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A Study on the Application of Chinese Architectural Form in Animation

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Abstract

Traditional Chinese culture, which has more than 5,000 years of history, has a rich cultural story and a variety of diverse cultures compared to other cultures. The Chinese traditional culture is used in various fields, and in addition to creating the aesthetic value of films and animations, it is also used to enhance the aesthetic value of the film and become the subject of fantasy. Chinese traditional cultural styles are widely used and used abroad as well as animations in China. However, observing the traditional forms of scenes appearing in animation or movies can reveal several cases of improper usage. .In this paper, we looked at the traditional Chinese architectural style centering on the Chinese traditional architecture and tried to classify the actual traditional styles of Chinese traditional architecture by referring to the historical characteristics of the traditional Chinese architecture.

Keywords-Chinese Architectural Style, Animation

1. Introduction

1.1. Research background

The movie <Jurassic Park, 1993> directed by Steven Spielberg , made the movie adaptation of a novel by Michael Crichton, a film based on the author's novel, " The Clone of Dinosaurs, " and the viewers all around the world were amazed by the fact that screeching dinosaurs looked unbelievably real out of fossils. The series of sequels to many children and adults who watched the movie have come to believe that they presented scientifically proven shapes and behaviors of the dinosaurs. The pattern of a dinosaur's shape and behavior in the movie has poured into a false sense of realism. In 2000, the audience began to wonder about the film adaptation of a slightly modified version of dinosaurs in a movie <Dinosaur>, which drew questions about actual shapes and behavior of dinosaurs. First of all, dinosaurs in the movie were mostly dinosaurs from Cretaceous Period which could deliver incorrect information regarding historical periods. Second, Dilophosaurus (Dilophosaurus) has no evidence of the ability to excrete venom in the film.

Third, T. Rex (T.Rex) is known as the setting of the movie, unlike other predators, unlike other carnivores, unlike other carnivores, unlike other carnivores, the figure is seen as a set up to enhance tension. The most visible setting is Velociraptor, which is considered to be the most visible form of the film, which is the most visible shape in the latter half of the Cretaceous period. It is also believed that the size of a small sized size of about 50 centimeters compared to humans is not far higher than that of other dinosaurs. Despite the obvious errors in the Figure 1, the film was exposed to many people without filtering, and the adult child became aware of the reality of life as a creature that appeared in the movie.

Fig.1 Left: Velociraptor in the film <Jurassic Park>, Right: Actual estimated size and shape

With the recent success of Chinese animation in China, the style of Chinese traditional styles is emerging as a new success factor in Chinese animation industry. Even in the background of the animation, the application of traditional Chinese architectural styles is an important indicator of the quality of the works. [1] Works such as <Kung Fu Panda, 2008 > and<Mulan, 2004> are examples of depictions of traditional architectural styles and distinctions of Chinese traditional architectural styles by embedding the aesthetic of traditional architectural styles. The unique cultural implications and aesthetics of traditional architectural styles add to the intrinsic depth of the scenarios in the creation of animation.

However, the lack of recognition of traditional forms of cultural differences due to the cultural differences between eastern and western cultures can incapacitate the distorted history and cultural consciousness, regardless of the nature of the painting, as shown in the example of the genre of the movie. Also, these factors end up causing the completion of the work. An incorrect perception of the audience's traditional culture may result in a cultural misunderstanding of the film's supply force, which could lead to a difficult situation in which the traditional culture of the traditional culture is difficult. Since other countries with long history and traditional historical traditions can also be in the same situation, the more systematic analysis and understanding of traditional Chinese architectural styles should not be made possible through more systematic analyses and understandings of traditional culture styles.

2. Traditional Chinese style architecture

There are many famous works of Chinese animation including traditional Chinese style, such as world-famous works <Princess Iron Fan(铁扇公主), 1941>, <Havoc in Heaven(大闹天宫), 1964>, <The gourd children(葫芦娃), 1986>, <Little Tadpoles Looking for Mama(小蝌蚪找妈妈), 1961>. Since then, Chinese architecture and natural environment have been building various ideas for creating animations.

It is somewhat unfortunate that the American movies which featured Chinese architectural aesthetics, began to garner praise from the Asian style of aesthetics, rather than from the meaning of historical fact from the 2000s. The combination of Chinese traditional architectural culture and cultural style have come to an attention from Chinese animation industry because the type of approach is not only showing distinctive styles between East and West, but also representing China's historical excellence. An animated scene plays a significant role in shaping the overall style of work, as an important part of the creation of an animation. In this thesis, we categorized Chinese traditional architecture centering on Chinese traditional architectural styles and examined examples of Chinese traditional architectural styles presented in animation by analyzing structural characteristics of traditional architecture by ages and regions.

Fig.2. From left: <Princess Iron Fan1>, <Havoc in Heaven>,
<The gourd children>, <Little Tadpoles Looking for Mama>

2.1. Traditional Chinese Architecture Method

China has a vast, rich, resourceful and historic history of architecture. Although China has a wide variety

of artistic styles depending on the wide area and long periods of history, it has similar characteristics in terms of architecture, spatial composition, architecture, architecture, and decorative arts. China's traditional culture, which differentiates itself from the West, is now gaining world-wide fame.[2] Traditional Chinese architecture was formed based on the resident population, and various styles of vernacular houses were formed depending on the characteristics and customs of each region. Building patterns were taken into consideration by climatic conditions, such as climate and sunshine, at the time of construction. Traditional Chinese architecture is divided into six sections: Huizhou Style, Min Style, Beijing Style, Supai Style, Jin Style, and River Style. [3]

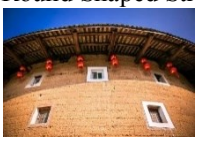
Fig.3. Geographical Distribution of Six Groups(地域分布图)

Table 1 Traditional Chinese Architectural Style by Region

Architectural style	**Region**
Huizhou Style	for example in Huizhou, Yanzhou
Min Style	for example in Fujian Province. Xiamen. Quanzhou. Zhangzhou
Beijing Style	for example in Beijing, Tianjin. Shandong. Hebei
Supai Style	for example in Zhejiang, Changzhou, Suzhou
Jin Style	for example in Shaanxi province,Gansu
River Style	for example in Sichuan, Yunnan, Guizhou

Table 2 Traditional Chinese Architectural feature by Region

Building style	**Characteristics & Images**
Huizhou Style	(a) Mixture of white walls, blue bases, and Moduk walls, which are characterized by splendid taste and flavor, are equipped with superb plastic surgery and fire suppression. (b) High Wall and Large Gardens for the Prevention of Theft (c) On a rainy day, appearance of falling rain drops from the roofs to the yards, reflecting the psychology of Huizhou people who accumulate little wealth.    (a) (b) (c)
Supai Style	(a) A type of garden in Natural forest harmony (b) An ancient entertainment establishment consisting of pavilion, (c) An ancient entertainment establishment consisting of pavilion (d) It is convenient to travel even for the rainy day for connected veranda between houses.     (a) (b) (c) (d)

Min Style	(a) a mud-plastered wall structure for fire prevention (b) Round Shaped Structure to Defend Enemy   (a) (b)
Jin Style	(a) underground tunnel construction for Fire Prevention (b) A community at the foot of the mountain for Preventing the Collapse of a Cave (c) Structure for warm in the winter and cool in the summer.    (a) (b) (c)
Beijing Style	(a) Constructional Structure for Family Consciousness (b) An honest and unselfish sculpture ornamentation (c) A symbolic color of wealth    (a) (b) (c)
River Style	(a) Pile dwelling building for moisture proofing and waterproof (b) A pedal for gout (c) Stilts to prevent animals such as snakes    (a) (b) (c)

2.2 Traditional Chinese Architecture by era

There has been a very strong degree of closure between the regions of the ancient kingdom of China. However, the traditional culture of each region was rapidly mixed with an attack of invasive culture and repeated aggression. And the ancient architecture of ancient times reflects the circumstances of the historic era. Three distinct characteristics of the Chinese dynasties, which are characterized by the most distinct characteristics in Table 3.

Fig.4. The location of the capital city by era

Table 3 List of Chinese dynasties by era

Era	Dynasty	Period	Metropolitan area
Jinhan era	Jin Dynasty	BC221-BC206	Shanxi Hamyang
	West Han	BC206-AD8	Shanxi province's Xi'an
	Xin Dynasty	8-23	Shanxi province's Xi'an
	East Han	25-220	Shanxi province's Xi'an
Sui & Tang era	Sui Dynasty	581-618	Shanxi province's Xi'an
	Tang Dynasty	618-907	Shanxi province's Xi'an
Ming & Qing era	Ming Dynasty	1368-1644	Beijing
	Qing Dynasty	1616-1912	Beijing

Table 4 The Characteristics of Chinese Traditional Architecture by the Time of Ages

Era	Characteristics of Architecture by Time		
Jin & Han	 very large form of roof	 Linear form structure	 very diverse in color and decoration
Sui & Tang	 A beautiful, bright color	 momentous Buddhist temples	 A combined form of foreign culture
Ming & Qing	 Lay stress on a garden	 Combined with a natural environment	 value on the theory of configuration of the ground

2.3. Cultural Implications of Traditional Chinese Architecture

2.3.1. Concept of the feudal class based on regal power

Since the establishment of the nation, 5,000 years of dictatorship has been the predominant political system in China. Because China has been implementing a hierarchy of classes for a long time, its influence is clearly reflected in the architectural style. Looking at the architecture of China, the composition, form, shape, size, structure form, decor of architecture and in every field, the color of the powerful political ethics is emerging, and it is even possible to discern the architectural structure of the period according to the laws of the imperial system. For example, in the era of Qing Dynasty, classification of architecture was divided into three categories. A building where the emperor and his family live and the building that handled the political affair was classified as a palace building. This type of architecture was built with grandeur and splendid features. Double eaves roof and various colors were permitted to use. The houses of each class of officials and wealthy merchants were classified as large-scale building blocks, but unlike palace buildings, gold glass roof-tiles and dragon-piping ornaments were not allowed to use. The building of the ordinary

people was classified as news architecture, and this type of architecture was constructed in a very simple form, since the purpose of this type of architecture was to be used in real life. In the meantime, the government was providing strict restrictions on the exterior doors, yard, length of gardens and buildings, the area of rooms, the width of the room, types of roofs, the decor, and colors. [18]

2.3.2. Precept of ancestors and notion of family

China's system of a code of clan regulation and notion of family are one of the most important provision in China's traditional culture. In particular, system of a code of clan regulation from confucian ideas has had a huge impact on society, especially after the theories of ideology have attained a dominant position in the fields of thought. In this context, these theories have become one of the themes highlighted in traditional Chinese architecture. [15] The most specific social conceptions of the architecture of the house are the religious system and the notion of family. The separation of geographical and psychological boundaries, separated by separated families and families, served as a distinction between geographical and psychological lines, which illustrate traditional ethical concepts.

3. Scene design of Animation

The scene in animation refers to the location and environment where characters act and perform. These locations and environments also include not only a single scene but also a background of landscape with a view and the time elements associated with various scenes. In animation production, animated scenes usually serve as a basis for acting of animation characters. The animated scene features a historical background, cultural appearance, geographical environment, and historical features in the direction of the animation that matched the demands of the animation. .It should be able to present the exact time of the story, and provide a suitable context for the animation character by designing the entire style of the work. The characters in animation works are subject to the storyline, so the animation scene design should be directed to the acting of the character in the works. [19]

The animation scene design is an important element in animation production, which directly influences the overall style of production. Therefore, the excellent animated background design is not full of works of art, but it is determined by how the screen effect can influence the main emotion of the works, the character personality, the atmosphere of the atmosphere, and the story of storytelling. [24] Since the nature of the animation, personality, and so forth is also highlighted in the match with certain scenes, the importance of the background design is closely related to the success of the animation or movie. Therefore, the background design plays an important role in helping audiences develop sympathy, not just visual aspects, but also psychologically.

3.1. A Case Study on the Design Application of Traditional Chinese Architectural Form

Short Animation film, <Lovesickness(相思), 2016>, is the second work of the " Chinese Choir" series animation. The story of this piece is set in a small town in the middle of the year, 300 years ago, where it rains frequently throughout the four seasons in the reign of Shanghai Jiading during Ming and Qing Dynasties.

Fig. 5. <Lovesickness(相思), 2016>

Figure 6 shows that the heroine is engaged in an engagement ceremony in front of the heroine's gate, and the hero looking furious going to the backdoor of the heroine's house to find her. In this scene, the front gate of the heroine shows the front door structure is very high whereas the back gate is relatively low. This reflects the architectural style of China at the time through accurate historical research.

