

Feng Shui Garden Adviser System (*FengShuiGAS*)

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ABSTRACT

This paper explores an approach to building an adaptive expert system prototype in an environment of human-computer collaboration. Components of an adaptive system are identified, with an emphasis on the mechanisms that enable adaptive behavior to occur. An adaptive expert system is necessary in order to communicate with the user and also adapts to user's needs. The adaptive expert system in this particular project is implemented on a Feng Shui garden design domain. A frame-based data representation and rule-based approach is applied to this project. In this research, the Feng Shui aspiration is adapted to users' assessment and choice based on their preferences. This experimental expert system prototype displays low level adaptive capabilities that show sufficient promise to warrant further research.

Keywords

Adaptive Expert System, Feng Shui, Frame-based, Rule-based

1.0 INTRODUCTION

Nowadays, many people are concerned about their lawn or garden decorations. The interests of designing *Feng Shui* garden among Malaysian Chinese are arising due to the new trendy and healthy lifestyle. The service providers for garden design also increases in numbers day by day. The initial individual who are interested in *Feng Shui* garden are confronted with the problem to design their garden based on their specific endeavors that associates with their garden entrance's wind direction. Most of them do not want to hire the garden designer or *Feng Shui* expert because the fees are usually too expensive. The landscape service providers on the other hand confronted with the problem of understanding the client's needs and specifications. They are also confronted with the problems of recommending landscape style and design based on the client's endeavors that related with the *Feng Shui*. Currently there is no such system that facilitates both client and the landscape service provider. Therefore the idea of developing a prototype system of *Feng Shui* garden design adviser is to recommend the best option for both client and landscape service providers. The aim for this project is

to develop an adaptive expert system prototype that provides a corresponding garden design style that satisfies the clients based on their *Feng Shui* endeavours.

2.0 FENG SHUI OVERVIEW

Feng Shui is not related to any religion or belief system. It is a scientific discipline based on the analysis of energy (Too, 2002). *Feng Shui* is not a superstition or a set of dos and don'ts. It is the art and science of understanding the forces of nature in order to design houses and workplaces that blend with the environment instead of clashing with it. It aims to help us live in harmony with the world by promoting the flow of positive energy and neutralizing or avoiding negative or destructive energy.

Based on an interview with Master Larry Sang from The American Feng Shui Institute, *Feng Shui*, means wind and water. It is an ancient Chinese study of the natural environment. Feng Shui can determine the best or most favorable location for anyone and assist that person to avoid the worst or least desirable location in any environment. *Feng* means "wind," and *shui* means "water". In Chinese culture, gentle wind and smooth water have always been associated with a good harvest and good health, while harsh winds and stagnant water have been linked to famine and disease. Therefore, "good" *Feng Shui* has come to mean good livelihood and fortune, and "bad" *Feng Shui* has come to mean hardship and misfortune.

Feng Shui basic principles are mainly based on *yin* and *yang*, the five elements, east or west compass directions, the solar system and the environment (Too, 2002). *Feng Shui* is based upon a set of theories and complex calculations derived from the *Yi Jing*. This includes an in-depth understanding and application of the theories of *Yin* and *Yang*, along with the balancing of the Five Elements (Fire, Earth, Metal, Water, and Wood) and taking into account the physical relationship between the natural environment and the magnetic field.

3.0 METHODOLOGY

There are three main function operates in *FengShui Garden Adviser System or FenghuiGAS*. The first function is an analyzing function whereby the system searches the knowledge based in order to get the advice. The second and third function is the searching and adapting function respectively.

3.1 Data Analysis

The knowledge was acquired from a known landscape expert and *Feng Shui* Master while the secondary data was obtained from literature reviews. Process of analyzing includes filtering, sorting and data classification. Knowledge is then represented in case frames based on aspirations.

reading, elements, flower, furniture, path, and cure. A set of twenty-four questions was constructed that is based on recommendation by the expert and reviews. Table 1 shows the questions and the confidence of each question in each aspiration. The table also shows the expected answer for each aspiration. Each match answer will carry a weightage that is calculated as follows:

$$\text{Percentage of aspiration_value} = (0.01/x) * \text{total_correct_match} \quad (1)$$

where x is total_expected_answers

User's answers will be analyzed to determine the weakest *Feng Shui* aspiration. The weakest *Feng Shui* aspiration value is obtained from the lowest aspiration value gained from the above equation.

