Smart home product

Design for home automation systems-
A new smart home product for children and families

Politecnico di Torino

Candidate:

Mu Xuanqi - S288330

Yao Yicong -S288325

Politecnico
di Torino

Design for home automation systems-
A new smart home product for children and families

A.Y. 2022/2023

September 2023

Master's Course Thesis - Systemic Design

Candidate:

Mu Xuanqi - S288330

Yao Yicong -S288325

Supervisor:

Bozzola Marco

Co-supervisor:

Di Salvo Andrea

In collaboration with Domethics S.r.l.

INDEX

INDEX

- CONCLUSION
- REFERENCE

INTRODUCTION

Over the past few decades, artificial intelligence (AI) has gradually evolved from a theoretical concept to a ubiquitous technology in real life. With its further evolution and progress, AI has become the core engine of technological development in our society and the main driving force for social change. Artificial intelligence has not only changed the field of science and technology, but also profoundly affected our daily life.

Our work aims to explore the background of home automation systems, especially from the perspective of designed technologies and new induced behaviors and lifestyles, on the basis of existing research on digital robots and artificial intelligence technologies, intelligent systems, and discover problems , solve problems, upgrade functions and innovate, and make these systems usable through the role of design in reading user behavior and needs, and focus on human-centered design to make artificial intelligence closer to life and truly become a life partner for human beings .

The design process started with the analysis of the partner company Domethics (a company based in Piedmont specialized in the development of home automation systems), understanding the company's products and the fields of work involved, providing a holistic perspective on the integration of design, technology and social markets, the study and seek the background, market and function of children's smart home products, deeply understand the user's perception and experience to tap the user's actual needs, enhance the user's sense of experience, and ensure that the conceived solution, form and function are balanced. The goal is to design a smart home product for children and parents.

DOMETHICS

1.1 The company

Areas of expertise

Values and mission

1.2 Adriano

1.1

The company

COMPANY SIZE

2-10 employees

FOUNDING TIME

2014

HEADQUARTERS

TORINO

Domethics

The company is an innovative Italian SME founded in 2014 with 2-10 employees and headquartered in Turin.

The company has won the 2022 CES Innovation Award, and its business scope includes the design and development of products and services in the field of Internet of Things, with a special focus on smart home, telemedicine, health and healthcare. Every work of the company upholds the positive impact on the sustainable development of society.

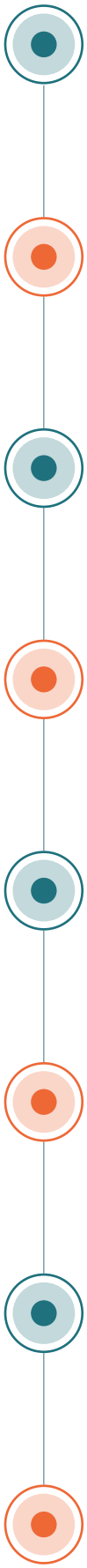
Areas of expertise

Domethics involves a variety of professional fields, including smart home, project management, technology exploration, Internet of Things, product development, software development, hardware development and mobile application development, etc.

Values and Mission

Them Create Value from Ideas.

Through the technology and capabilities owned by the company, support companies that are approaching and tackling the Internet of Things market and accompanying them to achieve their goals.



1.2

ADRIANO


Mirko Bretto
10
08
WEARABLE
2450 Passi
7h 30 min.
74 BPM
ADRIANO
25° C
45%

Background and Introduction

Estimates of the contribution of digital technologies to climate change suggest a range of 1.4%–5.9% of global GHG emissions, of which~31% is contributed by digital devices such as smartphones, desktops, displays, and netbooks (GEC, 2021).Increasing the useful lifespan expectancy of electronic devices by 50%–100% can mitigate up to half of the total GHG emissions. （Singh&A. Ogunseitan，2022）So Domethics designed the Adriano product. By recycling waste mobile phones, Adriano can be used for secondary use, and the combination becomes a brand-new innovative smart home for users, thereby reducing carbon dioxide emissions. This is through the global Inspired by the Sustainable Development Goals.

Adriano's Innovation

Adriano Innovates for Sustainable Development Goals.

Adriano can increase the energy efficiency improvement rate through the secondary use of old mobile phones, and it is also a sustainable smart home product that people can generally afford. Through recycling and reuse, the generation of waste is greatly reduced, achieving a sustainable production model.

Through the upgrading and innovation of technology, Adriano has realized the innovation of the form of smart home products, reflecting the diversification of smart home.

Through Adriano, we can control our house very well, reduce the possibility of accidents, and make our living environment safer and more comfortable.

With the increase of E-waste, the emission of carbon dioxide will also increase, so the idea of DOMETHICS designing adriano is also to reduce the environment and ecosystem damage as much as possible.

SMART HOME

2.1 What is smart home

Functional Classification of Home Automation

Smart Home Classification

How to work

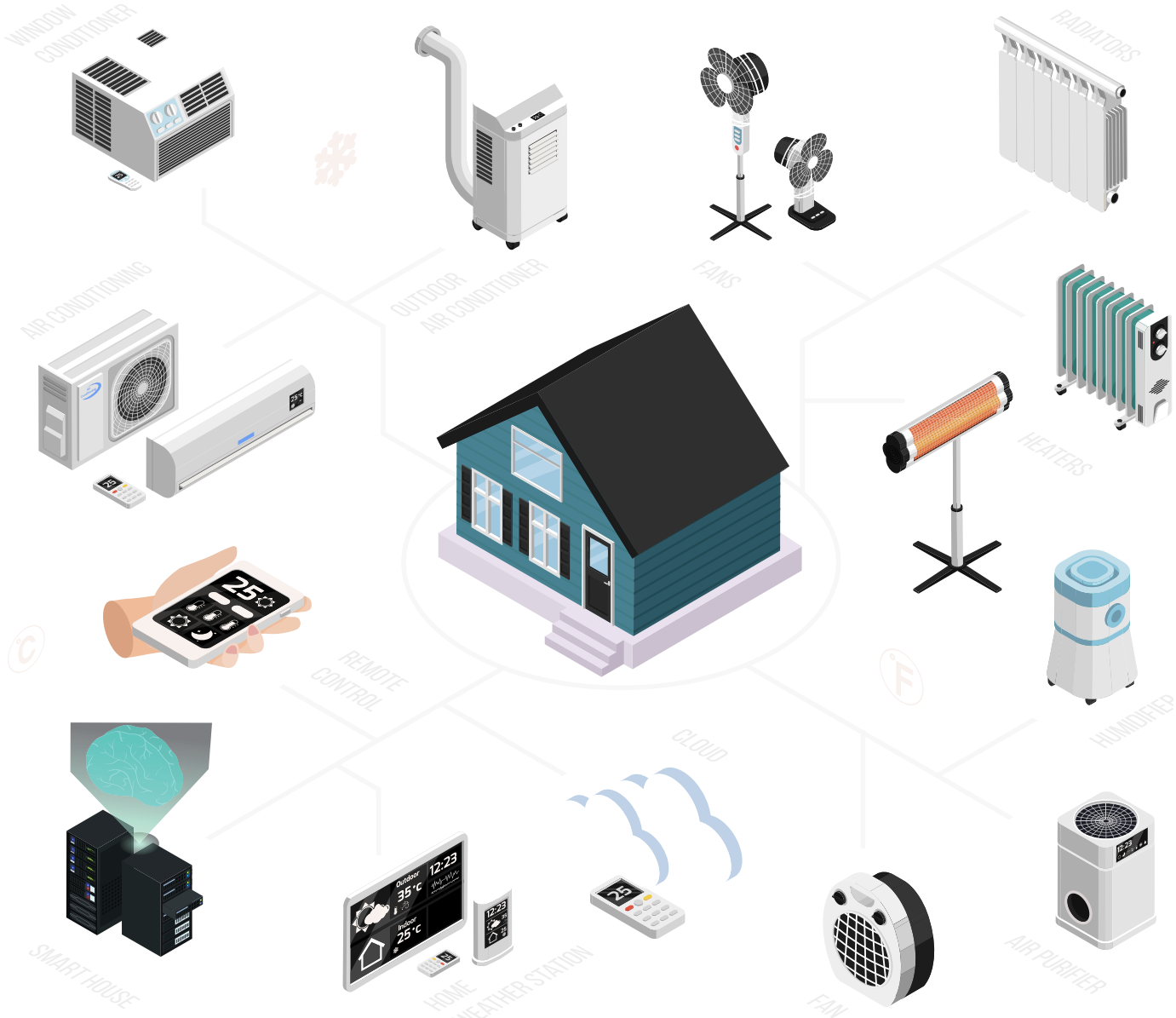
PROS and CONS

2.2 Market analysis

Current status and outlook of the home automation market

1.1

What is Smart Home?



https://www.freepik.com/free-vector/smart-home-flowchart_7439581.htm

IoT and Smart Home

First of all, when we mention smart home, we have to think of the most popular word in various researches at the moment, which is the Internet of Things（IoT）.“The Internet of Things is a system of interrelated computing devices, mechanical and digital machines, animals or peoples that are provided with unique identifiers and the ability to transfer data over a network without requiring human to human or human to computer interactions.”IOT has been widely cited as a solution to reduce stress in smart-homes（Kumar&Chawda，2020）Smart home is a network that can be connected to the Internet. Remote automatic control programs or sensors can be controlled from various places through the network, so the setting up of smart home is very convenient.

Definition of smart home

In the article "Smart Home Definition and Security Threats", what is a smart home is introduced in detail, which tells us that there is actually no accurate definition of a smart home. (Schiefer,2015) In fact, when we conduct research on smart homes, we also find that each researcher has a more or less different definition of smart homes.

Such as, “A smart home, or smart house, is a home that incorporates advanced automation systems to provide the inhabitants with sophisticated monitoring and control over the building’s functions. For example a smart home may control lighting, temperature, multi-media, security, window and door operations, as well as many other functions.” (Kalyni et al.,2016). Smart home technology, also often referred to as home automation or domotics (from the Latin "domus" meaning home), provides homeowners security, comfort, convenience and energy efficiency by allowing them to control smart devices, often by a smart home app on their smartphone or other networked device. (Kumar&Chawda,2020)

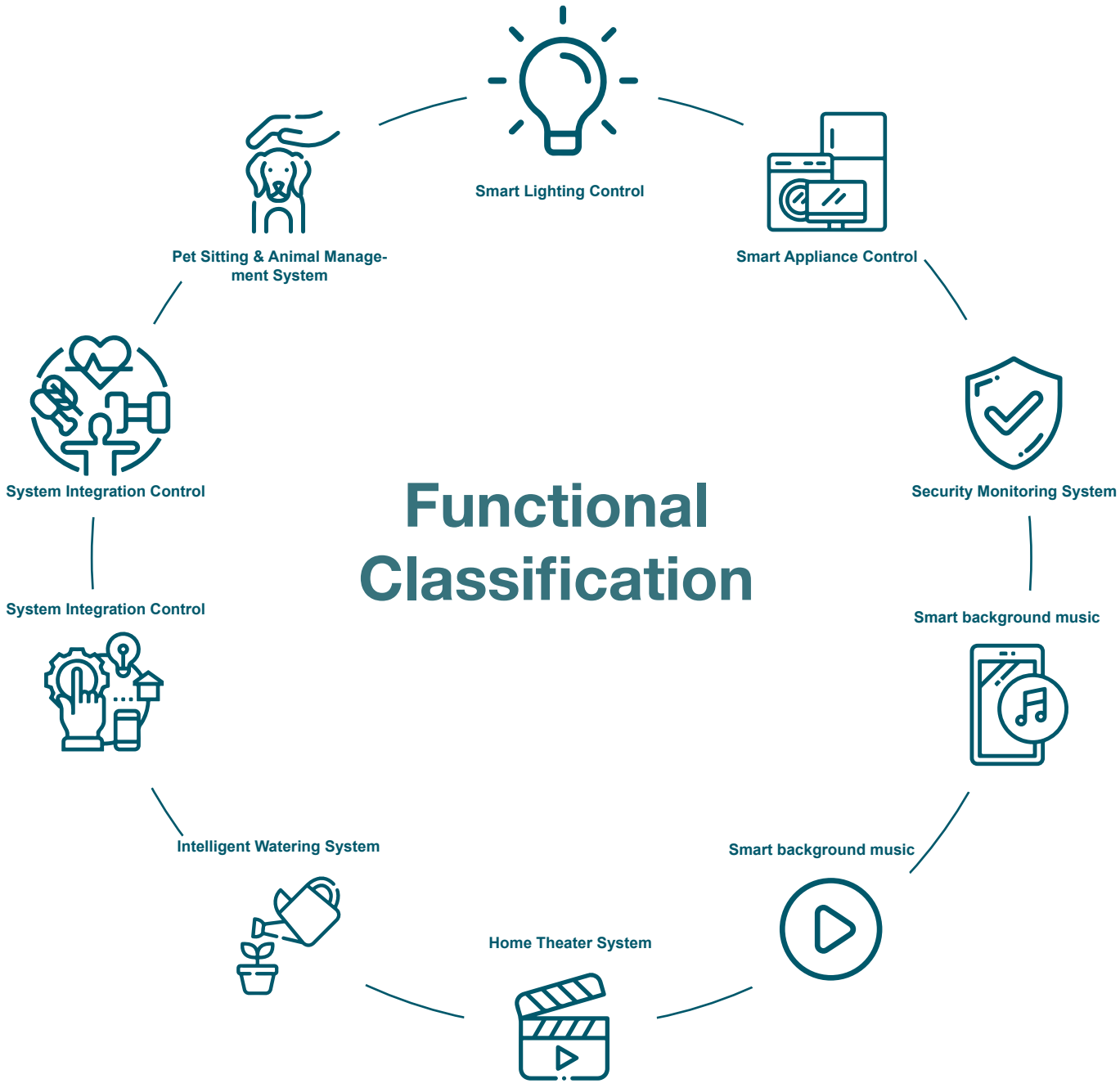
We can briefly summarize that a smart home is any connected home automation or entertainment device that is equipped with or more connected to the network and can be controlled remotely.

Functional Classification of Home Automation

In the article “Functional Classification of Smart Home”, it is mentioned that "the definition of smart home is different for users, investors, architects or designers of smart home equipment. The definitions are not consistent. But this paper provides us with a new solution, which is to directly use the software support system design specifications required by users, and provide them in the form of software and hardware implementations suitable for smart home functions. (Hamernik et al.,2012)

Group functions are divided according to their application in the Smart Home. They are the group as follows:

B1 Lighting B2 Shading system B3 Controlling of appliancesB4 Heating, ventilation and air conditioningB5 Safety functionsB6 MultimediaB7 HealthB8 KitchenB9 IrrigationB10 CleanB11 Control


Functional Classification
Smart Lighting Control
Smart Appliance Control
Security Monitoring System
Smart background music
Smart background music
Home Theater System
Intelligent Watering System
System Integration Control
System Integration Control
Pet Sitting & Animal Manage-ment System

Smart Home Classification

We knew beforeThe Smart Home is any home that is equipped with one or more interconnected deviceshome automation or entertainment systems that are connected to the web and controllable from remote To better qualify the scope of these analyses, “RAPPORTO SMART HOME Internet of Things nelle case italian CentroStudiTIM”(2021) identify various categories in which to segment the reference market so as to better understand the dynamic:

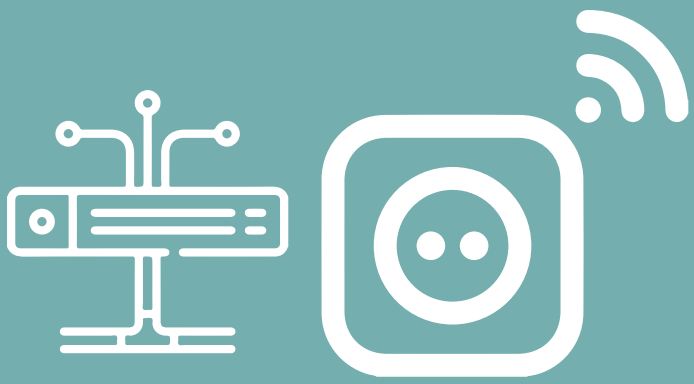
Smart Appliances

Smart appliances such as washing machines, refrigerators, dryers, ovens, robots, vacuum cleaners, microwave ovens

Safety

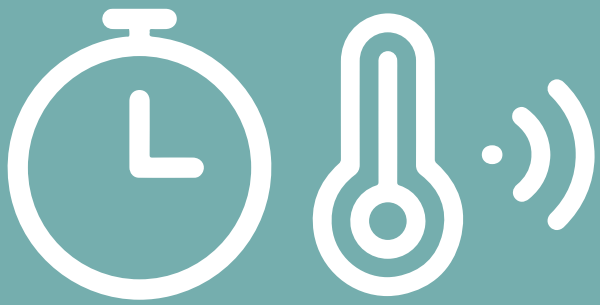
Cameras, digital peepholes and systems to prevent theft and intrusion, Motion sensors, door locks, smoke/fire sensors

Smart Speaker



Controls and Connectivity

Gateway and Hub for controlling devices, Smart sockets, programmable buttons, actuators



Energy Management

Products and services for the control and reduction of consumption
Timers, radiator valves, temperature sensors, actuator photocells

Lighting and Comfort

Sensors and actuators to improve home comfort, Smart lamps
Sensors for doors and windows, gate and shutter controls

Home Entertainment

Home entertainment systems and services, Multi-room audio, Streaming Systems (Chromecast, Amazon Fire Stick)

How a smart home works?

A smart home's devices are connected with each other and can be accessed through one central point—a smartphone, tablet, laptop, or game console. Door locks, televisions, thermostats, home monitors, cameras, lights, and even appliances such as the refrigerator can be controlled through one home automation system. The system is installed on a mobile or other networked device, and the user can create time schedules for certain changes to take effect.

Smart home appliances come with self-learning skills so they can learn the homeowner's schedules and make adjustments as needed. Smart homes enabled with lighting control allow homeowners to reduce electricity use and benefit from energy-related cost savings. Some home automation systems alert the homeowner if any motion is detected in the home when they're away, while others can call the authorities—police or the fire department—in case of imminent situations.

Once connected, services such as a smart doorbell, smart security system, and smart appliances are all part of the internet of things (IoT) technology, a network of physical objects that can gather and share electronic information.（HAYES，2022）

CONS of smart homes

While smart homes bring more convenience, there are also hidden dangers, such as **security risks** that have always troubled users and manufacturers. These include cost, privacy, security, reliability, and interoperability of different technologies.(Wilson et al.,2017)

Privacy and trust-related issues have delayed or halted smart-meter rollouts (AlAbdulkarim and Lukszo, 2011; Hoenkamp et al., 2011). Similarissues may arise with data collected by internet-enabled SHTs withinthe home (Cavoukian et al., 2010; Balta-Ozkan et al., 2013b). A widerset of sociotechnical concerns with SHTs includes an **increaseddependence on technology**, electricity networks or outside experts,and **the proliferation of non-essential luxuries inducing laziness indomestic life** (Balta-Ozkan et al., 2013b).

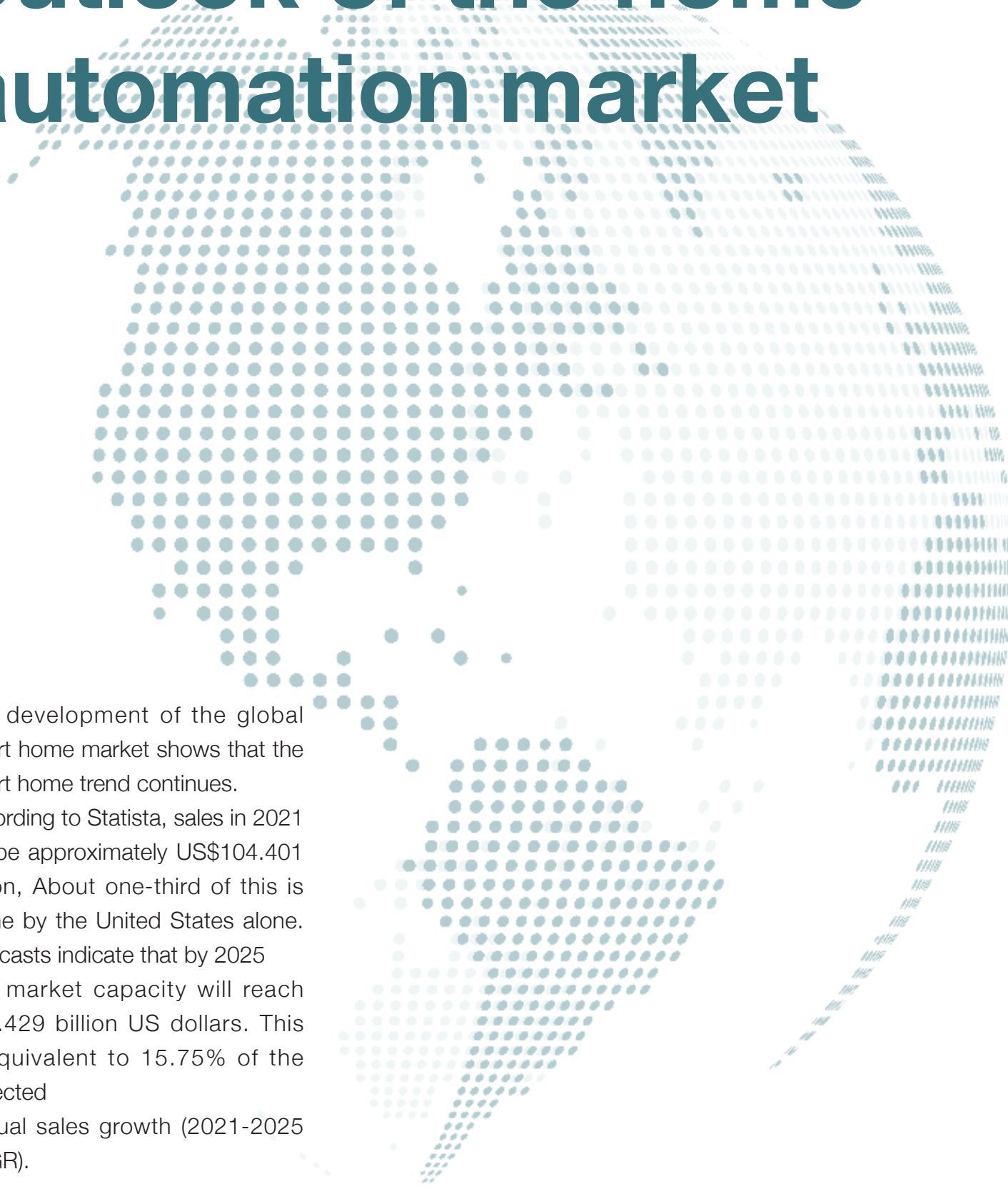
PROS of smart homes

Smart home systems provide users with a lot of convenience. Users can use one device to control all electrical appliances.Smart home technologies (SHTs) comprise sensors, monitors,interfaces, appliances and devices networked together to enable automation as well as localised and remote control of the domestic environment (Cook, 2012). Controllable appliances and devices include heating and hot water systems (boilers, radiators), lighting, windows,curtains, garage doors, fridges, TVs, and washing machines (Robles and Kim, 2010), no need to control these appliances separately.

From an energy saving perspective, smart homes can help users solve more costs. Smart homes are seen as an integral part of a future energy efficient system, helping to reduce overall demand as well as alleviating supply constraints during periods of peakload (Lewis, 2012; Firth et al., 2013).

Through smart home users, they can know the situation at home at any time outside, and they can also know the situation outside the door through smart doorbells at home. In terms of benefits, SHTs can provide not just enhanced energy management, but also improved security and security, enhanced leisure and entertainment services, and extended personal independence through health care provision and assisted living (Chan et al., 2009; Nyborg and Røpke2011). Smart homes can bring users a higher quality of life.

Current status and outlook of the home automation market



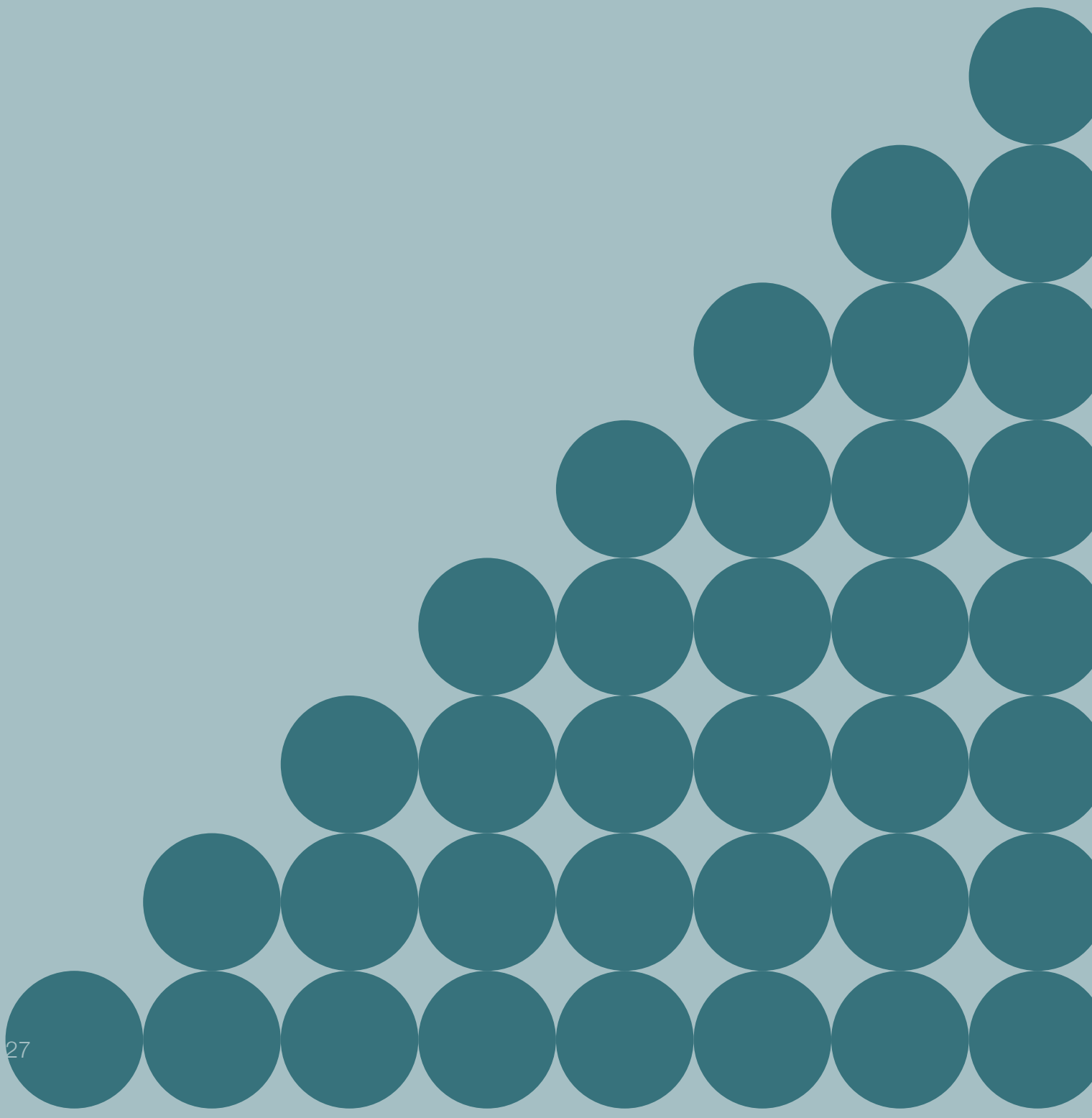
The development of the global smart home market shows that the smart home trend continues. According to Statista, sales in 2021 will be approximately US$104.401 billion, About one-third of this is borne by the United States alone. Forecasts indicate that by 2025 The market capacity will reach 187.429 billion US dollars. This is equivalent to 15.75% of the expected
Annual sales growth (2021-2025 CAGR).

