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Embodied Data Augmentation System Model

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Model Introduction

Model Specification>Documentation

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Created:4/17/17 4:29 PM.
Title: Embodied Data Augmentation System

This model serves the purpose of envisioning the (1) conceptualisation and (2) actualisation process (i.e. prototyping) of a product to be used to test a hypothesis for academic research. The main concept of this product is meant to capture, convert and feedback physiological data back to the user, in which case:

- "Embodied Data" refers to physiological data from the human body captured by a wearable device.
- "Augmentation" refers to the idea of converting subconscious embodied data into haptic feedback to the user.
- Haptic feedback in Design refers to the use of touch to communicate with users beyond explicit information.

Further details of the context are provided in the Requirements section of the model.

All Project Diagrams

1. Table of Objective Statements and Assumptions

Diagram Specification>Documentation
In: Concept Design.(a) Requirements.Table of Objective Statements and Assumptions

Requirement table contains the high level mission statements for this concept. Essentially the Embodied Data Augmentation System concept is meant to be used for research as a means to test a hypothesis.

#	Name	Text
1	1 System Concept	The system is dedicated to the purpose of creating bodily awareness to the broadest spectrum of people, but especially those living in modern society where the fast pace of life perpetuates habitual behaviour rather than responding to bodily intuition.
2	1.1 Design Definition	For the purpose of this project, we are take that responding to intuition refers to making decisions based on physiological cues rather than explicit information.
3	1.2 Not a Consumer Product	This project holds the stance that getting people to tune in to their own bodies should not require a product-oriented solution that further reinforces dependence on external information to understand the body.
4	4 Need for Haptic Feedback Function	To prevent dependence on, or distraction from more visual stimuli, the product needs to augment the user's physiological data in a way that is received through their bodies rather than just perceived visually.
5	5 Need for Documentation Over Time	Since the product ultimately aims to impact human behaviour in the long-run, it needs to capture any changes in the user's physiological tendencies over time.
6	6 Project Scope 1: Purpose	This project does not serve to explain the importance of why people should look inward. It aims to test the hypothesis that increased sensory acuity to the body's physiological responses would shape individuals' behaviour.
7	7 Project Scope 2: Context	The scope of this project is limited to the design of an embodied data-augmentation product to be used in the context of eating. In particular, it reads the user's pace and depth of breathing as the primary form of physiological data.
8	8 Not to Distract from Primary Activity	Any direct interfaces (HSI) with the user should not distract the user from the context of eating (i.e. Primary Activity).
9	9 Interface Requirement	System needs to be physically connected to the user's body.

Figure 1 Diagram Table of Objective Statements and Assumptions

2. Product Objectives and Assumptions

Diagram Specification>Documentation
In: Concept Design.(a) Requirements.Product Objectives and Assumptions

This requirement diagram shows the high-level requirements and their derivative relationships.

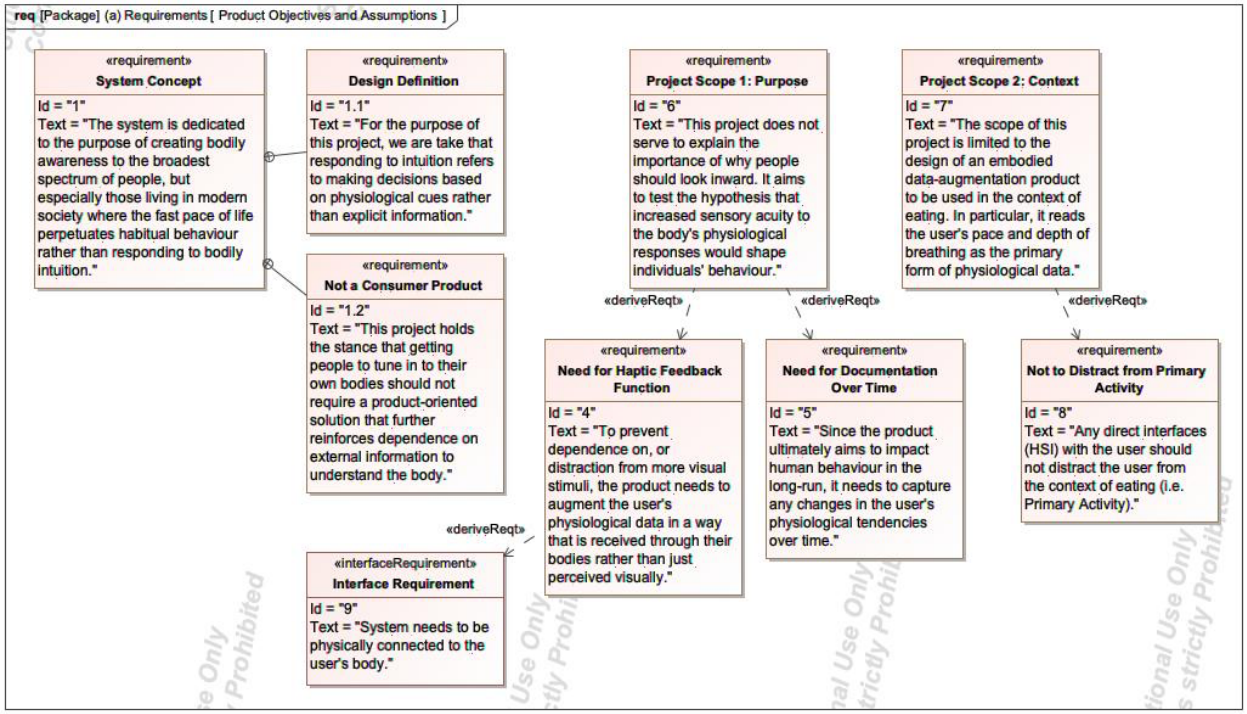


Figure 2 Diagram Product Objectives and Assumptions

3. Product Components

Diagram Specification>Documentation
In: Concept Design.(b) Concept Structure.Product Components

This bdd shows the 3 core components necessary to realise an 'Embodied Data Augmentation System'. It also shows which parts are associated and which part in particular is in contact with the user,.

