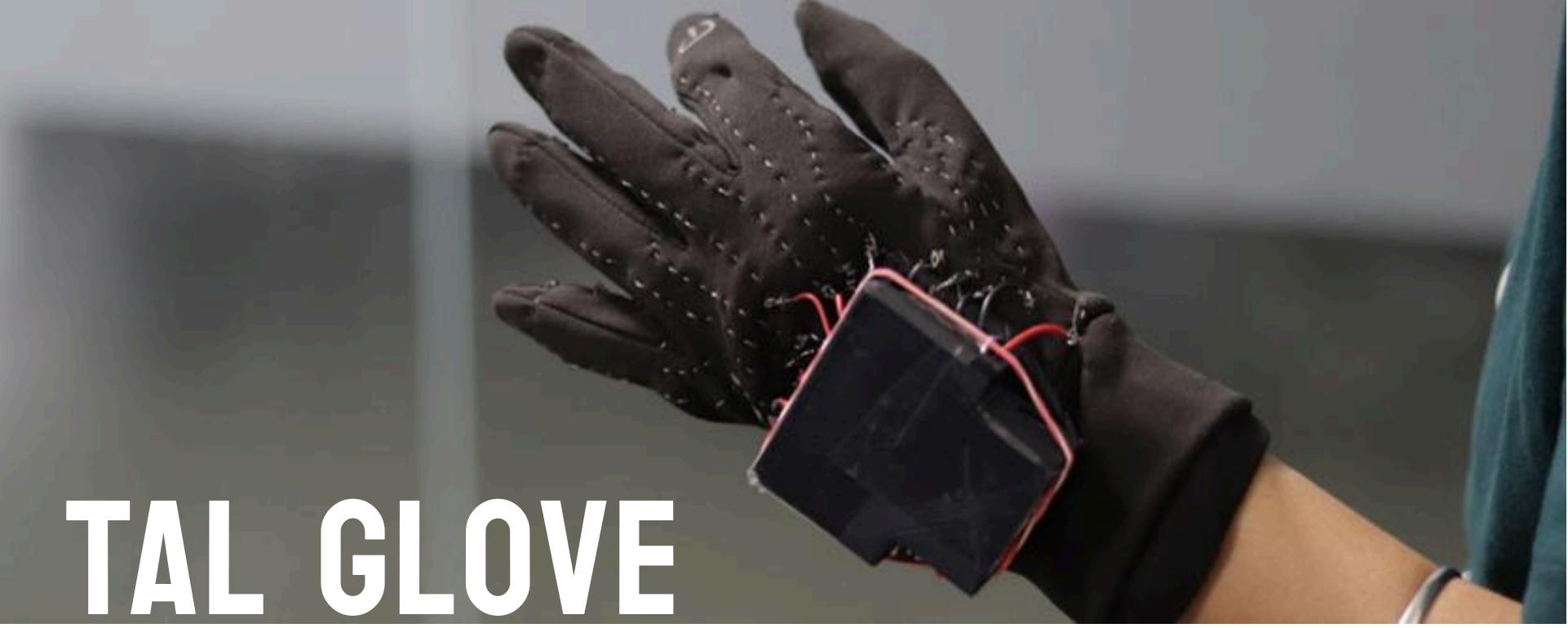


TAL GLOVE

An Accompanist for Musical Training and Exploration

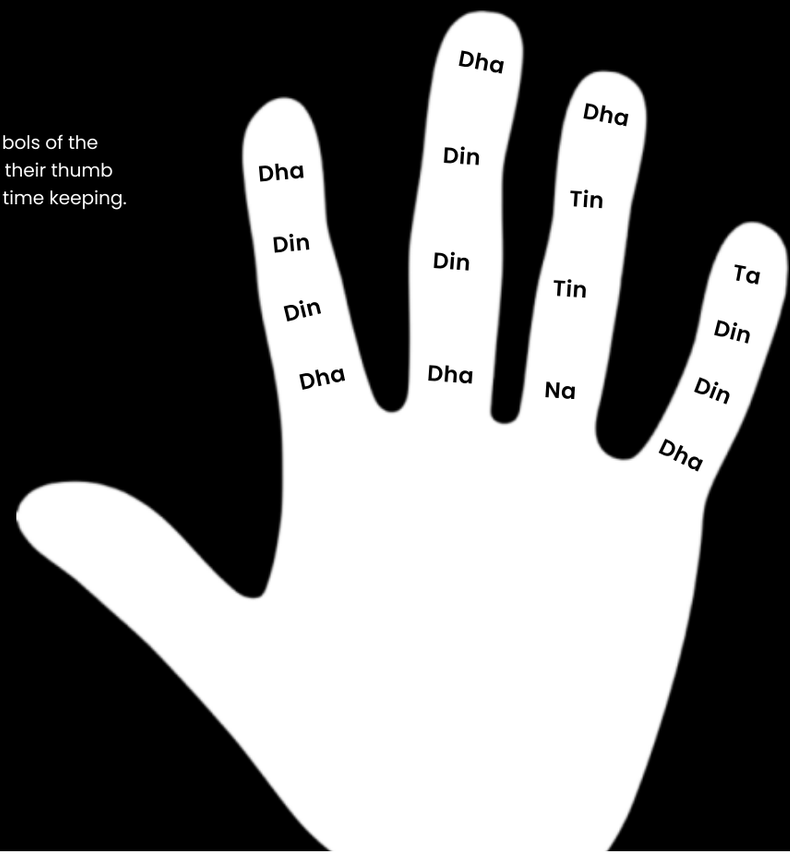
PROJECT OVERVIEW

Indian classical music employs oral transmission and gestural counting of taals. Vocalists who don't have tabla players employ hand tapping or pre-recorded backing.

Hindustani classical musicians rely on rhythmic accompaniment (tabla) to keep cycles of time (taal). During solo practice, it is seldom possible to have a tabla player, and computer apps have no gesture control. The Tabla Glove fills this void by mapping counting gestures into tabla sounds for taal keeping. This poster introduces the design, functionality, and experience of this wearable rhythm friend.

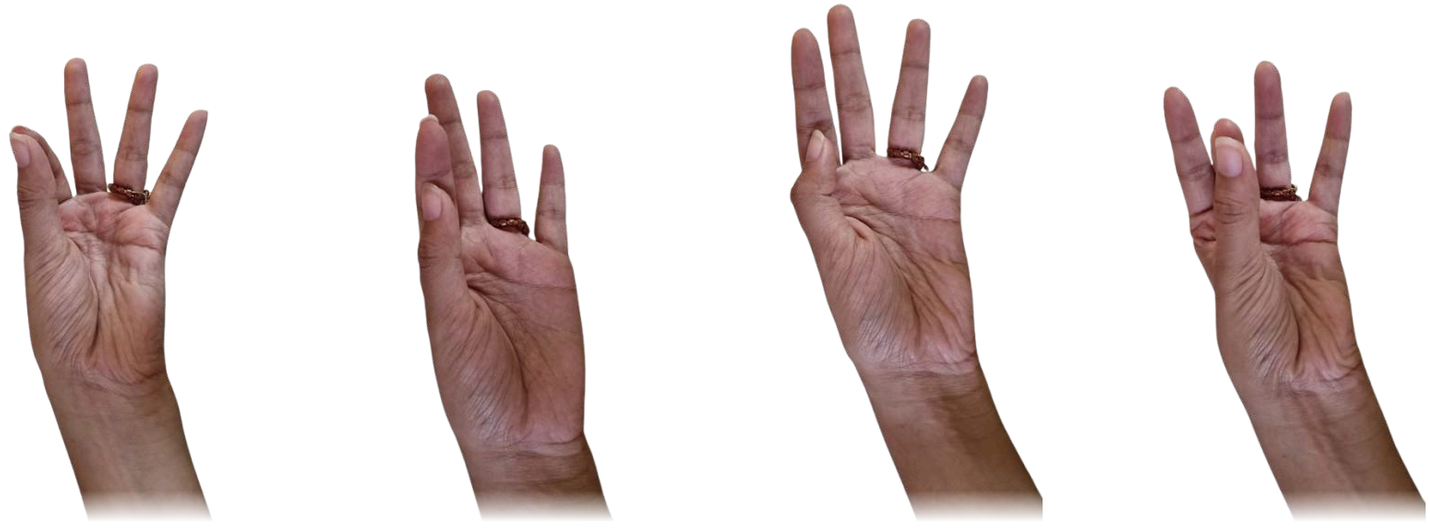
THALAM

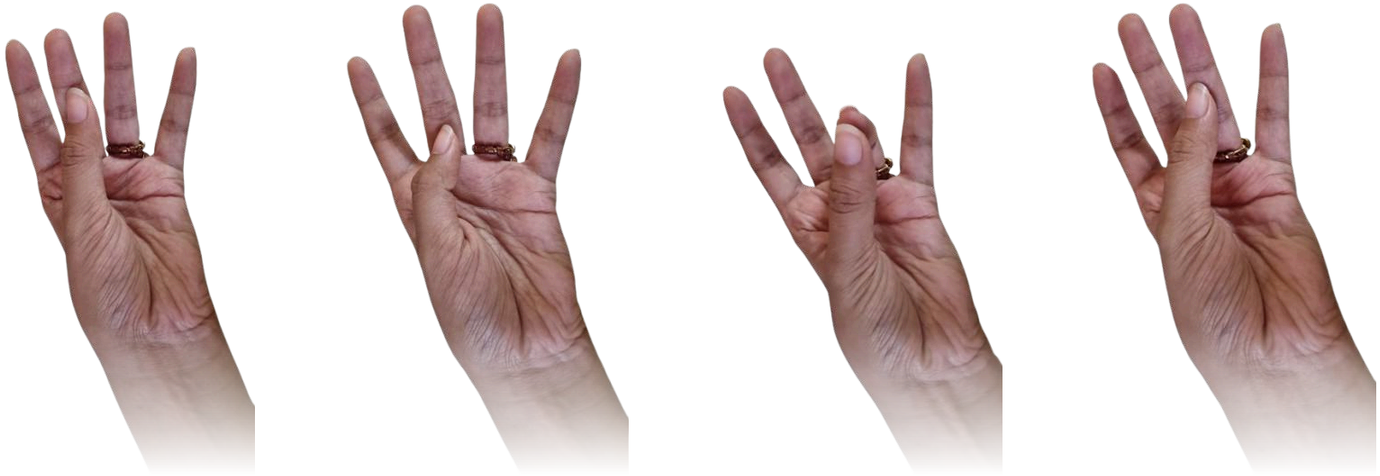
The four fingers is divided into 16 bols of the tabla and the vocalist would use their thumb to touch each of the sections for time keeping.