Fig.6. The main gate and back gate of the heroine's house in <Lovesickness(相思), 2016>

The arch over a gateway, appeared in the animation film in Figure 7, bears a similar pattern of Humble Administrator's Garden in the southern part of the Qing Dynasty. An arch over a gateway was used not only as decorations but also as symbols of identity. Bluestone roof tiles, white brick wall, narrow alley, the cozy atmosphere and mood of the one-strong array of stores shows orderly form of living in a traditional residential area around Jiāngnán. This is largely a way of following the ancient architecture of the Qing Dynasty that the correlation between the proportions and the size of each area of the ancient architecture serves to maintain a uniformed style of architecture. This is also referred to as the ratio and order of beauty influenced by tradition.

Fig.7. <Lovesickness, 2016> Left: Arch over a gateway in the film, Right: Arch over a gateway of Humble Administrator's Garden in the southern part of the Qing Dynasty

Fig.8. <Lovesickness, 2016>Left: Architecture in the film, Right: Architecture in the southern part of the Qing Dynasty

Key building materials used in buildings of the Ming and Qing Dynasty include soil, brick, timber, stone tiles, tiles and tiles used for roofs. The film sets its backdrop for a heavy-rainy Jiāngnán in the same way as the actual background, and sets its time for a couple of months after early spring. Blue roof tiles are installed on the rooftop which is characteristic by its angular formation of layering the blue roof tiles one by one.

According to local climate effects, rain falls beneath the eaves when it rains, the scenes that reflect these traditional forms of art maximize the ideal atmosphere for animation stories in the works developing the story of the movie and increases the perfection of their work. These works are said to have significant implications for the effective conveyance of Chinese traditional culture and establishment of historical views.

3.1.1. Case study of improper usage on traditional architecture form in scenes of animation film

There are cases of improper usage of traditional architecture in some animation film applying Chinese culture that is globally known through the analysis of the three widely known works. Scenes from the animation <Kung Fu Panda> are composed of three main types of space. Valley of Peace with the house of panda Abao, The spaces are the jade palace of Master Shifu's place, and a prison castle where tiger Taireong got locked in. The mountains and rivers of peace in the valley are very similar to the region of The Li River in China. The architecture of the valley of peace is divided into two types of structure, which is set next to a flowing river side by side, one side shows a house with a gray roof on a white wall, and the other side shows a house with a green roof on a red wall. On one side of the river, there are buildings that exude a strong sense of Water Town, similar to Hui style Architecture. And stately palaces are located on the other side, which is hard to see the exact meaning of the class and separation looking back on historical meaning

of Chinese architectural styles. In addition to that, the red wall is not the color that the ordinary people can easily use, it seems to be somewhat awkward in applying the design of Chinese architecture.

Fig.9. Chinese architectural styles that distinguish from the scene in <Kung Fu Panda>

For another example of improper application, the roof of the tower in <Kung Fu Panda 2> appears differently from the roof shape of a typical Chinese tower. The Chinese ancient pagoda is shaped like a spire, regardless of its shape, hexagonal, octagonal, and octagonal, but the roof of the tower in the film does not have the shape of its spire. The tower in the animation looks like a mixture of various types of buildings and towers, rather than traditional Chinese pagodas.

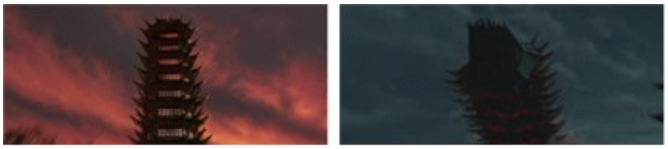


Fig.10. Appearance of spire in <Kung Fu Panda 2>

Perhaps many Chinese think that most of China's appearance in the animation film <Mulan> looks quite different from those in reality rather appeared in the view of Westerners. As shown in Figure 11, Mulan appears to have a shrine in the form of a pavilion in a yard, which is a distant setting from real.

The ancient Chinese people built shrines and gravestones to worship their ancestors inside their houses not in a yard because they respected their ancestors very much. And then you can see female ancestors coming out of their ancestral tablets to have a discussion about Mulan with other male ancestors, which is a rare occurrence in ancient Chinese society where the idea of predominance of men over women was definitely overflowing. There is a building with gray tiles on the white wall on the right side of the image in Figure 11, which is similar to the Hui style architecture of the Ming Dynasty and the Qing Dynasty. These buildings do not correspond to the house building of Mulan, which was built in the Supai(苏派) style of the Tang Dynasty.

Fig.11. Buddhist Temples and Hui style Architecture in <Mulan>

Fig.12. The Comparison between the Royal Palace in <Mulan> and the Royal Palace at the time of the Tang Dynasty

In the scene where Mulan is heading to the palace, the layout of the large and small houses around the palace in Figure 12 is impossible in those days. Since the power of the emperor in Chinese history was absolutely inviolable, soldiers were always stationed at the sides of the palace, not houses of ordinary people like in the film.

Looking at styles of the architecture of the successive dynasties, Golden glass roof tiles of the royal palace in the Sui Dynasty and the Tang Dynasty is depicted in <Mulan>, modeling the architectural style of the Ming Dynasty and Qing Dynasty. It appears that the architecture of the royal palace in the film clearly

shows inadequate usage of historical content of totally different styles of architecture of the Dynasties.

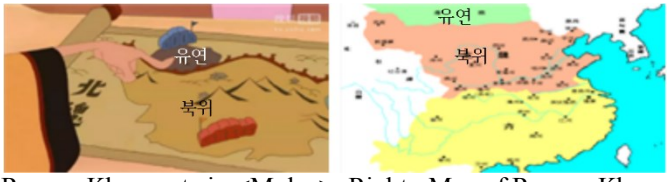


Fig.13. Left : Map of Rouran Khaganate in <Mulan> ,Right : Map of Rouran Khaganate in actual location

The Emperor sends Mulan to the area referred to in Figure 13 with the princess in <Mulan 2> According to the relevant data, the name of the area was Rouran where Northern Wei Dynasty was engaged in a war against Rouran and there is a record that there was a person named Mulan. Rouran is a nomadic country founded by nomadic tribes that have not been settled saddling sheep and horses and seeking for a grassy area in ancient China However, Rouran's royal palace follows the style of the Sui Dynasty and the Tang Dynasty, not that of the nomads, while the buildings on the street are following the style of the Hui architecture of the Ming Dynasty and the Qing Dynasty.

Fig.14. Scenes in <Mulan>

Observing another piece of work, the animation movie "Three Kingdoms(三国志)" is an animated series co-produced by the Japanese Shinano Production and the Beijing Huihuang Animation Company of China participated in the process partially. The animation "Three Kingdoms(三国志)" is consisted of three episodes: <Dawn of hero(英雄的黎明)>, <Buring inferno in the Yangtze River(燃烧的长江)>, <The vast land(辽阔的大地)>. The production began in 1987 and completed in 1991, reaching 1.4 billion yen in total production costs. The animation is considered one of the most authentic works of the Three Kingdom as it was produced through actual field survey on the Chinese continent, and is highly praised for making the most realistic feature out of China's own class. The production crew liaised for Chinese musicians to play the Chinese traditional musical instruments such as Chinese zither and Chinese two-stringed fiddle creating a unique atmosphere of China. Although the contents of the work are quite solid, there are several inadequate usage in the background of the work.

Compared to the historical records in Figure 15, the stairs of the royal palace in the animation movie are relatively low, unlike the high stairs built in front of the Luoyang Palace In addition, the inscription on the eaves of the actual palace is marked without cornices, whereas the eaves of the royal palace is decorated with cornices in the animation.

Fig.15. Left : Luoyang Palace featured in <Three Kingdoms> ,Right : The actual structure of Luoyang Palace

Buildings in Figure 15 shows yellow walls and red walls that were only available in the Chinese royal palace. These concepts were actually formed after the Tang Dynasty. Therefore the feature is supposed to appear in a much later period of time than the historical backdrop of this film. The combination of yellow and red colors is appeared in royal palaces of the Ming Dynasty and the Qing Dynasty. The structure of the architecture has another lack of observation in the movie. In ancient Chinese palaces, most of royal families

favored the establishment of an orderly and symmetrical structure which is shown in the image on the right in Figure 16 to boast the royal dignity and majesty of the royal palaces, however, the royal palace in the film displays mixed structures and disposition unlike the actual royal palace that was recorded historically.

Fig.16. Left : Structure of Luoyang Palace featured in <Three Kingdoms>, Right : The actual structure of Luoyang Palace

The yellow roof tile was originally used only by the royal family, which was originally appeared after the Tang Dynasty. However, the historical background of the film is the era of the East Han Dynasty, before the age of the Sui Dynasty and the Tang Dynasty, which is another example of improper usage of historical content.

Fig.17 . Scene in <Three Kingdoms>

4. Review

In the event of a scene in the animation design of a Chinese traditional architecture, it must be considered inclusively considering the elements of the historical background, regional characteristics, and architectural styles. Time setting can be factual or realistic depending on the scenario, and may include day and night and seasonal changes of the past, the present, and the future. On the other hand, if the existing space is used as a regional backdrop, it should be faithfully considered that the geographical features, natural characteristics, and architectural forms of each region.

Currently, most Chinese animation works with Chinese stories containing traditional forms. There was a situation where attempts to imitate the design of foreign animation which has been considered to be successful for the setting of backdrop until recently generating a problem of making obscure content of work related to the style of animation. Recently, there are moves to reinterpret traditional features among producers, and a film such as <Big Fish & Begonia, 2016> is bringing back Chinese audiences to theaters as one of the leading role. Thus, it will be necessary to create an animation scene that reflects the characteristic nature of the traditional architecture, not concealing the nature of the region, but putting the essence of traditional architecture out in designing scenes for animation.

The traditional topography of China often has different regional, time, and differentiated stories. Since geographical characteristics, folk languages, and lifestyle have various tales and legends in China, the scenarios and traditional forms are actually very closely linked. In the animation <Mulan>, the flow of stories is comprised of several distinct places, and the culture and traditions shown in each place enhance the aesthetic aesthetics of the work.

.In general, animations are usually set up five or six major scenes where the main characters of the story and the activities of major characters are developed. Since major scenes have a significant impact on the screen form of the entire animation, the focus should be placed on various aspects, such as design patterns, architectural features, and color preferences. If you want to refer to the traditional architectural style of the animation scene, we need to study scenarios to identify the overall style and style of the animation, styles of architecture should match the overall styles of the animation. Second, the architectural design of the architecture should conform to the historical background and traditional features described in the scenario and highlight the characteristics of the time and space of the work. Third, the historical and economic characteristics of the character should be studied, so that the character characteristics of the character and

culture of the character can be adapted to match the characteristics of the character.

Traditional Chinese architecture has a very long history and has been utilizing different styles of architecture depending on each dynasty, and various traditional architectural styles have been formed depending on the region and traditions. Therefore, researching the characteristics of traditional architecture is primarily required to design backdrop of animation. Although the style of palace architecture does not necessarily coincide with actual architectural styles, the overall setting of the entire picture should be characterized by a characteristic of design style and scene architecture, depending on the characteristic, regional background and time.

When collecting materials related to Chinese traditional architecture, some of the following are to be inspected: First of all, we need to understand exactly where the stories, times, and characters emerge. The characteristics of the character in the animation, social status, social culture, and materials used in the background should be gathered to collect references related to traditional architectural structure, decoration patterns, colors and materials, and collect materials related to folklore and natural environment. Secondly, the process of classifying and comparing collected materials should be found in the context of the era in which the work is based, and it needs to sort out the differences between diverse classes of society or specific features of regional architecture in each era.

5. Conclusion

In the text, it is presented by arranging six styles of Architectural Style in Traditional Chinese Architecture and analysis of the characteristics of individual architectural styles by each period and region. Through the examples of animated animations, we explored how much historical and regional characteristics of traditional Chinese architectural styles have been neglected to create aesthetic beauty. The gaps were particularly quite big in the animation that produced in western industries like in the example of <Jurassic Park>. Regarding the global influence of western-produced animation and movies, the facts of China's 5,000 years of history will be mixed, generate a false historical view for children who become main audience unless the proper direction gets suggested today.

In order to suggest a solution to the problem posed by the issue, we've examined the unnoticed errors found in each piece of work by focusing on the internationally recognized animation work or that is well-evaluated by audience to correct several improper contents and raise the alarm on the mistakes for viewers particularly for young audience.

Depending on the nature of the work, a mixed situation setting can be displayed in the scene. What we suggest in this thesis is presenting a new direction for the scenario and the setting of the scene in animation film through the process of classifying architectural culture of era and region rather than insist on preceding unconditional factual research. In the context of that, the texts examined the historical characteristics of Chinese architecture and geography. When producing a historical background of animation film, film-makers need to aware the importance of influence of the background and efforts should be made to create aesthetic feature for the background through more in-depth research above all.

