



Concept Document

Petter
2023

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Table of Contents

1. The IoT Product Concept	2
1.1. The Context and the Problem	2
1.2. The Solution	2
1.3. Key Design Requirements and Drivers	2
2. Possible System Architecture/Technology for the Concept	3
2.1. System Overview	3
2.2. Envisioned Physical Design	4
2.3. Envisioned User Interface (UI) & Prototype	9
2.3.1. Branding & Logo	9
2.3.2. Onboarding	10
2.3.3. Setting Up	11
2.3.4. Main Screens	12
2.3.5. App Navigation	13
2.3.6. Key Design Features	13
3. Viability considerations	16
3.1. Target market	16
3.2. Intended Price Point	16
3.2.1. App	19
3.2.2. Other pricing and business model considerations	19
3.3. Areas of expertise/collaboration needed for realization	19
4. Publicity of this Document	21
5. References	22

1. The IoT Product Concept

1.1. The Context and the Problem

During the pandemic, remote work reached an all-time high and is still a very prevalent option for many. In 2022, Finland was ranked 5th in Europe when it came to working remotely and second when measuring workers working remotely more than half of their designated work time (Taskinen, 2023). Another area the pandemic affected was the demand for pets, particularly puppies. Pets were in high demand during 2020 (Alanne, 2020).

We live in a post-pandemic world where working from home is part of everyday life for many and it is not always easy. As anyone with a dog or cat knows: the second you sit down to do something important is the moment they need your attention the most. Though we want to give them all the love and affection we can, they do not take into account our team's meetings or deadlines that our jobs demand of us.

1.2. The Solution

We wanted to create an IoT device that would give your pet the affection they crave while you take care of urgent work duties. We came up with the pet bed of the future: Petter, a smart pet bed for your affection-starved dog or cat. Petter combines a traditional pet bed, a wellness application and a massage pillow. It also allows you to track your pet's weight.

1.3. Key Design Requirements and Drivers

- Gentle massage
- Easy Onboarding with UX Experience
- Durability and longevity
 - Removable and washable cover
 - Pet-proof fabric
- Safe:
 - Prevent Overheating
 - Isolation of electric mechanism
- 2 massage modes
- Scalable (at least 3 standard sizes in real product)
- Weight monitoring for tracking pet's health

2. Possible System Architecture/Technology for the Concept

2.1. System Overview

The overall system architecture of Petter can be seen below, where our communication with the massage bed Petter (IoT device), mobile application and the cloud happens seamlessly.

Before using the bed, the pet owner needs to connect it with the application through Bluetooth. The mobile application serves as the primary user interface for pet owners. It allows them to set up profiles for their pets, specifying details such as pet name, breed, age, and specific massage preferences. The application also provides a range of customizable massage modes that owners can select for their pets. Additionally, the app allows users to monitor the pet's massage history, receive notifications, and control the bed remotely.

After setting up the app, The bed can be controlled by the app through Bluetooth or WiFi. The moment the pet lies down on the bed, the bed's sensors immediately collect data on the pet's weight and staying time on the bed which can be used to record the weight of the pet and optimize the massage experience. Pet Owners will receive notifications and choose massage mode for their pets. The bed can be programmed to deliver different massage techniques, such as vibrations or gentle kneading, to provide relaxation and relief for pets. The communication between the bed, App and the server is facilitated by program scripts for the Application Programming Interface (API) and a WebSocket application.

After receiving the sensor data, the server processes and analyzes it to update the pet's profile and optimize the massage experience for the pet. The server will provide suggestions for adjusting the massage settings based on the pet's weight and information that pet owners have set up, ensuring a customized and comfortable experience. The server also stores the message history and provides real-time data from the sensors.

Each time, after use, the server stores all relevant data related to the pet profiles, massage modes, and massage history. It provides a reliable and scalable storage solution for the system. The database allows for efficient retrieval and storage of data, ensuring that pet owners can access pet profiles, review massage history, and make informed decisions about their pets' massage preferences.

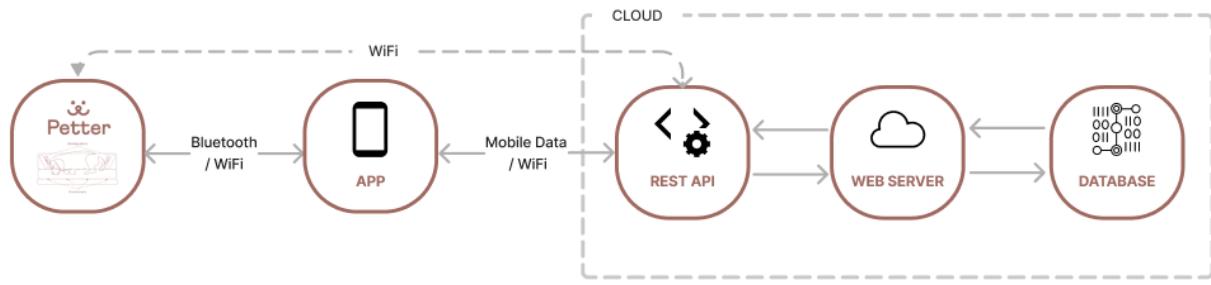


Figure 1: The Overall IOT System of Petter

2.2. Envisioned Physical Design

For physical design, the decided look and feel is to imitate a Nordic furniture-like design language for the object.

