Develop Sophisticated Engineering Software at the Start-Up Soley

Soley is a software spin-off at the Institute of Product Development (faculty of mechanical engineering) at TUM. We develop modeling- and data-analytics-software that is specifically targeted at engineering applications. Areas of application include product management, variant management, strategic planning, product architecture design and mechatronic simulation.

Our technology is based on an efficient graph representation that is used to model and visualize engineering systems. Furthermore, we use graph transformation to formalize expert knowledge in work flows. In this way, also non-experts are able to execute these workflows to perform complex graphs analyses, search for graph patterns and to perform any other graph manipulation.

Currently we develop and distribute two solutions as desktop applications:

**Soley Studio** is the environment for experts who develop workflows for data-analysis-, data-visualization and data-processing.

**Soley Desk** is the solution for non-expert users. It contains the workflows for one very specific application that were developed and formalized by workflow experts in Soley Studio.

Our solutions are developed based on the .NET technology stack (C# 6.0, .NET 4.5, WPF, XAML) and are successfully applied in academia (such as TUM’s Collaborative Research Center SFB 768) but also in industry (such as BMW, Festo, HILTI, MAN, Siemens, Tetrapak).
For the upcoming winter semester, we offer the following topics which can be adapted depending on your skills and interest:

- **Develop a graphical workflow editor**: Engineers often have to perform many different steps to perform their data analytics to tasks. We provide them with a tool that allows them to formalize and automate these steps. Help us improve this tool and make it even more user friendly and accessible!

- **Develop an app-store and marketplace for Soley apps**: Soley Studio can be used to create data analytics apps for engineering applications like product configuration, variant management or even the modeling wire harnesses. Such apps can be consumed by other engineers in Soley Desk. This project aims at developing an online platform where engineers can distribute these apps to other engineers and provide training materials for the respective areas of application. Project for a team of 2-3 students.

- **Design of an intelligent development environment for graph transformation systems**: The users of Soley Studio are engineers not software developers. This project aims at providing state-of-the-art development support features targeted to this special audience group. Common feature like auto-completion, refactoring or syntax checking should be adapted to special requirements for engineering applications.

- **High-performance graph visualization of engineering systems**: Within this project, our current graph visualization library should be analyzed with regard to optimization potential but also new solutions should, e.g. using OpenGL, should be studied and possibly realized. We have special requirements from the domain of mechanical engineering, e. g. from Model-Based Systems Engineering, that are to be considered in particular.

- **Integration of additional data analytics frameworks (Python, R, F#, etc.)**: To improve our data analytics solutions, this project aims at extending the data analytics capabilities by interfacing with third-party libraries/frameworks/languages. As an initial step we want to look in particular at analytics libraries for engineering applications, like the DEoptimR library for R.

- **Development of a compiler for our graph transformation language**: Our current compiler is Java-based and derived from a third-party project. It should be re-implemented and improved for .NET using Roslyn. Project for a team of 2-3 students.

- **Debugger for graph transformation workflows**: In order to support the creation of workflows in Soley Studio, debugging features are to be developed as they can be found in other modern IDEs. For this project it is important to bear in mind that our users are not classical software developers but mechanical engineers who have little experience in coding and need more assistance in programming.

- **Continuous integration**: Continuous production processes are designed in the engineering domain for decades. Many principles can be derived from Lean Production and Lean Development approaches. We want to apply some of these concepts to our current software development environment (based on Team Foundation Server and Visual Studio) as well as to our software development processes. By that, we want to achieve continuous performance measures, assessments of code quality, automated testing/deployment and configuration management.

- **UI-testing and UI-improvement**: This project should provide answers of how we could integrate continuous UI-Testing and UI-Improvement in our development activities. Current technologies and approaches should be reviewed as well as specific improvement suggestions should be elaborated. The group of users we are targeting are engineers who are already biased by existing tools like Matlab or CAD-tools.

- **Graph transformation as a service**: Currently, our solutions are desktop-only applications. Although the desktop is still the main working environment for engineers, more and more solutions tend to become cloud solutions, like Autodesk 360 or Simscale. The goal of this project is
to develop the software architecture that resource-intensive workflows can be offered as engineering application on the cloud.

- **Extraction and import of web data:** Web services such as import.io provide powerful, multi-purpose data sources. We would like to provide them as data sources to our workflow development solution Soley Studio.

Throughout the project, you will gain knowledge and experience in the challenges of the development of B2B-software in the context of engineering software within a start-up company. Further, insights will be acquired into our professional development based on TFS. To ensure the project process and to convey the required knowledge and information, regular project meetings will be scheduled.

If you have any further questions or want to discuss potential project topics, please feel free to get in touch. Please send your application (including CV and transcript of records) to Peter Grüner (gruener@soley.io).