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Website Based Student Activities Budgeting and Proposal Information System at Student Affairs and Alumni Administration Bureau of Petra Christian University

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Abstract

Every student activities has budget plan and report. The good budget plan and report can be achieved by synchronize with the applicable regulation and tax. But the reality in the activity committee is find it difficult when making the budget plan especially to determine which rule and tax correspond to the proposed budget.

Because of the problems, author designed the proposal submission system and the budget plan along with the accountability report which integrated with the applicable rule of Student Affairs and Alumni Administration Bureau of Petra Christian University. So that when the committee input the data, they can get the right information and warnings if the entered data doesn't match with the applicable rule.

The final result of the development is an information system that can give information about the applicable rule when the committee input the proposal, budget plan, and budget report. The result of this application testing show that it can answer the need of applicable rule information.

Keywords-information system;proposal;budget planning;accountability report;activities

1. Introduction

Each activity has its budget planning and reporting activities. Planning and reporting of good activity budget can be done if in accordance with provisions and rules apply.

The reality that occurs on the committee is the difficulty in making budget plans, especially when determining the amount of tax to be borne and the rules that bind to the proposed budget. This resulted in a miscalculation of the calculation of taxes on the plan and the budget report that ultimately led to losses at Christian University

Therefore the Budget Information System and Student Activities at the Student Affairs and Alumni Administration Bureau of Petra Christian University Based Website is made to answer the problem. The existence of budget planning features in this application can assist the committee in making plans and budget reports because the calculation of taxes that are automated and also there are checks of the budget against applicable rules. All budget inputs and activities of this committee will be directly integrated with the Student and Alumni Administration Bureau.

2. Theory

2.1. Type of Fund Allocation

Types of allocation of income funds consist of plafonds, contributions of participants, sponsors, and other sources [1].

2.2. Budget Number

The example of budget number that has been set by Petra Christian University can be seen in Table 1 [1].

Table 1. Provisions of Activity Budget

No	Name
513300	Speaker, Moderator
535300	Field Rental
523150	Taxi, Fuel, Parking, Toll, etc.

2.2. Provisions of Activity Budget

Some budgets have certain provisions regarding the size of the budget covered by Petra Christian University. Some examples of the provisions of the budget can be seen in Table 2 [1].

Table 2. Provisions of Activity Budget

No	Name	Maximum Percentage
523130	Accommodation	75%
535300	Field Rental	75%
523150	Taxi, Fuel, Parking, Toll, etc.	75%

2.3. Tax Provisions

Some specific budget are also taxed. The amount of taxes by each budget is not the same and based on specific criteria. It can be seen in Table 3 [1].

Table 3. Tax Provisions

Category	Activity	Tax	Notes
Salary	Coach, Speaker, Moderator	2.5%, 3%, 5 %, 6%	2.5% for Petra Staff that has ID tax number 3% for Petra Staff that doesn't have ID tax number 5% for non-Petra Staff that has ID tax number 6% for non-Petra Staff that doesn't have ID tax number
Rent/Service	Sound System, Tent, Decoration	2%, 4%	2% for who owns ID tax number 4% for who doesn't own ID tax number
Building & Land Rent	Field, Building, Retreat House, Exhibition Hall	10%	

3. Analysis and Design System

Analysis, interface design, and system design is an early stage done before the encoding. It aims to make the applications that are created can be well structured.

3.1. Application Programming

This application programming using PHP programming language [3] and Java Script [4]. For database storage using SQL server [5]. The server used is owned by BAKA.

3.2. Preparation Process Student Activities

In Fig 3 below is a flow of preparation process of the activity from the beginning determined the chairman of the activity to the task of each committee in charge. Parties involved in the preparation of activities of the organization, the head of activities, secretary activities, treasurer activities, division coordinator and divisional members.

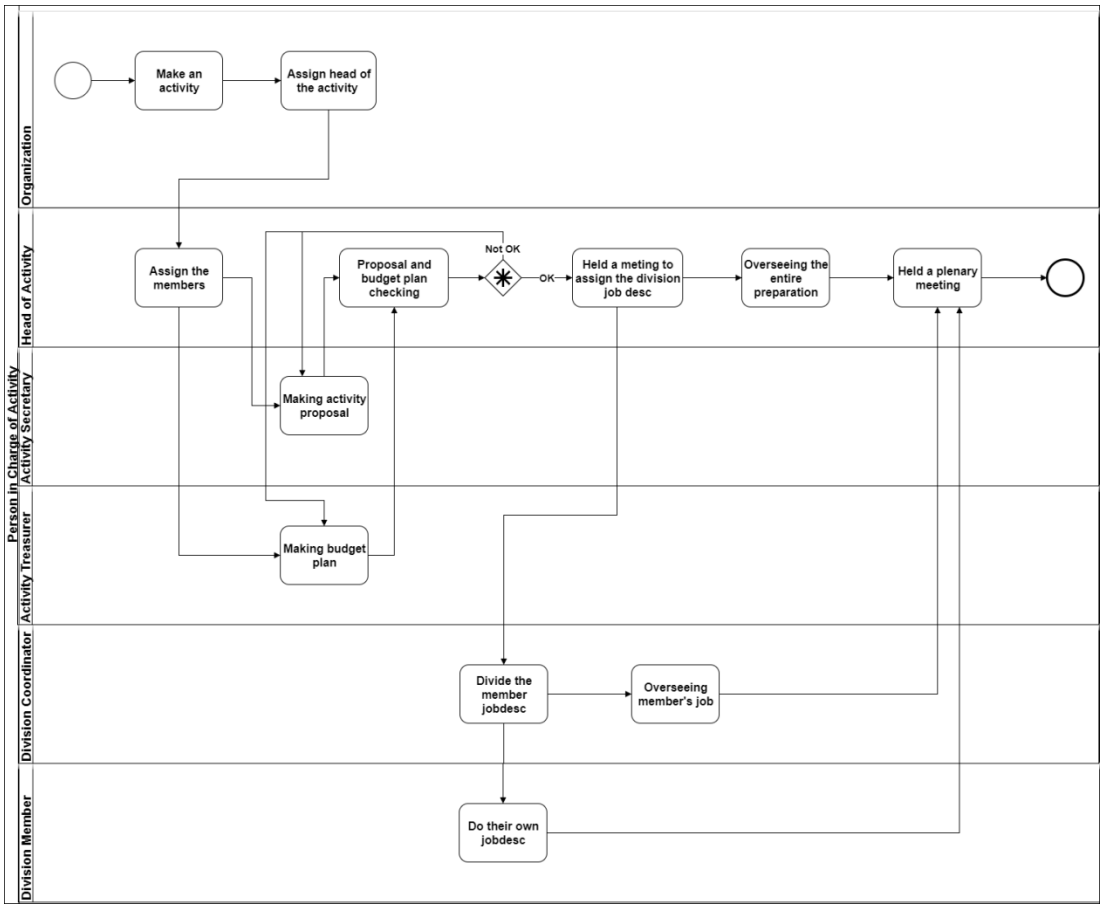

Fig 3. BPMN Process Activity Preparation

Activities are planned by certain student organizations. The organization will elect the head of activity as the main responsibility of the activity. After that the head of activities will determine the members of the committee either through close recruitment or open recruitment. The Chairman of the activity with the secretary of the next activity will make a proposal of activities. While the treasurer with the chairman will make a budget plan.

3.3 Provisional Bill (Bonsem)

In Fig 4 the following is a display of provisional bill submissions on the website of Adminsitration Bureau of Student Affairs and Alumni now [2]. The committee need to input the login username, password, mobile phone number, organization, activity name, activity date, total bill, detail of the bill. The activity name inputted manually by the committee and not integrated with the activity master data.

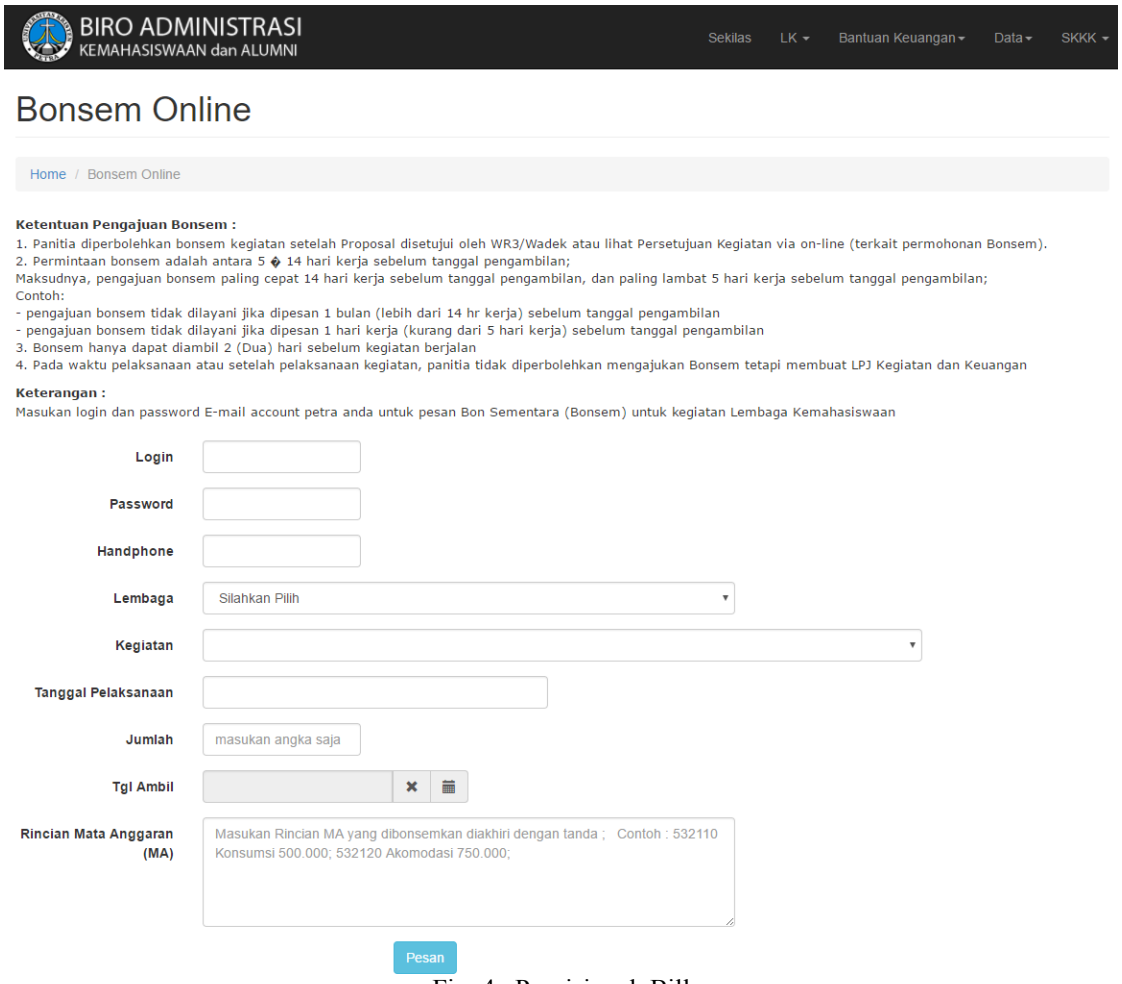

Fig 4. Provisional Bill

3.3. Context Diagram

Design stage begins with the design of the entire system using Data Flow Diagrams (DFD) that describes the process of the system. Context diagram design can be seen in Fig 5.
Based on Fig 5, it can be seen that the external parties of the system are:

• Student and Alumni Administration Bureau, as external entities in Petra Christian University who hold master data.
• Vice Dean and Vice Rector 3, as external entities that receive activity information and provide access to revised proposal and activity budget plan.
• Committee, as an external entity providing proposal data, budget plan, activity and financial accountability report, provisional bill.
• Student Affairs Institution, as an external entity providing activity data and receiving proposal information, budget plan, activity and financial accountability report, provisional bill.