2025

$187.429 billion

2021

$104.401 billion

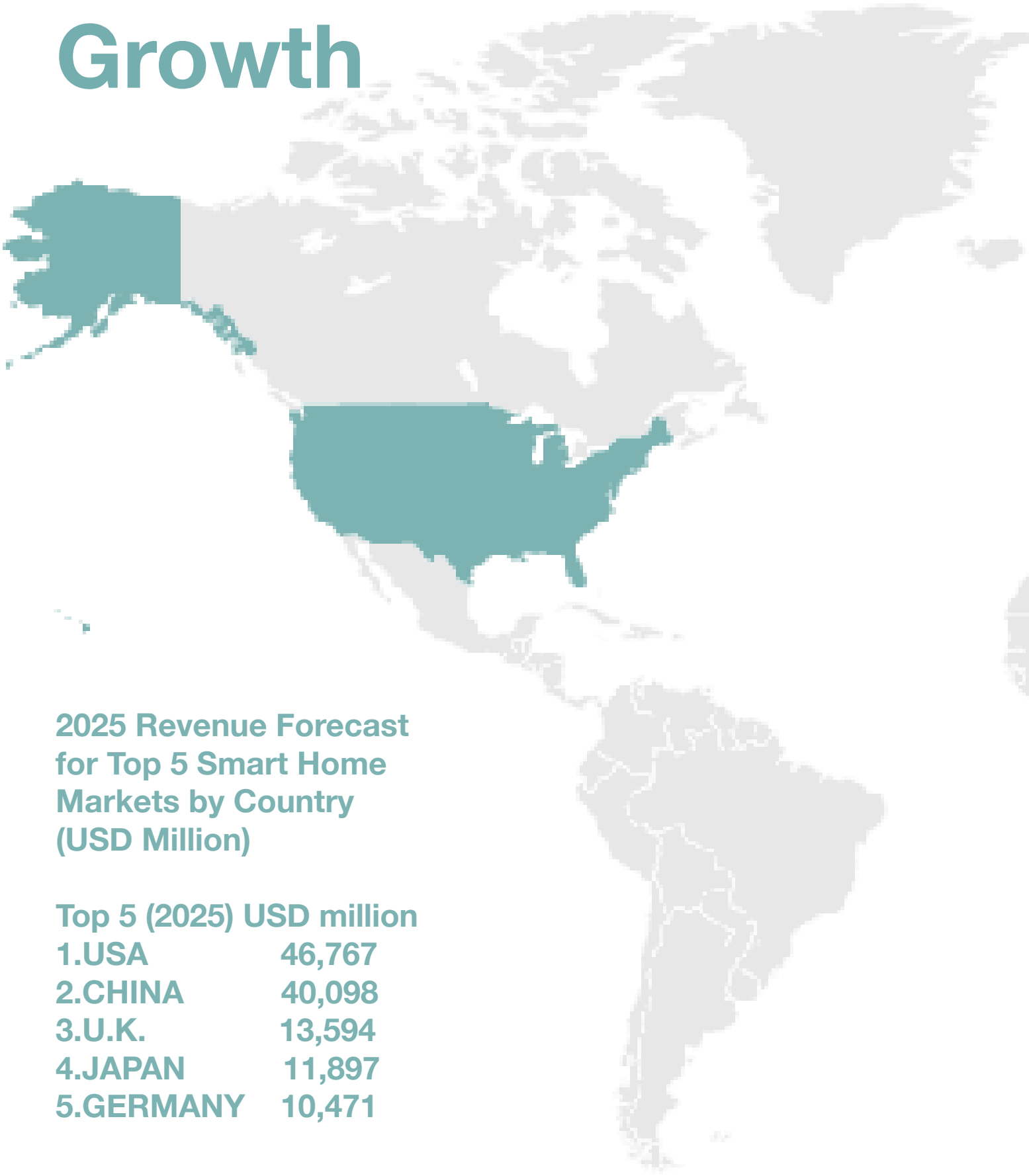


478 million

According to the Digital Market Outlook, the number of Smart Homes in the market worldwide is forecast to reach 478 million by 2025 (Lasquety-Reyes, 2021).

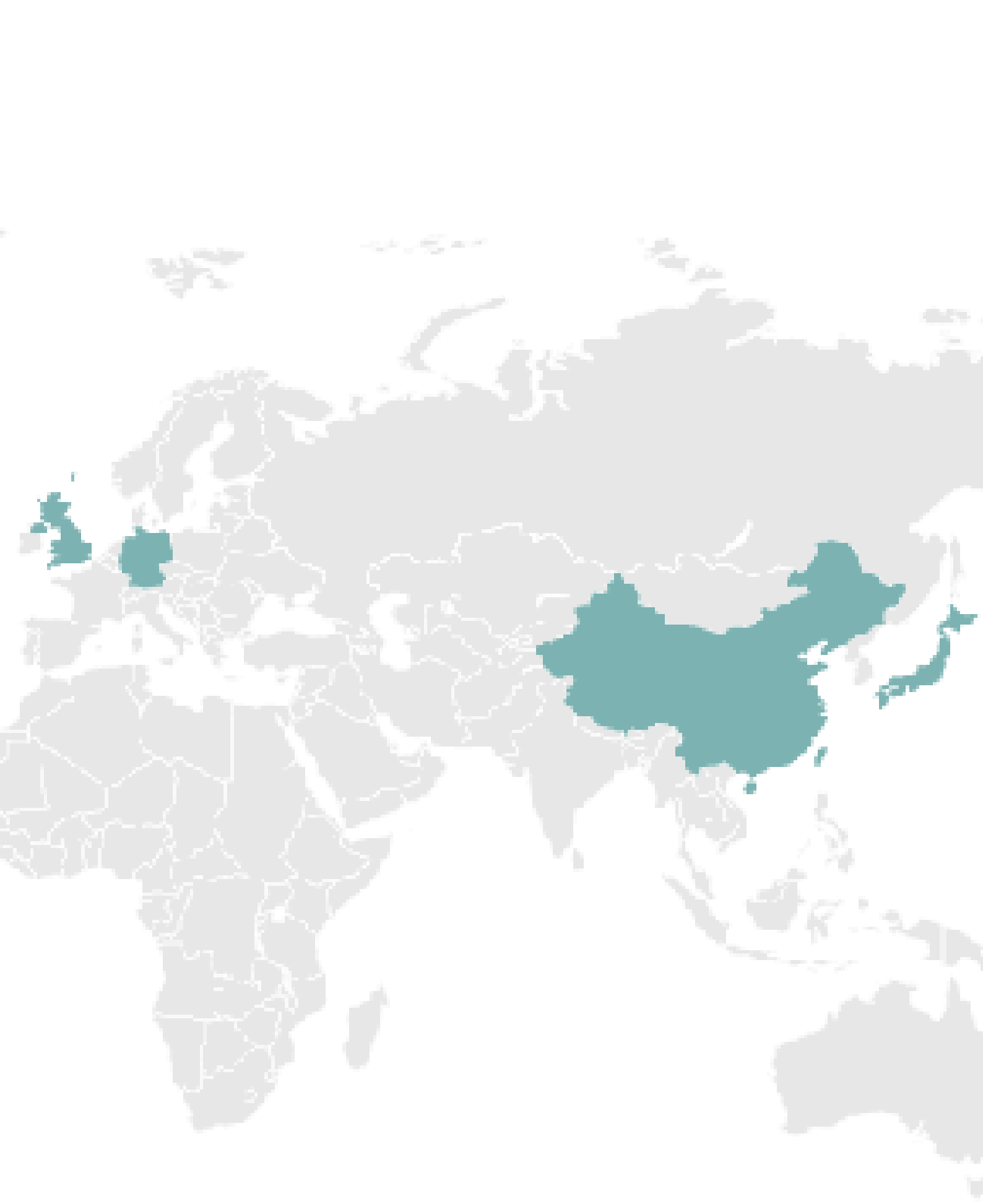
Undoubtedly, the fusion of the physical and digital world through smart devices at home has significant effects on the convenience and efficiency in daily life (Guhr et al., 2020).

Smart Home Market Growth



2025 Revenue Forecast for Top 5 Smart Home Markets by Country (USD Million)

Top 5 (2025)	USD million
1.USA	46,767
2.CHINA	40,098
3.U.K.	13,594
4.JAPAN	11,897
5.GERMANY	10,471



https://www.statista.com/outlook/dmo/smart-home/worldwide#revenue

€566 million

During 2020, due to the impact of covid-19, the market declined slightly, reaching a total value of around EUR 566 million.

46% people

would like to make changes to their home after the lockdown, of which 16% improve technological equipment 11% increase energy efficiency

In the research conducted by Bitkom, more than half of the interviewees recognize that Smart Home applications help to live more efficiently from an energy point of view and that, consequently, they should be promoted at a regulatory/ legislative level. The evidence that emerged from the survey conducted by Doxa in Italy also moves in an absolutely analogous direction.

The analyzes carried out lead to estimate a very sustained growth of the Italian market in the coming years, up to a size of over € 1 billion by 2023 (+ 26% average annual growth from 2020).

onsumption habits of Italians (By COOP)

e ideal home must have a garden, be larger, but also have Smart Home equipment that is al, safe and practical, also in order to reduce energy consumption.

1%

re Garden

26%

With more greenery/garden

24%

With low maintenance costs

23%

More technological

search carried out for Energy@Home, three s of people were identified based on their t in the Smart Home:

2%

"Already Smart"

3%

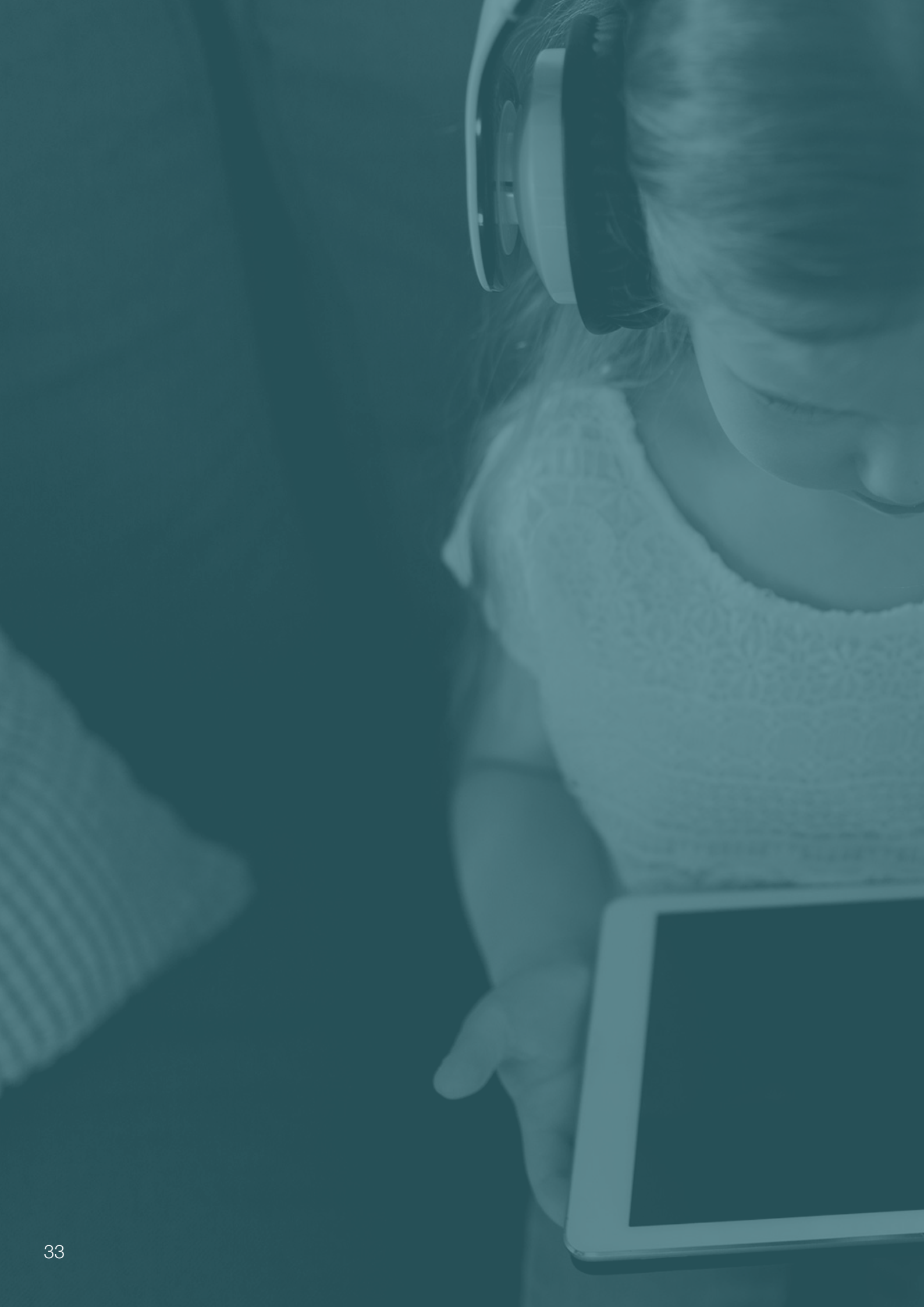
No, but considering buying

5%

Do not own and are not interested in

42%

According to the survey carried out in 2019 by Doxa for Polimi, 42% of Italians own at least one Smart object



USER RESEARCH

3.1 Data Research on Children and Families

The structure of children's social relation

Current situation of Italian family

Child life structure

Relationships between other users and children

3.2 Analysis of children aged 0-12

3.3 Children, Family Data Map

3.1

Data Research on Children and Families

The structure of children's social relations

Children's social relations are very simple. We analyze the social relations of children through four environments. The first is the **school context**. In school, there will be classmates, classmates from other classes, age groups, class leaders, and school staff.

Next is the **peer relationship**. In addition to social relationships at home and at school, children sometimes participate in activities outside. During the activities, they communicate with other children, teachers, parents, and staff. They also have social relationships with neighbors near home.

Family situational relationship. In addition to parents, brothers and isters, there are also grandparents at home. Some children also have pets at home. Usually when there are guests at home, in addition to other relatives, there may also be friends that the parents want to invite.

Current Situation of Italian Family

Through the data in the IstatData database, we have a complete understanding of the structure and proportions of Italian households. We divide the current situation of Italian families into 7 types.

1. Hosehold foewign citizens

There are a total of 1,977,150 private households in Italy with at least one foreigner, and 8,880,05 households with at least one member aged 0-1 years.

2.Housing crowding

It is defined as the number of people living in a dwelling divided by the number of rooms. According to this index, dwellings with more than 1 person per room are crowded, and those with more than 1.5 people per room are severely crowded.Couple with at least one children (4.1%),Single parent with at least one children (3.0%). In Italy, 76.2% of couples with at least one child own property, while 23.8% of families still rent. Among families with at least one child, 69.2% own property and 30.8% rent.

3.Employment and education of couples

In Italy, 69% of professional status brides are employed, 10.6% are not employed, 12.3% are housewives, and 8.1% are other. Professional status bridegroom 84.8% are employed, only 4.7% are unemployed, only 0.3% choose to be housewives, and 9.7% are others. Dual-income families account for 65.4% of Italian households. 61.4% of families have both spouses with a high school diploma or below, and at least one spouse has

Families with a college degree or above accounted for 38.6%.

4.Number of children

Italian women aged 15-24 accounted for 0.4%, women aged 25-34 accounted for 11.1%, women aged 35-44 accounted for 27.4%, women aged 45-54 accounted for 32.9%, younger children <5 years old had 22.6%, 24.8% for those aged 6-13, 12.1% for those aged 14-17, 46.8% for families with only one member, 42.8% for families with two members, and 10.4% for families with more than two members.

5.Type of households

Divided into three types, the first is Households with a nucleus, where a nucleus without Other persons accounted for 59.7%, couples without children accounted for 18.9%, couples with children accounted for 31.2%, and single-parent families with children accounted for 9.7%. a nucleus with other persons (with grandparents) accounted for 3.3%, those without children accounted for 1%, those with children accounted for 1.3%, and single parents with children accounted for 1%. The second type is Households with two more nuclei accounting for 1.3%, and the last type is Households without a nucleus, single perons accounting for 33.2%.

6.Households size

In Italy, 33.2% of families have only one member, 27.7% have two members, and 39.1% have more than two members.

7.Single parents

There are 392,000 single women in Italy who have never married, 1,102,000 separated and divorced women, and 867,000 widows. There are 79,000 unmarried single men, 272,000 separated and divorced men, and 215,000 widowed men. Those with only one child accounted for 68.8%, those with two children accounted for 26.6%, those with two or more children accounted for 4.6%, those with children <5 years old accounted for 10.4%, those aged 6-13 accounted for 15.5%, and those aged 14-17 Accounted for 10.4%.

Child life structure

We divided it into 8 parts, analyzing it from children's life, safety, privacy and security, health and entertainment, education, psychosocial development, and cognition.

Life

In life, the most important things for children are food, clothing, housing and transportation. The food they need to eat and the clothes they wear must be clean, hygienic and comfortable. They must pay attention to traffic safety when traveling and how to make travel plans.

Safety

We divide safety into indoor safety and outdoor safety. Indoors, we must pay attention to bumps and dangerous objects, and stay away from dangers such as water, fire, and electricity. Outdoors, we must pay attention to traffic safety, prevent car accidents, and daily falls and bumps. We must also pay attention to getting lost. Prevent trafficking.

Privacy

The privacy of children of different ages will also be somewhat different, such as data privacy and teenagers' privacy. When they grow older, they will have some privacy that they do not want their guardians to know.

Healthy

In daily life, healthy growth is the most important thing for children, but children cannot avoid getting sick, so they need to take medicine, see a doctor, get vaccinated, and stay asleep to ensure their health.

Entertainment

Children's nature is to play, sometimes by themselves, sometimes with family and friends, playing with toys, electronic products, listening to music, dancing, and doing some recreational sports, etc. There are also many outdoor entertainment activities, such as Traveling, camping etc.

Psychosocial development

Children's psychosocial development is divided into 5 stages,
from birth to 12-18 months, we call it the Trus vs. mistrust stage, children at this stage need a sense of trust and security.
From 18 months to 3 years, we call it Autonomy vs. shame & doubt, A sense of independence allows children to believe in themselves and their abilities.
From 3 to 5 years old is Initiative vs. guilt, Self-confidence; the ability to take the initiative and make decisions.
5-12 years old is Industry vs. inferiority, children will feel Feelings of pride and accomplishment.
12-18 years old is Identity vs. confusion, A strong sense of identity; a clear picture of their future.

Education

Education is divided into social education, family education and school education. In society, you can learn knowledge and broaden your horizons through extracurricular classes, intellectual games, visiting aquariums, zoos, museums or traveling. You can also go to libraries, bookstores, etc. You can participate in various activities and learn a lot of knowledge. Most family education tends to be related to parents or grandparents' need to learn about children's education, life attempts, interpersonal relationships, etc.

Educational services for children, managed by local authorities, public or private bodies (3-36 months) Guarantee them the opportunity to develop the potential for relationships, autonomy, creativity and learning;Kindergarten(3-years system) (3-5 years) his first phase of the educational process serves the education and emotional, psychomotor, cognitive,moral, religious and social development of children, promoting their autonomy, creativity and learning. Primary school(5-years system) (6-11 years) Allows children to acquire and develop logical-critical knowledge and skills, promotes personality development, promotes learning of the Italian and English languages, enhances relational skills and educates children to the fundamental principles of civil coexistence. unior high school(3-years system) (11-14 years) is aimed at developing autonomous study and social interaction skills, organizes and increases pupils' abilities, introduces the study of a second language of the European Union and helps to orient oneself for the subsequent choice of education and training High school(5-years system) (14-19 years) The cultural and methodological tools for understanding reality, facing situations, phenomena and problems with a rational, creative, planning and critical attitude and acquiring coherent knowledge, skills and competences suitable for continuing higher education, for entering social life and in the world of work. LeFP(3 and 4-years system) (14-19 years) Have set themselves the goal of enabling students to acquire the skills needed to pursue the technical careers required in the production sector.

Cognitive

1-3 months：Shows interest in objects and human faces May get bored with repeated activities.

4-6 months：Recognizes familiar faces Notices music Responds to signs of love and affection.

5-9 months：Brings hands up to mouth Passes things from one hand to the other.

9-13 months：Watches things fall Looks for hidden things

12-13 months：Has learned how to use some basic things like spoons Can point to named body parts.

18 months：May identify familiar things in picture books .Knows what common objects do.Scribbles Follows single-step requests like“Please stand up”

24 months：Builds towers from blocks May follow simple two-part instructions Groups like shapes and colors together Plays pretend games.

3 years：Can put together a 3-4 part puzzle Can use toys that have moving parts like buttons and levers Can turn door knobs Can turn book pages.

4 years：May be able to count Can draw stick figures May be able to predict what will happen in a story May play simple board games Can name a few colors, numbers, and capital letters.

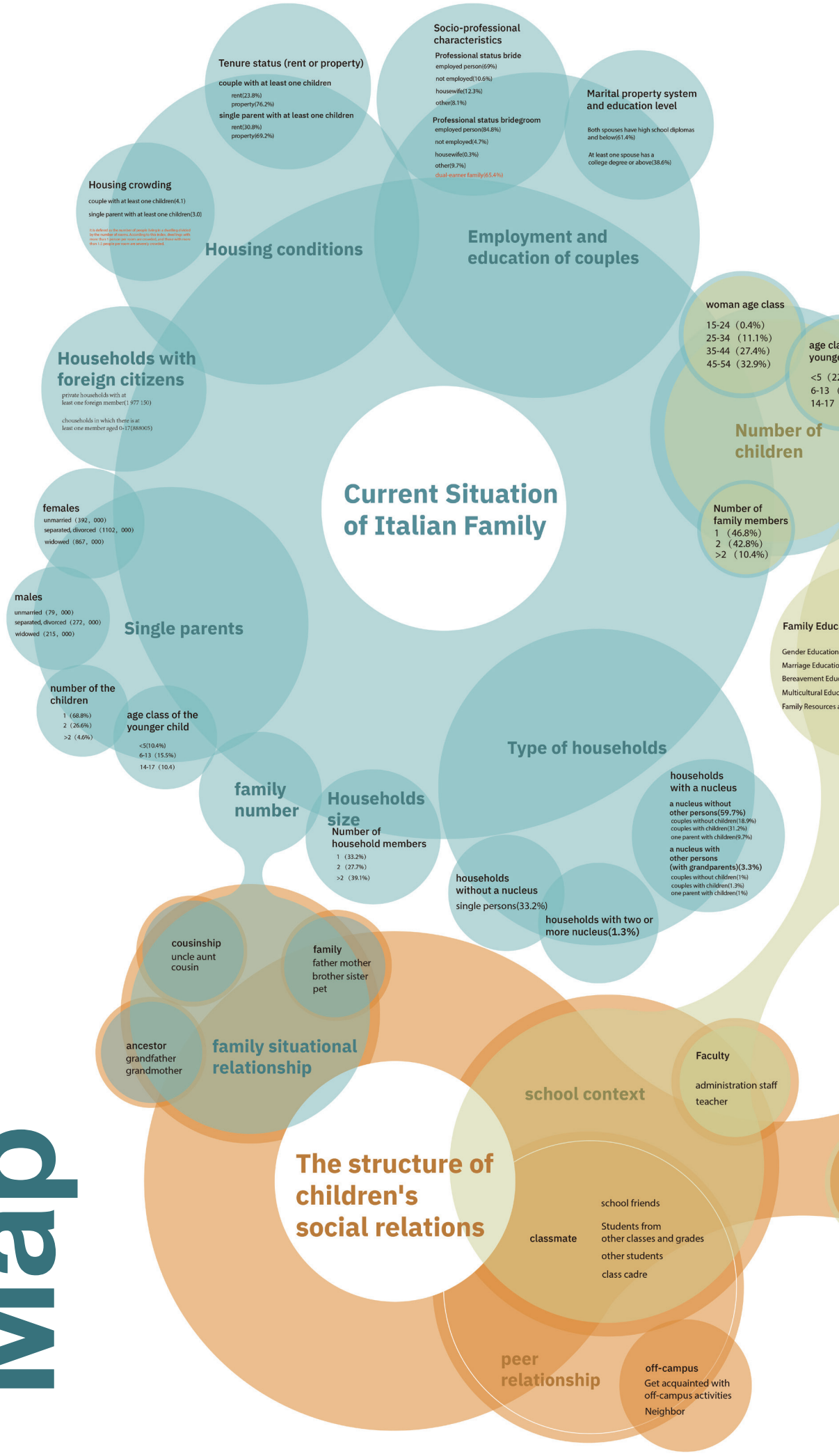
5 years：Draws more complex “people” Counts up to 10 things Can copy letters, numbers, and simple shapes.Understands the order of simple processes Can say name and address Names many colors.

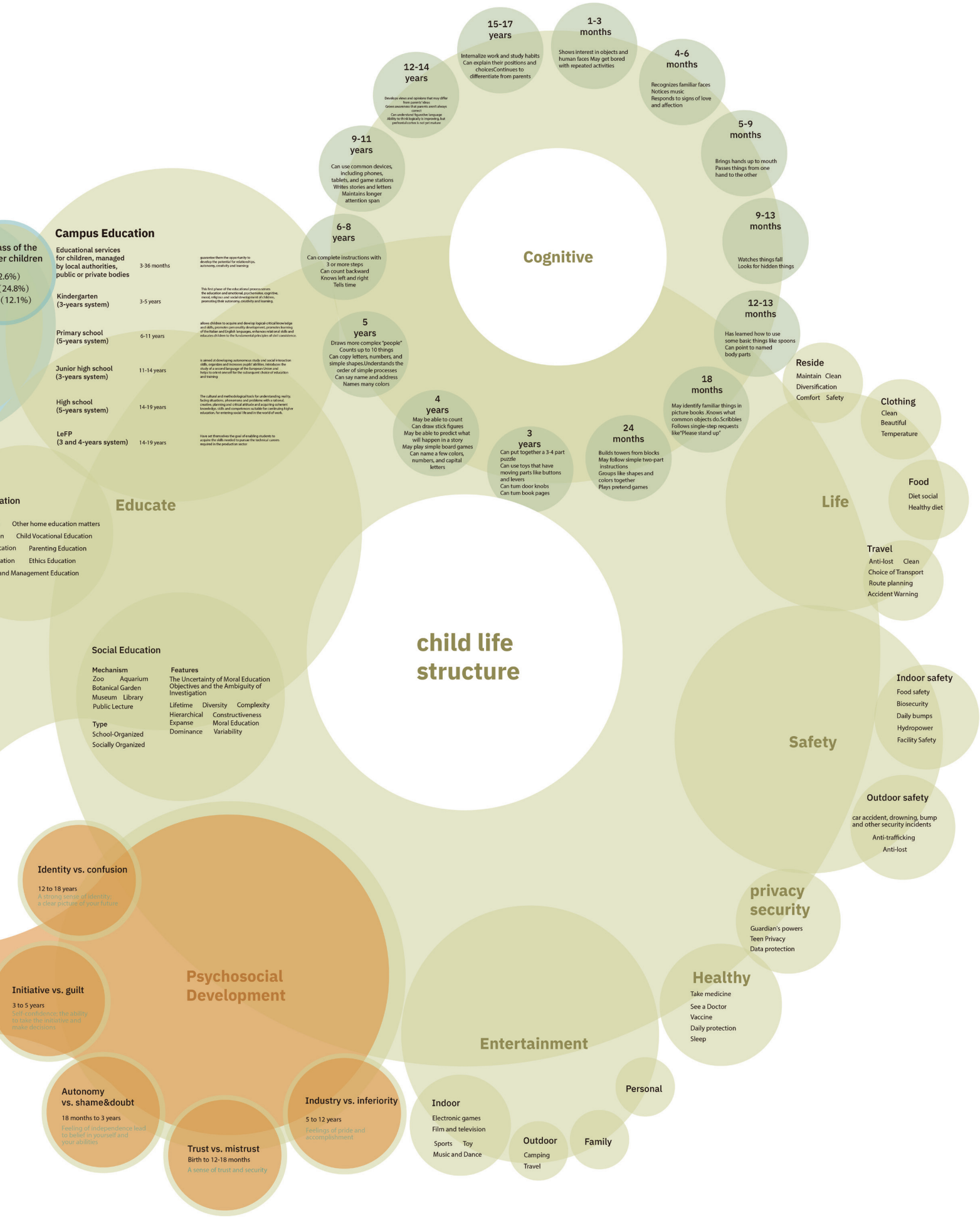
6-8 years：Can complete instructions with 3 or more steps
Can count backward nows left and right Tells time.9-11 years
Can use common devices, including phones,
tablets, and game stations Writes stories and letters Maintains longer attention span.

12-14 years：Develops views and opinions that may differ
from parents’ ideas Grows awareness that parents aren’t always correct Can understand figurative language Ability to think logically is improving, but prefrontal cortex is not yet mature.

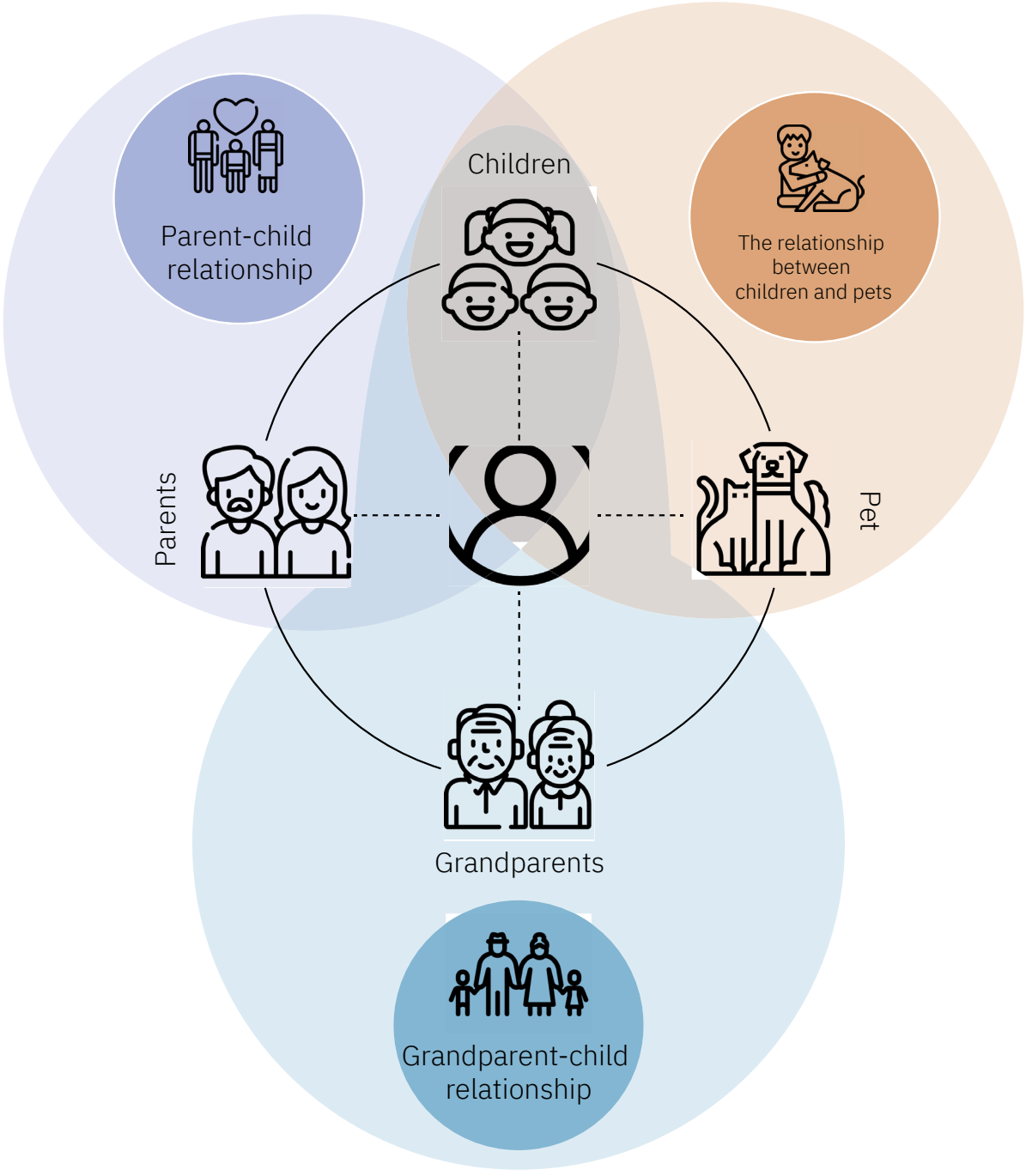
15-17 years：Internalize work and study habits Can explain their positions and choices Continues to differentiate from parents.

