Development of a Demonstrator Application for Model Based Weak Point Analysis of Bottling Plant

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Introduction

The LineMod - Project

The efficiency of today´s bottling plants is between 40 to 70 per cent (example fig. 1). In order to optimize the plants, downtime originating components should be identified automatically. For this reason the chair of Food Packaging Technology and the Chair of computer science IX of the Technische Universität München accomplished the research project LineMod from 2006 to 2008.
One result of LineMod was a structured database, that is based on the “Weihenstephan Standards”, a standard for production data acquisition of bottling plants. Their ontology was extended for usage of the database in all bottling and packaging plants in the food and brewery industries.
A second result was the development of model components, which stay not in context with the whole plant. It is possible with this components to model different plants by combining the components.
A consistency and a recursive algorithm were realized for analyzing the production data. Both of them gained a diagnosis performance of about 90 per cent.
A detailed information about the project is presented at the EBC 2009 in lecture L 42 by Tobias Voigt.
This poster presents the demonstrator application of the automatic weak point analysis of bottling plants. The demonstrator shows the opportunities of the new approach.

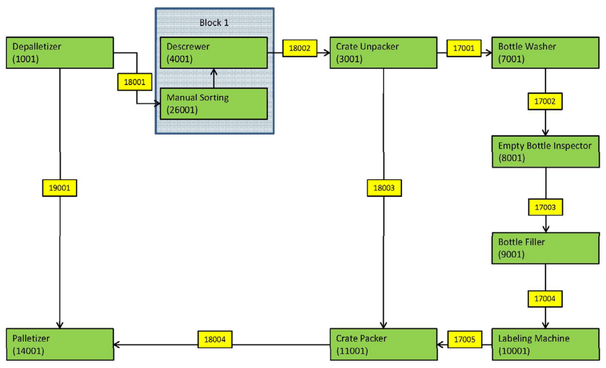

Figure 1: Bottling plant (schematic)

Demonstrator Application

Requirements

1. Example of the feasibility of the diagnosis function
2. Industry guidelines for using the project results in commercial products
3. Demonstration of the necessary steps for the automatic weak point analysis

Overview

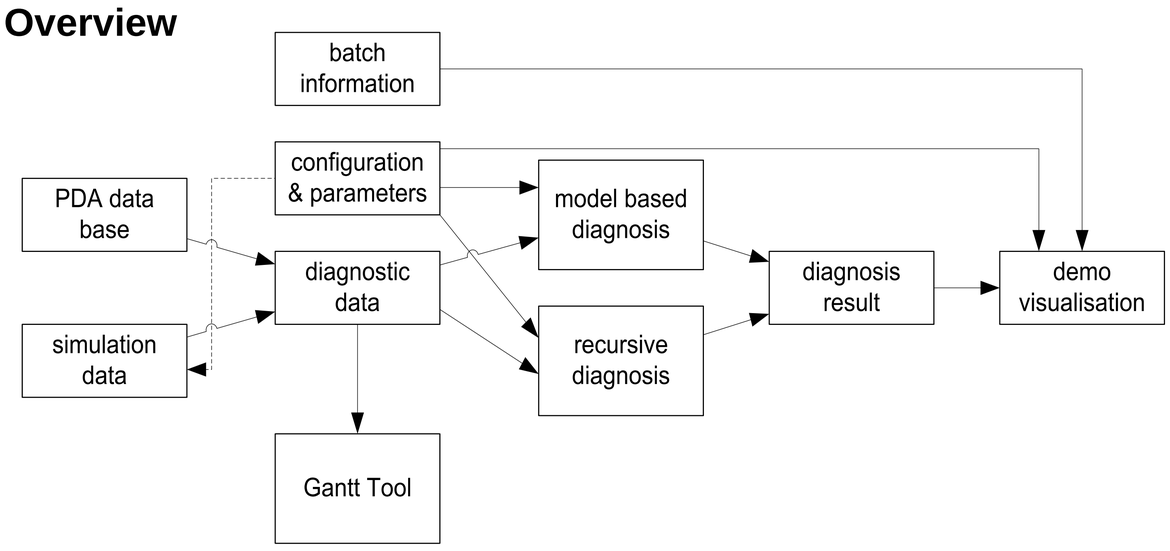

Figure 2: Elements of the demonstrator application

The elements of the demonstrator application are shown in figure 2. The *PDA data base* is a customized data base, that contains production data from the bottling plant. A standardized data base is required by the diagnosis algorithms: the *diagnostic data*. The diagnostic algorithm works with the *diagnostic data* and the information about the behavior of the bottling plant (in the fig. *configuration and parameter*).
The recursive and the consistency algorithm were developed in the LineMod project. Both of them localized downtime originating components with a performance of 90 per cent. The results of both algorithms are stored in the *diagnosis results*. The standardized behavior allows the interpretation of the results with the *demo visualization*.

Realization

The demonstrator application as shown in fig. 2 is already in use at a bottling plant of the Kulmbacher Brauerei AG (Fig. 1). At this plant it is possible to identify downtime originating components by analyzing the data base.

Steps to be done by the operator:
1. Generation of the *diagnostic data* (Fig. 3.1)
2. Choice of the analysis time
3. Start analysis (Fig 3.2)
4. Generation of the analyzing report with MS Excel (Fig. 3.3) (supported by VBA- program)

Figure 3.1: Gantt Chart of the diagnostic data

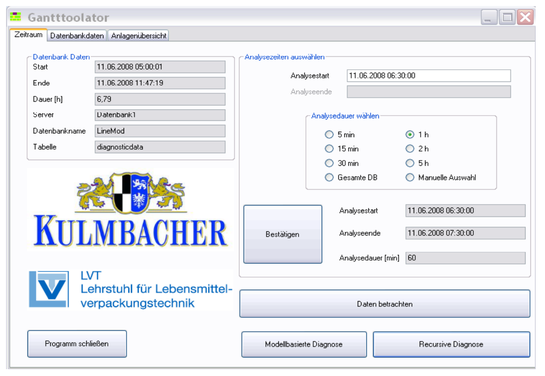

Figure 3.2: Analyzing-Interface

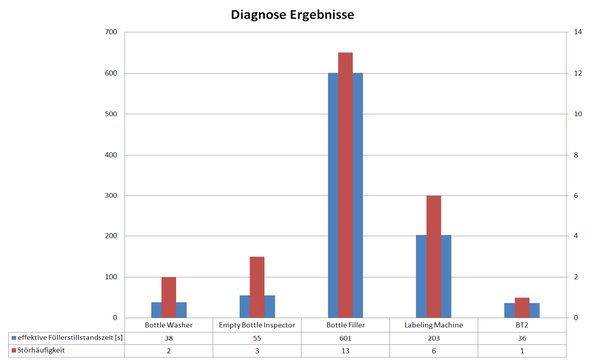

Figure 3.3: Diagnosis results

Perspective

The application meets the demands for the model based weak point analysis. The following steps are to be done to finally enhance the demonstrator to a commercial product:

1. The *diagnostic data* has to be built and analyzed automatically triggered by time.
2. The analyzing time has to be connected with batch or operating information for getting significant results.

Summary

The demonstrator application shows, that it is possible to find weak points in bottle plants with a good accuracy automatically. The realization, that was developed only in a laboratory style, is applicable in a real plant. The development of the demonstrator application helps directly to use the model based weak point analysis - algorithms in a commercial product.

In the future the demonstrator application will be extended for the research project “LineMet”. The new algorithm should localize failures in itemized machines. A second requirement is the connection of production information with the demo visualization to produce more significant results.

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