



Communication Aid in Ataxia

Submitted in partial fulfillment of the requirement of the degree of

Masters of Design
by

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Project Guide
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IDC School of Design

INDIAN INSTITUTE OF TECHNOLOGY BOMBAY
(2024)

Declaration Form

I solemnly declare that the content in this written report is a true representation of my own ideas, expressed in my own words. In instances where I have included the thoughts and words of others, I have duly cited and referenced the original sources of the same. I further attest that I have strictly adhered to the principles of academic integrity and honesty, and I have not engaged in any form of falsification, misrepresentation, or fabrication of ideas, data, facts, or sources in this submission.

I am fully aware that any breach of the above-stated principles may lead to disciplinary action by the educational institution and may also result in legal consequences if proper permissions have not been obtained or if sources have not been accurately cited.



Name of the student: Abhishek Purushottam Kushwaha

Roll No: 22M2232

Date: 24-11-2023

Acknowledgement

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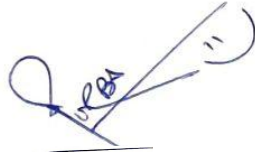
Finally, but just as importantly, I want to express my sincere gratitude to my family and friends for their unwavering support throughout this trip. Their encouragement and understanding have helped me stay motivated and resilient.

The successful completion of this project is greatly due to the cooperative efforts and assistance of these people and groups, and I sincerely appreciate what they have done.

Approval Sheet

This is to certify that the Industrial Design Project entitled "Communication Aid in Emergency for Ataxia Patients" by Abhishek P. Kushwaha is approved for partial fulfillment for the Master of Design degree in Industrial Design.

Pro. Purba Joshi (Project guide):



Signature of chair person: B.K. Khuntia



Signature of Internal examiner:

Bapat

24/11/2023

Signature of external examiner:



Abstract



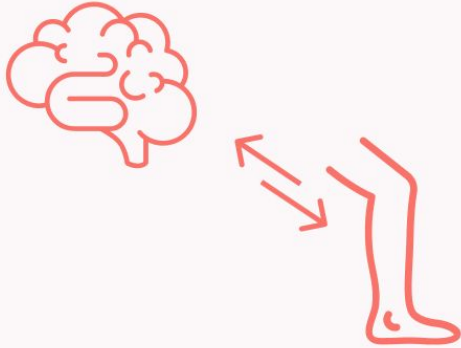
Ataxia is a neurological state that affects body coordination and muscle control and creates a danger to those affected in times of need. People in these conditions run the risk of losing control of their bodies, which causes hazardous or fatal circumstances. In the struggle of Ataxia, where each step is defiance, lack of communication magnifies the challenge.

Introduction:

What is Ataxia...?

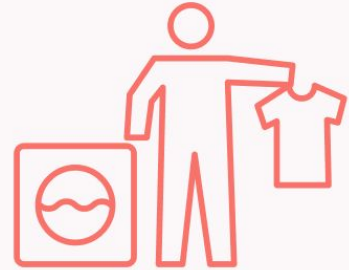
Ataxia, which means "lack of order," effects coordination in muscle movements in body.

It's a condition connected to problems in the brain's coordination system, including the cerebellum.



People with ataxia faces difficulties with everyday jobs like walking, balance, speaking, swallowing, using hands, and controlling eye movements.

Simple jobs become challenges for those with ataxia, things mostly people as usual without thinking.



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Problem Statement

In Ataxia, patients are in frequent need of assistance from their caretakers regarding various activities. Mostly, the caretaker (family, relatives etc.) are used to most of the situations (indoor/ outdoor) due to habit, interaction and experience. Sometimes, patients are not able to communicate their state, needs and condition, which can cause to a life threatening situation.

Design Brief

Design a communication facility between Ataxia patient and caretaker or anyone that can assist a patient in the time of need or emergency.



Research

Types

Cerebellar Ataxia (Brain)

The most common type of ataxia is cerebellar ataxia, which happens by the degeneration of the cerebellum, which maintains coordination and equilibrium. It can create impact on the spinal cord as well.

Symptoms include

- Changes in your voice
- Dizziness
- Fatigue
- Headaches
- Muscle tremors
- Slurred speech
- Trouble walking
- Wide gait

Sensory Ataxia (Nerves)

Damage to nerves in spinal cord or peripheral nervous system, which is located outside the brain, causes sensory ataxia.

Symptoms include

- Difficulty in touching your finger to your nose with closed eyes
- Inability in sense vibrations
- Trouble in walking in dim light
- Walking with "heavy step," or stomping when you walk

Vestibular Ataxia (ears)

Problems with vestibular system, consists of the inner ear and ear canals, cause vestibular ataxia. incharge of the equilibrium and spatial attitude.

Symptoms include

- Blurred vision and the other eye issues
- Nausea and vomiting
- Problems in standing and sitting
- Staggering when you walk
- Trouble walking in straight line
- Vertigo or dizziness

The Indian Context



Credits: google Image

Risk factors for gait abnormalities

- Age more than 60.
- Experienced an injury.
- Having condition that affects your movement, joints, bones, muscles, brain or spinal cord.

credits:- Science direct

- “12% of the diagnosed cases were of SCA 2 (Spinocerebellar ataxia 2), the second most
- diagnosed ataxia, with the highest cases being from North India (49%), followed by the
- West region (30%). South India accounted for 4% and Central India accounted for 14%.”

credits:- Neurology India

“Spinocerebellar ataxia-2 is one of the most prevalent SCA type across the world and one of the commonest in India.”

credits:- Science india

Unveiling Ataxia's Story

Started hospital visit at Sancheti Institute for orthopedics & rehabilitation at Pune.

Gathered insights from patients about the condition and personally visited and saw tremors, imbalance and issues faced by them.

Understood various challenges faced by the caretaker throughout the day.

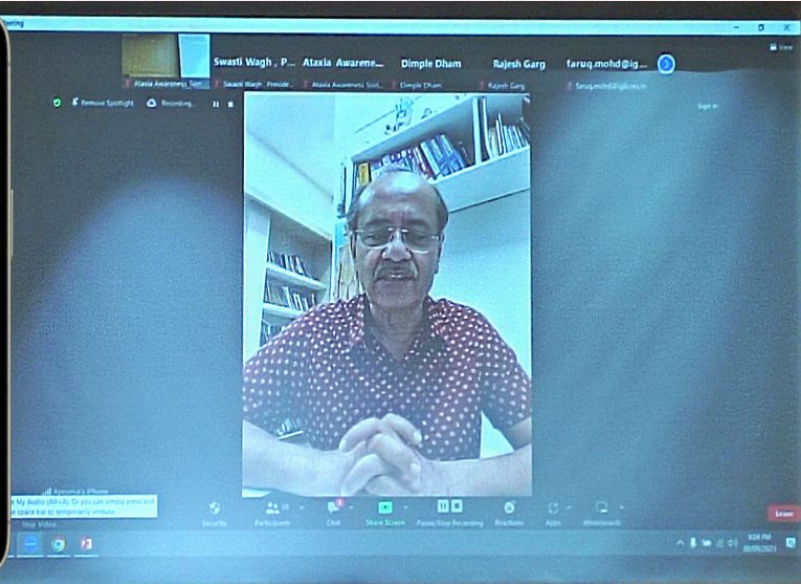


Unveiling Ataxia's Story

Engaged in the intimate interviews with patients, blending online and in-person insights in Pune.

Attended a seminar about Ataxia, causes and the treatment.

Dr. Jai kate, Neuro physiotherapist, illuminated the medical landscape for us.



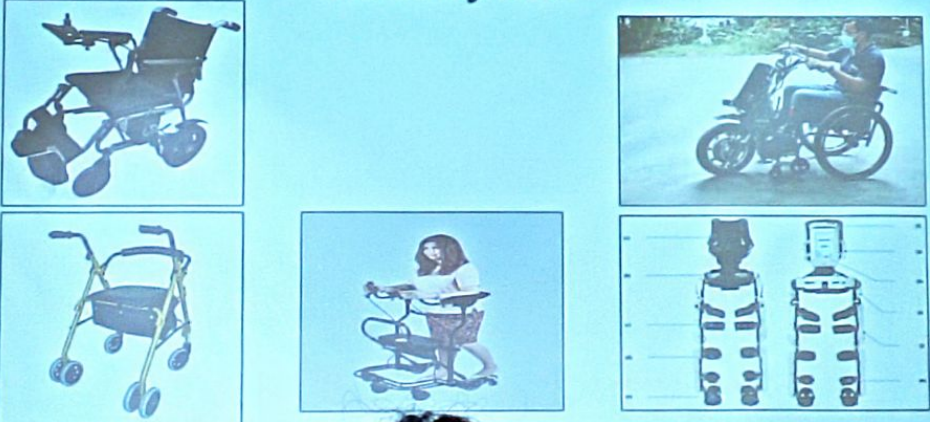
Unveiling Ataxia's Story

Engaged in the intimate interviews with patients, blending in online and in-person insights in Pune.

sancheti Healthcare Academy

College of Physiotherapy

Mobility aids



Saturday, September 30, 2023

SANCHETI INSTITUTE OF PHYSIOTHERAPY, PUNE

Interview

Contextual inquiry has been taken place with patients with the help of questionnaires.