- Diagonal-shaped pillows so pets can lie on them comfortably
- The massager placed inside the pillow which is protected by a wooden case
- Layers of silicone and pillow stuffing give additional protection for the massagers
- Wooden platform gives a warm and Nordic product-like feeling
- Wood such as oak, spruce or pine could define the product price range
- Scale sensors are carved inside the durable wood
- The bed consists of three pillow pieces in a modular structure
- Flat mattress-like pillow and three pillows on the edges of the bed
- Two same-sized pillows and one longer pillow on the backside
- The idea was to give an option for the customer to choose whether they want to have the massagers for all the pillows or just one pillow
- Then there would be additional pillows without the massage feature in the sale.
- The idea to support the modularity was to attach the pillow to the bed with durable lycra
- Pillow covers could be removed for machine wash

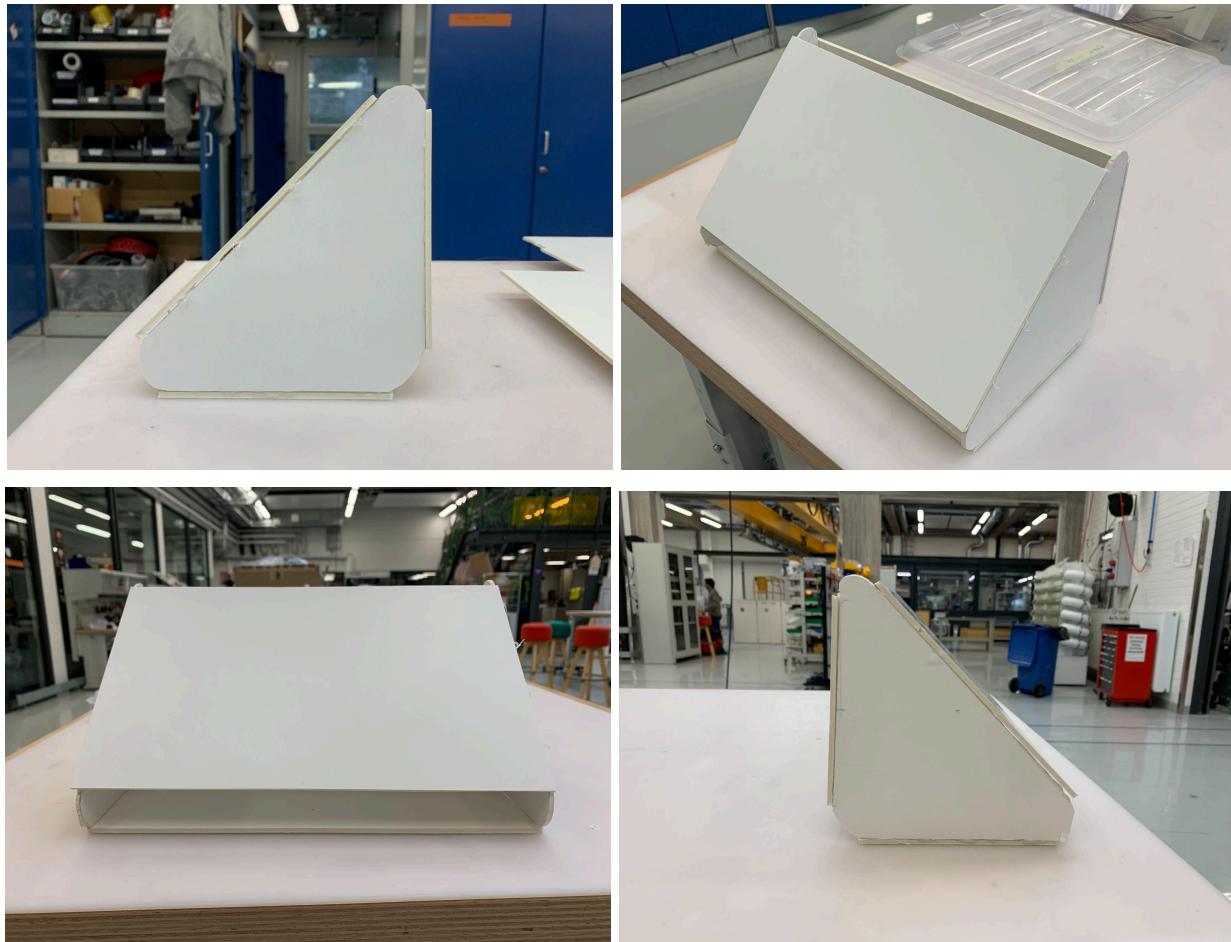


Figure 2: Initial Mockups Of The Pillow Structure

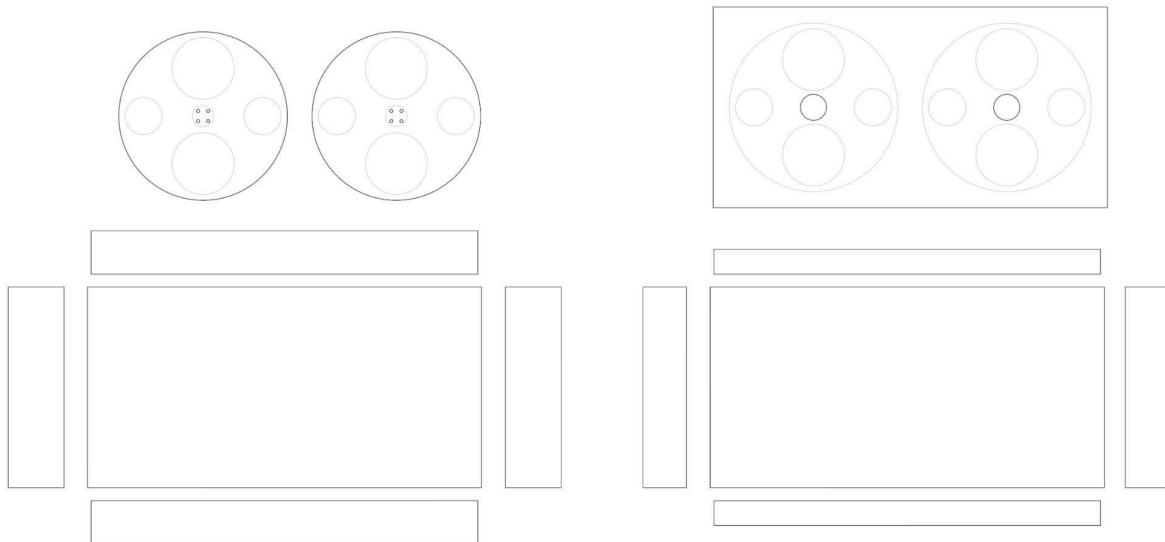


Figure 3: Final Assembly Of The Prototype Body