Children,Family Data Map




child life structure
Cognitive
15-17 years
Internalize work and study habits
Can explain their positions and choicesContinues to differentiate from parents
1-3 months
Shows interest in objects and human faces May get bored with repeated activities
4-6 months
Recognizes familiar faces
Notices music
Responds to signs of love and affection
5-9 months
Brings hands up to mouth
Passes things from one hand to the other
9-13 months
Watches things fall
Looks for hidden things
12-13 months
Has learned how to use some basic things like spoons
Can point to named body parts
18 months
May identify familiar things in picture books .Knows what common objects do.Scribbles
Follows single-step requests like"Please stand up"
24 months
Builds towers from blocks
May follow simple two-part instructions
Groups like shapes and colors together
Plays pretend games
3 years
Can put together a 3-4 part puzzle
Can use toys that have moving parts like buttons and levers
Can turn door knobs
Can turn book pages
4 years
May be able to count
Can draw stick figures
May be able to predict what will happen in a story
May play simple board games
Can name a few colors, numbers, and capital letters
5 years
Draws more complex "people"
Counts up to 10 things
Can copy letters, numbers, and simple shapes.Understands the order of simple processes
Can say name and address
Names many colors
6-8 years
Can complete instructions with 3 or more steps
Can count backward
Knows left and right
Tells time
9-11 years
Can use common devices, including phones, tablets, and game stations
Writes stories and letters
Maintains longer attention span
12-14 years
Develops views and opinions that may differ from parents' ideas
Grows awareness that parents aren't always correct
Can understand figurative language
Ability to think logically is improving, but prefrontal cortex is not yet mature
Campus Education
Educational services for children, managed by local authorities, public or private bodies
3-36 months
guarantee them the opportunity to develop the potential for relationships, autonomy, creativity and learning;
Kindergarten (3-years system)
3-5 years
This first phase of the educational process serves the education and emotional, psychomotor, cognitive, moral, religious and social development of children, promoting their autonomy, creativity and learning.
Primary school (5-years system)
6-11 years
allows children to acquire and develop logical-critical knowledge and skills, promotes personality development, promotes learning of the Italian and English languages, enhances relational skills and educates children to the fundamental principles of civil coexistence.
Junior high school (3-years system)
11-14 years
is aimed at developing autonomous study and social interaction skills, organizes and increases pupils' abilities, introduces the study of a second language of the European Union and helps to orient oneself for the subsequent choice of education and training
High school (5-years system)
14-19 years
The cultural and methodological tools for understanding reality, facing situations, phenomena and problems with a rational, creative, planning and critical attitude and of acquiring coherent knowledge, skills and competences suitable for continuing higher education, for entering social life and in the world of work.
LeFP (3 and 4-years system)
14-19 years
Have set themselves the goal of enabling students to acquire the skills needed to pursue the technical careers required in the production sector
Educate
ation
Other home education matters
n Child Vocational Education
cation Parenting Education
ation Ethics Education
nd Management Education
Social Education
Mechanism
Zoo Aquarium
Botanical Garden
Museum Library
Public Lecture
Type
School-Organized
Socially Organized
Features
The Uncertainty of Moral Education Objectives and the Ambiguity of Investigation
Lifetime Diversity Complexity
Hierarchical Constructiveness
Expanse Moral Education
Dominance Variability
Life
Reside
Maintain Clean
Diversification
Comfort Safety
Clothing
Clean
Beautiful
Temperature
Food
Diet social
Healthy diet
Travel
Anti-lost Clean
Choice of Transport
Route planning
Accident Warning
Safety
Indoor safety
Food safety
Biosecurity
Daily bumps
Hydropower
Facility Safety
Outdoor safety
car accident, drowning, bump and other security incidents
Anti-trafficking
Anti-lost
privacy security
Guardian's powers
Teen Privacy
Data protection
Healthy
Take medicine
See a Doctor
Vaccine
Daily protection
Sleep
Entertainment
Personal
Family
Indoor
Electronic games
Film and television
Sports Toy
Music and Dance
Outdoor
Camping
Travel
Psychosocial Development
Identity vs. confusion
12 to 18 years
A strong sense of identity; a clear picture of your future
Initiative vs. guilt
3 to 5 years
Self-confidence; the ability to take the initiative and make decisions
Autonomy vs. shame&doubt
18 months to 3 years
Feeling of independence lead to belief in yourself and your abilities
Trust vs. mistrust
Birth to 12-18 months
A sense of trust and security
Industry vs. inferiority
5 to 12 years
Feelings of pride and accomplishment

Relationships between other users and children



Parent-child relationship

Infancy（0-1years)

Infancy is when the bond and attachment between the parent and child is developed. This is the stage where parents need to be the most attentive and nurturing. Creating a bond between the parent and baby is critical to the infants development both the infant and parent start to develop an understanding and expectation of each other. The infant gaining the expectation that the parent will take care of their needs and the parent responding to their baby and having the ability to anticipate their needs creates the basis of developing that parent-child relationship.

Toddler Hood（1-5years）

Toddler hood is when the parent-child relationship begins to change for the first time. Stage in which parents start trying to socialize their children Examples: Potty training,weaning,Rules & Discipline. Parents begin teaching their child appropriate behavior and child rearing truly starts to come into play. Stage in which children can start to challenge their parent.Known as "Terrible Two's" it is normal for a toddler to go through this type of behavior. It can be a healthy development of independence.

Middle Childhood (6-8years)

It's during middle childhood that specific parenting styles start to emerge. They are the following: Authoritative- responsive, demanding & loving. Authoritarian-highly demanding, less responsive, withdrawal of affection. Indulgent- responsive, not demanding, little discipline & few expectations .Disengaged- neither responsive nor demanding, neglectful

This is the stage where parents have to start interpreting the actions of others such as their teachers and peers children go to their parents for the answers to everything and listen to what they have to say.

Late Childhood (9-12years)
Amount of time parent and child spend together decreases. Stage in which the child becomes very interested in their peers and their social world starts to expand and grow outside of the relationships they have at home.
-Parenting becomes easier for those who established authoritative parenting style during the earlier years. Growing independence= parents dealing with "New Issues" Ex: school problems, types of friends the child has, allowances, etc. Parents guide and monitor from a distance and effectively communicate what it is they expect from their child.

The relationship between children and pets

Matt Cassels' research shows children often have a closer relationship with their pet than their siblings. Children without siblings are more attached to pets than children with siblings.Young children develop high-quality relationships with pets, particularly those which are taxonomically closely related, such as dogs and cats。Interest in pets may decrease with increasing age (Borgi & Cirulli, 2015).

Grandparent-child relationship

Kivnick (1982) wrote that contemporary grandparents seem to view their roles as being less associated with power and more associated with indulgence, warmth, and pleasure without responsibility.

Roles for contemporary grandparents: (a) historian—a link with the cultural and familial past (b) role model—an example of older adulthood (c) mentor—a wise adult experienced in life transitions (d) wizard—a master of story-telling to foster imaginationand creativity (e) nurturer–great parent—an ultimate support person for familial crises and transitions.

3.2

Analysis of children aged 0-12

1-3 months Cognitive: Shows interest in objects and human faces , May get bored with repeated activities.
Social and Emotional: Tries to look at you or other people , Starts to smile at people.
Language: Tries to look at you or other people , Starts to smile at people.
Movement/Physical: Lurns toward sounds , Follows objects with eyes , Grasps objects , Gradually lifts head for longer periods.

4-6 months Cognitive: Recognizes familiar faces , Notices music , Responds to signs of love and affection.
Social and Emotional: Responds to facial expressions , Enjoys playing with people , Responds differently to different voice tones.
Language: Begins to babble or imitate sounds , Laughs.
Movement/Physical: Sees things and reaches for them , Pushes up with arms when on tummy , Might be able to roll over.

5-9 months Cognitive: Brings hands up to mouth , Passes things from one hand to the other.
Social and Emotional: Enjoys mirrors , Knows when a stranger is present.
Language: Responds to hearing their name , May add consonant sounds to vowels , May communicate with gestures.
Movement/Physical: Starts sitting up without support , May bounce when held in standing position , Rolls in both directions.

4-6 months Cognitive: Watches things fall , Looks for hidden things.
Social and Emotional: May be clingy or prefer familiar people.
Language: Points , Knows what “no” means , Imitates sounds and gestures.
Movement/Physical: Pulls up into standing position , Crawls.

9-13 months Cognitive: Has learned how to use some basic things , like spoons , Can point to named body parts.
Social and Emotional: May engage in simple pretend games , May have tantrums , May cry around strangers.
Language: Knows how to say several words , Says “no” , Waves bye-bye.
Movement/Physical: Walks holding onto surfaces , Stands alone , May climb a step or two May drink from a cup.

13-17 months Cognitive: Has learned how to use some basic things , like spoons , Can point to named body parts.
Social and Emotional: May engage in simple pretend games , May have tantrums , May cry around strangers.
Language: Knows how to say several words , Says “no” , Waves bye-bye.
Movement/Physical: Walks holding onto surfaces , Stands alone , May climb a step or two May drink from a cup.

18 months Cognitive: May identify familiar things in picture books , Knows what common objects do , Scribbles , Follows single-step requests like , “Please stand up”.

Social and Emotional: May help with tasks like putting away toys , Is proud of what they’ve accomplished , Recognizes self in mirror; may make faces , May explore surroundings if parent stays close by.

Language: Knows several words , Follows simple directions , Likes hearing short stories or songs.

Movement/Physical: Can help in getting dressed , Begins to run , Drinks well from a cup. Eats with a spoon , Can walk while pulling a toy , Dances , Gets seated in a chair.

24 months Cognitive: Builds towers from blocks , May follow simple two-part instructions

Groups like shapes and colors together , Plays pretend games.

Social and Emotional: Enjoys play dates , Plays beside other children; may start playing with them , May defy directions like “sit down” or “come back here”.

Language: May ask simple questions , Can name many things , Uses simple two-word phrases like “more milk” , Says the names of familiar people.

Movement/Physical: Runs , Jumps up and down , Stands on tip-toes , Can draw lines and round shapes , Throws balls , May climb stairs using rails to hold on.

3 years Cognitive: Can put together a 3-4 part puzzle , Can use toys that have moving parts like buttons and levers , Can turn door knobs , Can turn book pages.

Social and Emotional: Shows empathy for hurt or crying children , Offers affection , Understands “mine” and “yours” , May get upset if routines are changed , Can get dressed , Knows how to take turns.

Language: Talks using 2-3 sentences at a time, Has the words to name many things used daily, Can be understood by family, Understands terms like “in,” “on,” and “under”.

Movement/Physical: Can walk up and down steps with one foot on each stair, Runs and jumps with ease, Catches a ball, Can slide down a slide.

4 years Cognitive: May be able to count,Can draw stick figures,May be able to predict what will happen in a story,May play simple board games,Can name a few colors, numbers, and capital letters.
Social and Emotional: May play games that have roles like “parent” and “baby”, Plays with, not just beside, other kids, Talks about their likes and dislikes Pretends; may have trouble knowing what’s real and what’s pretend.
Language: Can talk about what happens in daycare or at school,Speaks in sentences,May recognize or say rhymes,Can say first and last name.
Movement/Physical: Can hammer a peg into a hole,Walks backwards,Climbs stairs confidently,Can hop,Pours liquids with some help.

6-8 years Cognitive: Can complete instructions with 3 or more steps,Can count backward Knows left and right,Tells time.
Social and Emotional: Cooperates and plays with others, May play with kids of different genders, Mimics adult behaviors, Feels jealousy, May be modest about bodies.
Language: Cooperates and plays with others, May play with kids of different genders, Mimics adult behaviors, Feels jealousy, May be modest about bodies.
Movement/Physical: Can jump rope or ride a bike, Can draw or paint, Can brush teeth, comb hair, and complete basic grooming tasks, Can practice physical skills to get better at them.

9-12 years Cognitive: Listens for specific reasons (like pleasure or learning), Forms opinions based on what’s heard,Can take brief notes,Follows written instructions Draws logical inferences based on reading, Can write about a stated main idea, Can plan and give a speech.
Social and Emotional: May have a best friend, Can see from another person’s perspective, Experiences more peer pressure.
Language: Listens for specific reasons (like pleasure or learning), Forms opinions based on what’s heard, Can take brief notes, Follows written instructions, Draws logical inferences based on reading, Can write about a stated main idea, Can plan and give a speech.
Movement/Physical: May experience signs of early puberty like breast development and facial hair growth, Increased skill levels in sports and physical activities.

CASE STUDY

4.1 Product Case Study

4.2 Product Technology Research

4.1

Product Case Study

Summary of robot types

We have conducted research and summary on the types of robots currently on the market

Housekeeping robot

Educational robot

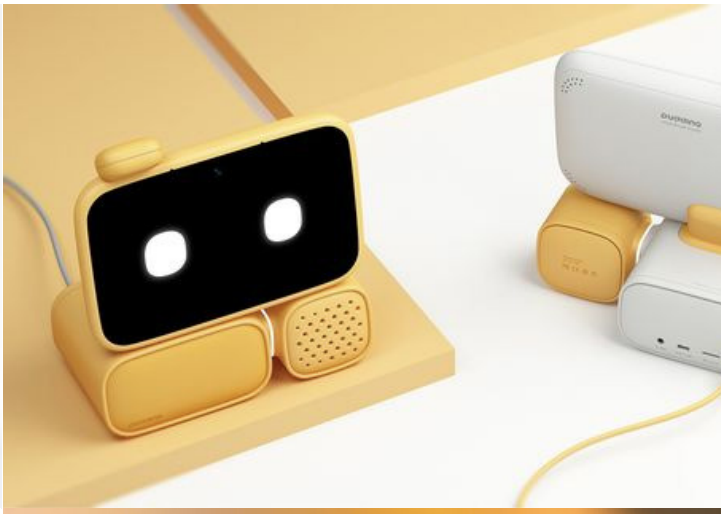
Entertainment robot

Elder care/handicapped robots

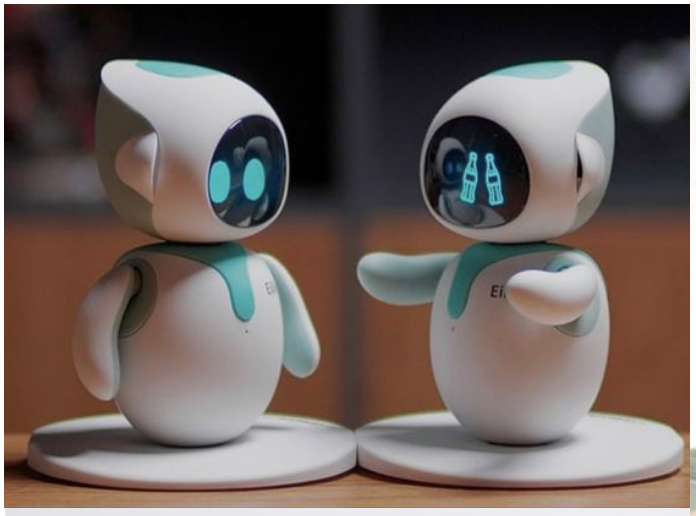
Home security robot

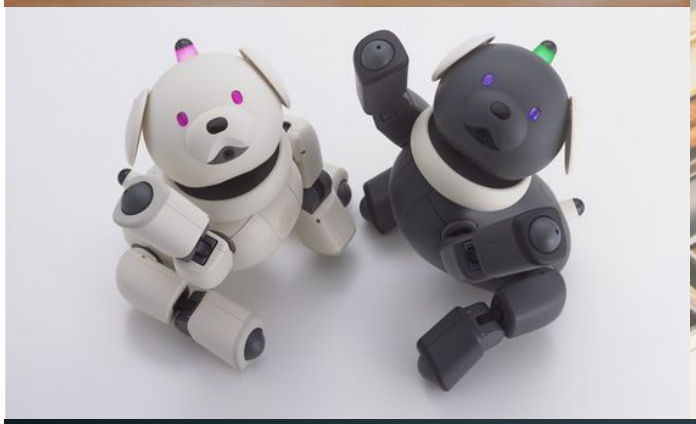
Personal transport robot

Children's educational robot



Children's companion/ entertainment robot

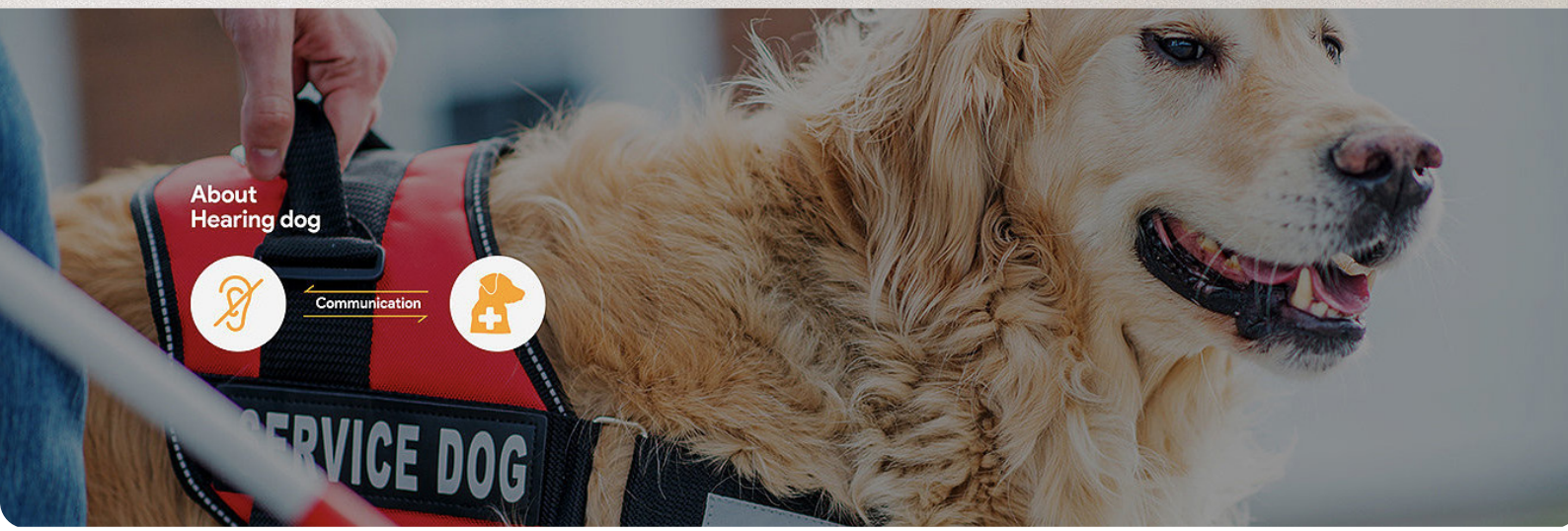




Children's safety monitoring robot

Competitive product analysis

We have summarized all the types of smart home products in the market, and then according to our design goals, we have carried out a detailed analysis of some products of the same type



8:00	8:30	9:30	13:20	17:30
Smart home system	Product Pairing service	Convenient communication	Smart home system	Sound recognition

Name: Hearingbot

Designers: Fountain Studio, JC HAM and Boseon K

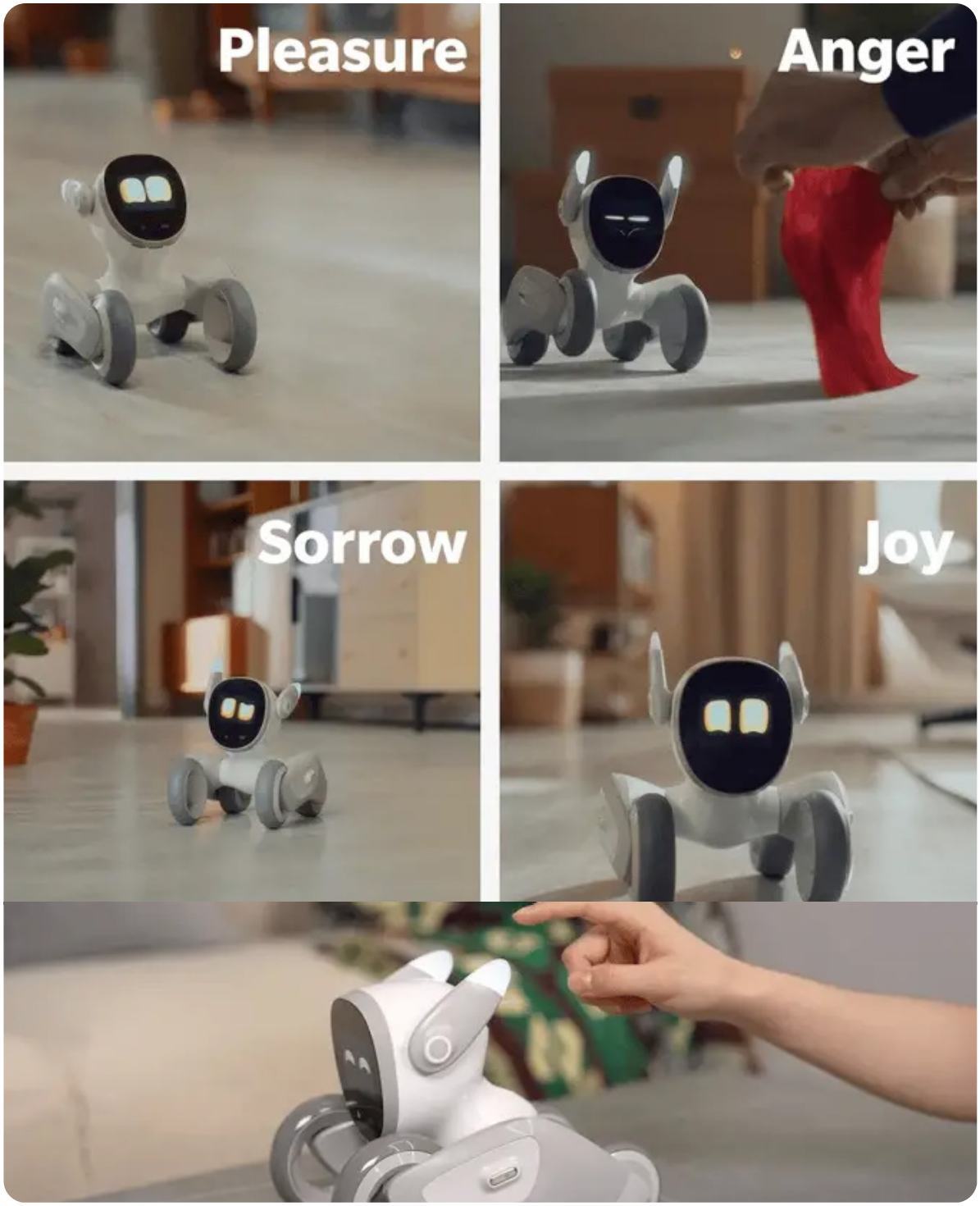
Aim of design: There are problems with the "hearing aid system", such as high training costs, long training times and insufficient supply. The design is an AI robot with high reliability and ultra-latency.

Introduction: Called ‘Hearingbot’, this AI-powered robot comes with an integrated smart home system for seamless and reliable use through the day. One of the components is the hearing clock which wakes you up with vibrations while the Hearingbot smart home system raises the curtains for you. A cool feature is gesture recognition which makes communication easy for those who rely on sign language. The robot can recognize the signs and uses speakers as well as subtitles to communicate with its user. “It interprets sign language of the deaf through motion sensor and projects it into a projector.Through these process, it helps easy and natural conversation between deaf and ordinary people,” explains the design team. It can be paired with different products, for example, Hearingbot will manage the cooking status and schedule of the dish while the hearing-impaired person cooks and prepares the dish individually. It is also synced with a smartwatch that keeps you alert about real-time information, dangerous situations, public transport, and if someone is ringing your doorbell.

Function: Ringtone Reminder/Alarm Recognition, Smart home, Mobile monitor, Close at identification, Emoticon interaction, Trip record, Watch synchronization record, Vibration reminder, Carry


engadget
BEST
OF CES
ROBOT / DRONE
2023


person


Pleasure
Anger
Sorrow
Joy

Name: PetBot Loona

Designers: KEYI TECH

Aim of design: Loona is an incredible pet, who just happens to be a robot. When you come home, she'll come quickly to say hello. When you walk around, she loves to follow, and when you pet her, she'll be soooo happy. She can also have fun by herself- She sneezes, scratches, roams your home easily and even investigates suspicious objects.

Introduction: LOONA recognizes our face and more, it recognizes human movement, our caresses, the commands given by our hands and our voice, the objects in the room (the cameras map the surrounding environment with depth perception), it does not bump into corners of furniture and does not fall down steps and is even capable of planning the best route to reach its destination.
A PERSONALITY that will evolve over time and that she will show on her DISPLAY / FACE using up to 700 DIFFERENT EXPRESSIONS, together with articulated movements allowed by her many motors, even her EARS move and are equipped with an LED at their ends . PLAY, HAVE FUN and LEARN with LOONA, it will even be possible to PROGRAM it via its intuitive DEDICATED APP for smartphones and tablets.

Function: entertain yourself,With safety detection function, Facial recognition, Gesture recognition, Body movement recognition, Emotion perceptio, Watch synchronization record, Vibration reminder, Carry

Name: poiq

Designers: SONY

Aim of design: As Sony says, “poiq will become part of your life and will find a place in your heart.” All this sounds quite disturbing, but on the other hand, it can be a good solution for people suffering from loneliness.

Introduction: Sony unveiled its AI entertainment robot poiq. The AI engine equipped with poiq can make it smarter and more personalized through questions and answers and conversations with users. The poiq is about 118mm tall and has a capsule body with a diameter of about 72mm. The bottom is equipped with double peripheral wheels, which can move forward and backward or rotate in place. The face and eyes are movable, and the whole appearance looks very cute. Poiq can recognize the facial images of multiple users who have logged in, remember the place of residence and food preferences of the person talking to it, and answer questions based on the information of the person talking to it. Previously, Sony had launched the popular robot dog product Aibo. Faced with the widespread loneliness caused by busy modern life and changes in family structure, the constantly iterative artificial intelligence robots are obviously bringing new solutions to complex social problems in a warm and soft way.

Function: By chatting with poiq , Teaching knowledge

4.2

Product Technology Research

Performances and Parts

Housekeeping robot

HOUSEKEEPING ROBOT FUNCTIONS

The traditional housekeeping robot has single function, which is difficult in applying to family daily life (Yu & Zhang ,2008)
Added to the indoor network, Control the robot by APP,
Control the robot to move in home, Ndoor environment is shown on the phone screen, Composition of the home gas environment, Function of controlling indoor appliances, Grab items, Indoorsecurity monitoring.

ROBOT SYSTEM FUNCTIONS

Internet system, Control System for Home Appliances, Motion Control System, Visual system, Environmental Monitoring System, Infrared remote control, Motion Control System, Security Monitoring and Environmental Monitoring System

KEY TECHNOLOGIES

Conversion between WiFi signal, conversion between WiFi signalreal-time video function, Robot Motion Chassis Ultrasonic obstacleavoidance sensor Ultrasonic rangemeasurement sensor, hd camera, range sensor, gas detection sensor ,Smoke detector, infrared signal, Internet of Things technology, manipulator ,mobile platform, face recognition, Action recognition.

Entertainment robot

ENTERTAINMENT ROBOT FUNCTIONS

Action interaction(follow people,running after the ball), call Automatic movement and obstacle avoidance, Emoticon interaction

ROBOT SYSTEM FUNCTIONS

3D motion capture,object recognition,emotion perception,label recognition. Sound Source Identification System, command recognition system. Environmental Monitoring System, Navigation System, 3D-intelligent trajectory planning. Display system, gesture recognition system, Expression Recognition System.

KEY TECHNOLOGIES

HD Camera with cloud platform, Ultrasonic obstacleavoidance sensor, Ultrasonic rangemeasurement sensor, mobile chassis. Microphone. 3D-ToF (time-of-flight) camera, RGB camera, Ultrasonic obstacleavoidance sensor, Ultrasonic rangemeasurement sensor, mobile chassis. HD screen.

USER'S NEED

5.1 Children's needs

5.2 Parents

Pain Point

Needs

5.1

Children's Needs

0-1 Years

Need to breathe healthy air (smoking households)
Need protection from knocking, violent shaking (babies have fragile bones)
Need to pay attention to food, eat healthy and not swallow too much food, easy to choke
Need prevents swallowing of small toys and objects, which can easily lead to choking
Need to pay attention to vaccination
Need to be aware of nearby hazards, such as sharp objects and hot liquids or items
Need to stay active and ensure a certain amount of exercise
Need to limit screen time. For children younger than 18 months of age, the American Academy of Pediatrics (AAP) recommends that it's best if babies do not use any screen media other than video chatting.
Need enough sleep

1-2 Years

Need to keep safety around the action (bolts, sharp objects, etc.)

