Patent Analysis with Innovative Patent Map System

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Abstract

Among the research on patents, the applications of Patent Map to Patent Analysis have been gradually emphasized. For three years, the researchers have applied Patent Map Theory Model to establishing Patent Map System (PMS) assisting decision-makers in Patent Analysis. Based on the system requirements, relevant function components are planned, and UML technology is utilized for the design and establishment of Patent Map Database. In the actual case study on non-glue rubber mat design, the researchers apply PMS to assist WPIC in Patent Analysis. With the concept of Expert Systems to establish PMS, it is used for the research and development in enterprises as well as for patent management. With PMS, enterprises could understand the patent oppression of competitors and monitor the growth and decline of patent right. PMS can benefit enterprises to confirm the distribution of all patent in the industry and assist them in making definite patent distribution strategies.

Keywords: patent analysis, expert system, patent map, case study

1. Introduction

According to the data in World Intellectual Property Organization (WIPO), 90-95% inventions would be published on patent literatures annually, and 80% of them would not appear on other journals [1]. Apparently, patent literatures are an enormous technical database. With patent retrieval, R&D personnel could master the latest product technology. Patent data provide the required concepts of product R&D and Patent Around so as to shorten the time for R&D, reduce the risk of R&D, and enhance the patentability of products.

Patent documents are considered as a unique document with the combination of technology and legislation. With patent analyses, it not only assists in understanding the R&D status of competitors, but also masters the technology and market opportunities [2-3]. However, it has attracted a lot of researchers investing in the research on patent documents because of the patent data being abundant and hard to be interpreted [4].

Within the relevant research on patents, Patent Map has been stressed on. By organizing the data in patent documents, Patent Map could effectively analyze the patent news with graphics. In other words, it professionally integrates individual patent literatures for the trend of technology development and competitors' techniques.

Design Patent Map has certified design patents be the studied entity. Practically, most design patents are mainly the protection of exterior styling. As a result, the establishment of Design Patent Map is more difficult than it of invention patents, as they present objective data for patent claims, such as temperature and stress, while design patent claims are mostly subjective judgment, such as creativity and similarity [5].

Research on Patent Map has not been much so far; the development of specific Patent Map System is even less. Since exterior designs are easily plagiarized and imitated, the analysis of design patents plays a critical role in the competitiveness of design industry. The researchers spend a long period of seven years on Design Patent Map Theory and the establishment of Patent Map System (PMS). This study therefore is expected to be the index of pioneer research in the field.

Expert Systems, as one of the core research on Artificial Intelligence (AI), aim to store expert experiences and knowledge in various industries into computers so that the relevant personnel could utilize dialogues to acquire the required knowledge for decision-making [6-7]. Newquist pointed out Expert Systems as the problem-solving software with the characteristics of

human logic [8]. The basic structure of Expert Systems contains (1) User Interface, (2) Knowledge Base, (3) Inference Engine, (4) User, (5) Domain Expert, (6) Knowledge Acquisition Sub-System, and (7) Interpretation Sub-System.

Expert Systems can be simply defined as the software with similar judgment and problem-solving capabilities to human beings. Basically, it presents a group of facts for describing problems and a set of inference rules, which deduce a new fact from present facts according to the correlations [9]. For instance, reliability, flow control, network structure design, network function test, and error detection and management could be solved with Expert Systems within a short period of time so as to enhance the network efficiency.

Expert Systems have been successfully applied to high-value and expert-required fields [10]. Some sectors apply Expert Systems not to reducing personnel or hardware costs, but to enhancing efficiency, simplifying trainings, and extending expert knowledge. Patent Analysis is regarded as the type.

Having concluded the research, Expert Systems present the following characteristics of (1) being able to deal with complex and comprehensive knowledge in real life, (2) showing expert capability on problem-solving, (3) being able to apply or handle problems in specific fields, and (4) presenting reasonable inference and interpretation functions.