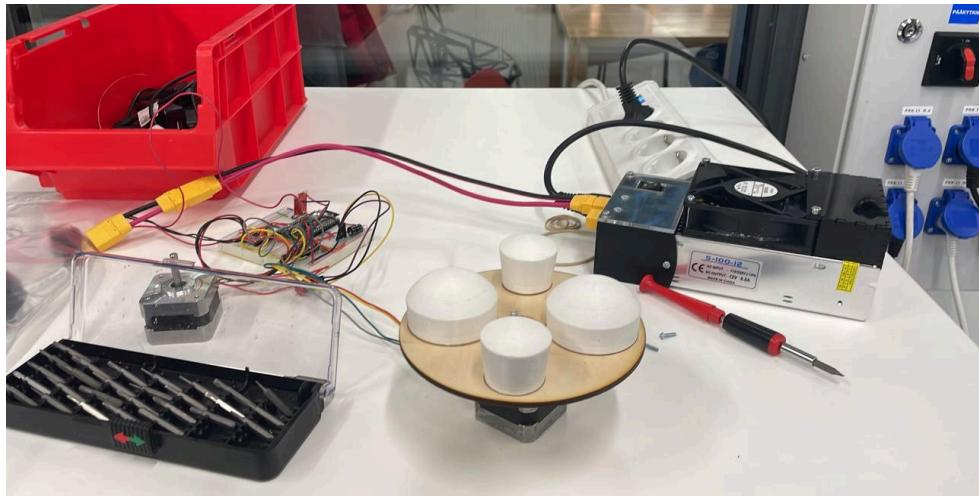
Options of how the system could work:

- Stepper motor for each massage plate or gearing (one motor between 2 or more plates)

Massage pillows for humans include:

- DC motor in the middle with 2 rotary axes on both sides and 2 massage plates geared
- DC motor with one axis placed between 2 massage plates so that both are attached simultaneously

DC motors can not be coded, they produce only continuous motion. So, for our product, we chose a stepper, which can be controlled.



Massage plates

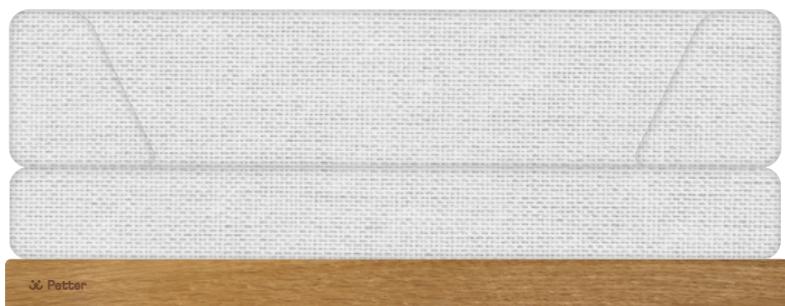
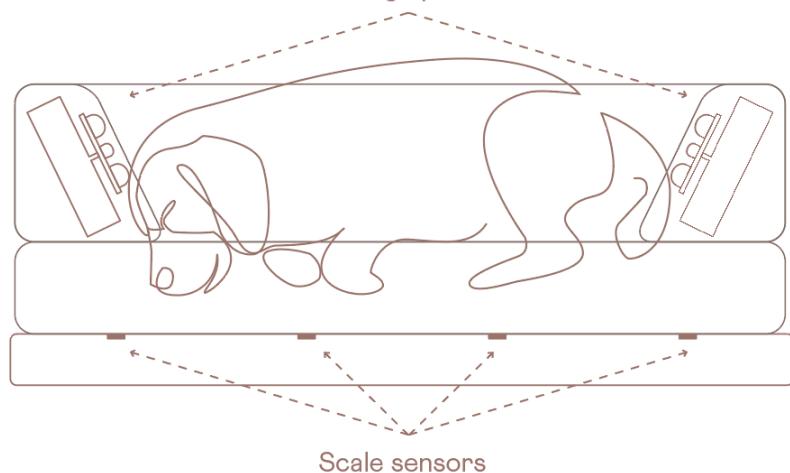


Figure 4: The Prototype Massage Plate And The Look And Feel Of The Final Product

Sizes:

Generally bed sizes vary a lot and there are no absolute standard sizes.

3 standard sizes:

- S (60-80 cm)
- M (80-100 cm)
- L (over 100cm)

It is advised to choose a bed where a dog can lie fully straight back with an extra allowance. As our brand is promoting wellbeing for pets, we choose to produce large enough beds even for small dogs. So, the S size will be 60x80, M 80-100, and L 100x140. We consider S size suitable also for cats.

