








Articulating Socially Aware Design Artifacts and User Stories in the Conception of the OpenDesign Platform

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Abstract: Gathering and understanding requirements and features in a system play a central role in its acceptance and proper use. Unconventional systems involving uncertainties about their requirements demand methods that adequately support the capture of stakeholder's needs, desires and objectives. The OpenDesign project aims at supporting the design of computational solutions to wide-ranging problems under a holistic and socially-aware perspective through an open and collaborative platform. Designing this platform with a proper understanding of the desired features is for sure a hard task. In this paper, we investigate and characterize an ideation process to be used in situations involving uncertainties about requirements, as experienced in the OpenDesign Project. This process involves the collaborative construction of user stories, articulated with Socially Aware Design artifacts, created through participatory practices, as part of the platform design and prospection of potential uses of it. Based on the results, we organize the core concepts permeating the OpenDesign proposal, expressed in a map synthesizing its features.


1 INTRODUCTION


In recent years, the unwanted impacts computer systems can have on economic, ethical, political, and societal issues have become more evident. Several cases reported in international and national media illustrate these impacts, such as the Volkswagen Scandal, one of the largest auto companies, which admitted in 2015 (with deployment to date) to have developed software that alters pollutant emissions results (G1, 2015). In the Brazilian context, the eSocial platform was also criticized by renowned Brazilian researchers, highlighting what he called “gross errors”, such as not considering zip codes, email address format, and even worrying with the level of computer proficiency on the part of potential users (G1, 2019). Such problems


seem to stem from a software development view that does not privilege the social world in which solutions are used and make sense; that is, a view that does not consider software development as a socio-technical activity. Such a diagnosis was already point out in the area of industrial design since the 1970s by Papanek (Papanek, 1971), who highlighted the impacts caused by a culture driven by economic and technical issues while neglecting the social context of design, the intended audience and society in general.


In this sense, open-source communities sometimes excel at creating quality software products, emerging from their philosophy, governance and participation. The phenomenon of open-source distributed development has drawn the attention of the scientific community to ways in which open source communities articulate themselves. However, literature does not reports about extensive community efforts similar to open-source in the design of interactive systems, as activities preceding code development itself, such as clarifying the design problem and proposing alternative solutions.


The OpenDesign Project (Baranauskas, 2017) is situated in this context, which stems from the ab-


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sence of open environments for software system design that involves stakeholders with a socio-technical perspective, and integrates various artifacts, methods, guidelines, and tools to support different stages of a project. OpenDesign is based on principles associated with agile (Beck et al., 2001) and lean (Poppendieck and Poppendieck, 2003) methods of software development, as well as open-source movements. The aim is to obtain open collaboration, egalitarianism, meritocracy and self-organization. Additionally, the project is based on theories, practices and methods of Organizational Semiotics (Liu and Li, 2014), Universal Design (Connell et al., 1997), and Participatory Design (Muller et al., 1997). In general, OpenDesign aims to provide an approach and software platform to support the design of computational solutions in a systemic and socially conscious view, starting from the initial activities of understanding the problem and proposing solution ideas.

Existing literature lacks studies in the direction of our investigation. Boisseau et al. (2018) presented a literature review related to the concept of open-design. Although it contributes to disseminate the open approach, their work emphasized product design. Our work presents further concerns related to technology design and our approach to design includes addressing early problem clarification steps. Investigations have described the benefits of participatory practices and user stories in software development. Kautz (2011) presented an exploratory study to assess user participation in agile software development projects. Lucassen et al. (2016) studied the perceived effectiveness of user stories by showing benefits in employing user stories in everyday work environment.

This work contributes to the early stages of the ‘open’ process for system design. In this paper, we propose: (1) a meta-design template to support OpenDesign practices, and (2) a process template for requirements clarification. First, the concept of OpenDesign was clarified in a collaborative dynamic with the following artifacts of Socially Aware Design: Stakeholders Diagram (SD), Evaluation Frame (EF), and Semiotic Framework (SF). In the following, we conducted the clarification, creation and prioritization of user stories for the OpenDesign platform. The process featured a practice inspired by Participatory Design and resulted in a set of user stories from various stakeholders involved in the process. Based on user stories, a concept map was collaboratively built by organizing feature groups for the platform.

