USABILITY IMPROVEMENTS OF THE THERMIPIG MODEL FOR PRECISION PIG FARMING

Who did the research?

AUTHORS

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What is the reason behind the research?

CONTEXT

Pig livestock farming systems encounter several **economic** and **environmental challenges**, connected with **meat price decrease**, **sanitary norms**, **emissions** etc. To deal with these issues, methods and models to assess the performance of a pig production system have been developed. Pig farms can be found everywhere in Europe, but in each country different types of building and management rules can be applied. As well climatic conditions vary from country to country. All these factors influence the performance and welfare of the pigs and more generally the multiple performances of the pig fattening unit. **Accurate definition of the wide panel of local situations requires collection of precise information** on climate, barn characteristics, indoor management rules, type of pigs and feeding strategies. Afterwards a modelling approach can be used to simulate and predict pig growth and behaviour as well as the behaviour of the fattening unit system through a representation of interactions among its components. **There are several models available** to simulate the growth performance of the pigs, **but none of them deal with the interaction with ambient conditions**.

What was the objective?

OBJECTIVE

The objective of this research was to **propose usability improvements** in the form of **data gathering and analysis modules** for our previously proposed Thermipig model. The Thermipig model is of a **multi-object type**, **mechanistic**, **dynamic**, **deterministic** and **pig centered**, and combines growth model proposed by Cadéro *et al.* in 2018 and bioclimatic model proposed by Marcon *et al.* in 2016.

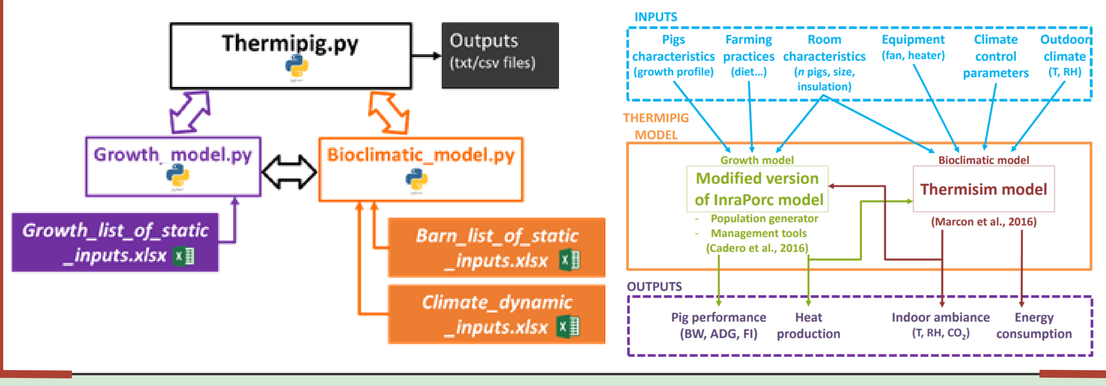
What methods did we apply?

METHODS

The Thermipig model is written in **Python language** and several additional Python modules and Excel files are used to run the overall model. To achieve the objective extensions to data warehouse were implemented to incorporate Thermipig model as external data source and replace its original need for Excel files as the only input. Usability improvements in the form of Web interface for Data Warehouse (DW) were developed in **Angular** and **Bootstrap** (front-end) and **Java 8**, **Spring Boot** and **MongoDB** (back-end).

What is Thermipig model?

THERMIPIG MODEL



What improvements are needed?

LIMITATIONS

There are many disadvantages of using the Excel files for variable input. Firstly, the user is required to have the corresponding software, which is not free. Secondly, it is fastidious to input a lot of information when all the fields are difficult to observe simultaneously. In addition, the Excel files can be accidentally lost or deleted when they are stored on a local computer. Another challenge is to maintain and organise all the files in order to store and process the data describing multiple and different samples.

What are the improvements we implemented?