How ataxia impact your daily life in terms of movement, coordination, and balance?

What specific tasks and activities become challenging due to your ataxia?

Have you used any devices and products to help with your ataxia symptoms?

How you envision this product fitting in your daily routine?

What features would you like to be in the product to assist with ataxia?

When you face the most difficulty with balance and the coordination?

Are there any safety concerns you'd like in the product to address for your well-being?

Have you had to give up or modify any hobbies due to the ataxia?

How important it is for the product to discreet and aesthetically pleasing?

Are there any other features or functions you believe would benefit ataxia patients?

How do you imagine this product will helping in social situations outside your home?

Have you had any positive experiences with the past products/devices for ataxia?

What usability expectations do you have with this product?

Do you have any kind of concerns about using a new product to manage ataxia symptoms?

Would you prefer wearable product or the one easily accessible in your environment?

Inference

In India, there is no any products available for ataxia, and in the foreign countries, they are way too expensive.

For every small activity, specialized and different products/equipment is needed.

Recovering from falling is different for each person due to response time and severity of condition.

Patients with ataxia appear to be fine, so people don't consider helping them.

As time passes, condition of the patient only gets worse.

Dignity and preferences of self-dependence also varies from person to person.

Communication is big concern with slurred speech.

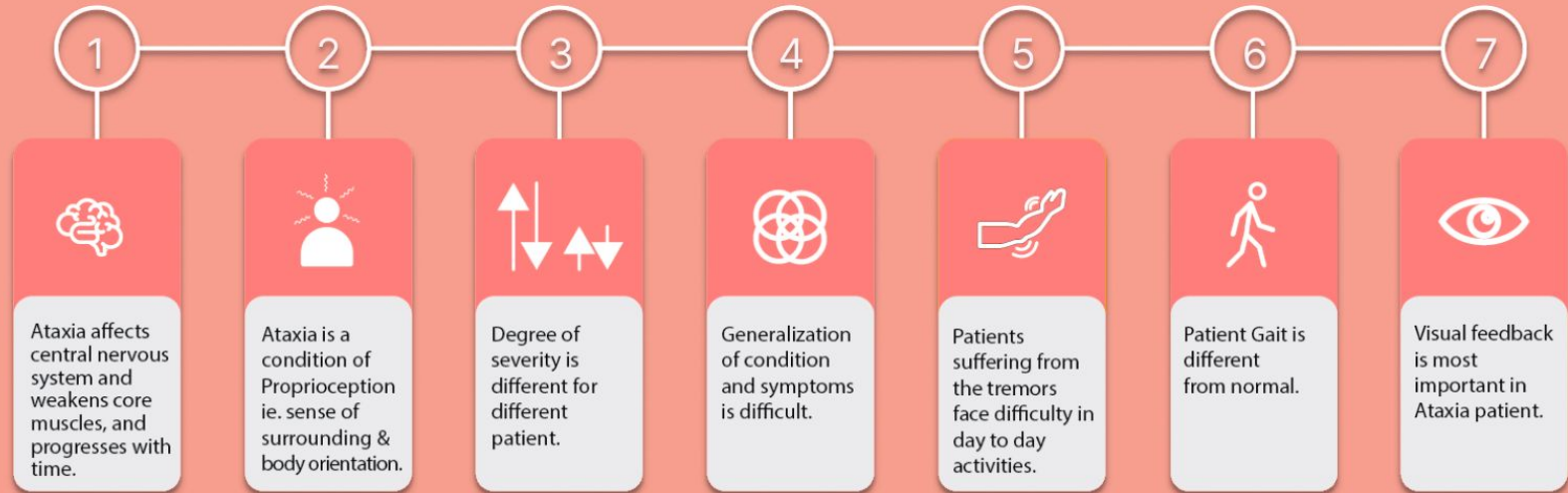
Muscle stiffness is common issue among the ataxia patients.

Constant tremors forms knots in the muscles.

They can get completely frozen physically in some situations.

Fingers are better than body.

Findings



Pain points

Product Gap

No local solutions in India.
Foreign options are too expensive.



Diverse Independence

Varying preferences of dignity and self-dependence.



Physical Freezing

They can be freeze physically in certain situations.



Seeking Small Wins

Patient's desire is of even minor improvements.



Pain points

Helplessness in Falls

Recovery varies person to person. falls lead injuries.



Speech Hurdle

Slurred speech hinders the communication.



Common Stiffness

Muscle stiffness and knots are universal in the ataxia.



Pain points

Yes

- Devices / aids should be normal looking.
- Looks doesn't matter to their condition. (caring / helping / sympathy).
- Should get first aid as needed in ataxia. Has to be on standby.

Paradox

Also yes...

- Do not want to wear anything.
- Preferring to look like patient.
- Inconvenient to wear any aid.
- No one knows anything about ataxia.
- Wants to get / use when conditions happen.

Design thinking

Consists of...

Tech Development

Creating the user-friendly hardware and software to integrating diverse communication methods in it.

User-Centric Testing

Testing it with ataxia patients and caregivers to valuable feedback, to refining functionality.

Safety Integration

Embedding the safety features for enhanced the patient security and well-being.

Ergonomics

- Less button / controls.
- Simple to operate (Patient / caretaker)
- Big buttons: Easy to locate.
- Easy to wear and press.
- No accidental / false activation.
- Within visual reach.
- Manual mode (light + sound)
- Shouldn't create obstruction when wore it.

Electronic requirement

- Light: torch & blinker.
- Sound: Speaker / buzzer.
- Jerk / vibration / fall detection: Switch / trigger.
- GPS: location.
- Bluetooth: App and Smartphone connection.
- Battery: power supply.
- App: Display, location, battery, contact.

Wearability

- On wrist.
- Palm.
- Finger tips.
- Ankle.

Design thinking

Situations

Indoor	-	Outdoor
Day	-	Night
Crowd	-	Alone
Mild	-	Severe
Attention	-	Emergency
Brief	-	Instantaneously (time response)
Full time	-	Preference (wearability)

Application

The device is integrated with an application as an extension for seamless functionality and convenience.

Working

- Connects by Bluetooth to device.
- To add contacts.
- Automatic contact to desired people.
- Battery percentage indication.
- Calling / message.
- GPS location tracking.
- Button to prevent false fall detection.

Requirements

- Should access Bluetooth, GPS, call, message facility of phone.
- Access to contacts to choose/select people to whom call, message & location.
- can be get contacted Automatically.

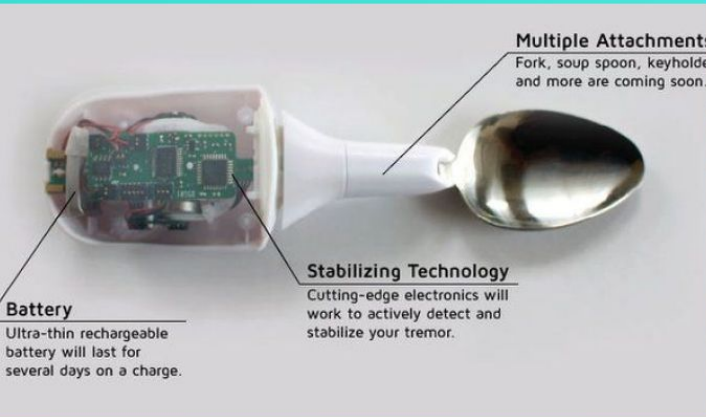
Algorithm

- Patient wears this device daily.
- Problem / emergency occurs.
- Accelerometer, Gyro (sensors) detect dynamics in patient & gets triggered.
- Device sends signal to App via Bluetooth.
- App Contacts the caretakers by call, message & GPS Location within same app automatically (can be used by both caretaker & Patient).
- Pop-up of app on screen to take actions if false alarm happens like cancel / stop the protocol & also send a message of false alarm.

