

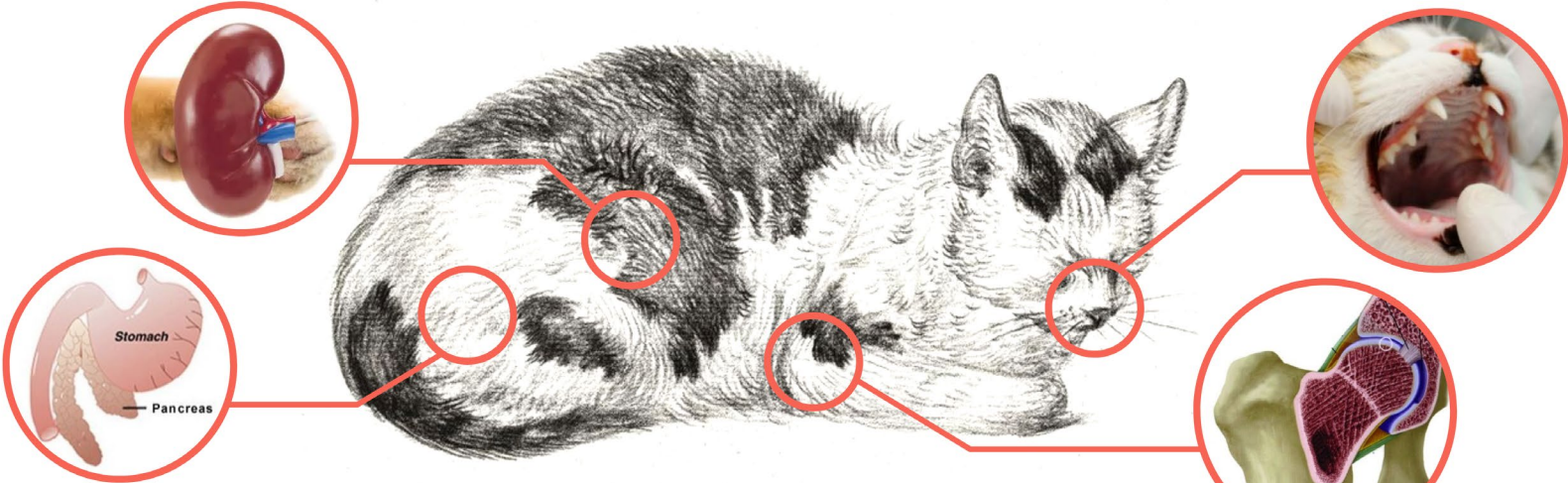
BACKGROUND & FINDINGS

Cats are one of my favorite pets, and I find their early symptoms to be difficult to detect, so when a cat has obvious behavioral abnormalities, it may have reached a more serious stage. This problem caught my attention and I wondered if there was a way to detect the cat's discomfort early.

Chronic kidney disease

Prevalence: 30% Hard perceive Latent disease

As soon as the cat's nephrons are abnormal, the healthy ones take over, so chronic kidney disease may not have obvious symptoms in the early stages. When symptoms are found, they are usually in the advanced stages of the disease.



Chronic pancreatitis

Prevalence: 90% (10+) Hard diagnose Complex etiology

Chronic pancreatitis in cats can be difficult to detect and distinguish clinically because there is no single test that can identify the disease. Cats with chronic pancreatitis rarely show signs of abdominal pain.

Feline chronic gingivitis stomatitis (FCGS)

Prevalence: 3%~12% Behave normally Need early treat

FCGS pain depends on the stage of progression of the condition, they may appear normal at first, followed by a range of diseases such as swollen gums, ulcers and bleeding.

Osteoarthritis

Prevalence: 90% (10+) Hard diagnose Need early treat

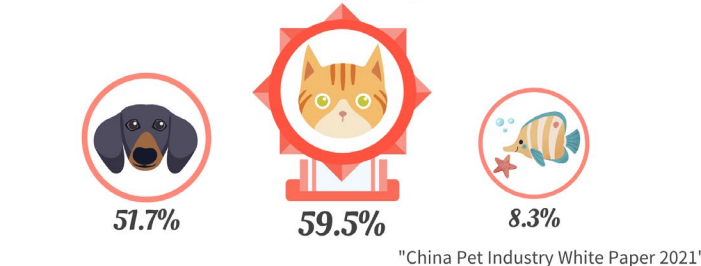
Diagnosing osteoarthritis in cats can be difficult, even for experienced veterinarians. Because the same joints are often affected on both sides of the cat's body, the cat can compensate and appear to walk normally.

Finding

Cats often try to hide pain, so a cat with a chronic disease looks basically the same as a cat without one. That's why it's so hard to recognize.

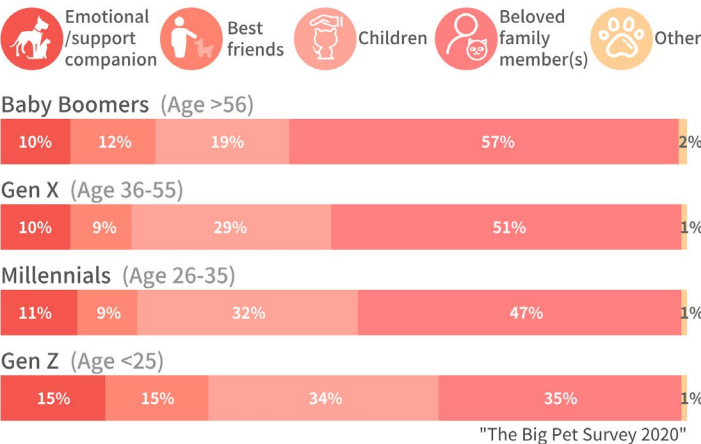
DATA RESEARCH

Pet classification proportion



The number of cat owners has become the largest number of pet owners.

How do you feel about your pet?



Global pet care industry:

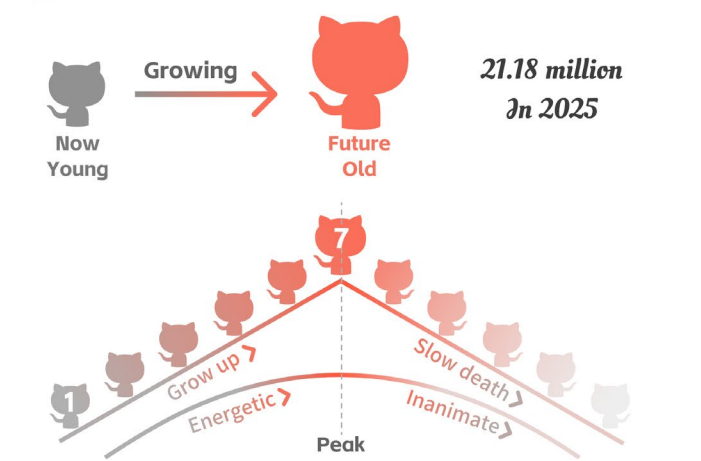


Younger generations are also seeing themselves more as "pet parents" and have been investing in the health of their pets to ensure they have a high quality of life. As a result, many pets are living longer.

Conclusion

This means that chronic cat disease will be a major problem for more and more cat owners, and there are currently no very efficient means to solve this problem.

Age Related Conditions



The general average age of the meow is increasing, and with it the increase in chronic diseases.