The PMS developed in this study, essentially as Expert Decision Support System (DESS), is based on the theories of software engineering and database design [11-14]. Expert Decision Support System, a computerized system, could assist in major and subordinate decisions. When making decisions, people are likely limited in some awareness. In this case, Expert Decision Support System could assist people in improving such restrictions [15-16].

2. Research Method

Referring to the establishment of Design Patent Map proposed by Dr. Chen [17-18] as the blueprint of PMS, Dr. Rain Chen spent four years on the theoretical model of Design Patent Map, covering the steps of (1) deciding the range of patent samples, (2) analyzing the one-time data, (3) analyzing the two-time data, (4) establishing the overall distribution of design patents, and (5) interpreting the overall distribution of design patents. Based on such a theoretical model, a specific and operable PMS is established.

According to the steps, the researchers plan the major procedures for PMS. (1) Requirement collection and analyses. Based on the function requirements for PMS, the necessary functions of PMS are concluded and the relative functions to various events and sub-systems are understood. (2) Case study. PMS is divided into the sub-systems of (i) Login system, (ii) Management system, (iii) Patent comparing system, and (iv) Patent map display system. Besides, the cases are applied to describing the system functions and tracing the implementation of requirements. (3) Database design. Aiming at the database design for PMS, the relative attributes in the system are analyzed and Entity-Relation Diagram (ER Diagram), database schema, SQL descriptions in the database, and sub-systems are designed. (4) PMS interface planning. Aiming at the system interface design and planning, the actual simulation presents the operation process.

According to the system requirements, the researchers design the system function components and ER Diagram of PMS with the relationship between attribute analyses and the entity Figure 1.

3. Results and Analysis

By expanding the theoretical model of Patent Map proposed by Dr. Rain Chen, the following designs are planned according to the system requirements, including (1) System function components (expressed with Case study in UML), (2) Design diagrams of various components (expressed with Activity diagram in UML), and (3) Patent Map database design (containing ER diagram, database schema design, and SQL descriptions in database).

In order to have readers thoroughly experience the contents of PMS and the operations, System Buildup is introduced in this section, in which the researchers describe the operation of PMS with the case study on an innovative product design project of Ministry of Economic Affairs.

Figure 1. ER Diagram of PMS

3.1. System Buildup

The front page of the system is classified into "Administrator", "Participant", and "Browser" for different purposes of Users, who can access to the system for operations.

Accessing to the system from Administrator, User can add a new account for the authority. After Login system, Administrator could directly enter the patent management for appending, revising, and deleting patents. During appending, Administrator could upload the images of the patent sample.

When accessing to Participant, the account password is required. Having completed the basic information and password setting, Participant completes the registration and could precede the determination of patent similarity.

For comparing patents, the system offers Participant with Table View, Figure 2. When selecting "Start test", the system displays the options of "Card Comparison" and "Matrix Comparison". After entering Table View, Participant could start the comparison, and the system would prompt to continue the pair comparisons.

When Participant randomly selects two cards, the system would compare the cards, and Participant could click for the similarity determination, which is classified into Extremely dissimilar, Slightly dissimilar, Ordinary, Slightly similar, and Extremely similar.

After completing the comparison, Participant could choose to answer with Card comparison or Matrix comparison. When Matrix comparison is selected, the frame is skipped to Matrix View, and then the cases not being compared would be shown with bright color after completion.

Once Browser enters the system, "Display patent data" and "Display Patent Map" in PMS can be browsed. When the former is selected, the system would show the attributes of patent data, such as patent number, patent name, international code, application date,

announcement date, oblige, nationality of oblige, and power. According to Browser's requirements, PMS could precede ascending and descending ordering.