Need to stay away from medicines, household cleaners, and poisons

It is necessary to always pay attention not to let children be alone in a confined space, similar to a car .

Need to have a certain choice space, keep trying new things, need a certain amount of time to accept and like an item

Need to develop coordination (running, jumping, etc.) to become strong.

Need to limit screen time

Need enough sleep

2-3 Years

Need a play partner

Simple songs, teaching of names needed

Need to learn how to express emotions in the right way

Need to be responded positively (encouragement, reward) and stop (criticism, punishment) if doing something wrong

Need to limit screen time (no more than 1 hour per day)

Need to ensure the length of sleep (11–14 hours per 24 hours per night)

3-5 Years

Requires age-appropriate play equipment such as balls and plastic bats

Need to know how to stay safe around strangers

In addition to indoor safety, we must also pay attention to outdoor safety

Needs to be encouraged to play with other children. This helps to learn the value of sharing and friendship.

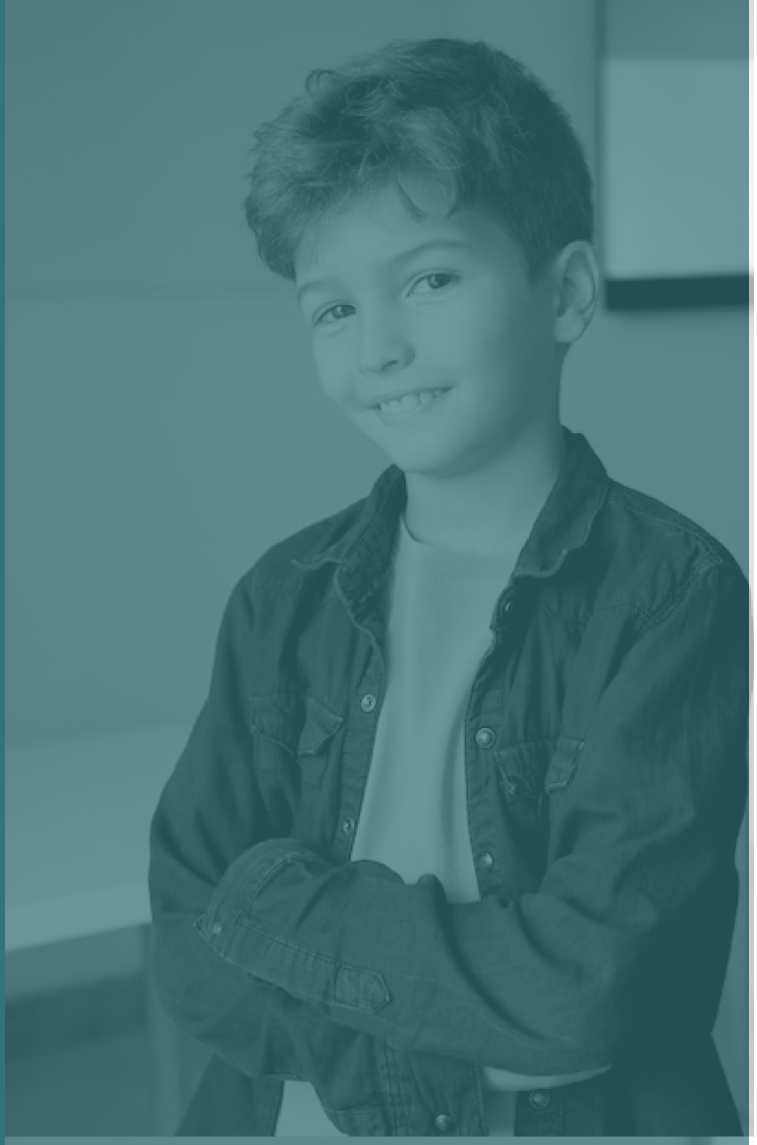
Need help knowing what steps to take to resolve the issue

Need to be offered a limited number of simple choices (e.g., deciding what to wear, when to play, and what to eat for snacks)

Need to pay attention to a balanced and healthy diet (children start to be independent, picky eaters have become greedy for snacks)

Need enough sleep

Need to limit screen time (no more than one hour per day)



6-8 Years

Need to be loved, to be recognized

Responsibility needs to be cultivated

Need to learn better ways to describe experiences and talk about thoughts and feelings

Need to actively participate in group activities and play with family members

Need to learn to read, read aloud

Needs parental guidance and protection, not punishment to make him feel bad about himself

Need to learn to solve problems by themself

9-12 Years

Needs parental presence, and communication (her friends, her achievements, and the challenges she will face)

Parents are required to participate in school and group activities

Need to develop a sense of right and wrong

Need to learn how to respect others

Need to learn to set your own goals

Responsibility needs to be cultivated

Need to know about normal physical and emotional changes during puberty

5.2

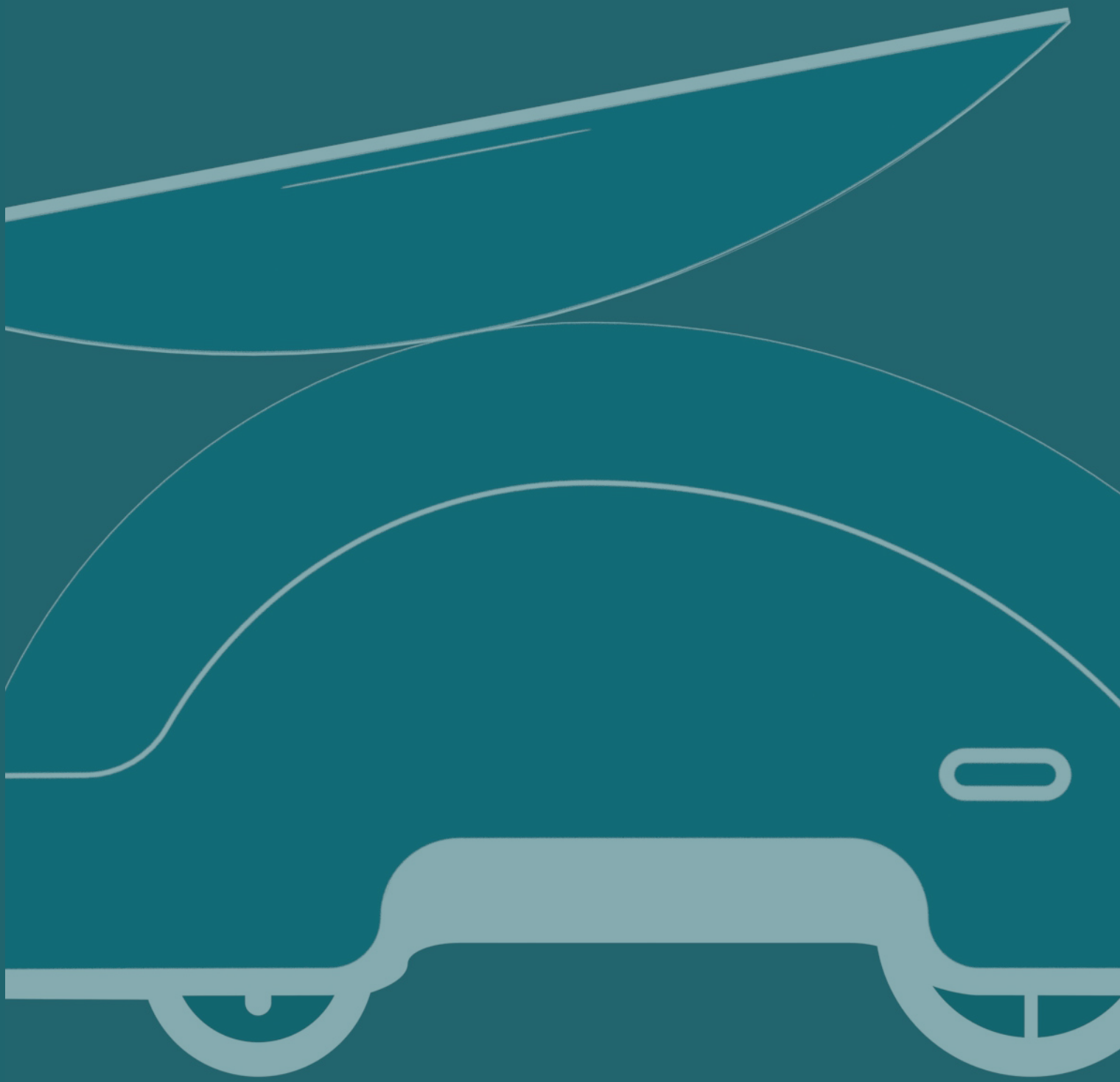
Parents

Pain Point

Difficulty balancing work and family
Feeling exhausted, may become depressed, and find it difficult to be patient with children and understand their needs.
Parents may become more stressed when children's needs are not being met
Concern for the safety and well-being of your child at all times when you are not around
Don't know how to properly educate children
Not knowing what the child really needs
No own living space
Always put the child's needs first, and eventually forget your own real needs
When children are noisy and disobedient, they don’t know how to control them
Families with multiple children cannot balance care for each child
Not having much energy to take care of everyone in the family, resulting in physical and mental exhaustion
Not getting enough rest time
Parents do not do well to prevent grandparents from overspending (families living with grandparents)

Needs

Need someone to share childcare with
Need Someone to talk to and vent
Need someone to help with housework
Need to do something fun to de-stress and ease the mood
Need to have a good plan to prevent chaos caused by too many things
Not knowing what the child really needs
Need Set strict limits and personal boundaries
Need to maintain your own health
Need more personal space



PROJECT 6

6.1 Function output

5.2 Concept

6.3 Model and Testing

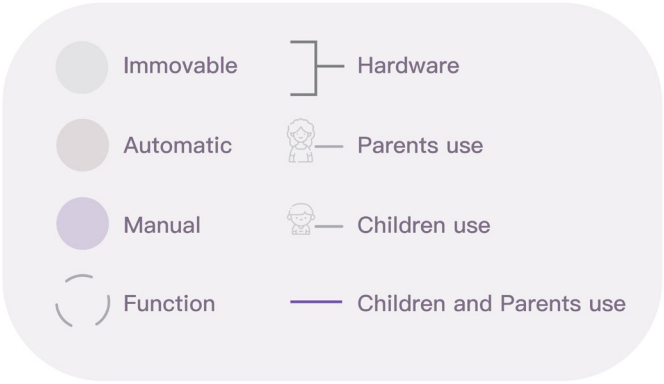
6.4 Interface design

6.1

Function output

Through research on smart home products, children's smart products, etc. on the market, and analyzing the needs of children of all ages and the needs of parents, we have produced 8 main functions, targeting entertainment, life, education, and companionship. , safety and other aspects. It introduces the usage scenarios, required technologies, specific functions, etc. in detail, summarizes all this information, draws a Product Feature Type Map, and introduces each function in great detail in the form of illustrations and text.

Product Feature Type Map



HD Camera with cloud platform
Ultrasonic obstacleavoidance sensor
Ultrasonic rangemeasurement sensor
mobile chassis
microphone
RGB camera
Ultrasonic obstacleavoidance sensor
Ultrasonic rangemeasurement sensor
mobile chassis
HD screen
Multimodal dialogue system
Interactive screen
Expression sensor
Voice assistant

Play partner

Entertainmen

Nteractive screen
Heart rate sensor
Breath sensor
Audio

Bedtime stories, music

Alarm in special circumstances, adjust the volume through the depth of sleep

Clock, night light

Alarm clock

Night care

Gas detection sensor
Smoke detector
Voice assistant
Microphone

Diet collocation, cooking teaching

Diet care

Immovable

Kitchen dangerous situation alarm

Language model
Speech recognition system
Microphone
Audio
Multimodal dialogue system
Interactive screen
Expression sensor
Voice assistant

Knowledge Bank, Answers to Questions

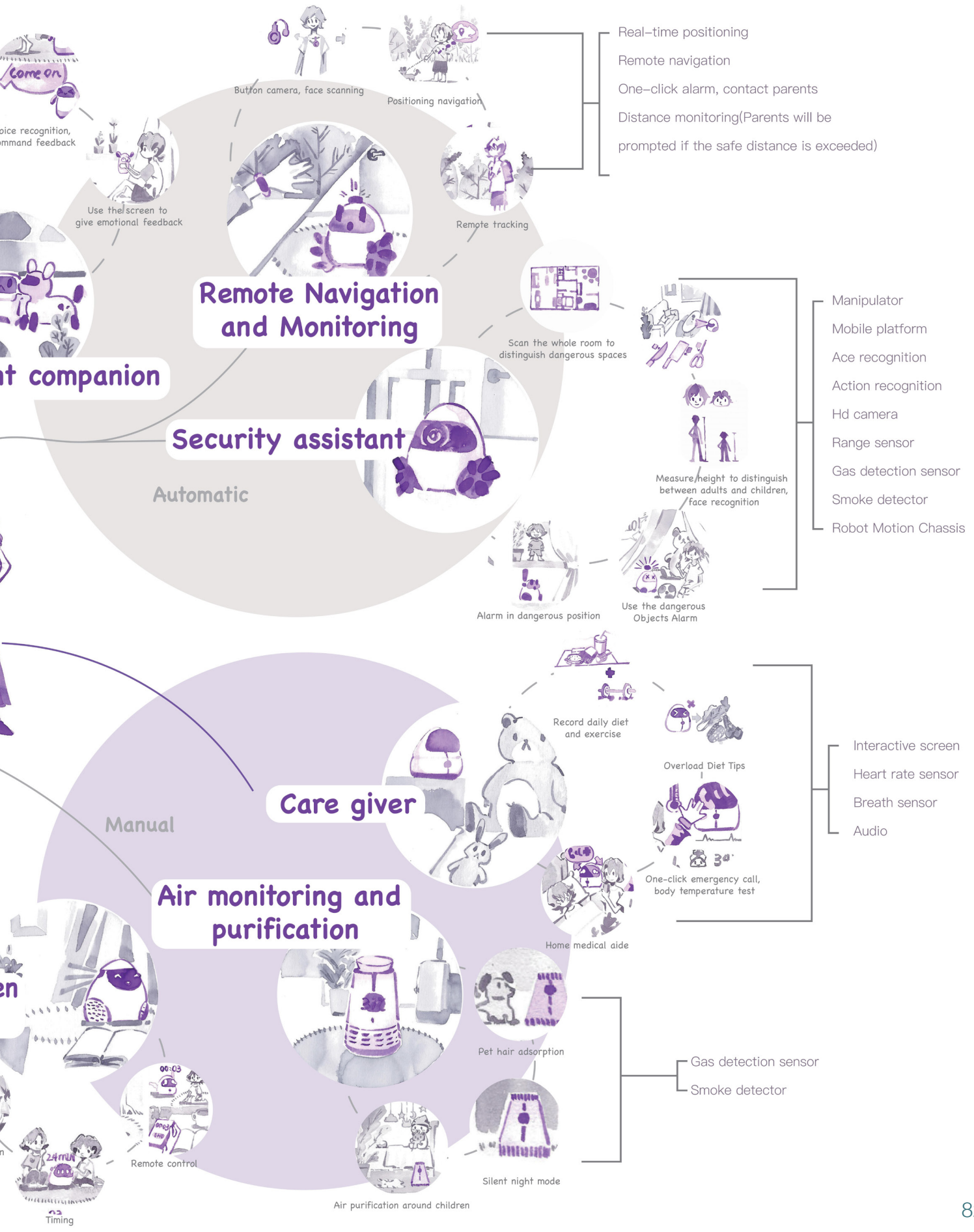
Education care

Homework tutoring, course tutoring, extracurricular tutoring

Exchanges inside and outside the school

Electronic scree management

Screen projectio


Button camera, face scanning
Positioning navigation
Real-time positioning
Remote navigation
One-click alarm, contact parents
Distance monitoring(Parents will be prompted if the safe distance is exceeded)
Use the screen to give emotional feedback
Remote tracking
Remote Navigation and Monitoring
Scan the whole room to distinguish dangerous spaces
Manipulator
Mobile platform
Ace recognition
Action recognition
Hd camera
Range sensor
Gas detection sensor
Smoke detector
Robot Motion Chassis
Security assistant
Automatic
Measure height to distinguish between adults and children, face recognition
Alarm in dangerous position
Use the dangerous Objects Alarm
Record daily diet and exercise
Overload Diet Tips
Interactive screen
Heart rate sensor
Breath sensor
Audio
Care giver
Manual
One-click emergency call, body temperature test
Home medical aide
Air monitoring and purification
Pet hair adsorption
Gas detection sensor
Smoke detector
Remote control
Silent night mode
Air purification around children
Timing

Air care

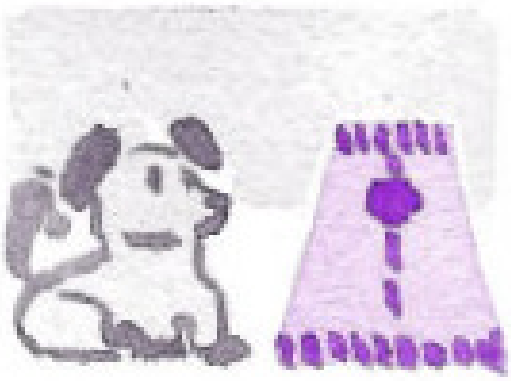
Position
Where air purification is required
on the floor
on the table

How to move
User moves manually

Function
Purify
Deodorant
Pet hair adsorption
Silent at night

Key technologies
Gas detection sensor
Smoke detector

Interactive mode
Manual control



Alarm

Position
Near children
On the floor

How to move
Moves by itself

Interactive mode
Visual interaction (The virtual screen expresses whether the child has come into contact with dangerous objects through facial expressions)
Auditory interaction (Alarm by sound of alarm)

Function
Dangerous goods NFC ident
Height measurement distingu
children
Automatically distinguish wh
objects in the area
Record facial recognition of f

tification and alarm
uishes between adults and

ether there are dangerous

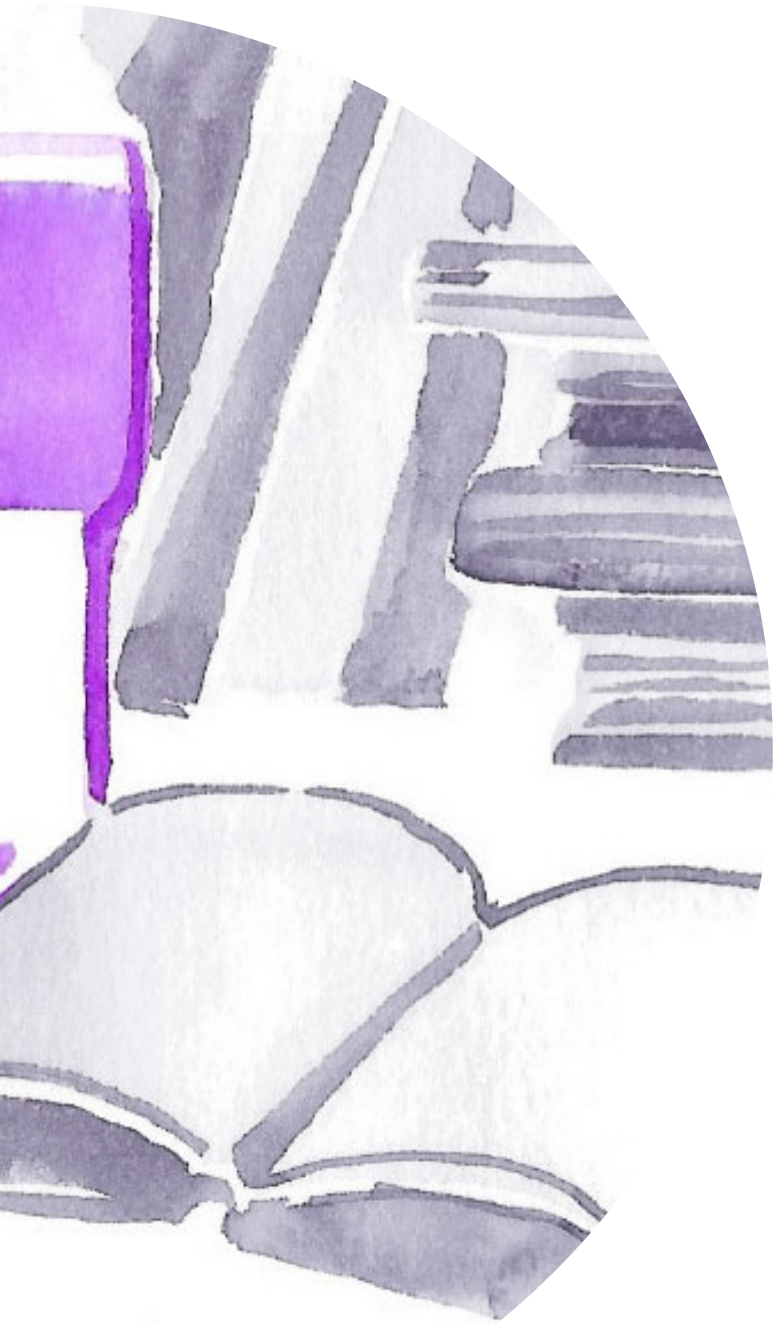
family members

Key technologies

Manipulator
Mobile platform
Ace recognition
Action recognition
Hd camera
Range sensor
Gas detection sensor
Smoke detector
Robot Motion Chassis
Object recognition
Ultrasonic range measurement
3D motion capture
Label recognition
Emotion perception


APPLE

Study education



Position
Near children
Place of study
On the table

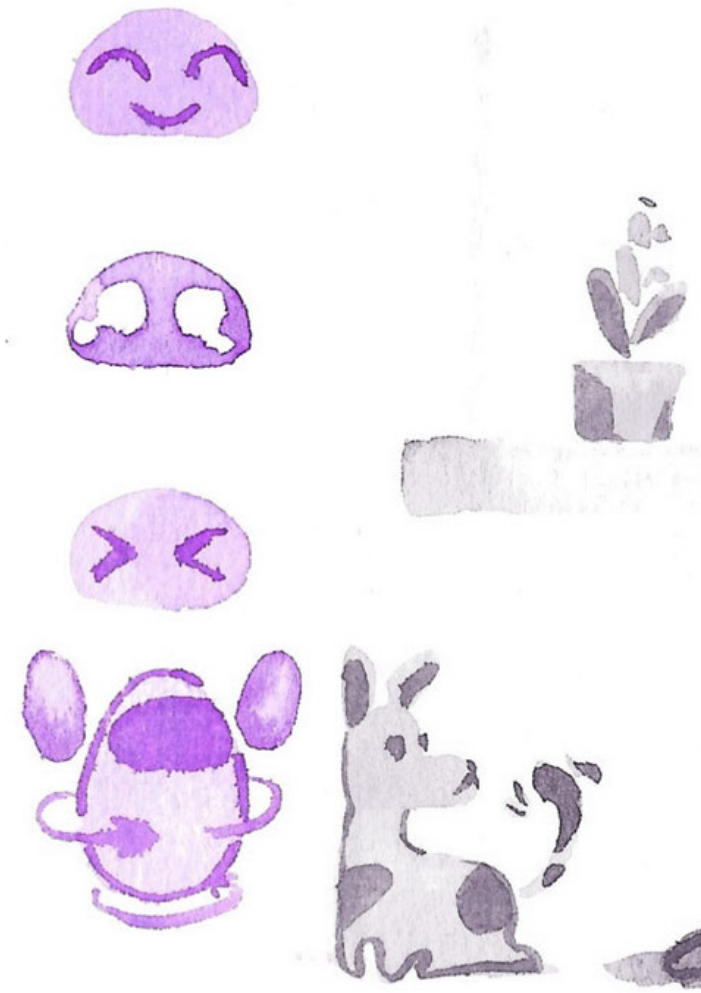
How to move
User moves manually

Function
Book reading
Topic analysis
Learning games
Exchanges inside and outside the school

Key technologies
Language model
Speech recognition system
Microphone
Audio
Multimodal dialogue system
Interactive screen
Expression sensor
Voice assistant

Interactive mode
Visual interaction
Auditory interaction (Can answer user's questions like a friend, like a teacher)

Companion



Position
Near children
Anywhere in the house
On the floor

How to move
Moves by itself

Function
For entertainment, you can use action
games for interaction, aerobics teaching,
etc.
Anthropomorphic, pet-like, interactive
behaviors with users, including dialogue,
execution of instructions, and emotional
expression

Interactive mode
Visual interaction (Can show different expressions in different situations)
Auditory interaction (Chat with users like friends)

Key tec
HD Cam
Ultrason
Ultrasonic rangemeasurement sensor
mobile chassis microphone RGB camera
Ultrasonic obstacleavoidance sensor
Ultrasonic rangemeasurement sensor
mobile chassis HD screen
Multimodal dialogue system
Interactive screen
Expression sensor Voice assistant


come on

Diet care

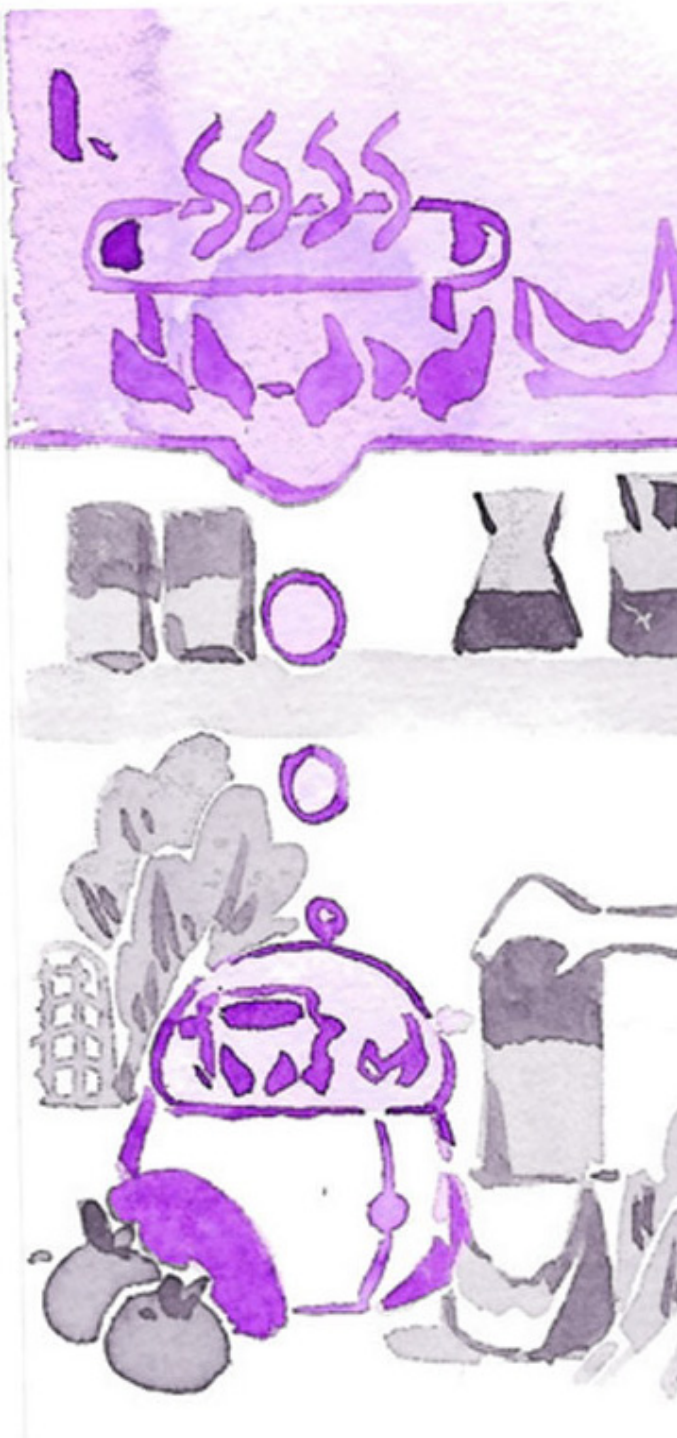
Position
Kitchen
on the table

How to move
User moves manually

Function
Cooking Step Planning
Cooking Teaching
Change recipes according to children's age
Hazard alertt

Key technologies
Gas detection sensor
Smoke detector
Voice assistant
Microphone

Interactive mode
Visual interaction (Used to play cooking teaching videos)
Auditory interaction (Alarm by sound of alarm)