THALAM GESTURES

The following is to show how a vocalist would count thalam. The following eight are examples





What if?

There was a system where the vocalist could not only count the tals but also emit the sound of the bol corresponding to the gesture.

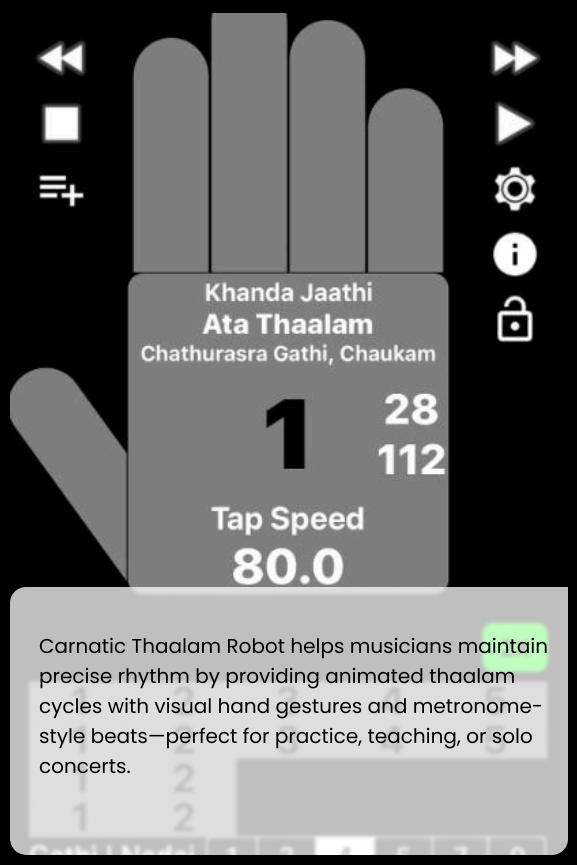
Need?

This allows for real time performance for students who are practicing without the need for a tabla player.

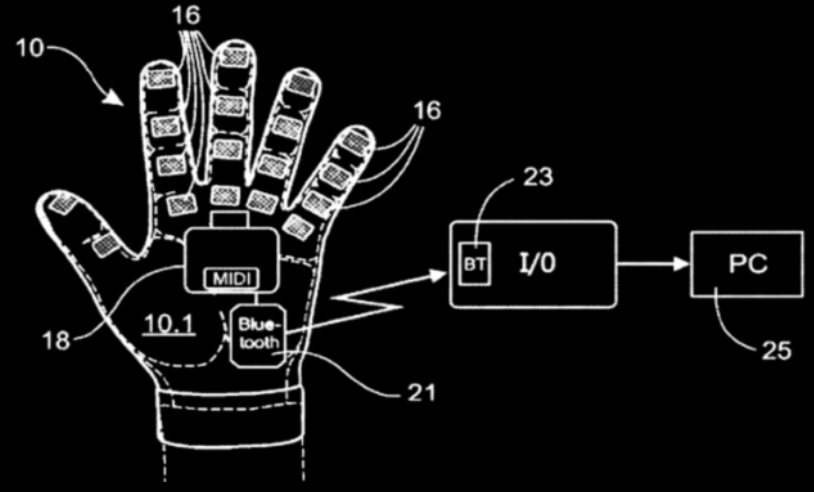
MARKET

TAAL BOT

IPAD VS MUSIC GLOVE



Carnatic Thaalam Robot helps musicians maintain precise rhythm by providing animated thaalam cycles with visual hand gestures and metronome-style beats—perfect for practice, teaching, or solo concerts.



This project enables real-time musical performance by translating hand gestures and muscle movements into sound through a wearable glove. Using embedded sensors like flex sensors and IMUs, the glove becomes an expressive interface for live composition and performance.

PROTOTYPING

The Tabla Glove underwent several design iterations to **improve finger mobility and prevent short circuits.** The initial version used four trigger rings per finger , connected to an Arduino Uno via jumper cables, resulting in a wired and bulky setup. Various materials were tested for the rings, including 3D-printed parts, copper tape, and aluminium wire with electrical insulation. To reduce clutter, the cables were later stitched into the glove. A key improvement came with the use of conductive yarn, which replaced 16 jumper cables, offering a more streamlined and flexible solution. The transition to ESP32 boards enabled wireless communication, further enhancing comfort and freedom of movement during use.

1. Rings + Copper wire three forth cover
2. Copper wire with tape
3. Conductive wires

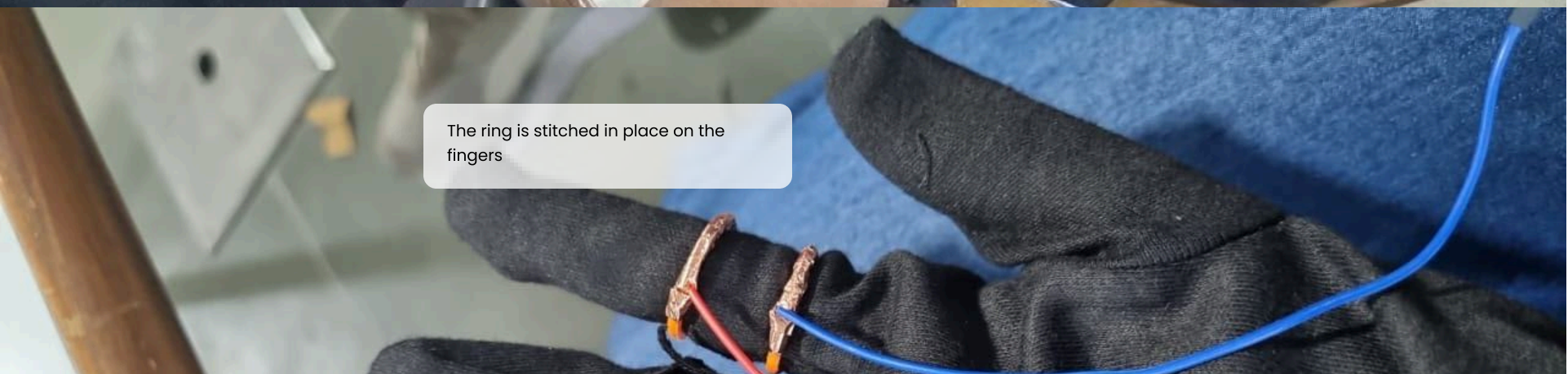
COMFORT MOBILITY

I. COPPER WIRE

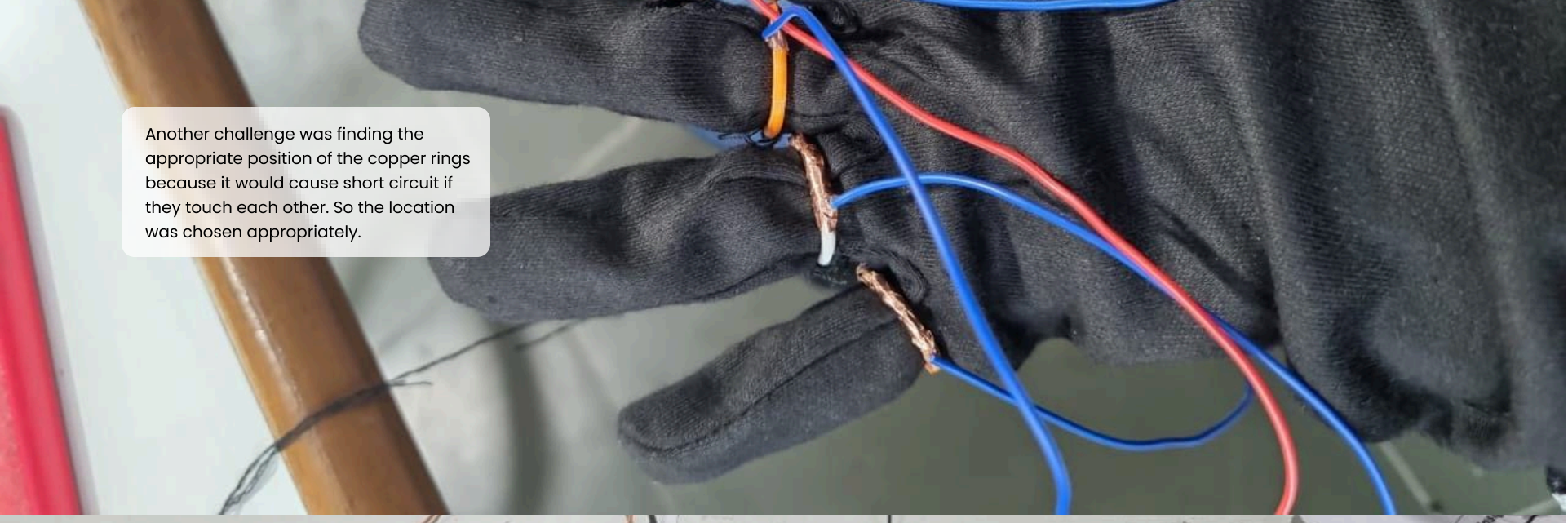
The use of copper wire didnt go too far, it was too flimsy, ergonomically inconvenient and increased chance of short circuit, so a 3D printed option was chosen, And with this approach we saw more challenges.