Existing Products

Credits: National Ataxia Foundation

Electronic spoon for stability



Suction cup handles



Adjustable table



Cap-less toothpaste pouch



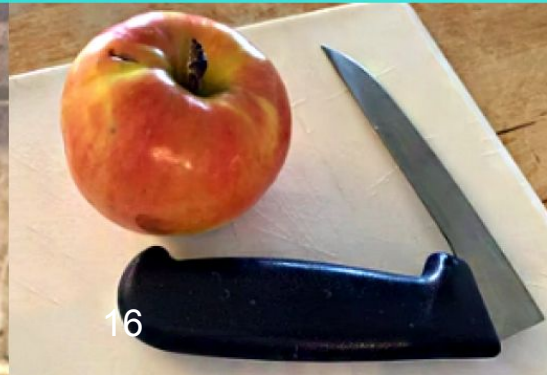
Grab bar



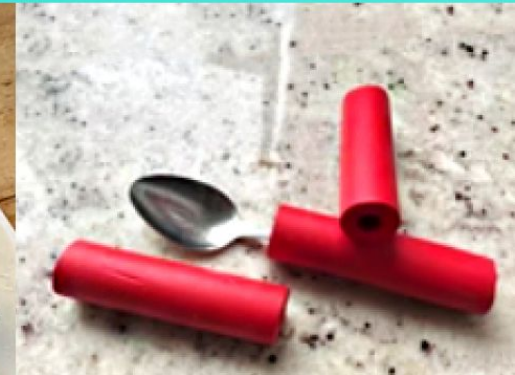
Bottle opening aid



Inclined handle knife

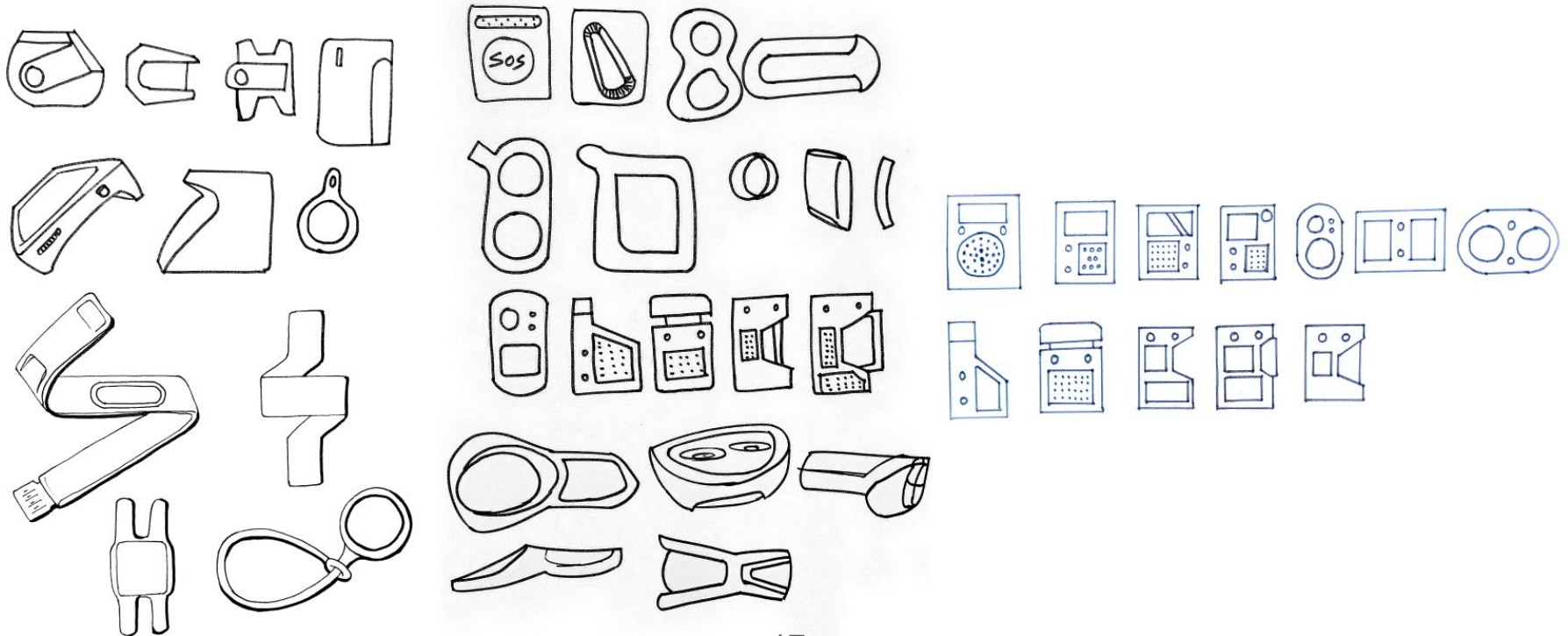


Sponge handle cutlery



Ideation

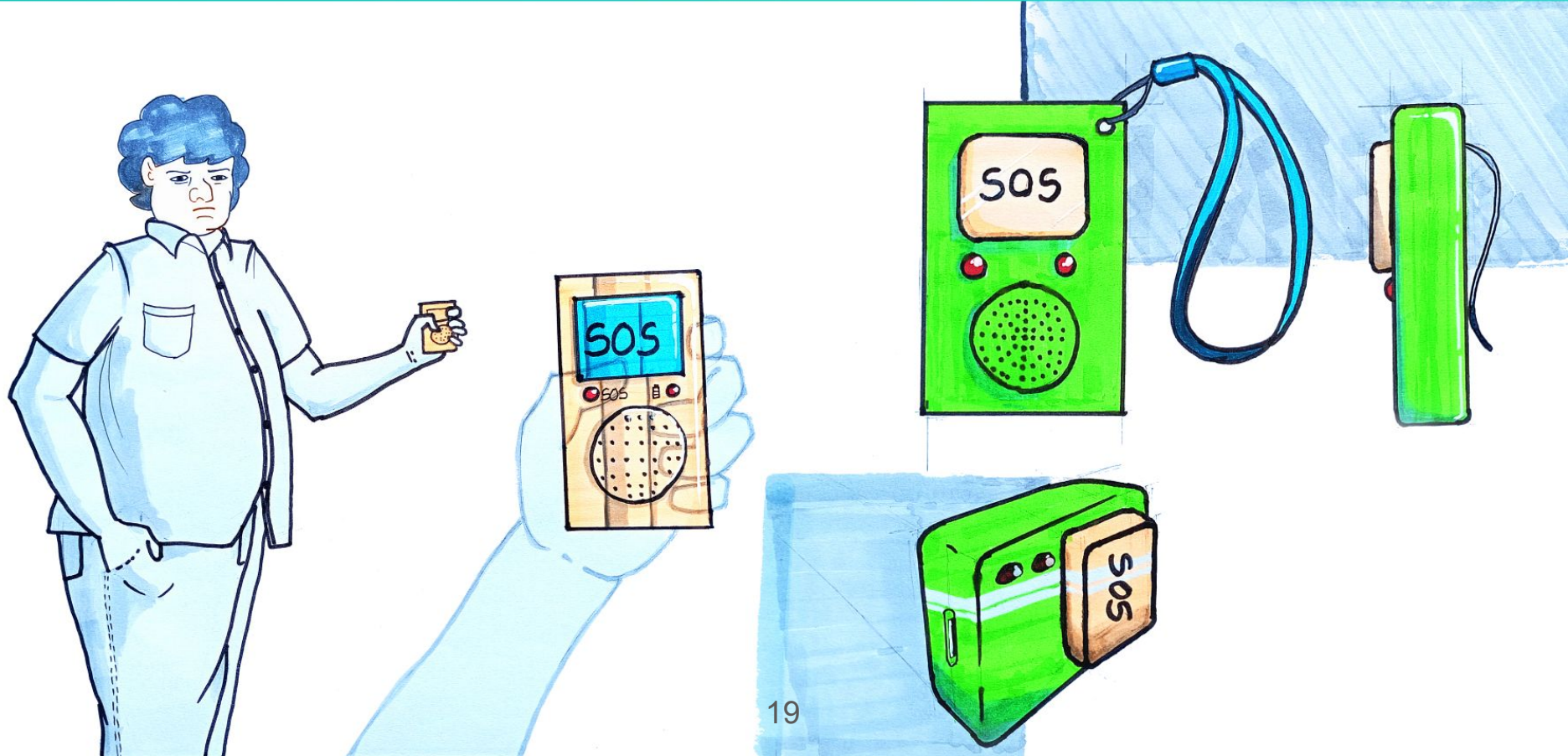
Usability and accessibility is a primary objective.