Care giver

Position
Anywhere in the house
On the table
On the floor

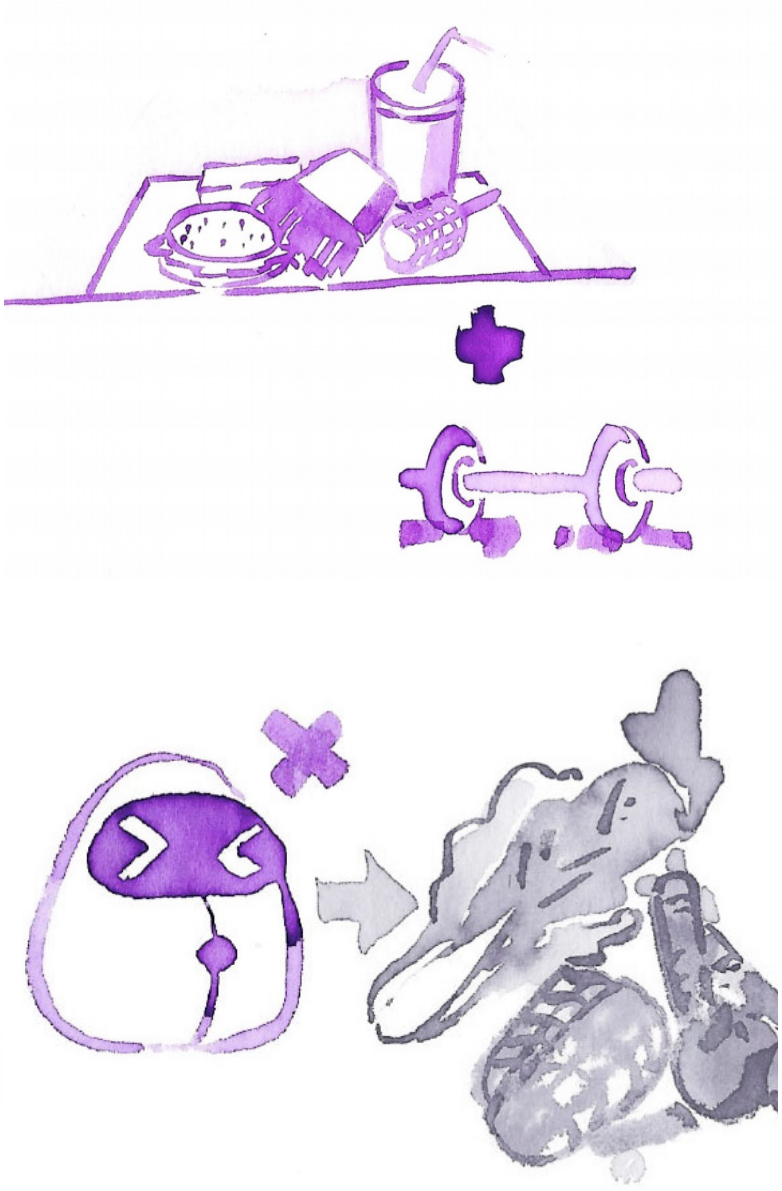
How to move
User moves manually

Function
Interact with doctors
Heart rate monitor
Body temperature monitoring
One-click contact
Overload Diet Tips
Record daily diet and exercise

Key technologies
Interactive screen
Heart rate sensor
Breath sensor
Audio

Interactive mode
Visual interaction
Auditory interaction
Tactile interaction


1. 34X
2. 34X
3. 34X



Screen, use time management

Position
Living room or Bedroom
On the table
On the floor

How to move
User moves manually

Function
Timing function (you can set a specific time or play an episode of cartoons)
Parent Remote Shutdown
Screen projection

Key technologies
Interactive screen
Heart rate sensor
Breath sensor
Audio

Interactive mode
Visual interaction (Smile, serious, angry, change expressions with voice)
Auditory interaction (When the set time is up, use a friendly voice to prompt the first time, use a serious voice to organize the second time, and force the remote shutdown for the third time to cultivate children's self-consciousness)


24min
00:03
00:03
END

Night care

Position
Bedroom
Near the bed

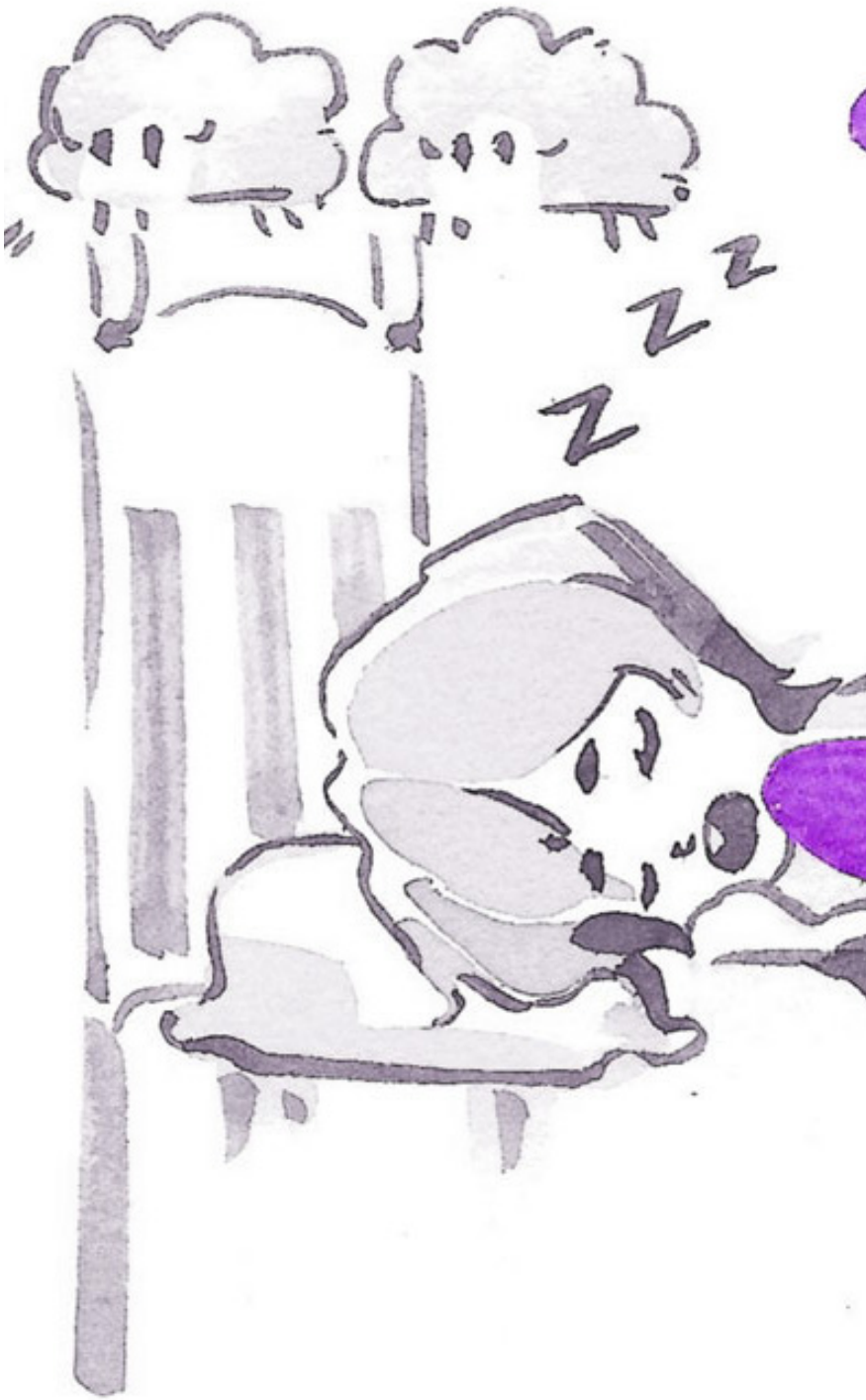
How to move
User moves manually

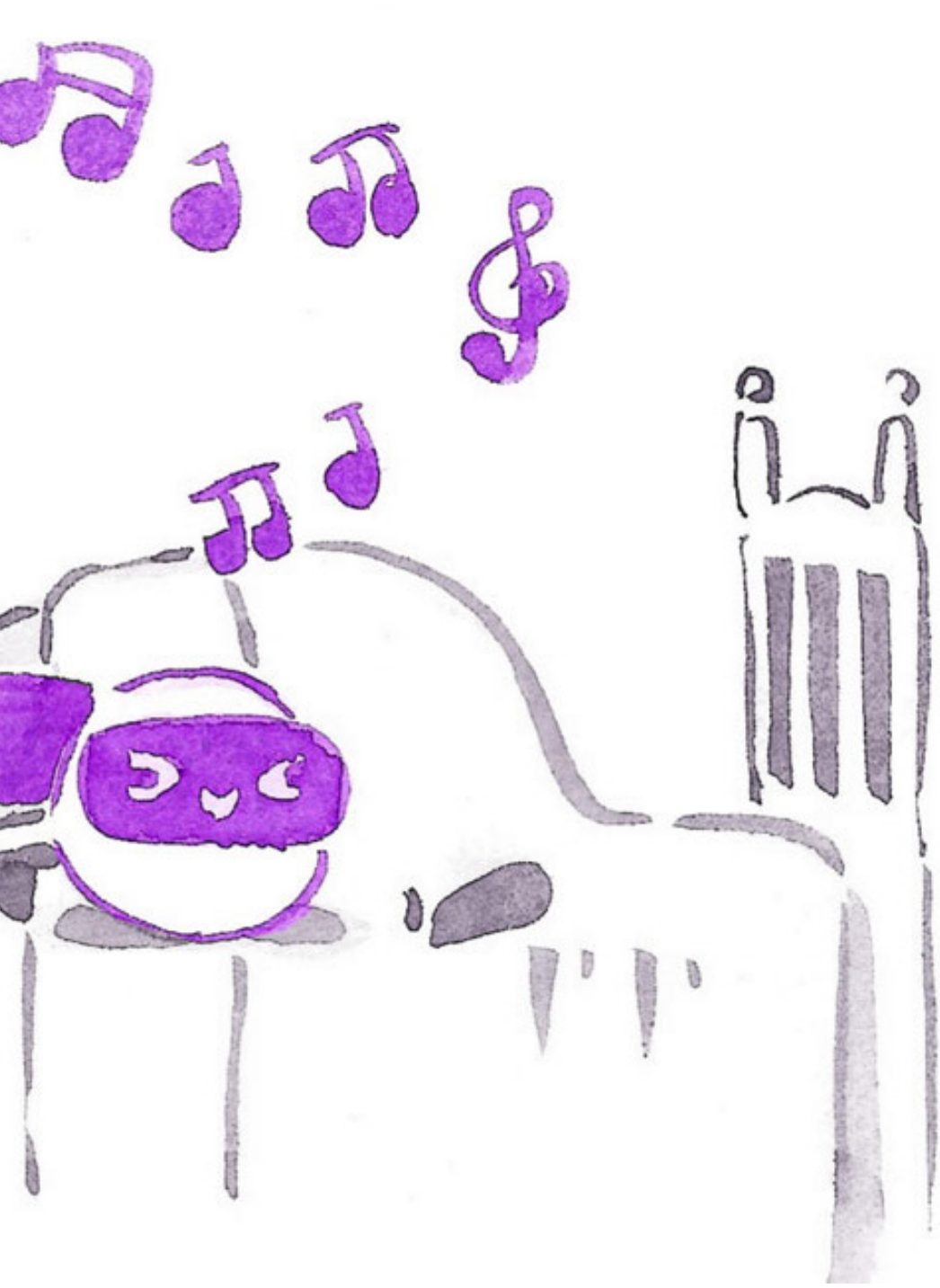
Function
Night light (yellow light)
Wake up with light (blue light)
Music/Bedtime Stories
Sleep monitoring
Alarm in special circumstances, adjust the volume
through the depth of sleep

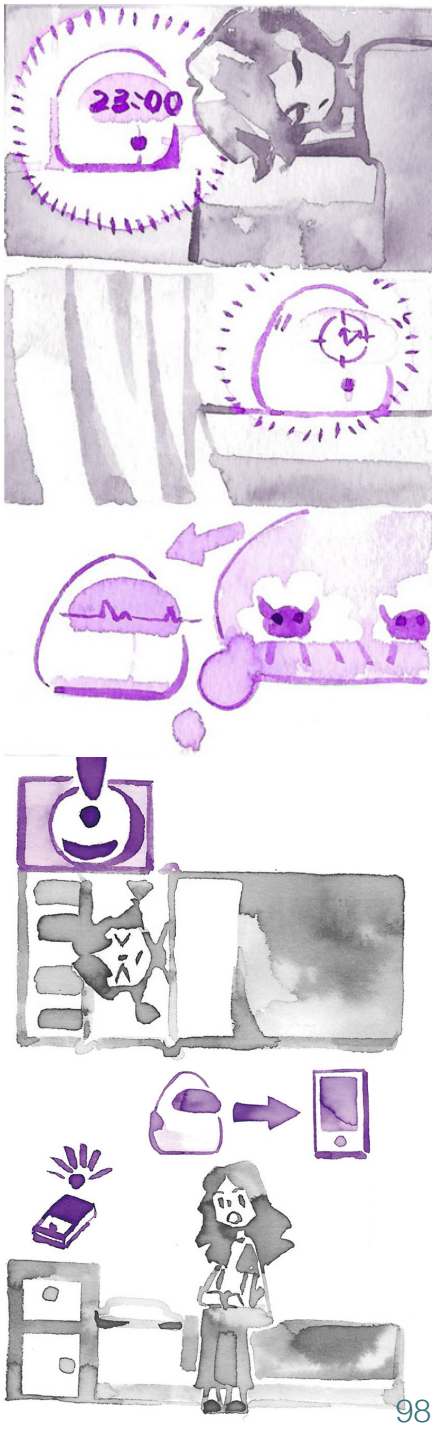
Key technologies
Nteractive screen
Heart rate sensor
Breath sensor
Audio

Interactive mode
Visual interaction (Time, sleep light at night and wake-up light during the day)

Auditory interaction (You can set the user's favorite voice, play bedtime music or stories, Alarm clock)






23:00

Remote Navigation and Monitoring

Position
Wearable products
Follow the child

How to move
User moves manually

Function
Real-time positioning
Remote navigation
One-click alarm, contact parents
Distance monitoring(Parents will be prompted if the safe distance is exceeded)
Button camera, face scanning(identify strangers)

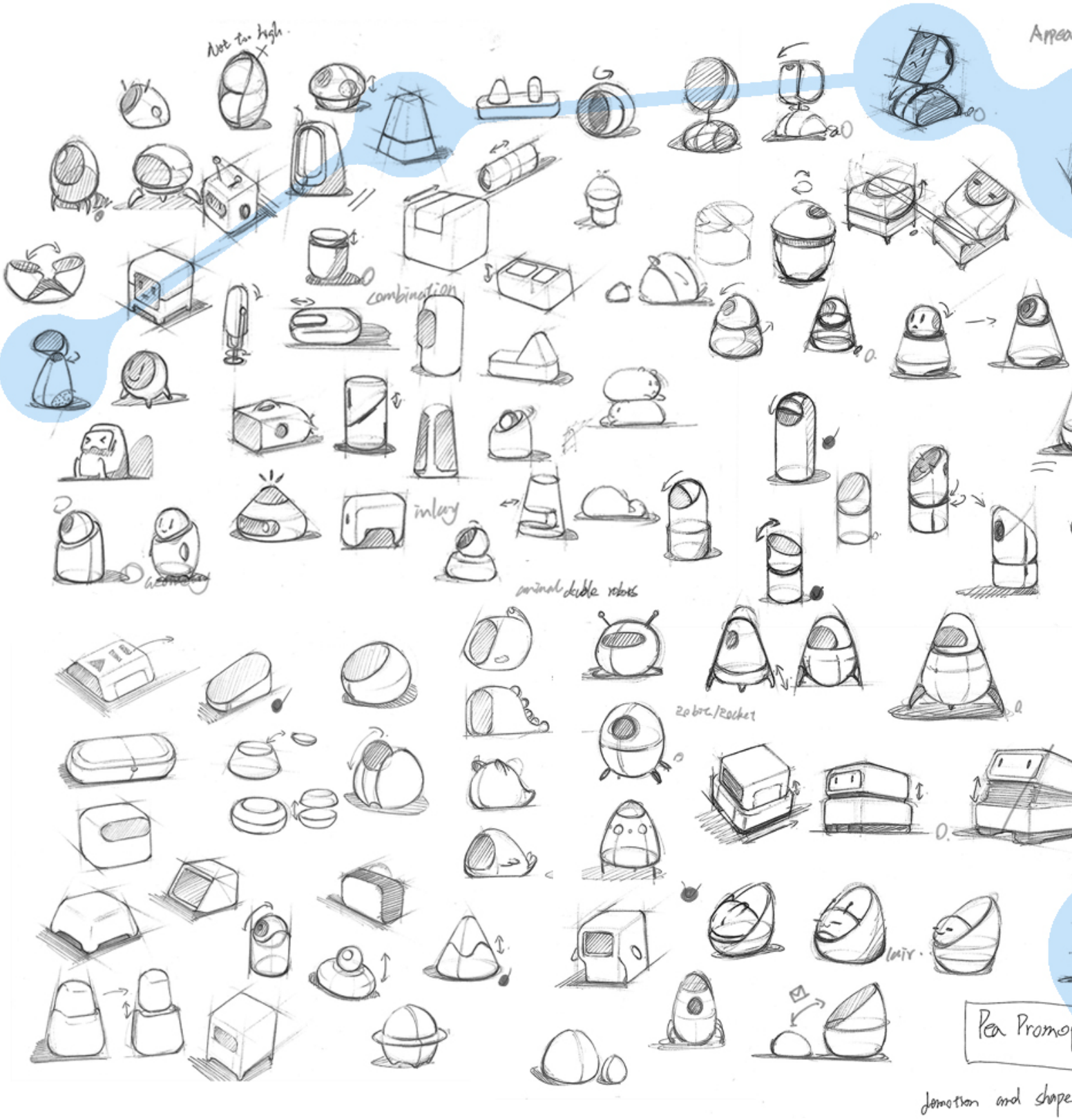
6.2

Concept

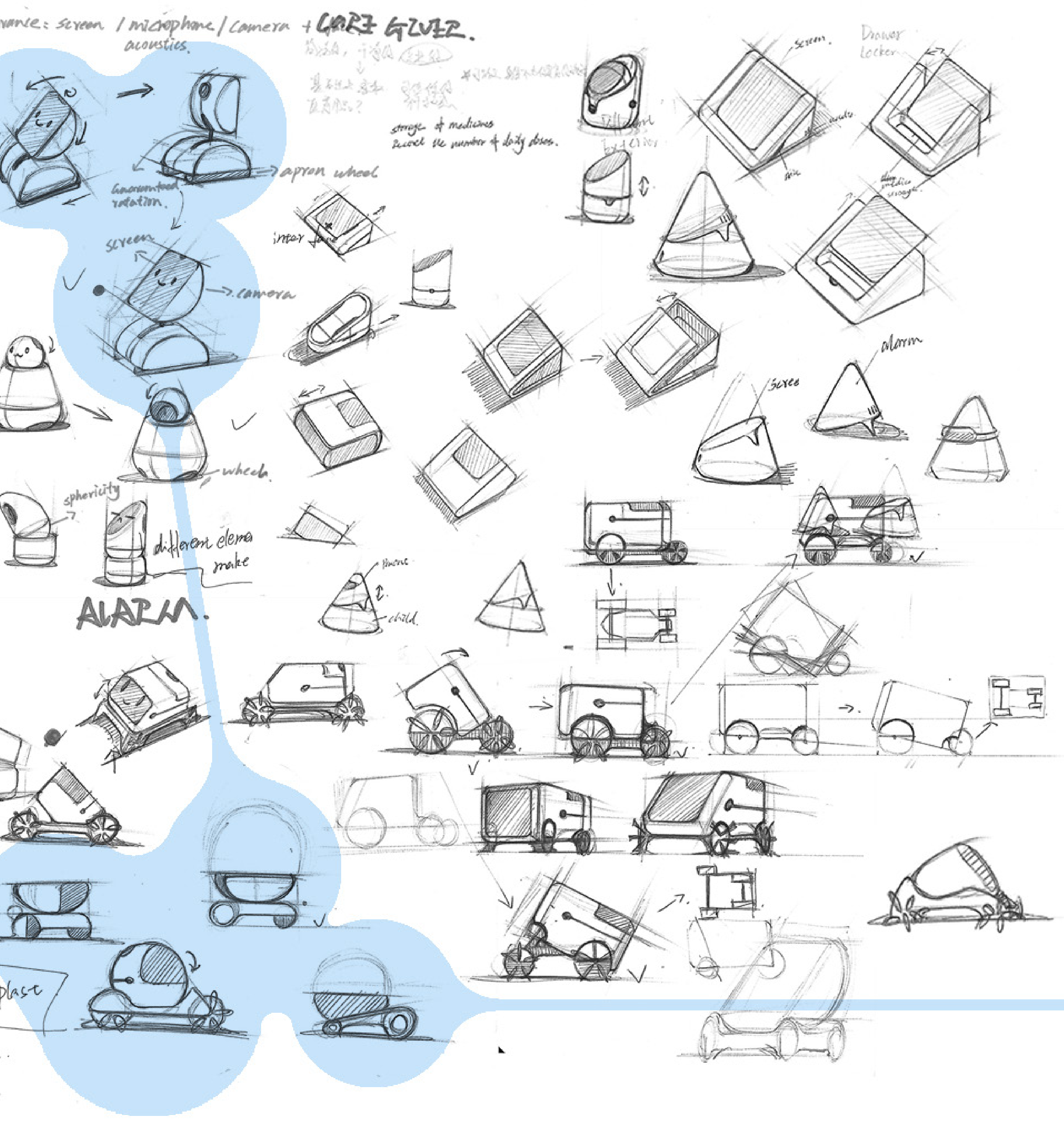
With key words such as smart home, children, etc., we drew a lot of sketches, with smooth curved surfaces to reflect the safety of the product, the combination of the camera and the shape of the car's shift lever, and the shape of the car to reflect the characteristics of smart products, such as the pumpkin carriage. The shape represents fairy tales and the innocence of children. In addition, we also designed a large number of product appearances around the keywords.

Morphological Analysis

Homely, Soft, Cozy



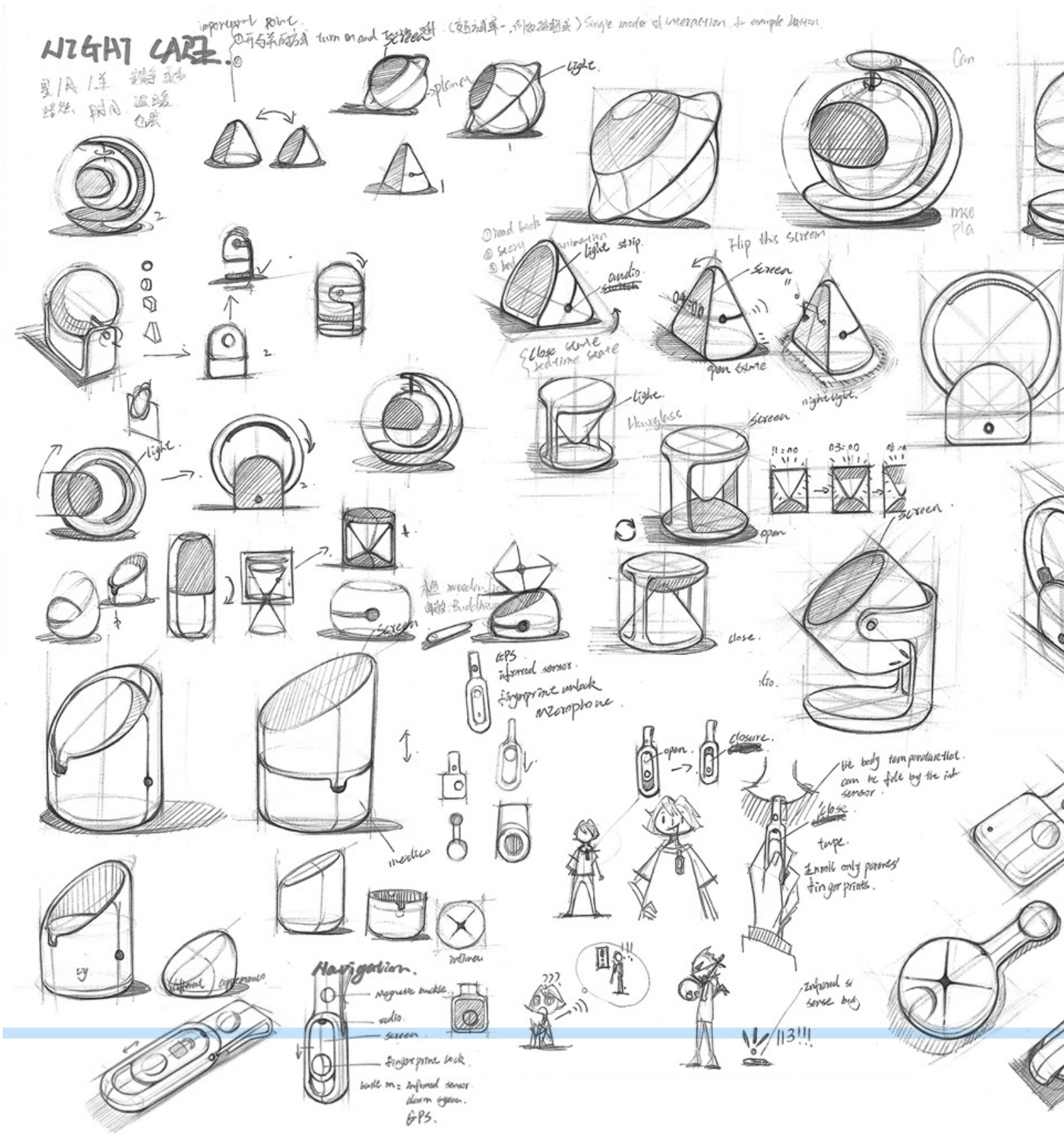
Sketch



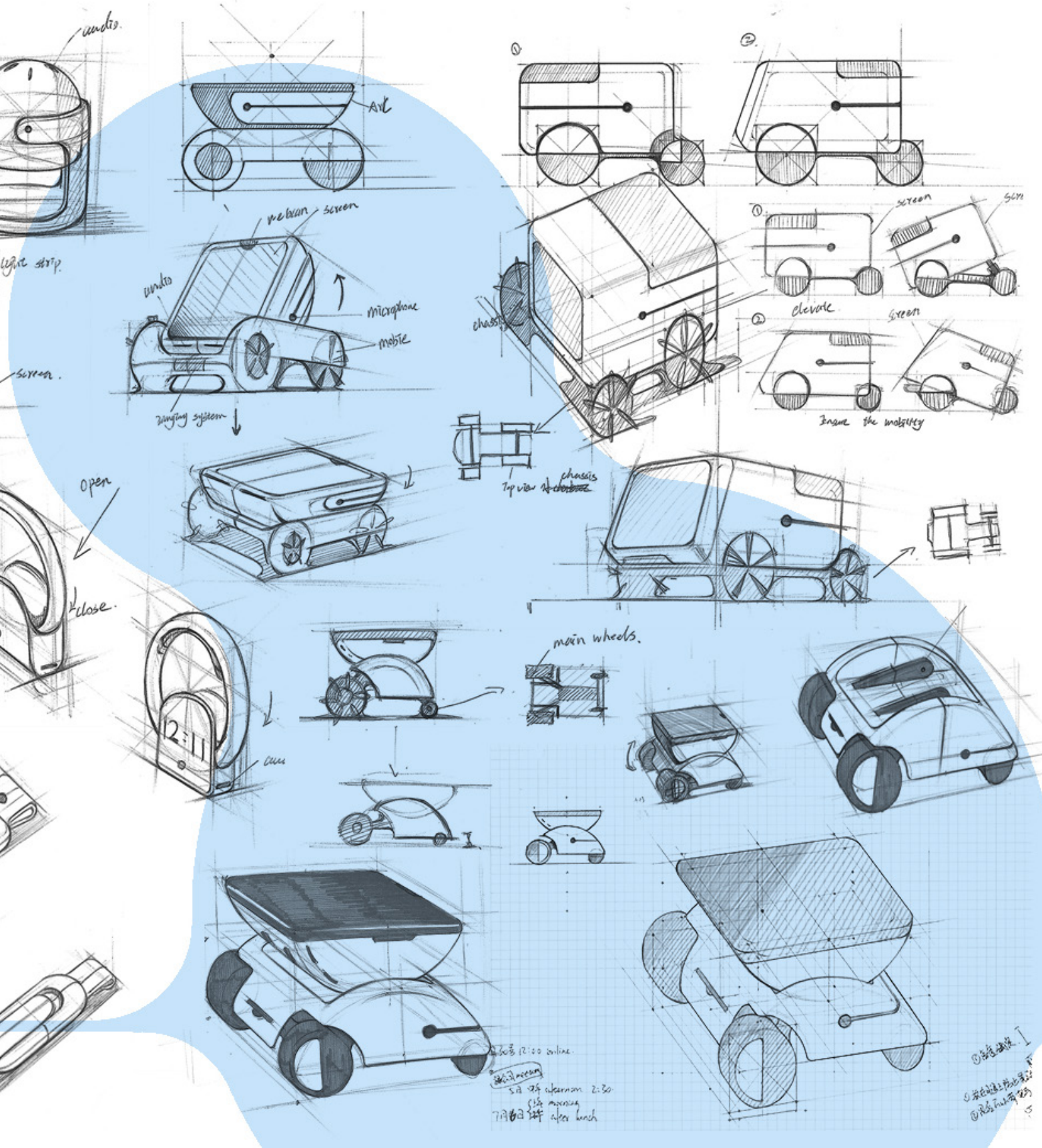
screen / microphone / camera
acoustics.
storage of medicines
Record the number of daily doses.
apron wheel
camera
screen
wheels
sphericity
different elements make
ALARM.
Drawer
Locker
alarm
Scree
child
plast

