Improvement of material selection for plastic parts

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The assignment covers the improvement of the material selection for plastic parts, this is done by designing, prototyping and analyzing a design aid that helps the user to select materials.

Background

SIL Products focuses on the development of good consumer electronics for a fair price. Thereby Sil Products aim is that a good-looking product should not necessarily be expensive, with the use of good design a low-price product can appear high end. This focus leads to a specific material selection for injection molded plastics. The selected material should not only fulfill the technical requirements, the product must also appear luxurious due to the selected material. Until now SIL products has not found a tool, method or application for material selection that considers material appearance elaborately.

For a new product development, designers and developers need to determine a suitable material for the project. The selected material must fulfill the requirements resulting from the demands of different stakeholders or the requirements resulting from analyses. The material selection can be done with the use of a selection tool or with the use of rough estimates and past experiences. Until now there was no selection method that considered appearance of the material thoroughly. The design aid supplies the needed insight in material specifications that contribute to the sensation of quality and luxury for consumers such as surface finish, surface quality and color. At the same time, it eases the material selection process for the development team. The improved material selection process can be relevant due to the decreased sampling costs since less sampling iterations are needed and material exploration possibilities are extended. Eventually final product quality can be improved thanks to a proper material selection.

The aim of this assignment is to improve the material selection process for plastic parts. This is done by evaluating the result of the design aid by means of the research question: "To what extend is it feasible to optimize the selection of material and production process for a new plastic product part?". Note that the aim of the assignment is to assess the potential of a conceptual material selection tool. A detailed development and building a functional design aid is out of the scope of the assignment.

Approach

To test the concept of this easy to use material selection tool a mock-up prototype is developed. With the use of this prototype first user tests were performed to prove the potency of the design aid. Subsequently the results of the user tests are used for the redesign of the concept. The user test showed that the design aid was considered user-friendly and was valued as a potential alternative for other material selection tools.

Results & limitations

The design aid is a material selector as no other. It offers a streamlined focused functionality and it only considers thermoplastics relevant for injection molding. With the use of material characteristic filters, templates and visualization the selection process can progress fast and fluently. All is presented in a fresh

and serene environment creating a proper insight in the process and leading the users to their goals. The design aid is developed considering optimal cognitive ergonomics, using direct feedback to reduce overload of working memory and limiting the number of elements to keep all information comprehensible.

The user starts at the home screen to navigate to the different functionalities of the design aid (see Figure A). From there on the user can choose amongst others to determine their presets (see Figure B) or to browse and select for a suiting material (see Figure C). If the user has made a material selection, a report of the selection process is made (see Figure D). This report clarifies the material selections for stakeholders that are less involved in the process.

Conclusions & Recommendations

The design aid can be considered as a helpful tool for material selection that optimizes the selection process. The analyses lead to an insight in the material selection process combined with the user test. This assignment showed the potency of the design aid. Resulting from this assignment a concept material selection tool is now available for SIL product. This concept can be used for the development of the design aid. Recommended is to continue the development of the design aid and the design aid should be introduced to the market as an alpha version, from there on the design aid could be tested and improved thoroughly.

SIL products

| New project | Load project | Preset | Settings |

Figure A Home screen of design aid, used for navigation

New project | Load project | Preset | Settings

Appearance preset

Insert name...

Structure

Coating ☐ Yes ☑ No

Shape

Color

Character

Create Preset

Presets
Sophisticates
Classic
Modern
Vintage
Rough
Cold
Warm
New
In
Integer

Confidential

Selection Specifics
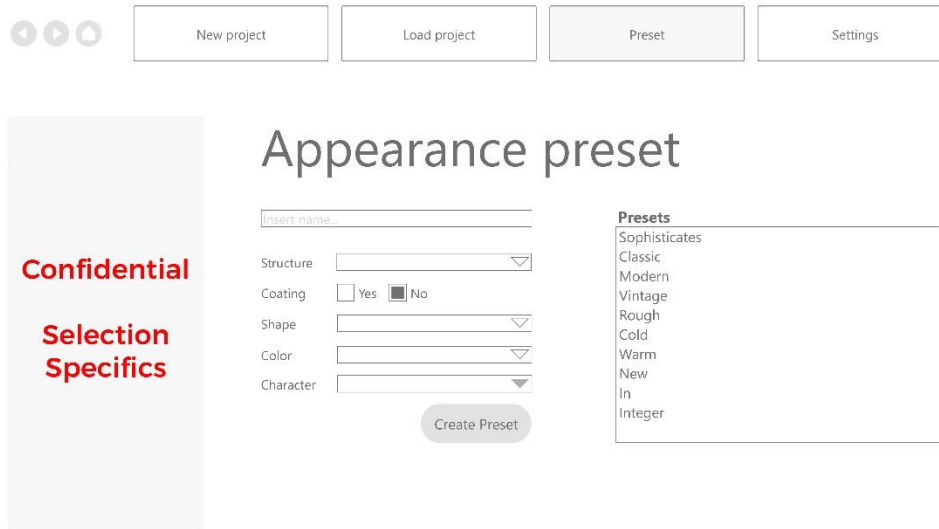
Figure B Preset screen, used for creating presets

Compose Report

Type Project Name Here....

