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FAKULTÄT II Nachwuchsforschergruppe CASCADE USE

AN ARCHITECTURE FOR AUTOMOTIVE RECYCLING DECISION SUPPORT

INTRODUCTION

Scarce and valuable resources, including potentially hazardous materials, are increasingly present in end–of–life (EOL) vehicles. There is a substantial knowledge gap between stakeholders in the EOL phase of vehicles. Consumers are generally unaware of the material composition of their vehicle and its components, while recyclers and dismantlers are faced with problems when deciding whether to dismantle a part or recycle it. The key decisions which are common between all stakeholders are material value, disassembly costs, reuse potential, legal compliance and environmental impact.

This study investigates the requirements of stakeholders with the goal of creating an open–source decision support tool based on a conceptual framework for data aggregation between the varied recycling data sources. The heterogeneity of these data sources and limited access raises interesting questions in how they could be effectively used to support decision making.

KEY RESEARCH QUESTIONS

The key research questions posed in this study are:

1. What are the key requirements for decision making when recycling automobiles with regards to material value, disassembly cost, reuse potential and legislation compliance?
2. How readily available, complete and accurate are recycling data sources and databases to support decision making?
3. How can the heterogeneous data sources and databases identified be consolidated while providing data quality management to minimise and report on data defects?
4. How can the requirements of the recycling industry be realised using the identified knowledge systems and databases through a software architecture?

PROPOSED ARCHITECTURE

The high–level architecture posed for this study is shown in Figure 1, with detailed architectural considerations shown in Figure 2. Web services are used as wrappers for individual data sources to ensure reusability of the services and continuous access. A data warehouse is used to capture query information for cached responses to the logic and presentation layers.

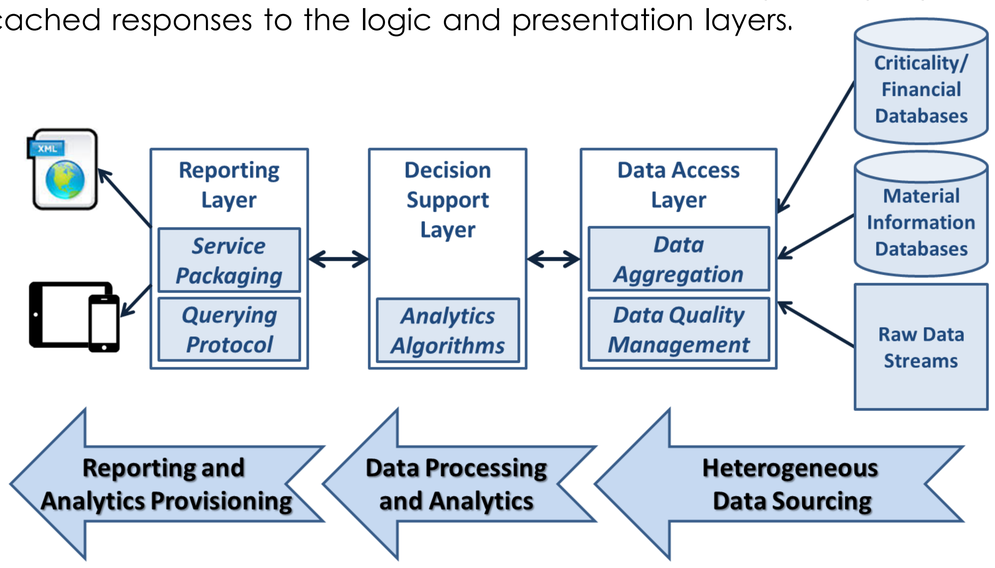

Figure 1: Overview of data flows for decision and reporting tool

MANAGING DATA SOURCES

When analyzing the available data sources, numerous requirements appear for relevant queries to be produced (Fig 2), such as:

- → Car environmental impact (environmental sources)
- → Car/component/material costs (cost information from each, with hierarchical calculations)
- → Car/component material value and contents (material information and composition information)
- → Whether to recycle a part or rather aim to sell it (market price versus material price)
- → To obtain an overview of the criticality of materials in a car or component (element information and composition)
- → Component hierarchies and bills of materials in components and cars (all levels with mapping services)