Chronic disease survey



Pain point problem

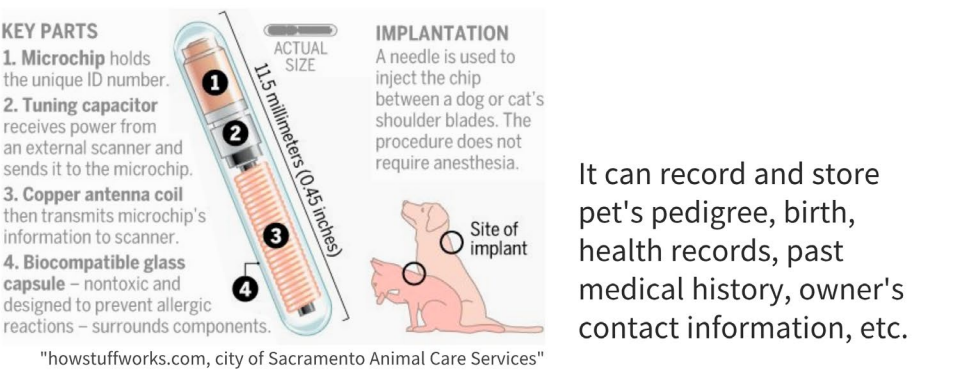


Although owners are willing to pay more money to invest in pet medical treatment, there are still major defects and deficiencies in the current medical treatment level.

GROUP DISCUSSION

In order to reduce the incidence of chronic diseases in cats, how can we as owners learn about diseases from our cats and address them? Our group had a discussion.

Maybe a pet microchip would be a good way to go?



The product is lacking in real-time monitoring capabilities for acquired diseases in cats. Also numerous users are more resistant to internal implants, which are not applicable to all cats.



We need to focus our attention on ways to detect chronic pain in cats and distil some key observations.

Summary

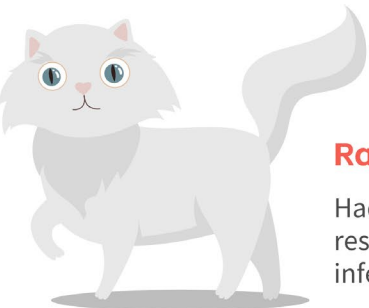
- 1、It can **judge the difference of cat status** through the comparison of behaviour, habit, reaction, facial expression and so on.
- 2、Help parents **make periodic records** through facial recognition, motion capture, cardiorespiratory monitoring, etc.
- 3、Through the product to help the doctor to **assess whether the cat's pain level needs medical treatment**.

USER INTERVIEW

For the perception of pain in cats with chronic diseases, we did relevant and targeted research with cat owners and doctors and filtered out important information.

What key information do you need from the owner when you are treating your pet?
We want to be aware of changes in the cat's behaviour, especially obvious anomalies.

What steps do you need to take before your pet's disease is diagnosed?
Observe and touch the body.
Ask if there are associated symptoms.
Ask about the duration of the illness.
Conduct further tests to confirm the diagnosis.



Ragdoll cat

Had a history of respiratory infections and FCGS.



British Shorthair

Had a cat nasal branch.

What do you know about chronic diseases in cats?
Knowledge of the subject, but lack of practice.

Not really.

What are some of the unusual changes a cat can experience during a period of illness?
Not very mobile anymore, sleep growth.

Often in a prone crawling position.

What information do you need to determine that your cat may be experiencing a chronic illness?
Health is determined by regular medical reports.

Observe appetite and bowel movements.

Is it acceptable to let your cat wear a collar?
Both said they would like to, but would take into consideration the comfort and safety of the cats.

Do cats meow on their own? (Outside of interacting with the cat)
It barks occasionally, but I see it as it playing with itself. Doesn't bark much, except when he's sick.

Finding

We found the following from our interviews with vets and cat owners.

The state of life is a key factor

Users rely too much on their own judgement

The cat's posture is not easy for us to detect

Safety and comfort are key for collars

Case history is a supporting element

The cat isn't as active as usual

We can't tell what a cat is trying to say when it purrs.

Users prefer to monitor their cat's condition rather than treat it

In drawing conclusions, what then are the reasons behind these phenomena?

Need for objective data

Limitations of subjective observation

Preventive care for users

Technology and Data Drivers

So what should we do?

- Users are more likely to care about the condition and health of their cats.
- With an understanding of chronic disease, users are more concerned about early signs of pain in their cats.
- Users value the ability to monitor their cat's health status and record data in real time, and are somewhat willing to wear a collar on their cat.

LITERATURE RESEARCH

Why pain in cats is difficult to identify? Why subtle pain in cats is difficult to assess properly?

- a. Difficulties in recognition include a lack of prompts/triggers, lack of data connecting different maladies with pain levels, and the often obscure nature of clinical signs associated with neuropathic pain.
- b. Cats often try to hide pain, especially in the presence of humans and other animals. Although this assists with their survival in the wild.
- c. Clinical signs and changes in behavior associated with chronic pain in cats can be subtle and are often mistakenly attributed to their age. Owners and even veterinary professionals may inadvertently attribute behavior changes to age or common agerelated issues rather than to chronic pain caused something else.

Cat pain rating scales

Clinically available: UNESP, CMPS
Can be used by owners: Feline Grimace Scale, Behavior changes that can indicate illness, pain or distress in a cat.
Determination of chondromalacia: FMPI
A general guide for veterinarians: 2015 AAHA-AAFP Pain Management Guidelines for Dogs and Cats.
External factors: History-taking information: home life and environment .

Subject 1: PAIN MONITOR CHANGE (C-12)

Previous history

Household information

Behavior observed in the home

Vocalization

Daily habits

Facial expression

Self-protection

Aggression

Activity level

Subject 2: PAIN EXPRESSION (C-12)

Previous history

Household information

Behavior observed in the home

Vocalization

Daily habits

Facial expression

Self-protection

Aggression

Activity level

Subject 3: PAIN MONITOR CHANGE (C-12)