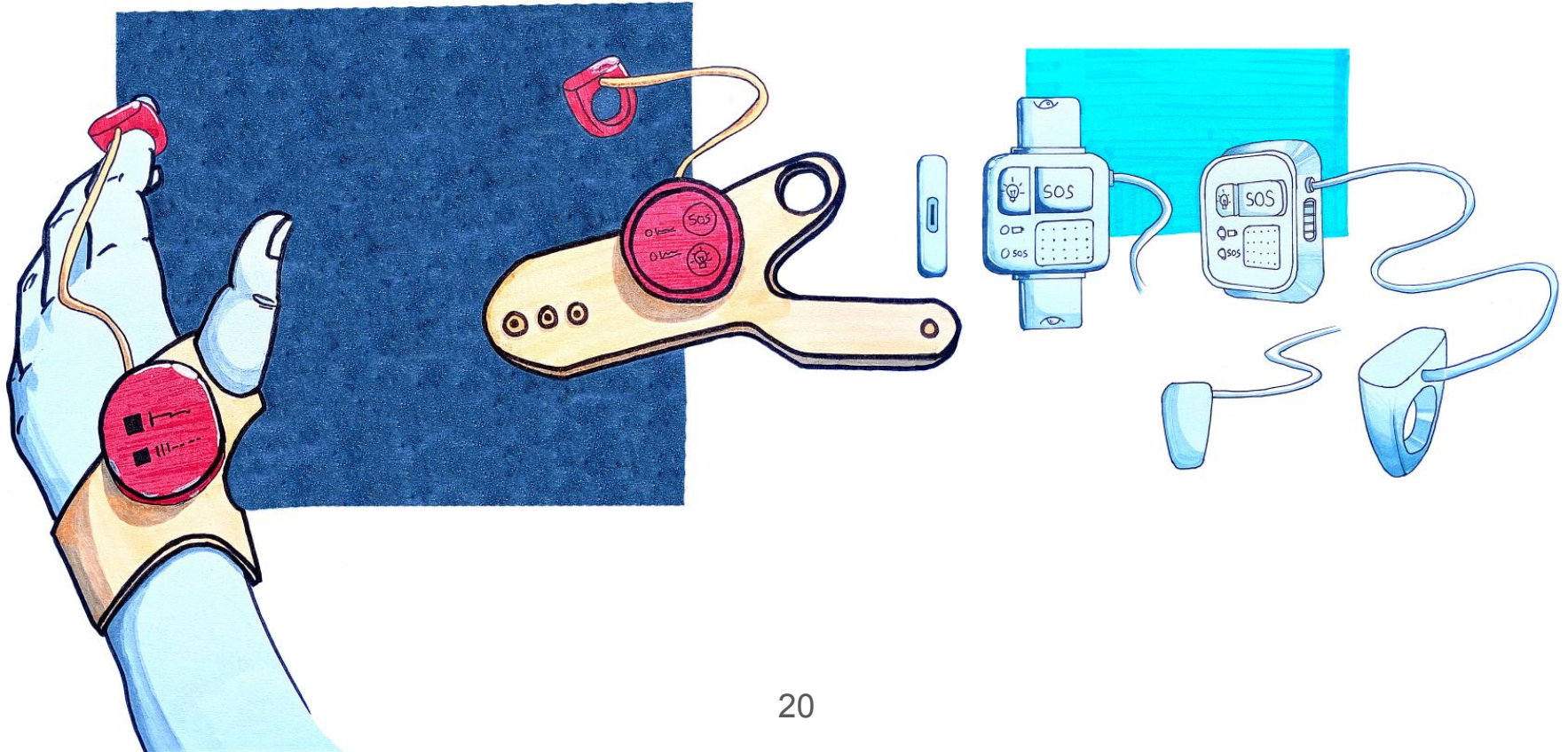
Ideation



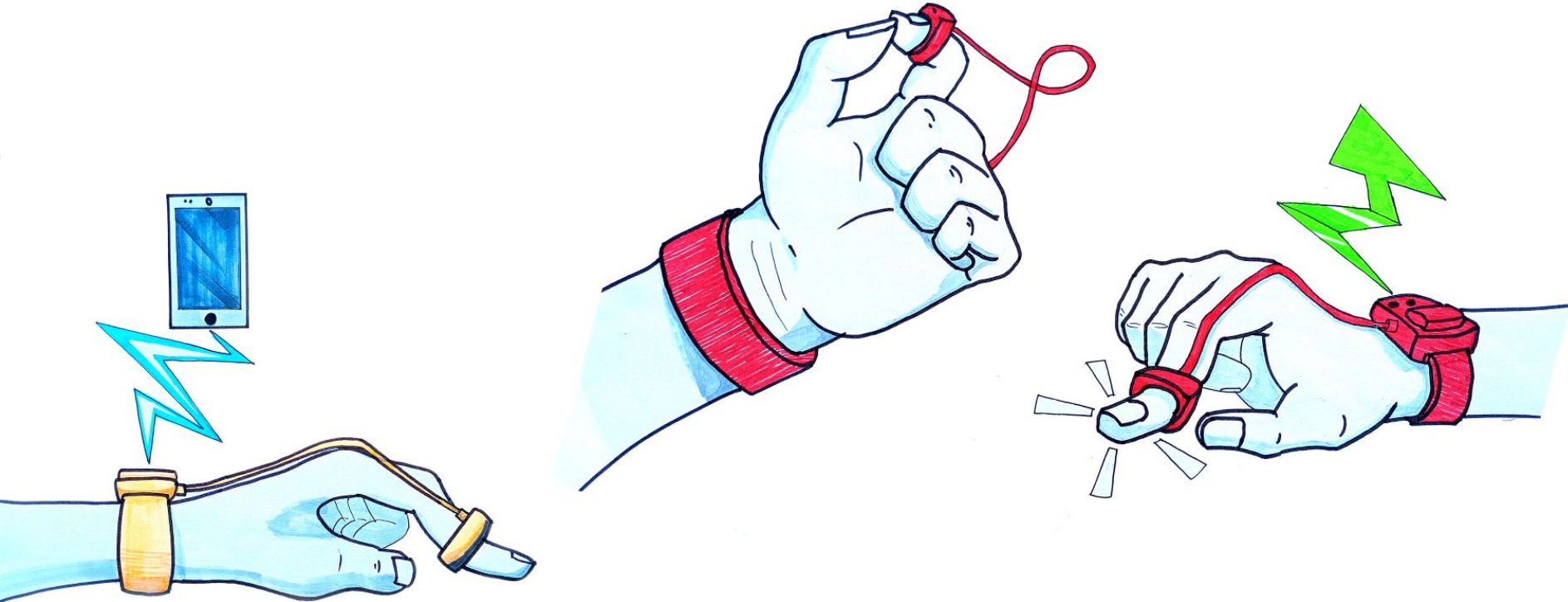
Ideation



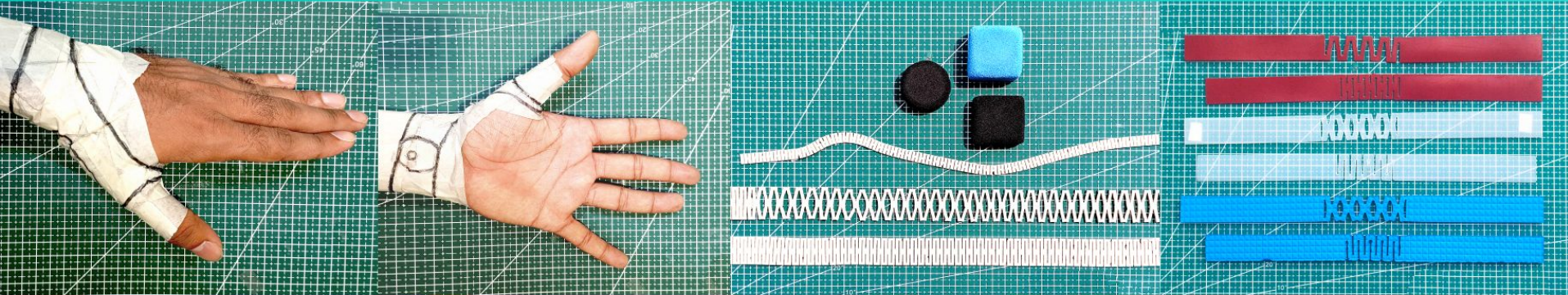
Ideation



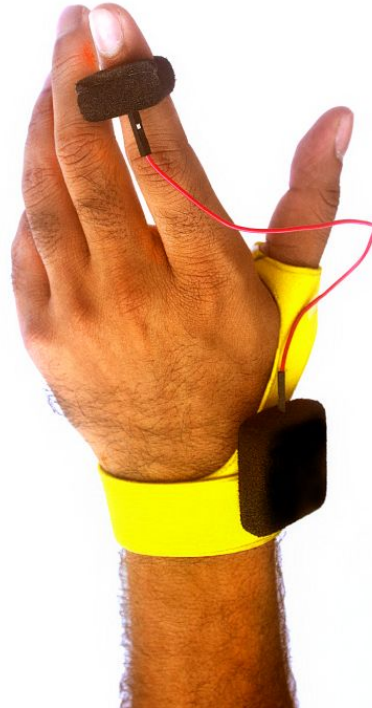
Ideation