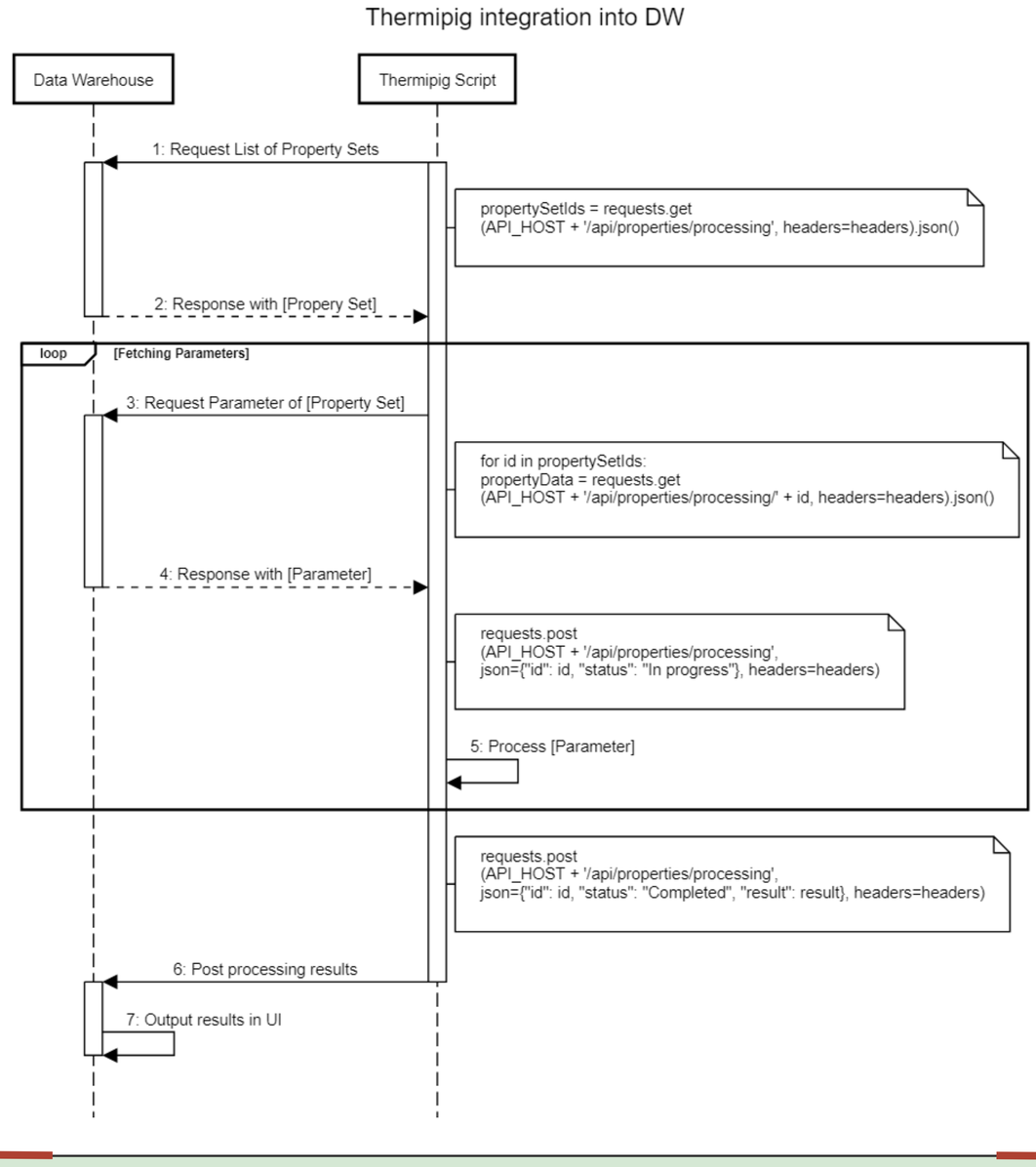
IMPROVEMENTS

Thermipig model was initially developed using Excel files for input variables. Then Python script used the Excel file, processed it by the rows and columns and assigned local Python variables to values defined in each specific cell in the Excel file. In this case, it was needed to use an additional library to ease the processing of the Excel files, like xlrd library. In the modified procedure Thermipig **model is directly getting the input values from the remote Data Warehouse.** Data warehouse (DW) is considered as a cloud-based data storage and processing unit with capabilities to combine unlimited data sources like other existing systems and available on-farm generated data. The developed data warehouse follows best practices in distributed and asynchronous data processing by utilizing multi-agent techniques in conjunction with real-time data warehousing approach. After the Thermipig model executes and makes calculations and simulations, its outputs are transferred directly to the remote data warehouse and are available in user interface. There are different outputs from the Thermipig model. One output set is related to the individual pig's performance including age, body weight, average daily gain, feed intake, protein and lipid content and deposition and mineral (N, P) retention and excretion. The other set is related to room ambient conditions including hourly temperature, ventilation and heating rates and energy consumption, hourly relative humidity and CO_2

Want to see the integration script?