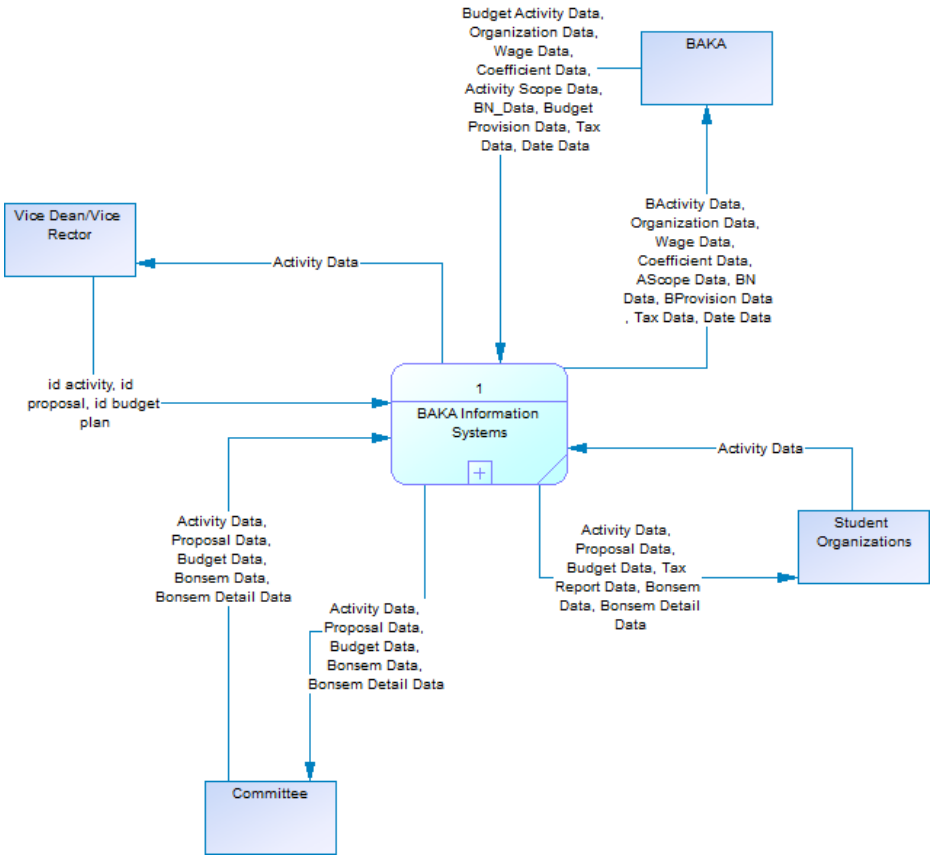

Fig 5. Context Diagram

3.4. App Designs

In this section will be explained the design of the application display which consists of the view of the login page, the layout of the master view, layout display of each feature on the application.

3.4.1. Application Primary View

The main view of the application consists of four parts, namely header, menu, content, and footer. The header contains a user role and a logout button (marked with the number 1 in Fig 6). The menu contains a list of modules contained within the application (marked with number 2 in Fig 6). Content is the location to display the view file (marked with number 3 in Fig 6). The footer is the bottom of the layout containing only the copyright application (marked with the number 4 in Fig 6). The main view design can be seen in Fig 6.

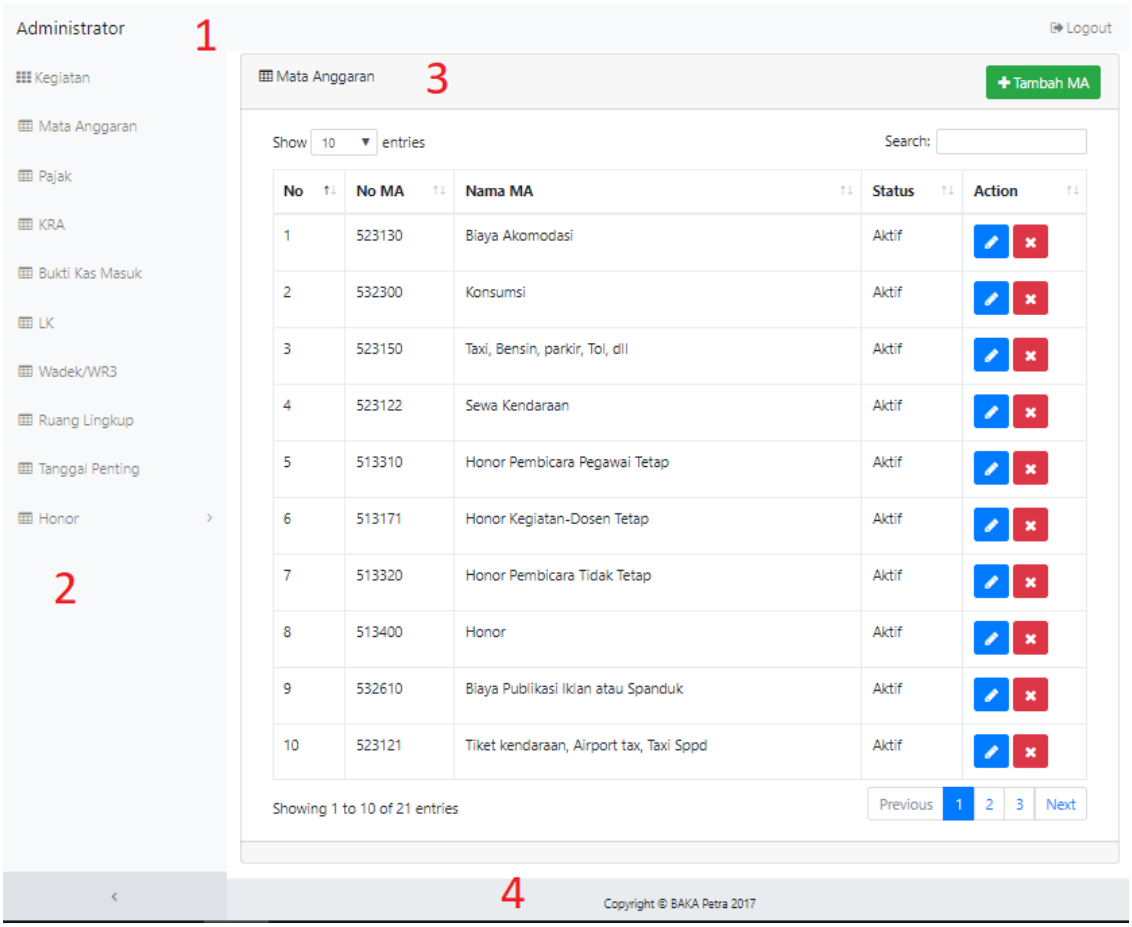

Fig 6. App Main View

3.4.2. Activity Details Page

Activity Details page is a list of icons of activities that can be filled. The green color indicates that the data is already filled and cannot be changed again. While the red icon to indicate that the data has not been filled. The design of the Activity Details page view can be seen in Fig 7.

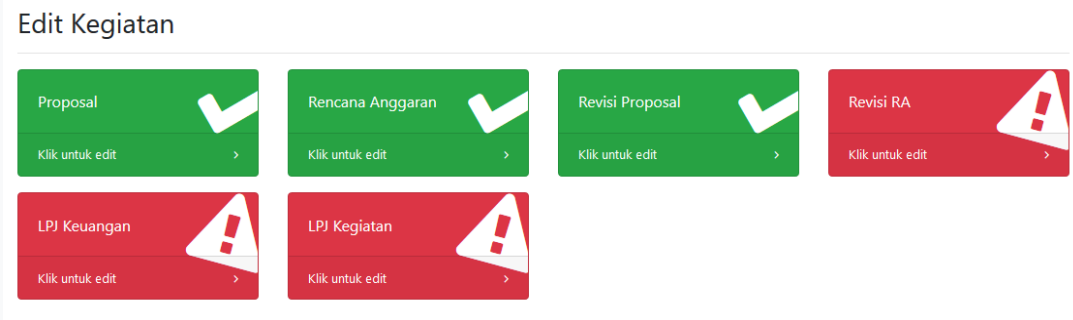

Fig 7. Activity Detail Page

Edit Kegiatan = Edit Activity; Rencana Anggaran = Budget Plan; Revisi = Revision; RA (Rencana Anggaran) = Budget Plan; LPJ Keuangan = Budget Report; LPJ Kegiatan = Activity Report

3.4.3. Budget Input Display Plan

The proposal input page contains two parts: income and expenditure. In the income section there are inputs of plafond and other sources. The add source button serves to add the import details. Then on the

expenditure section there is budget input, tax, description, price, quantity, total, total pay, ceiling allocation, other allocation, along with a table containing the details of the budget that has been included. Also available are two buttons namely the save button and the validation button. Page Design Input Proposal can be seen in Fig 8.

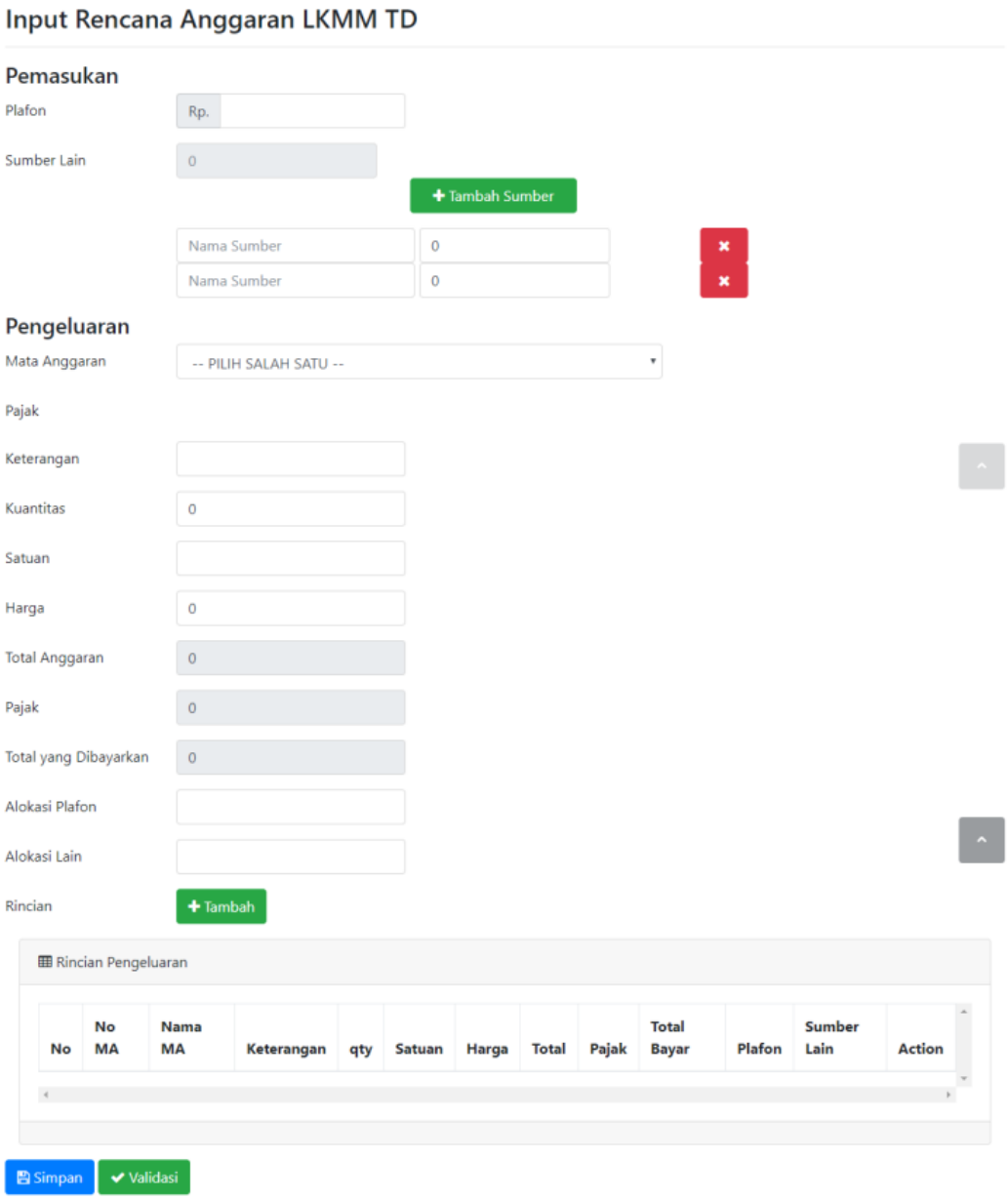

Fig 8. Display Proposal Input

Pemasukan = Income; Plafon = Plafond; Sumber Lain = Other Sources; Pengeluaran = Expense; Mata Anggaran = Budget Number; Pajak = Tax; Keterangan = Notes; Kuantitas = Quantity; Satu an = Unit; Harga = Price; Total Anggaran = Total Budget; Total yang Dibayarkan = Total Paid; Alokasi Plafon = Plafond allocation; Alokasi Lain = Other Allocation; Rincian = Detail

4. Result

This application has to be tested to find out the end result and its ability to respond to the existing needs. This test consists of two parts, namely the test section based on a case study and questionnaire to

several parties involved in the process of submitting the document of this activity.

4.1. System Testing Input Budget Plan

An example of a case study of student organizations HIMANIFRA wishes to conduct a work meeting activity with budget as follows:

- Budget Currency: Accommodation
- Description: Lodging
- Price: Rp. 2,000,000, - / night
- Duration of use: 1 night
- Type of accommodation: Villa, villa owners do not have NPWP

For villa including type of accommodation not hotel. Therefore this budget is taxed at 10%. So the tax to be paid is Rp. 200.000, - and the budget paid to the villa at the initial price minus the tax. In this case means the villa will receive the money of Rp. 1.800.000, -. In addition the budget of the accommodation has a provision should only take the budget ceiling as much as 75% of the total price. This calculation is done precisely on the system and there is also information that can be seen in Fig 9.