Table 1: The question set with the expected answers

No	Question	Career	Creativity	Health	Knowledge	Love	Prosperity	Reputation	Wealth
1.	There is a mirror in my entry way	Y			Y		Y	Y	Y
2.	I do satisfy with my job	Y		Y					Y
3.	I do satisfy by the way my superior treated me	Y						Y	Y
4.	Do you feel that your colleague or friend(s) is/are backstabbing you?	N				N			N
5.	I have a healthy happy pet	Y				Y	Y		
6.	My home has dusty corner and cobwebs	N		N			N		
	.								
	.								
	.								
22	I have fruity plant(s)/tree(s) in my garden		Y	Y	Y		Y	Y	Y
23	My potted plan(s) is(are) in earth ware/ceramic container(s)			Y		Y	Y		
24	I have musical instruments in my house		Y		Y		Y	Y	
	Total (x)	14	14	12	12	13	15	14	12

3.2 Searching Function

There are eight aspirations namely career, creativity, health, knowledge, loves, prosperity, reputation and wealth. Each frame has attributes on direction, compass

The lowest aspiration value that was calculated from the analysing function will be used as the criteria of searching. There are seven elements involves in Feng

Shui's suggestion namely, direction, element, compass reading, flower's colours and types, pathway styles, type and colour of furniture and cures. *FenghuiGAS* searches the database to find those elements that match with the lowest aspiration value. Figure 1 shows an example of searching result. One can see that the weakest aspiration is 'health' which is 30.029% and followed by the Garden Design Advice.

3.3 Adapting Function

The adapting function allows the user to change some of the elements value. *Feng Shui's* principal only allows two out of seven elements to be changed, which is type of flower and furniture's color. For example, the initial suggestion as in Figure 1 for flower is blue and furniture type is wood. User may change the flower type from the suggested options whether lobelia, verbena or violet. The same concepts apply to furniture color whereby the user may change it into other colors.

<p>Query (In term of a set of question): Answers entered by user.</p>
<p>Comparison – Provided by the system: The weakest Feng Shui (health– 30.029%)</p> <p>Garden Design Advice (from database):</p> <p>1) direction: east 2) compass: 67.5 – 112.5 3) element: wood 4) flower: f5 (colour: blue; name: lobelia,verbena,violet) 5) furniture: r5 (based: wood; colour: white) 6) path: p4 (type: bluestone paving; shapes: undulating line; edgings: pressed metal) 7) cure: c7 (bagua: c7; five_element: c7)</p>

Figure 1: The searching and analyzing function

4.0 ADAPTIVE EXPERT SYSTEMS

An expert system could be viewed as one heuristic rule, or if-then statement, since all rules in the system working together to define a specific condition, which is achieved by asking user relevant questions. Thereafter, the system reacts with one or more actions. It is postulated that an expert system becomes adaptive during an interaction with a human user if this system proves to be capable of the formulation of new relevant questions and the adjustment of actions (Pan, 2000).

4.1 Adaptive Approach

A significant amount of time is required in building an expert system with many hours are on testing and

debugging. If a human expert comes to an incorrect conclusion, he may be able to learn from the mistake and avoid making the same or similar mistakes in the future. Once an expert system is found to have an error, the only way to correct that error is to reprogram the expert system. In other words, most current expert systems are lacking an adaptive capability. Computer based adaptive capabilities are essential in situations where environments change, in situations where standards of expertise are changing, and in situations where there are no historical data and learning occurs as a task that has been performed.

According to Pan (2002), nature adaptation is sometimes referred to as 'evolution' whereas in the context of a system it may be referred to as a 'self-organization capability', and, in the case of human beings, as a 'learning capability'. Therefore, since the intent of expert systems is to emulate human experts, this paper refers to an adaptive expert system as a learning system or, a learner. According to Langley (1998), learning is any relatively permanent change in behaviour brought about through experience that is, through interaction with the environment. An approach to learning, therefore, is through the interaction between the learner and its environment. The interaction operates in terms of three basic elements that are precepts; actions; and, goals (Shen, 1994). Thus, a learning process is a process in which a learner builds models of its environment.

Adaptivity is the possibility for the user to change various aspects of a system explicitly. Adaptive systems may adjust the interface according to the user's skills, knowledge and preferences. For example, an adaptable system allows the user to control these adjustments, such as user can configure and customize the user interface as per her or his needs by changing the properties like colour or font size.