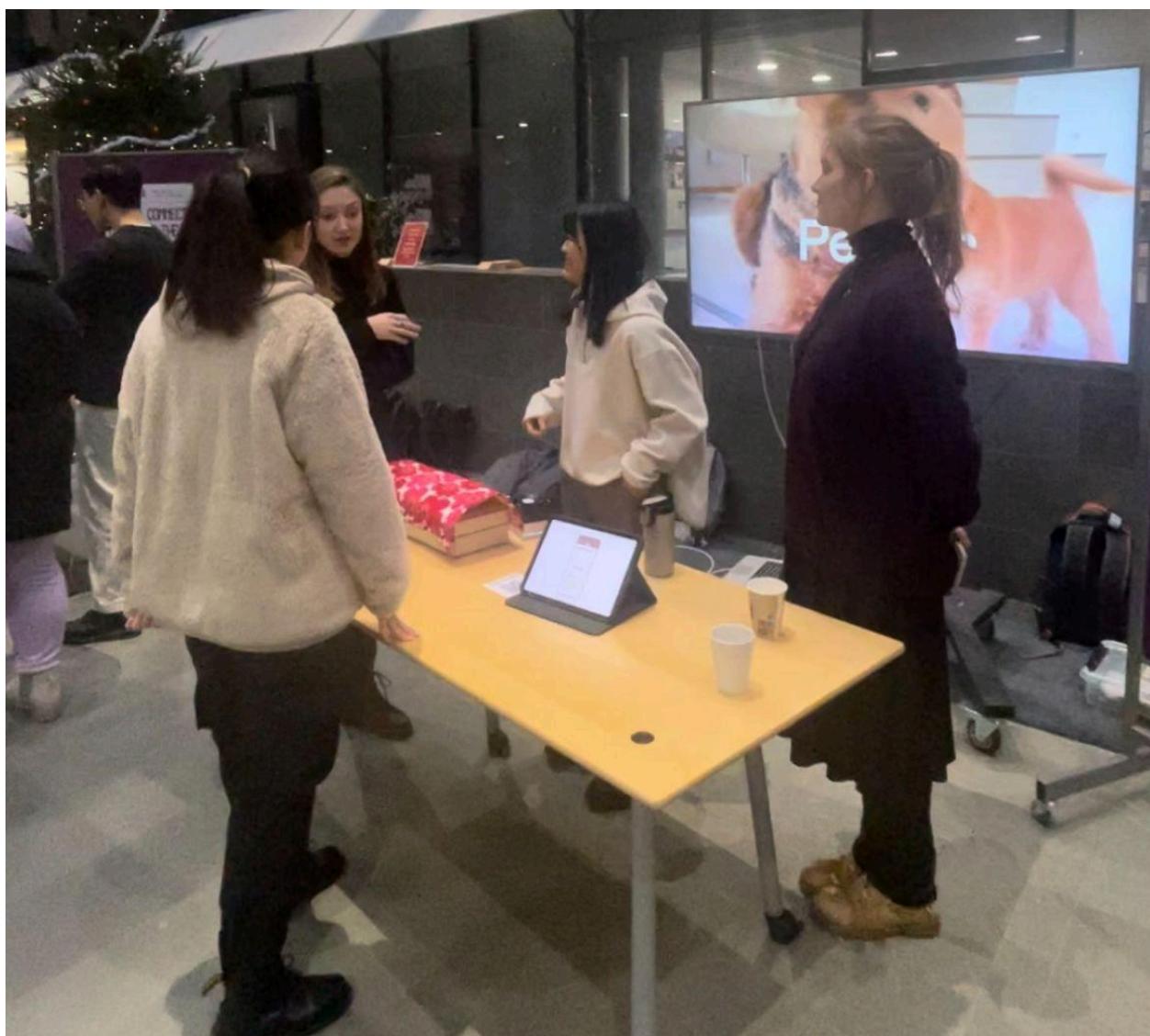


Figure 5: The Petter Prototype And Stall At NEXPO



2.3. Envisioned User Interface (UI) & Prototype

2.3.1. Branding & Logo



Figure 6: Petter Logo & Branding