We highlight the key contributions of this article as follows: (1) the instantiation of a Socially Aware Design process for ideation to be used in situations in-

volving uncertainties about requirements, as we experienced in the OpenDesign platform proposal, promoting solutions that make sense to stakeholders; and (2) clarification and organization of the requirements for building a collaborative platform that can openly promote system design. This includes the selection, creation, adaptation, and experimentation of techniques and artifacts in the early stages of system design.

This paper is organized as follows: Section 2 presents the theoretical and methodological foundations of Participatory Design, Socially Aware Design and User Stories; Section 3 presents the dynamics of activities conducted, which reflects the methodological path taken in the ideation of the OpenDesign Platform; Section 4 presents and discusses results of this process with respect to the OpenDesign concept and the feature concept map that characterizes the OpenDesign platform; finally, Section 5 presents the conclusion remarks.

2 THEORETICAL AND METHODOLOGICAL BACKGROUND

In the OpenDesign perspective, the design of interactive systems is understood as a social process that involves both the characterization of the design problem and its solution. It involves a dialogue not only of the designer with the design materials as proposed by Schön (1990), but also mainly among the individuals participating in the process (*e.g.*, designers, developers, users and other stakeholders). This dialogue contrasts various design views and various ways of framing design situations. Several artifacts (informal, formal and technical) are used as communication and mediation tools among participants during the process of creating the interactive system (Baranauskas, 2009, 2014). Thus, system functionalities should be defined based on the understanding of the stakeholders’ needs, their aspirations and objectives. To this end, it is necessary to enable the effective participation of stakeholders in the process, from joint clarification of the problem to the definition of system functionalities in design. In this paper, this process is supported by techniques and practices based on Participatory Design, Socially Aware Design, and collaboratively constructed User Stories. These concepts are described in the following subsections.

2.1 Participatory Design

The Participatory Design is characterized by the active participation of system end-users throughout the software design and development cycle (Vieira and Baranauskas, 2003). More than sources of information, end-users (and other stakeholders) perform effective contributions at every stage of the design and development cycle, reflecting their perspectives and needs. The quality in the design and the resulting system is a consequence of the mutual learning and combination of backgrounds from the various participants.

Participatory Design methods are characterized by the use of simple techniques and small compromise of materials or digital resources; Brainstorming, Storyboarding, and Workshop techniques are widely used. Participatory practices extend throughout the (conventional) software life cycle. Muller et al. (1997) presented a collection of 61 participatory practices used at different stages of the system life cycle (pre-design, design, evaluation, post-design). Our work does not focus on a specific practice, but on a more systemic view, uses ideas, practices and principles existing in Participatory Design as a way to stimulate the effective participation of stakeholders in the understanding of functionalities.

2.2 Socially Aware Design

Socially Aware Design (Baranauskas, 2014) aims at supporting the work of understanding problems considering technical, formal and informal aspects in the design process. In this framework, it is assumed that a design solution depends on and impacts on the formal and informal aspects of organizations and society towards the construction of a technical solution. Socially Aware Design consists of a set of artifacts and practices for clarifying the problem, including the SD, EF, and SF, some of which originated in Organizational Semiotics (Liu, 2000; Liu and Li, 2014). These artifacts are used to support the design problem clarification and the proposition of ideas and/or solutions to different stakeholders. They support the understanding of social and technical issues involved in the problem, without losing their relation to the situated context of the design, which gives meaning to the problem and stakeholders' demands.

2.3 User Stories

User Stories is one of the key development practices for teams using agile software development and project management methods (*e.g.*, Scrum or eXtreme

Programming). A User Story is a representation that aims to capture a description of a software resource from an end-user perspective. The user story spells out the user's role, what they want, and why. A user story helps creating a simplified description of a requirement and can fit into agile process structures. Therefore, a "user story" represents a definition of a high-level requirement, containing enough information for developers to produce a reasonable estimate of the effort to implement it.