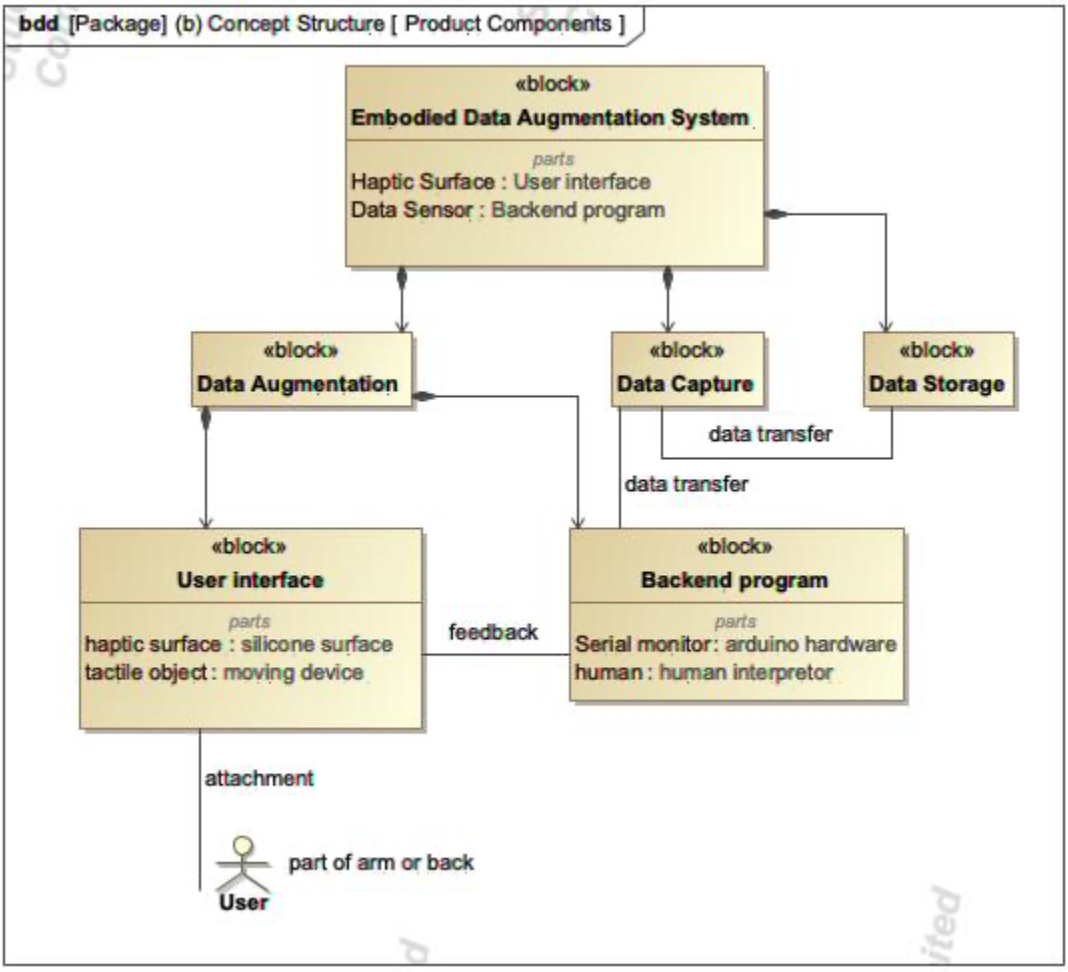


Figure 3 Diagram Product Components

4. Product Utilisation

Diagram Specification>Documentation
In: Concept Design.(b) Concept Structure.Product Utilisation

This use case diagram shows the core scenarios/functions and actors of the concept.

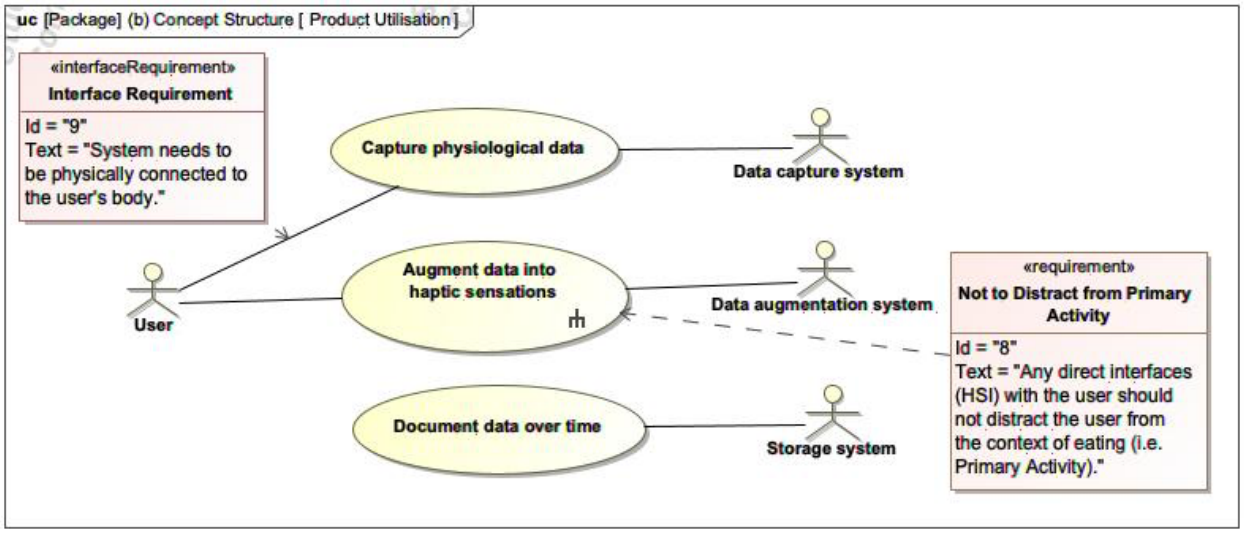


Figure 4 Diagram Product Utilisation

5. Potential System Setup

Diagram Specification>Documentation
In: Concept Design.(b) Concept Structure.Embodied Data Augmentation System.Potential System Setup

Documented in this ibd are:
(1) Potential ways to create the Data Capture function. It either uses existing devices, or existing codes to build a DIY device that captures breath data.
(2) Existing software that performs the Data Storage function, for example Apple watch and AppleHealth data, Google Health, Garmin technology. Or, user data can simply be stored in a computer, transferred from the Data Capture device.
(3) The association between the Backend program and User interface (typed: haptic sense : feedback) is to be prototyped (see PoC Pathways).

