A Web-based Platform for Mass Customization

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Design of the Web-based Platform - Architecture

**Web framework responsible for:**

- Design
- Supervision
- Planning
- Distribution

**Production Phases**

- Network Infrastructure
- User Adaptation
- Decentralized Manufacturing

**End User**

**Actor Specific GUIs**

- Request Processing
- VR/AR Module
- Database Instance
- Database Instance
- Web Server
- Security
- Authentication
- Request
- Response
- Manufacturing Environmental Impact
- Feasibility/Availability, Cost, Updates, Supply Strategies, Production Schemes
- Customer Information/Selections, Customized Product
- Environmental Impact

**Database Instance**

- Alternatives Generation Module
- Decision Module
- Production Evaluation Module
- Environmental Assessment

Design of the Web-based Platform - Overview

"modular architecture"

Customer, OEM, Supplier, Dealer

Graphical User Interfaces

User Design Module

Decentralized Manufacturing Planning Module

Environmental Impact Module

VR / AR Module

Data Level

Material

Process

Resource

Facilities

Product

(e-CUSTOM (260067) – Description of Work)
### Design of the Web-based Platform - User Involvement in Product customization

- **Different interfaces** to different actors - level of expertise
- **Provision of sets of functionalities** according to the end user’s needs
- **Modularity**

<table>
<thead>
<tr>
<th>Customized Interfaces</th>
<th>Web-platform</th>
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<tbody>
<tr>
<td>HTML view</td>
<td>Designing, Ordering, Commenting</td>
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<td>WML view</td>
<td>Planning, Manufacturing, Production, Monitoring</td>
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<td>JFC/Swing view</td>
<td>Simple Functionalities</td>
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<td>XML-based Web service</td>
<td>Advanced Functionalities</td>
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<table>
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<tr>
<th>Actors</th>
<th>Novice Users</th>
<th>Expert Users</th>
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<td>Web Customer</td>
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<td>OEM</td>
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<tr>
<td>Wireless Customer</td>
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<td>Supplier B2B Agent</td>
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<tr>
<td>OEM</td>
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<td>Supplier B2B Agent</td>
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</tbody>
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- **Enablers**
  - Java Programming Framework
  - Model-View-Controller (MVC) Architectural Pattern
  - Struts, Hibernate, Tiles etc.

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The involvement of the customer in the design of a new product is aided by:

- **Virtual Reality (VR)**
- **Augmented Reality (AR)**

**Enablers**

- Immersive Visualization at specific sites
- **AR product visualization** using a PC and a webcam
- **3D product manipulation** inside a browser, through straightforward commands (pan, zoom, rotate)
Virtual Reality Features

“supporting the customer involvement in the initial design of products”

3D editing tool embedded inside the browser

Immersive VR visualization

(e-CUSTOM (260067) – Description of Work)
Augmented Reality Features

- The customers have the ability to print the AR marker and visualize the product at their computer screen, using just a webcam.

- AR visualization through smartphones / tablets, using free and open source applications.

(Working paper: Mourtzis D. and Doukas M., “A web-based virtual and augmented reality platform for supporting the design of personalized products”, 45th CIRP CMS 2012)
e-CUSTOM - A Typical Scenario

1.1. OEM

- Defines customizable options
- Creates new concept designs

1.2. Customer

- Orders customized product
- Leaves feedback about concept designs

2. OEM

- Receives feedback, order
- Produces customized product
- Updates concept designs

3. Customer

- Receives finished product

(e-CUSTOM (260067) – Description of Work)
e-CUSTOM Web-based Platform - Supporting the Planning of Decentralized production networks

- Creation of Bill of Materials and Bill of Processes for customized products
- Efficient production / supply schemes generation
- Dispersed production and assembly
- Coordination of the supply and production network

(e-CUSTOM (260067) – Description of Work)
e-CUSTOM Web-based Platform – Environmental Assessment

Customized Order → Environmental Simulation

Environmental Impact of Customized Product → Environmental Impact

Legislation, Emissions, Energy

(e-CUSTOM (260067) – Description of Work)
Software Design of the Web-based Platform

Identification of Workflow Commonalities

Automotive Scenario Workflow Analysis

Healthcare Scenario Workflow Analysis

Generic Scenario Workflow

Generic Data Model

Domain independent solution

Generic Interfaces

Domain 1

Domain 2

Domain n

“towards a domain independent solution”

(e-CUSTOM (260067) – Deliverable 2.1)
Software Design of the Web-based Platform

User-friendly Graphical User Interfaces (GUIs)

"workflow visualisation"

(e-CUSTOM (260067) - Deliverable 2.2)
Software Design of the Web-based Platform

- **Entity Relationship Diagrams (ERD)**
- **Unified Modelling Language (UML)**
  - Use Case Diagrams
  - Sequence Diagrams
  - Class Diagrams
Software Development Tools

- **Service-oriented Architecture (SoA)**
  - Modular and autonomous solutions
  - Interoperable services
  - Platform independent applications
  - Reusable

![Diagram of software development process](image)

- **Database Implementation**
  - Oracle 9i
  - Oracle SQL Data modeller V3.0

- **Web Server**
  - Apache Tomcat v7.0.19

- **Revision Control**
  - Apache Subversion SVN v1.6.17

- **Web platform Design and Implementation**

- **Integrated Development Environment**
  - Eclipse Helios J2EE SR2

- **Software Design**
  - IBM Rational Architect v8.0.2
  - UML Diagrams:
    - Use case
    - Activity
    - Sequence
    - Class

- **Programming Languages**
  - Java
  - Javascript
  - JSP
  - XML
  - HTML

- **Frameworks**
  - Struts
  - Hibernate
  - Tiles

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Software Development Status

- **Current status of software development:**

  - Requirements Extraction
  - Requirements Formalization
  - **Software design** using Unified Modelling Language (UML) diagrams
  - Software implementation
    - First prototype
    - Testing
  - Integration
Software Development Status – Automotive Industrial Case

(e-CUSTOM (260067) – Deliverable 2.3a)
Software Development Status – Healthcare Industrial Case

(e-CUSTOM (260067) – Deliverable 2.3a)
For more information please visit the e-CUSTOM project portal at the following link:

http://www.ecustom-project.eu/

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