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Procedia CIRP 21 (2014) 515 – 520

www.elsevier.com/locate/procedia

24th CIRP Design Conference

Innovation through pertinent patents research based on physical phenomena involved

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Abstract

One can find innovative solutions to complex industrial problems by looking for knowledge in patents. Traditional search using keywords in databases of patents has been widely used. Currently, different computational methods that limit human intervention have been developed.
We aim to define a method to improve the search for relevant patents in order to solve industrial problems and specifically to deduce evolution opportunities. The non-automatic, semi-automatic, and automatic search methods use keywords. For a detailed keyword search, we propose as a basis the functional decomposition [1] and the analysis of the physical phenomena involved in the in the achievement of the function to fulfill. The search for solutions to design a bi-phasic separator in deep offshore shows the method presented in this paper.

Selection and peer-review under responsibility of the International Scientific Committee of "24th CIRP Design Conference" in the person of the Conference Chairs Giovanni Moroni and Tullio Tolio
Keywords: Creative; Inventive design; Patents.

1. Introduction

Some solutions to industrial problems can be found by looking for knowledge using different information sources such as patent databases, journals, etc. as well as different search techniques to find innovative ideas such as: brainstorming, benchmarking, Delphi 6 sigma, checklists, etc [2]. Patents are a large source of free technical knowledge that describe, explain and reveal current technologies used, and provide solutions to problems. White [3] states that patents disclose information not published in scientific journals or conference proceedings. Eighty percent of the information contained in patents is not published elsewhere.

Different methods are used to find knowledge about patents. Computer tools partially or completely limit human intervention. They use techniques such as text mining, data mining, ontologies, natural language processing (NLP),etc. in order to satisfy multiple goals such as: problem solving, technology forecasting, classification of patents in categories, network, citations occurrence, trends etc. Despite the reduction of human involvement, many troubles are still present, i.e. in the semantic analysis: homography, polysemy, synonymy, fuzzy nature of the relationship between words in human language, partial synonymy, the hierarchical relationships (hyperonymy and hyponymy), and use of some jargon [4]. In traditional keyword search methods, the search is made using the keywords associated to the problem; then an analysis must be done manually. Finding relevant results depend on the user's experience and skills. Different reasons show that this method cannot be considered exhaustive, i.e. the level of detail descriptions of patents, inaccurate terminology, multiple languages etc [5].

Our methodology aims to improve the effectiveness of traditional keyword searches using functional and physical analysis (functional flow path, section 3.1). Performing a function involves an energy which is converted and transmitted to a component that will produce an effect [1]. Exhaustive analysis of all possible initial energy, transmitted energy, and the phenomena of physical conversion allows us to select the physical effects. These physical effects comprise the relevant parameters. The energy conservation laws allow us to validate these parameters and their relevance, and to

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doi:10.1016/j.procir.2014.02.061

define desired behaviors. The relevant parameters and the searched behaviors will structure the keywords to be used. Then we generate an iterative keyword database that, at each research, grants finding new technological keywords that will be used to refine the search. Based on the findings, we perform a classification structured by keywords in a discovery matrix form. The concepts found will be analyzed from the evolution trends of the TRIZ theory. The empty cells in the matrix outline new opportunities for innovative solutions.

The rest of the paper is organized as follows; in section two we explain the work in relation with patent analysis and situate the proposed methodology. In section three, we present our method of innovation through the description of the functional analysis, retrieval of relevant physical phenomena and relevant parameters, followed by the classification method. Section four will show the application case in a bi-phasic separator in deep offshore. We will finalize with the conclusion and perspectives.

2. State of the art

Two primary questions are presented in order to build the state of the art and position our method. First, "how" (Fig. 1) i.e. the methods and techniques used. Then, "why" (Fig. 2), specifically, the objectives frequently found in the literature.

Text mining has been used to extract significant-rare keywords by Li [6], the selected words are those less frequently used by scientists and technologists. Yoon and Park [7] use this technique to transform raw data (patents expressed in text format or in natural language) into structured data. They exploit it as an extraction tool, to identify keywords and to measure similarity between patents. Choi and Park [8] used the text mining technique for the analysis of Subject-Action-Object structures (SAO), ranked them by similarity, and identified them by the type of technological implications.

Data Mining techniques and NLP are used for data extraction and classification of patents in several categories of inventiveness [9]. Yoon and Kim [10] propose a method to extract binary relations between patents through NLP; then they find out specific trends and phases of evolution trend (TRIZ evolution trends[7]). The tool, "TrendPerceptor" [12] is based on this method.

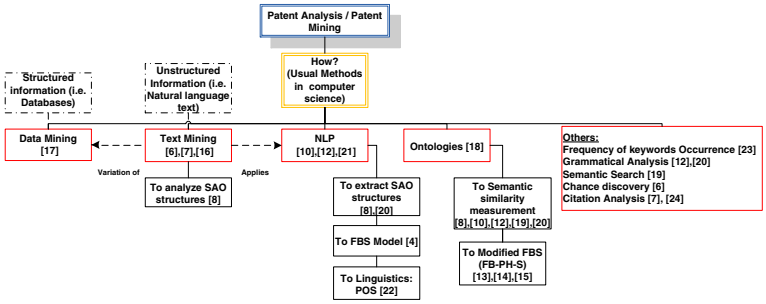

Fig. 1. Synthetic map of techniques found in literature. A double border box indicates the main subject studied. A dash line arrow designates a relationship and a dash-lined box stands the type of information commonly used.

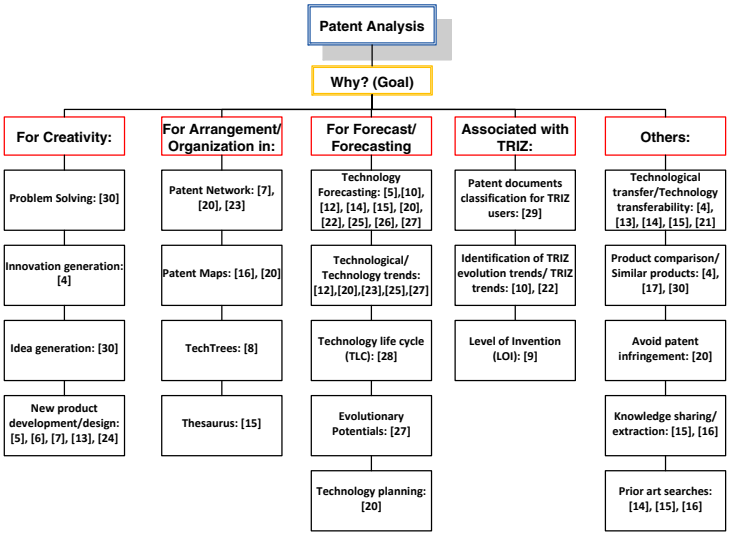

Fig. 2. Overview of the common objectives in patent analysis. A double border box indicates the main subject studied.