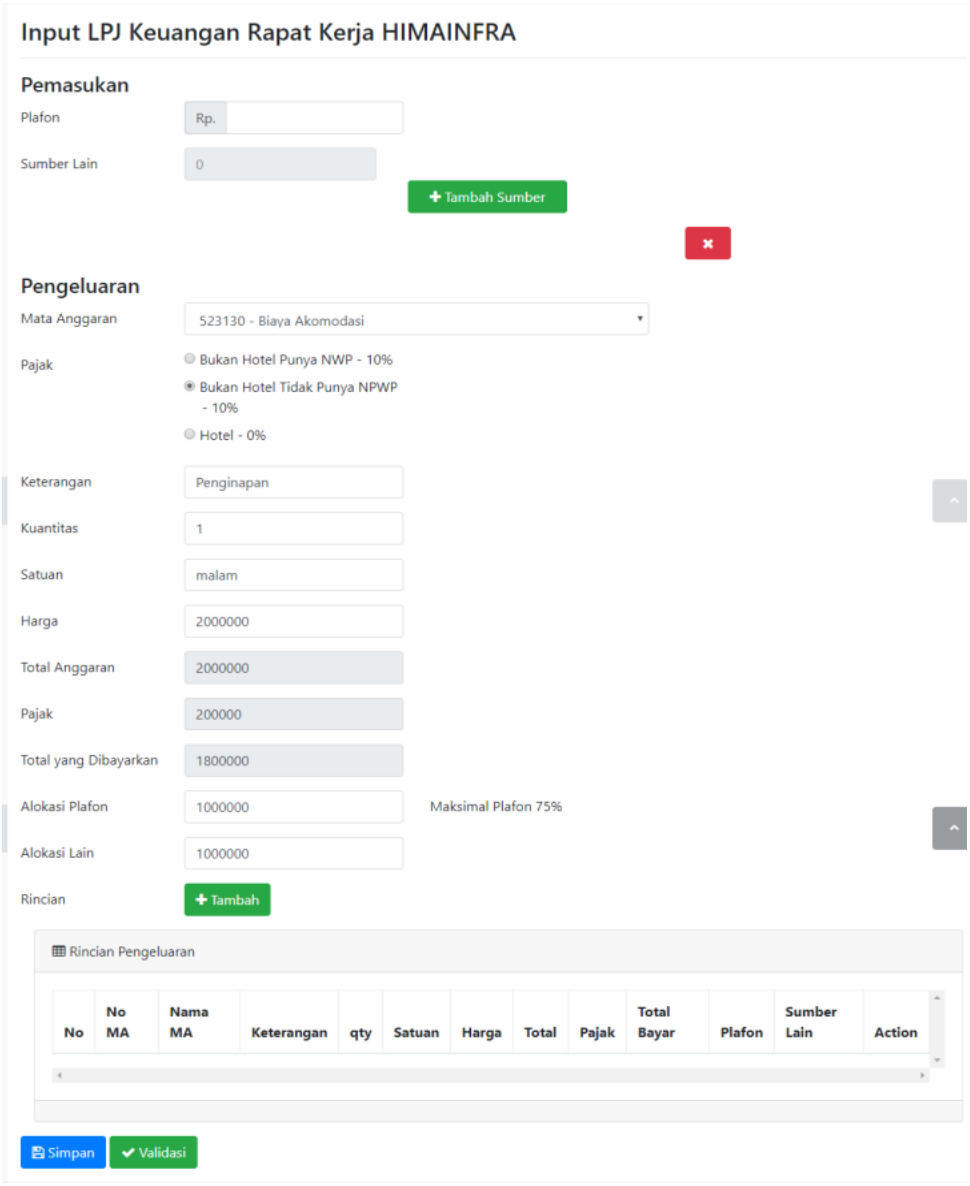

Fig 9. Input Testing Budget Plan

Pemasukan = Income; Plafon = Plafond; Sumber Lain = Other Sources; Pengeluaran = Expense; Mata Anggaran = Budget Number; Pajak = Tax; Keterangan = Notes; Kuantitas = Quantity; Satu an = Unit; Harga = Price; Total Anggaran = Total Budget; Total yang Dibayarkan = Total Paid; Alokasi Plafon = Plafond allocation; Alokasi Lain = Other Allocation; Rincian = Detail

4.2. Questionnaire Results

To know the user's assessment of this application, conducted research on the use of this application. Samples of this assessment are the parties involved in the process of submitting activities, among others:

1. Raymond Arif, S.Kom. as Programmer Staff of the Student and Alumni Administration Bureau
2. Tanti Octavia, S.T., M.Eng. as Vice Dean of Industrial Technology Faculty
3. Amanda Tanari as Treasurer of Informatics Engineering Student Association 2017/2018.

To collect data, distributed questionnaires containing assessment indicators of completeness of the menu, application interface design, ease of use of the application, ability to address user needs, and overall application. From the results of questionnaires that have been collected, the calculation of the percentage of user satisfaction in using this application can be seen in Table 2.

Table 2. Appraisal Table on Application Usage

Indicator	1	2	3	4	5
Completeness of the menu available			1		2
Application interface design				2	1
Ease of Use				1	2
Answering applications needs			1		2
Entire application				2	1

Description of rating scale:
• Value 1: Very bad
• Value 2: Bad
• Value 3: Fair
• Value 4: Good
• Value 5: Very good

The percentage of user ratings for completeness of the menu available is as follows:
• Value 3 = (1/3) * 100% = 33.33%
• Value 5 = (2/3) * 100% = 66.67%
The percentage of user ratings for the application interface design is as follows:
• Value 4 = (1/3) * 100% = 66.67%
• Value 5 = (2/3) * 100% = 33.33%
The percentage of user ratings for ease of use is as follows:
• Value 4 = (1/3) * 100% = 33.33%
• Value 5 = (2/3) * 100% = 66.67%
The percentage of user ratings of the ability to answer answering applications is as follows:
• Value 3 = (1/3) * 100% = 33.33%
• Value 5 = (2/3) * 100% = 66.67%
The percentage of user ratings for the entire app is as follows:
• Value 4 = (2/3) * 100% = 66.67%
• Value 5 = (1/3) * 100% = 33.33%

5. Conclusion

• The developed application provides the main features of proposal input, budget plan, activity and financial accountability report and its revision.
• Applications that have been made are in accordance with the budget and tax provisions applicable to the Student Affairs Administration Bureau and Alumni Petra Christian University
• The features provided by the application are useful for the activity committee and student organization

because this application provides a forum for the activity committee to input the proposal and budget plan as well as the provision of applicable information.

• Application users judge 100% good app display, 100% good ease of use, 66.67% good and 33.33% completeness of the menu is fair, application ability answer 66.67% good and 33.33% fair, and the entire application is 100% good. This shows that the developed application has benefits for BAKA officers, vice deans and vice rector 3, and the activity committee.

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Indoor evacuating guidance system based on direction matrix in case of emergency situation

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Abstract

Something dangerous that happens suddenly is called emergency. It requires immediate action as for example earthquake. In such a case routing method for guiding and protection is the most. So we proposed indoor evacuating guidance system based on direction matrix to escape out from the building. For this showing arrows from smart phone and giving information can play important role. It can send message and navigate from the fixed current positions. Our main focus is to save life of people in short time. Main purpose of this paper is to find out the shortest path up to nearest exits in the time of emergencies and rescue them. In addition it can also be same in case of fire out, gas explosion and other emergencies mainly inside the building. It can also be the future research topic for the huge and tall buildings to reach up to the nearest door or exits.

Keywords: Direction matrix, Guiding system, Escape out, Smartphone. Shortest Path

1. Introduction

Recently disaster occurred many part of the world. We are at the risk from unpredictable emergencies such as earthquake, fire, typhoons, heavy snowfall and so on. It is our social issue and big concern. Now question is here, how to be safe? Because it can occur in a sudden manner, damage the property and create social problems. So we must stay careful earlier. To be careful in this complex data-driven society. We found the solution through routing from smart phone. It can guide and let them know the shortest path. For this direction matrix and dijkstra algorithm considered the most effective method to evacuate route. Therefore we apply dijkstra algorithm for shortest path. Direction matrix and app inventor application applying from smart phone to find the exits. However in such a emergency cases sometime above mention methods may not work, even though we try to find fast escape out ideas using arrow guidance. We focus Indoor Positioning System (IPS) from the building through various ways like broadcasting, calling 119 and other efficient ways to be secure. Finally we also suggest them to use windows, ladder or jump carefully if nothing works at all. This paper purposes evacuating guidance system in indoor building structure[1]. We apply direction matrix, arrow guidance, dijkstra algorithm and various other ways like door-to-door path finding approach for emergency response and research technologies like Radio Frequency Identification (RFID), IEEE 802.12 (Bluetooth) for indoor environment too [2]. Moreover we analyze various types of disaster monitoring systems like, Ultra Wideband (UWB), beacons, robot navigation etc. Among them we purposed evacuating guidance system based on direction matrix in case of emergencies response.

2. Evacuation model

Evacuation model and indoor navigation influence has been rapidly increasing in this data centric society. We found huge and tallest buildings need guidelines information up to the exits. There are many more ideas from multiple resources like Wi-Fi, RFID, Wireless Local Area Network (LAN) for the location identification. All this can be possible using smart phone because we can collect large volume of data using it to find out other computer technologies especially for indoor location using building modeling [3]. Data

analysis using smart phone also can provide solution for the emergency problems like disaster even though they are big and messy. This massy amount of data can search from smart phone with in short time and find out house model and structure [4]. In addition from social media, Social Network Sites (SNS), google and other ways we can inform them to stay safe by informing and broadcasting. As a result of which it is easy to reduce injuries in the time of emergencies in case of IPS [5].

2.1. Indoor navigation strategy

Table 1. Hoseo University engineering building II

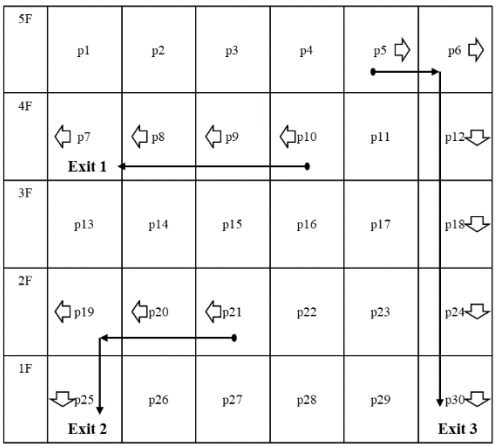

Table 1. is a 5 floor building with 30 plots and 3 exits made of 5x6 matrix in array base. Out of 3 exits, two of them are in 1st floor and 1 is in 4th floor. We choose three starting position considering current position p5, p10 and p21 for the shortest path up to the exit1, exit2 and exit3 respectively. And assume Hoseo University engineering building II for our research. Here F: floor, p: plot. From 5th floor to→↓4th floor, one exit out and 1st floor ←two exit→ out having 30 nodes and fixed values 0, -1, 30, 35, 50, for each distance p1 to other p2, p3, p4, p5, p6, (p7), p8, p9, p10, p11, p12, p13, p14, p15, p16, p17, p18, p19, p20, p21, p22, p23, p24, (p25), p26, p27, p28, p29 and (p30). This 30 are nodes for path finding route according to the data analysis. We choose three points for the experiment. They are 10, 21 and 5.

p10→p9→p8→p7→(Exit1)→4F. Shortest path

p21→ p20→ p19→ p25→(Exit2)→1F. Shortest path

P5→P6→P12→P18→P24→P30→(Exit3)→1F. Shortest path

This three route are the evacuating and guidance path using direction matrix up to the exit1, exit2 and exit 3. Because rapidly developing areas became wide in scale in the globe. So our idea in the time of emergency using shortest path from source to destination can became essential for the indoor navigation in modern super high and large buildings too. According to our research smart phone play a great role to choose the location for nearest exits. This is how using navigation from Access Point(AP) people can use mobile and search the exit from their position and go to the exit quickly by the help of arrows for their safety. We made escape out scenario for emergency situation in the flow diagram as Location Based Service(LBS) for mobile devices which help to find out accurate place using beacon, Wi-Fi, Bluetooth and other technologies. Similarly from smartphone, IPS, google map, location can also be search for direction path along the route and try to predict emergency situations using advanced IoT devices [6]. Below is the scape out scenario for emergency situation steps by steps:

