

Applying the Design Structure Matrix (DSM) for the design of an in-home wearable solution

The Design Structure Matrix (DSM), is an analytic methodology to study system structures or models for various research areas and applications (Eppinger & Browning, 2012). In the design practice, a DSM is presented as a square matrix having an equal number of rows and columns. It is used to analyze and present the relationships and connections among various system components.

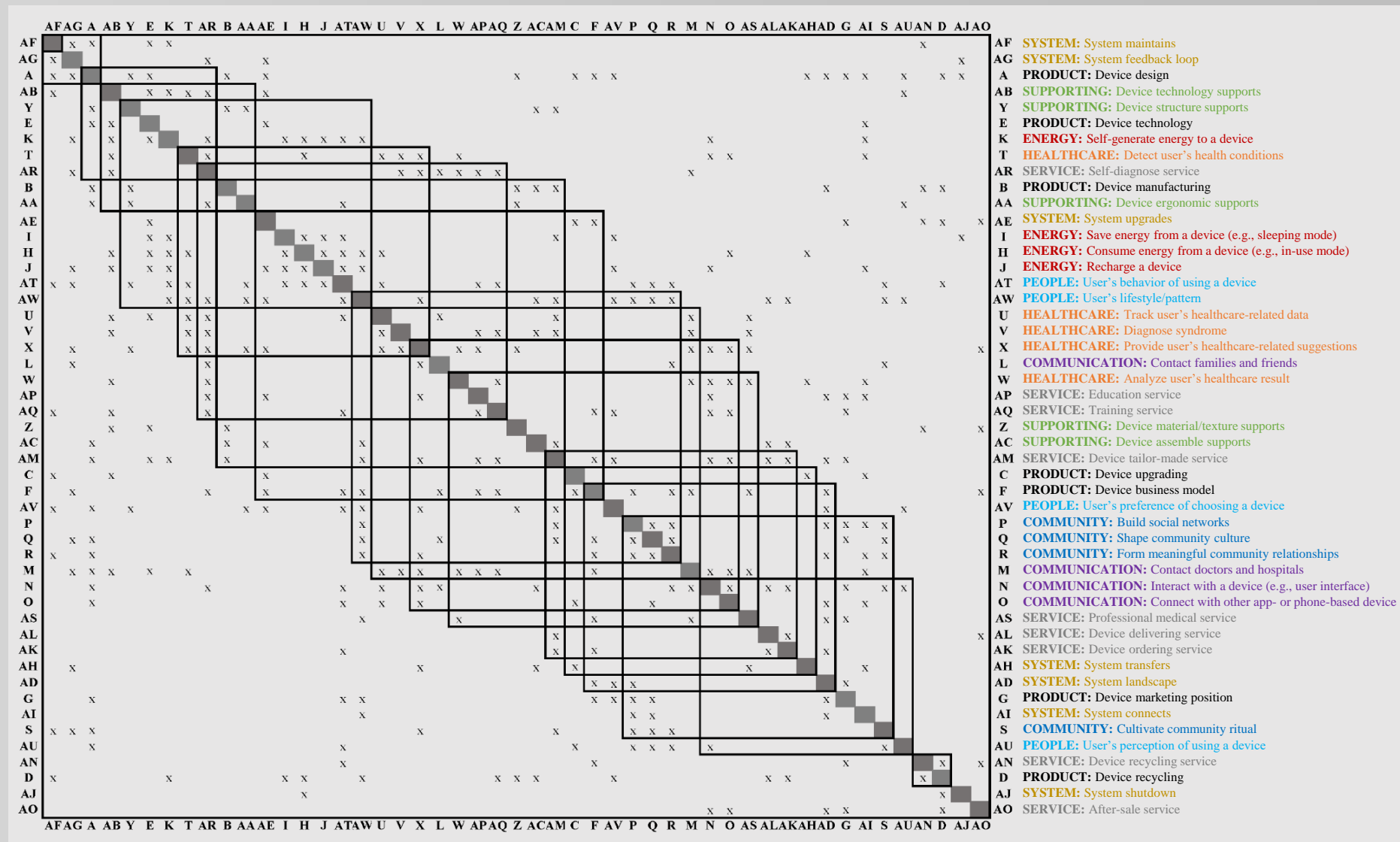
A DSM provides an intuitive yet precise way to demonstrate the design of a complex system by clustering and sequencing its components. A key strength of a DSM is its modularity, and that it easily can adapt to different research problems: product innovation (Ulrich et al., 2020), organization design, and social-technological challenges (Laboratory for Product Development and Lightweight Design, 2021).

The AgeLab C3 Consortium's design research studies include a comprehensive survey of applicable design theories and methods, and utilize approaches that are highly relevant and applicable to the research questions and issues. The master's thesis project by Sheng-Hung Lee explores the application of human-centered design principles to developing technology-enabled smart footwear for older adults (Lee, 2021). His research utilizes DSM to analyze interconnections in the system architecture and to effectively leverage system thinking approaches (Lee et al., 2021).

The figure on the right presents the DSM created for this project, and illustrates how a variety of layered, socio-technical system components are interrelated. In this matrix, various sub-systems/components forming the entire user experience of a technology-enabled smart footwear are provided: product, energy, communication, community, healthcare, supporting, system, service, and people. The structure of the analysis enables an effective display of their interconnections. This application of DSM facilitates the introduction of complex systems thinking and holistic approach to designing technology-enabled smart footwear, a wearable home technology product we may see in the near future.

Implications: For socio-technical and complex systems with multiple components, applying the DSM can be useful for structurally organizing various design components and understanding their relationships. Several benefits can be expected from using DSM:

- Enabling designers and service providers to clearly define the form, function, and design goals for each component.
- Understanding and prioritizing design features and their relationships for multiple stakeholders, which may include older adults, family or caregivers, service providers, product designers, engineers, policymakers, and more.
- Streamlining the design process and reducing unexpected incidences or emergent issues.



Eppinger, S. D., & Browning, T. R. (2012). Design Structure Matrix Methods and Applications (Engineering Systems). MIT Press.
 Laboratory for Product Development and Lightweight Design. (2021). Design Structure Matrix. DSMweb.org
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