2. RINGS + COPPER TAPE + TAPE

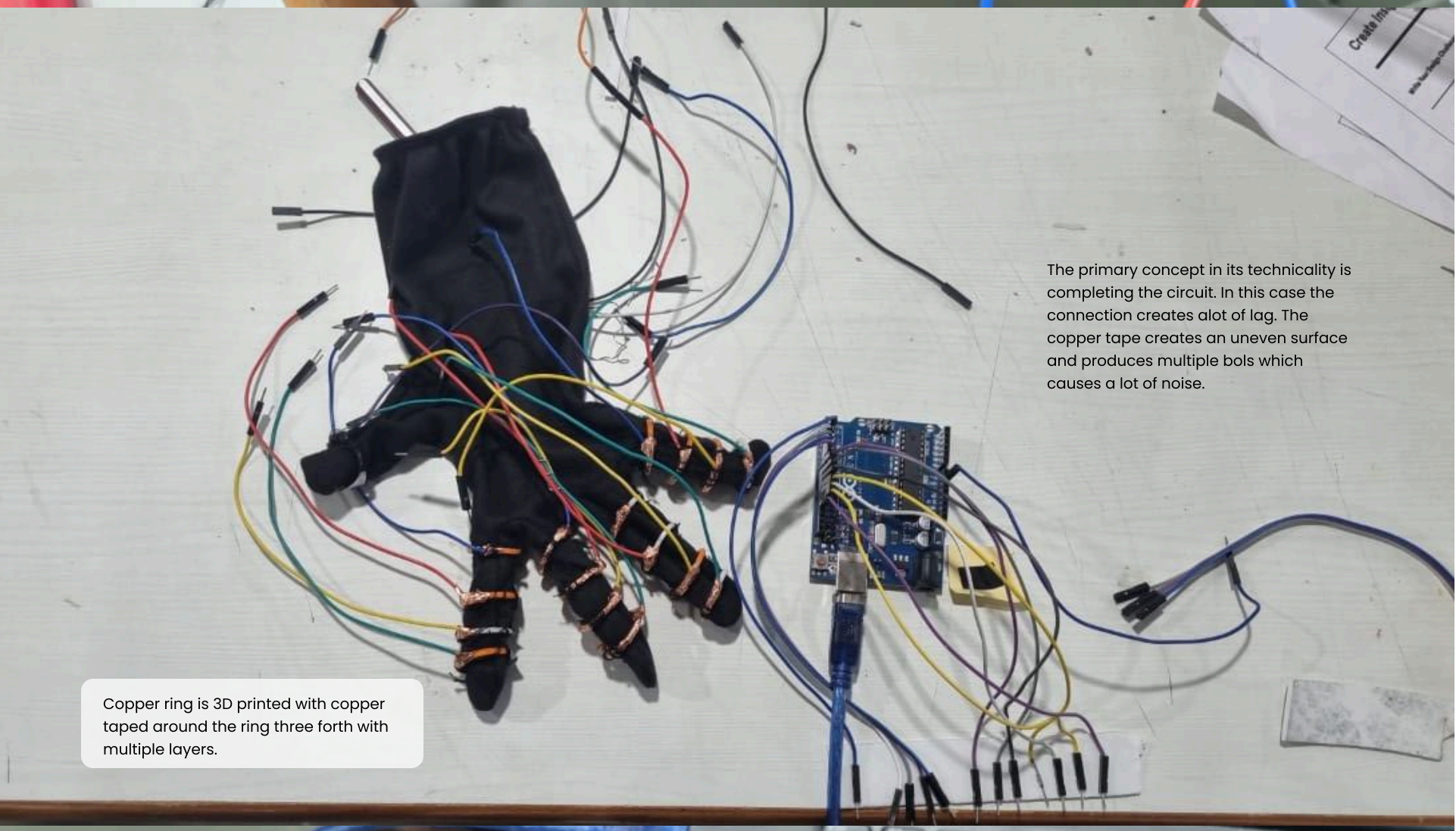
Copper 3D print to keep the segments corresponding to the bols.



The ring is stitched in place on the fingers

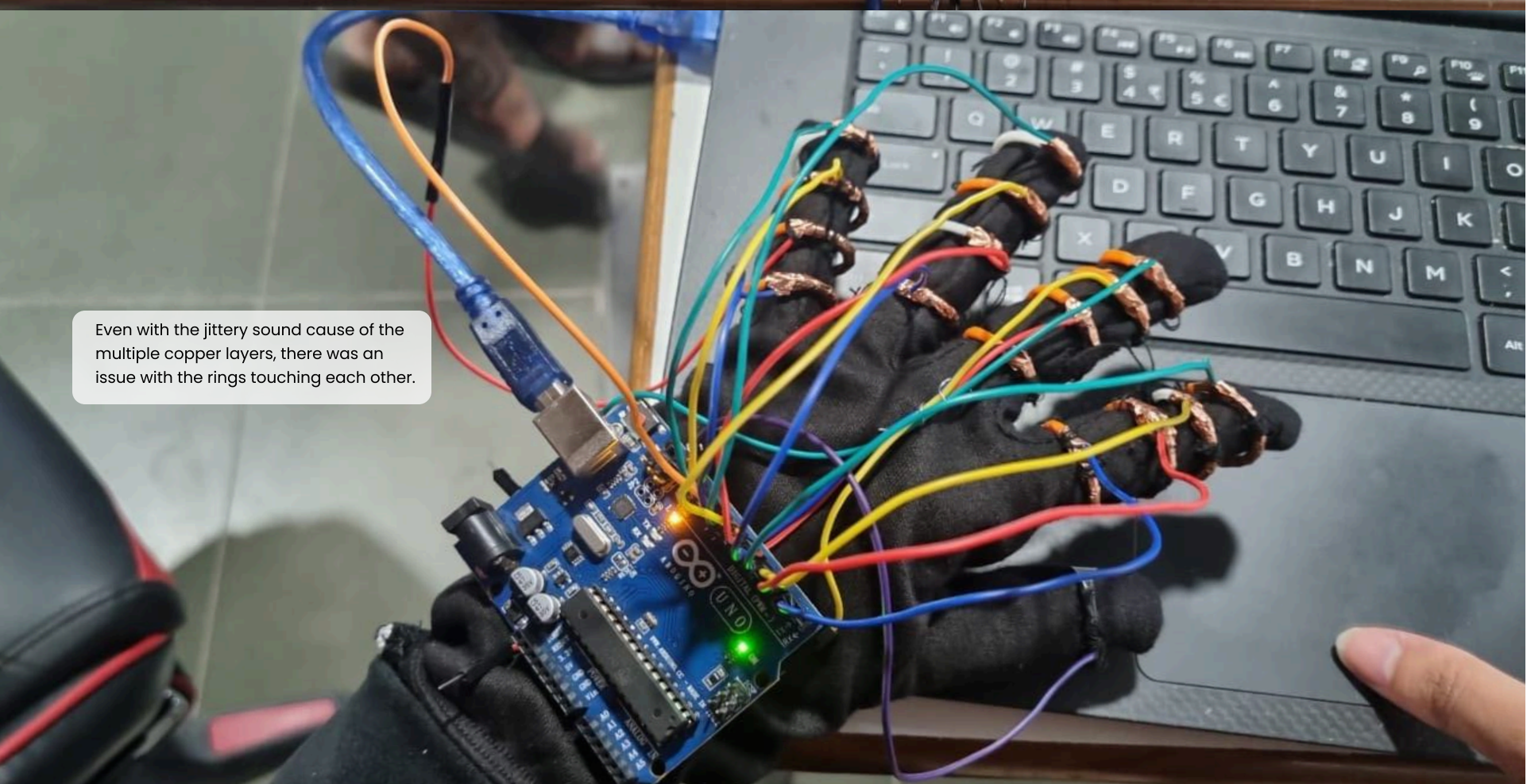


Another challenge was finding the appropriate position of the copper rings because it would cause short circuit if they touch each other. So the location was chosen appropriately.



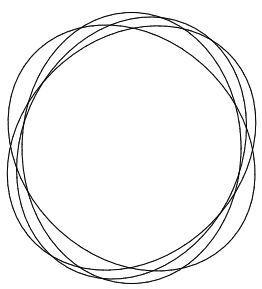
The primary concept in its technicality is completing the circuit. In this case the connection creates alot of lag. The copper tape creates an uneven surface and produces multiple bols which causes a lot of noise.

Copper ring is 3D printed with copper taped around the ring three forth with multiple layers.

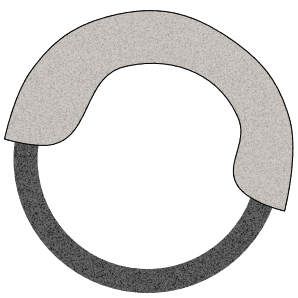


Even with the jittery sound cause of the multiple copper layers, there was an issue with the rings touching each other.

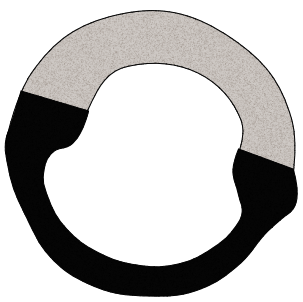
A WAY TO SUMMARIZE..



Copper wire rings are too flimsy , high risk of short circuit .