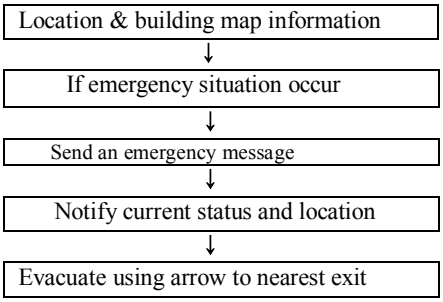

Fig. 1 Escape out scenario

2.2. Pathfinding algorithm

Pathfinding algorithm is the shortest route between source and destination of two points. In our research we made direction matrix array in the form as in the Fig. 2. We use Microsoft Visual Studio 2017 and make a program on it. We write code dynamically for the shortest path1, path2 and path 3 according to direction matrix and array base as like below in Fig. 2.

```
#define MATRIX_SIZE30
int path1[4] = { 10, 9, 8, 7 };
int path2[4] = { 21, 20, 19, 25 };
int path3[6] = { 5, 6, 12, 18, 24, 30 };
```

Fig. 2 Direction matrix in array form

After coding we found pathfinding way starting at one vertex and exploring adjacent nodes until the destination nodes is reached up to the exits. This is for the shortest path between two points. So in this paper we use simple way to go through function reducing the distance between two points as their source and destination for the shortest path. Moreover we apply euclidean metric between two points p and q which is given below.

$$d(p,q) = d(q,p) = \sqrt{(q_1 - p_1)^2 + (q_2 - p_2)^2 + \cdots + (q_n - p_n)^2}$$
$$= \sqrt{\sum_{i=1}^{n}(q_i - p_i)^2} \quad \ldots\ldots(1)$$

Given set of point p=(p_1, p_2,....p_n) and q=(q_1, q_2,.....q_n) are two points. Distance (d) from point

q - p = (q_1 - p_1, q_2 - p_2, ….., q_n - p_n)……(2)

For the two dimensions if p = (p_1, p_2) and q=(q_1, q_2) where distance is given by

$$d(p,q) = \sqrt{(q_1 - p_1)^2 + (q_2 - p_2)^2} \quad \ldots\ldots (3)$$

We use this for dynamic purpose according to dijkstra algorithm, #define MATRIX_SIZE 1O. Writing code as int matrixBase [MATRIX_SIZE]= {{0, 30}} between two points where (p, q) are two p=start point(source), q=exit point(destination) focusing direction arrow and path movement in the grid system within the floor in short time for tall buildings [7]. Moreover we are researching utilization and collecting of big data efficient path finding advanced algorithms for the emergency in the days to come [8]. We came to know how importance is the evacuation guidance in case of emergency for quick response in the time of emergencies to minimize the risk for the super high-rise buildings [9]. Therefore finding position identification through online, mobile robot and other ideas like boundry tracing, we also can guide them in the time of emergency evacuation zone [10].

3. Design and Implementation

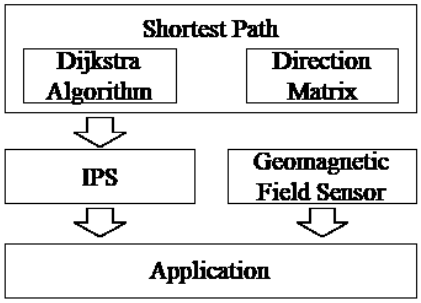

Fig. 3 Application design

Fig.3 is the application design specially for evacuating guidance system based on direction matrix in case of emergency situations. From this Fig. 3 it is clear that for the shortest path we apply dijkstra algorithm and direction matrix for IPS environment. Therefore to complete this application we implement geomagnetic field arrow through smart phone using App Inventor software showing them exit1 starting from 10→9→8→7→exit1 (4F)

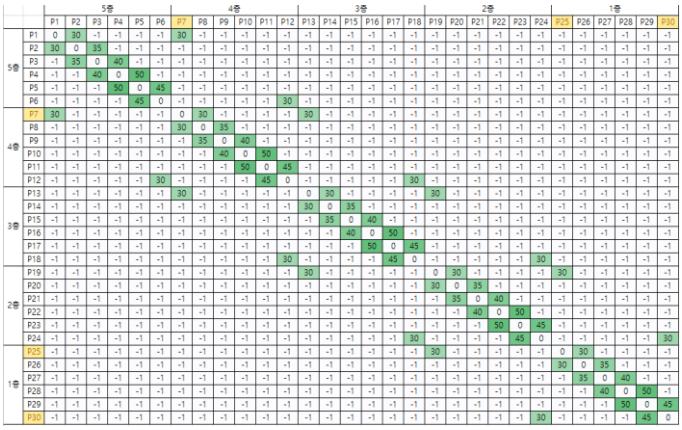

Fig. 4 Map data of engineering building II structure

Fig.4. is the map data of 5th floor building having MATRIX_SIZE 30 in total. We can see 30 plots in both horizontal and vertical. They are nodes from p1 to p30 in both sides with specific values like 0, -1, 30, 35, 50. Here -1 indicate cannot move, p7, p25 and p30 are exit1, exit2 and exit3 respectively. Exit 1 is in 4th floor, exit 2 and exit 3 are in 1st floor. In addition left side vertical floor is source, start point where we can see 1st floor to 5th floor. It has p1, p2, p3, p4, p5, p6 at the 5th floor, (p7) exit1, p8, p9, p10, p11, p12 are in 4th floor, p13, p14, p15, p16, p17, p18 are in 3rd floor, p19, p20, p21, p22, p23 and p24 are in 4th floor and (p25) exit 2, p26, p27, p28, p29 and (p30) exit 3 are in 1st floor[11]. Similarly horizontal line of the main top plane having floor indication is the destination for the exits. We collect building information data starting from 5th floor p1 which is 0. If we follow from this point then we can reach to destination as exit1 fast and easily and the step by step to exit2 and exit3.

3.1. Starting position 10 for exit1

```
start position = 10
10->9->8->7->escape (105)
10->11->12->6->5->4->3->2->1->7->escape (355)
10->11->12->18->17->16->15->14->13->7->escape (355)
10->11->12->18->17->16->15->14->13->19->20->21->22->23->24->30->escape (585)
10->11->12->18->17->16->15->14->13->19->25->escape (385)
10->11->12->18->24->23->22->21->20->19->13->7->escape (415)
10->11->12->18->24->23->22->21->20->19->25->escape (385)
10->11->12->18->24->30->escape (185)
10->9->8->7->exit1
Result of Dijkstra Shortest path algorithm is: 10->9->8->7 exit1. Which Time
cost is 105. Which is the best shortest path from the starting position 10.
```

Fig. 5 Implementation result for exit 1

Fig. 5 is the escape out direction matrix arrows according to Table 1. We can see many directions for the exits here. Among many direction we choose shortest path as•10→ 9→ 8→ 7→ escape out for exit1. Its time cost is 105. As seen in the 2nd line in the above Fig. 5. It will take less time which is the shortest path among all and best way to escape out using exit1 in case of emergency.

3.2. Starting position 21 for exit2

```
start position = 21
21->20->19->13->7->escape (125)
21->20->19->13->14->15->16->17->18->12->6->5->4->3->2->1->7->escape (585)
21->20->19->13->14->15->16->17->18->12->11->10->9->8->7->escape (525)
21->20->19->13->14->15->16->17->18->24->30->escape (355)
21->20->19->25->escape (95)
21->22->23->24->18->12->6->5->4->3->2->1->7->escape (455)
21->22->23->24->18->12->11->10->9->8->7->escape (395)
21->22->23->24->18->17->16->15->14->13->7->escape (395)
21->22->23->24->18->17->16->15->14->13->19->25->escape (425)
21->22->23->24->30->escape (165)
10->9->8->7->exit1
Result of Dijkstra Shortest path algorithm is: 21->20->19->25 exit2. Which
Time cost is 95.Which is the best shortest path from the starting position
21.
```

Fig. 6 Implementation result for exit2

This Fig.6 is another escape out direction matrix arrows according to Table 1. We can see many directions for the exits above. Among many direction we choose shortest path as •21→20-→19→25→ escape out using exit2. It's time cost is 95 as seen in the 6th line in the above Fig. 6. This will take less time which is the shortest path among all and best way to escape out using exit2 in case of emergency.

3.3. Starting position 5 for exit3

```
start position = 5
5->4->3->2->1->7->escape (185)
5->6->12->11->10->9->8->7->escape (275)
5->6->12->18->17->16->15->14->13->7->escape (335)
5->6->12->18->17->16->15->14->13->19->20->21->22->23->24->30->escape (565)
5->6->12->18->17->16->15->14->13->19->25->escape (365)
5->6->12->18->24->23->22->21->20->19->13->7->escape (395)
5->6->12->18->24->23->22->21->20->19->25->escape (365)
5->6->12->18->24->30->escape (165)
10->9->8->7->exit1
Result of Dijkstra Shortest path algorithm is: 5->6->12->18->24->30 exit3.Which
Time cost is 165. Which is the best shortest path from the starting position 5.
```

Fig. 7 Implementation result for exit3

Similarly another escape out direction matrix according to Table1. is •5→6→12→18→24→30 to escape out using exit 3. It's time cost is 165 as seen in the 9th line in the above Fig.7. This will also take less time which is the shortest path among all and best way to escape out using exit3 in case of emergency

3.4 Direction matrix

Direction matrix plays an important role in order to implement arrow guidance system proposed in this paper. For this four kind of data are required they are 1. Current location of the user 2. Target location that needs to be moved 3. Current direction of the user looking towards 4. Direction that the user should look at. In general navigation system, first and second cases can be obtained by using the shortest path algorithm, but the third and fourth are not used. However, in case of an arrow guiding system, data is used because user must be able to see only the arrow. Since the data that the user is looking at should be updated in real time, but the system cannot be built in. Therefore it is necessary to prepare in advance for the direction in which user should look, the target direction before the system operates this is called direction matrix. It is also a bi-directional graph like the distance matrix. And other two up down are stairs which are not showing in the smartphone below as in Fig.9. As a result of which people can escape out from the exits in case of emergency using this direction and stairs from both the sides. Originally it has input six data in total they are East(E), West(W), North(N), South(S) Up(U) stairs and Down(D) stairs, current position alphabet Oh (o), cannot go 'X', stairs in both side. But East and West are not showing in lookup table in the Fig.8. So we made geometric arrows and evacuation route using App Inventor as like in Fig 9. Specifically left side stairs connected with p1, p7, p13, p19 and p25 and right side stairs is connected with p6, p12, p18, p24 and p30. Data is character type, in addition data in the direction matrix is used to show the arrow to the user on the system, which uses a random access method to access common data therefore we use user's (current) direction and the target(destination) direction in our proposed direction matrix. This is the important proposed method for the evacuating system in emergency situations. This is how we made this direction matrix using char arraydirij [30][30] = { in our source code for geometric arrow and evacuation route for the exits .

```
char arraydirij[30][30] = {
{ O, S, S, S, S, D, X, X,  X, X,
,{ N, O, S, S, S, S, X, X, X, X,
,{ N, N, O, S, S, S, X, X, X, X,
,{ N, N, N, O, S, S, X, X, X, X,
,{ N, N, N, N, O, S, X, X, X, X,
,{ N, N, N, N, N, O, X, X, X, X,
,{ U, X, X, X, X, X, O, X, X, X,
,{ X, U, X, X, X, X, N, O, S, S,
,{ X, X, U, X, X, X, N, N, O, S,
,{ X, X, X, U, X, X, N, N, N, O,
```

Fig. 8 10x10 direction matrix

Table 2. Experiment result of direction matrix

10→9→8→7 Exit1. N→N→N→ distance = 105m 21→20→19→25 Exit2. N→N→D→ distance = 95m 5→6→12→18→24→30 Exit3. S→D→D→D→D→ distance = 165m

Table 2. is the experiment result of direction matrix. We use direction as North(N), South(S), Up(U), Down(D), cannot go(X) and current position(o) which can be seen in the Fig.7. Among 30 we just use 10x10using lookup table for direction matrix up to the exit1, exit2 and exit3. So for the result 10→9→8→7 it is denoted as N→N→N from the starting position 10 to destination exit1 because from the Table 1. It is clear 3 times west sides. It takes 105m in distance for evacuation. In the same way for the exit2 person can go using 21→20→19→25 it can be N→N→D which take 95m for evacuation as starting position 21 to destination exit2. Finally for the exit3 person can go 5→6→12→18→24→30 it is denoted as S→D→D→D→D taking 165m for exit3 starting position 5 to destination exit3.

4. Geometric arrow and evacuating route for the exits

We apply direction matrix using geometric arrow from App Inventor. This arrows can guide people using mobile after installing app taking QR (Quick Response) code and download from the mobile. All the sources are in the PC computer. From which we can search the direction looking the arrows as there east west, north and south. It gives guidance system sequentially based on direction matrix. We apply App Inventor application using smartphone as a receiver and PC as a server, in which every code are saved[12]. So we use our mobile and download, signal can transmitted from the access point for the routing purpose up to the exit.