Previous history

Household information

Behavior observed in the home

Vocalization

Daily habits

Facial expression

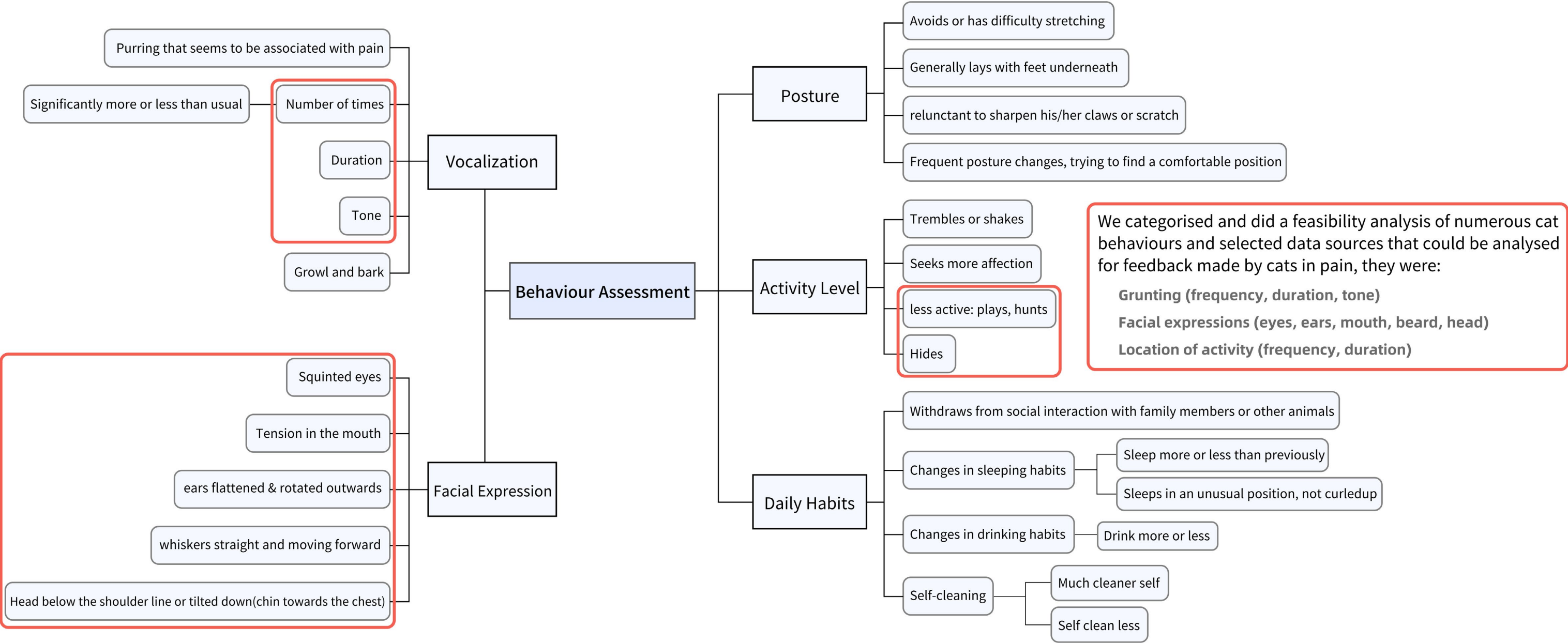
Self-protection

Aggression

Activity level

MIND MAP

In conjunction with the symptoms of chronic disease in cats and the methods of identifying pain in cats, behavioural changes are often the first sign of a change in health, so we use 'behavioural assessment' as a starting point for problem solving.

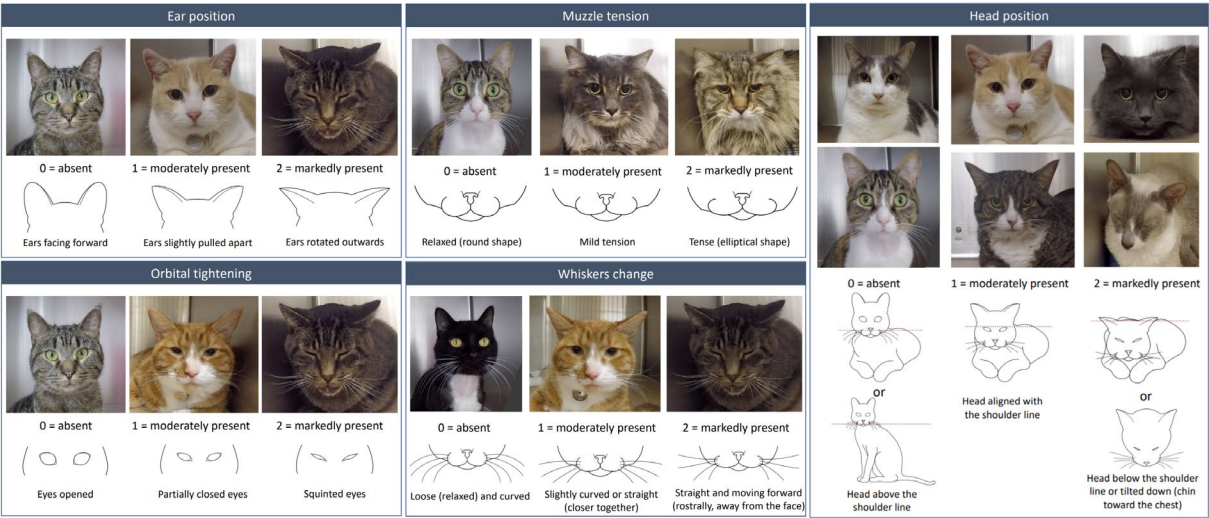


COMPETITIVE ANALYSIS

The Feline Grimace Scale (FGS)

Researchers at the Universit de Montreal collaborated to develop and validate the Cat Grimace Scale to improvepain management in cats.

This is an existing method of detecting chronic pain in cats.



Three members of our group tried this test by scoring five different cats to see the accuracy of judging their facial expressions.

(Test)					
Me	5	8	3	2	0
Member A	3	7	1	2	1
Member B	4	9	5	1	2

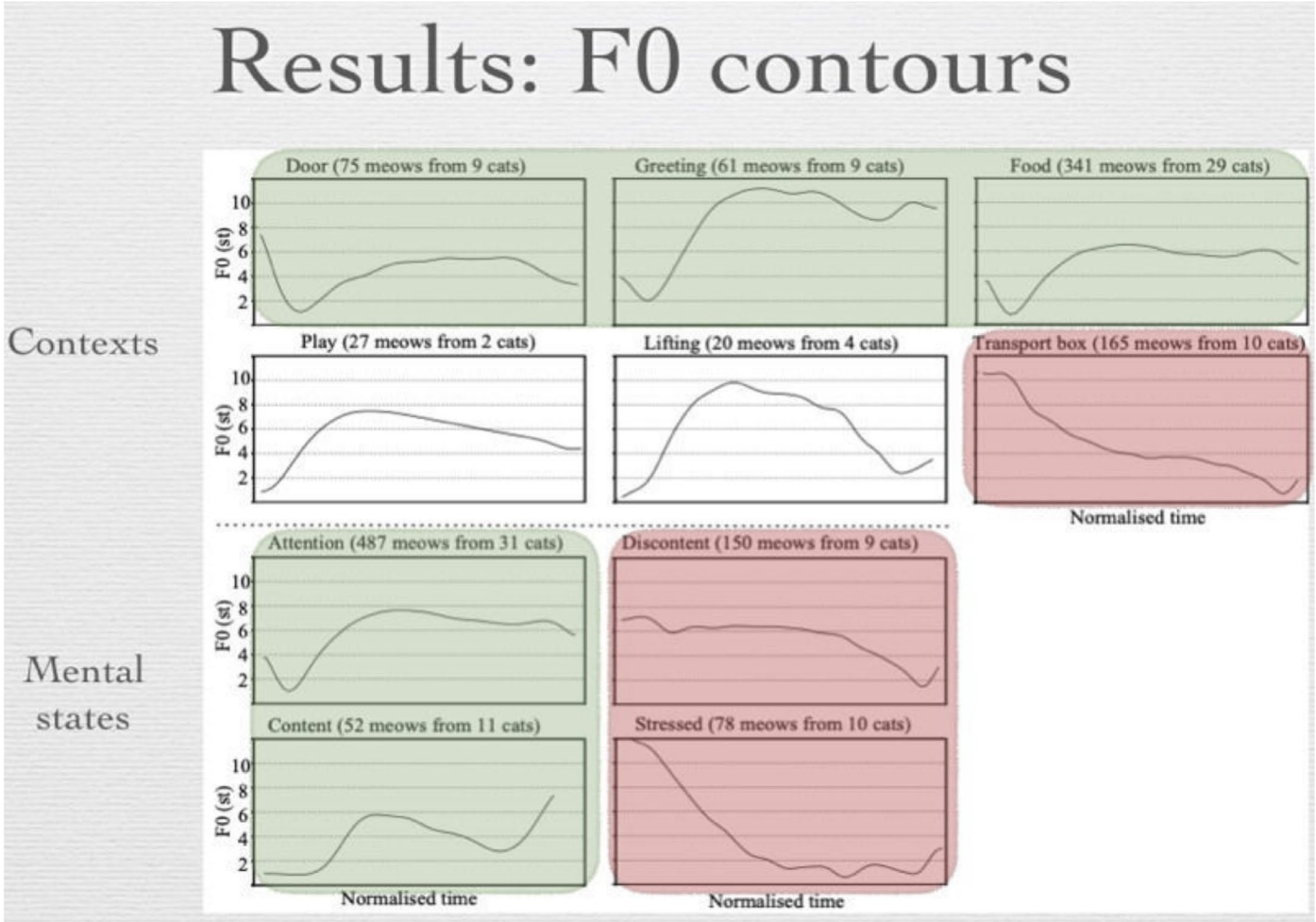
From the results of the test, it is clear that different people will get different results based on their own subjective bias, and our accuracy in determining a cat's pain level from its facial expression is not high. Also getting still photos of the cat's facial expression is not very easy because it does not match the cat's living habits.

