(Source: The researchers)

3. Application & Discussion

The results of visual analysis of façade for selected samples (figure 2) shows that facades of contemporary era affected by the new materials and technology of construction, which provided a pl atform to implement any design that architects produced. Also the regularity is the theme of the trend architecture in Mosul, which implement pure geometric shape in the façade such as squire frames and rectangular frames.

Figure 2. Samples of facades designed by different designers (Source: 1: ArtDeco Architects, 2: Mosul Horizon for Architecture, 3: Azawi construction Company, 4: Aser Al Takwen for Architecture)

Vertical and horizontal organisational line are in balance with the perpendicular surfaces (figure 3), which usually is the

dark theme of the façade using wooden or dark gray marble. The principles of balance applied without reaching any type of symmetry (figure 4). Scaling principles used in 35% of the samples and applied for pure regular shape (figure 5).

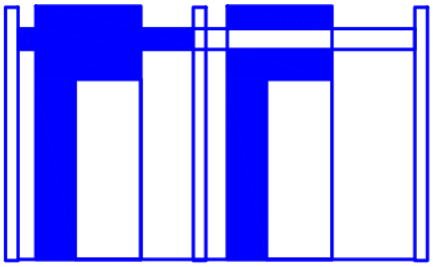

Figure 3. Vertical, horizontal, and perpendicular surfaces relations (Source: the researchers)

Figure 4. the imperfic balance by shape and void in the façade (Source: the researchers).

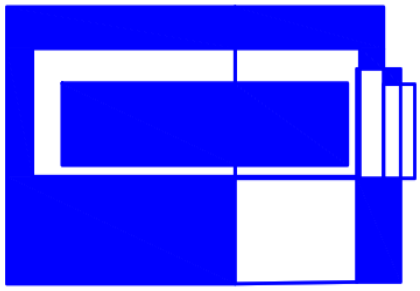

Figure 5. the scaling of pure shape in the façade (Source: the researchers).

The ratio of mass to void is 78%, which most of void ratio are applied in the second level of the houses. The result of analysis highlighted that the relationships of intersection and overlapping are mostly used in the design. While the tangency is less than 8% for all samples. The principles of addition and subtracting from the façade form are observed in the analysis of the facades, which is mostly the results of intersections of the façade elements or created by creating the opening (doors, windows).

From the results of analysis, the second step of the study going to apply the rules that concluded from the results with few modifications to generate new models from one or iginal facades in order to examine the algorithmic process of the facades and dr aw out the rule and data set for the algorithmic process of generating new models (Figure 6).

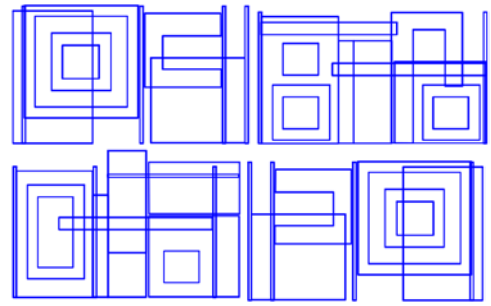

Figure 6. Some alternative models of façade generated from one existing façade (Source: The researchers).

The similarity checked between the produced facades and m ost similar facades are presented in (Figure 6). Although the new models is nearly matched by the elements and organizational lines, but the differences are in the implementation of the principles and r ules on the original elements of the façade. Appling the colour and m aterial theme, which mostly

applied the contrast relation with the façade main wall. The ration of contrast colour or material to the background wall are (3-1) and (3-3-1). The results of generating alternative models show that similarity in the design of façades for one designers can create a parallel trend for the designer and in the same time achieved the needs of the client in the following the trend of the facades in the city, this done without creating visual deformation in the image of the street because the source of the shapes and principles are same, but the relationships are totally affect the results of similarity.

4. Conclusions

Producing alternative models of facades is acritical process, because it could create positive or negative impacts on the new models in term of similarity and copy for a façade to create identical or semi-identical facades. Therefore, identifying the elements, rule, and principles in a systematic way following algorithmic steps to produce facades with aesthetic relationships and elements linked to the architectural trend of the city and carrying the specialty of the designer.

The algorithmic process and steps to generate alternative models of the contemporary façade included four main steps, which can be applied in any programing language with providing data set (figure 7). The first step is to select the overall frame of the façade (R1) and the depth of the void (R1-1). The second step to select the rule of shapes (R2) in the façade (background wall, vertical – horizontal- perpendicular surfaces, basic shape….etc) (r1,r2,r3…….rn) which depends on the analysis of the facades that designer want to derive new models from it. Moreover, in this step the ration of area covering the façade from the selected shapes (R2-1). The third step is to define the principles (R3) and relationship (R4) for each selected element in the second step. The final step to define the colour (R5) and material (R6) with the ratio of contrast relations (R7).

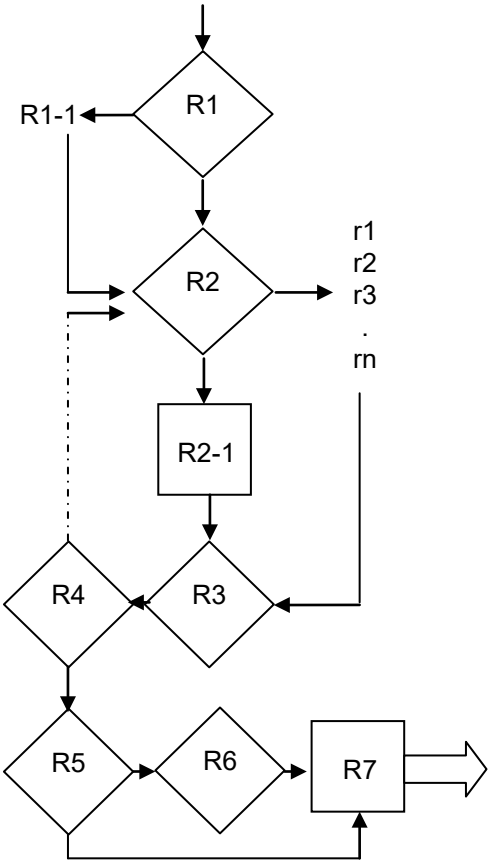

Figure 7. algorithmic diagram of generating alternative models (Source: The researchers).

5. Acknowledgment

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