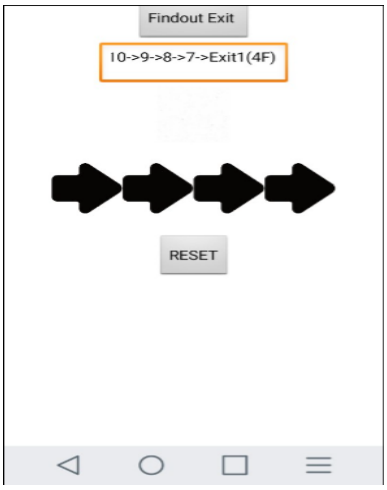

Fig. 9 Direction arrow from smartphone

This is the direction matrix result using arrow from our experiment. From this arrow guidelines people can go exit 1 using 10→9→8→7 exit1 (4F) as arrow like in Fig.9 after taking QR code from their mobile, which can help them to escape out in emergency situations and guide them using direction matrix. Among various evacuating method for the 5 floor building we take one best example of 4^{th} floor as above Fig. 9. This is the best shortest path using arrows for exit1 in 4^{th} floor for evacuating guidance system based on directional matrix in emergency situation.

5. Conclusion and future plan

Every year, disasters affects many things and damage billions of properties. Not only that it also destroy environment globally. Looking for ways to mitigate these losses, researchers are investigating different methods, including GPS, electromagnetic, big data, wide application ranging from situation awareness, decision-making to the area for the future with man-made and other research analysis about data. Finally

From this paper we proposed evacuating guidance system based on direction matrix to solve the problem in case of emergency. So we made routing navigation using building structure showing arrow from the smartphone up to the exits. Our main goal is to help people from smart phone by navigating from unpredictable disaster specially during the dangerous situations. In conclusion it can proof that evacuating navigation from smart phone can be possible in case of emergency situations. For the future we are focusing to handle for the tallest and large building more dynamically applying navigation method automatically in real time online base as like compass direction, road network and magnetic positioning. Like navigation style which we are using this days in the vehicle for road and transportation. In addition our research will be continue for the evacuating guidance using locator sensor and other new ideas applying mobile devices for Indoor atlas, magnetic sensor, IoT devices from smartphone. Not only in one and particular building but also for the tallest and huge building to rescue people in the emergency and finally give evacuating guidance for the future in the society using computer technique. Therefore Indoor evacuating guidance system become significant issue for the increasing number of buildings. That need to be research and prepared using advanced technique for monitoring in the further century in all over the world.

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Smart Grid Big Data Processing and Analysis: A Novel Framework

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Abstract

The rapid increasing demanding of electrical energy in our society is leading to the imbalance between supply and demand, the difficulty of power supply, as well as the huge volume of grid data. Meanwhile, the smart grid is becoming a research trend since smart grid can efficiently improve the reliability and reduce the fault ratio. However, the traditional communication infrastructure and data transmission technologies cannot satisfy the requirements of communication, and big data technology is integrating with it in order to improve the communication quality, and provide the strong technical support for the construction of smart grid. To this end, this paper mainly elaborated the development and analysis for big data processing and analysis in smart grid. Technically, this paper proposed a novel framework for s mart grid data processing and analysis. The main idea of this framework is firstly to tensorize th e various types of smart grid big data collected from the grid. Then, these tensorized data will b e factorized viaMap-Reduce computational paradigm. Next, the refined tensorized data will be ana lyzed by using the existing machine learning and AI algorithms, the hidden valued are extracted for providing more intelligence for various real-world applications.

Keywords*- *Big data; Smart grid; Electrical engineering

1. Introduction

In recent years, the increase of population and electricity consumption enables the changes of power supply environment, increase of power load. That is to say, the infrastructure of conventional grid is facing many challenges. Fortunately, the advancement of pervasive computing, mobile internet technologies spawned a novel power supply paradigm, called smart grid. Smart grid can efficiently improve the stability of electricity supply and further address the existing issues caused by traditional grid. In addition, smart grid also can provide the excellent services, and allow the various forms of electricity generation access. Therefore, smart grid owns the self-healing ability, can resist the attack, is of great significance to promote smart grid. Smart grid is based on integrated two-way or multiple communication network, and carries out power data transmission, which has certain requirements for communication network. But, the traditional communication effect is poor with much possible fault, big data technology can greatly improve the communication efficiency and accuracy, should actively integrate into the big data technology of smart grid construction, the construction of new dynamic power communication network, so as to solve the problem of communication in smart grid.

This paper aims to propose a novel framework for smart grid big data. Firstly, this paper makes the detailed analysis on smart grid and big data (as shown in Section II). Then, the recent related works on smart grid big data technologies are overviewed (as shown in Section III). Based on the existing work, we present a novel framework for big data processing and analysis in smart grid (as shown in Section IV). Section V illustrates a case study on user's electricity load prediction. Finally, Section VI concludes this paper.

2. The Features of Smart Grid and Big Data Technology

Smart grid and big data are emerging technologies in recent years. With the development of computer technology, communication technology, network technology, digital technology and the development of high technology, Smart grid and big data technology has brought new opportunities for the economic development and social progress. This section will analyze the features of smart grid technology and big data technology.

2.1. Smart Grid Technology

Smart grid as the intelligence of electricity network, refers to the use of a large number of intelligent devices to access the power system for achieving intelligent, automatic power grid operation. In smart grid, sensor technology, decision support system technology, intelligent automation control technology and measurement technology are fully integrated into many smart communication networks. Its core system is composed of intelligent substation, intelligent distribution network, intelligent dispatching system, intelligent power meter, etc.. The smart grid can reduce the operation cost of power grid, improve the power grid rigidity, reduce the loss of power grid, and realize the economic, safe and reliable operation of the power grid. The smart grid allows multiple power generation access, which provides convenience for the use of new energy, and has a certain self-healing function and attack resistance ability, effectively reducing the power grid failure rate. Smart grid first appeared in 2005, and now the smart grid has become the mainstream direction of modern power grid construction, many countries all over the world have invested a lot for smart grid construction.

2.2. Big Data Technology

In twenty-first Century, human society has entered the information age, information technology has been integrated into various fields, and the amount of data generated in social activities is growing. Big data was firstly proposed by McKinsey, he thinks the industrial economy in the information society is gradually transformed into knowledge economy. In this background, who can have the information resources, the market, and the advantage of big data era has come, economic activities, business activities and other fields of all social activities cannot do without data.

IBM defined a concept for big data, which is commonly accepted by many researchers and industrial fields. Generally, Big data has 5V features.

Volume: The main characteristic that makes data “big” is the sheer volume. It makes no sense to focus on minimum storage units because the total amount of information is growing exponentially every year.

Variety: Big data is composed of various types of data:

Structured data like information tables, Twitter feeds, audio files, MRI images, web pages, web logs can be easily stored in the computers. But, unstructured data is a fundamental concept in big data. Differs from the structured data, the unstructured data have no rules, and cannot be stored with a structured table. For example, a picture, a voice recording, and a tweet-they all can be different but express ideas and thoughts based on human understanding. Importantly, one of the goals of big data is to use technology to take this unstructured data and make sense of it.

Veracity refers to the trustworthiness of the data.

Velocity is the frequency of incoming data that needs to be processed. In another word, the big data should be quickly response the users’ request.

Value as a last and most important feature, it mainly emphasizes the importance and potential value hidden behind of the big data.

With the above features on smart grid and big data, smart grid is bringing the new requirements for data transmission and communications. Obviously, the smart grid is different from the traditional working mode of power grid, and it requires advanced data communication technology. If the communication quality cannot be guaranteed, it will inevitably have a negative impact on the power grid system. Safe and efficient operation of the smart grid cannot do without the support of network communication. During the operation of the power grid, we need to handle the power production, transmission, scheduling, consumption and other related information technology efficient and timely processing, control, transmission. Therefore, the requirements of communication network has to meet the stability, high efficiency, real-time, two-way data

services and business, involving graphics and special operations three categories. Smart grid has a high requirement on the quality of communication, communication encoding error, may cause the system malfunction and wrong operation problems caused by network fluctuation, and even lead to unplanned outage, affecting the stability and reliability of power supply. The large power communication data traffic, the dynamical flow direction, and the complex communication nodes, are very suitable for the application of big data technology. Hence, by incorporating the big data technology into smart grid, the difficulty of control system can be reduced and the system stability and data transmission rate are improved.

3. Related Work on Smart Grid Big Data Technology

This section overviews the related work on big data technology in smart grid. Particularly, we will survey the state-of-art from (1) the smart grid big data transmission and storage; (2) smart grid big data processing technologies; (3) smart grid visualization technologies.

3.1 Data transmission and storage

Data compressing technology is attracting much attention in big data. Yan et.al [1] explored the real-time data compression and reconstruction algorithm based on the improved fault process signal. They adopted the linear integer transmission for implementing the data compression and decompression in power system. Ref. [2] studied periodic 2-D lifting wavelet compression algorithm for smart grid data. Based on these work, Zhang et.al [3] investigated the steady state parameters of power system data compression algorithm. And this algorithm can efficiently improve the quality of wireless communication, network bandwidth for finding out the insulation sub discharge, leakage current, high sampling frequency and large amount of data.

Regarding to the big data storage, most data generated from smart grid are usually stored with Hadoop HDFS system. As we all known, although HDFS can store a huge volume of data, it cannot satisfy the real-time requirements in power systems. Hence, it is necessary to devise an efficient framework for storing these smart grid big data in order to achieve the real-time processing and updating.

3.2 Heterogeneous Data processing

Heterogeneous data processing is mainly composed of dimensionality reduction and optimized computation of those big data.

Previous studies for data dimensionality reduction have not taken into account the size and dynamics of big data and no systematic research has been dedicated to the computing paradigm which can support for incremental distributed processing. Previous approaches include Principal Component Analysis (PCA) [4], Incremental Singular Value Decomposition (SVD) [5], and Dynamic Tensor Analysis (DTA) [6]. These methods are available for low dimension reduction but suffer from some limitations because they are time consuming when being performed on high-dimension data and fail to extract the core data sets from streaming big data. As for the aspect of computation reduction, the incrementally arriving data can be linearly represented and are inessential for recalculating the principal dimension space. Second, these approaches only consider distributed computing from the server-driven point of view, in which the heterogeneous client equipment are unable to participate in the big data processing, even they are idle. Third, quantitative methods for optimal scheduling for computing resources and steaming data are rare.

3.3 Data Visualization

For the massive smart grid data generated from power systems, how to organize and display it to users in a friendly way is a very challenging issue [7]. Visualization method has been proved to be an effective method to solve large-scale data analysis, and has been widely used in practice. Large-scale data generated by various applications of smart grid, including high-precision, high-resolution data, time-varying data and multivariate data, etc. How to extract useful information quickly and effectively from these huge and complex data has become a key technical problem in the application of smart grid.

4. The Framework on Big Data Processing and Analysis in Smart Grid

Motivated by the above features and challenges of smart grid and big data technologies. This section is devoted to presenting a novel framework on big data processing and analysis in smart grid environment.

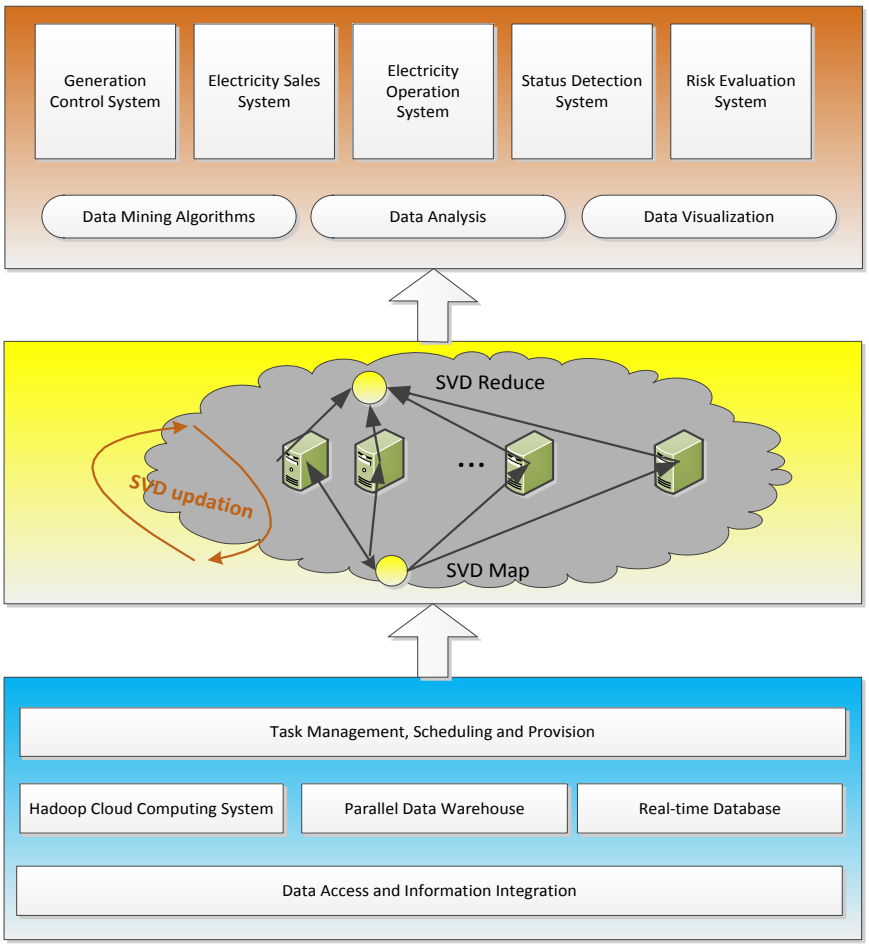

Fig. 1 The Framework of Big Data Processing and Analysis in Smart Grid

Figure 1 shows our proposed framework of big data processing and analysis in smart grid. Clearly, it is composed of three modules: (1) Data collection and storage; (2) Data dimensionality reduction and processing; (3) Application services. We will elaborate this frame with the bottom-top approach.