Morphological Analysis

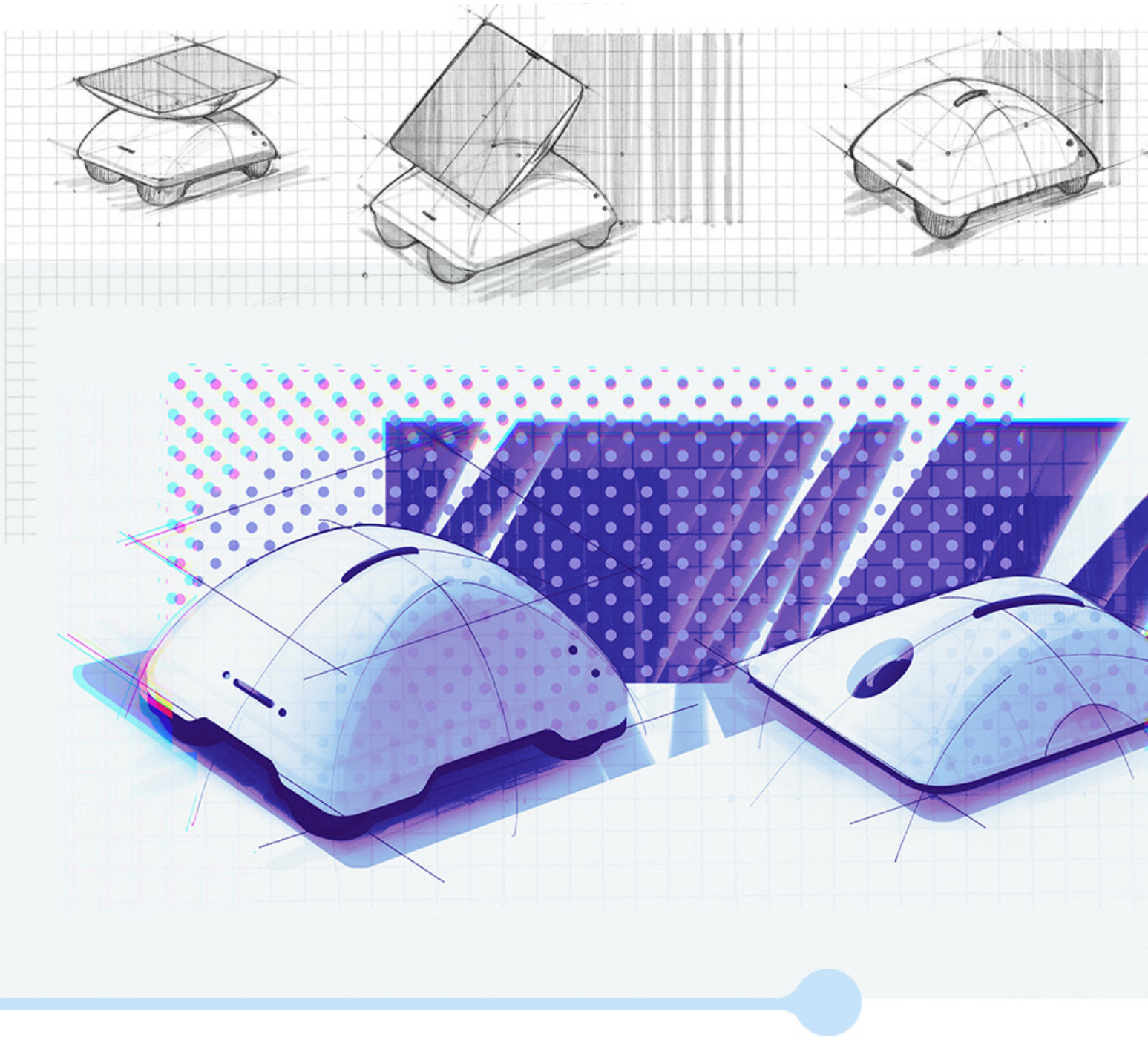
Homely, Soft, Cozy



Sketch



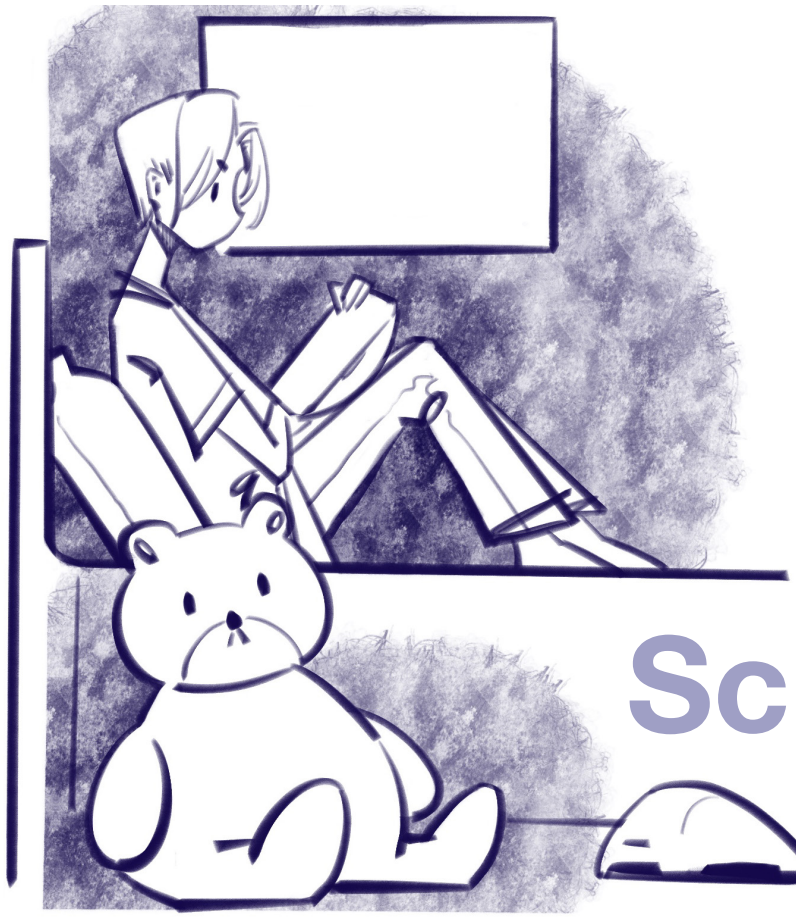
Renderings: Home, Movable, Modular



In the end, we decided to define our product in a customized form, with the screen supporting the combination of these two modules, which can be applied in different specific usage scenarios.

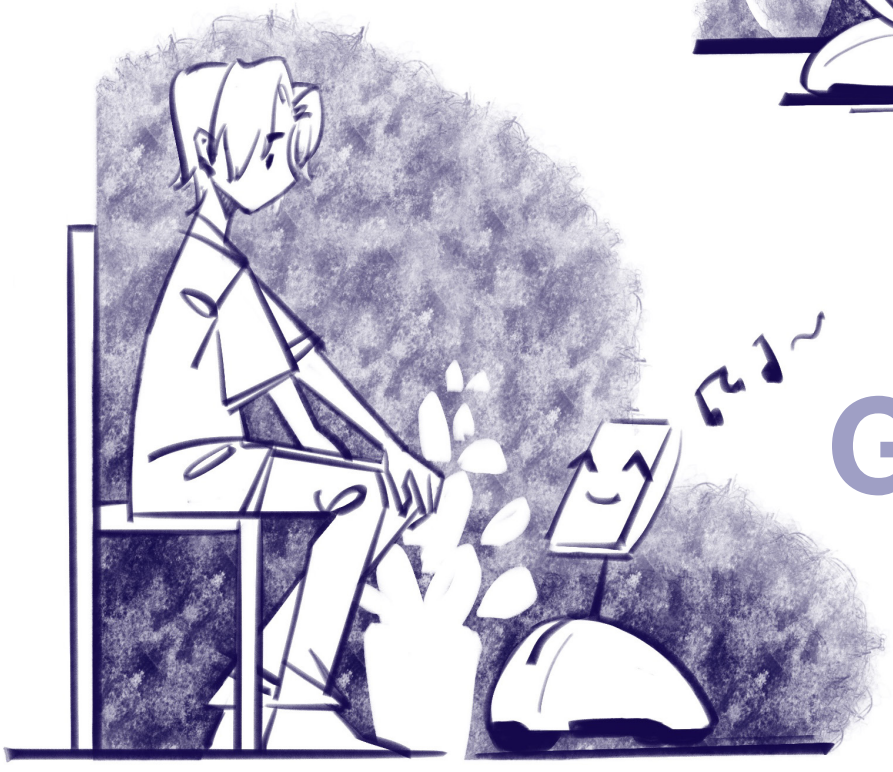
Possible usage scenarios

The screen can be detached and used as a tablet on the bed or on a chair. Put it together and put it on the table, the wheels will automatically retract and can be stably fixed on the table. It can also be placed on the floor, and the wheels drive the product to move on its own. The neck is elongated, which is ergonomic and makes the user more comfortable when viewing the screen.



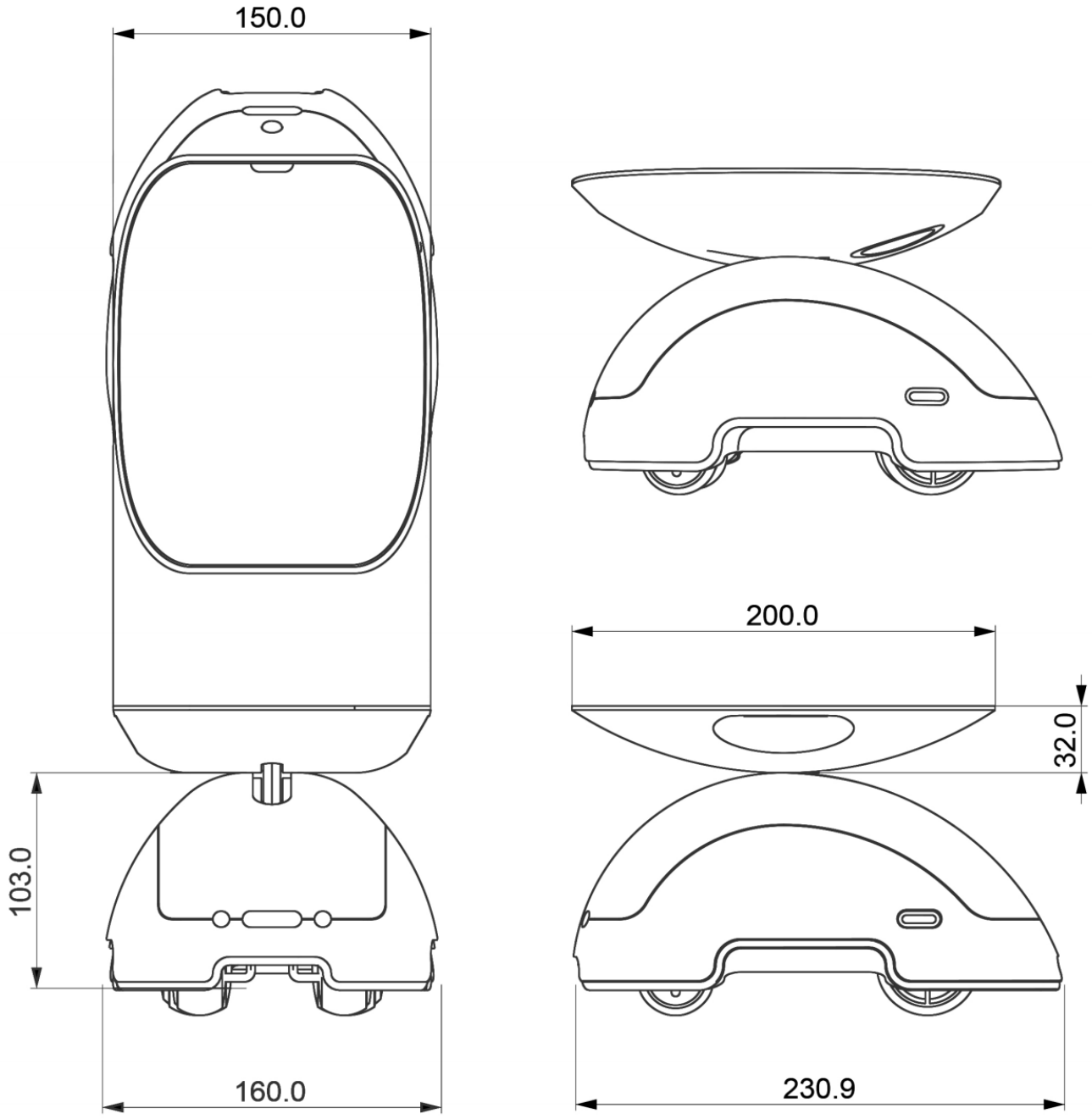
Screen only

Desktop



Ground

Model Draft and Dimensions

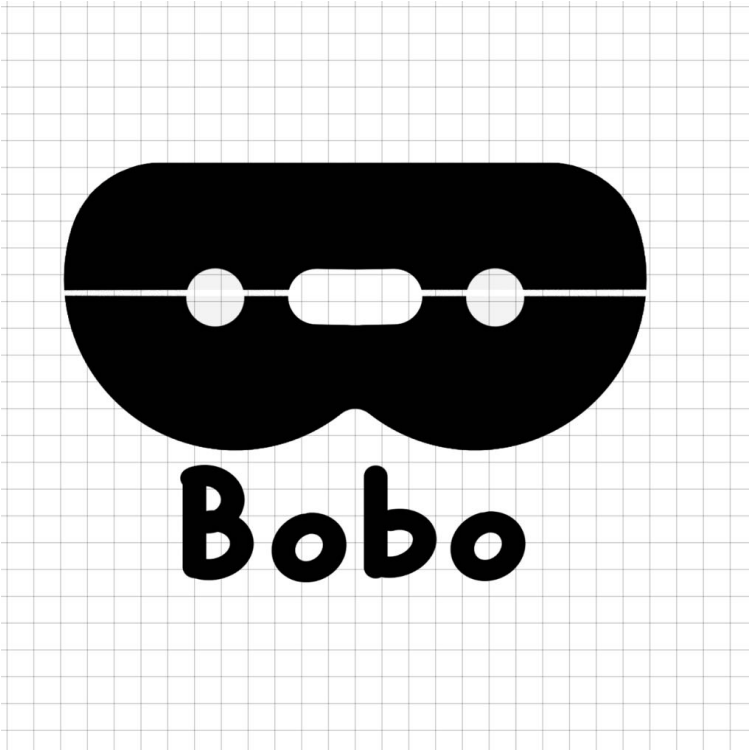


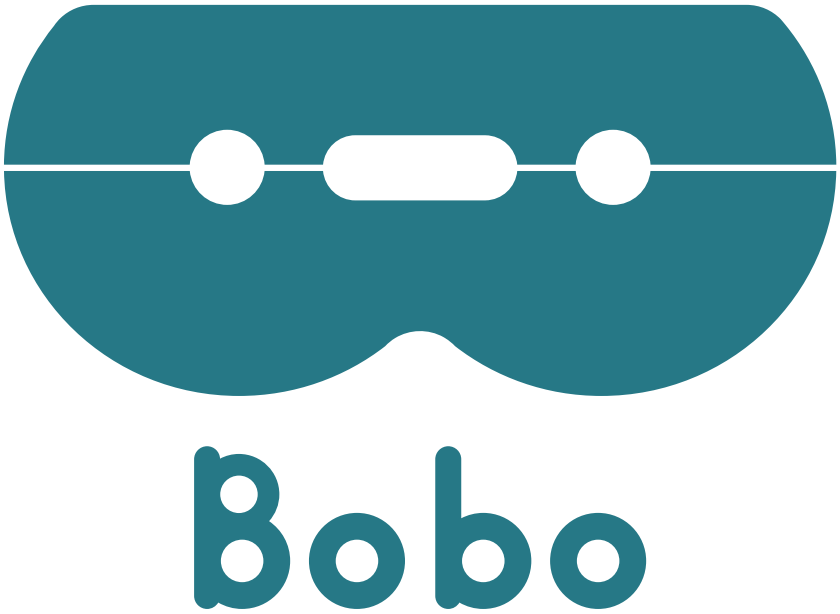
Unit: mm

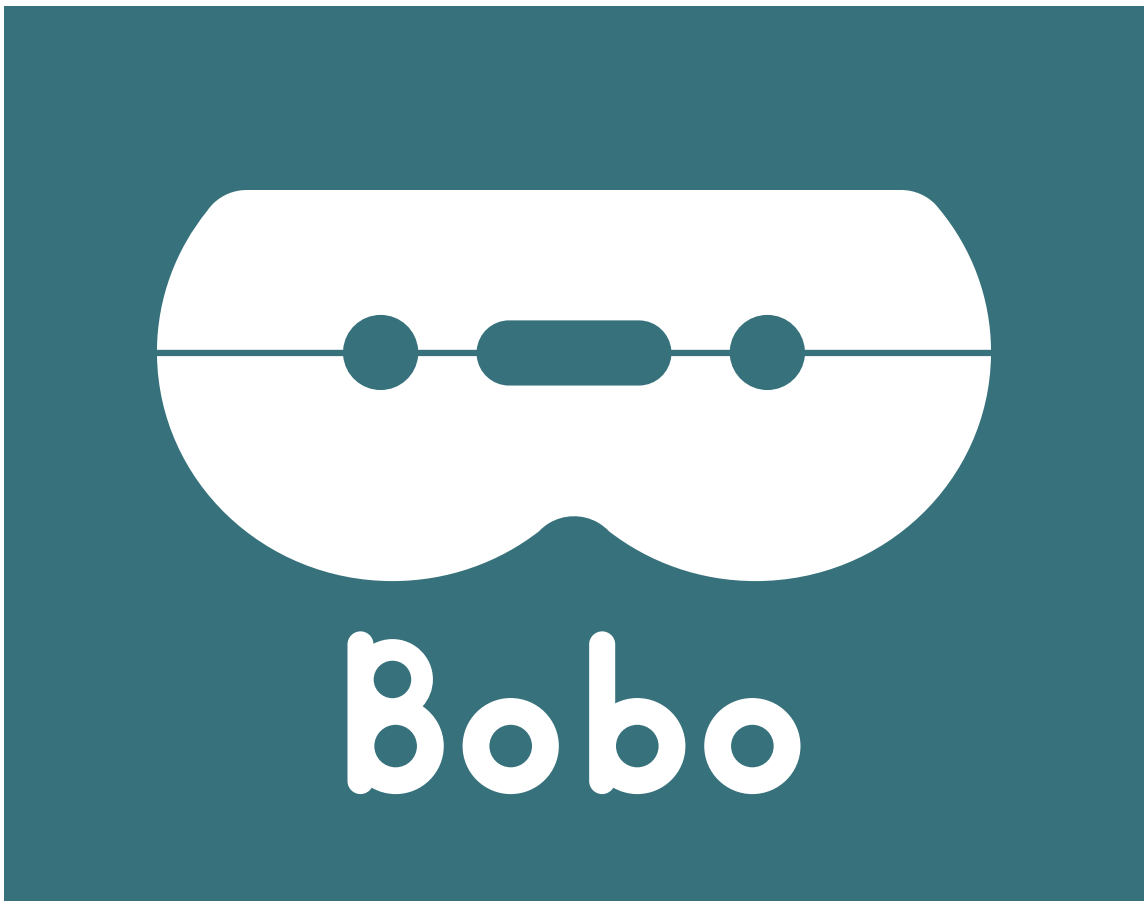
LOGO Design

Since our product is a smart product for children, we need to add a little cute element while being convenient. Inspired by the appearance of the product we designed, which is composed of two rounded parts, we came up with the name bobo.

The logo combines the letters themselves and the shape of the product components. It is cute and also reflects the relevance to the product itself.




Bobo

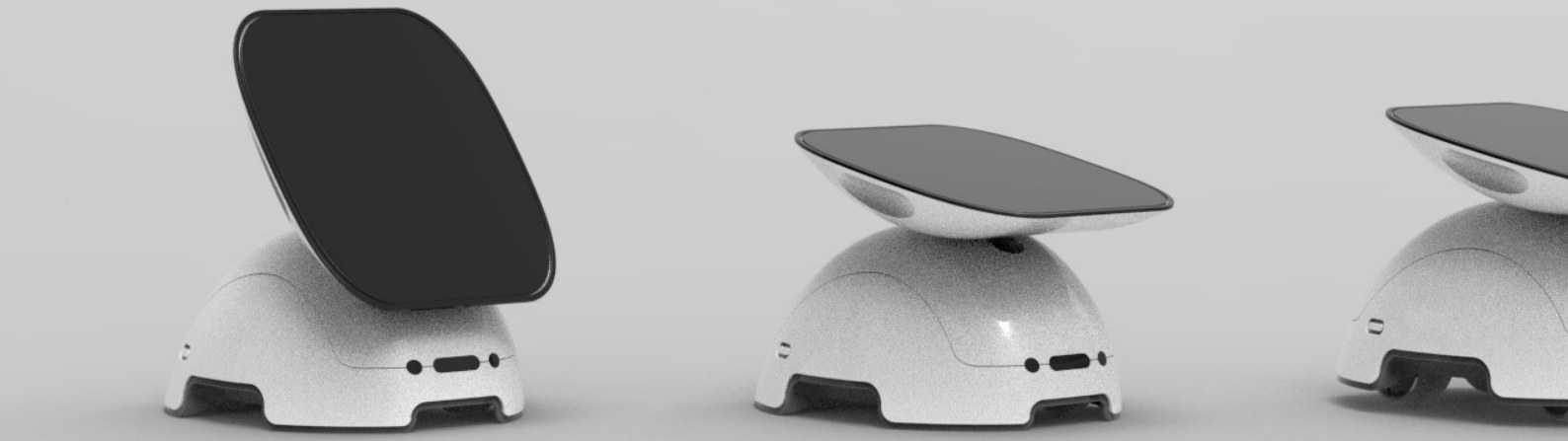

Bobo

Model Draft—
Different Usage Forms

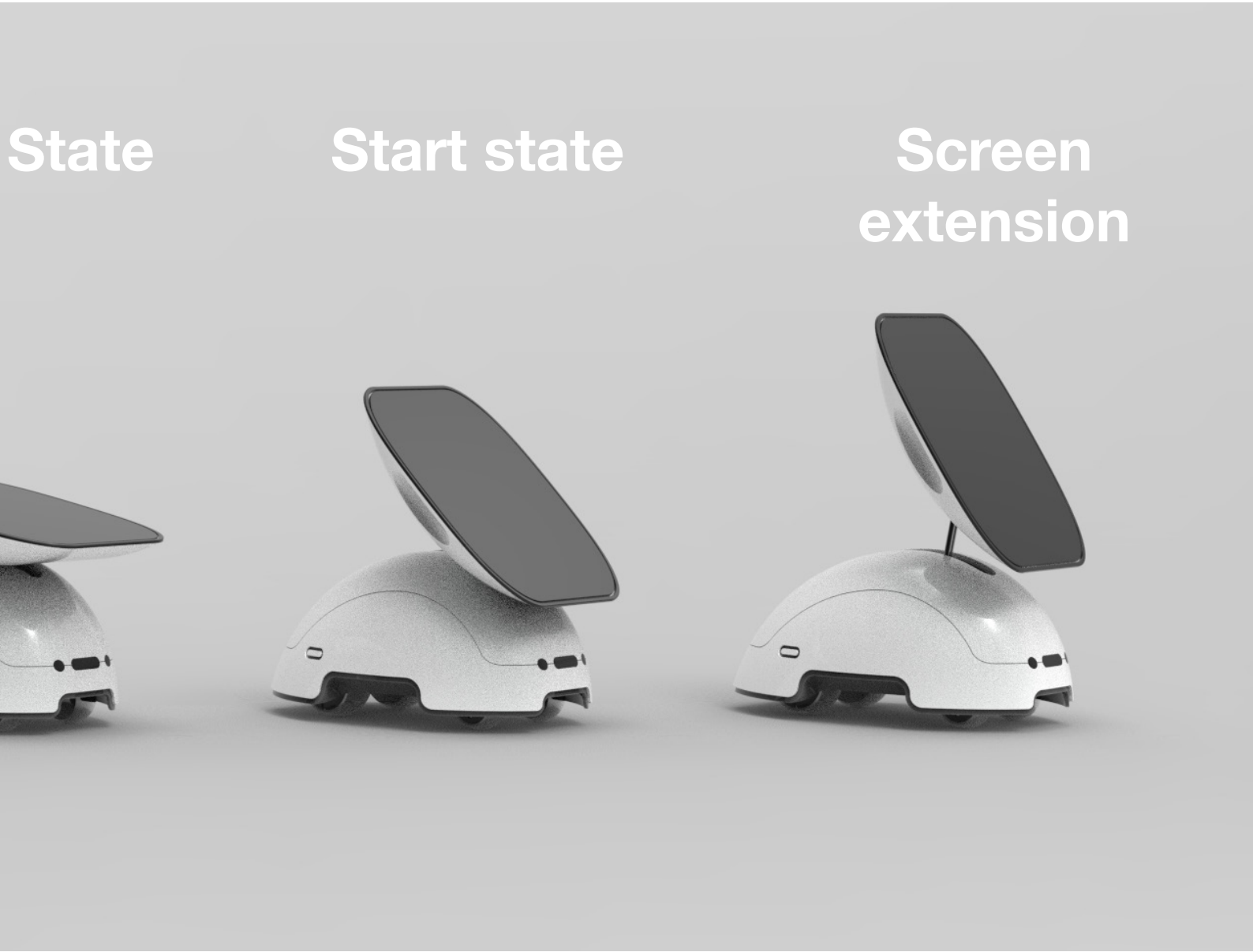
Desktop form

Desktop Form - Sleep State

Sleep



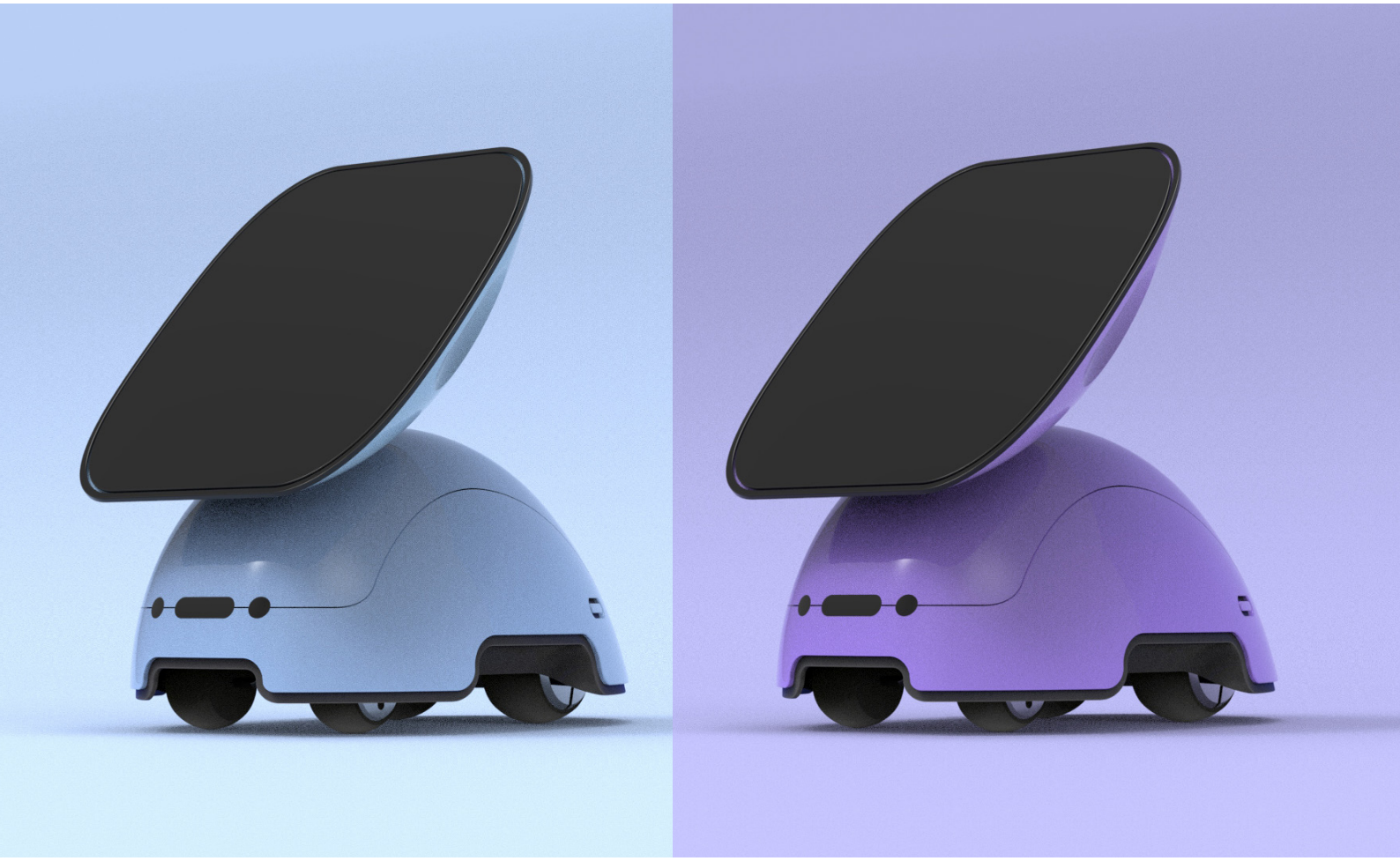
Our product has five forms, the first one is on the table, the wheels are received inside, and the screen is tilted to the user's best viewing angle for use. The second is desktop sleep mode, where the screen is retracted to an angle that is almost parallel to the desktop.



The third is the normal sleep mode. The tilt angle of the screen is not completely parallel to the ground to prevent children from using the product as a bench and causing damage to the product. The fourth is the normal startup mode, where the screen is tilted to the optimal angle and the wheels are removed to move on its own. The fifth type is for user convenience, the screen can be raised to the optimal height.