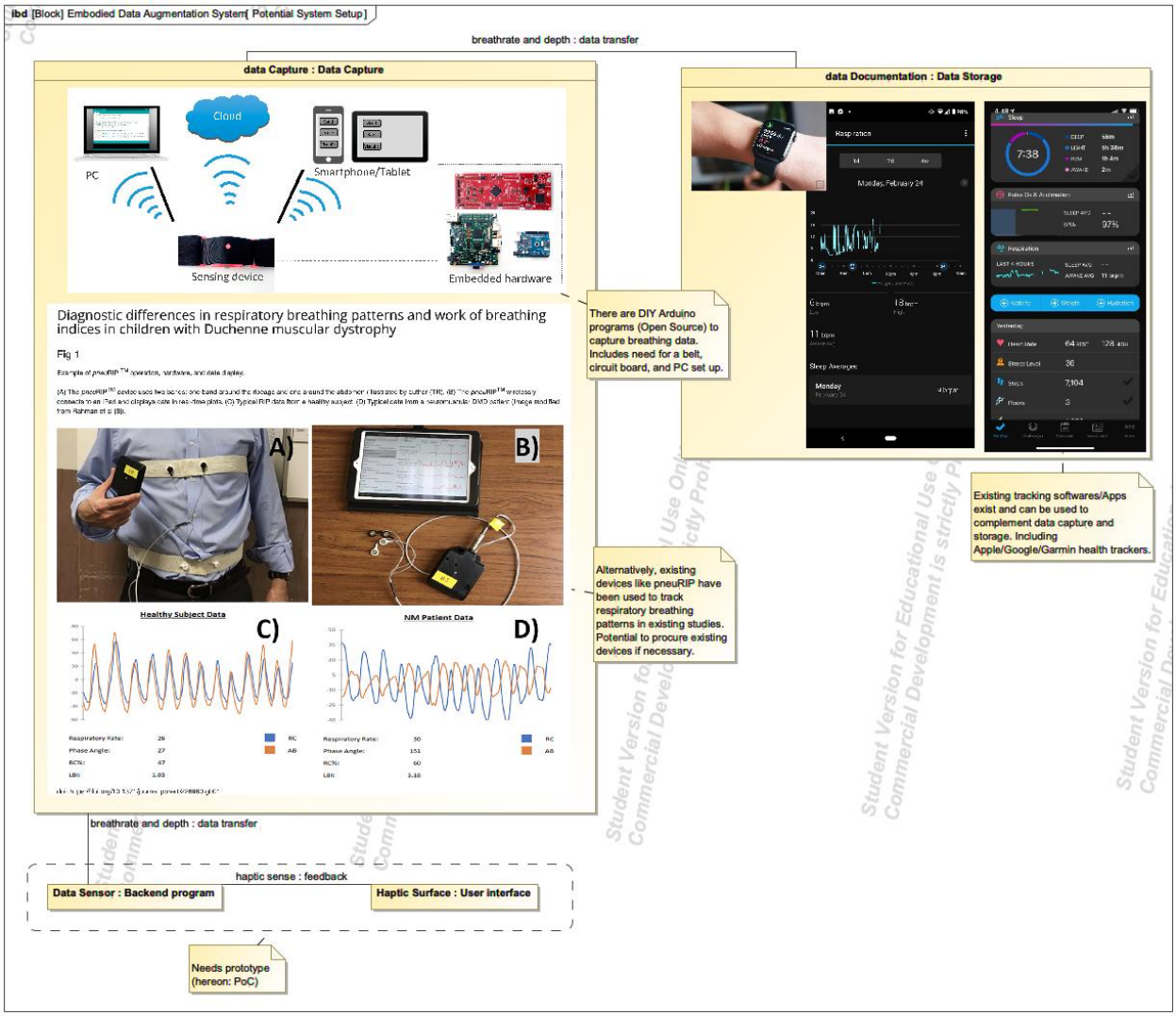


Figure 5 Diagram Potential System Setup

6. Augmentation workflow

Diagram Specification>Documentation

In: Concept Design.(b) Concept Structure.Augment data into haptic sensations.Augmentation workflow.Augmentation workflow

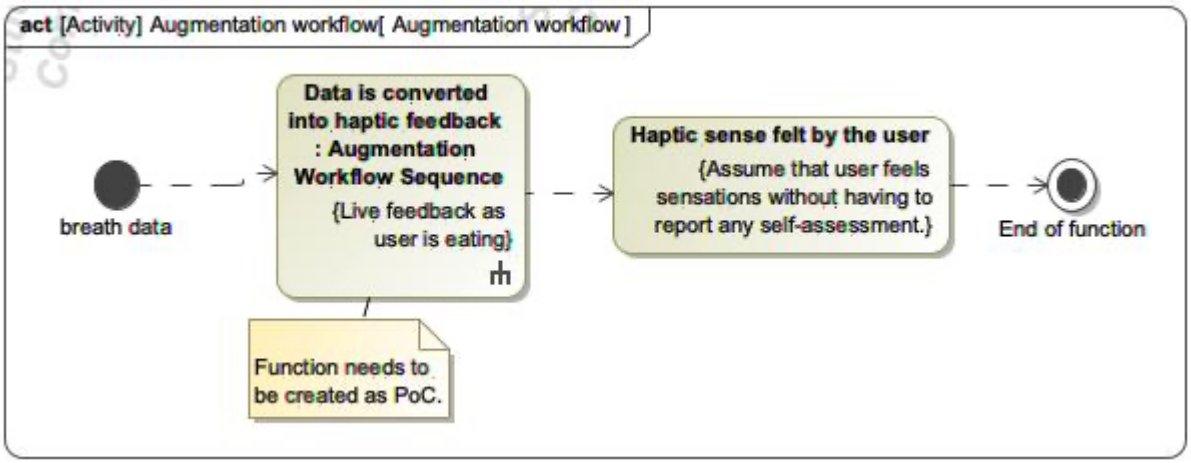


Figure 6 Diagram Augmentation workflow

7. Augmentation Workflow Sequence

Diagram Specification>Documentation

In: Proof of Concepts.(c) Architectures.Augmentation Workflow Sequence.Augmentation Workflow Sequence.Augmentation Workflow Sequence