Yes, please!

THERMIPIG MODEL INTEGRATION INTO DATA WAREHOUSE



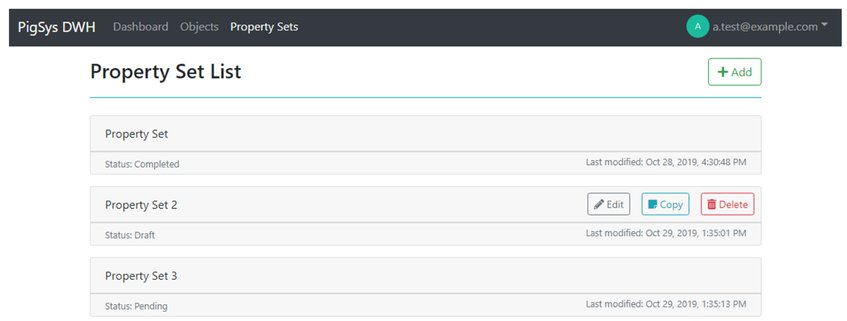
THERMIPIG MODEL INTEGRATION INTO DATA WAREHOUSE

No, thanks!

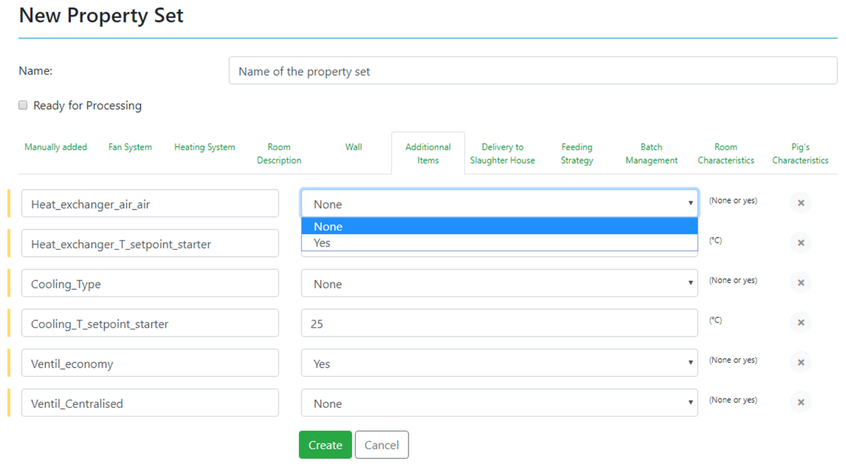
How can we setup input parameters?

USER INTERFACE

The DW system is extended with 'Property Sets' section dealing with all the operations which can be performed to a set of input variables. Each system user can define multiple property sets, copy and delete them, edit the drafts and see the results of the modelling performed upon property set (the ones that have been processed by the Thermipig model):



All variable inputs are divided into groups to ease the process of filling the data and make it more organized. It is possible to either add properties one by one manually or add predefined sets of static properties and their default values automatically. To make the input process as easy as possible, inputs that can only have predefined values are represented by list boxes:



To make the property set available for the Thermipig model to process, the user must check 'Ready for processing' changing status from 'Draft' to 'Pending'. Once the property set is saved with the status 'Pending' it becomes read-only and is processed by the model during next computation session. For usability purposes, when users want to define some other practices, such as the feeding strategy, the type of pig and/or regulation rules in a given room, a copying function for all property sets, including pending and completed, is available.

Any conclusions?

CONCLUSIONS

- Developed data warehouse is a **universal system** as it allows connectivity to different multiple external systems, each of which can produce different data aimed for various livestock of PLF branches.
- Presently, the data warehouse system and external Thermipig model are located in different geographical locations. Model is processed in France, and inputs and outputs stored in Latvia.
- Implementation of the user-friendly web interface for variable input increases the usability of the Thermipig model and eases the input process.

We would like to acknowledge

ACKNOWLEDGEMENT

Scientific research, publication and presentation are supported by the ERA-Net SusAn Project „Improving pig system performance through a whole system approach (PigSys - 2817ERA08D)" funded by the Latvian State Education Development Agency, subordinated to the Ministry of Education and Science and by the French ANR (grant n°ANR-16-SUSN-0003-02).