1.3 Functional Decomposition

Introduction

Functional decomposition is the breakdown of a larger, more complex system into smaller parts. In many systems that are used in today's age, such as phones and vehicles, functional decomposition is an important part of the design process. It minimizes the confusion when designing a product and in turn, makes it easier to accurately address the customer's needs when it is time to start creating solutions. This part of the process does not present solutions, but rather a deeper understanding of what the product has to be able to do.

Data Generation and Hierarchy Introduction

In the 103 SD group's functional decomposition, the measuring device for Biosense Webster was examined and broken down into its main functions that it must perform. These broken-down functions are shown in Figure 1 and were convened by evaluating the main goals this device must be able to complete. Figure 1 follows a hierarchy chart format where the main systems are broken down further into simpler functions.

Needs into Outcomes

After speaking with Charles Lindholm (BSW) the main emphasis for the 103 SD team is developing the testing arena and sensibility for the catheters. When considering this the team concluded that these two areas of emphasis would be the primary focus of functional decomposition. Subfunctions in these categories iterate that the sensor process must be reproducible and sterile, while offering a consistent method for data collection and interpretation. This coexists with the need for a testing arena that offers a stable and consistent way of replicating how the catheters will function inside the human body.

Table Breakdown

The functions, or physical actions required from our product, were broken down into subsystems, or the outcomes of the physical actions. In Table 1, the functions are listed horizontally across the top row, while the subsystems are listed vertically on the left side. If a subsystem is an outcome of a function, an 'x' is placed in the box corresponding to said subsystem and function. This is done to better understand the dependence or independence of the functions, and to ensure that every outcome from our customer needs could be related back to an action. The 103 SD team identified four major functions sensibility, data collection, compatibility, and environment simulation.

Table 1

Functional Decomposition Table

Functional Cross Reference Table				
	Sensibility	Data Collection	Compatibility	Environment Simulation
Detect Translation	x			
Detect Rotation	x			
Detect Deflection	x			
Data Aquistioning		x		
Data Manipulation		x		
Live-Positioning Visual	x	x		
Veinal Replication			x	x
Sterialization				x
Sensor Adjustability			x	x
Reproducability		x		x
Stabilization	x			x

Smart Integration/Function Interrelationship

After analyzing the function relationships in Table 1, it was discovered that that three of the subsystems/minor functions crossed multiple systems/major functions. These three minor functions were "Live-Positioning Visual", "Veinal Replication", "Sensor Adjustability" and "Stabilization", each of these spanning across two of the major functions each. This allowed the

103 SD group to best outline which of their subfunctions should be prioritized to fulfil the major functions in the most efficient and practical manner.

The first one of the subfunctions that serve more than one system is the live-positioning visual subsystem. This subsystem is quite tactical in terms of what it can do for the project as a whole. It is noted down that contributes to both “Sensibility” and “Data Collection”, both of which relate to the measurement of the catheters displacement and analysis that is conducted from said results. By marking live-position visual as a key function to target, the *103* SD team will best be able to successfully achieve critical goals outlined by the sponsor.

The next subfunction of interest was veinal replication, spanning across “Compatibility” and “Environment Simulation”. One of the key goals that was outlined by the sponsor was to create a testing arena for our measuring device. Since the catheter is inserted and funneled through the veins that lead to the heart, the *103* SD team decided that replicating the veinal structure will significantly add to the ability to accurately develop the product to be compatible to all catheters as well as include an appropriate environment to run tests in.

Another subfunction that was outlined that span more than one system is sensor adjustability, contributing to both “Compatibility” and “Environmental Simulation”. The sensors are one of the more crucial aspects to implement in order to have a successful measuring device. The *103* SD team noticed this need and it was validated in the functional cross reference table, allowing the team to target that subsystem as another function that may require extra attention to detail to ensure the measuring device is hitting the metrics outlined by the sponsor.

The last minor function that crossed more than one major function was stabilization. This subsystem hits both “Sensibility” and “Environment Simulation” and deals mostly with the ability to allow the measuring device to not have external factors affecting its performance. By

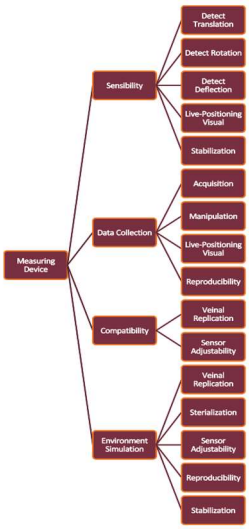
ensuring that both the environment and sensing systems are not impacted from uncontrollable factors, such as a heartbeat for a real-life comparison, the measuring device will be able to perform its best. The capacity and precision at which the measuring device can operate is crucial to the SD team.

Flow Chart

The functional decomposition flowchart in Figure 1 is a visual representation of how the *103* SD team broke down their product and its various functions. The flowchart starts with the project, in this case, the measuring device. It then branches out into various functions that have been identified. Within each of these functions, various sub-branches have been incorporated that introduce the concepts and abilities that said function allows. For example, the measuring device has a function that is labeled as “Data Collection”, within this function, it has been identified that to properly ensure data collection, the product must be able to perform “Aquisition”, “Manipulation”, and a “Live-Positioning Visual” of the data. This procedure was repeated for all of the ways the product provides functions.

Figure 1

Functional Decomposition Flowchart



Connection to Systems/Prioritization of Function

All major functions are crucial to the success of this device, but certain functions have a higher importance. The hierarchy chart demonstrates the major functions on the top and the minor functions on the bottom, with all functions being interrelated that contribute to the overall main functions. Sensibility is seen as the main function of the measuring device due to the need to detect translation, rotation, deflection, stability, and live simulation serving as the overall objective. Environment simulation also includes five minor functions and serves as an important focal point but was not chosen as the top priority. This is due to it not being stated in the objective statement of this device.