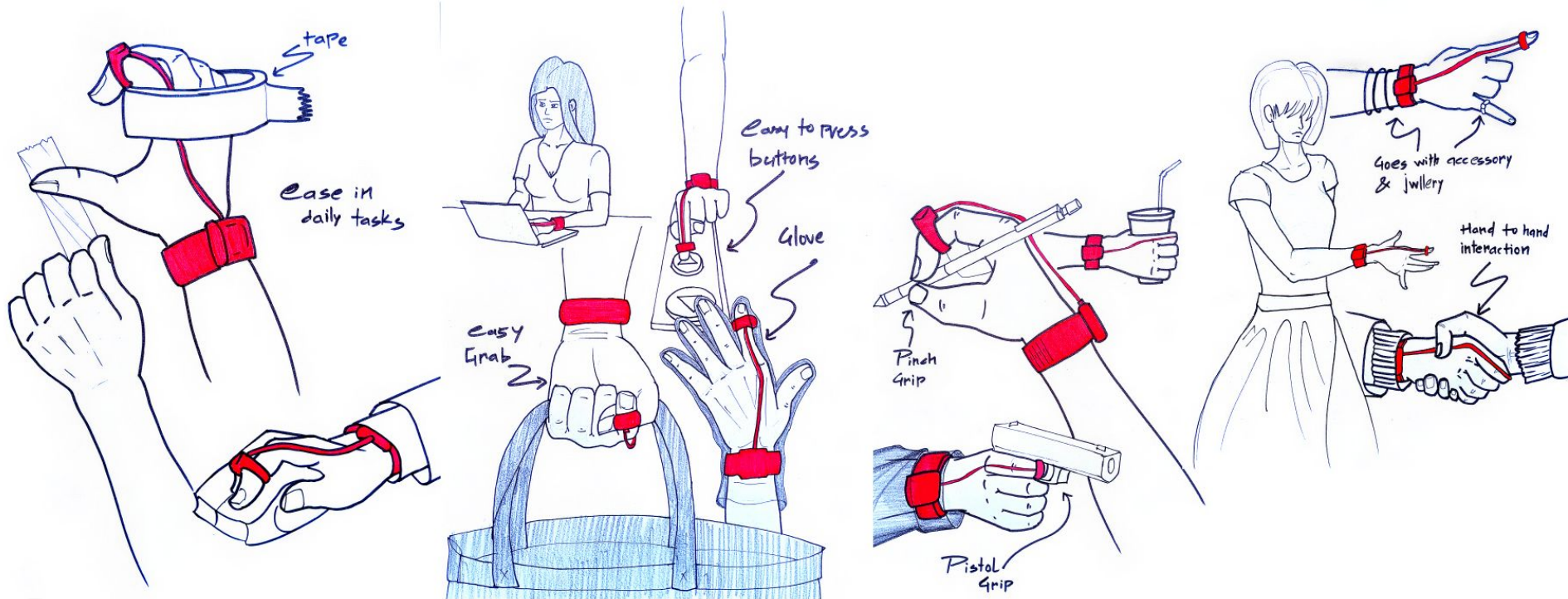
Prototyping



Prototyping

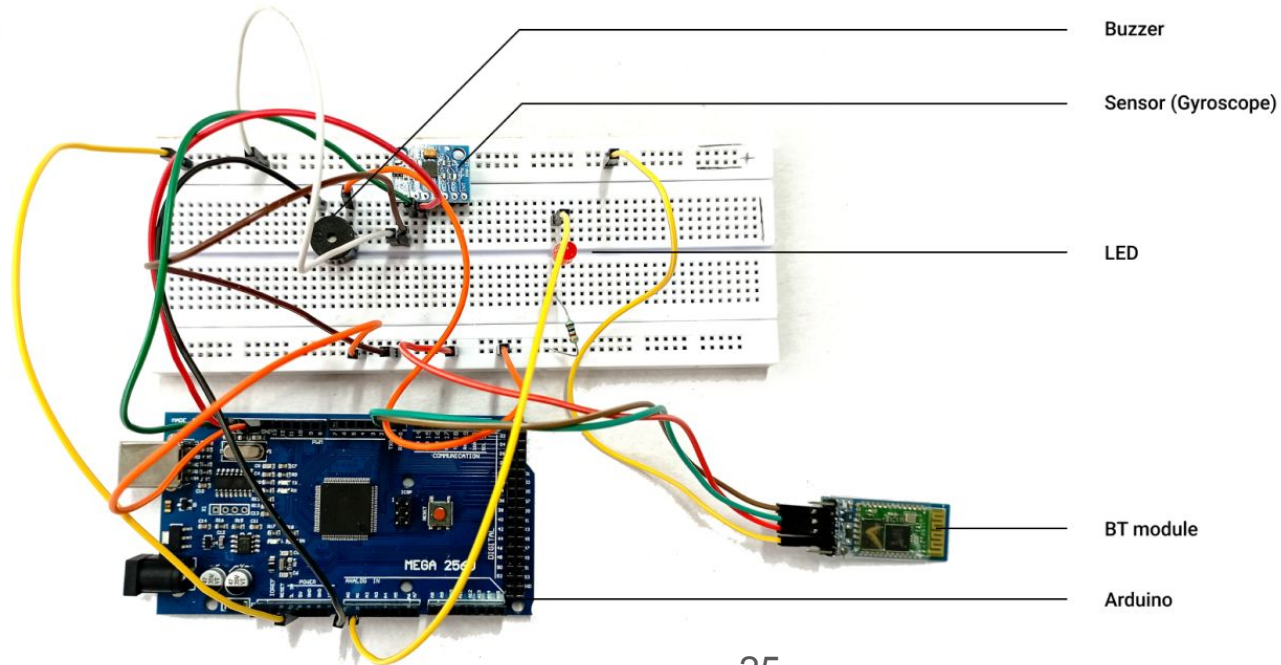


Prototyping



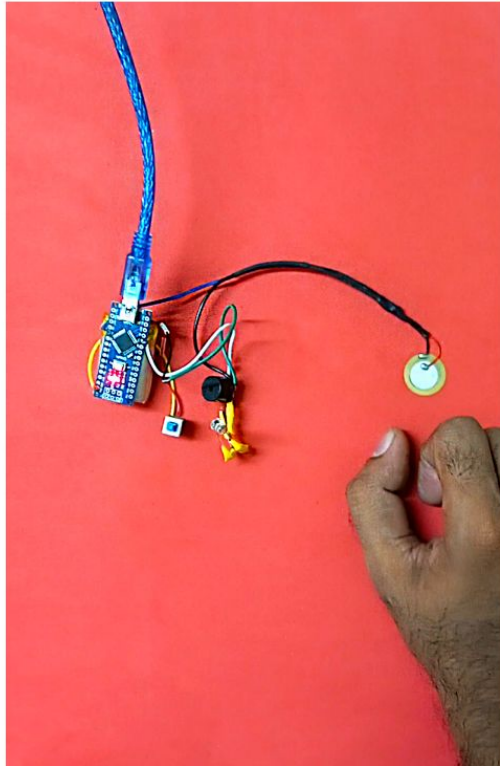
Hardware Development

Arduino is used to fabricate a desired electronic system.