So we won't be taking facial recognition.

TECHNOLOGY RESEARCH

Meows record and analyse

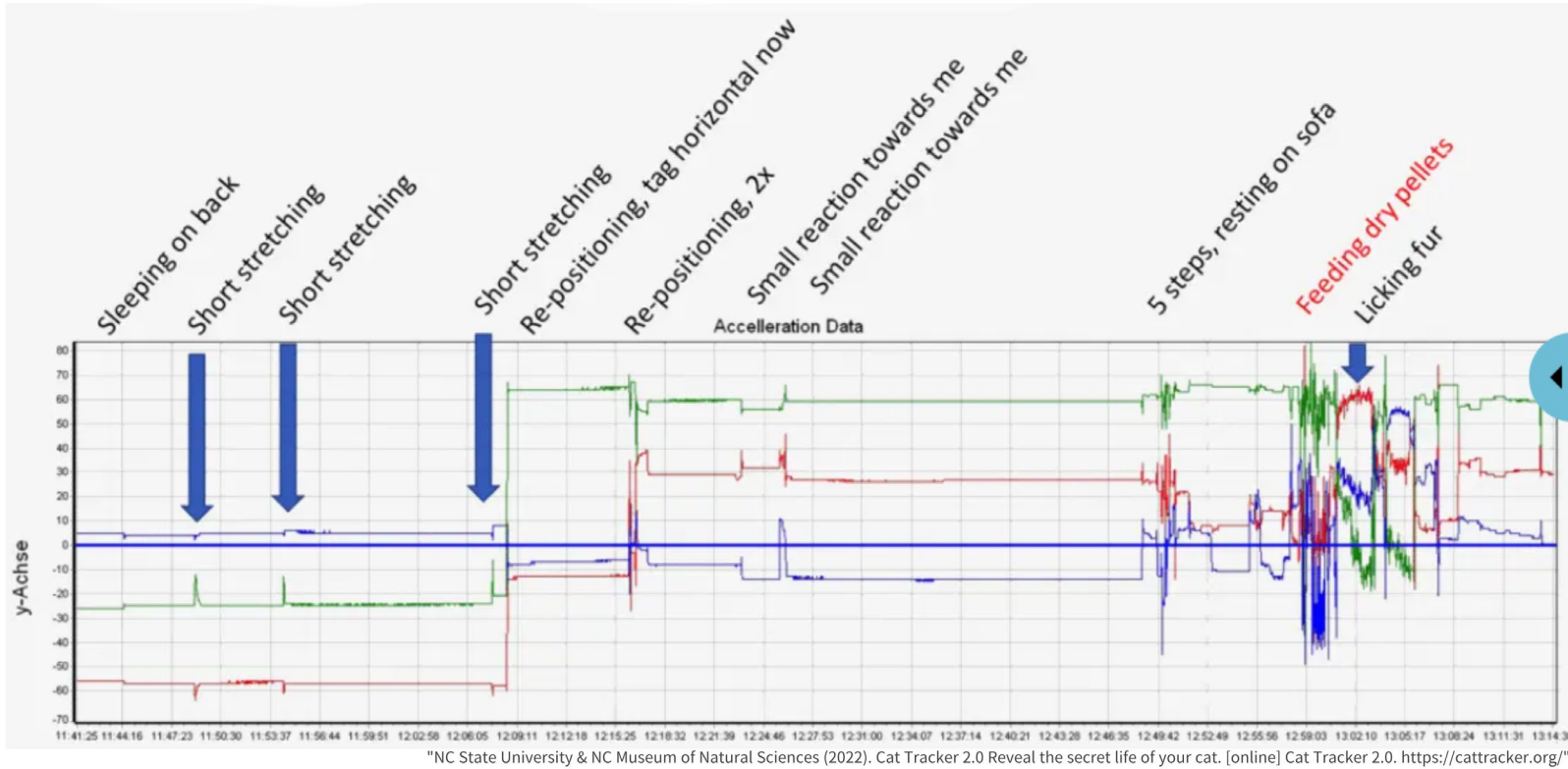
Studies have shown that cats change their purring according to their own mental state. We use the results of cat purring studies to determine the positive or negative meanings represented by a cat's purr.



- Meows in positive and requesting contexts and mental states (highlighted in green in the figure) are often characterised by a **short duration**, and by a **high and rising melody** (fundamental frequency; f0).
- Meows in negative contexts and mental states (highlighted in red in the figure) are often chracterised by a **long duration**, and by a **low and falling melody** (fundamental frequency; f0).

Behaviour (activity) record

Cat Tracker 2.0 uses GPS and ACC tracking, which helps us to capture the cat's location as well as movement very well.We determined in our tests that the acceleration tracking method approach is feasible.



Start a seven-day participation to help with the research:

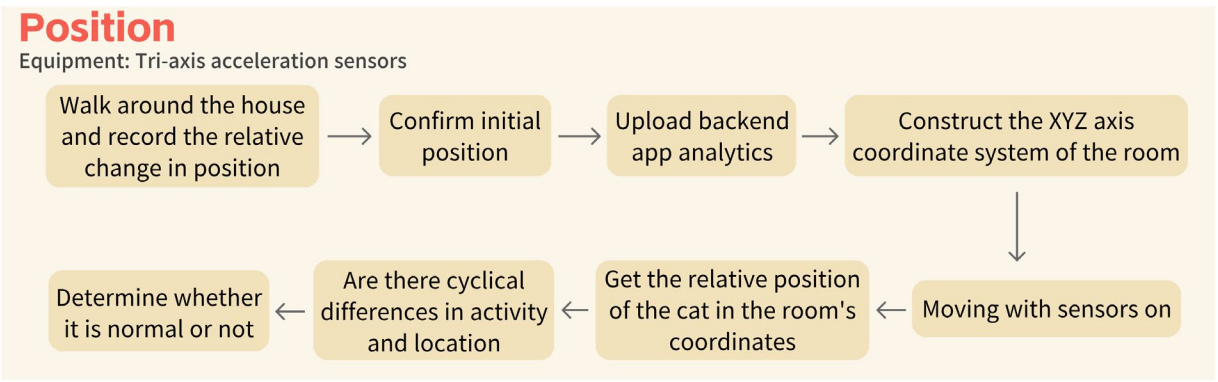
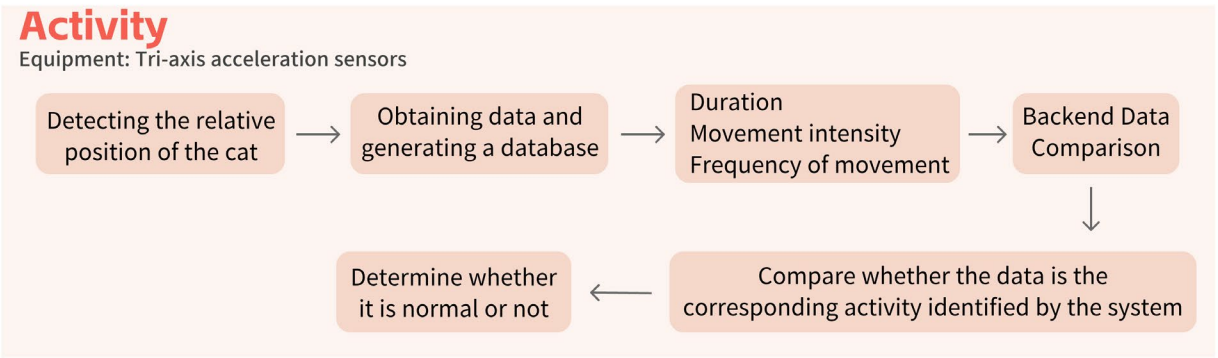
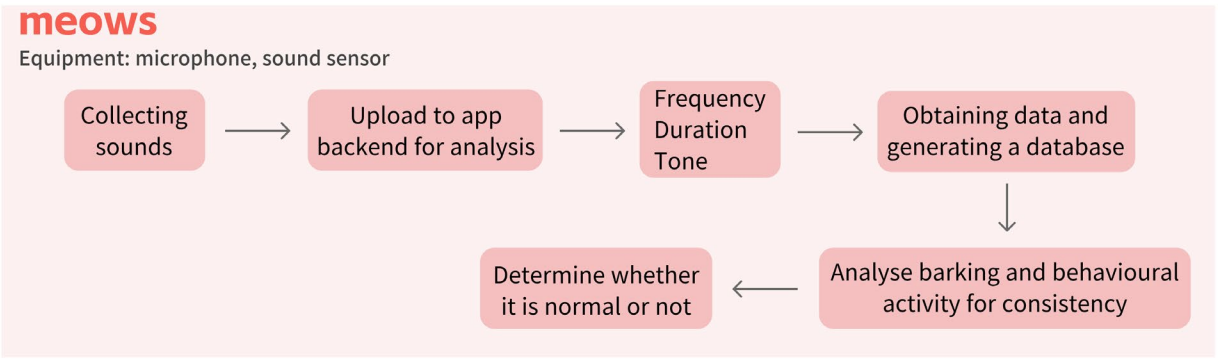