User Stories can be considered a starting point for a conversation that establishes the actual requirements of the product. In this paper, they were written collaboratively by product stakeholders, also helping to prioritize prospective functionalities during the system design period. Identifying and describing user stories thus serve as reminders of what is still missing and why of those needs to be developed. Coupled with user stories, product backlog, and sprint practices are accomplished (Schwaber and Beedle, 2002). A backlog acts as an ordered list of stories to be developed based on priorities set by their business value and technical feasibility (Schwaber and Beedle, 2002). In our work, user stories were aligned with Participatory Design practices because user stories specify involved roles, the notion of purpose and business value.

3 OpenDesign IDEATION PROCESS: METHODOLOGY AND MODEL

The activity dynamics adopted in this research reflects the path conducted by the OpenDesign project team aiming to articulate the Socially Aware Design model with open source practices and lean agile methods. This dynamic considers the insertion of collaborative and participatory practices, used to assess their relevance to the design process of the OpenDesign platform. The elicitation and understanding of features in the OpenDesign followed a process in which the project team and other researchers, as stakeholders, were invited to collaborate on participatory practices for the creation, prioritization, and organization of features. Participants included 7 researchers of Human-Computer Interaction and Software Engineering fields, 13 graduate students, and 1 undergraduate student. Stakeholders contributed to include their vision and needs in the context of the project.

The process described in Figure 1 does not repeat a conventional software development. In our work, there was an initial effort in its conception, that is, in

understanding the concept to be implemented through design activities (rounded blue boxes with dotted border in Figure 1). Subsequently, these were associated with the development of the software itself (red rounded boxes with a continuous border in Figure 1). The activities represented in gray and dashed boxes have both design and software development nature. The SD, EF, and SF are artifacts of Socially Aware Design. User Stories were also used in the process in a participatory and online manner.

Each of the defined activities (rectangles in Figure 1) was carried out collaboratively (*i.e.*, involving multiple stakeholders) and at least in two moments: (1) in activities, we call *warm-ups*, in which participants contributed individually and previously to the elaboration of artifacts (documents), usually using online tools; and (2) in face-to-face meetings, in which participants interacted to generate a consolidated artifact. At both times, collaborative tools were used to provide a shared view of the project to all participants. Among the collaborative face-to-face meetings and online activities, we highlight the following: (1) anticipation of problems and solutions; (2) initial definition of requirements; (3) creation of User Stories; (4) prioritization of stories; (5) refinement of functionality; and (6) summary of features.

1. **Anticipating Problems and Solutions:** From the identification of stakeholders, it becomes possible to anticipate prospective problems and their associated solution ideas. To this end, the Evaluation Frame was used for describing, for each layer of the Stakeholder Diagram, a set of problems or questions. Also, it associates possible solutions or ideas on how to solve these problems succinctly. This artifact was completed online and collaboratively with the support of the SAwD tool (da Silva et al., 2016).
2. **Initial Requirements Definition:** Possible solutions and ideas described in the Evaluation Framework were used to support the initial identification of requirements at a high level of abstraction. For this purpose, the requirements were described based on the different steps of the Semiotic Framework. The framework is typically populated from the highest step (Social World) to the lowest step (Physical World), in a refinement approach in which a requirement on a higher step may derive requirements on the immediately lower step. However, the up and down movements of the ladder can be performed iteratively, as the understanding of the initial requirements matures as they are listed. This was the third and final artifact to be completed online and collaboratively by the project participants.
3. **Creating User Stories:** For this first step, Participatory Design contributed with action dynamics that made it possible to bring stakeholders into the design process. We proposed a participatory practice that combined the concept of User Stories with a collective brainstorming session to create stories for OpenDesign. The session was facilitated and used as materials a whiteboard on the wall, visible among the participants, on which user stories written with post-its were glued and organized by all participants. User stories were designed and crafted for potential OpenDesign stakeholders, previously raised using the Stakeholder Diagram. All user stories were later inserted into the Trello¹ tool, which allowed us to visually organize the project in the form of charts and tasks in the form of cards. Such organization helped to categorize user stories and to obtain an overview.
4. **Prioritization of Stories:** We used the *ConsiderIt*² tool to prioritize User Stories, inserted into the tool for discussion and voting by project members. *ConsiderIt* provides a slider where users can vote for how much they agree or disagree with an idea (in this case, a user story), while listing positive or negative points for that idea. *ConsiderIt* enables participants to justify their rating, or comments on points raised by others. Thus, user stories were put into *ConsiderIt*. Those involved in the project were asked to rate them according to their priority for developing the OpenDesign platform.
5. **Refinement of Features:** To better define the features raised and prioritized, we performed a collective and face-to-face refinement of user stories. To this end, involved researchers in the project looked at the list of user stories prioritized in *ConsiderIt* and deliberated on what were, in fact, the key stories for the OpenDesign platform to be implemented. Following this deliberation, an online form was created that allowed participants to associate features with more detailed specifications to each user story; so we come to a lower granularity and therefore closer specification to implementation.
6. **Summary of Features:** Finally, in the last step, the participants jointly and in person created a synthesis of backlog in a concept map. The creation of a functional synthesis map involved the collaborative analysis of the user stories and suggestion of categories to organize them. This syn-