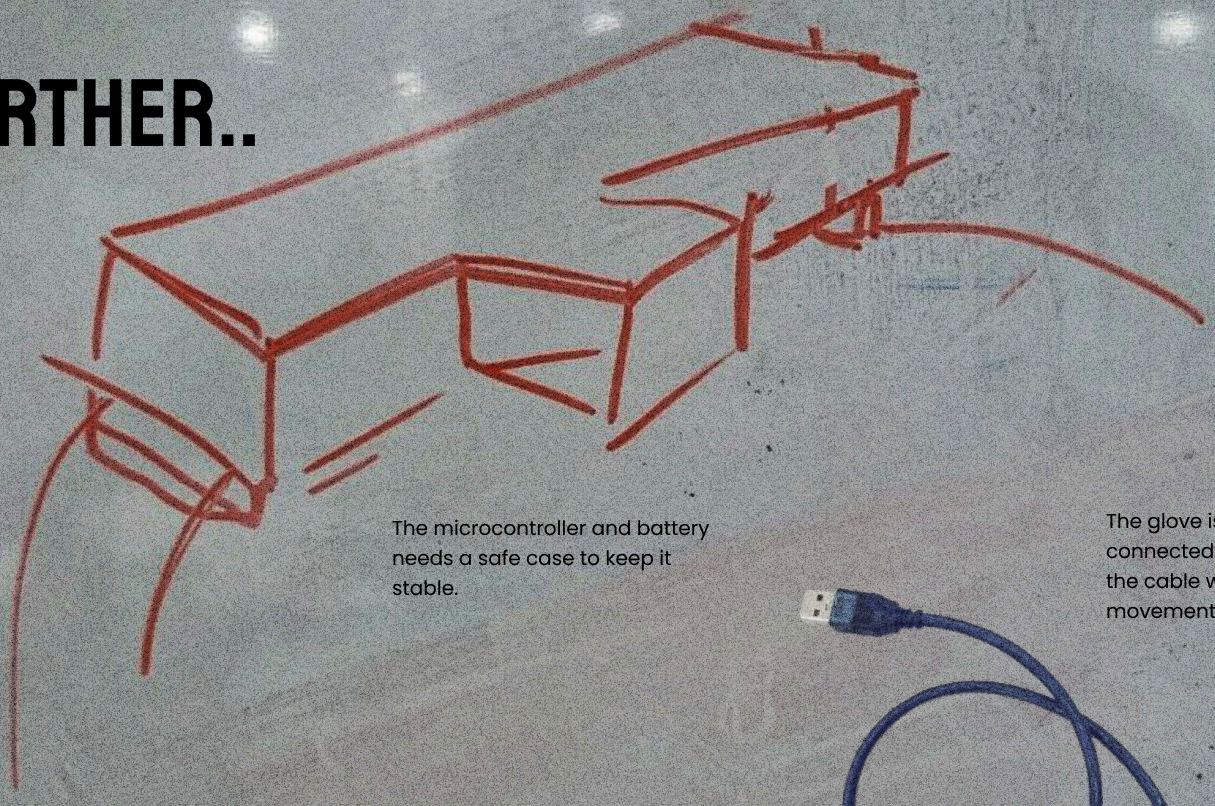


Restricts mobility ,jittery sounds cause of multiple copper layers and causes risk of short circuiting.

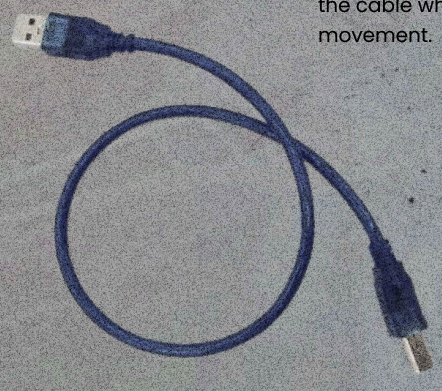


Solved problem for short circuiting but the jittery sounds havent been solved.

FURTHER..

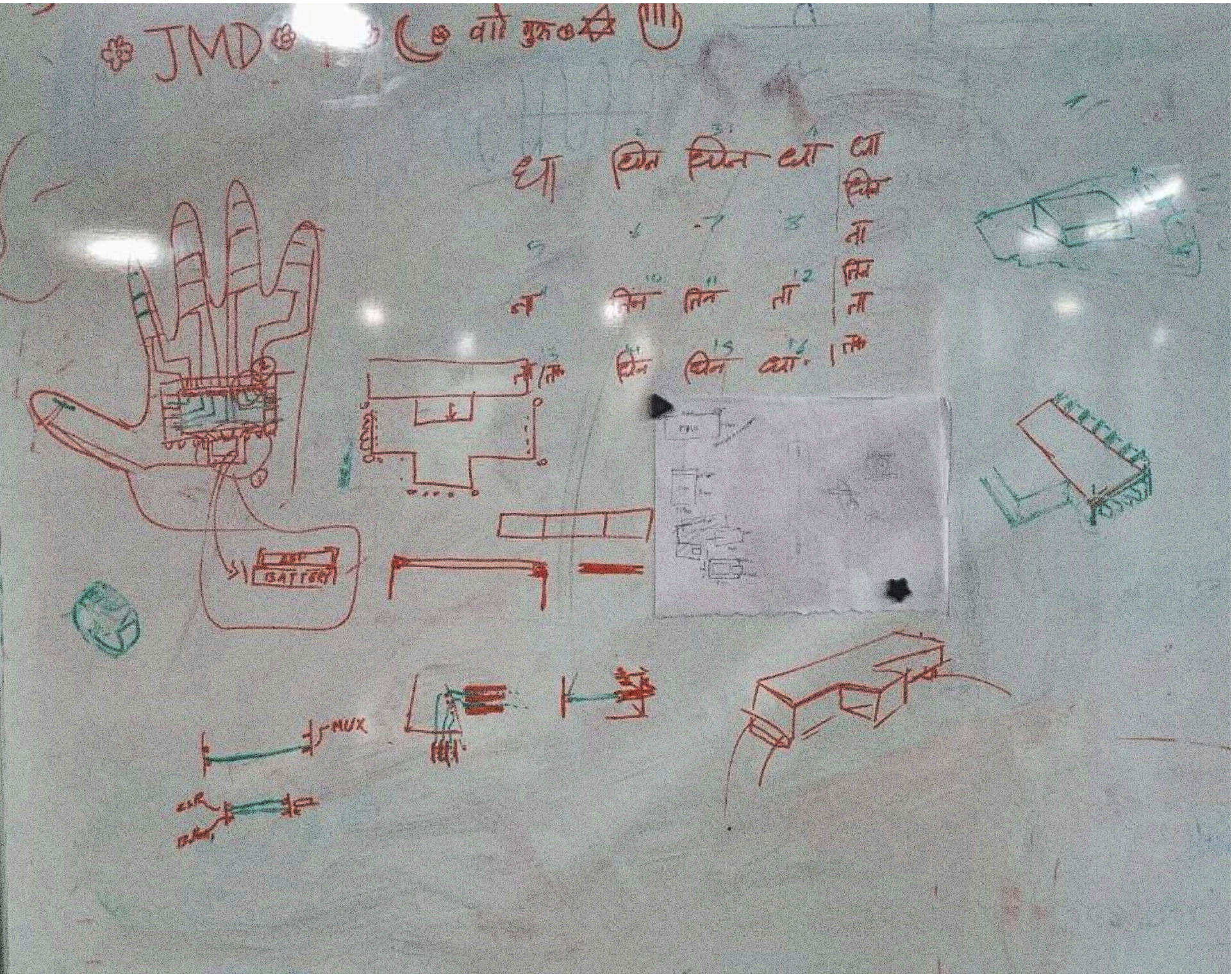


The microcontroller and battery needs a safe case to keep it stable.

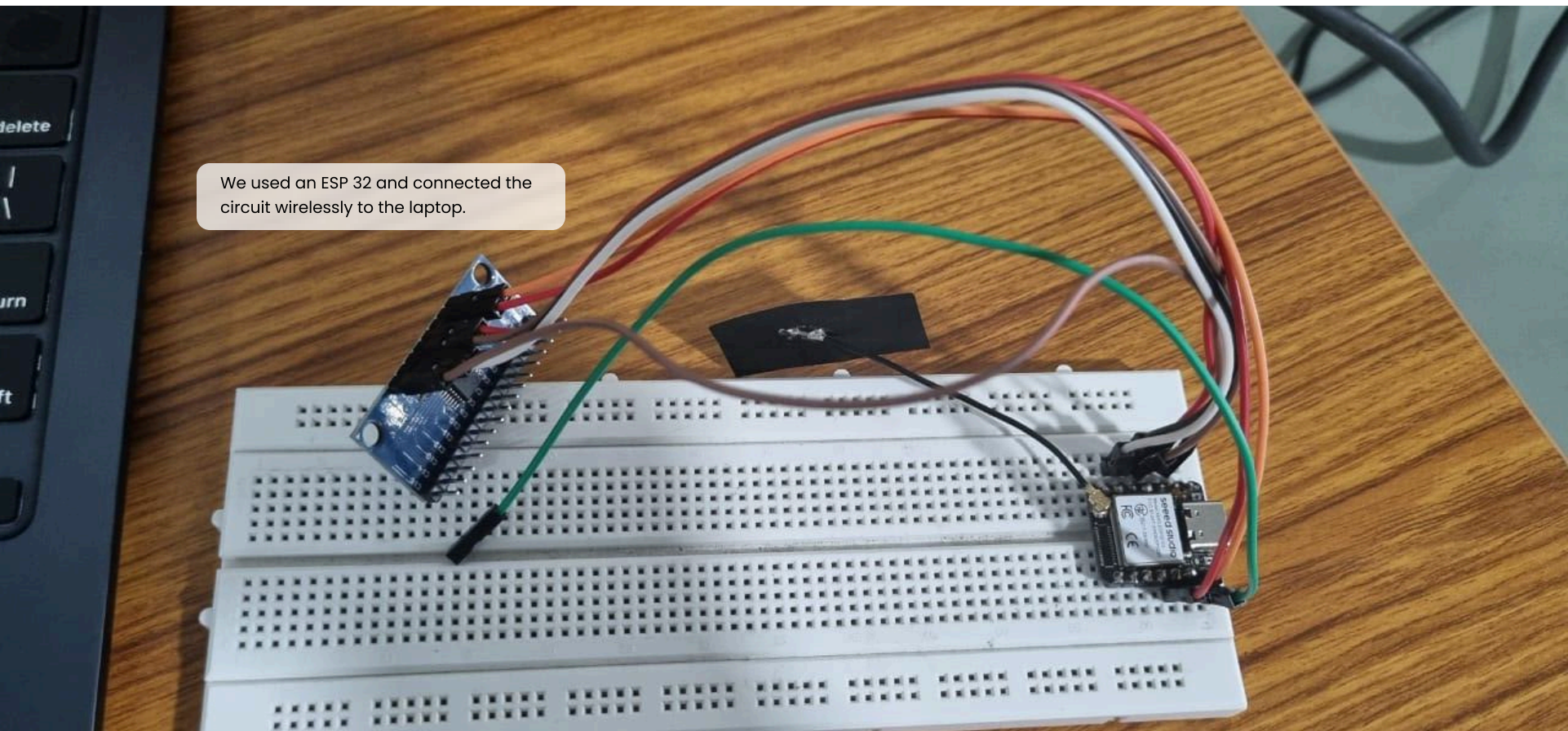


The glove is works only when it is connected to the laptop through the cable which hinders natural movement.