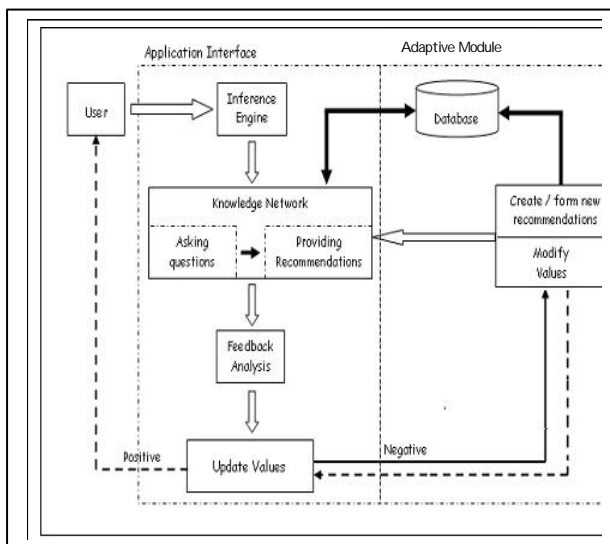
4.2 System Framework

FenghuiGAS was developed by adapting to Pan (2000) architecture. According to him, in terms of inference process, an adaptive expert system describes a generate-and-test loop that endows a system with a learning capability, while a conventional expert system describes a unidirectional flow with no adaptive behaviour. From a system structure perspective, an adaptive expert system differs from a conventional expert system as follows;

- Unlike a static knowledge base in a conventional expert system, an adaptive expert system contains a dynamic knowledge base. Knowledge is represented by a knowledge network (such as objects and their interactions), that can be dynamically modified in real-time based on interactions with the human user.

- In addition to containing the capabilities of a conventional inference engine, an adaptive expert system is capable of real-time adaptation to feedback and restructuring of the knowledge network.

The framework of *FengShuiGAS* consists of two major components: an application interface and an adaptive module. The application interface is divided into inference engine and knowledge network. The inference engine infers through condition-satisfaction action selection. In the rule-based system, it searches for the rules satisfied by facts or objects, and executes the rule with the highest priority. The knowledge base is composed of knowledge nodes and their connections. Meanwhile, the adaptive module performs the recommendation task. The mechanism provided by this system demonstrates a primitive adaptive capability of a computer-based expert system as shown in Figure 2.



4.3 Inference Engine

Inference engine is the heart of rule-based implementations where it provides the mechanism that controls the course of consultation, combining the rules in the knowledge base with input data to develop recommendation. Both forward chaining and backward chaining mechanisms were used in this project. *FengShuiGAS* evaluates the aspiration once the users answered all the 24 questions. Each answer will carry a weight for each aspiration and then the percentage of each aspiration is calculated.

Forward chaining and backward chaining were used as a state space search. Forward chaining or data driven reasoning, works by starting with facts and rules, and tries to generate new facts. In *FengShuiGAS*, this mechanism was applied for analyzing and searching function. Forward chaining is used when the system

determines user's aspirations and advises on garden design based on the questions and answers session.

On the other hand, if users dislike the advice, they may change the preferences. In implementing this situation, *FengShuiGAS* will apply the backward mechanism. The adaptive function will prove the goal using the facts and rules whereby the aspiration value acts as a goal state. The modification can be done until users are satisfied with the recommendation.

5.0 DISCUSSION

In the first stage, the knowledge is represented using a frame-based as it provides a natural way for the structured and concise representation of knowledge (Higginbotham 1996, Nebel, 1999). It can organize knowledge in slots in order to describe various attributes and characteristics of the object in a meaningful way. The system is developed using object-oriented programming technique as it defines the object in a real world through a natural way of representation into computer environment.

Five sets of frame-based knowledge representations were constructed which was based on Feng Shui's elements. Figure 3 shows an example of frame-based knowledge representation that has been constructed.

During the development process, we have found that it is difficult to constantly represent the knowledge in the frame-based because it has to deal with many constraints. For example, the system required the user to answer a set of multiple choices questions (in the form of Yes/No). It is hard to interrelate between the outputs and the system assessment with the frames. Therefore, frame representation was used only to represent the information in a real world.

The system used rule-based technique that combined with a weighted score for each primary value. The results that are produced by the system are the garden design style including the flower's colours and names, the path styles, auspicious furniture based and colours and Feng Shui's cures that are suitable with the user's weakest aspiration. If the user does not satisfy with the result or the system advice, the user can change the flower types and the furniture colour.