¹<https://trello.com/>

²<https://consider.it/>

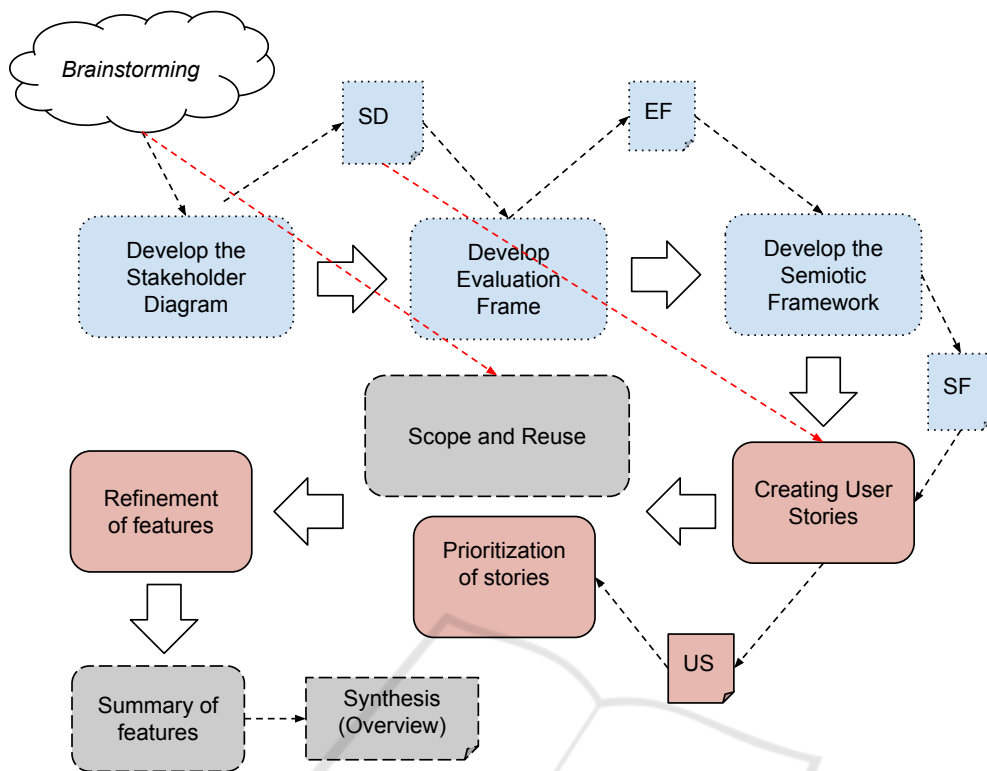


Figure 1: Process Conducted in the OpenDesign Project.

thesis map plays a key role in the elaboration of an overview of the platform's potential modules. The categories emerged from the analysis of the stories and they were refined through face-to-face discussions among the participants. Researchers iteratively suggested new categories and changes of elements from one category and to another until the conclusion of the map.

4 RESULTS: OpenDesign CONCEPT AND USER STORIES

This section presents the results of the process definition and instantiation in the OpenDesign project. Among our results, we highlight the clarification of the OpenDesign concept (*cf.* Subsection 4.1) and the prioritized set of user stories (*cf.* Subsection 4.2). In addition, at the end of this section, we present a discussion in which we analyse the process and the obtained practical results (*cf.* Subsection 4.3).

