Mechatronik Trinational
Mécatronique Trinationale

2017

Analysis, Design and Implementation of a tractor parameter database

Erfahrungsbericht zur

Industriephase II (Stage II)

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Studiengang Mechatronik

Trinational

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Intial situation

CLAAS is a family business founded in 1913 and is one of the world's leading manufacturers of agricultural engineering equipment. The company, with corporate headquarters in Harsewinkel, Westphalia, is the European market leader in combine harvesters. CLAAS is the world leader in another large product group, self-propelled forage harvesters. CLAAS is also a top performer in world-wide agricultural engineering with tractors, agricultural balers and green harvesting machinery. The CLAAS product portfolio also includes state-of-the-art farming information technology. CLAAS employs 11,500 workers worldwide and reported a turnover of 3.8 billion euros in the financial year of 2015. (Source: http://www.claas-group.com).

Picture 1: Claas 930 Axion tractor (at exhibition hall / Harsewinkel plant)

For a new application, CLAAS needs a database to store tractor parameters. Preliminary the data had been analysed to find out how accurate they have to be. Then a dataset should be read and provided to another software module.

Method / procedure

To find a suitable way to handle the tractor parameters, the systems engineering approach, developed at the ETH Zurich and included in the Mechatronik Trinational program was used.

First of all the system had to be analysed, to understand where the information is found, where something can or needs to be changed and what can be unattended (System delimitation). Then the tasks were analysed and the objective catalogue was declared.

Solution variants / solution

The database should include all relevant tractor models. The generation of the database should be safe, easy and also depend on an existing Excel file. Other criteria are: Existing tools are preferred, there should be experience in the department and the database should have a low access time and little memory capacity.

The tractor database has to supply the tractor parameters to other modules. The right dataset should be selected, depending on the tractor configuration. This configuration is received via CAN-Bus.

After brainstorming, three possible concepts were found to handle the tractor parameters. To validate the concepts a balance of arguments was used, according to the objectives.

Concept	+	-
xml	- Generation with a macro out of an Excel file - No new program needed - Generation with a xml editor depending on Excel file - Easy to update - Low access time and little memory space needed - Already used in department	- Possible compatibility problems with Excel - New program needed
SQL	- Database creation depending on Excel file - No new program needed	- Complex to generate and update - High access time and more memory space needed - Experience on old platform
Hard coded	- Easy to implement into software modules - Low access time and little memory space needed	- No database - Complicated to administrate - Inflexible

Figure 2: Argument balance (pros and contras)

According to the balance of arguments, the Variation hard coded fits the fewest of the declared objectives, it is no database and therefore the administration process will be complicated and inflexible.

With SQL it is possible to create a new database depending on the tractor parameter Excel file. The creation of this database and as well the administration process will be more complex. There is experience in the department but on the old platform with C#, today C++ is used.

The concept that fits all declared objectives the best is the xml. It is easier to generate than the SQL concept and the department already has experiences in using and generating an xml with the new platform. Xml has also a low access time and little need of memory space.

As there are two possible variations to create the xml, it was decided do another validation of these variations.

Variation 1

Creating an xml structure using an xml-Editor and typing in all tractor parameters manually.

Variation 2

Programming a macro to create the xml automatically from the tractor parameter table.

Variation	+	-
Variation 1	- Easy and safe structure generation	- Manual parameter editing - Complicated to update - New program needed
Variation 2	- Once the macro is created, the parameters can be updated in the Excel file and the xml will be built - Easy to update - One program for administration and xml generation	- Complex to create the macro - No structure control

Figure 3: Concept variation validation

The reason why it was decided to do another validation of the two possible variations is, on one hand **Variation 1** has the benefit of a safe and easy structure generation, contrariwise to **Variation 2** and on the other hand **Variation 2** does not need a new program and is much easier to update in contrast to **Variation 1.**

The question now is, to find out, which of the two variations will be better.

The balance of arguments (Figure 2) shows that **Variation 2** will be much easier to administrate than **Variation 1**

There is also the possibility to equalize that there is no structure control with **Variation 2**. It is possible to copy and paste the structure into Visual Studio during the creation process to validate the structure.

So the final decision is to implement **Variation 2**, this variation has the biggest benefit and the administration process will be much easier than with **Variation 1.**

Outcome

With the resulting Excel file of the sensitivity analyses to find out how accurate the tractor parameters have to be, CLAAS has a tool for further analyses.

With the macro it is easy to administrate the tractor parameter database and directly create the xml. The software module which is getting the right dataset out of this xml database will be used in the series software.

Interesting aspects

Intercultural competences as well as language skills are nowadays needed everywhere. This second internship has shown to me, that the mechatronic trinational studies include the technical skills as well as the intercultural competences which are a big advantage.

Picture 2: Sven Saladin (exhibition hall at Harsewinkel plant)

How I got this internship

Agricultural machines always fascinated me, so I was looking for something in this business area. After some research in the internet I found the internship platform from CLAAS. As I already knew the company I applied on this platform for an internship. The internship was offered at the location of Harsewinkel (Germany), near Münster and Bielefeld.

Relation to the study program Mechatronik Trinational

In this Internship I was able to use all aspects of the Mechatronic trinational studies. I had to program and therefore understand the mechanical background. The intercultural competences were also very useful as CLAAS is an international company. Since CLAAS Tractor is manly located in France French skills are a big plus. I have actually done some translation from German into French, used for a user interface.

The whole studies prepare us to be able, to deal with intercultural and interdisciplinary differences.

Suggestions

If you are interested in something, be not afraid to look for an internship outside of the TriRhena region. In my case it was a great experience and I only can recommend to look after something you are interested in. Being a Swiss student (studying at the FHNW), I appreciated the international / European experience of an internship in Northern Germany.

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