



UNIVERSITY OF TRENTO - Italy
Department of Information Engineering
and Computer Science

TRAINING REACTION TOOL

Project for the course Multisensory Interactive Systems

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INTRO



Our objective was to build a **multisensory interactive system** to aid the **training of reaction time and hand-eye coordination**.

INTRO



Our objective was to build a **multisensory interactive system** to aid the **training of reaction time and hand-eye coordination**.



Sportsamen can use our system to **enhance** their ability and **other users** can **enjoy** it for their own fun.



INTRO



The **user** tries to **catch balls**, which are released from the wooden plank, before they reach the **ground**



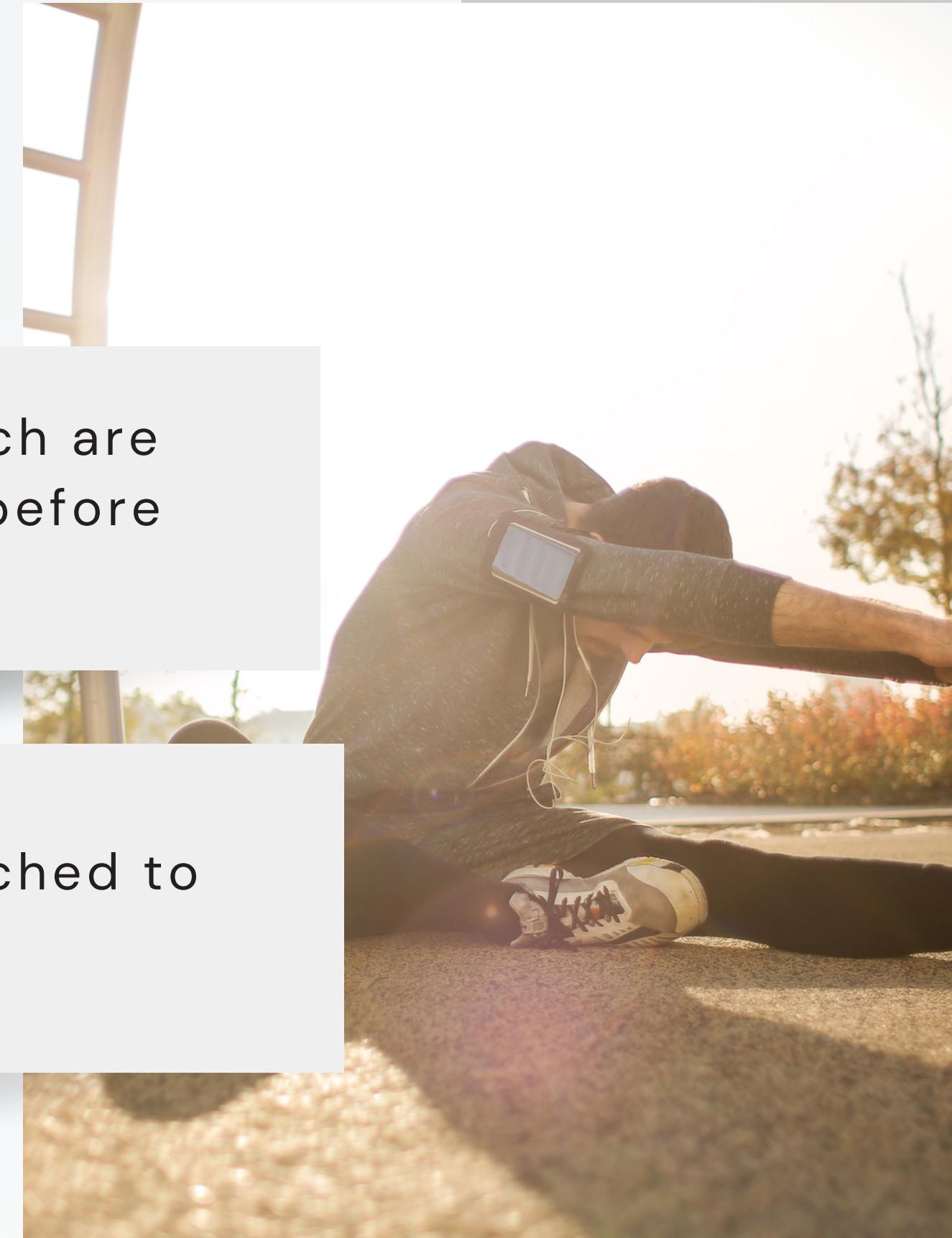
INTRO

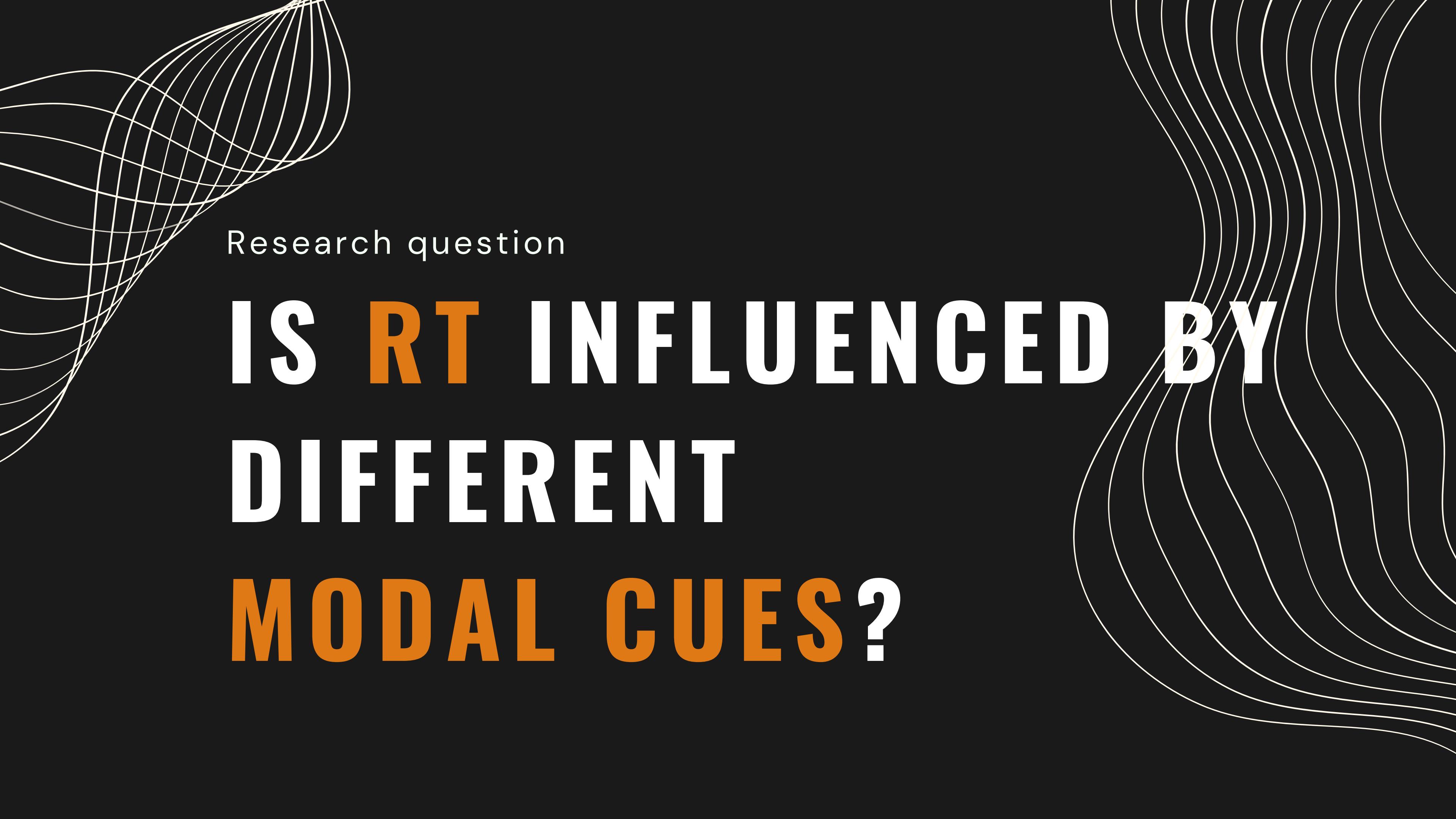


The **user** tries to **catch balls**, which are released from the wooden plank, before they reach the **ground**



Different **modal cues** can be attached to the fall to aid the catch





Research question

IS RT INFLUENCED BY DIFFERENT MODAL CUES?

