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EDITORIAL

Understanding and Utilizing Requirements and Needs for Product and System Design

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Understanding human needs and user requirements is very critical to realize appropriate and acceptable product and system design. The primary measure of the success of a product, service, or software system is in its ability to meet the purpose for which it was intended (Jones, I. *et al*. 2015). To translate customer needs into more quantifiable engineering requirements and utilize the requirements for design, several methodologies have been established and used within the design community. Examples include Quality Function Deployment (QFD) based methods (Pullman, M.E. *et al*. 2002, Jin, J. *et al*. 2014), the Kano model and Affinity Diagrams (Xu, Q. *et al*. 2009), Trend Mining by (Tucker, C. and Kim, H. 2011), Sentiment Analysis and Opinion Mining (Liu, B. and Zhang, L. 2012), and Preference Comparison (Aurup, G.M. and Akgunduz, A. 2012). To further advance the research domain of understanding and utilizing requirements and needs for product and system design, this issue includes three articles that provide a fundamental understanding of human needs and their relationship with engineering design and systematic customer requirement extraction and evaluation criteria selection methods.

The first paper written by D. Tesar entitled “Meeting Human Needs by Leveraging the Next Wave of Technology” provides an engineering perspective on fundamental human needs. The author presents ten human needs and associates these needs with present and future technologies in the mechanical engineering domain, including intelligent actuator design and intelligent mobile platforms and vehicles. It is noteworthy that some highly ranked needs (i.e., engineering software, high efficient system, man-machine interaction, and computational mathematics) are highly related to human needs. The author lists the classes of actuator technology as they are related to the basic human needs. For future component development, this paper exemplifies the direction for the future development of intelligent mobile platforms and vehicles. The next wave of technology proposed by the author, particularly to USA policy makers, leads to the author’s conclusions. In conclusion, the author challenges whether basic human needs are considered for machine design or whether we continuously use our resources to develop features and components that are non-critical to human needs. The author’s work provides very useful insight into the relationship between basic human needs and product/process design.

The second paper, entitled “Systematic Service Product Requirement Analysis with Online Customer Review Data” written by Jones, I.A. and Kim, K.-Y., presents a systematic method to extract and utilize service product requirements from online customer review data. In the modern era, more and more user communities are involved in product and service evaluation. Various Internet and information technologies allow these communities to share their opinions in real time. This emerging trend provides a great

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opportunity to understand actual and timely product and service requirements and needs. However, it is very challenging to properly and systematically extract the requirements and needs because of information scarcity and ambiguity about the customer review data. This paper presents a systematic approach to requirement analysis and attempts to use the natural language processing and service product requirement analysis framework based on machine learning algorithms. The authors note that this hybrid approach can be utilized for service product customer review data and for extraction of potential service requirements to improve service product quality. This effort integrates natural language processing and machine learning methods for a systematic service product requirement analysis.

The third paper, entitled "EBD extended Analytic Hierarchy Process (AHP) approach to evaluating the effectiveness of engineering projects" written by Chen, D. *et al*., is about how the evaluation criteria can be determined systematically for various product development and engineering projects. This paper addresses engineering project management and effectiveness evaluation criteria. Determining evaluation criteria is very critical but has been conducted in an ad hoc manner instead of through a systematic approach. There have been significant research efforts to develop evaluation methods (e.g., AHP, Pugh method, utility theory, etc.); however, selecting evaluation criteria has been left to the decision makers. It is challenging to define and select the criteria, especially when it is ambiguous. The authors employ Environment Based Design and the Recursive Object Model (ROM) methods to support the decision makers and converge these into more objective and context-driven evaluation criteria. In this paper, an eco-concrete project case is used to illustrate the systematic criteria selection process with the aid of ROM. Comparison is made between the effectiveness of non-systematic criteria selection versus systematic ROM based criteria selection. The authors conclude that this approach is more effective, is more objective, and can be used for engineering project effectiveness evaluation activities.

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