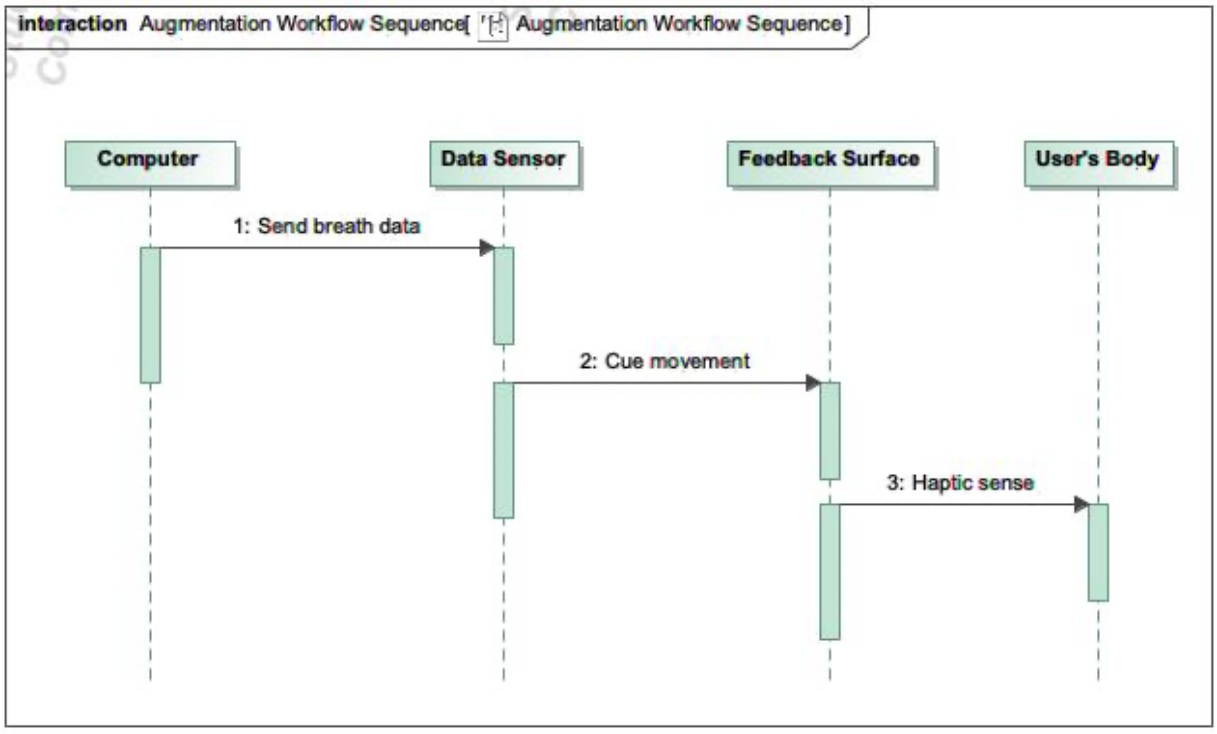


Figure 7 Diagram Augmentation Workflow Sequence

8. PoC: Augmentation workflow

Diagram Specification>Documentation
In: Proof of Concepts.(c) Architectures.PoC: Augmentation workflow

This bdd [PoC:Augmentation Workflow] represents the architecture of 1 of 3 core components of the Embodied Data Augmentation System that require a PoC. Augmentation workflow shows 3 ways I can currently envision to prototype the connection between the backend and user interface of this function, from lower to higher fidelity and complexity. The lowest configurable unit for this function is to have a human/the researcher act as the backend program to channel feedback to the user.