2.3.2. Onboarding

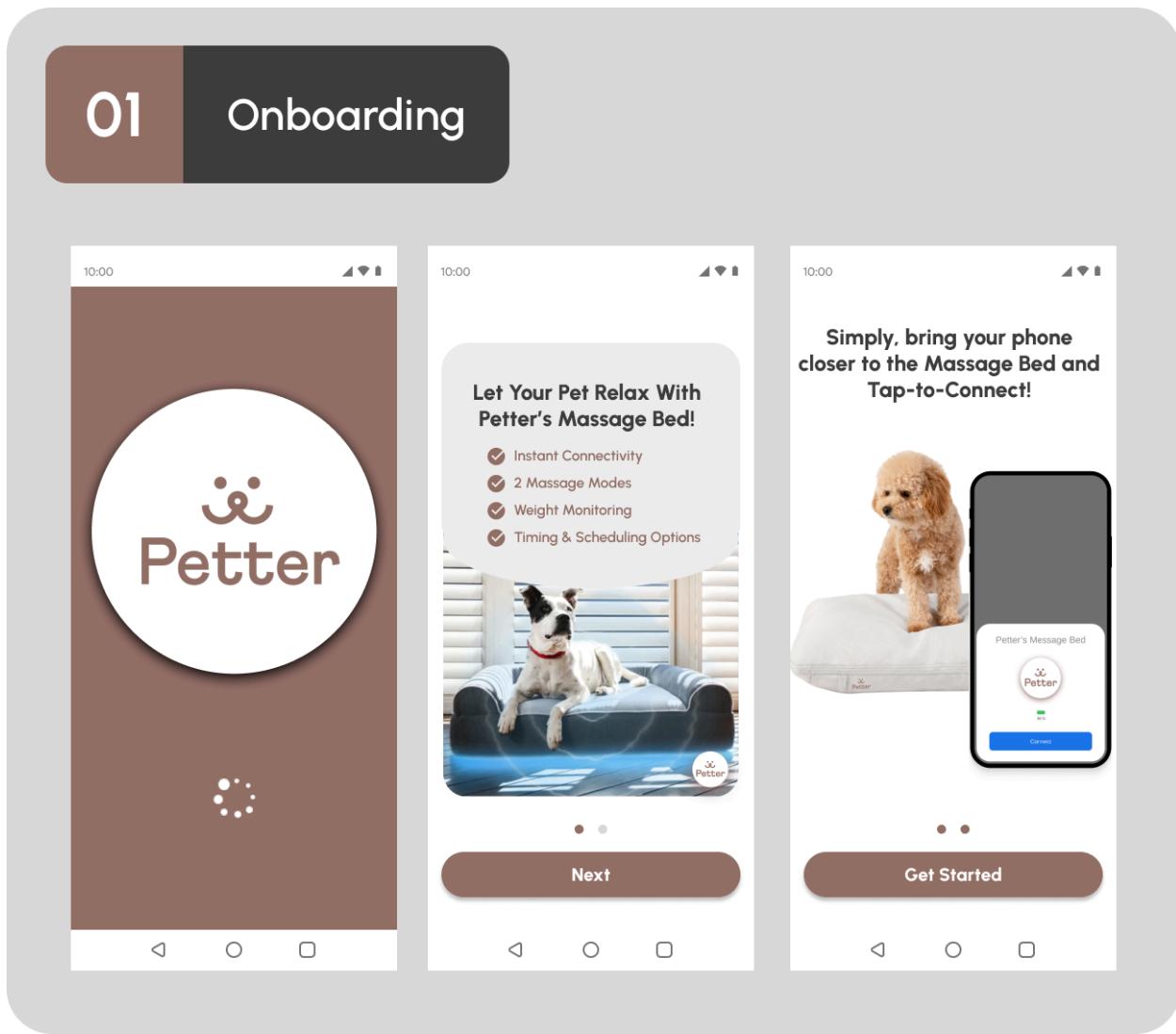


Figure 7: App Onboarding Process UI Screens

2.3.3. Setting Up

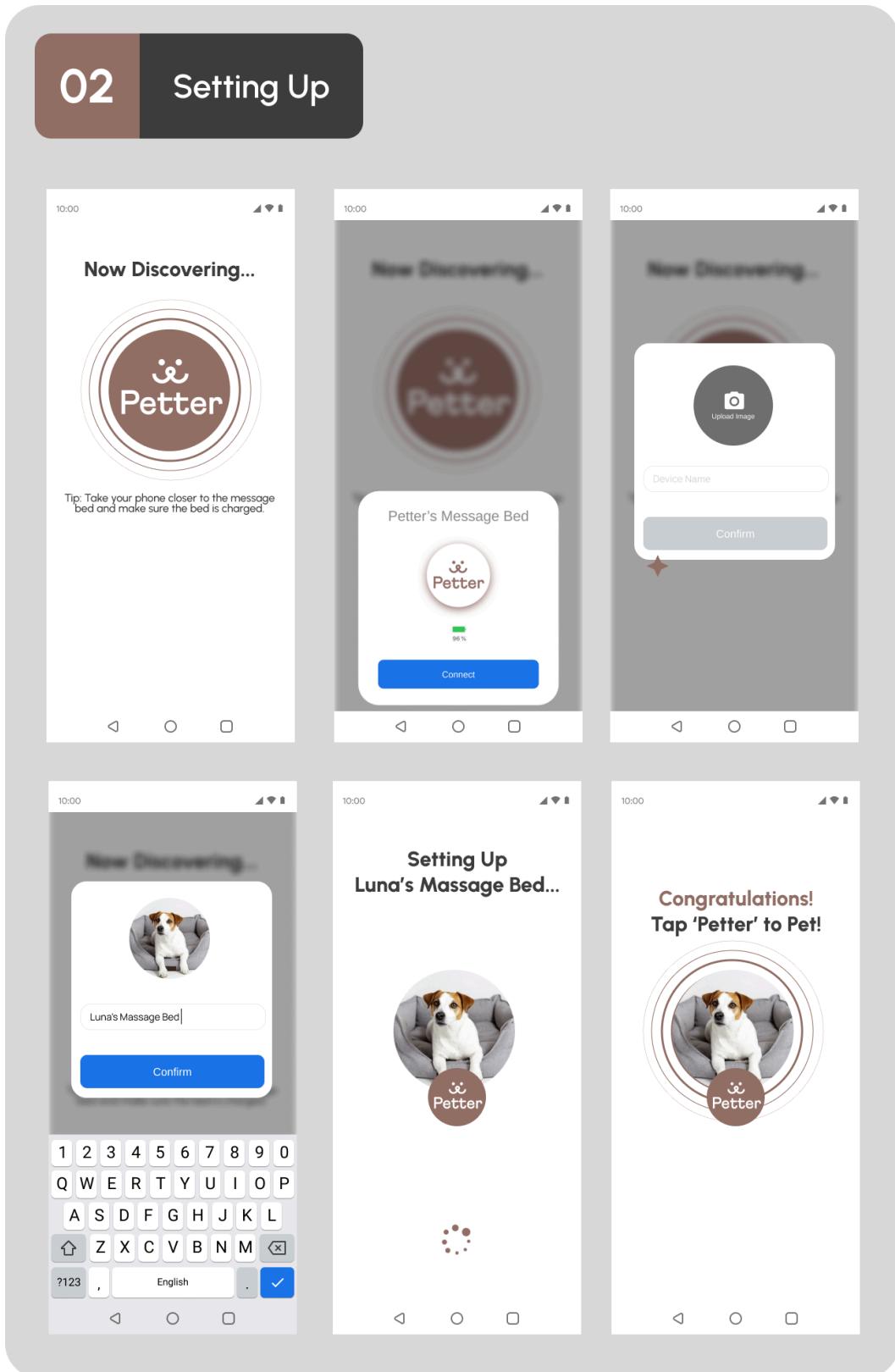
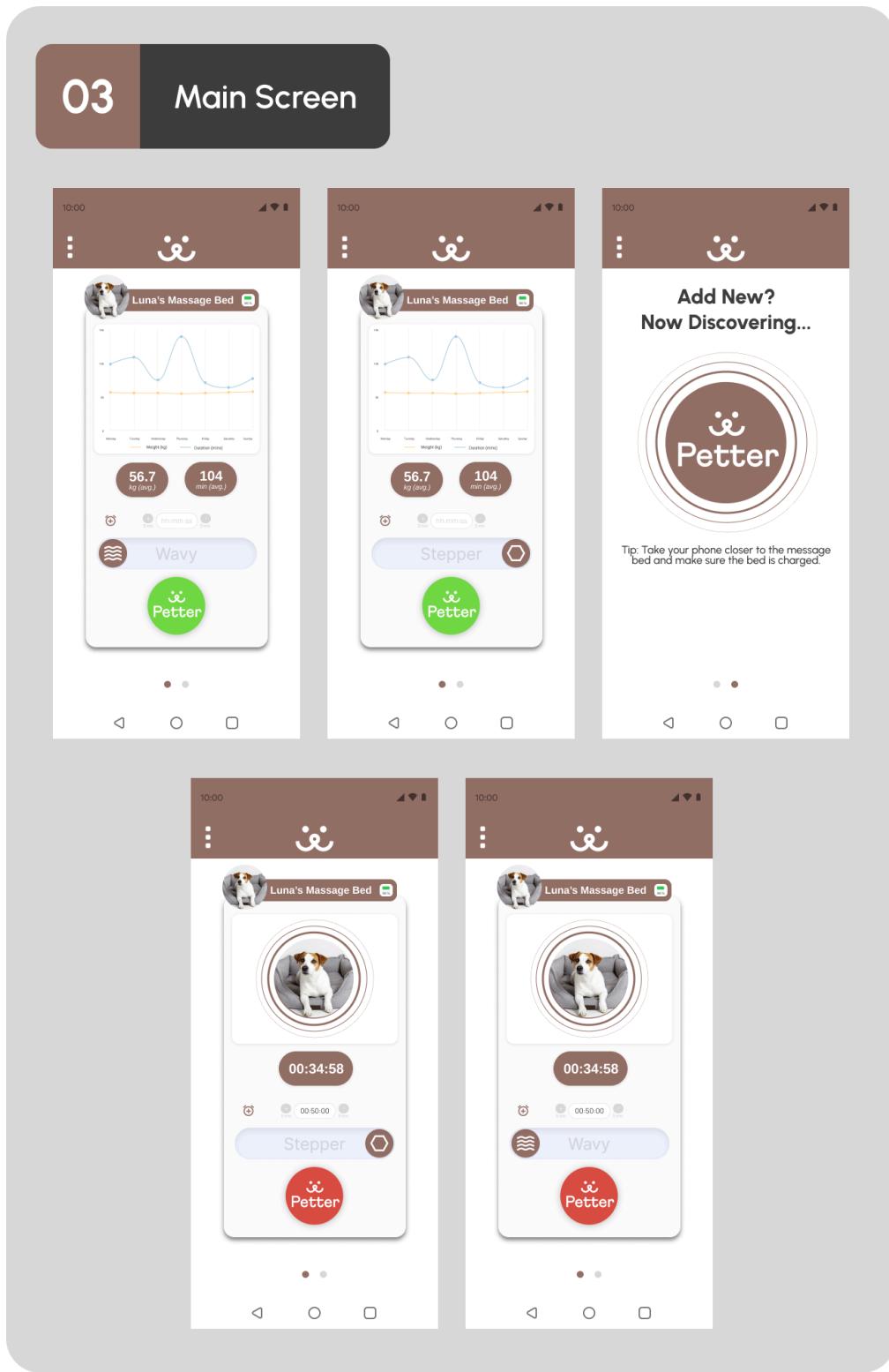