Ethical Considerations

Both studies passed local code review requirements.

IMPLEMENTATION PATH

The three methods screened earlier are used to identify the behavioural manifestations of cats and form a database. The criteria for determining whether or not a behaviour is normal are based on periodic comparisons of the same behaviour.

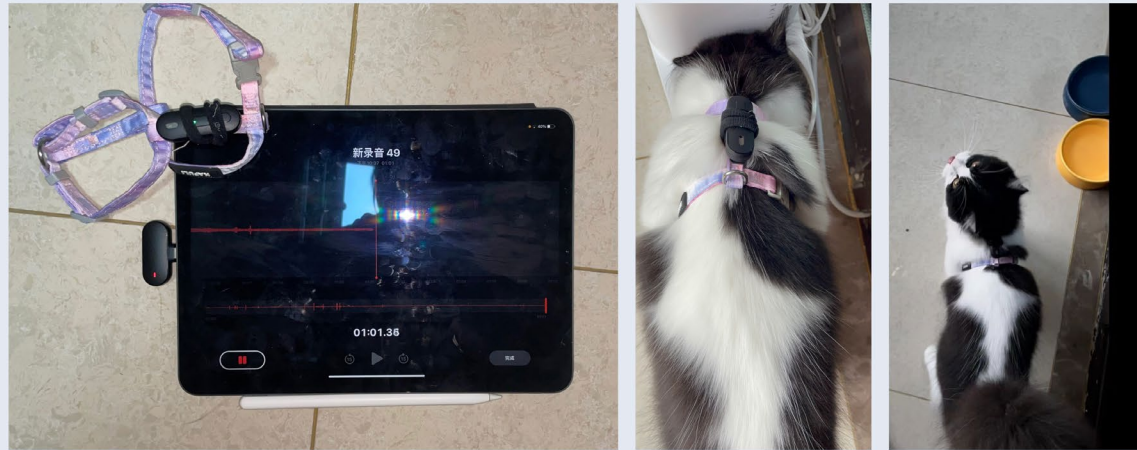


Note that the normal and abnormal here need to be combined with external factors and vets' diagnoses to make the final judgement.**The method will only give reminders in these three different areas by way of periodic comparisons.**

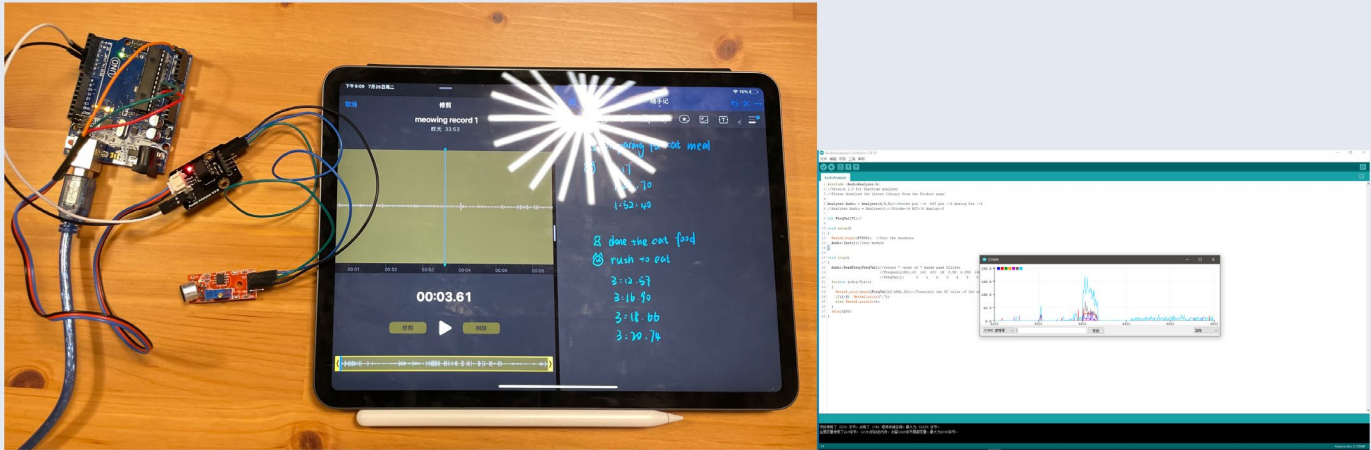
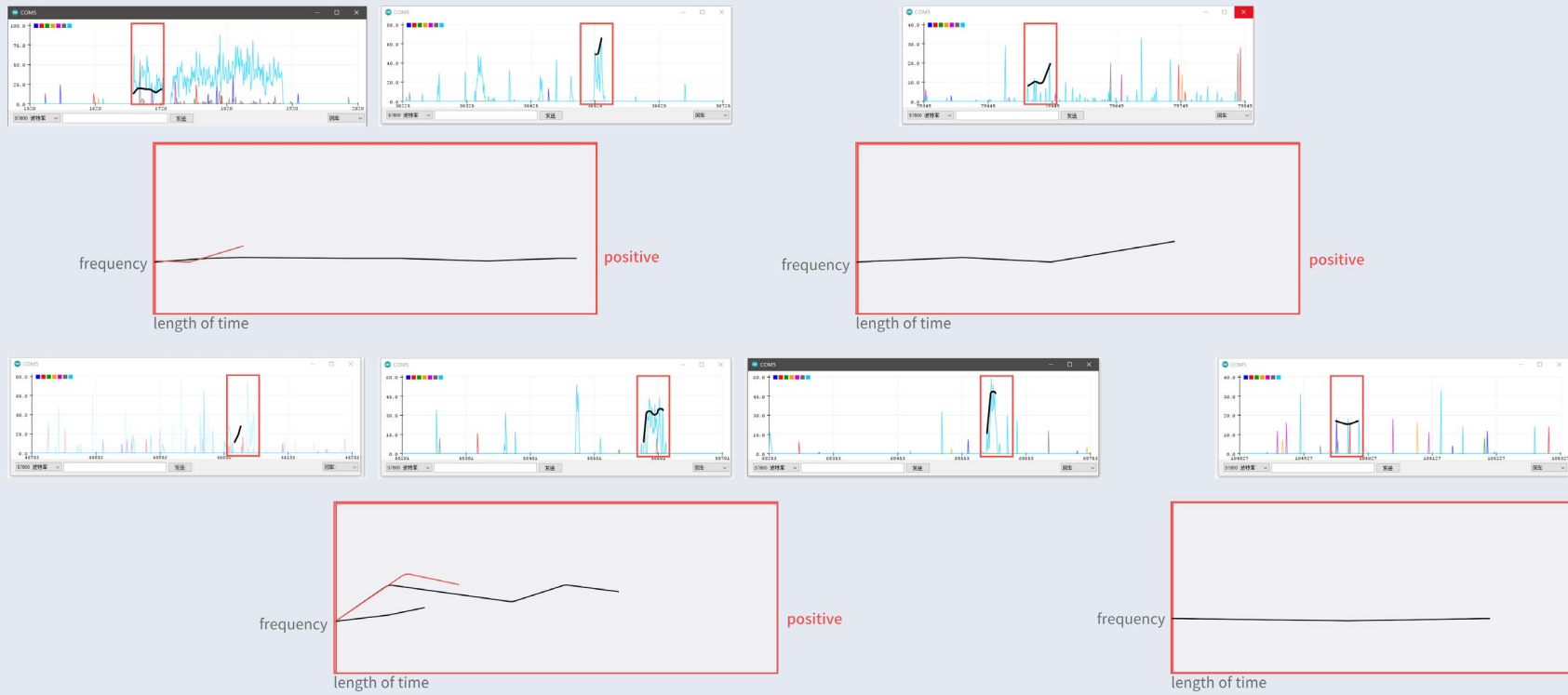
TECHNOLOGY TESTING