Considering the shortcoming of the smart grid data cannot be processed in real-time over the cloud platform, we devise the data collection and storage module. Specifically, many front-end computers are deployed in the front of data access and information integration. And, these front-end computers are in charge of receiving the alarming signals or detected data. After that, the collected smart grid big data will be processed. This processing work contains dimensionality reduction and computation over the cloud. The basic idea here is working like: the SVD operations are deployed on the cloud. By virtue the powerful computational ability of the cloud, the coarse smart grid big data will be efficiently reduced and handled. The top layer is in charge of analyzing and mining useful knowledge from the reduced data obtained from the processing layer, and further providing more intelligent services for users or electricity companies. For example, the extracted intelligence services are applied into generation control system, electricity sales system, electricity operation system, status detection system, and risk evaluation system.

5. Case Study

In this section, we take the electricity load prediction as a case study for validating the feasibility and effectiveness our proposed framework.

Since electricity load forecasting of the residents is a classic demand for the Power Grid Corporation, it

can provide the decision support for scheduling center, and present the efficient guidance of power plant, further help to enhance the safety and stability of power system.

Here, we collected the data on electricity load usage (between 3 March and 24 March 2017) for an anonymous user in Vanke strict at Xi'an city (as shown in Table 1).

Table 1: The Electricity Load Usage for an Anonymous User in Vanke Strict at Xi'an City

Time	T1	T2	T3	T4	T5	T6	T7	T8
Electricity Load	62	62.5	60.3	59.1	59.3	59.8	59.4	60.0
Time	T9	T10	T11	T12	T13	T14	T15	T16
Electricity Load	60.0	59.7	60.8	62.0	61.6	64.5	69.3	73.0

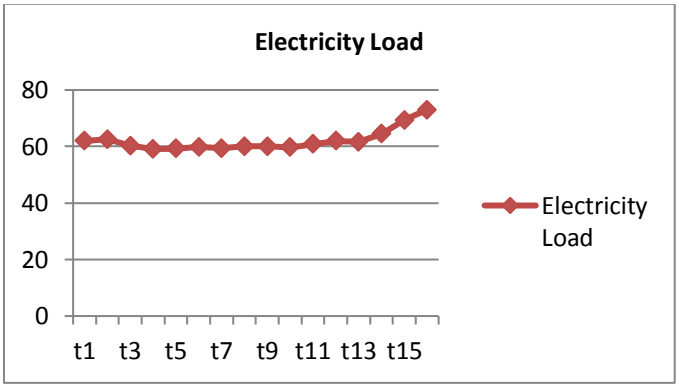

Fig. 2 The Trend of Electricity Load Usage in Our Case Study

The implementation of our case study is described as follows.

We firstly used the smart sensing devices for remotely collecting the data on electricity load usage for the targeted user in Vanke strict of Xi'an City. Then, removing the noisy data by our SVD algorithm. Consequently, the normal electricity load usage data are filtered out from the system. After that, the secondary exponential smoothing algorithm [8] are executed for forecasting the future electricity load. The predicted electricity load or pattern can be used for assisting the power grid corporation making the right decision for scheduling the electricity and determining the appropriate pricing strategy. Based on this approach, we can easily obtain the following results on the trend of electricity load usage and prediction results in our case study. As can be seen from Fig.2, the segment line falls into the rectangle denotes the forecasting electricity load in the future 3 time stamps (Note that, the time stamps are set up according to the user pre-defined parameter, such as there are 3 days interval between time stamps).

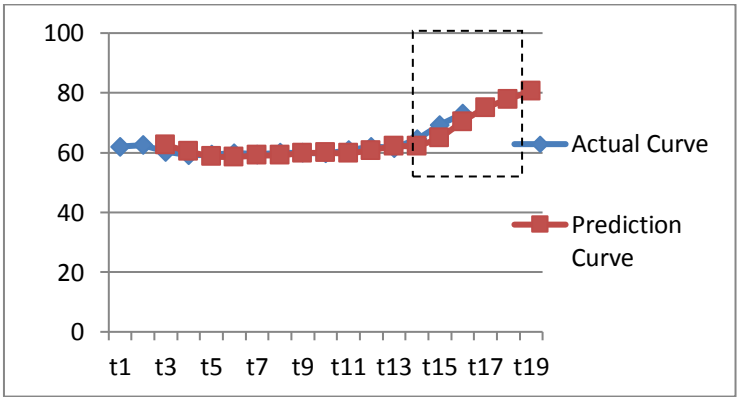

Fig 3. The Trend of Electricity Load Usage and Prediction Results in Our Case Study

Experimentally, for this anonymous, we can adopt the proposed framework to predict the future electricity load and give the right decision making strategy in both sides of company and clients.

Table 2: The Future Electricity Load Usage for an Anonymous User in Vanke Strict at Xi'an City in the following 3 days

Time	T17	T18	T19
Electricity Load	75.1	77.8	80.6

The trend of this user is increasing, so we may suggest this user control their power usage behaviors in the daily life since the price follows the step pricing mechanism. From the safety point of view, the power grid corporation also need to reconsider the scheduling the surrounding electricity load usage behaviors in order to balance the load and guarantee the safety.

6. Conclusions

Considering the current existing shortcomings of data transmission, storage and processing according the features of in smart grid, this work mainly presented a novel framework for big data processing and analysis in smart grid. Especially, we devised the effective data transmission and storage infrastructure via data access and integration. With this proposed framework, a case study on user's electricity load prediction was conducted for validating the feasibility and effectiveness of the framework.

Acknowledgment

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IJCT Instructions for Authors
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Center the Authors Names Here

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Center the City, States and Country Here
Center E-mail Address Here

Abstract

(Use 10 point Times New Roman) The abstract is a brief (50-80 words) synopsis of your paper. Its use is to provide a quick outline of your presentation, giving the reader an overview of the research. This is an important aspect of your paper, as it is this description that may attract the reader to continue and finish your full report. Keywords should be so chosen that they best describe the contents of the paper. In most cases, these words can be found in the title and abstract. Noun forms without articles must be used. The use of hyphens and prepositions should be avoided. Keywords, 5-10 in number, should be typed on the next line after the abstract, starting with the headline Keywords: Each keyword, except proper nouns and acronyms, should be typed in lower-case letters and followed by a comma, except for the last one. (Example keywords: VLSI, CMOS and SOI)

Keywords-component; formatting; style; styling; insert (key words)

1. Introduction

These instructions give you basic guidelines for preparing camera-ready (CR) papers for IJCT. The instructions assume that you have computer desktop publishing equipment with several fonts. Your goal is to simulate, as closely as possible, the usual appearance of published papers in the ACM Journal. These instructions have been prepared in the preferred format.

2. How to Format the Page

2.1. Full-Size Camera-Ready (CR) Copy

Prepare Camera-Ready paper in full size format, on A4 size or 8 1/2” x 11” (215.9 mm x 279.4 mm) paper.

2.2. Heading

The **headings** and **subheadings**, starting with "**1. Introduction**", appear in upper and lower case letters and should be **set in bold and aligned flush left**. All headings from the Introduction to

Acknowledgements are numbered sequentially using 1, 2, 3, etc. Subheadings are numbered 1.1, 1.2, etc. If a subsection must be further divided, the numbers 1.1.1, 1.1.2, etc.
The font size for **heading is 12 points bold face** and **subsections with 11 points bold face.** Do not underline any of the headings, or add dashes, colons, etc.

2.2. Fonts

The best results will be obtained if your computer word-processor has several font sizes. Do not use fonts smaller than the fonts specified in Table 1. As an aid to gauging font size, 1 point is about 0.35 mm. Use a proportional, serif font such as Times or Dutch Roman.

2.3. Formats

In formatting your A4-size paper, set top margin to 30 mm, bottom margin to 25.4 mm (0.98 inches), left margin to 25.4 mm and right margin to 25.4 mm.

You should left- and right-justify your columns. On the last page of your paper, try to adjust the lengths of the two columns so that they are the same. Use automatic hyphenation, if you have it. Don't forget to check the spelling.

3. Illustrations

Position figures and tables at the tops and bottoms of columns, if possible. Large figures and tables may span both columns. Figure captions should be below the figures; table captions should be above the tables. Try to place the figures and tables after their first mention in the text. Use the abbreviation (e.g., “Fig. 1”) even at the beginning of a sentence.

All half-tone illustrations (pictures/photographs) should be clear black and white prints. Do not use photocopies. These illustrations should be furnished within the copy. Make certain to include a caption in the paper for the illustration as well as to label the illustration on the back.

Table 1. Font Sizes for Camera-Ready Papers

Font Size	Bold	Italic	Text
10			Main text, authors’ affiliations
10	Yes		Headings, i.e. **Abstract**
12			Authors’ names
14	Yes		Paper title
11	Yes		Sub-headings, i.e., 1.1
10			References, table, table names, table captions, figure captions
9			Footnotes, sub- and superscripts

Fig. 1 This is a sample figure. Captions exceeding one line are arranged like this.

4. Helpful Hints

4.1. References

List and number all references at the end of the paper. When referring to them in the text, type the corresponding reference number in square brackets as shown at the end of this sentence [1]. Number the citations consecutively. The sentence punctuation follows the brackets. Do not use "Ref. [3]" or "reference [3]" except at the beginning of a sentence.

Number footnotes separately in superscripts. Place the actual footnote at the bottom of the column in which it is cited. Do not put footnotes in the reference list.

Give all authors' names; do not use "et al" unless there are six authors or more. Papers that have not been published, even if they have been submitted for publication, should be cited as "unpublished" [4]. Papers that have been accepted for publication should be cited as "in press" [5]. Capitalize only the first word in a paper title, except for proper nouns and element symbols.

For papers published in translated journals, please give the English citation first, followed by the original foreign-language citations [6].

4.2. Abbreviations and Acronyms

Define abbreviations and acronyms the first time they are used. Acronyms such as MOSFET, AC and DC do not have to be defined. Redefine acronyms when first used in the text, even if they have been defined in the abstract.

4.3. Equations

Number equations consecutively with equation numbers in parentheses flush with the right margin, as in (1). To make your equations more compact, you may use the solidus (/), the exp function, or appropriate exponents. Italicize Roman symbols for quantities and variables, but not Greek symbols. Use a long dash rather than a hyphen for a minus sign. Use parentheses to avoid ambiguities in denominators. Punctuate equations with commas or periods when they are part of a sentence, like this,

$$\int_0^{r_2} F(r,\phi)\,dr\,d\phi = \left[\sigma r_2 / (2\mu_0)\right] \cdot \int_0^{\infty} \exp(-\lambda|z_j - z_i|)\,\lambda^{-1} J_1(\lambda r_2) J_0(\lambda r_i)\,d\lambda. \quad (1)$$

Be sure that the symbols in your equation have been defined before the equation appears or immediately following. When you refer to equations in the text, refer to (1). Do not use "Eq. (1)" or "Equation (1)" except at the beginning of a sentence: "Equation (1) is used...."

4.4. Other Recommendations

Use either one or two spaces between sections, and between text and tables or figures, to manipulate the column length. Use two spaces after periods at the end of sentences (full stops).

5. Conclusion

Following these instructions will improve the quality of your paper and the ICCT 2017 Proceedings. If you have questions, please contact the Technical Program Committee chairs.

Acknowledgment

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