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A BEHAVIOUR-BASED MAINTENANCE PREDICTION SYSTEM

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ABSTRACT

In the last years we have assisted to several and deep changes in industrial manufacturing. Many industrial processes are now automated in order to ensure the quality of production and to minimize costs. The industrial production becomes more complex, contributing to this a need for increased efficiency, greater flexibility, product quality and lower costs (Bansal, et al. 2004).
The maintenance process involves performing corrective and improvement actions during the selection and utilization of equipments, as well as proactive actions that are designated by preventive actions if the intervention is based on time or predictive actions if the intervention is based on the equipment state (Palmer 1999).
Manufacturing enterprises have been collecting and storing more and more current, detailed and accurate production relevant data. The data stores offer enormous potential as source of new knowledge, but the huge amount of data and its complexity far exceeds the ability to reduce and analyze data without the use of automated analysis techniques. Thus, in the late 80's emerged the area of Knowledge Discovery in Databases (KDD), using models and data mining techniques for extracting useful knowledge, patterns and tendencies previously unknown, in a autonomous and semiautomatic way (Apte, et al. 2002).
This work addresses an organizational architecture that integrates data gathered in factories on their activities of reactive, predictive and preventive maintenance. The research is intended to develop a decentralized predictive maintenance system based on data mining concepts. Predicting failures more accurately will enable taking appropriate measures to increase reliability.
The aim of the system to be developed is to integrate the occurrences of faults data in similar machines from different factories, creating a system of distributed databases which allows, using data mining, the prediction of failures in a way to perform timely interventions in equipment and consequently increase availability and productivity (Fig. 1).

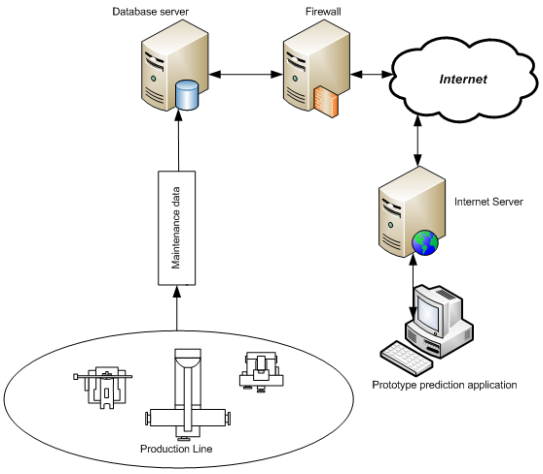

Figure 1: Project overview

The data collecting process has to be performed by agents, which will be responsible for adapting and transforming the information. Even when data on the factory floor is collected through maintenance operators (using a formalized internal registry, for example), this information has to be interpreted by software agents, to adapt and transform the data structures into a semantically viable knowledge base.
Data mining techniques will focus on data to discover implicit and hidden knowledge in order to generate predict patterns of behavior and events. The possibility of events occurrence will be provided through a prediction system for each plant. Data related to the intervention process, the used material, the consequences of non-intervention and scenario generation will be provided over the form of decision support system.
The global system will be based on three main processes, as shown in the Figure 2: data management

and communications (A1), knowledge prediction system (A2) and information summary and events generation (A3).

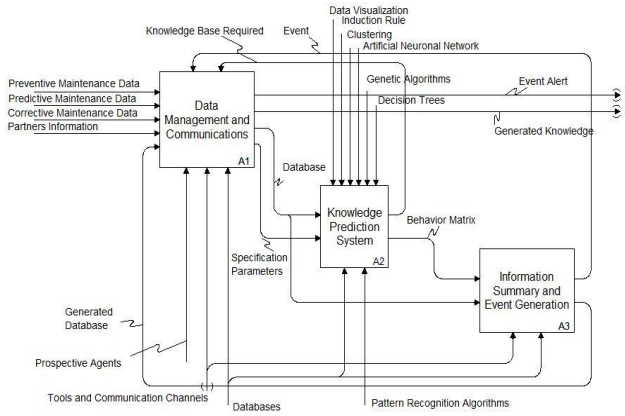

Figure 2: Main System in IDEF0 Format

The A1 activity will be responsible for data collection. The A2 activity is the main module of knowledge production and inference of behavior patterns related to each equipment of a factory unit. This activity will generate as an output a behavior matrix that will be the input of the information synthesis module and events generation (A3) which in turn use the resources of the A1 activity to generate events that consists in proactive failures notifications. This output function aims to advise the person responsible for maintenance in order to act over the equipment before malfunctioning.
The proposed system will help enterprises to collect, extract and create knowledge in order topredict with more accuracy the moment to realize maintenance actions and thus improve the productivity of manufacturing process. The innovative point of this system is the capability of collecting and treats data dispersed in different facilities that result from maintenance interventions in different environments.

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