Meows record & identify

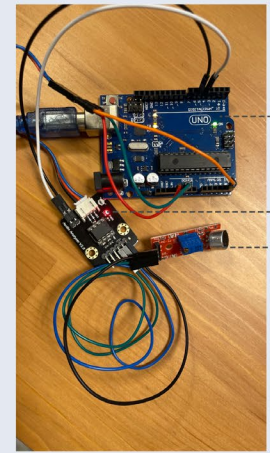
The microphone is used to receive the cat's meows, the sound sensor is used to analyse cats' voice.



Sound collection: We used a Bluetooth microphone fixed to the cat's vest for the recording. The recording lasted 4 hours.



Audio Analysis: Firstly the cat's voice was edited out of the previous recording. Then matched them to the time and activity. Finally, we analysed the sounds using Arduinio to obtain a spectrum.



UNO Mainboard

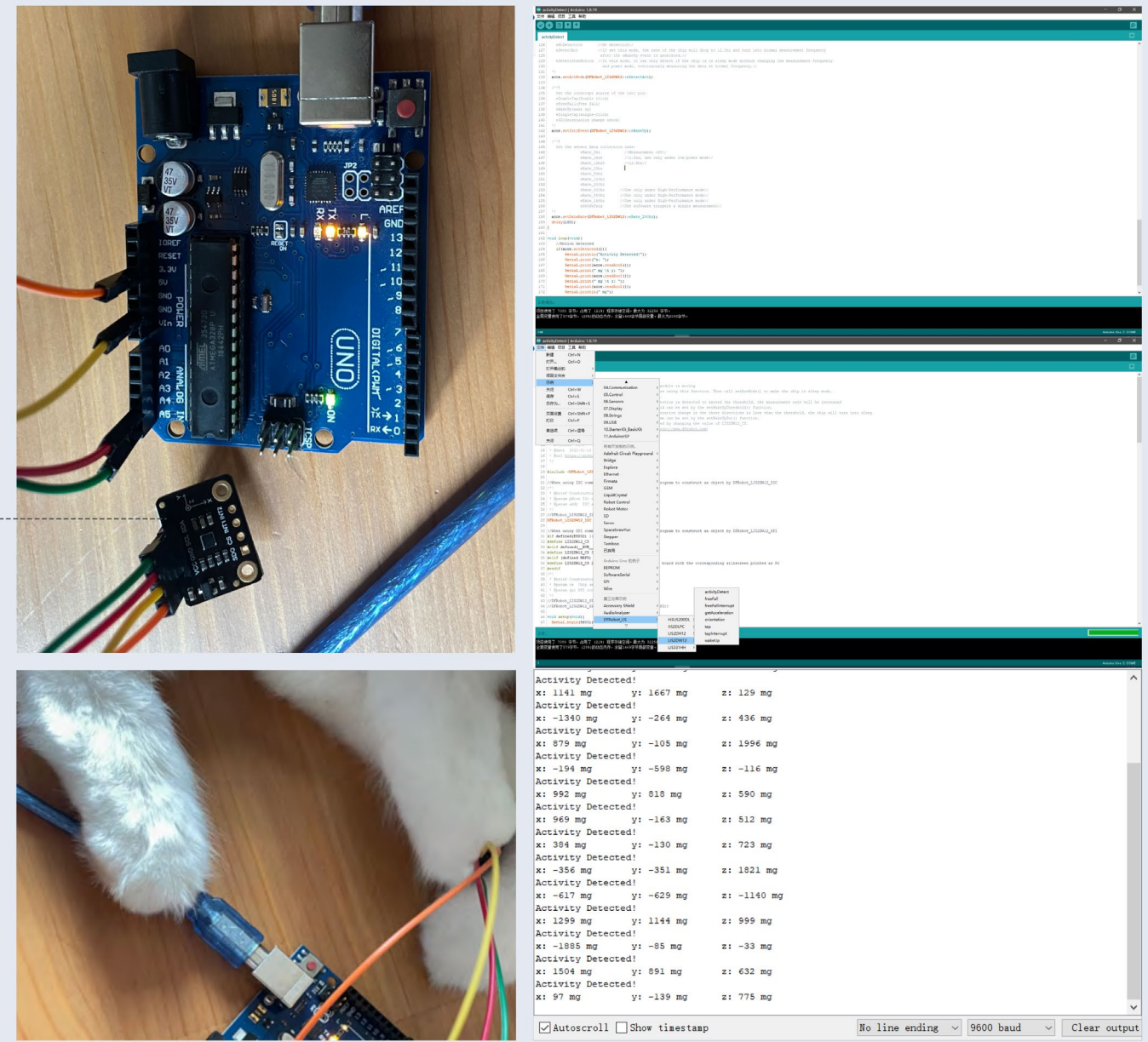
Spectrum analysis module
Sound sensors

LIS2DW12
Triple Axis Accelerometer

It is basically possible to determine from the sound whether a cat's meow expresses a positive or negative meaning. The usability of the method has been verified. However recordings inevitably contain ambient noise and their accuracy may not be sufficient to be analysed using the Arduino alone.

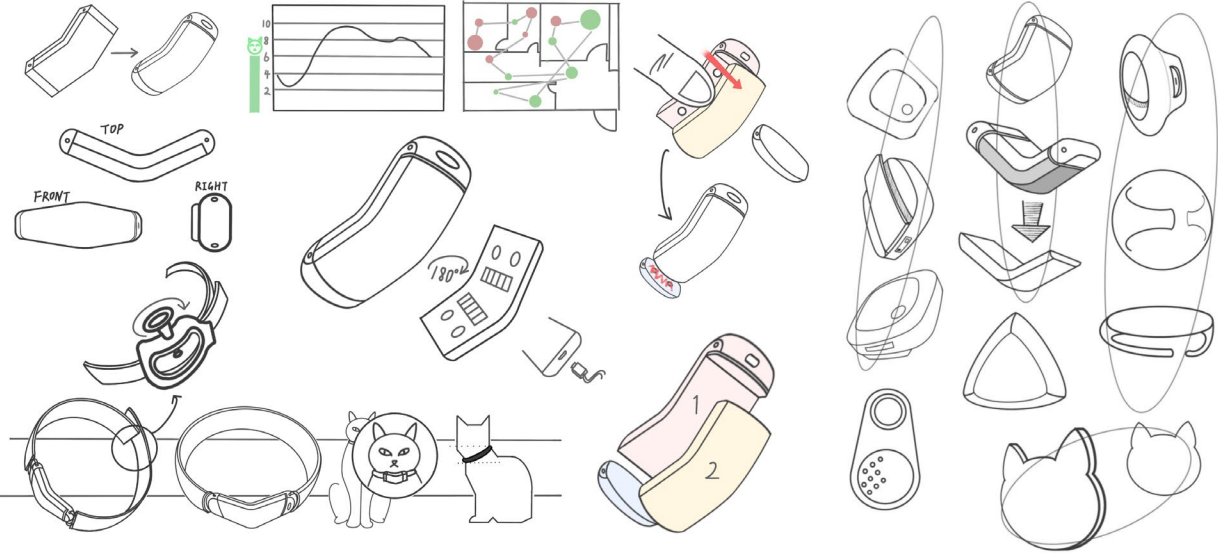
Activity record & identify

The three-axis acceleration sensor is used for three-axis positioning and activity detection, uploads the data to the APP back-end for analysis, and displays the data to the user in the APP side through data visualization.