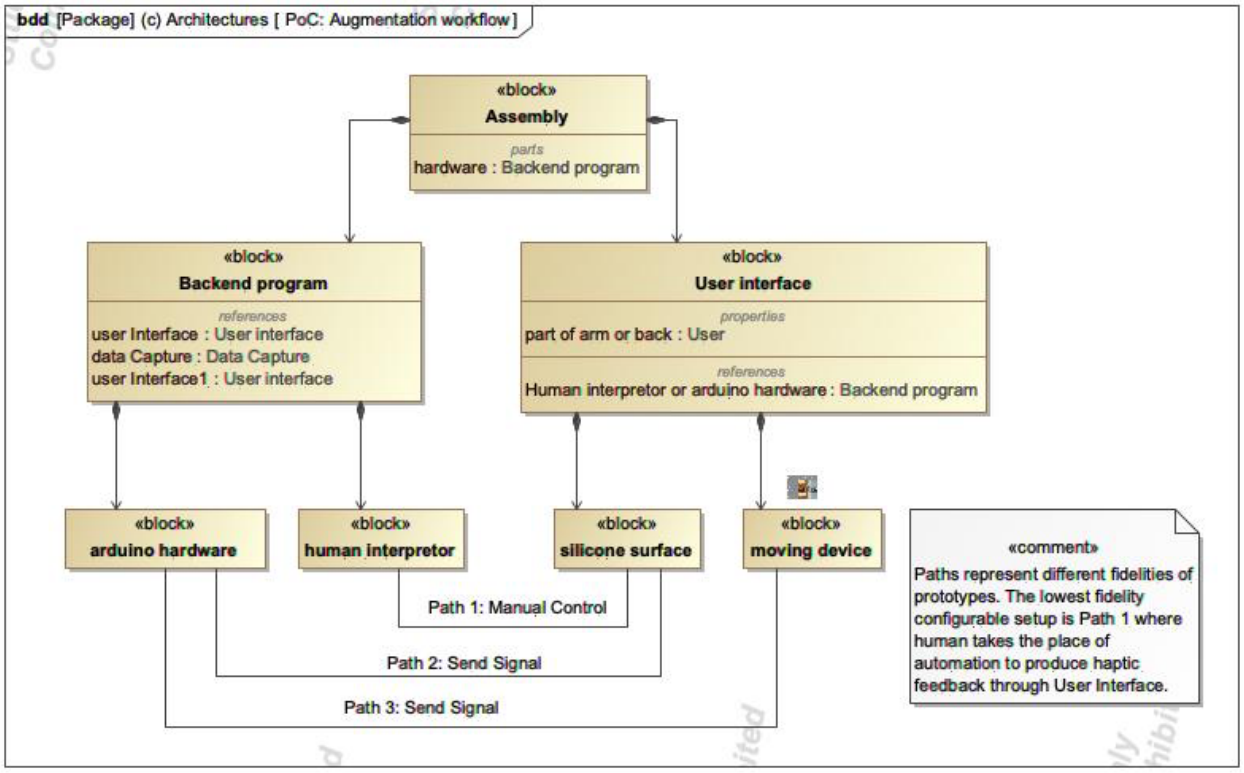


Figure 8 Diagram PoC: Augmentation workflow

9. Assembly General

Diagram Specification>Documentation
In: Proof of Concepts.(c) Architectures.Assembly.Assembly General

There are 2 ways to prototype the "backend" function for Augmentation shown below:
- serial monitor
- human

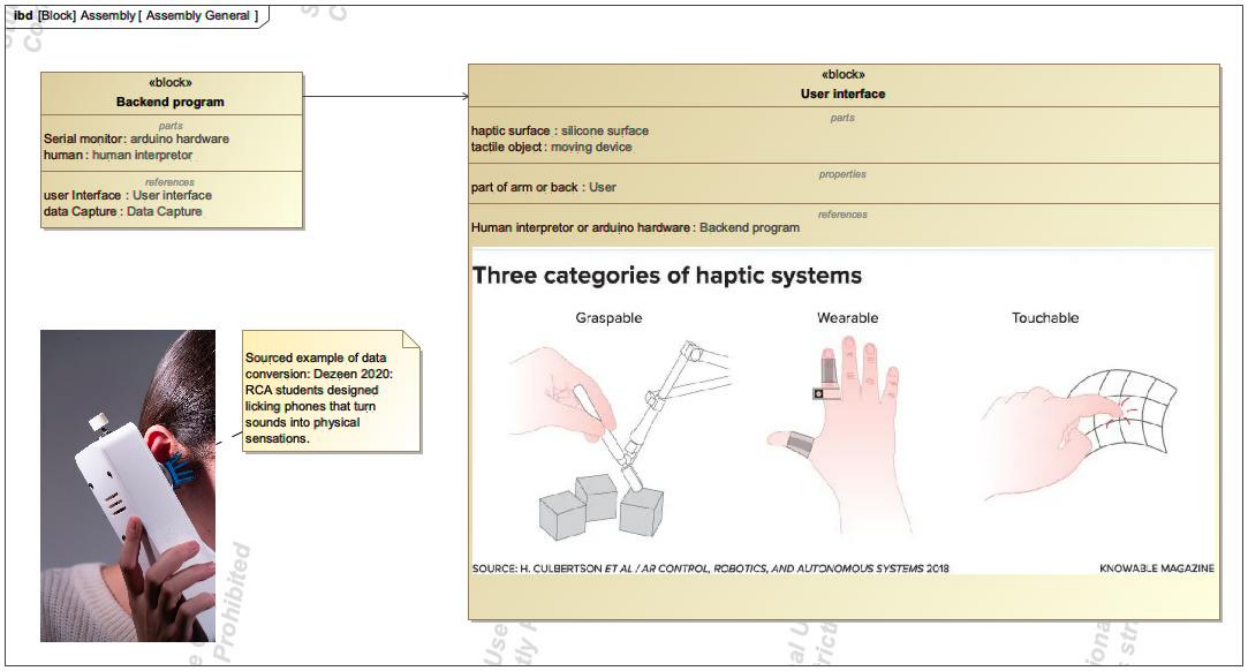


Figure 9 Diagram Assembly General

10. Path 1: Manual Simulation

Diagram Specification>Documentation
In: Proof of Concepts.(c) Architectures.Assembly.Path 1: Manual Simulation

Path 1 involves a human interpretor converting physiological data capture from the user into feedback for the user in the form of an expanding and contracting silicone object. Imagine an object that is soft to the touch and mimics the user's breath rate and depth. This path produces a rough prototype that provides feedback to the user but is not discrete because the user would have to keep his arm/wrist on the object.