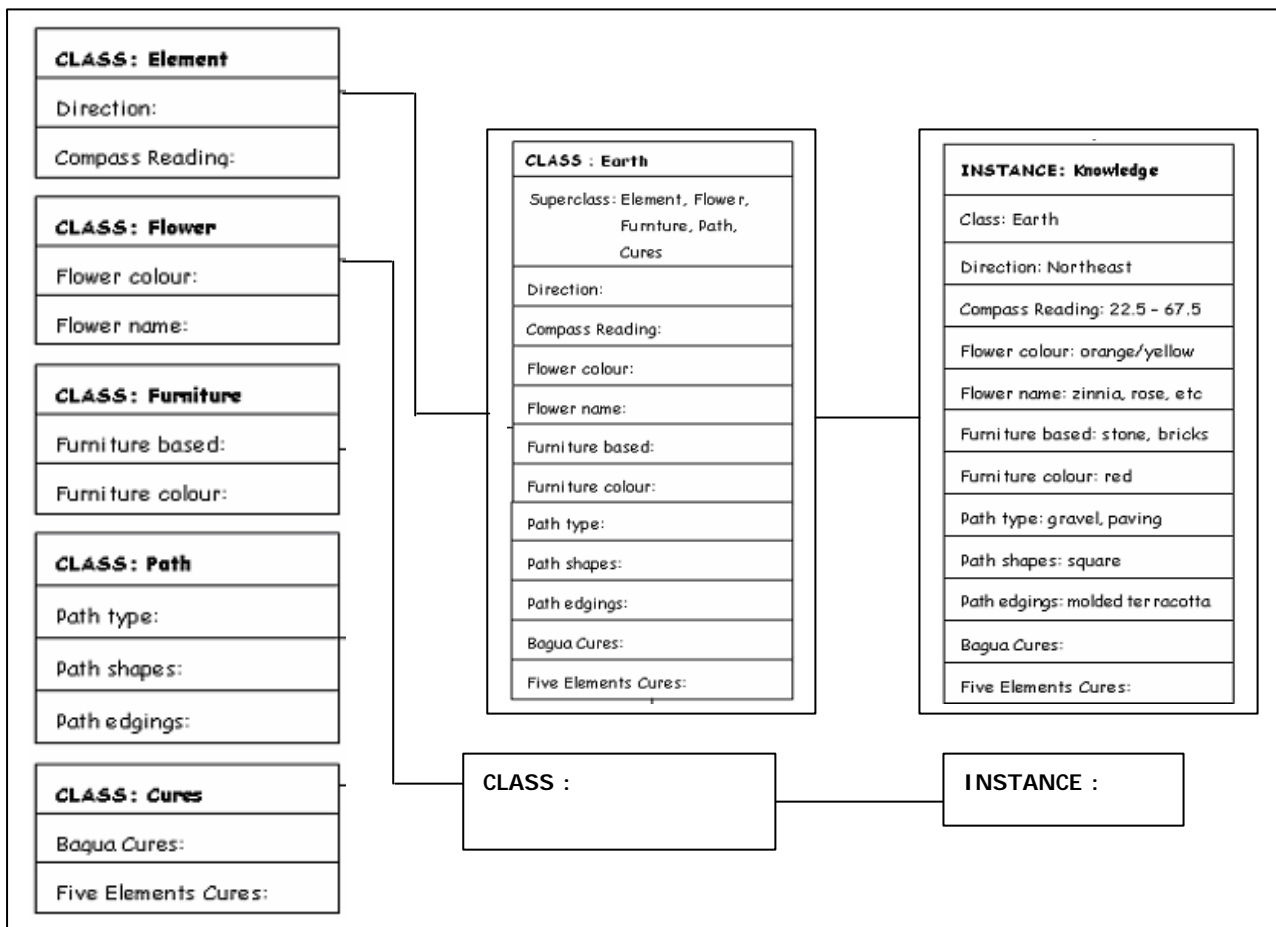


Figure 3 : An example of frame-based data representation

The explanation facility reacts when the system does not produce a result or advises that does not satisfy user needs. In addition, the explanation facility was created to give more explanations about how and why the user gets the result. If the user clicks the button “Why I get this result?” on the result page, the system will prompt a reason page to inform the user on how the system evaluated the result. Meanwhile, the explanation facility can be viewed when the user clicks the button “No – Changed” in the adviser form. For example, if the user clicks the button on the flower tips section, the system will display the message “Flower: You cannot change the colour because this is the auspicious colour to cure your weakest Feng Shui. This is to make sure the user understands why such result or advice is given to them.

6.0 CONCLUSION

This paper provides an alternative approach by using frame-based data representation and rule-based to develop a prototype of an expert system to advise on Feng Shui aspirations. If FengShuiGAS is commercialised, it

will be benefited to both clients and landscape providers who are interested in a Feng Shui's garden design.

By using the weakest aspiration generated from the system, both clients and landscape service providers will be facilitated on how to design the garden, considering elements of Feng Shui. It is hoped that clients' budget of hiring an expert garden designer can be saved. The prototype may encourage and expand the use of e-commerce applications in a landscape industry. Further improvement may be obtained by incorporating with other domains, such as home and office interior design and the use of 3D environment interface design for interactivity.

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