PRODUCT DESIGN

The concept of the collar design focuses on safety and comfort for the cat as well as ease of use for the user.



Easy to adjust
tightening buckle

Leather collar

Battery indicator

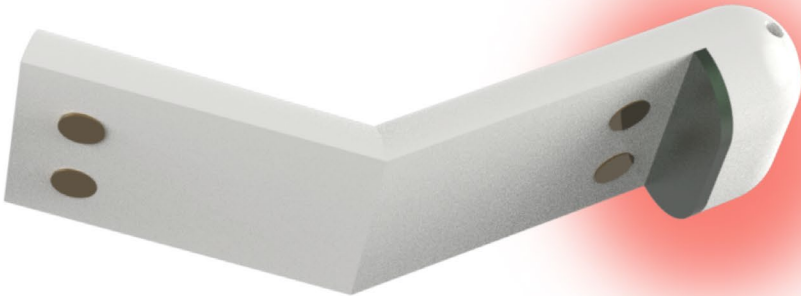
One-click open

Component 1 is mainly used to join the collar, making it easier to disassemble and providing protection at the same time.



Connect

Part 2 is a removable battery that provides power continuation for part 3, while the user can see the battery level in real time.



Connect

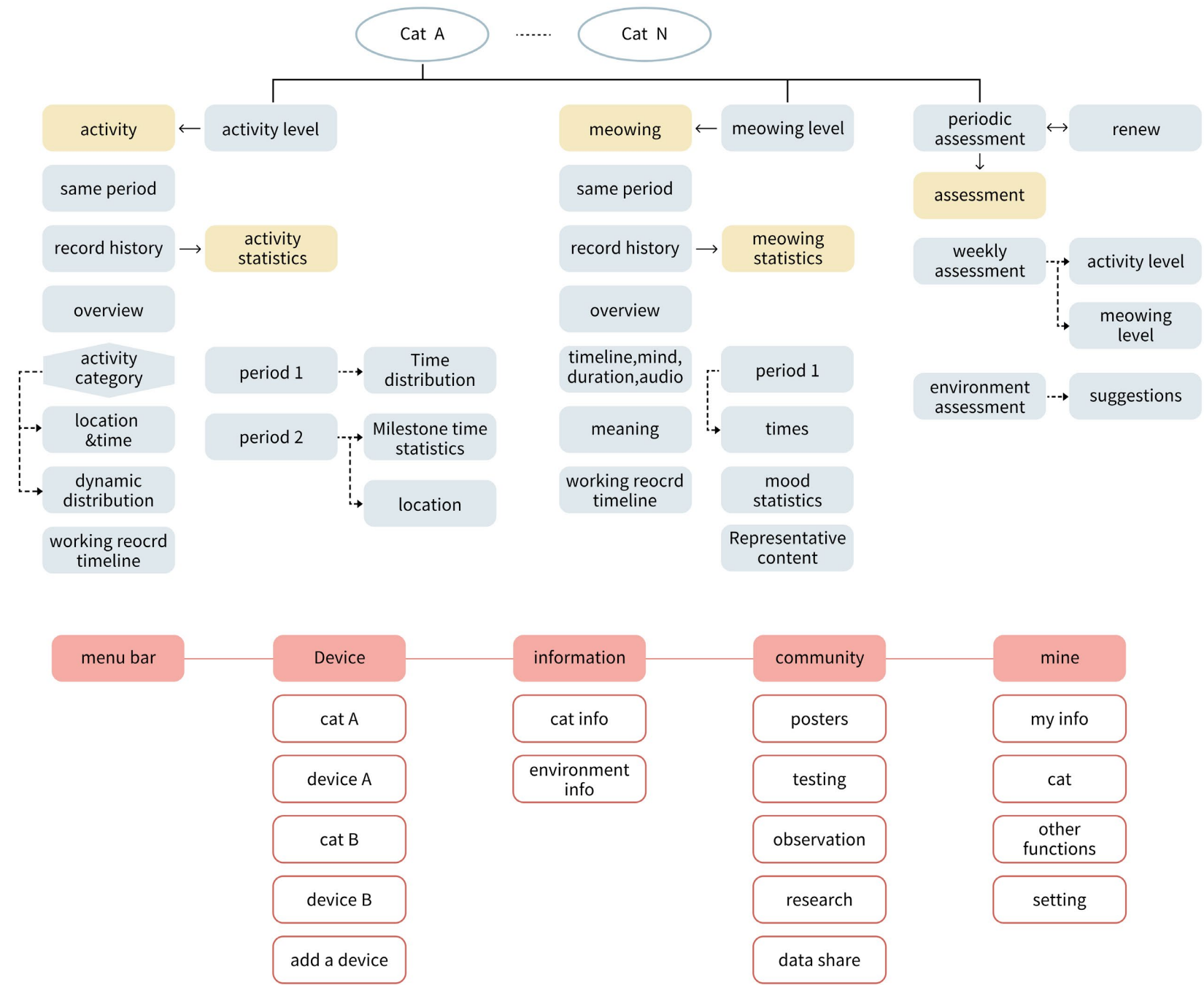
Component 3 is the host part that contains the sensors and is the initiator of the functional realisation of the whole product.