SO WE START OVER...

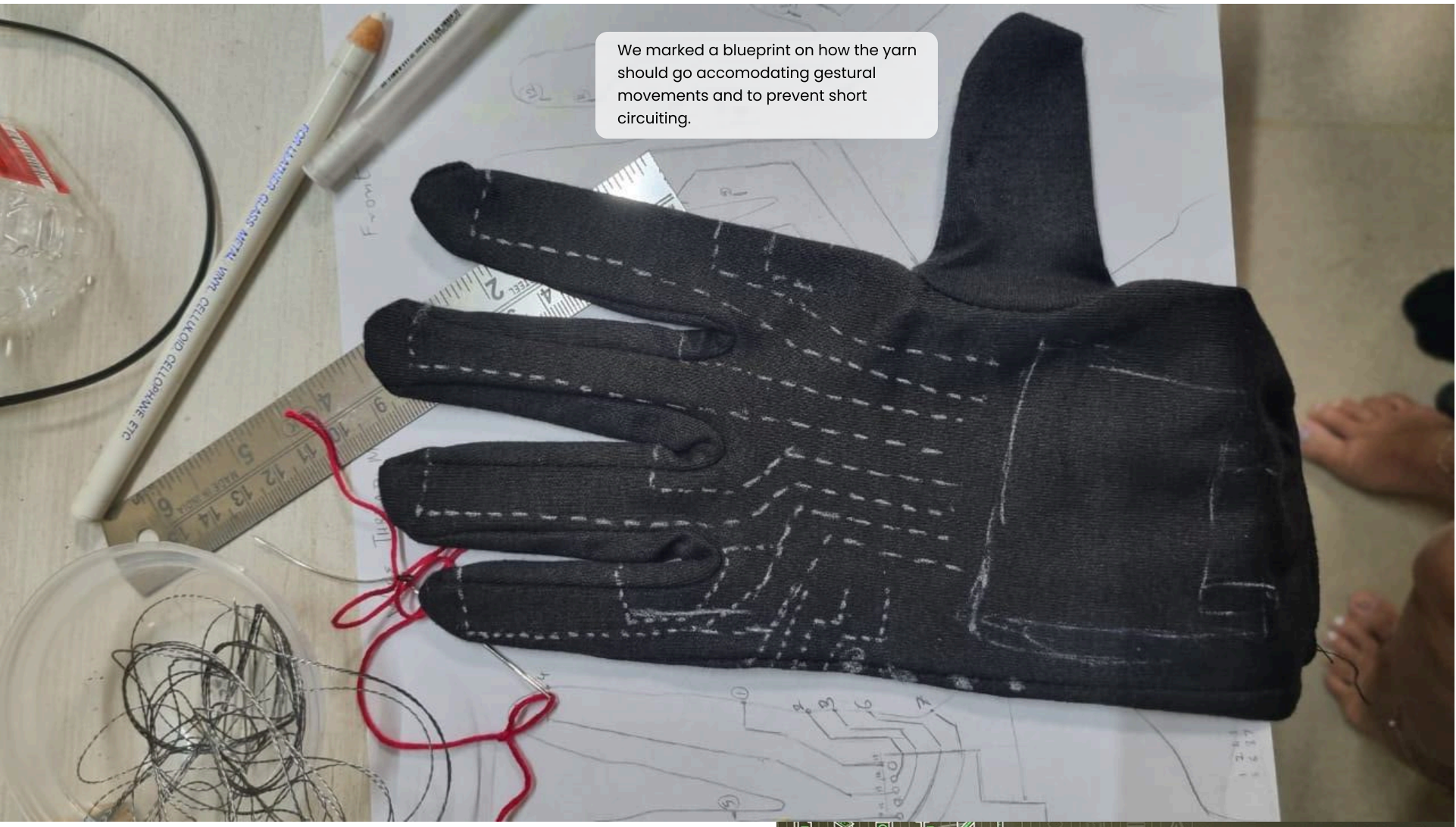


TECHNICALITY



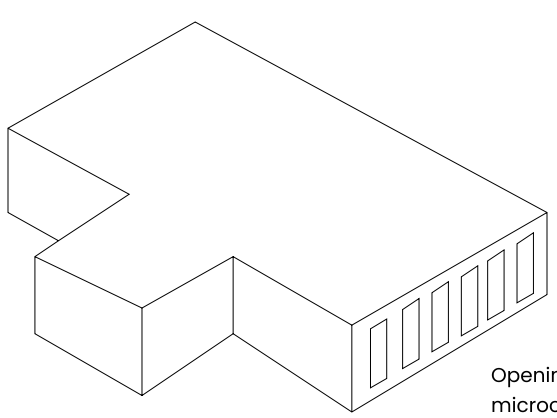
NOW FOR THE GLOVE..

We decided to use conductive yarns and stitch it on the glove. We decided to make two layers of glove to prevent the yarn from brushing the skin.



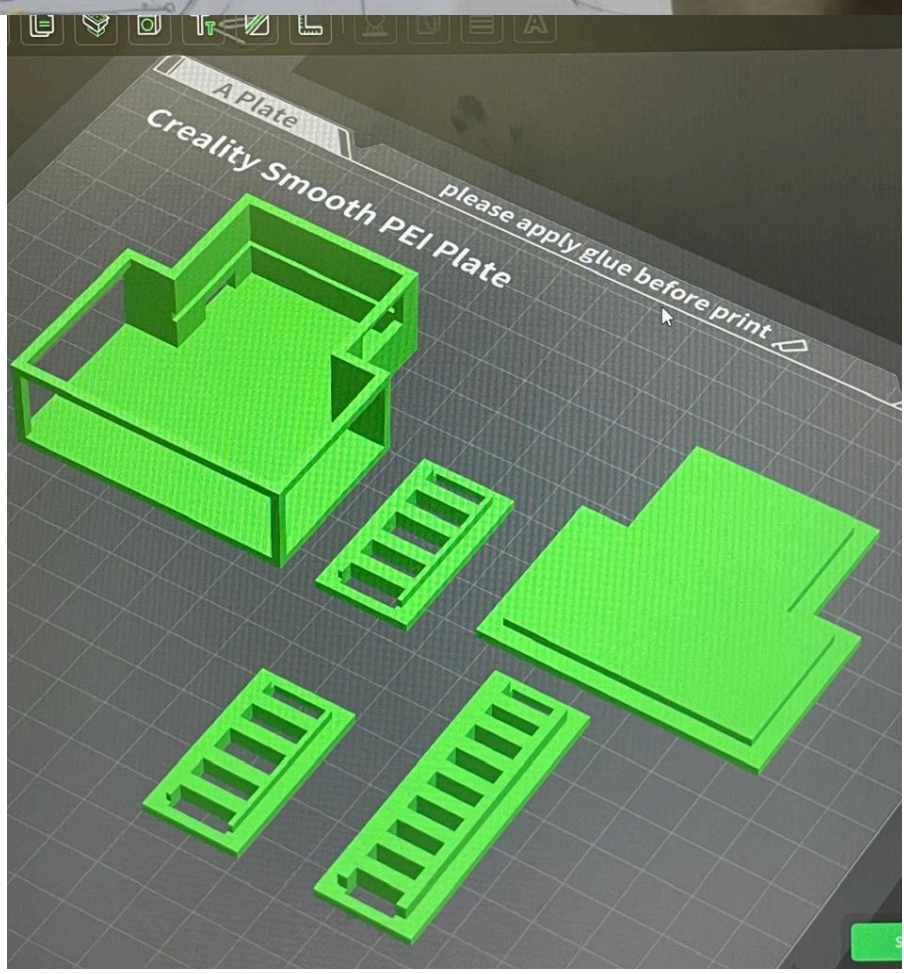
We marked a blueprint on how the yarn should go accomodating gestural movements and to prevent short circuiting.

THE CASE

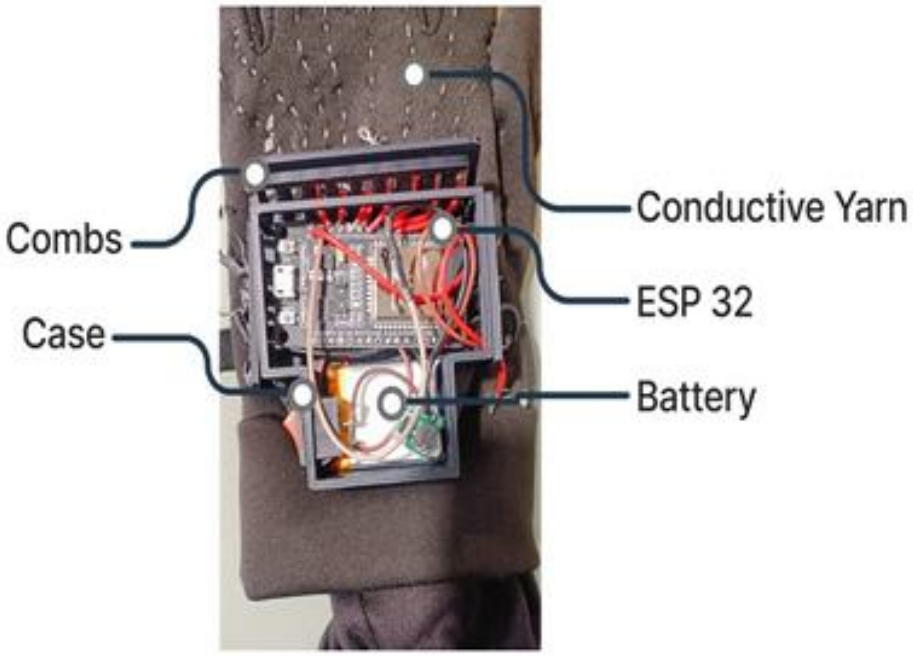


battery space

Openings where the microcontroller connects with the conductive yarns



CIRCUIT



The thumb and the contact points interact, the circuit is complete, which causes current in the conductive yarn th...