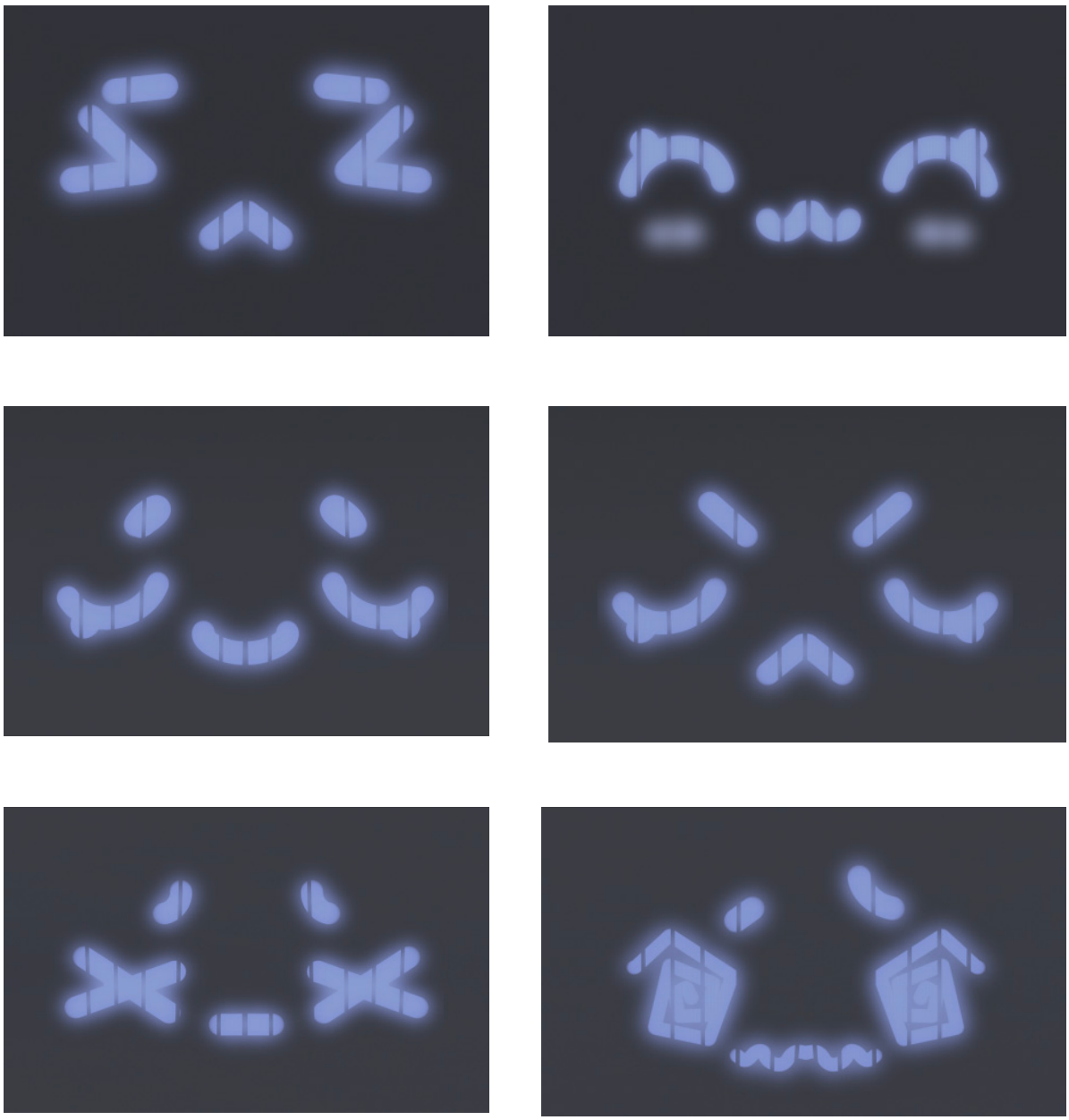
Renderings: Model Draft - Color Possibilitie

es



Since our main users are children, we think the color of the product can be brighter and not too rigid, which is also in line with the liveliness and cheerfulness of children.

Interactive interface - expression display



Bobo has a variety of emotional expressions, including starting, excitement, anger, sadness, etc., and its expressions change as the usage scenarios and situations change.

Use scene display

User portrait

Lily

Hi, I am a designer and a mother of a 5-year-old child. I am very busy at work every day. When I am in the company, I am doing projects except for meals. Whenever I go home, I just want to wash Take a bath, sit on the couch, drink a glass of red wine and watch a new movie, but what is very distressing is that my son really has a hard time falling asleep. Like many children, he is afraid of sleeping alone in a dark room, so I have one after I get home. I spent most of the time coaxing him to sleep, which made me feel tired and irritable, and sometimes I couldn't control my emotions to reprimand him,it bothers me so much.

Age

38

Disposition

Analytical — Creative

Analog — Digital

Sedentary — Sporty

Busy — Rich in time

Introvert — Outgoing

Hobby

Draw

Wine tasting

See a movie

Skiing

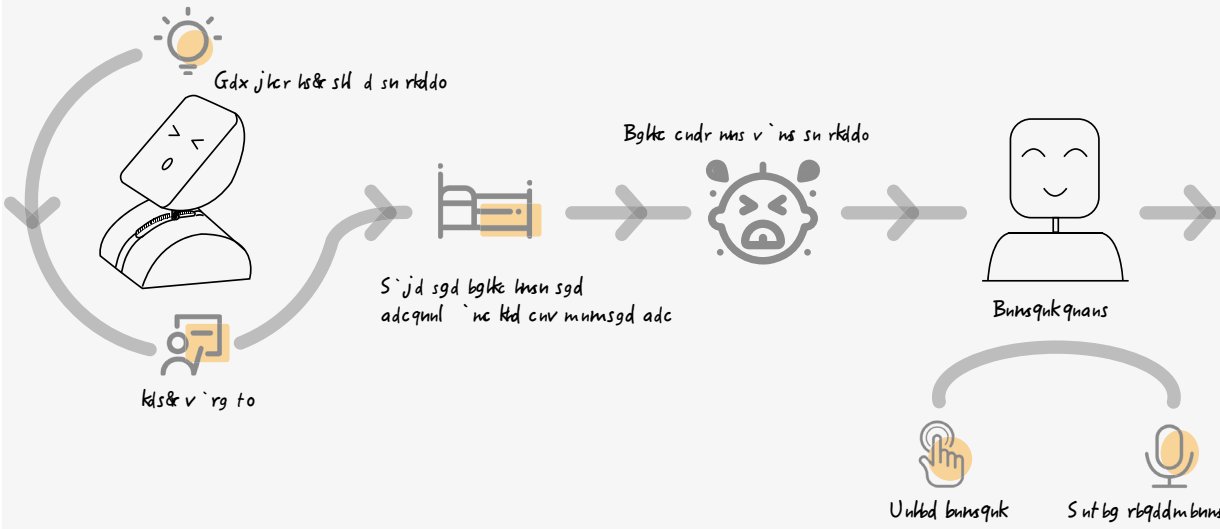
Swimming

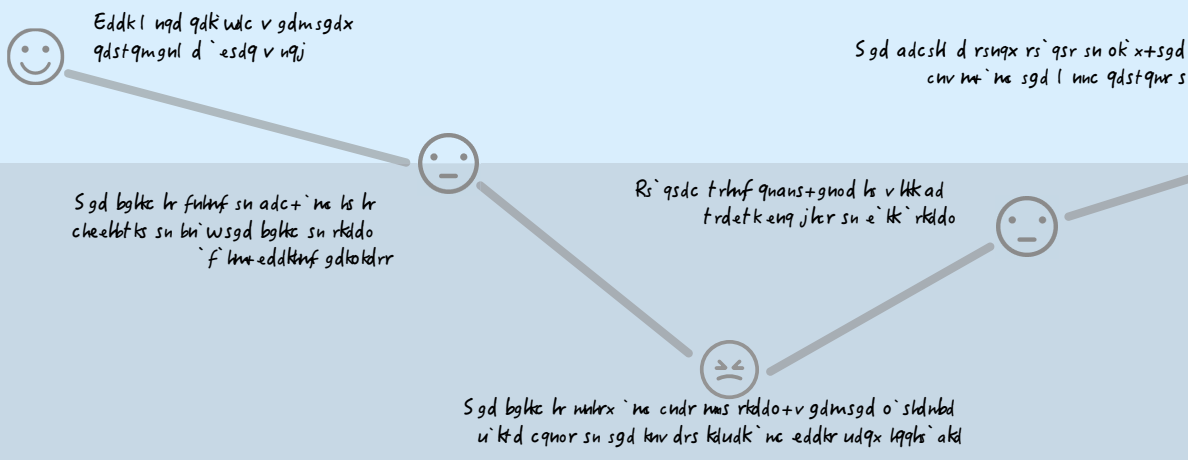
Party

Shopping

Gourmet foo

Stages	Sleep reminder	Wash up	Soc
Doing	When it's bedtime, guide and tell the child that it's time to go to bed and wash up	When putting the child to sleep, the child keeps crying, naughty and unwilling to sleep	I tell th night l or tap with m
Feeling			
Touch Point	• Robot	• Robot	
Pain Point	How to prompt if the robot is not around	Difficult to perform complex interactions in a restless mood	How to tell if





pthe before bed

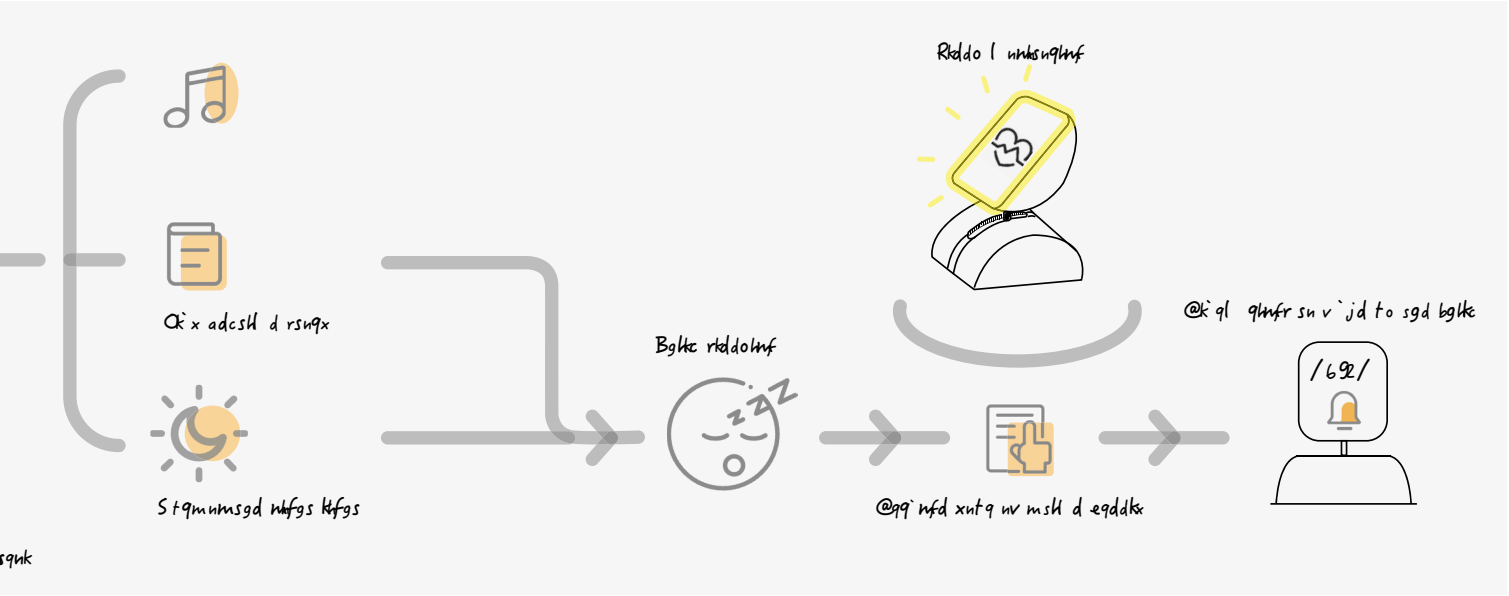
he robot "Please turn on the ight and play a bedtime story", the play button on the screen ny finger

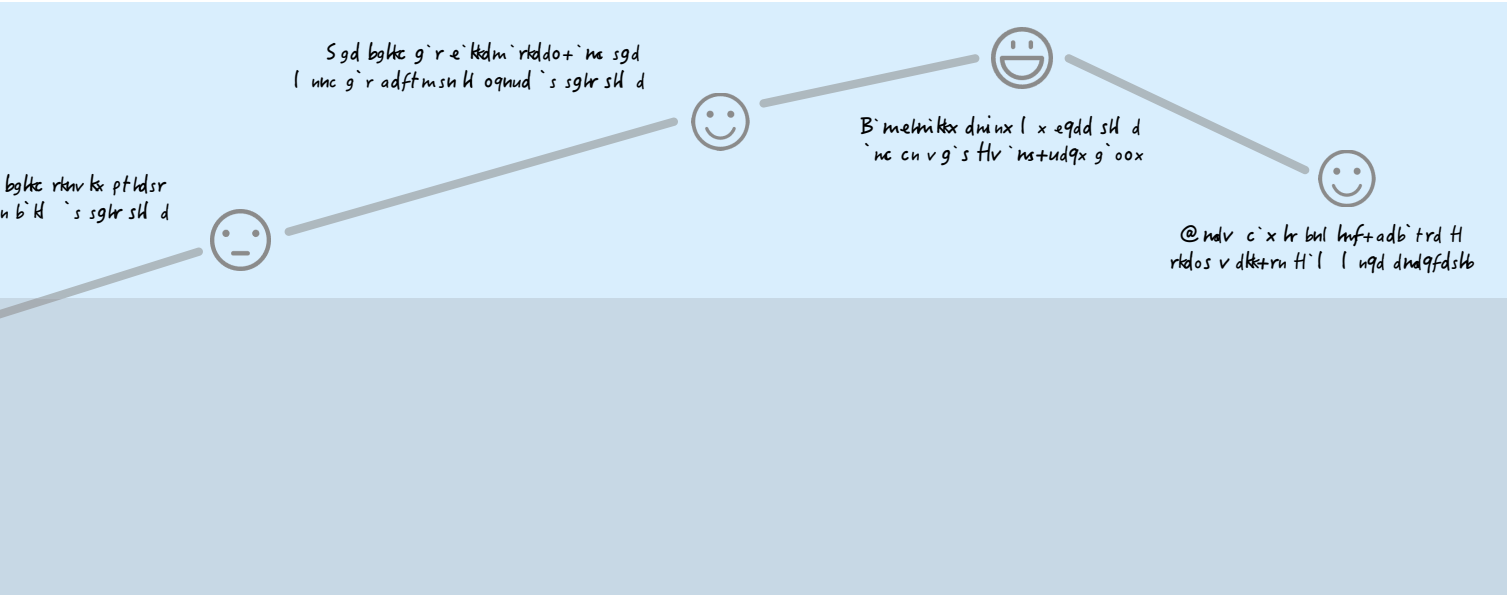
Free time

The child slowly quieted down and fell asleep listening to the short story. I walked out of the room and began to arrange my own free time

Get up

The alarm wakes me up in the morning and I pack up with the kids and head out for school and work





- Robot
- Mobile Phone
  (Sleep data can be checked on the phone)

your baby is asleep

How to switch from the bedtime story interface to the sleep monitoring interface (automatic or parental operation)

The robot will stay in the children's room, how parents can operate it remotely

6.4

Interface design

DIET CARE PAGE

When the user enters the Diet Care page, there are two functions to choose from. The first is Look after the kitchen, which uses simple and clear illustrations to inform the user of the purpose of this function. You can swipe left with a gesture to select the desired function.

Diet care Care giver Night care Education care

Look after the kichen

Diet care Care giver Night care Education care

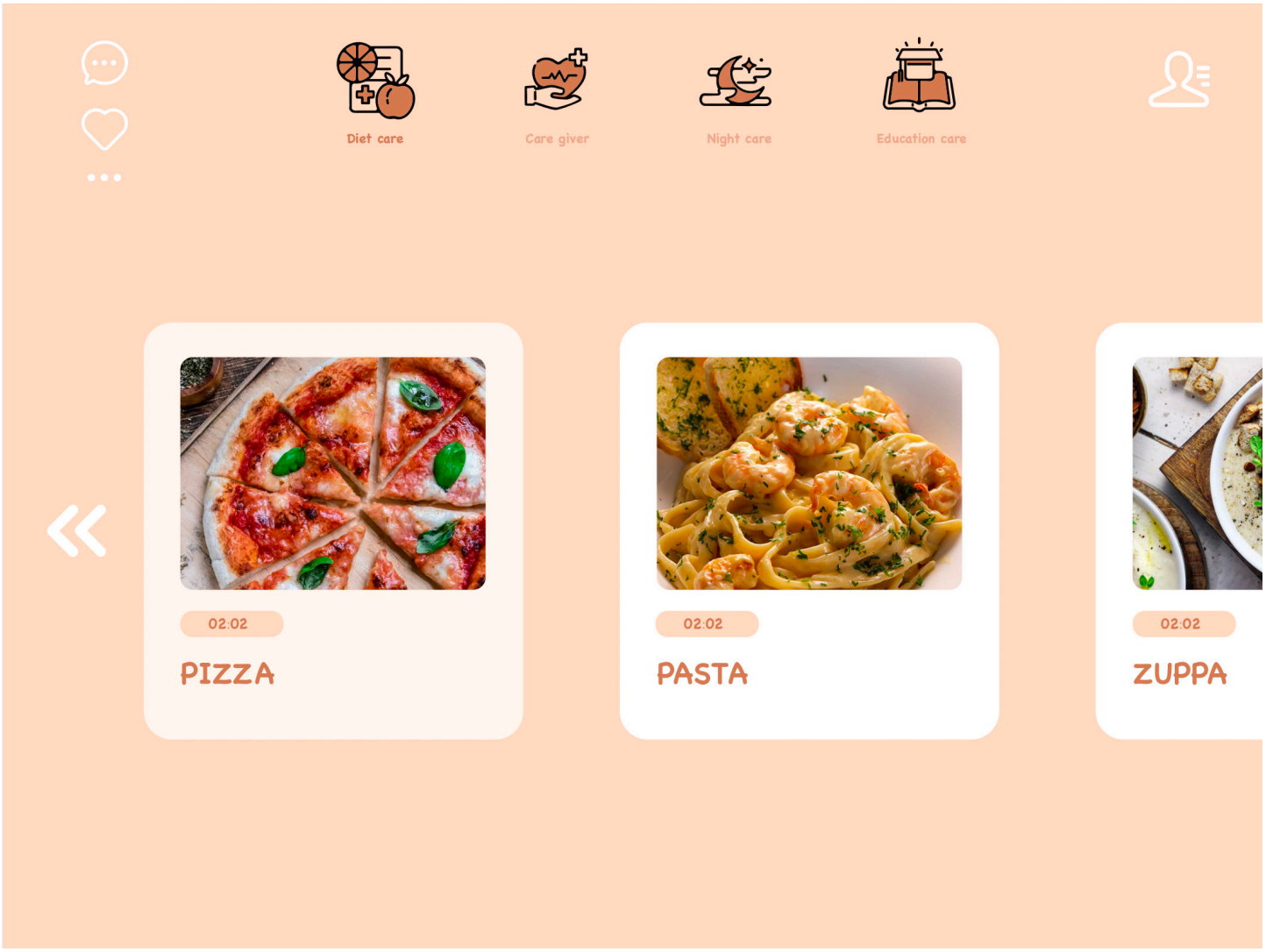
Cooking teaching

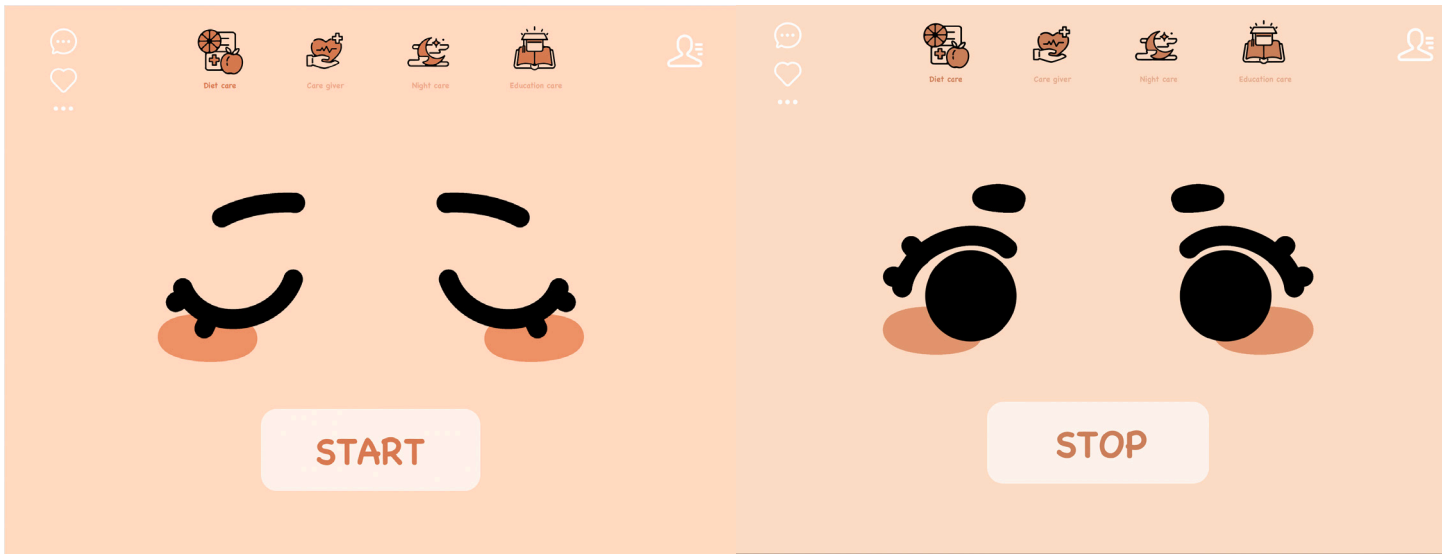
Cooking teaching

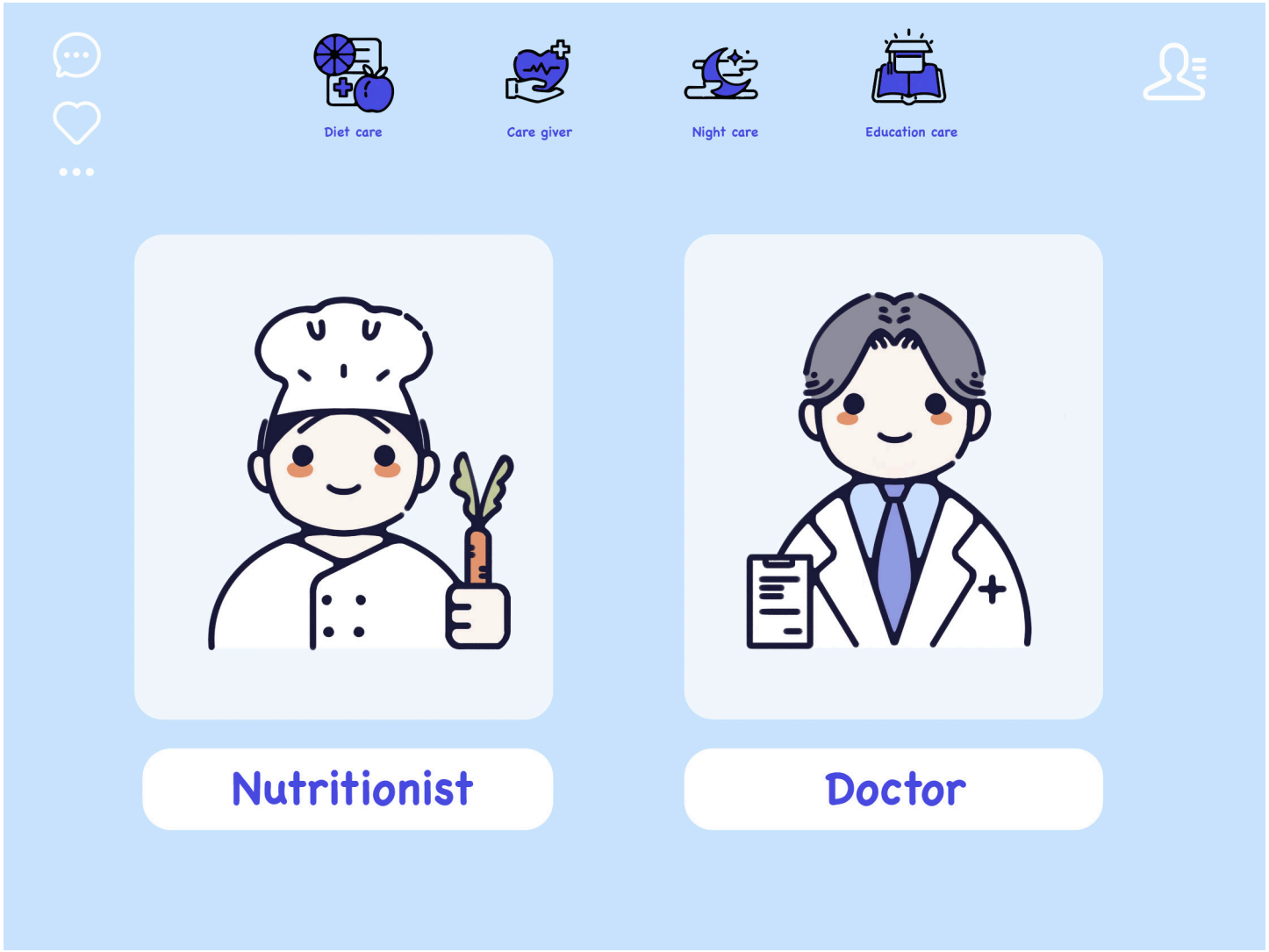
Click to enter the Cooking teaching interface, and a menu will appear. By sliding, you can select the recipe you want to learn. You can also collect your favorite recipes by clicking the heart in the upper left corner

Look after the kichen

If the user wants to start kitchen monitoring, the patrol function can be clicked to start. Opening the eyes means that the user is helping the user patrol the kitchen to prevent danger. Closing the eyes means that the function is turned off, and the lens is also turned off, which can protect the user's privacy.


Diet care
Care giver
Night care
Education care
02:02
PIZZA
02:02
PASTA
02:02
ZUPPA


START
STOP

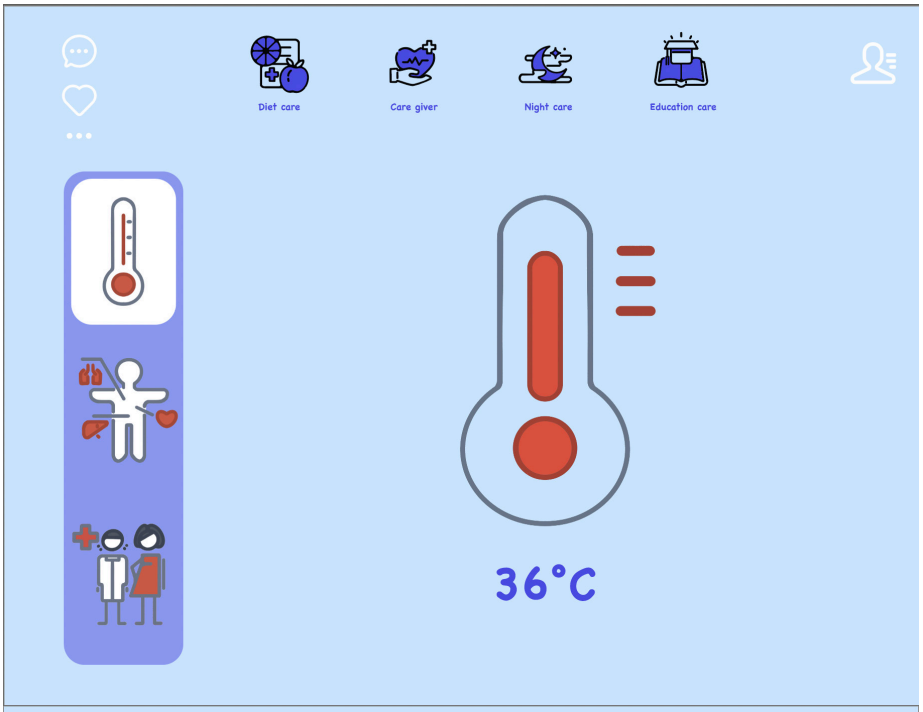


CARE GIVER PAGE I chose to express it in the form of comics. While it has a good look and feel, it can also be used to teach children about doctors and chefs. When using it, users can enter the functional interface by clicking on the text part.

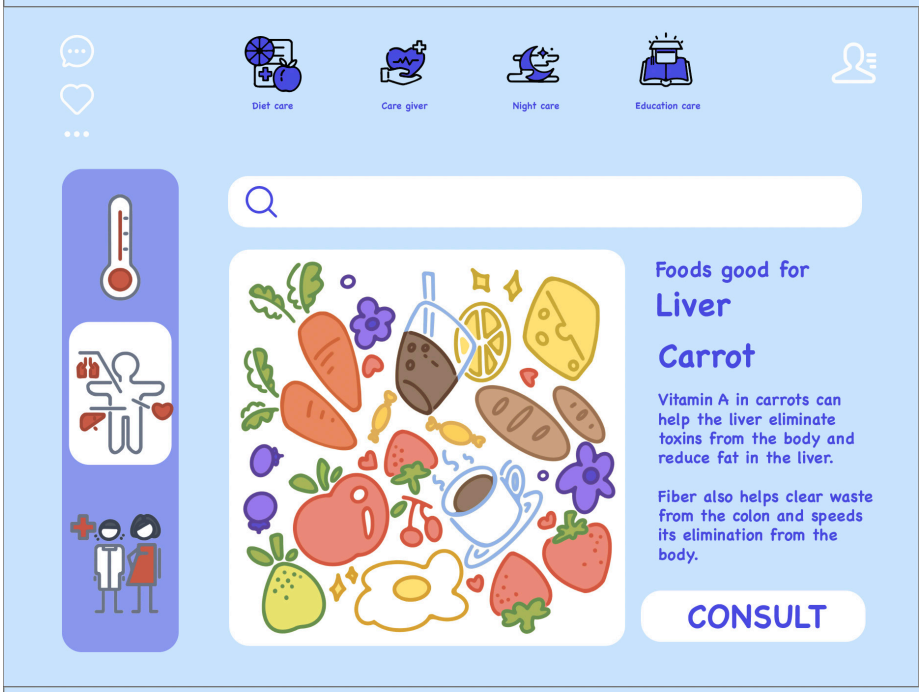
Nutritionist Page

Click Nutritionist and you will enter the user's exclusive nutrition matching interface, which will make a reasonable match for each day's diet.