Figure 8: App & Massager Device Setting Up Process UI Screens

2.3.4. Main Screens



2.3.5. App Navigation

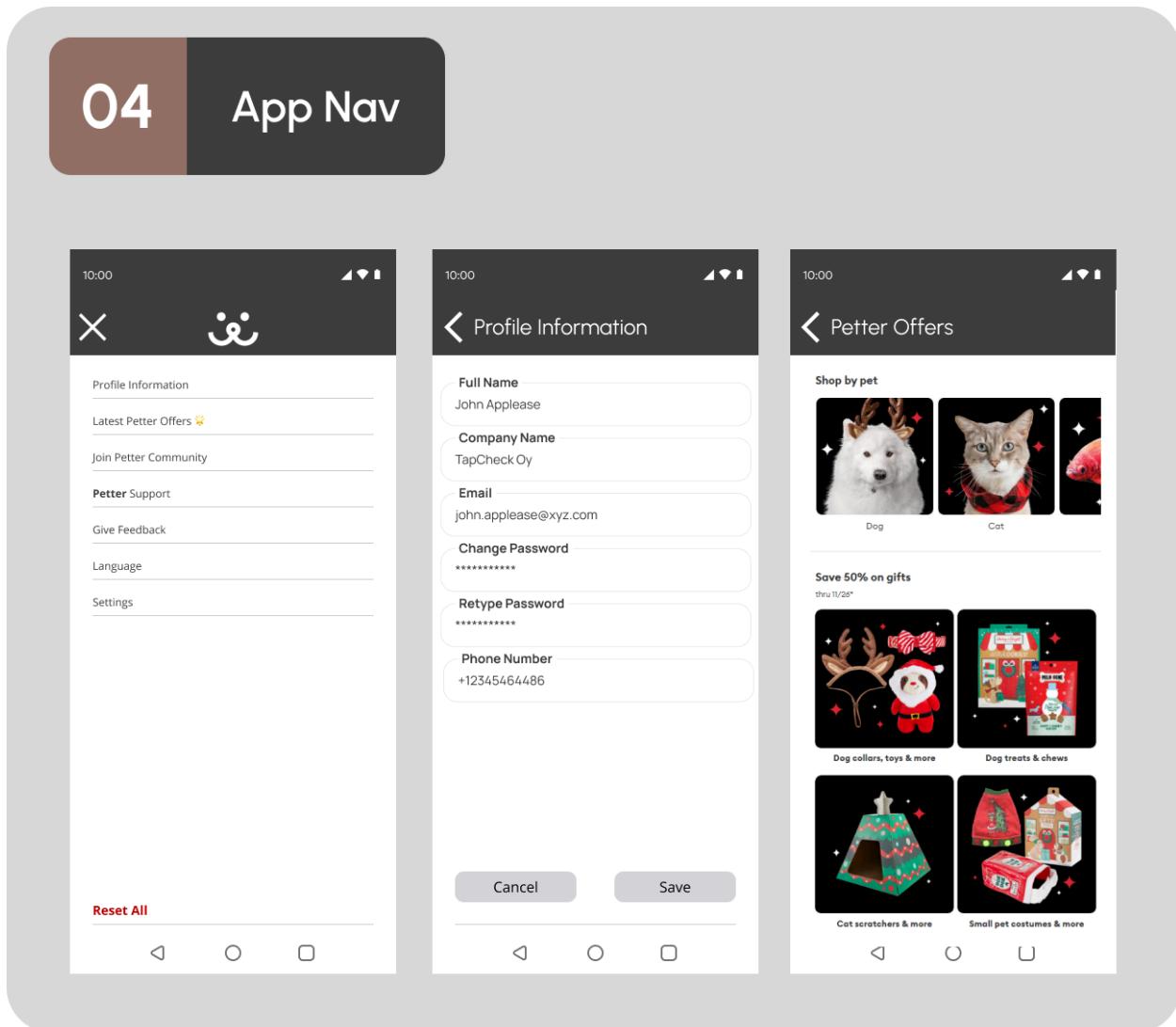


Figure 10: App Navigation & Settings UI Screens

2.3.6. Key Design Features

The design features of the Petter app UI, as presented in the series of screenshots, focus on user engagement, clarity, and functionality. Here are the key features based on the different aspects of the UI:

Usability and User Flows

- **Progressive Onboarding:** The onboarding screens guide users through the features of the app and the product, ensuring that users understand how to

connect their device and what functionalities it offers.