4.1 OpenDesign Concept Clarification

The collaborative use of the Socially Aware Design artifacts (Stakeholder Diagram, Evaluation Frame, and Semiotic Framework) provided clarification of the OpenDesign concept among the project stakeholders. Figure 2 presents examples of artifacts produced by the participants.

In the SD, illustrated in Figure 2a, several categories of professionals and organizations were indicated as stakeholders at all layers. For example, on the one hand, even distant from the development of the OpenDesign platform itself (in the outermost layer), educational institutions such as the Campinas State University (Unicamp), and funding such as São Paulo State Research Support Foundation (FAPESP), affect and are affected by the OpenDesign to some degree, so they should not be overlooked. On the other hand, programmers and HCI professionals involved in the project have a direct relationship with the project, and consequently, with the OpenDesign platform. Figure 2a presents a complete list of identified stakeholders and their position in the diagram.

In the EF, partially illustrated in Figure 2b, many questions and problems were raised for the identified stakeholders. The participants also proposed ideas

and solutions using this artifact. For example, for the stakeholder “computer student” the problem arose that “*they (the students) might find that design is just the “make-up” of a computer system, can be done later, on top.*”³ (Translation from Portuguese language of the original phrase by the researchers). For such problem, the following solution/ideas were proposed: “*Providing teaching materials, tutorials and concrete examples; Providing simplified versions and grounded and detailed versions of the materials, with practical tips and examples; Suggest ‘next’ steps for the work done.*” (Translation from Portuguese language of the original phrases by the researchers). The anticipation of potential problems and issues provided by this artifact supported to raise initial requirements for a solution within a design project, in this particular case, initial requirements for the OpenDesign platform.

Finally, the initial definition of requirements based on the SF, partially illustrated in Figure 2c, enabled the organization of requirements into the levels of the Framework. This encompassed requirements from the social world (e.g., contributing to distributed design and providing universal access to people) to the physical world requirements (e.g., server needs and platform compatibility with assistive technologies). At a high level of abstraction, the requirements in the SF inspired a participatory approach, described in the next subsection. Based on the identification of User Stories from the SD, we seek a level of abstraction closer to the prospective use of the OpenDesign platform by the identified stakeholders.

4.2 User Stories

The use of the artifacts (described in the previous section) represented the basis for creating user stories. In the user story creation stage, a total of 95 user stories were created after the participatory practice, already considering the removal of redundant/duplicate stories. In the next step, we chose the user stories that would be essential for the development of the OpenDesign platform and then associated system functionalities with each one. Table 1 lists those user stories considered essential. With this practice, participants collectively produced a map that synthesizes the key concepts involved in the OpenDesign concept, as well as groups desired functionalities for the OpenDesign platform. Figure 3 graphically illustrates the concept map and requirement groups from user stories. In the following, we describe the conceptual groups,

³This “on top” means the frontend be constructed on top (and after) of the backend of the system.

including functional and non-functional requirements associated to the number of the user stories:

- **OpenDesign:** The platform should present a list of featured projects, as well as allow its users to search existing projects; The aesthetics of the platform must be pleasant and customizable; The philosophy behind the platform should be communicated, as well as tutorials and demonstrations on how to use the platform; the platform must have a support forum, terms of use and a mechanism for reporting terms violations; Finally, the platform must follow accessibility criteria and recommendations. This description relates to some of the essential stories (#33, #38, #41 and #92) that appear in this group.
- **OpenDesigners:** Platform users can have a portfolio that highlights projects they have contributed to; users can bookmark projects for follow-up and later reference; users can communicate with each other privately via chat; the platform should provide a form of reputation among its users, according to their contributions and their peer recognition. This description relates to some of the essential stories (#23, #84 and #87) that appear in this group.
- **Project:** The platform should allow the creation and maintenance of projects, by considering the choice of a desired software license; the platform must allow the control of project visibility (public or private); a project overview as well as a dashboard with metrics; project access control; Possibility to export, version, compare, diverge and combine projects; ways to publicize (share) an existing project; and a view of the history of existing projects on the platform. This description relates to some of the stories considered essential (#35, #47 and #54) that are in this group.
- **Collaboration:** Within a project, the platform should enable design steps to be established; it should be possible to suggest or propose ideas to which users can contribute by voting, rating or feedback; There should also be a way to moderate contributions as well as deliberate ideas and make decisions. It should still be possible to create evaluations within the project and request feedback from any input, product, and/or artifact. This description relates to some of the stories considered essential (#49 and #3) that appear in this group.
- **Repository:** Within a project, the platform should enable the creation of a repository of knowledge and design artifacts, where users can store digital files, manage project documentation, and write