↓

The digital connections are transmitted to the XIAO Board.

↓

The XIAO Board maps the Digital data into MIDI numbers

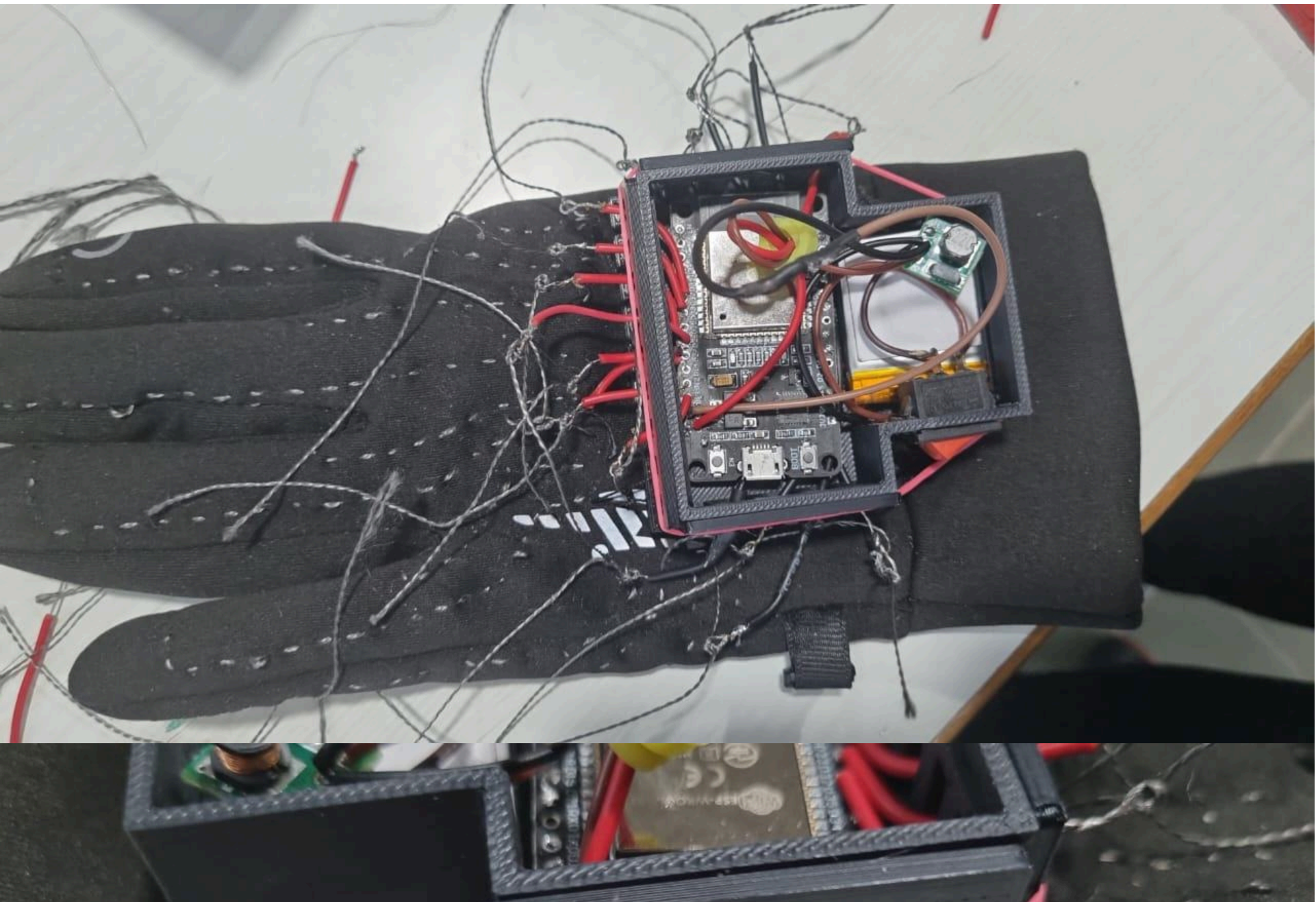
↓

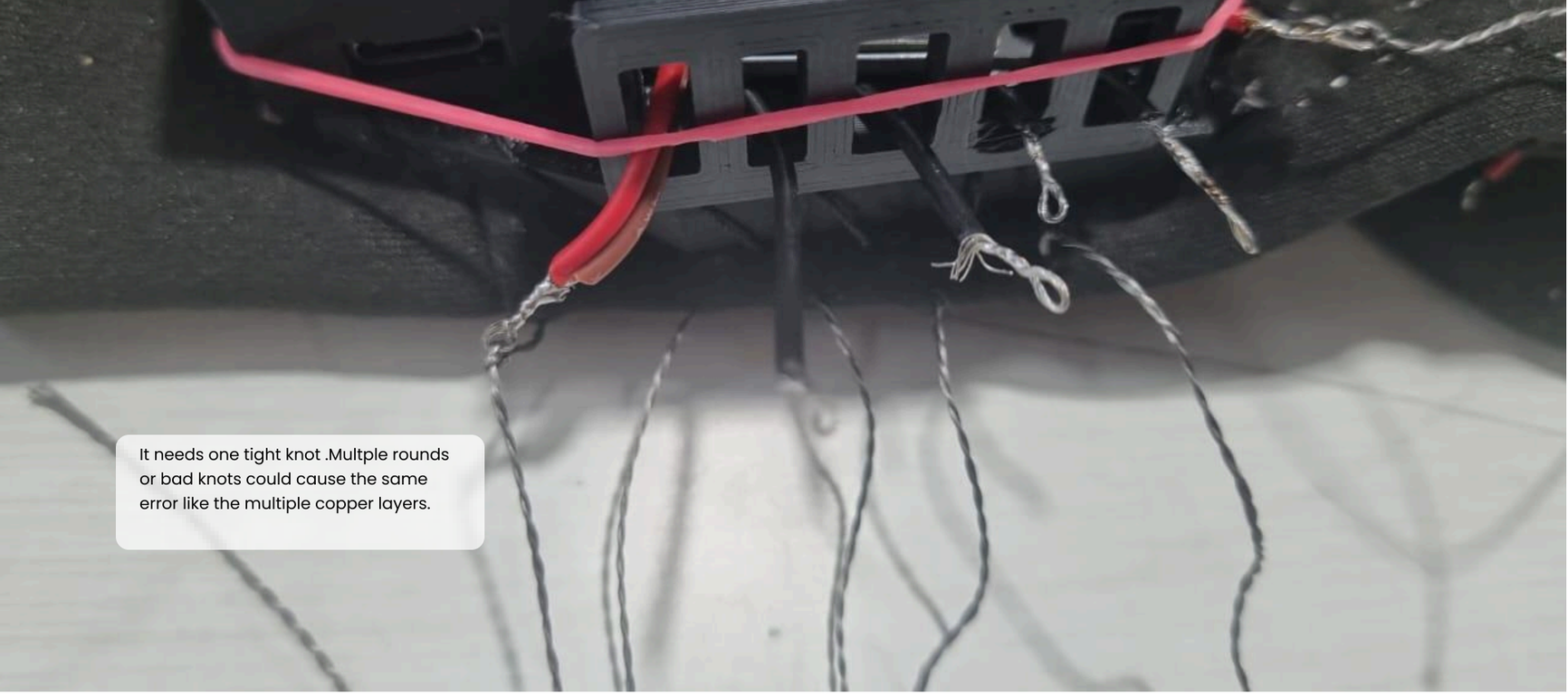
The data goes to LoopMIDI and Hairless MIDI and into DAW (Studio one 7)

↓

Sound is transmitted in external speakers

Both elements are set, both the casing with the circuit and the stitching of the conductive yarns. The real challenge hers is connecting the yarn to the loop.