- **Device Setup Flow:** There is a clear step-by-step process for setting up the massage bed, which likely includes device discovery, image upload for pet recognition, device naming, and confirmation, culminating in a congratulatory message, ensuring that users have a smooth setup experience.
- **Main Interface:** The main screen provides a dashboard-style interface where users can view the status of the massage bed, select massage modes, and see the massage bed in action with a timer. The interface is graph-driven, giving users a quick visual reference to the massage bed's activity and their pet's use over time.
- **App Navigation:** A slide-out menu (hamburger menu) contains clear, self-explanatory options for navigating the app. This includes profile information, latest offers, community engagement, support, feedback, language, and settings, which are all essential parts of app navigation.
- **Interactive Elements:** Interactive elements such as buttons, sliders, and switches are prominently displayed and appear to be easy to understand and use.

Visual Design

- **Consistent Color Scheme and Branding:** All screens maintain a consistent color scheme that matches the branding of the Petter logo, which is used throughout the app for continuity.
- **Typography:** Clean and uniform typography is used throughout the app, enhancing readability and providing a seamless experience.
- **Iconography:** Icons are used to represent different features and actions, such as the petter paw, graph icon for analytics, and shopping icon for offers, which makes the app intuitive.
- **Imagery:** High-quality images are used to represent pets and products, which are likely clickable to provide more information or perform actions.
- **Notifications:** There are notification dots on some menu items, presumably to alert users to new offers or important information.

Interaction Design

- **Feedback Mechanisms:** The app provides feedback through the device connection process with status indicators and through the use of active/inactive states for buttons.
- **Confirmation Dialogs:** There are prompts for saving changes, like in the profile information section, which helps prevent accidental data loss or unwanted changes.
- **Personalization:** The ability to upload a picture of the pet and name the device allows for a personalized experience for the user.
- **Responsive Design:** The UI elements scale and organize themselves efficiently across different screens, suggesting a responsive design that adapts to various device sizes.

Accessibility

- **Language Options:** The inclusion of a language setting implies the app caters to a multilingual user base.
- **Legibility:** High contrast between text and background should make the app more accessible to users with visual impairments.

2.3.6. Usability Tests & Feedback

During our usability testing sessions utilizing Figma prototyping for the Petter app's UI/UX, we received overwhelmingly positive feedback that highlighted the app's user-friendly design and intuitive navigation. Observability tests showed that users could effortlessly move through the onboarding process, seamlessly setting up their IoT pet massager device without confusion, indicating that the visual cues and step-by-step guidance effectively facilitated user understanding and interaction. Users particularly appreciate the personalized features such as pet photo uploads and device naming, which enhanced their engagement with the app. Moreover, Figma prototyping allowed for quick iterations based on real-time feedback, enabling us to refine the app iteratively, which was instrumental in achieving such positive results in the usability of the Petter app.

3. Viability considerations

We consider the viability of our product primarily by comparing it with similar products for humans and baseline products for pets. Our product combines three product types: pet bed, massager, and weight scale. As an IoT product, internet connectivity and app-related costs are also accounted for in the viability consideration.

3.1. Target Market

According to Finstat, 40,4% of workers did remote work from home at least time to time in 2022. Over 20% of workers did remote work for more than half of their work time (Taskinen, 2023). There are about 800,000 dogs and 800,000 – 1,300,000 cats in Finland (Kukkonen, 2023). Our customer profile is a dog or cat owner of age 25+ who is doing remote work from home at least occasionally. Our customers have a middle- or bigger income level, they value and prioritize well-being and comfort not only for themselves but for all family members including their pets. The desirability of our product for this target market is based on the comfort of a pet owner and the well-being and health benefits of their pets. Effortless and regular weight monitoring of their pet provides a possibility to avoid overweight-related health problems in their pets.

Pet owners are facing many regular and unexpected expenses. For many dog owners expenses depend on the size of the dog, breed and individual aspects. For example the yearly insurance payment for a purebred dog ranges between 500–1000€ (Lähitapiola 2023). Basic doctor appointment without procedures and medicines ranges from 80–200€ (Taikatassu, 2023; Evidensia, 2022) in a private clinic in a capital region. Dog massage therapy price is about 50€/h (Musti ja Mirri Oy, 2022). We believe that many pet owners are willing to make an effort to increase their pets' well-being and would be ready to invest in products, which they find useful. Although our product is not meant to compete with personal massage therapy for pets, the weight monitoring feature can be extremely helpful for pet owners who struggle with their pet's weight control and thus it can reduce overweight-related health problems and medical expenses. It is difficult to weigh big dogs, who weigh more than 30kg regularly at home with a scale designed for humans. Thus, the weight measuring feature makes our product more desirable for dog owners who are especially careful about monitoring their pet's health.

3.2. Intended Price Point

We have explored the Finnish market in terms of three products: usual pet beds, scale and massage mats for humans. We have also explored the main components which are

used in scale and massage mats to estimate roughly the price of components needed for our product.

- Dog beds are usually sold in three sizes: small, medium and large. Prices vary respectively 20–50€, 50–80€, 80–120+€ (Musti ja Mirri Oy, 2020; Peten Koiratarvike Oy, 2020).
- Human scale price is 15–20€ (Tokmanni, 2019; Clas Ohlson, 2022).
- Massage mats for humans can be purchased in Finland for the price of 80–180€. Massage seat covers can be purchased for the price of 160–280€. (Hobbyhall, 2023; Kuntokauppa, 2022; Puuilo, 2023; Tokmanni, 2023)
- We found only one massage bed for pets, which is an IoT device, which provides vibrating therapy, and its normal price is 1249\$ (Dog Cloud Pty Ltd, 2023)

We aim to use similar technology of mechanical massage as which is used in massage mats and seat covers. Dog Cloud Pty Ltd (2023) is positioned as a sophisticated therapeutic massage bed addressing orthopedic health problems in dogs. Petter provides a way of relaxation and calming and its main function is to provide scratching for a dog, while the owner is next to him busy with some other activity. The main health benefit of Petter is the effortless weight control feature. We have estimated that our target price of a physical product for a customer would be 320€ (size S), 350€ (size M) and 380€ (size L). In addition to a one-time purchase of a physical product, application use will be charged monthly. Subscription-based pricing of the application will help to cover operational costs and further development of the application. The target price of the subscription is a maximum of 5€/month, in the initial stage we consider the price of 3–5€/month.

3.2. Justifications for the Price Point

The intended price point presented above is a rough estimate which is based on a comparison with existing products. We have explored massage pillows and scale teardowns to investigate commonly used components.