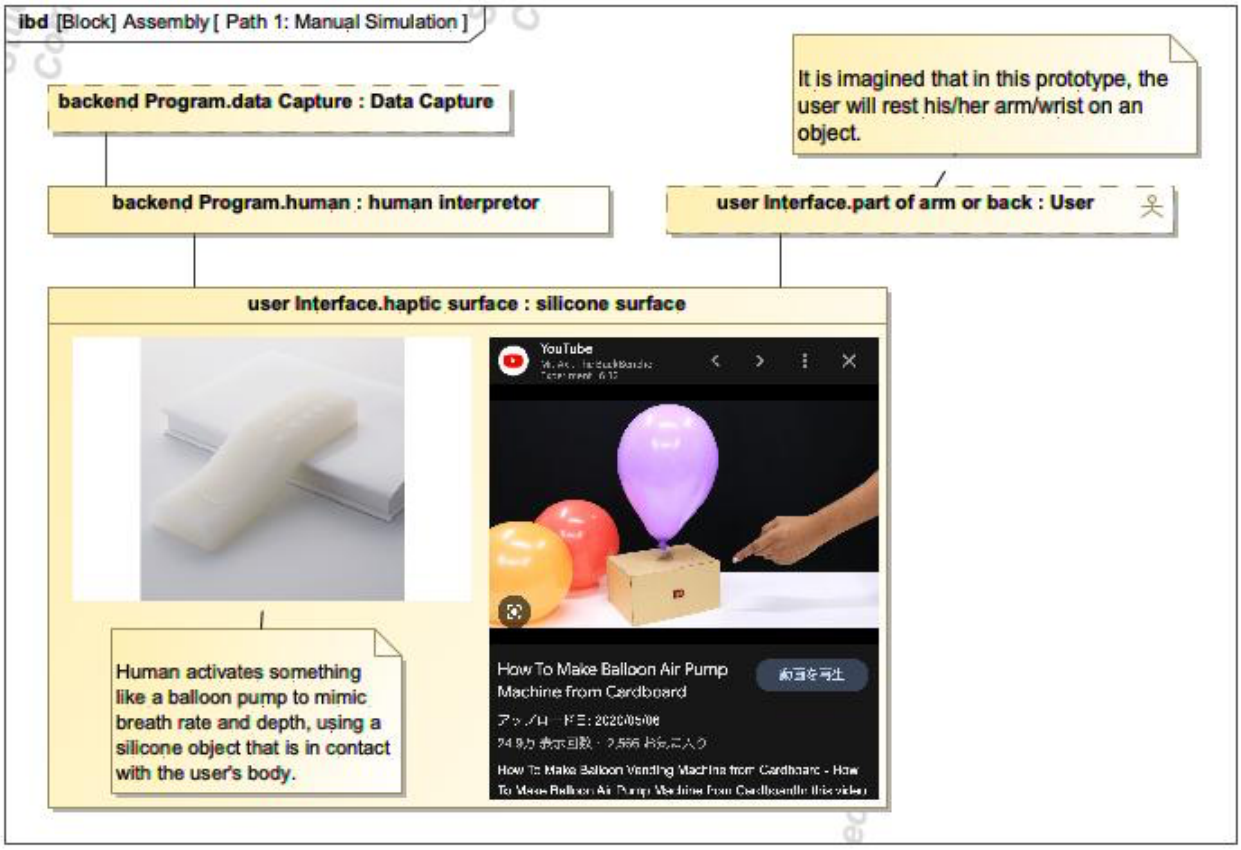


Figure 10 Diagram Path 1: Manual Simulation

11. Path 2: Programmable Moving Object

Diagram Specification>Documentation
In: Proof of Concepts.(c) Architectures.Assembly.Path 2: Programmable Moving Object

Path 2 tries to automate feedback using an arduino backend setup. The issue is that arduino parts and programming might not be able to create subtle movements that mimic the user's breath. Arduino seems to be able to read and translate data into objects that move automatically (robots), but I am not sure if it is possible to program a setup that expands and contracts or creates gentle movements that more accurately reflect the user's breath rate and depth.

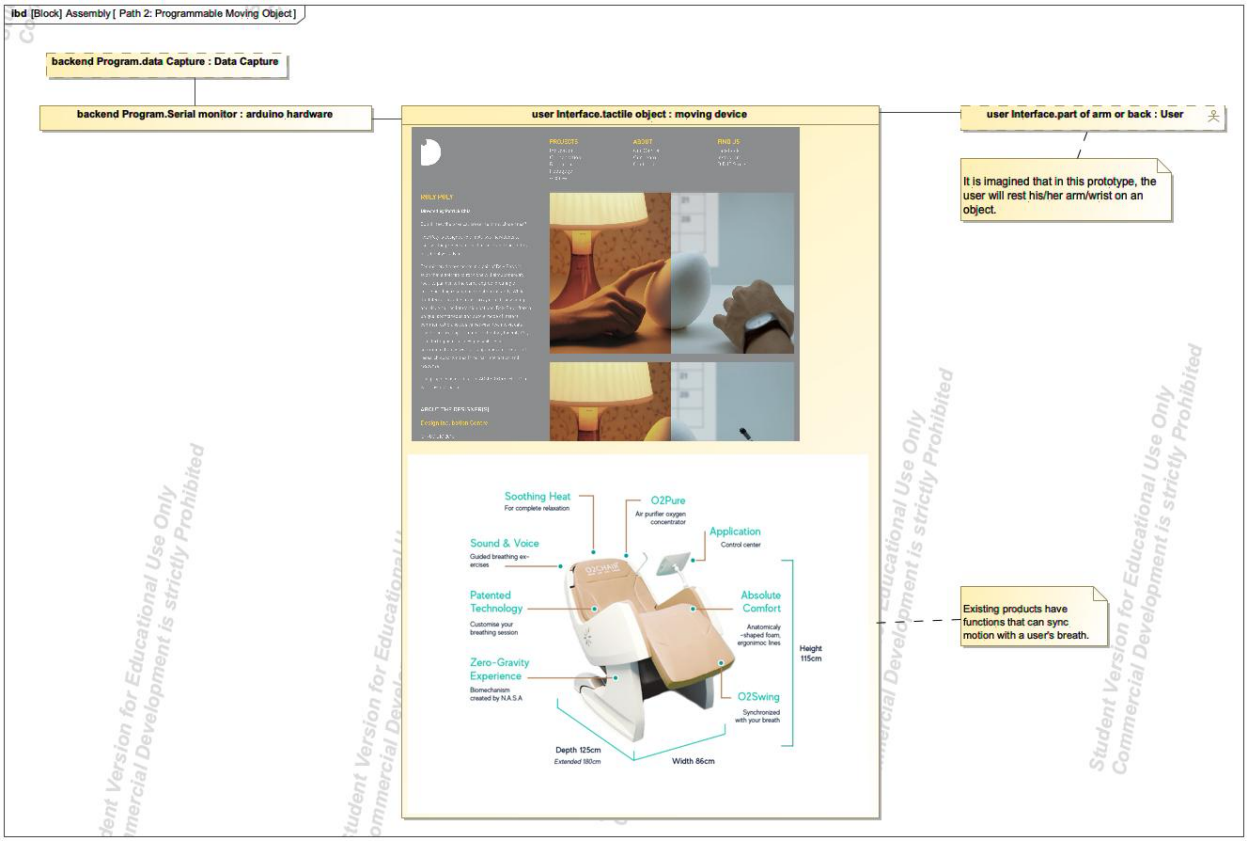


Figure 11 Diagram Path 2: Programmable Moving Object

12. Path 3: Programmable Surface

Diagram Specification>Documentation
In: Proof of Concepts.(c) Architectures.Assembly.Path 3: Programmable Surface

Path 3 represents the potential to procure technology that could preform the function of generating subtle haptic feedback in the form of vibrations through skin-like silicone.