Confidential

Selection Method

ABS
Price $
Mechanical ⚡
Appearance 👁 👁

Meldin
Price $ $
Mechanical ⚡
Appearance 👁 👁

Nylon fabric
Price $ $
Mechanical
Appearance 👁 👁

PET
Price $
Mechanical ⚡ ⚡
Appearance 👁

Phenolic
Price $ $
Mechanical
Appearance 👁 👁

Polysulfone
Price $ $ $
Mechanical
Appearance 👁

PDVF
Price $ $ $
Mechanical
Appearance 👁

Radel
Price $ $ $
Mechanical ⚡ ⚡
Appearance 👁

HDPE
Price $
Mechanical ⚡ ⚡ ⚡
Appearance 👁 👁

PEEK
Price $ $ $
Mechanical ⚡ ⚡ ⚡
Appearance 👁 👁

Nylon
Price $ $
Mechanical ⚡ ⚡
Appearance 👁 👁

PP
Price $
Mechanical ⚡
Appearance

Calezole PBI

Material

Material

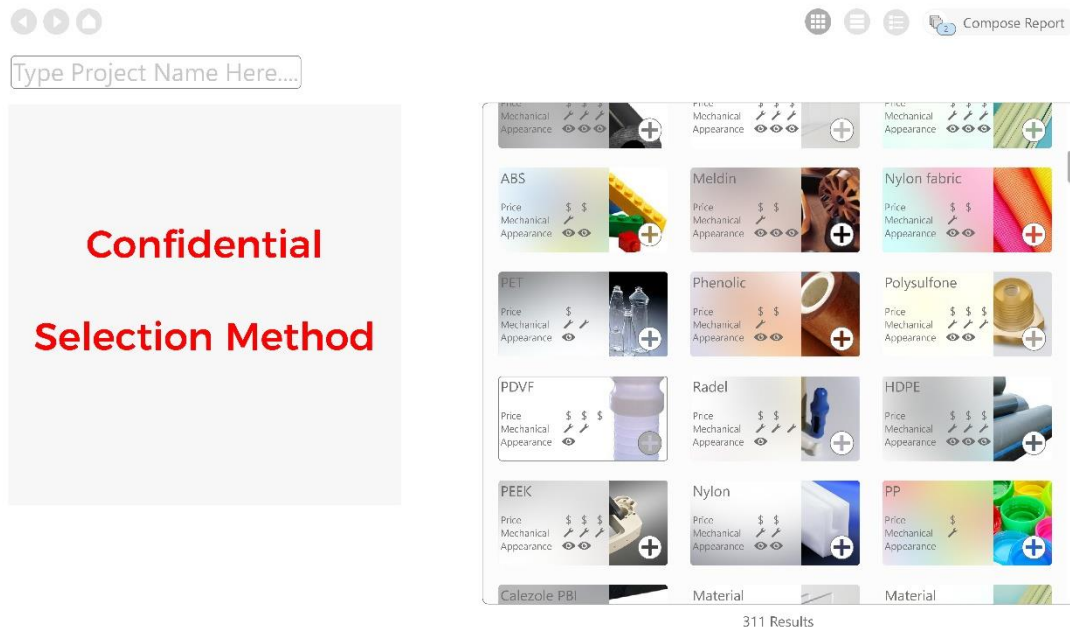311 Results

Figure C Material selection/browsing screen, used to select materials for a project

Report

- Suiting materials
- Celazole PBI
- Laminate G-11 Glass Epoxy
- PEEK bearing grade
- PVDF
- Export as PDF

Suiting materials
Celazole® PBI
Laminate G-11 Glass Epoxy
PEEK bearing grade
PVDF

Tensile Elongation, ASTM D638, %
Izod Impact strength (73 F) ASTM D256 (notched), ft*lbs/in
Flexural strength, Yield ASTM D790, psi
Flexural modulus ASTM D790, psi
Compressive Strength, Yield ASTM D695, psi
Coefficient of linear thermal expansion ASTM D696, in/in/F
Flammability UL 94
Surface resisitivity ASTM D257, ohm/cm
Water Absorption - 24hrs ASTM D570, %

1.30 x 10-5	0.72 x 10-5	0.31 x 10-5	7.10 x 10-5
V-0	HB		V-0
>1013			5 x 1014
0.4	0.2		<0.04

Celazole® PBI

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Phasellus nec orci ut lectus efficitur ullamcorper. Aenean sit amet suscipit tortor, eu fringilla eros. Vestibulum placerat malesuada mauris, et consequat lacus rhoncus quis. Donec nunc ante sed nibh sodales, nec hendrerit velit posuere. Vivamus massa diam, laoreet interdum sapien eu, egestas sagittis neque. Suspendisse nec leo cursus, molestie erat ut, rutrum nisl. Donec at nibh eu nisl cursus accumsan a ac nisl. Aliquam tincidunt pretium nisi, nec pharetra urna fermentum vitae. Cras sit amet orci sit amet ante hendrerit interdum.

Figure D Report screen, used for making and exporting a report