When "Display Patent Map" is clicked, the relevant Patent Map would be shown so that Browser could enquire the detailed information with the function keys. For example, Browser could enquire the information of patents similar to specific patent number.
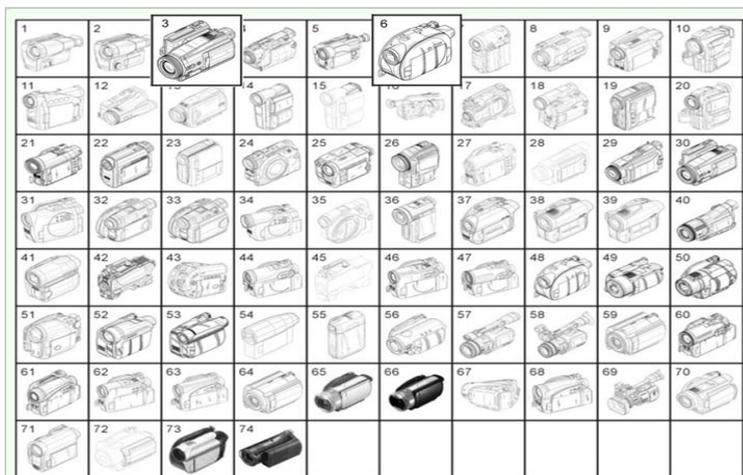

Figure 2. Table View mode

3.2. Case Study

Supported by Ministry of Economic Affairs, the researchers cooperate with a famous rubber mat manufacturer in Taiwan to precede Patent Analysis with PMS in this innovative product design project (No. 110527).

Winton Plastics Industries Co., Ltd. (hereafter called "WPIC"), founded in 1972, mainly manufacturing rubber mats for exporting to European markets. With forty-year experiences in rubber mat manufacturing, WPIC possesses stable customers internationally with certain popularity. The strict quality control makes WPIC be leading the industry.

Originally, WPIC's rubber mats are laid and stuck on the ground with glue. Such a method allows the products being used for merely one time, as they could not be moved to other places after being stuck on the ground. With the rising awareness of environmental protection, the consumption market has turned to non-glue rubber mats connected with interlocks. The core patent of such design has been acquired the key technology and patent by a European company, Valinge.

WPIC intended to ask for the license from Valinge. With negotiations, Valinge proposed the following requirements. (1) WPIC should pay Valinge the patent royalty 0.1 million European dollars; (2) WPIC should purchase the mat manufacturing machines from Valinge; and, (3) WPIC should pay extra USD1 royalty to Valinge for every square meter product. Based on WPIC's annual production of rubber mats, 0.2 million square meters, the patent royalty would reach 0.7 million US dollars. After deliberate evaluations, WPIC authorized Southern Taiwan University of Science and Technology (Taiwan) to solve the problem with Patent Analysis and Patent Around.

The researchers first designed fifteen types of non-glue rubber mats. After Nan-E International Patent & Trademark Office retrieving more than 2000 patents globally, three designs were confirmed for Patent Analysis, Figure 3. According to the reports of patent retrieval, the possible patents similar to the above case for the patent claims of (1) Additional type, (2) Round interlocks, and (3) Embedded type could be Case US7896571B1 (System code 4), Case US2740167 (System code 5), Case US7856784B2 (System code 6), Case US6516579B1 (System code 7), and Case US4426820 (System code 8).

(1) Additional type   (2) Round interlocks   (3) Embedded type

Figure 3. Three types of non-glue rubber mat design

After Participant (product designers) inputting the data to PMS, Table 1, the system would proceed algorithms with Multi-Dimensional Scale (MDS). As the samples are insufficient, Patent Map is utilized for visualizing patent information for high-level managers to make decisions. The presentation of MDS therefore is two-dimensional. Figure 4 shows the distances between the eight samples where the shorter distance appears, the more similarity between samples is shown [19].
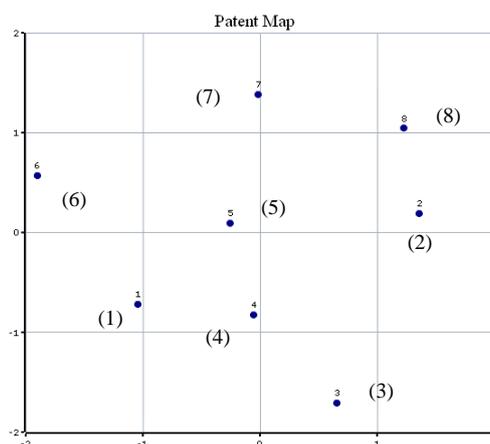
Patent samples (1)~(8)