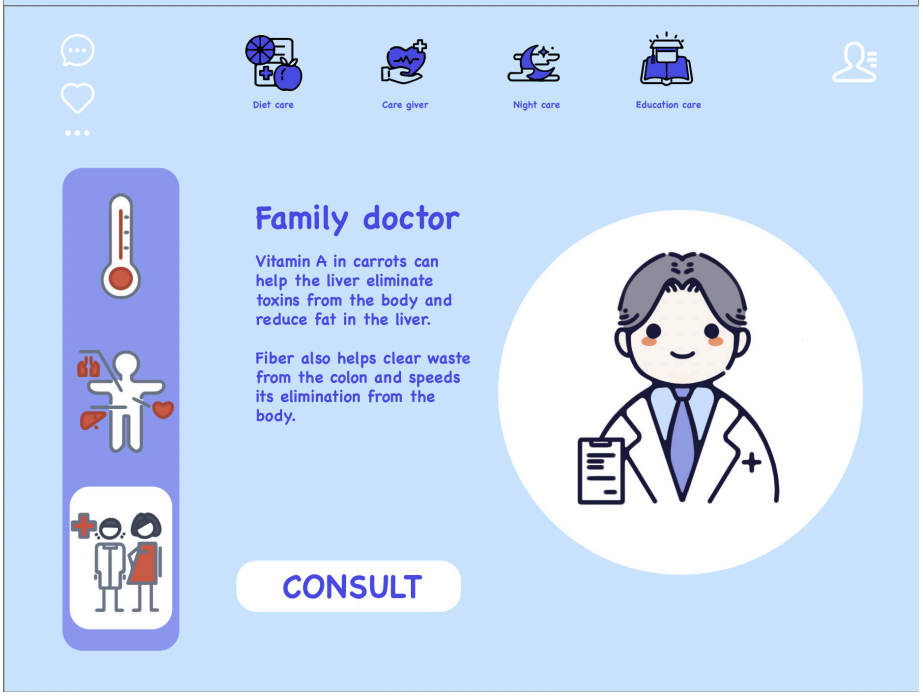
Doctor Page
Temperature measurement



Doctor Page
Special diet care



Doctor Page
Family doctor

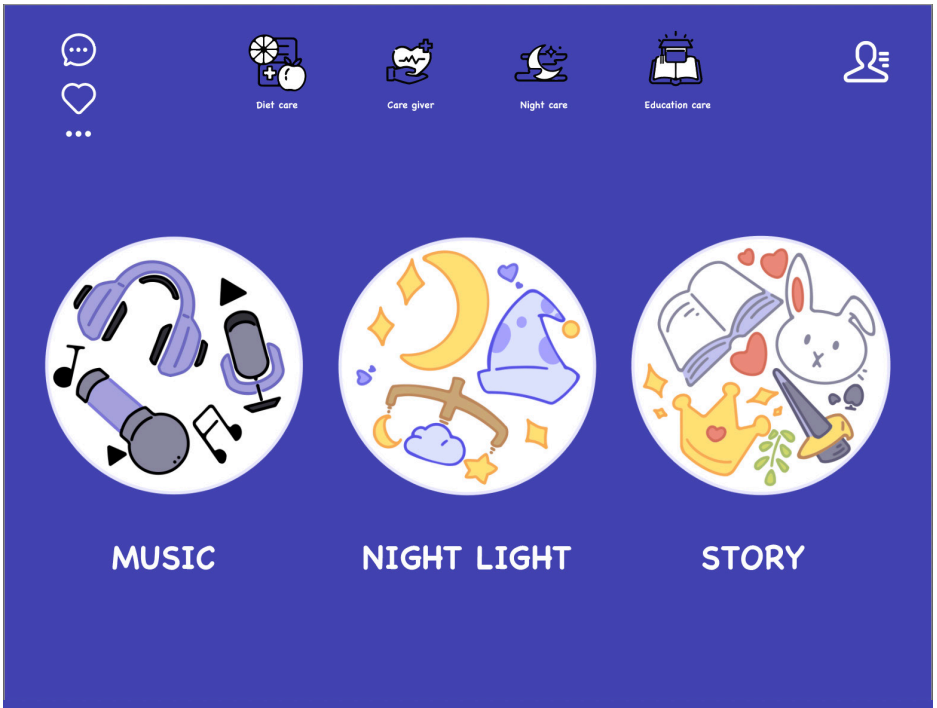


Click on the doctor to enter the doctor interface. There are three functional options: temperature measurement, special diet care, and family doctor. Click on the thermometer to start measuring the temperature.

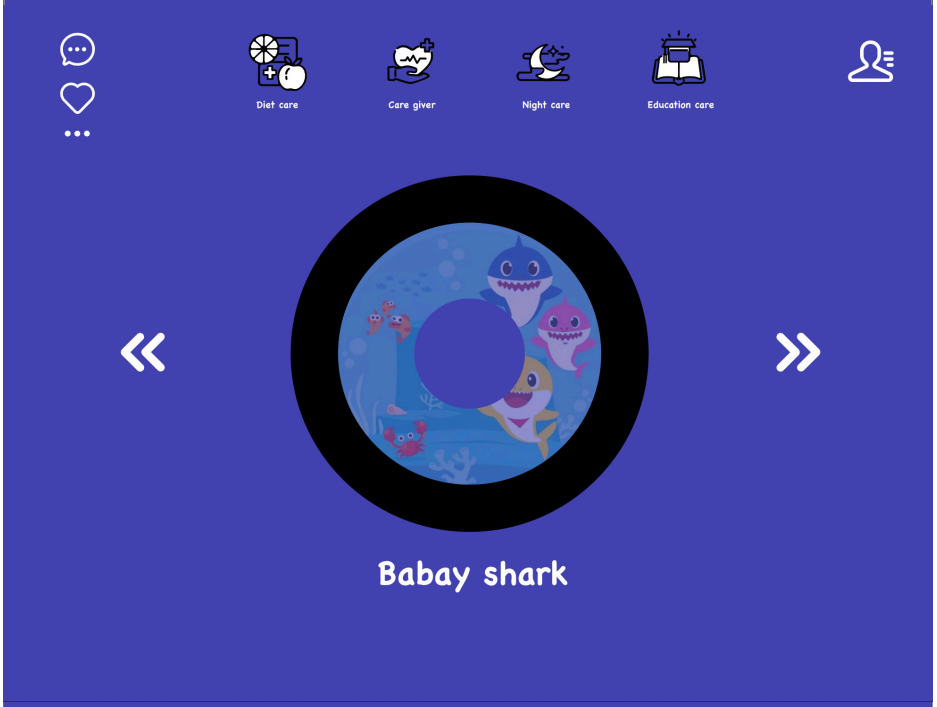
After entering the special diet care interface, there will be science popularization about what to eat when you feel unwell, or users who face allergies will screen the foods they can eat

In this interface, you can find the user's family doctor and consult on your physical condition online.

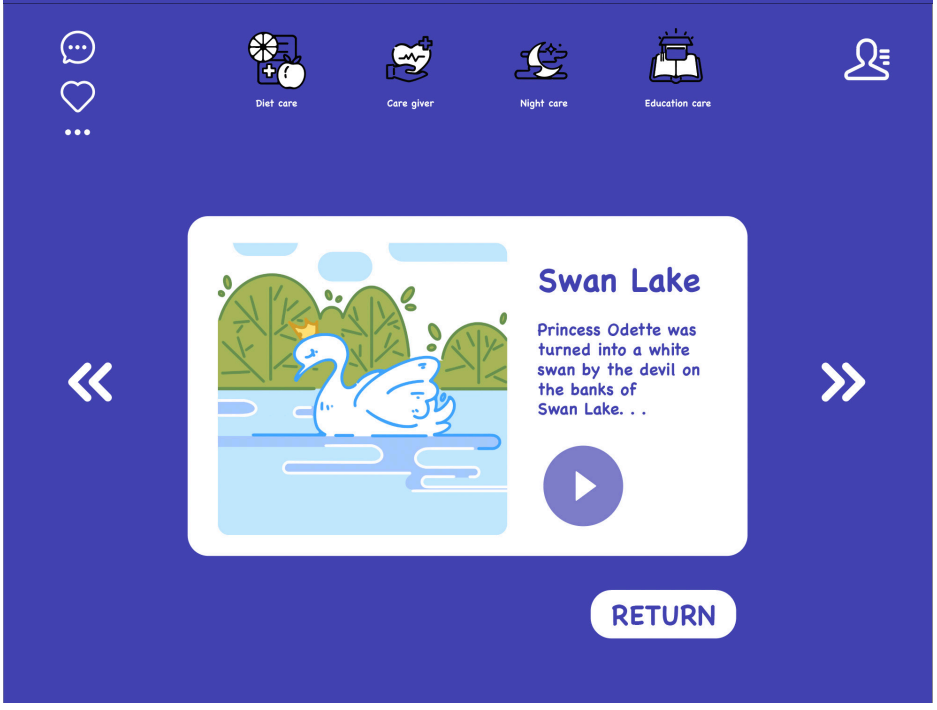
NIGHT CARE PAGE



Bedtime music



Bedtime story



Before the child goes to bed at night, you can click on or call up the night care page, which has bedtime music, sleep lights and bedtime stories to help the child fall asleep faster and more peacefully.

You can slide your finger left or right, click on the arrows, or use voice control to select and play tracks.

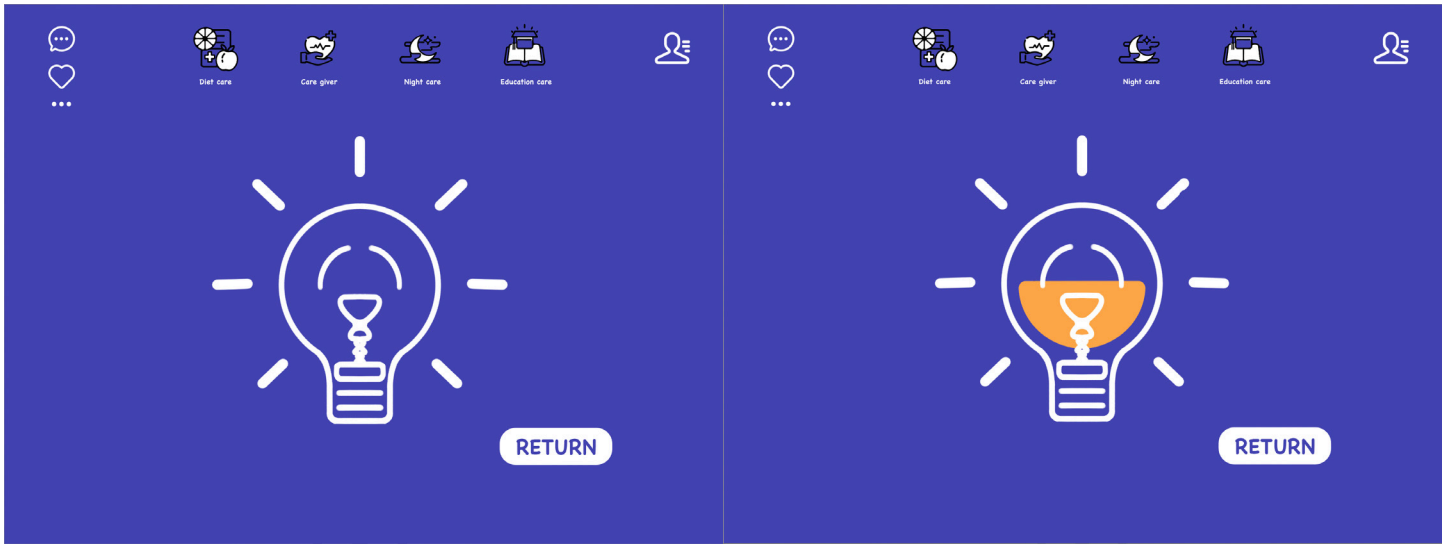
You can slide your finger left or right, click on the arrow, or use voice control to select a story and play it. The short story also has subtitles, so you can listen to the story or watch the story.

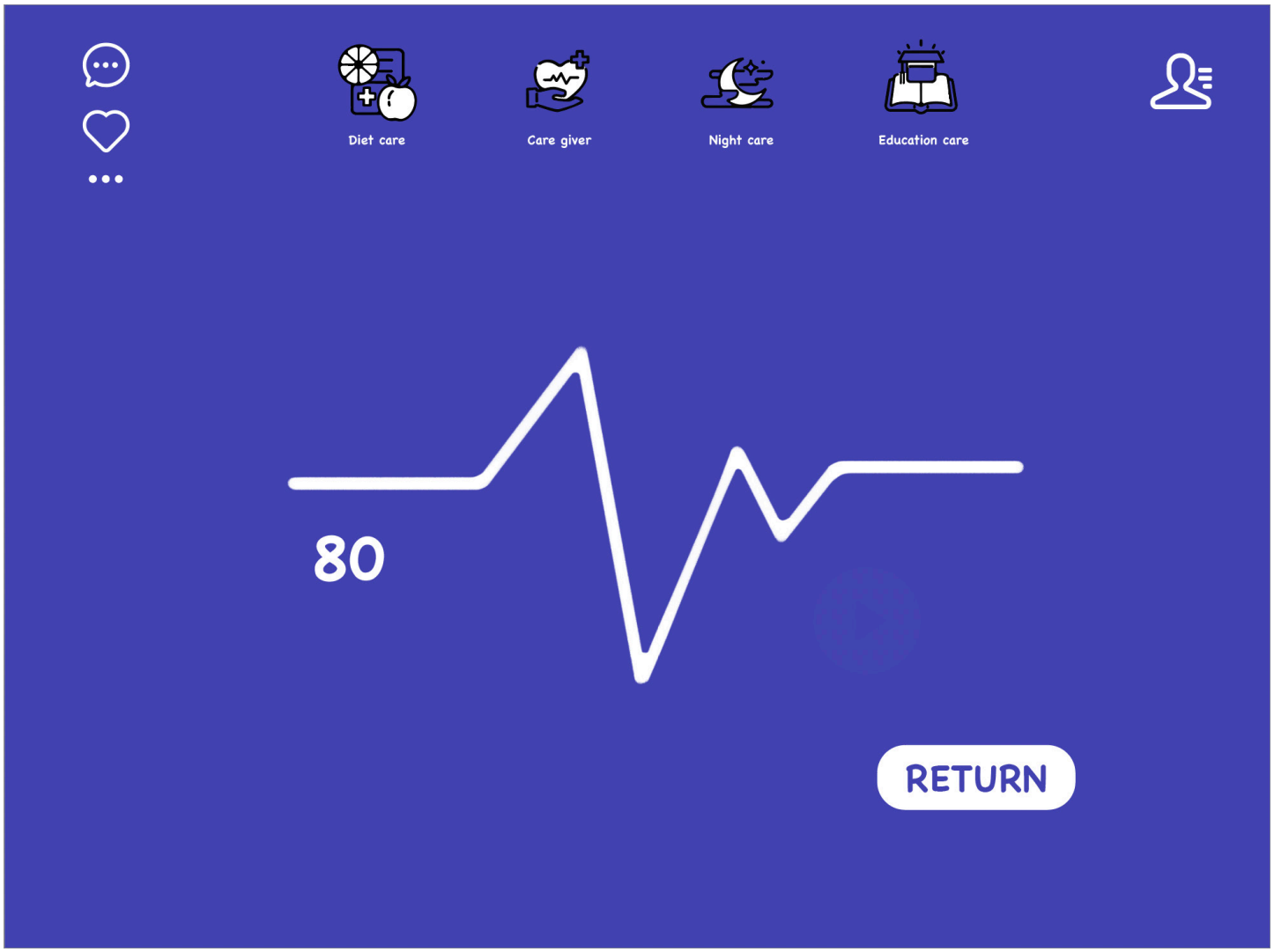
Night light

Click the light bulb on the screen with your finger to turn on the night light. Slide your hand up and down to adjust the brightness of the light. Click the RETURN button to return.

Look after the kichen

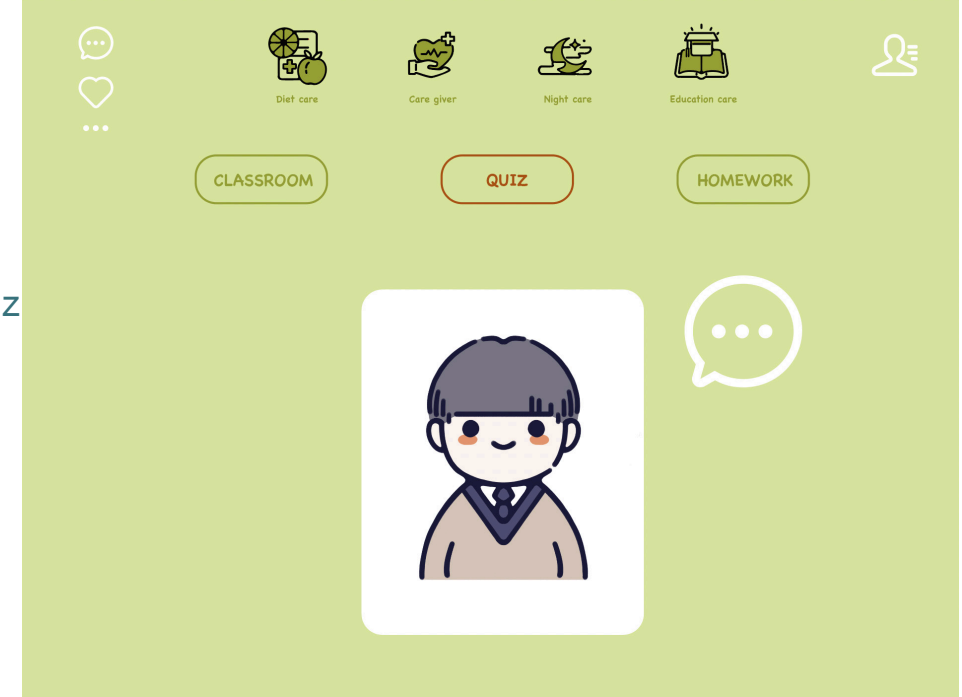
When the child falls asleep, Bobo starts to enter the sleep heart rate detection mode on its own to prevent the child from the danger caused by physical discomfort during sleep.


Diet care
Care giver
Night care
Education care
RETURN
Diet care
Care giver
Night care
Education care
RETURN

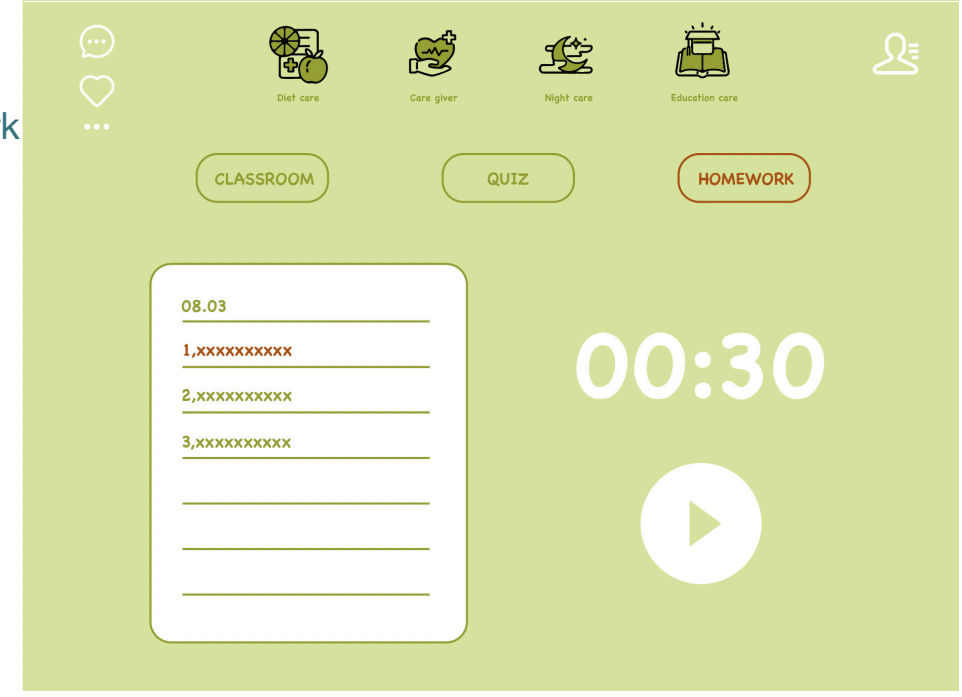

Diet care
Care giver
Night care
Education care
80
RETURN

Calssroom

Quiz



Homework



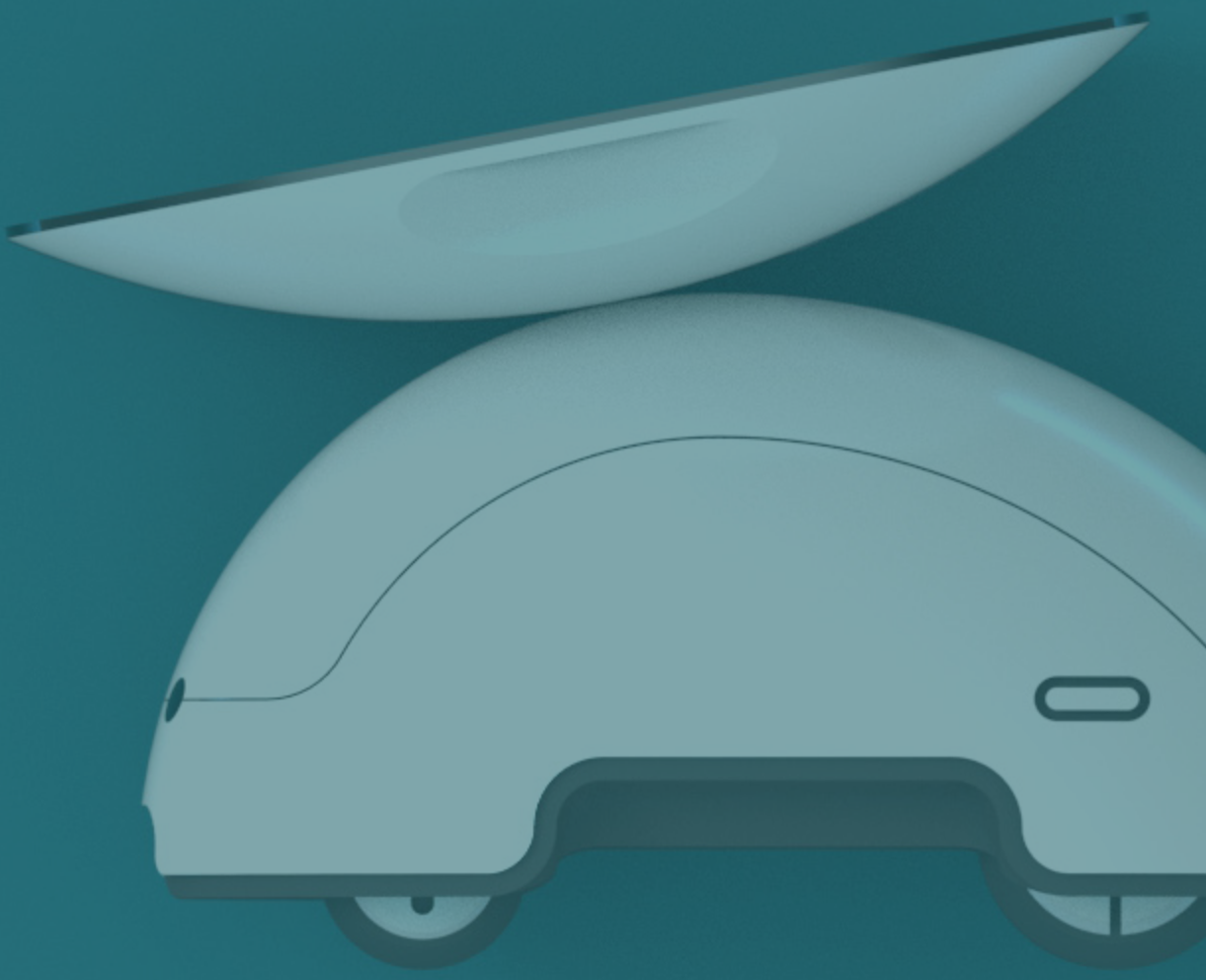
EDUCATION PAGE

There are three optional functions in the Education page. The first one is courses, which includes the course schedule of his school, videos, and announcement classes. The user can choose any course he wants to learn here, and the last one is a live class. , some live classes, public lectures, etc. will be regularly arranged in each time period

In this interface, users can talk to Bobo, learn in the form of knowledge questions and answers, and get the answers to the questions they want to know.

When the user clicks Homework, the user can make a study plan and time it, allowing the user to better arrange their homework time and reject bad habits such as procrastination.

CONCLUSION



Through a lot of research and research in the early stage, through research on the types, functions, and technologies of smart homes, we found that cost control is very important for landing products. We also received a lot of information during the docking of the program, such as having wheels Products with telescopic functions are more expensive. User research gives us a clearer understanding of what children, parents, and families really need.

We have innovated in terms of market, product, function and user, insisted on people-oriented design, and finally produced Bobo: a new multi-functional, multi-form, automated modular smart home product for children and families.

Future development of the project: take from the produced model, collect feedback and make a working prototype with the help of Domethics, test it and realize its market absorption potential, predict the development of the product in the market and revenue expectations.

REFERENCE

Michael Schiefer (2015). Smart Home Definition and Security Threats.
http://dx.doi.org/10.1109/IMF.2015.17

Vijay Laxmi Kalyani, kavita patidar, Harshita Sharma, Chanchal meena (2016).Smart Home System Using Green Energy.
https://www.researchgate.net/publication/296638969_Smart_Home_System_Using_Green_Energy

P. Hamernik, P. Tanuska, Member, IACSIT, and D. Mudroncik (2012). Classification of Functions in Smart Home.
http://dx.doi.org/10.7763/ijiet.2012.v2.98

Cento Studi TIM (2021). RAPPORTO SMART HOME- Internet of Things nelle case italiane.
https://www.gruppotim.it/content/dam/gt/gruppo/documenti/RapportoSmartHomeCentroStudiTIM23032021.pdf

Adam Hayes (2022). Smart Home: Definition, How They Work, Pros and Cons.
https://www.investopedia.com/terms/s/smart-home.asp

Diane J. Cook (2012).How Smart Is Your Home?.
http://dx.doi.org/10.1126/science.1217640

Robles RJ, Kim T (2010) Applications, systems and methods in smart home technology: a review. Int J Adv Sci Technol 15:37–48

Firth, S.K., Fouchal, F., Kane, T., Dimitriou, V., Hassan, T. (2013). Decision supportsystems for domestic retrofit provision using smart home data streams.

Chan M, Campo E, Esteve D, Fourniols J (2009) Smart homes—current features and future perspectives. Maturitas 64:90–97

Lewis SCR (2012) Energy in the smart home. In: Harper R (ed)
The connected home: the future of domestic life. Springer, London, pp 281–300

Nyborg, S., Røpke, I.(2011) Energy impacts of the smart home –conflicting visions.

Wilson, C., Hargreaves, T., & Hauxwell-Baldwin, R. (2017). Benefits and risks of smart home technologies. Energy Policy, 103, 72–83.
https://doi.org/10.1016/j.enpol.2016.12.047

AlAbdulkarim, L., Lukszo, Z., 2011. Impact of privacy concerns on consumers'acceptance of smart metering in the Netherlands. In: IEEE International Conferenceon Networking, Sensing and Control (ICNSC), Delft, The Netherlands.

Hoenkamp, R., Huitema, G.B., de Moor-van Vugt, A.J.C., 2011. The neglected consumer:the case of the smart meter rollout in the Netherlands. Renew. Energy Law PolicyRev. 4, 269–282.

Cavoukian, A., Polonetsky, J., Wolf, C., 2010. Smart privacy for the smart grid:
embedding privacy into the design of electricity conservation. Identity Inf. Soc. 3 (2), 275-294.

Balta-Ozkan et al., 2013b N. Balta-Ozkan, R. Davidson, M. Bicket, L. Whitmarsh
Social barriers to the adoption of smart homes
Energy Policy, 63 (2013), pp. 363-374
https://doi.org/10.1016/j.enpol.2013.08.043

J Lasquety-Reyes (2022). Number of Smart Homes forecast in the World until 2025

N. Guhr, O. Werth, P.P.H. Blacha, M.H. Breitner (2020). Privacy concerns in the smart home context.
SN Appl. Sci., 2 (2020), pp. 2523-3971

Kivnick, H. Q. (1983). Dimensions of Grandparenthood Meaning: Deductive Conceptualization and Empirical Der-ivation. Journal of Personality and Social Psychology, 44(5), 1056-1068.

Marta Borgi, Francesca Cirulli. (2015). Attitudes toward Animals among Kindergarten Children: Species Preferences DOI:10.2752/089279315X14129350721939
http://dx.doi.org/10.2752/089279315X14129350721939

YU Jian-li, ZHANG Zong-wei, “Initial Analysis on the development of Autonomous Mobile Service Robots”, Journal of Zhongyuan University of Technology,vol.19(4),pp.8-12,April 2008

Global Electronics Council (CEC) (2021). State of Sustainability Research: Climate Change Mitigation.
https://globalelectronicscouncil.org/wp-content/uploads/GEC_Climate_Change_SOSR_DRAFT_For_Public_Comment_1APR2021.pdf

Narendra Singh ,Oladele A. Ogunseitan (2022). Disentangling the worldwide web of e-waste and climate change co-benefits.
https://doi.org/10.1016/j.cec.2022.100011

Vinit Kumar, Rahul Chawda (2020). A RESEARCH PAPER ON SMART HOME.
http://dx.doi.org/10.33564/IJEAST.2020.v05i03.088