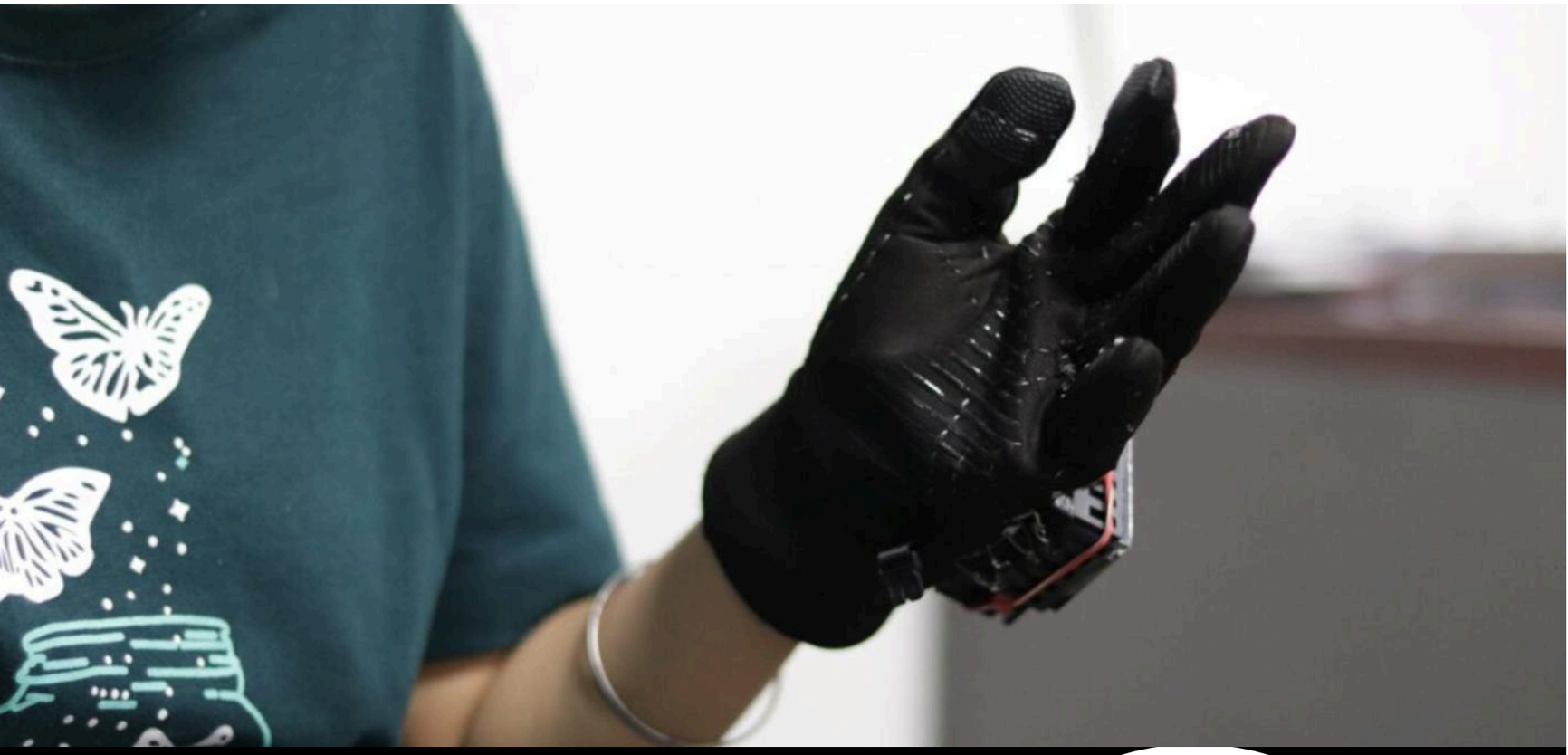




It needs one tight knot .Multple rounds or bad knots could cause the same error like the multiple copper layers.

PROTOTYPE 3

Clean, less weight and better mobility



RESEARCH QUESTION

To what extent can the table Glove act as a suitable (explain 'suitable' in paper) accompaniment to Hindustani classical singers while practising.

How do people in the Indian classical music space, view this tabla glove incorporating taala counting gestures, which is not using traditional methods of sound generation?

PROBING

I) First Reactions – How do users react when first introduced to the glove?

II) Learning Curve – How long does it take to understand how to use it?

III) Finger Interactions – Do they struggle to find the correct finger points?

IV) Rhythm Accuracy – Are they able to maintain the rhythmic cycle correctly?

V) Physical Movements – Are they using too much or too little force while playing?

VI) Latency Issues – Do they notice a delay between touch and sound output?

VII) Engagement Level – Are they enjoying the experience, feeling frustrated, or finding it useful?

VIII) Performance Adaptation – Can trained musicians seamlessly use it while practicing?

SEMI -STRUCTURED INTERVIEW

1. First impressions & Learning

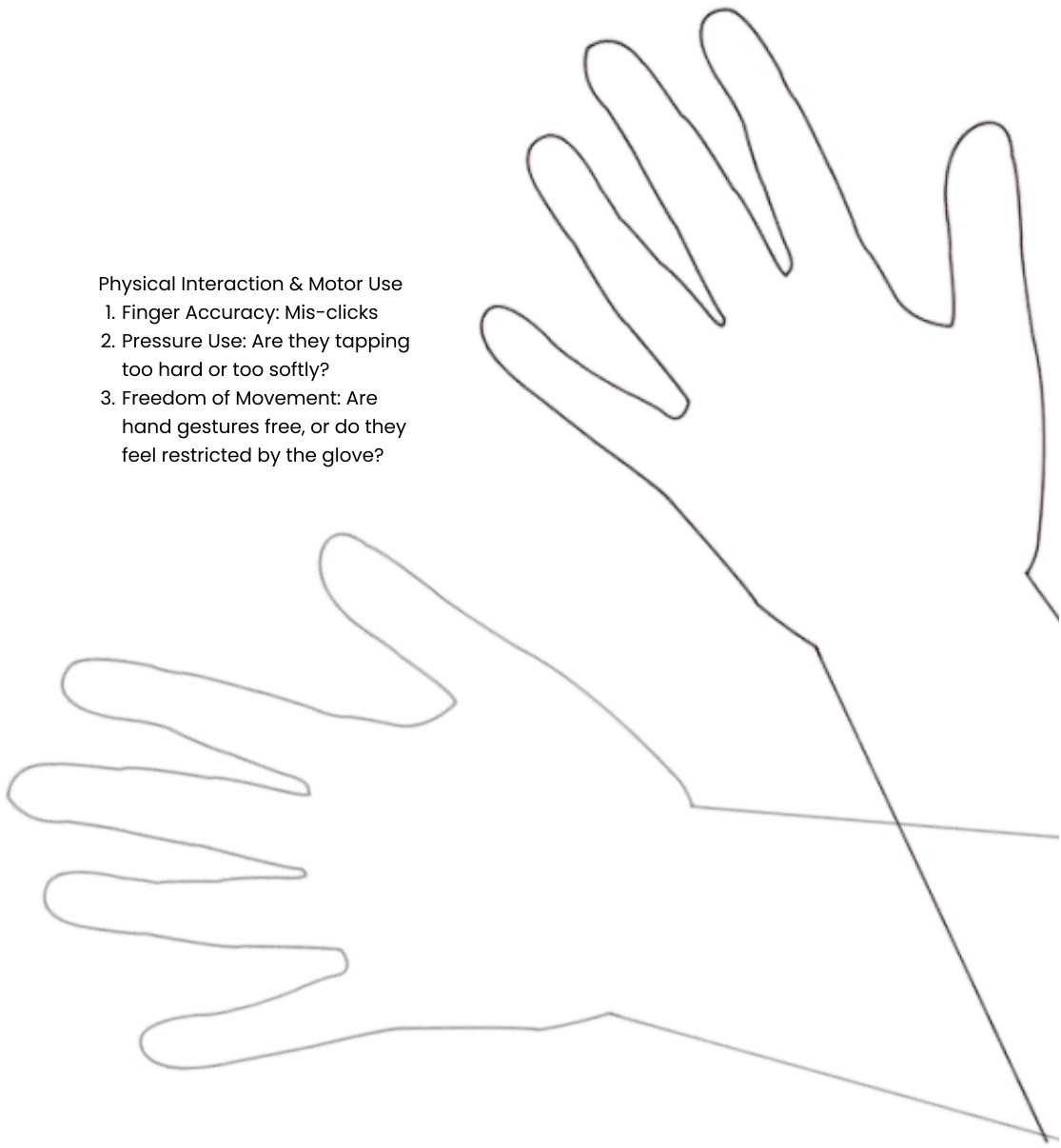
1. Initial Reaction: Body language, verbal cues, or emotional responses when introduced to the glove.
2. Time to Learn: How long it takes the user to understand and start using the glove.
3. Comfort Level: Does the glove fit well? Any visible discomfort or fidgeting?
4. Fitting issues: How they adjust the glove for their need
5. Learning Challenges: Are there moments of confusion? Do they ask for help?

Multitasking & Cognitive Load

1. Attention Division: Does operating the glove cause them to forget song lyrics or miss beats?
2. Multitasking Impact: Do they struggle to keep rhythm or taal while singing?
3. Rhythm Accuracy: Can they maintain the correct taal structure (e.g., Teentaal) while singing and using the glove?
4. Any other activities a person is doing while wearing the glove.
5. Mistouches: How often do they trigger unintended sounds?
6. Reaction to Mistouches: Do they visibly get frustrated or try to adjust?

Physical Interaction & Motor Use

1. Finger Accuracy: Mis-clicks
2. Pressure Use: Are they tapping too hard or too softly?
3. Freedom of Movement: Are hand gestures free, or do they feel restricted by the glove?



Overall Engagement & Use

1. Engagement Level: Are they focused, enjoying, or disengaging?
2. General Body Movement: Are movements stiff or flowing naturally with rhythm?

USABILITY TEST & THEMES

Participants were introduced to the device and were asked to explore and familiarize themselves with it. The two tasks were then assigned in sequence. Any doubts the participants had were cleared by the moderator. Once they were done with the tasks, the participants were asked to remove the device and proceed for the interview. In the semi-structured interview, 3 people were involved: 1 researcher who was taking the interview, 1 researcher who was the passive listener, and 1 participant who was part of the study. A total of 4 interviews were done. The predetermined questions are attached in the supplementary material.