Table 1: User Stories Considered Essential.

#	User stories
#31	As designer I want design process documentation so I can understand how to replicate that proposal.
#33	As amateur I want filter projects and backlogs to choose how and what to contribute.
#35	As amateur/enthusiast I want to see images and videos of projects on the platform so I can get to know the enabled jobs.
#38	As OpenDesigner I want to look for problems/projects so I can contribute to it.
#41	As OpenDesigner I want to know the artifacts available on the platform so that I can use in my project.
#47	As an OpenDesigner I want to share my project so that I can engage the community.
#54	As the project owner I want set the license to secure and set limits for contributors.
#67	As an IHC teacher I want the platform supports multiple design paradigms so I can work multiple with my students.
#92	As a user, I want an FAQ to resolve recurring questions by collaboratively building solutions.

help documentation and tutorials. The story considered essential #31 appears in this group.

Other desired aspects were elicited, but not considered priorities for the first versions of the platform, such as integrated code creation (IDE) functionality, prototype hosting, *kanban* style card functionality for various uses. Also portability so that the platform can be used on different devices, as well as communicating with different devices, and finally the desire for the platform to be made available as a service. These desired, but not priority aspects, were categorized in a priority rank to be considered in the next versions.

4.3 Discussion

From the methodological point of view, the main feature of the proposed process is the integration between design and requirements engineering. The motivation for this integration is given by the idealization proposed in the project, formalized in the light of agile methods of software development and practices of free software development without losing sight of the practices of Socially Aware Design. This integration occurs primarily in the planning and at end of each iteration with ongoing reviews and ongoing stakeholder involvement. In this sense, the different levels of abstraction that were used to describe functionalities (SF, User Stories, and Functionality Map) were necessary to think design and development in an integrated way. While one type of abstraction is better suited to software development itself, another type is better suited to the design and prototyping of interaction with the platform and user interfaces.

In general, we understand that the SD was a valuable source for reflecting on the necessary roles in defining user stories and, hence, the platform. The EF allowed participants to anticipate problems that permeate the platform and potential solution referrals, both from a divergent perspective, where alternative paths are identified in an ideation process. Afterwards, they need to converge in a deliberation process

to a solution through the SF. In this stage, it was possible to understand the value or type of contribution of each functionality to the OpenDesign platform.

Practices conducted to prospect and refine several stakeholder requirements on the OpenDesign platform culminated in two complementary views: 1) the feature map being an overview of the platform concept; 2) the user stories set in a backlog, expected to continue with software development. By adopting the practice of User Stories, conducted in a participatory manner with different stakeholders, it was possible to identify candidate features for the platform that were refined in participatory analysis and detailing activities. Participatory practices fostered the emergence and discussion of new ideas that took shape and evolved during the discussions. This favored the maturation of user stories and served as an object for the construction of shared meaning among participants.

Refined user stories during participatory practices resulted in functionalities related to several aspects of the platform, which included: project management; people's engagement and participation; collaboration and sharing of knowledge; and technical aspects involved in building the platform. These stories proved adequate to form a basic set of functionalities for the platform and indicated possible extensions. Currently at the moment, the tracking of design artifacts happens continuously at development time. The project is in the beta phase of the platform⁴.