Hardware Development

Electronic fabrication



Housing

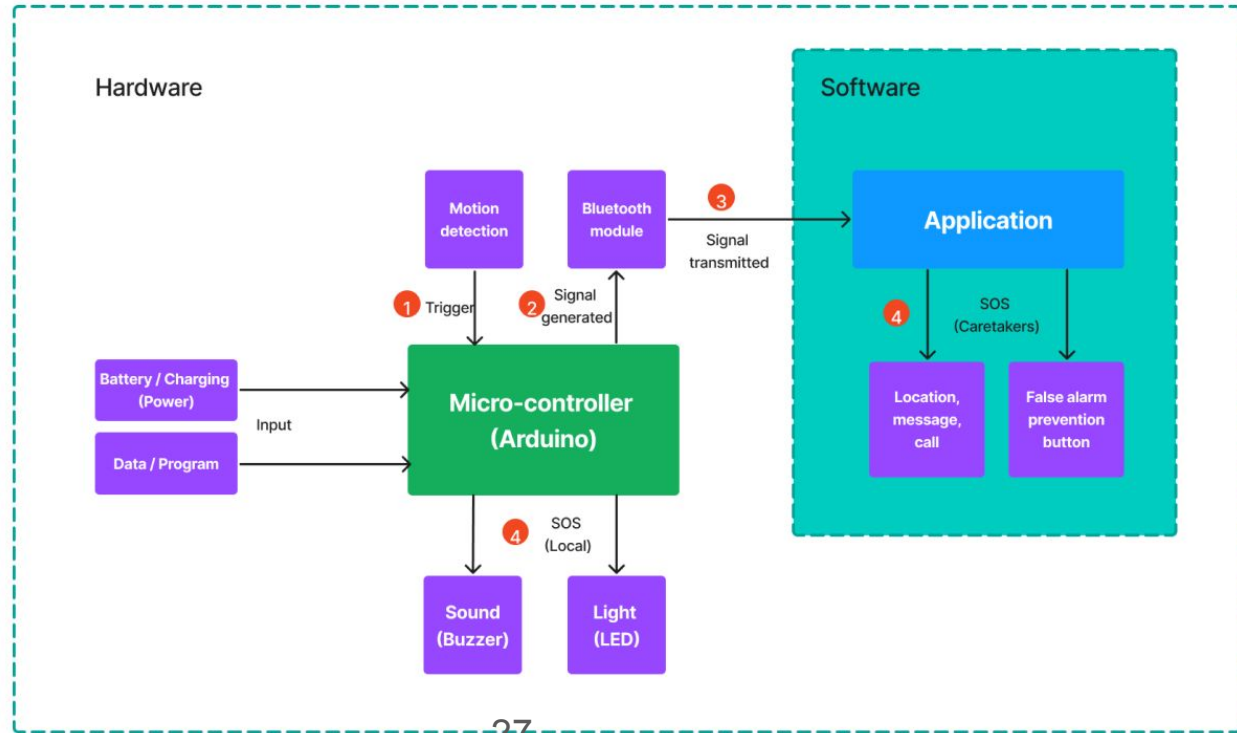


Integration with wearable form

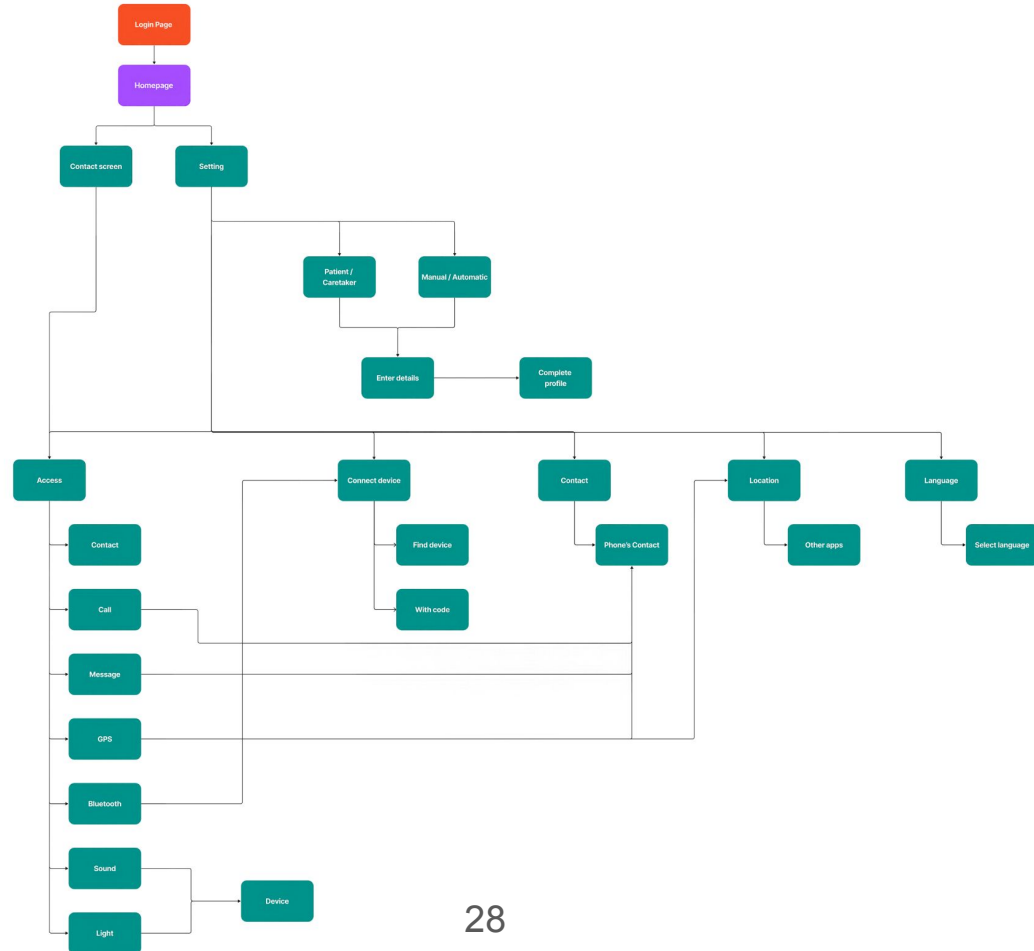


The Application

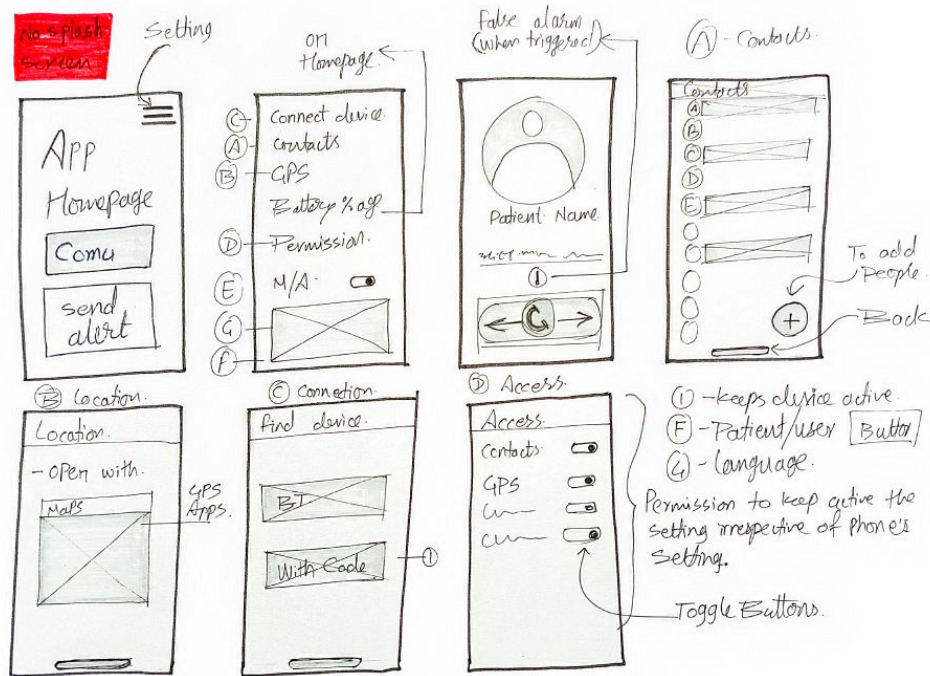
System schematic



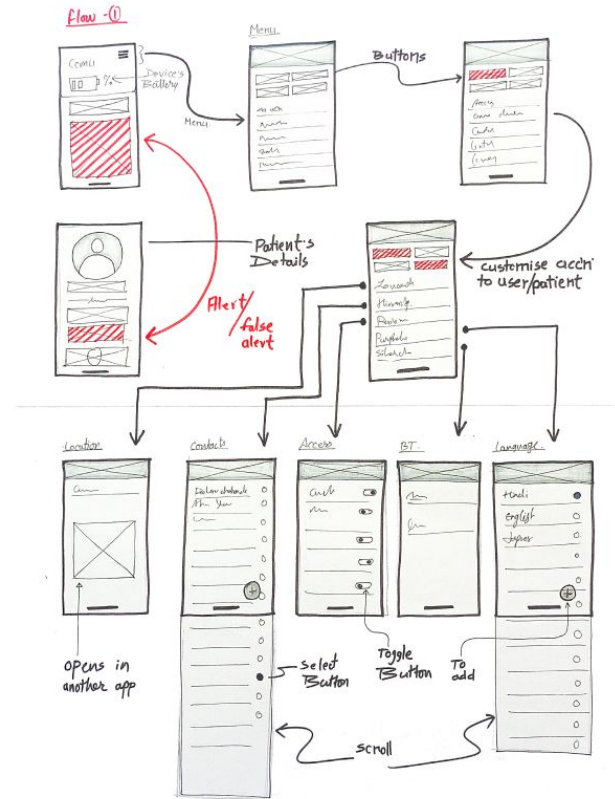
Information Architecture



Low fidelity wireframes



The device is integrated with an application as an extension for seamless functionality and convenience.