Usual pet beds can be taken as a basis for our product, but additional materials should be used for insulation of the electronics and a firm scale base. Pet beds can be usually washed. To make a washable pet bed, which includes electronics, we must make detachable coverage, so additional materials, such as zippers and additional layering must be used in our product. This will increase expenditures on fabric, stuffing and leak-proof insulation. If we take a normal pet bed as a baseline for estimating our product price, due to greater fabric, additional zippers and more complicated sewing patterns we assume a greater price for this part of the product. In addition, we use the following components to estimate roughly materials price for production:

Insulation		
Silicon sheet (leak-proof insulation)	5-20€/kg	(Focus Technology Co Ltd, 2023)
Electronics		
MCU	ESP32 with LEB (or similar) ≈3€	(Mouser Electronics Inc., 2023)
Load Cell Amplifier	(SparkFun HX711) ≈ 10€	(SparkFun Electronics, 2016)
Load Sensors	50kg (Generic) ≈ 4€ x 4	(SparkFun Electronics, 2017)
Power supply	AC/DC wall adapter ≈ 10€	(DigiKey Electronics, 2023a)
Actuators (motors) Stepper / DC motor	≈10-20€/piece	(Adafruit Industries, 2023)
PCB	≈5€	(Eurocircuits N.V., 2023)
Temperature sensor Low-Power Linear Active Thermistor ICs to prevent overheating	≈1€	(DigiKey Electronics, 2023b)
Wiring	≈5€	Assumption based on several resources
Plastic elements (massage heads, casing, firm base)	≈10-20€	Assumption based on several resources

We assume that load sensors can be purchased for a cheaper price when comparing the price of these components with the price of bathroom scales on the market. The most expensive part of Petter will probably be motors. In our prototype, we used two Nema17 stepper motors each attached to the massage head without gearing. The price of this stepper motor is about 15€. This motor without gearing was insufficient to provide enough torque to produce rotatory motion under load. As we found from massage pillows teardowns, DC motors with gearing are usually used in those massage pillows. We also consider the price of the massage mat and massage seat cover. In these products, there are usually 4-8 massage heads, several vibrating points and a heating function. The important difference is however the absence of connectivity to the internet. Those products are controlled by the wired remote controller.

We note that additional research and prototyping are needed to find out the best solution for motors and gearing that we would use in the final product. We can not use

the price of the motor used in our prototype, but we can assume from other massage mat and seat cover prices, that it would be possible to use at least 2 motors and 4 massage heads and keep the price of production per unit under 100€ for electrical and mechanical parts of the product.

3.2.1. App

We estimate that our app for the MVP can be launched for about 10000€ price with an outsourced app development project (Hion Digital Oy, 2023). UI and UX design can be produced by our experienced team members. Yearly maintenance costs might include at least 10 working days of outsourced service, which will add up to 10000€ to yearly operational costs. We would like to keep the monthly price of the subscription no more than 3-5€, as we take as a baseline other health-related apps for humans such as Oura ring application (5,99€/month) or Clue (3,33€/month).

3.2.2. Other Pricing and Business Model Considerations

For the real product price estimate capital expenditures and operational expenses must be accounted for and they will depend on how much the manufacturing process can be outsourced. Operational costs of a small company including a manager, salesperson, marketing person, IT professionals and customer servicers will mainly include salary, office and marketing expenses, while the production line will demand initial investments and much greater CapEx and OpEx. Partnering with existing manufacturers of pet beds and other pet equipment would be the way to launch the product with less investment.

3.3. Areas of Expertise/Collaboration Needed for Realization

The successful development and implementation of Petter requires a multidisciplinary approach involving expertise in various fields. While our project team would maintain active engagement in management, business administration, design, and product development, we recognize the necessity for engineering collaborations to drive technological advancements. Ideally, we seek experienced engineering partners and those with manufacturing expertise to bridge this gap. Collaboration with professionals and specialists in the following areas is essential for the realization of Petter:

- **IoT and Embedded Systems:**

Petter relies heavily on IoT technology for remote control and monitoring. Collaborating with/hiring experts in IoT and embedded systems is crucial for

designing a seamless and efficient connectivity framework. This includes integrating sensors to ensure optimal performance.

- **Mechanical Engineering:**

The physical design and functionality of Petter demand expertise in mechanical engineering. We would need to hire employees in this field who can contribute to the ergonomic design of the massaging mechanism as well as the massage bed, ensuring it is comfortable, durable, and safe for pets of varying sizes.

- **Veterinary Medicine:**

Input from veterinary professionals can guide the development of massage patterns and intensities that cater to different pet needs and health conditions. Although we have a trained physiotherapist on our team, the expertise of vets is crucial to ensure that Petter's massage functionality is enjoyable and beneficial for pets.

- **User Interface (UI) and Experience Design:**

Developing a user-friendly interface for pet owners to control and monitor Petter remotely is essential. Although we have designers on our team, hiring a team of designers to continuously improve the app based on user feedback will enhance the overall usability and accessibility of the product.

- **Funding:**

Our team would need to raise funding for the abovementioned needed collaborations. The following are a few steps to approach this:

1. Clearly outline the financial requirements for collaboration in each specific area. This includes budgeting for engineering partnerships, research and development (R&D), manufacturing expertise, and any other essential collaborations.
2. Develop a comprehensive business plan and pitch deck that outlines the startup's mission, market opportunity, product roadmap, and financial projections. Highlight the specific collaborations needed and the expected impact on the business.

3. Reach out to venture capital firms that specialize in supporting startups. Pitch our business to these VCs, emphasizing the potential for growth and the strategic importance of the collaborations.
4. Seek out individual angel investors who may be interested in our startup. Angel investors often bring not only capital but also valuable industry connections and expertise. They may be more willing to take risks on early-stage ventures.
5. Explore crowdfunding platforms to raise funds from a larger pool of individuals who believe in our product. This can be an effective way to validate market interest while securing the initial capital needed for collaborations.

4. Publicity of this Document

This document has been created to explain our design concept and research findings. It is intended as a public document. Therefore the content given in this document can be used for education and research purposes when properly referenced. Please get in contact with the authors if you wish to get more background information.

The document is not intended for commercial purposes. The report including all figures is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License. This concept is at the moment not further developed by our team.

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