5 CONCLUSION

Unwanted impacts that computer systems can trigger on economic, ethical, political, and societal issues have become increasingly visible. Such impacts have been associated with systems development visions that do not privilege the social world in which solutions are used. In this paper, we envisage the design

⁴<http://opendesign.ic.unicamp.br/>

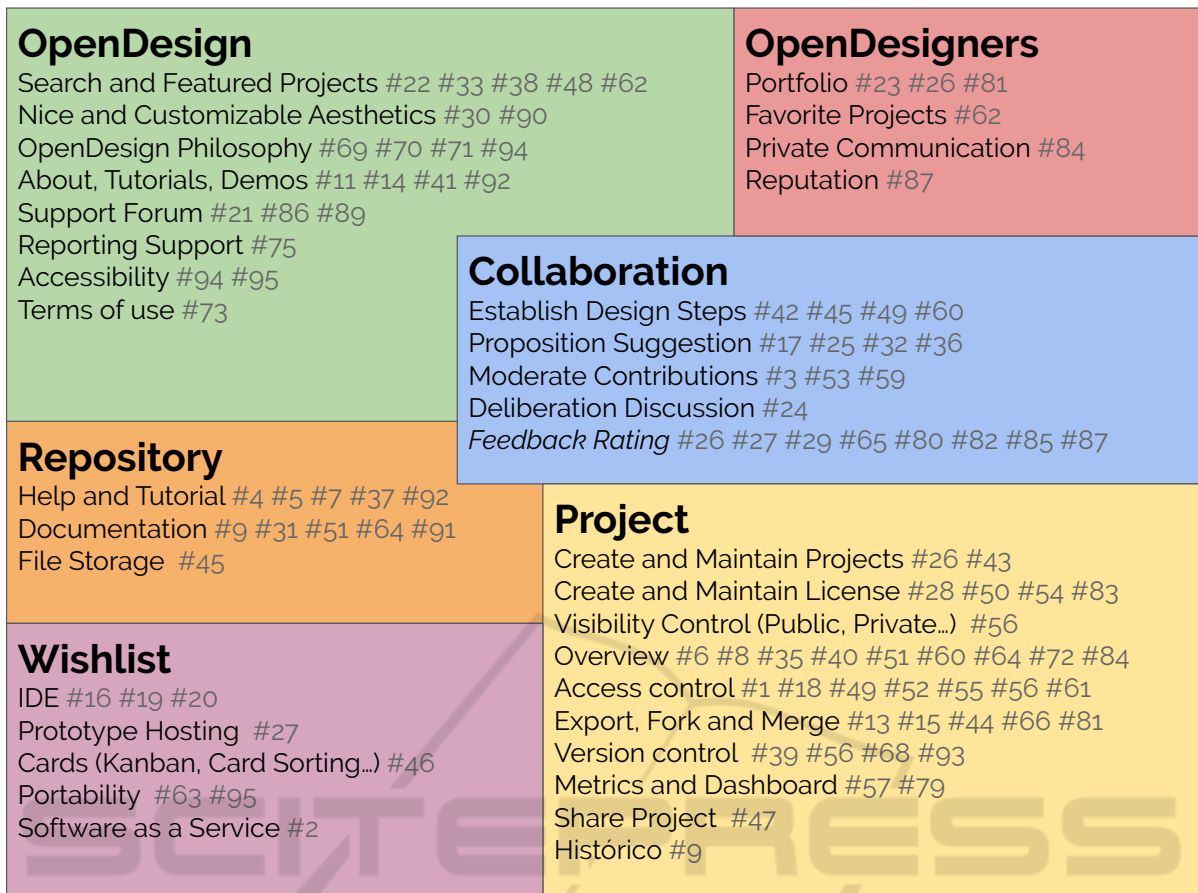


Figure 3: Map of Features Defined for the OpenDesign Platform (with Indication of Number of the User Stories).

of systems as a socio-technical activity, for which the involvement and perspectives of stakeholders should be considered from the ideation of such systems. We investigated the concept of OpenDesign and illustrate the methodological process and artifacts used in the design of a platform to support the ideation and collaborative creation of systems aligned with this concept. We adopted participatory practices to understand the problem and identify requirements involving different stakeholders and integrated them with practices known as user stories. The synergy between these practices favored the identification of different interests and perspectives, which resulted in the specification of requirements towards the construction of a software platform that implements the concept. The platform has been implemented in sprints enhancing OpenDesign concepts and practices. A beta version of the platform is currently being tested for evaluation in relevant cases. Future work will involve the investigation of the several use cases with the platform.