The above queries are examples of typical questions posed by consumers, recyclers and other stakeholders. These requirements are then realised in the form of the decision tool which is implemented to provide dynamic information provisioning.
Data aggregation from heterogeneous sources and mapping remains the largest challenge due to limited OEM data. The other main challenge lies in data availability and completeness for material costs, information, component details and environmental impacts

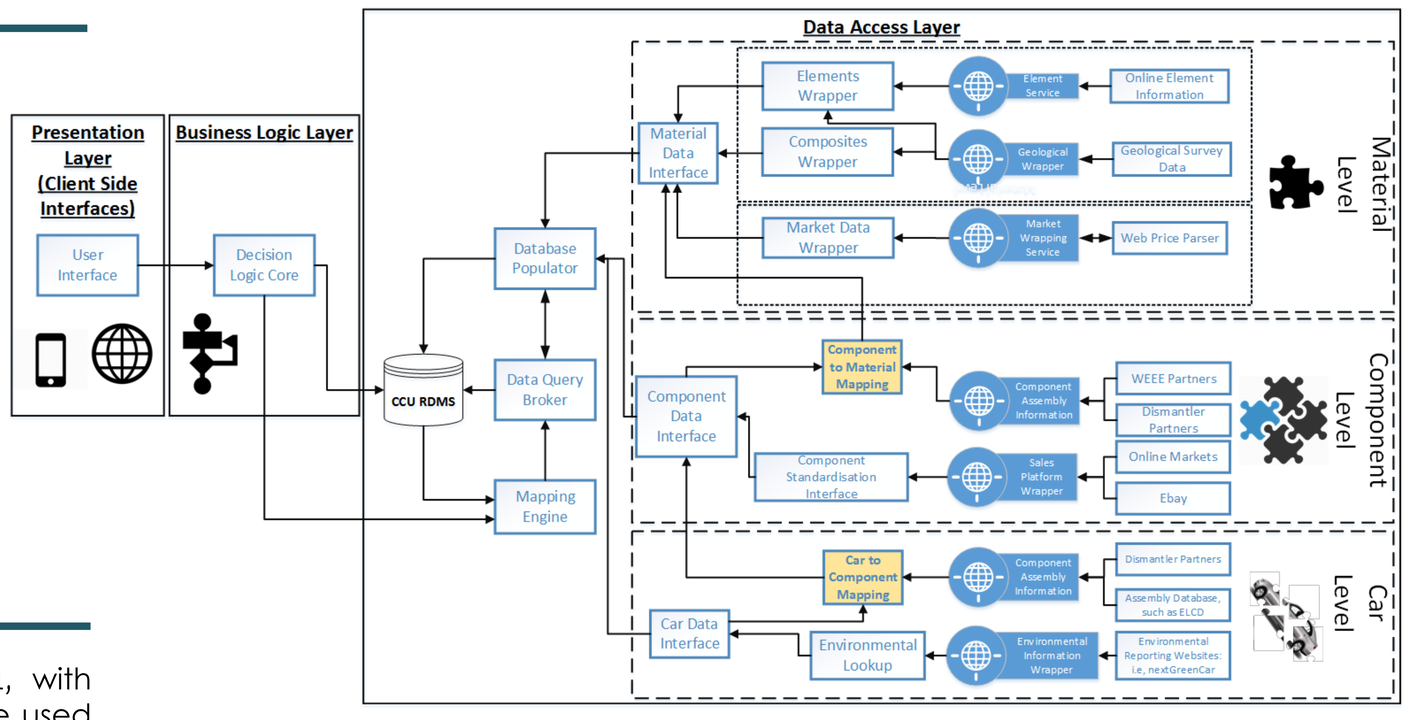

Figure 2: Detailed overview of service framework for decision and reporting tool

CURRENT STATUS

The current status of this study focuses on data acquisition for composition of cars and components. Data sources are transformed into accessible web services after assessing the relevance and quality of the data source as a website, document repository, existing service or data set. In this phase, the set of services is expanded as broadly as possible before technical implementation and further evaluation from stakeholders begins.

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