Colour



#FF4858



#1B7F79



#00CCC0



#72F2EB



FFFFFF

Typography

Roboto 20

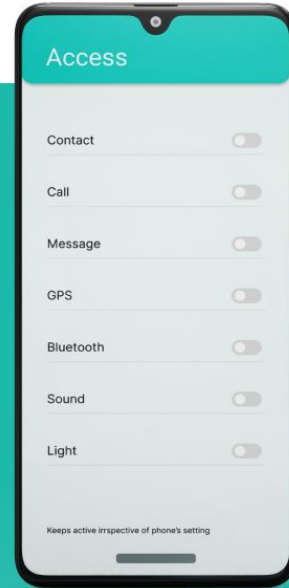
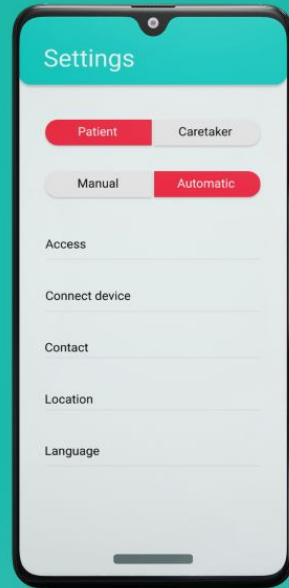
Roboto 32

Roboto 36

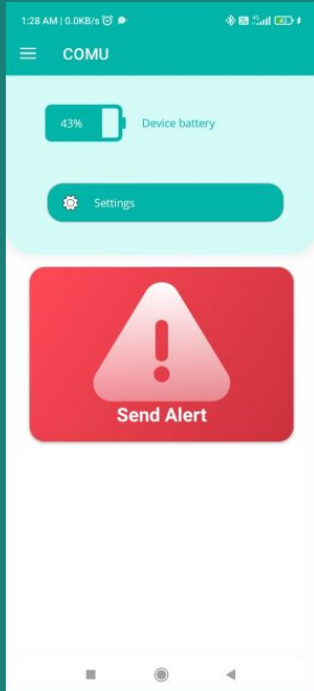
Roboto 40







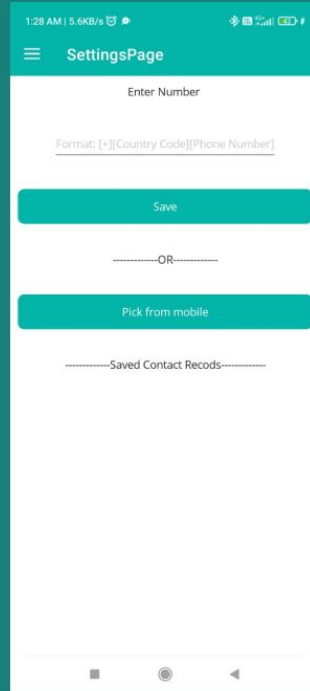
Homepage



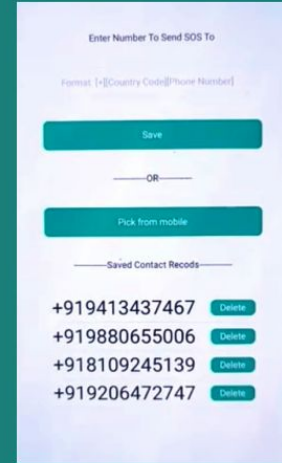
Settings



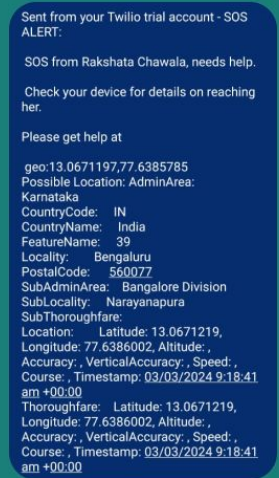
To add contacts



Added contacts



Generated message SOS



Scenario

You start /spend your daily life as ataxia Patient (Irrespective of your severity)



Suddenly, symptoms of Ataxia kicks in.



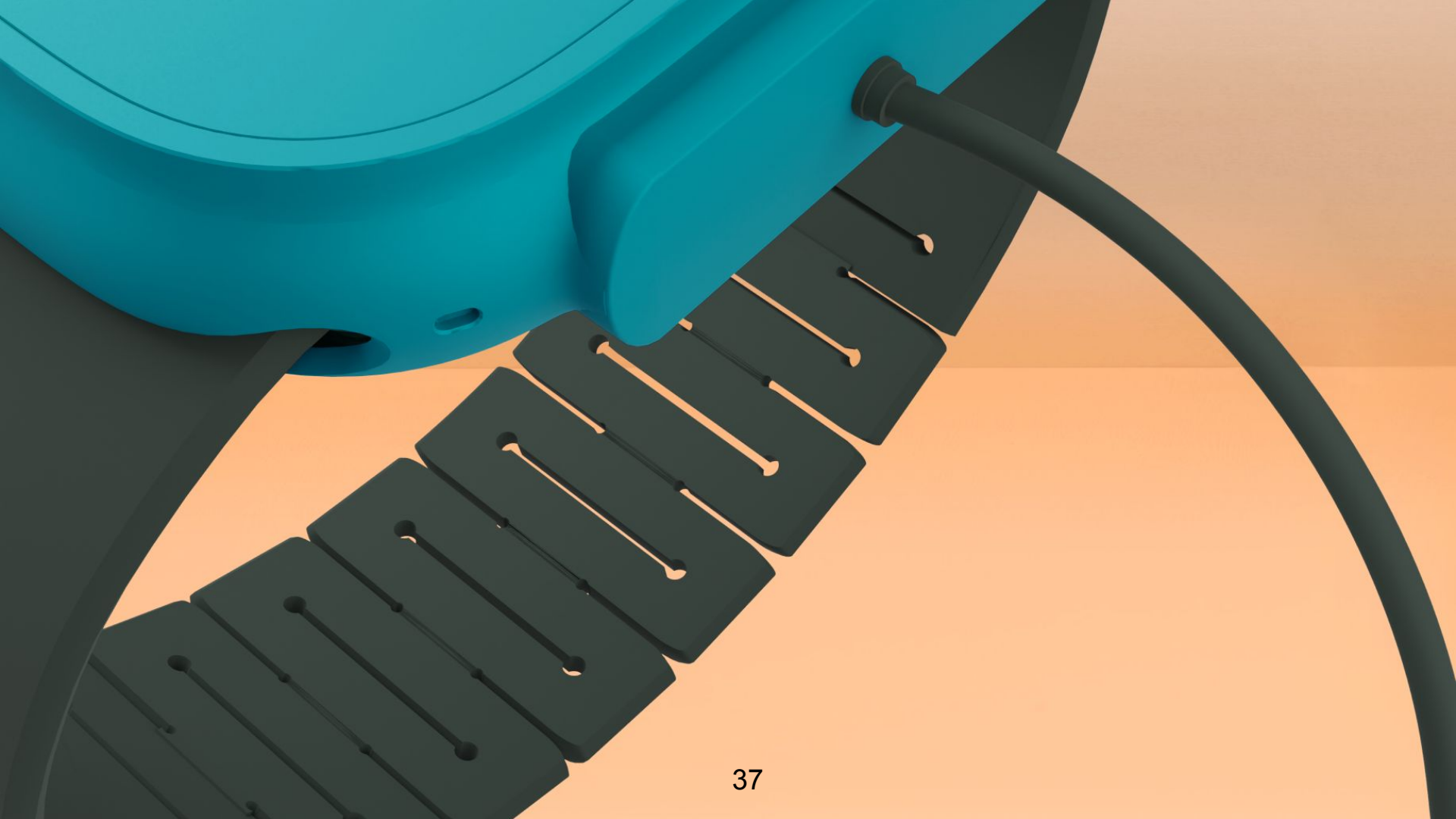
You are unmonitored and unable to help yourself and request assistance. (situation may be simple to critical).

