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Computer-Aided Problem Solving: A Dialogue-based System to Support the Analysis of Inventive Problems

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Abstract

The paper presents the research activity developed by the authors in the field of Computer-Aided Inventive Problem Solving: an original dialogue-based software application has been developed by integrating the logic of ARIZ with some OTSM-TRIZ models in order to guide an user also with no TRIZ education to the analysis of inventive problem. The proposed software system, even if still at a prototype stage, is radically different from any existing TRIZ-based software tool and it has been already tested both with students at university and with employees of a few Small and Medium Enterprises. The full presentation will detail the structure of the algorithm and the results of the first testing activities.

Extended Abstract

Computer-Aided Innovation (CAI) systems constitute an emerging technology in the field of computerized means for product development. Being these systems at an infancy stage of development, this domain is characterized by fuzzy borders with other disciplines and different perspectives in terms of objectives, end-users, reference sciences etc.

Nevertheless, providing a systematic support to the solution of inventive problems certainly constitutes a key aspect in the CAI domain; up to now, the existing systems available on the market have been mostly based on the implementation of the classical instruments of TRIZ into an electronic format, but just marginal benefits are provided to the user both in terms of capability to manage complex systems and lack of competence with TRIZ fundamentals. Moreover, existing systems have mostly neglected past research outcomes in the field of problem solving with computers as those achieved with Artificial Intelligence and Case Based Reasoning.

Among the objectives of the work, the attempt of overcoming, through a software application, troublesome issues recurring in complex problem solving cases, such as multiple goals, manifold interrelations and lack of clarity, holds the utmost importance. With this purpose, the paper describes an algorithm, implemented in a dialogue based system, which systematically supports the analysis of problems arising during the design phase. The system assists the user in formulating technical problems using terms and concepts of OTSM-TRIZ, being a physical contradiction expressed as an intensified conflict the expected output of the questioning procedure. The methodological approach, as well as the capability of the algorithm to integrate useful information, supports such

goal. The algorithm includes several logical branches, whose questions and outputs allow the refinement of the system analysis. An iterative questioning procedure guides the user in performing the problem analysis under different detail levels and focusing on the different stages of the system lifecycle, alike through the multi-screen logic of the System Operator. Such broad investigation allows to focus on the whole set of features concerning the technical system, including useful, insufficient and harmful effects, their operative time and space, evaluation and control parameters, involved resources, components hierarchies, process phases. After the problem formulation, the user is led towards the setting-out of a search in the databases of patents and scientific articles, thus getting a set of documents that broaden the knowledge domain viable to trigger the problem solving path.

The whole investigation is carried out without the use of TRIZ jargon, enabling even non-practitioners to follow the procedure, but allowing however to describe the system through TRIZ categories.

The functioning of the system is clarified through a dialogue excerpt from a real case study.

The proposed framework, together with the robustness of the algorithm and the time elapsed in the problem formulation procedure, has been tested by means of test cases carried out by students at the University of Florence and at Politecnico di Milano, representing a wide group of TRIZ beginners and real case studies in Italian SMEs, whose designers were not aware of any TRIZ technique.