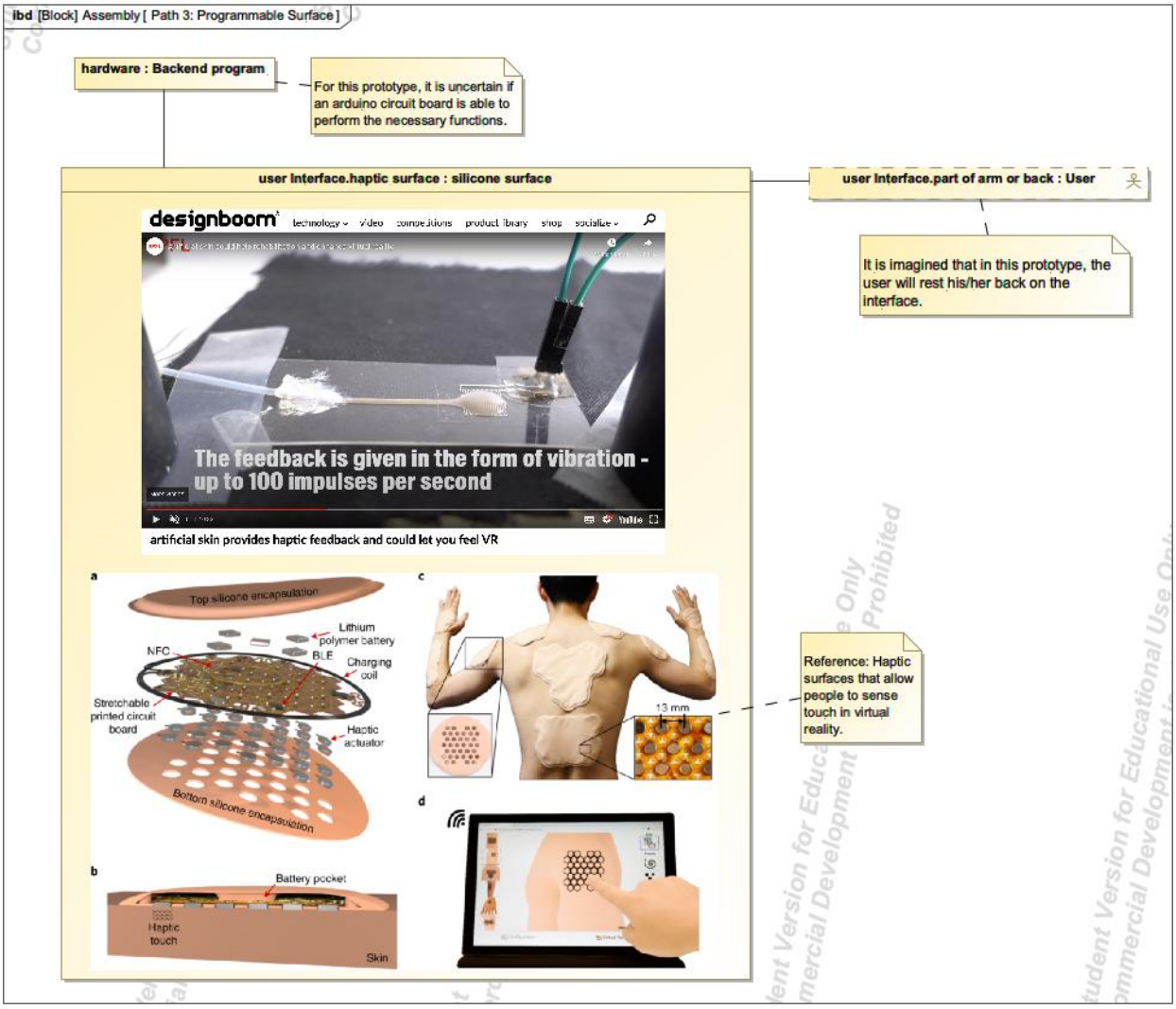


Figure 12 Diagram Path 3: Programmable Surface

13. Allocation Matrix

Diagram Specification>Documentation
In: Proof of Concepts.Allocation Matrix

Allocation matrix is used to indicate which parts of the PoC correspond to the functions of "<<block>> Data Augmentation" structure that need to be tested before the product can be considered viable.