Figure 4. Two-dimensional Patent Map of samples (1)~(8)

Having the sample (1) as the center of a circle, three most similar patents are retrieved, with the order of (4), (5), and (6). However, the distance between (4) and (1) reaches 0.99, showing obvious differences between them.

Having the sample (2) as the center of a circle, three most similar patents are retrieved, with the order of (8), (5), and (4). Nonetheless, the distance between (8) and (2) reaches 0.86, presenting obvious differences between them.

Having the sample (3) as the center of a circle, three most similar patents are retrieved, with the order of (4), (1), and (2). Nevertheless, the distance between (4) and (3) reaches 1.13, revealing obvious differences between them.

From Patent Map, the evaluated designs (1) to (3) could result in patents similar to the previous cases (4) to (8). According to the comparisons, the three designs would not be rejected the patent because of not presenting novelty. Within the three designs (Sample (1) to (3)), (3) appears the best novelty, and followed by (1) and (2). Overall speaking, all the designs (1) to (3) present patentability and can receive patents. With limited patent resources, WPIC is suggested to focus on (3), as it shows the least competition.

4. Conclusion

The importance of patents is not the capability of competitors, but understanding the dynamic of the industry through Patent Analysis in order to orientate the R&D for the enterprise. This study develops PMS with Patent Map Theory for enterprises to precede Patent Analysis on their own. With various retrieval conditions, enterprises could analyze the technical movement and technology development trend of competitors with Patent Map. The establishment of PMS could assist enterprises in planning brand-new product development strategies and largely enhance the competitiveness.

Referring to Dr. Rain Chen's Patent Map Theory Model, this study designs function components according to the system requirements and utilizes UML technology to design and establish Patent Map database. In the real case of non-glue rubber mat design, the researchers directly apply PMS to assisting WPIC in Patent Around and patentability evaluation. With PMS, WPIC saves enormous amount of patent royalty and could definitely point out the orientation of the patent. Such a system could largely benefit the industry.

In addition to the normal operation of the system, the researchers conclude the best interface design corresponding to PMS, based on the design principle of Graphical User Interface (GUI) and emphasize the system interface design of GUI so that User could easily operate the system with less errors and enhance the quality of decision-making.

Referring to Chen's Design Patent Map as the blueprint of PMS and having Multi-Dimensional Scale present the two-dimensional space of patent samples, the researchers establish PMS with the concept of Expert Systems for the R&D and patent management of enterprises.

With the rapid change of information, Intellectual Property Rights have become critical. When developing and selling products, the relative Patent Analysis is also critical. The established PMS indeed assists designers in understanding the similarity of competitors' relevant patents when designing products.

Two important meanings are presented on the proposed PMS. (1) Passively, it helps the design not becoming others' patent claims, resulting in tort. (2) Actively, it actively precedes patent distribution for design strategies to cope with the changeably competitive environment.

Applying PMS, enterprises could receive the benefits of (1) realizing the technological development trend of the industry (2) understanding the patent pressure of competitors, (3) monitoring the growth and decline of patents, (4) ensuring the patent distribution of the industry, and (5) definitely determining the patent distribution and investment of the enterprise.

The established PMS could effectively transform patent information for enterprises to plan patent competition strategies. The establishment of such PMS is presently the first case that both system functions and interface planning can be greatly developed.

It is expected that PMS could be developed into dynamic PMS, presenting data update function for User to precede high-level decision-making. The research outcomes are expected to actually benefit industries.

Acknowledgement

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