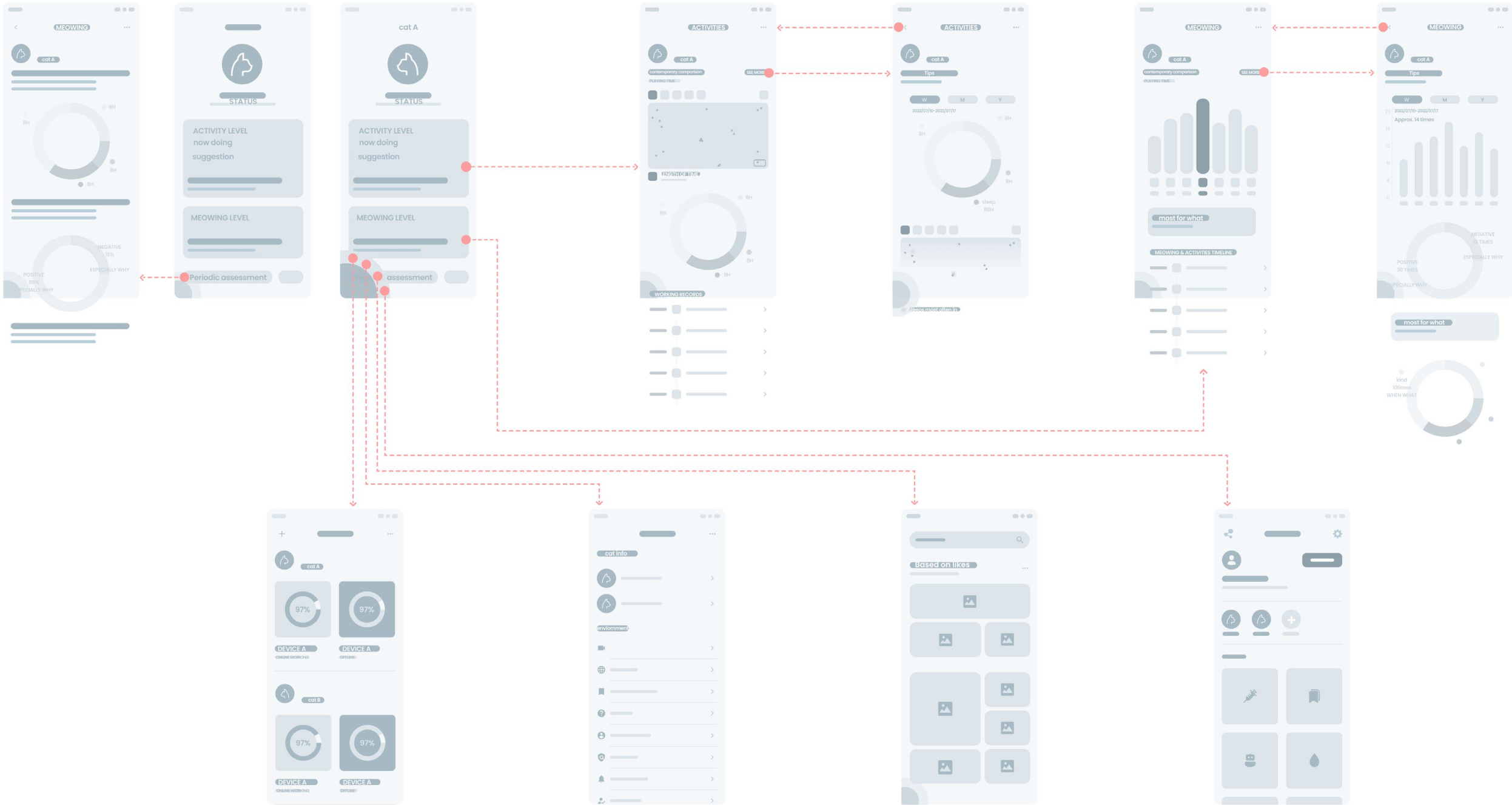
Part 1 and Part 2 are connected by magnetic suction, the purpose of this is to prevent the cat from choking by getting stuck in the mouth, it can be broken free in time and prompt the user to adjust it in time on the APP side. And part 2 and part 3 are the most important parts, they connect can start the system, play the monitoring function of the product.



INFORMATION ARCHITECTURE

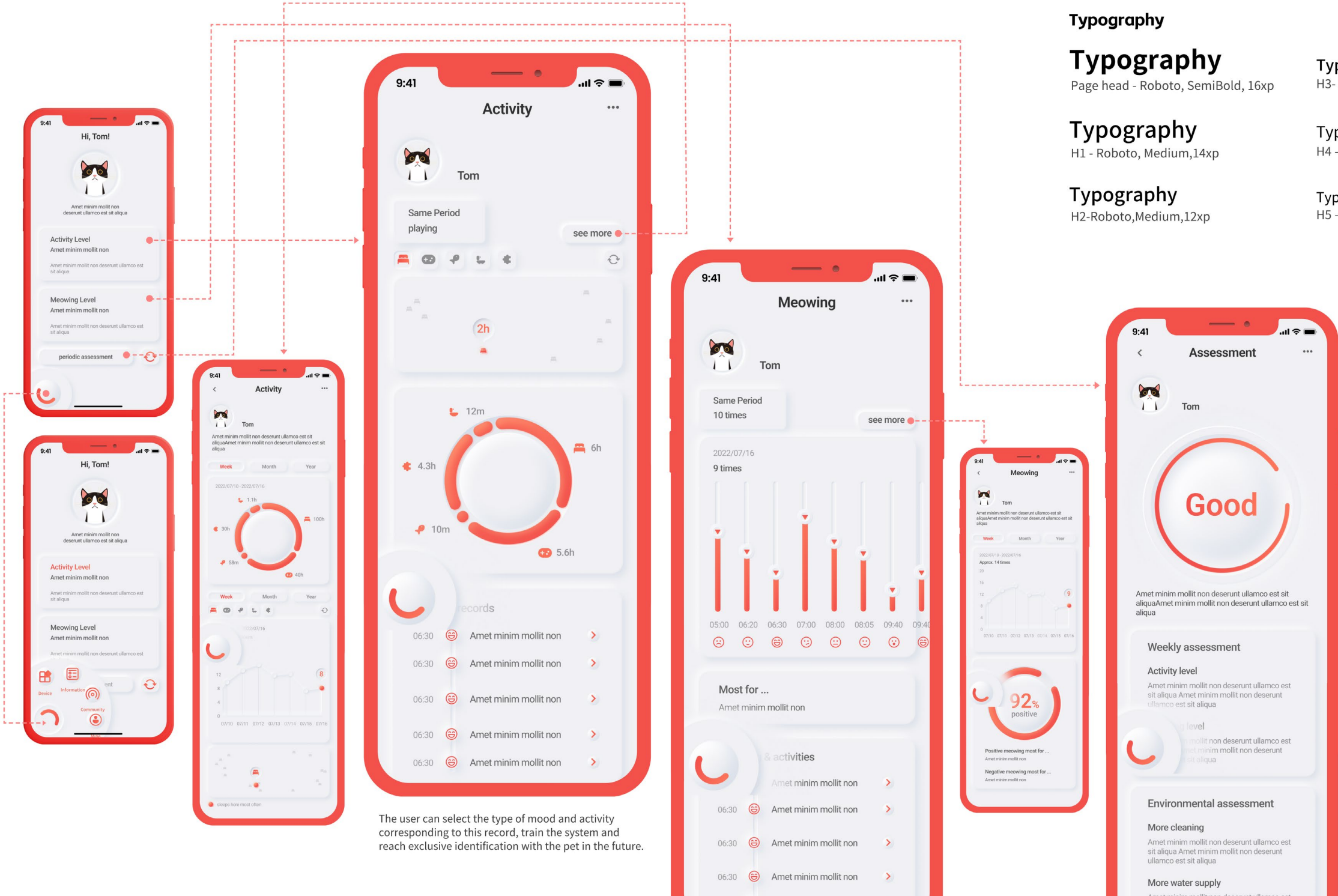


APP WIREFRAMING



DETAILS OF INTERFACE

We used the Neumorphism/soft UI style. Even though this is a new and different style of interface, the anthropomorphism of the components corresponds to the users perception of the actual object, which reduces the users cognitive load. The design of the buttons, both raised and recessed, prompts the user to click on them. The user does not have to spend extra time learning the new interface.



The user can select the type of mood and activity corresponding to this record, train the system and reach exclusive identification with the pet in the future.

Typography

Typography

Page head - Roboto, SemiBold, 16xp

Typography

H1 - Roboto, Medium,14xp

Typography

H2-Roboto,Medium,12xp

Typography

H3- Roboto,Medium,10xp

Typography

H4 - Roboto, Regular, 10xp

Typography

H5 - Roboto, Regular, 9xp

Colour Theme

Main color



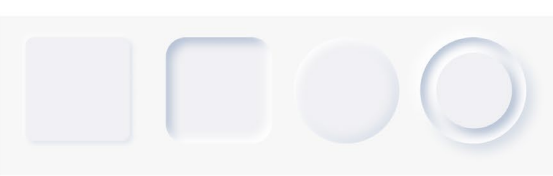
Word color



Functional color



shadow



- **Device** - users match devices and cats, check the working status of devices, add or delete devices
- **Information** - pain management takes into account the cat's personality, breed, age and gender, as well as objective environmental and human influences
- **Community** - view relevant tweets, research, tests etc. related to cat pain management and cat behaviour assessment
- **Mine** - user information, other functions