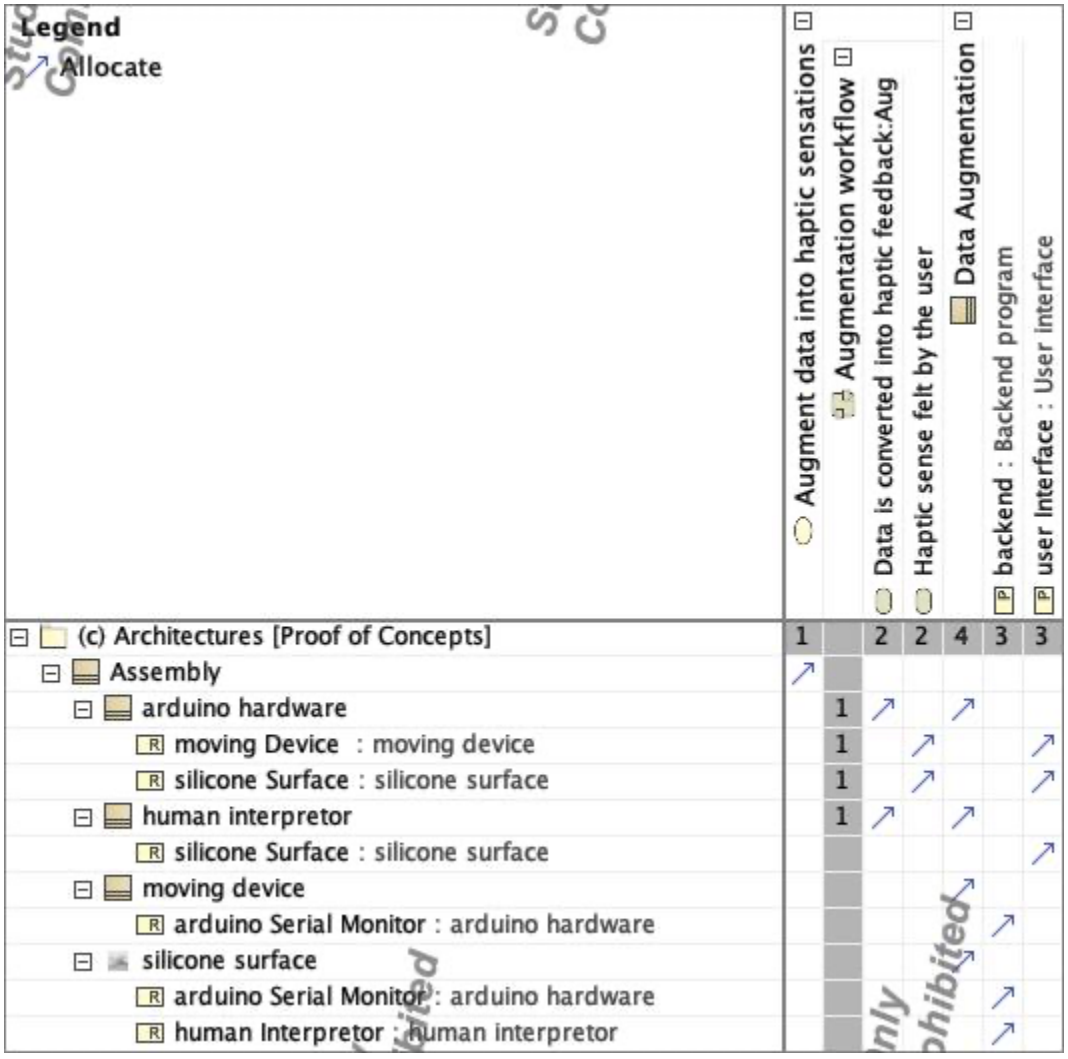


Figure 13 Diagram Allocation Matrix

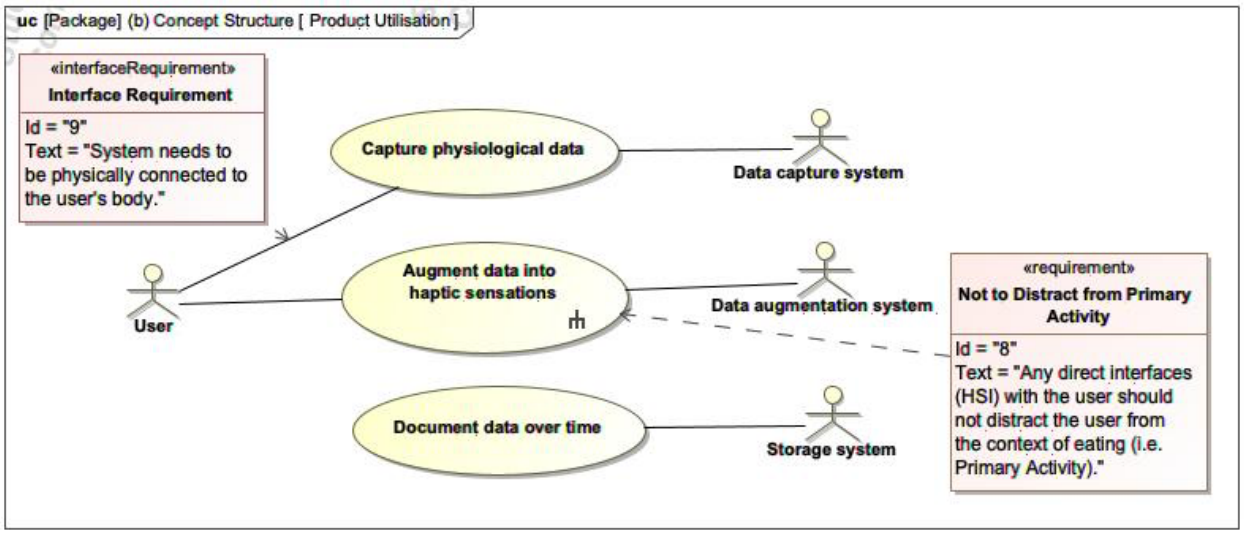
Concept Use-Cases

UseCase
Augment data into haptic sensations
Capture physiological data
Document data over time

Actor Summary

Primary Actor	Use Cases
Data augmentation system	• Augment data into haptic sensations
Data capture system	• Capture physiological data
Storage system	• Document data over time
User	• Augment data into haptic sensations • Capture physiological data

Use Case: Product Utilisation Diagram



Augment data into haptic sensations Use Case

Use Case Name	Augment data into haptic sensations	**ID**	
Complexity	Average Complexity		
Description	System needs to augment user's physiological data into haptic sensations to be felt by the user.		
Actors	• Data augmentation system • User		
Goal			
Assumption	No assumption for this use case.		
Non Functional Requirements	No non-functional requirement for this use case.		

Relations	
Association	• Data augmentation system Actor • User Actor
Generalization	

Capture physiological data Use Case

Use Case Name	Capture physiological data	**ID**	
Complexity	Average Complexity		
Description	System needs to be able to capture physiological data from the user. In the PoC, this data is specified as breathing data including breath rate and depth of breathing.		
Actors	• Data capture system		

	• User
Goal	
Assumption	No assumption for this use case.
Non Functional Requirements	No non-functional requirement for this use case.

Relations	
Association	• Data capture system Actor • User Actor
Generalization	

Document data over time Use Case

Use Case Name	Document data over time	**ID**	
Complexity	Average Complexity		
Description	System needs to document the data that has been captured over the time that the user is using the product.		
Actors	• Storage system		
Goal			
Assumption	No assumption for this use case.		
Non Functional Requirements	No non-functional requirement for this use case.		

Relations	
Association	• Storage system Actor
Generalization	