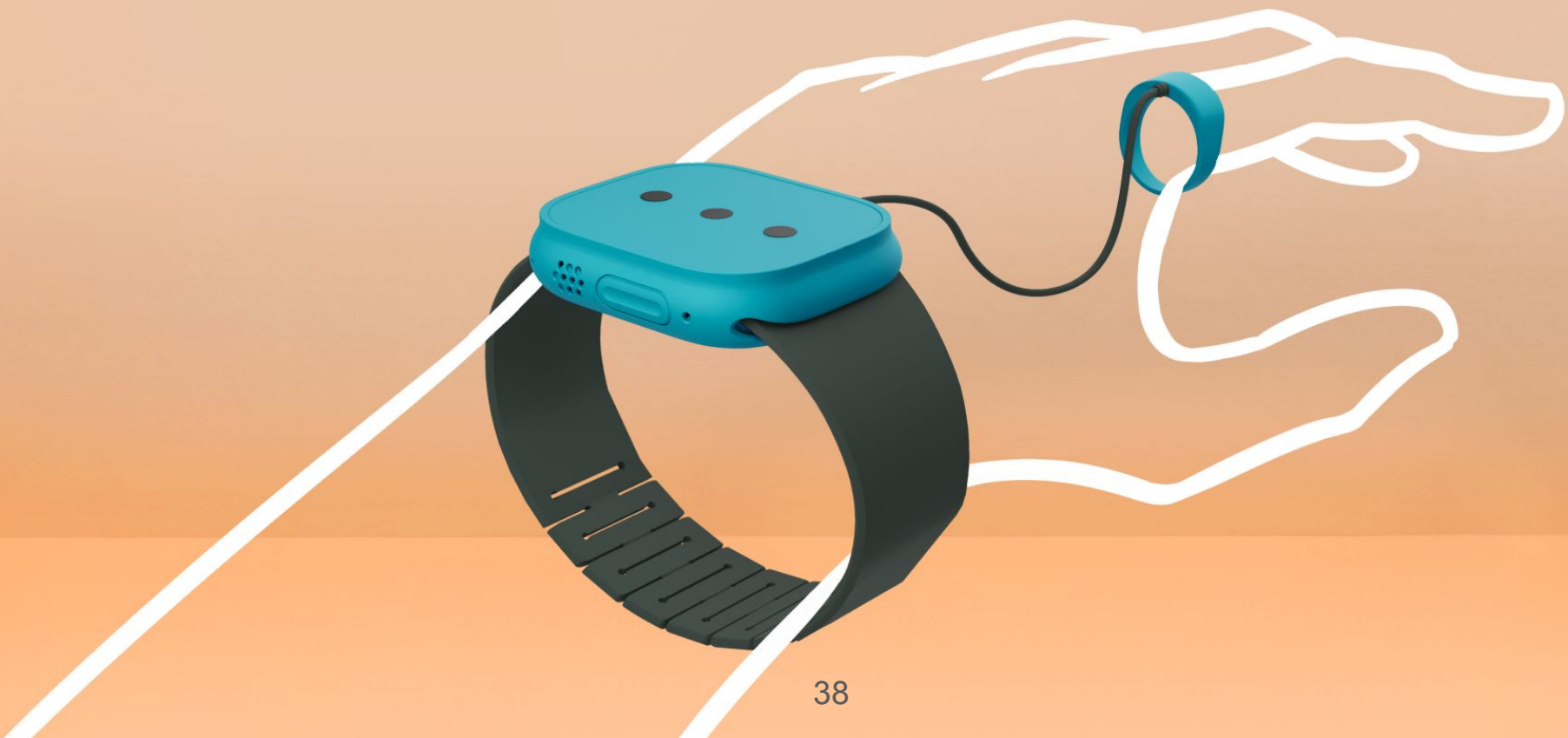


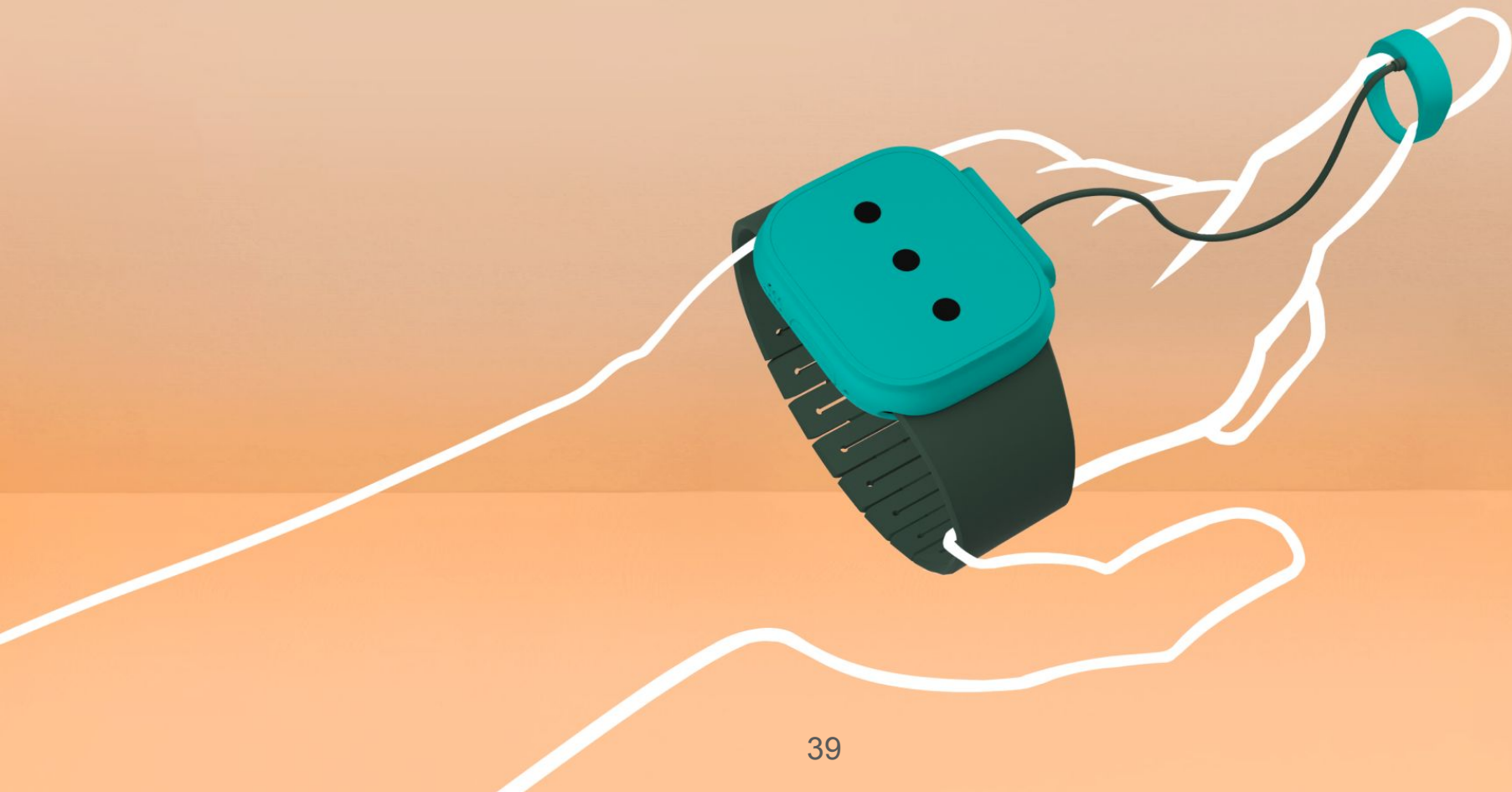
You use COMU to communicate with your caretaker or any nearby person to help you in recovery.











Learning

Ataxia can profoundly impacts the lives of those affected, presenting challenges across the various dimensions. Emotional and societal factors further complicates the matters, it often compromising the individual's dignity. The condition's unique nature defies the generalization, demanding a nuanced approach to improvement, achievable only through the incremental changes. Comprehensive support, encompassing caregivers, technology, medication, and the emotional and physical well-being, is essential for enhancing the quality of life for Ataxia patients. Given its rarity, addressing the Ataxia requires an unconventional strategies and dedicated attention to promote the progressive well-being.



Conclusion

In the conclusion, the critical need for the assistance in managing the Ataxia highlights the dire consequences of the communication barriers, which can exacerbate already challenging circumstances. Just by fostering effective communication channels between Ataxia patients and their caregivers, significant improvements can be realized, greatly enhancing their ability to address the myriad issues which they encounter on a daily basis.



References

Existing product Images:

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Products on ataxia

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<http://birdlab.dei.uminho.pt/>