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REFERENCES

- Baranauskas, M. C. C. (2009). Socially aware computing. In da Rocha Brito, C. and Ciampi, M. M., editors, *Proceedings of the ICECE'2009 VI International Conference on Engineering and Computer Education*, pages 84–88, Buenos Aires, Argentina. Council of Researches in Education and Sciences (COPEC).
- Baranauskas, M. C. C. (2014). Social awareness in hci. *Interactions*, 21(4):66–69.
- Baranauskas, M. C. C. (2017). Opendesign: técnicas e artefatos para o design social-

- mente consciente de sistemas computacionais. <https://bv.fapesp.br/pt/auxilios/98824/opendesign-tecnicas-e-artefatos-para-o-design-socialmente-consciente-de-sistemas-computacionais/>. More info like: Regular Fapesp research Grant: #2015/24300-9. Accessed October 2019.
- Beck, K., Beedle, M., Van Bennekum, A., Cockburn, A., Cunningham, W., Fowler, M., Grenning, J., Highsmith, J., Hunt, A., Jeffries, R., et al. (2001). Manifesto for agile software development. <http://agilemanifesto.org/>. Accessed October 2019.
- Boisseau, E., Omhover, J.-F., and Bouchard, C. (2018). Open-design: A state of the art review. *Design Science*, 4:e3.
- Connell, B. R., Jones, M., Mace, R., Mueller, J., Mullick, A., Ostroff, E., Sanford, J., Steinfeld, E., Story, M., and Vanderheiden, G. (1997). The principles of universal design.
- da Silva, J. V., Pereira, R., Buchdid, S. B., Duarte, E. F., and Baranauskas, M. C. C. (2016). Sawd-socially aware design: an organizational semiotics-based case tool to support early design activities. In *International Conference on Informatics and Semiotics in Organizations*, pages 59–69. Springer.
- G1 (2015). Erros grosseiros: esocial rejeitou e-mail com hífen. Posted in em 05/11/2015. Accessed October 2019.
- G1 (2019). ‘dieselgate’: veja como escândalo da volkswagen começou e as consequências. Posted in 23/09/2015 15h48 and updated 05/02/2019 20h51. Accessed October 2019.
- Kautz, K. (2011). Investigating the design process: participatory design in agile software development. *Information Technology & People*, 24(3):217–235.
- Liu, K. (2000). *Semiotics in information systems engineering*. Cambridge University Press, Cambridge, United Kingdom.
- Liu, K. and Li, W. (2014). *Organisational semiotics for business informatics*. Routledge, Abingdon, United Kingdom.
- Lucassen, G., Dalpiaz, F., van der Werf, J. M. E. M., and Brinkkemper, S. (2016). The use and effectiveness of user stories in practice. In *International working conference on requirements engineering: Foundation for software quality*, pages 205–222. Springer.
- Muller, M. J., Haslwanter, J. H., and Dayton, T. (1997). Participatory practices in the software lifecycle. In Helander, M. G., Landauer, T. K., and Prabhu, P. V., editors, *Handbook of Human-Computer Interaction (Second Edition)*, pages 255 – 297. North-Holland, Amsterdam, second edition edition.
- Papanek, V. (1971). Design for the real world, including less developed countries. Accessed October 2019.
- Poppendieck, M. and Poppendieck, T. (2003). *Lean Software Development: An Agile Toolkit: An Agile Toolkit*. Addison-Wesley, Boston, MA, USA.
- Schön, D. A. (1990). The design process. In Howard, V. A., editor, *Varieties of Thinking: Essays From Harvard's Philosophy of Education Research Center*. Routledge, Abingdon, United Kingdom.
- Schwaber, K. and Beedle, M. (2002). *Agile software development with Scrum*, volume 1. Prentice Hall, Upper Saddle River, NJ, USA.
- Vieira, H. and Baranauskas, M. C. C. (2003). *Design e avaliação de interfaces humano-computador*. Unicamp, Campinas, SP, Brazil.