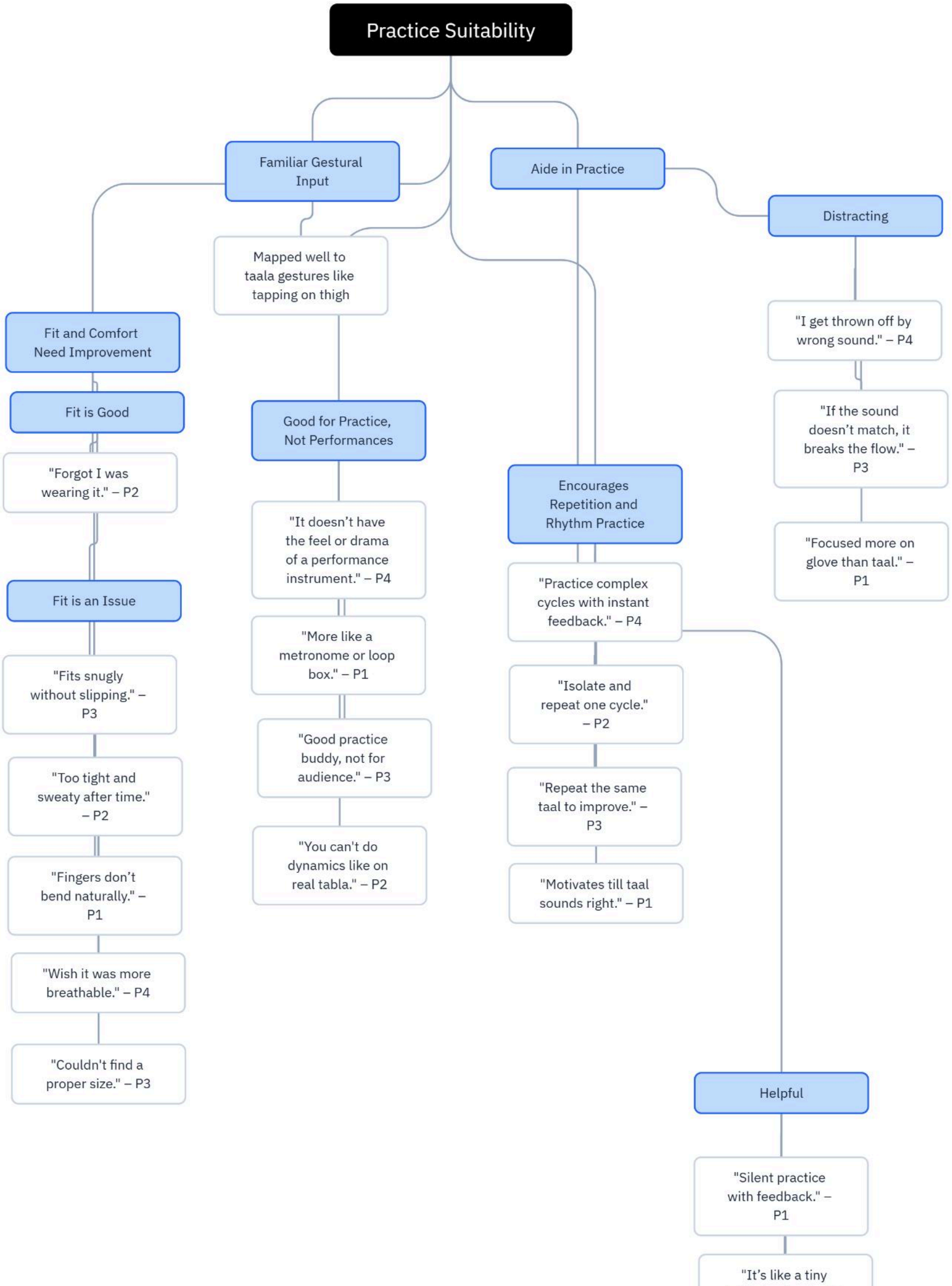
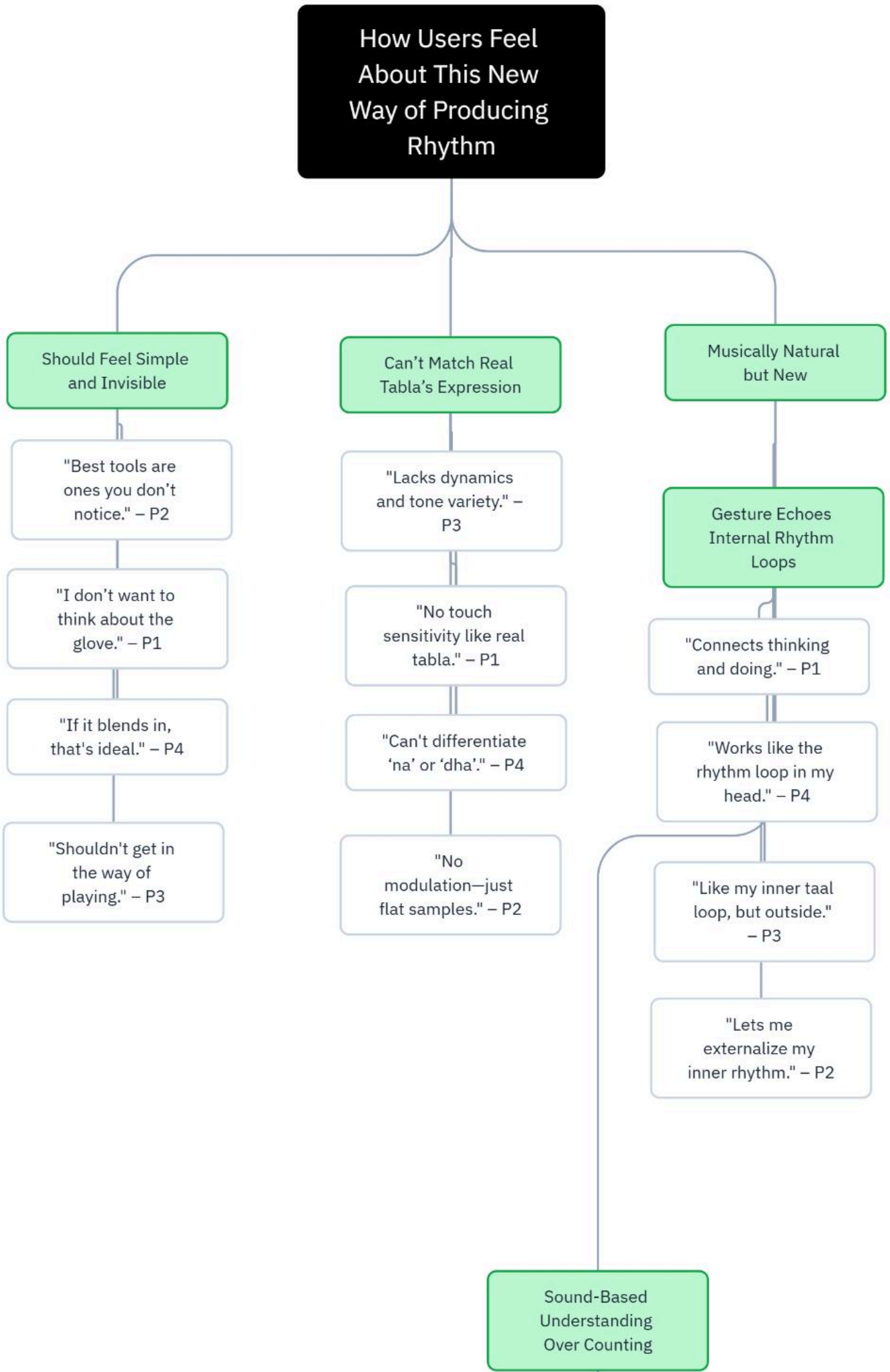
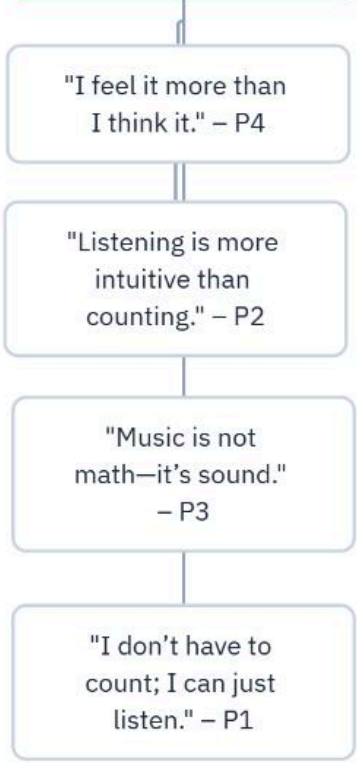

Practice Suitability
Familiar Gestural Input
Aide in Practice
Distracting
Mapped well to taala gestures like tapping on thigh
Fit and Comfort Need Improvement
Fit is Good
"Forgot I was wearing it." – P2
Fit is an Issue
"Fits snugly without slipping." – P3
"Too tight and sweaty after time." – P2
"Fingers don't bend naturally." – P1
"Wish it was more breathable." – P4
"Couldn't find a proper size." – P3
Good for Practice, Not Performances
"It doesn't have the feel or drama of a performance instrument." – P4
"More like a metronome or loop box." – P1
"Good practice buddy, not for audience." – P3
"You can't do dynamics like on real tabla." – P2
Encourages Repetition and Rhythm Practice
"Practice complex cycles with instant feedback." – P4
"Isolate and repeat one cycle." – P2
"Repeat the same taal to improve." – P3
"Motivates till taal sounds right." – P1
"I get thrown off by wrong sound." – P4
"If the sound doesn't match, it breaks the flow." – P3
"Focused more on glove than taal." – P1
Helpful
"Silent practice with feedback." – P1
"It's like a tiny

tabla teacher." – P4

"It tells me if I'm on time." – P2





flowchart.fun

RESULTS

Based on the results from the thematic analysis, it was found that the participants saw the glove as a viable device for personal practice. Additionally, they felt the interaction was engaging and supported sound-based learning. The interaction was immersive, as the finger counting resonated with the traditional methods of counting taals, making the process intuitive.

The device also had some limitations which were highlighted during the study. There were instances where the cognitive load was becoming high for the participants, especially when they were asked to sing and count taals at the same time. A few associated this with a lack of practice with the device. The latency and the treble were another issue which was hindering the performance of the glove and making it difficult for the participants to keep beat.In terms of physical design, fit and comfort varied across users. It fit well for some people but was a bit uncomfortable for others, resulting in misclicks.

GOING FORWARD

By taking a few steps, the Tabla Glove can be made more robust and usable in a larger setting. Adding more taals would increase the use case, as would making the glove's design even more seamless and concealing the microprocessor housing compartment. Reducing latency and treble, however, will take priority, as that was the cause of major confusion among the participants and made it harder to keep the beat.

HAPTICS