HYPOTHESIS

auditory cue
> single mode stimulus

HP N°1

haptic cue
> visual stimulus

HP N°2

multimodal
> single mode

HP N°3

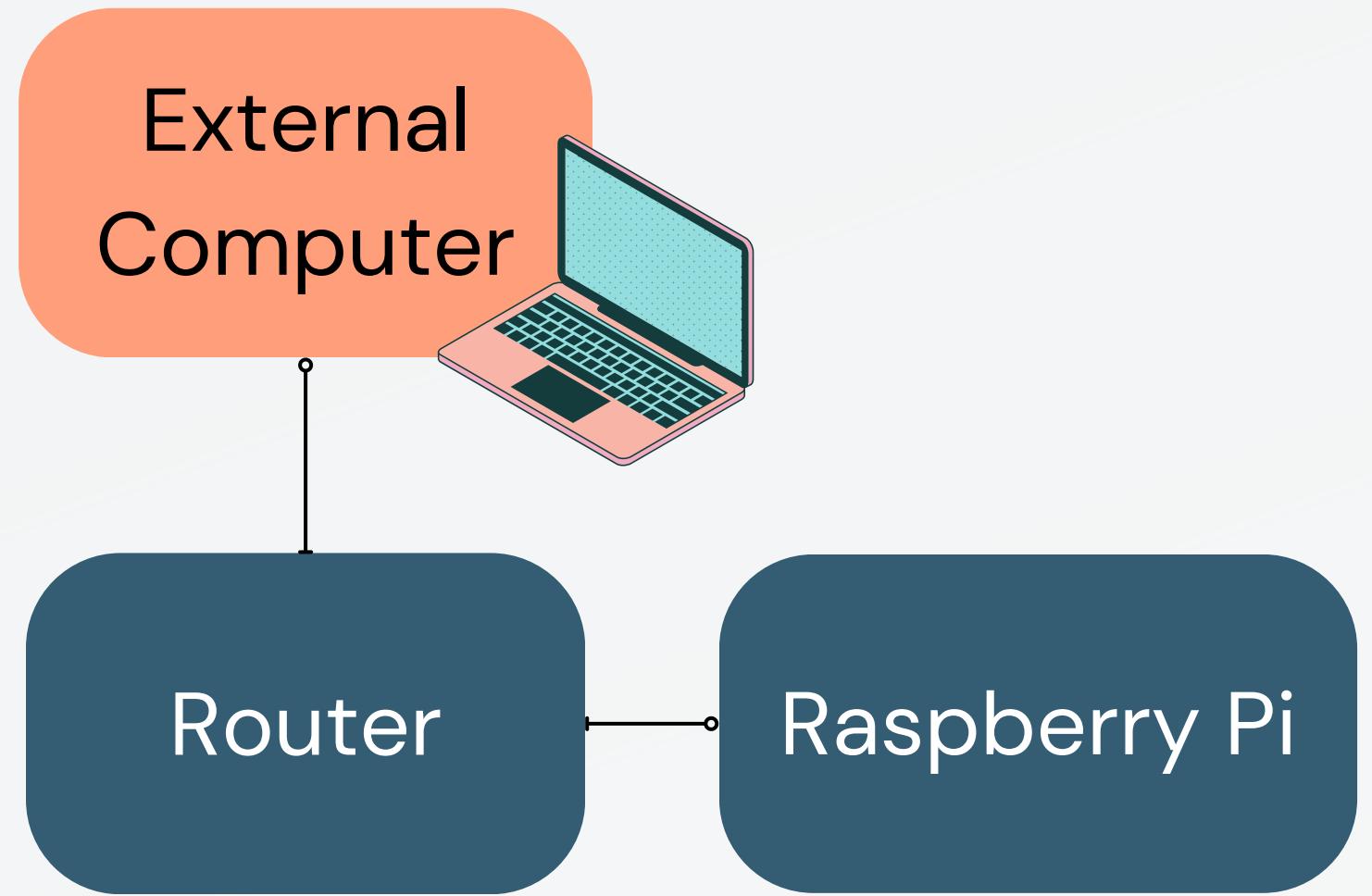
fast attack audio
> slow attack audio

HP N°4

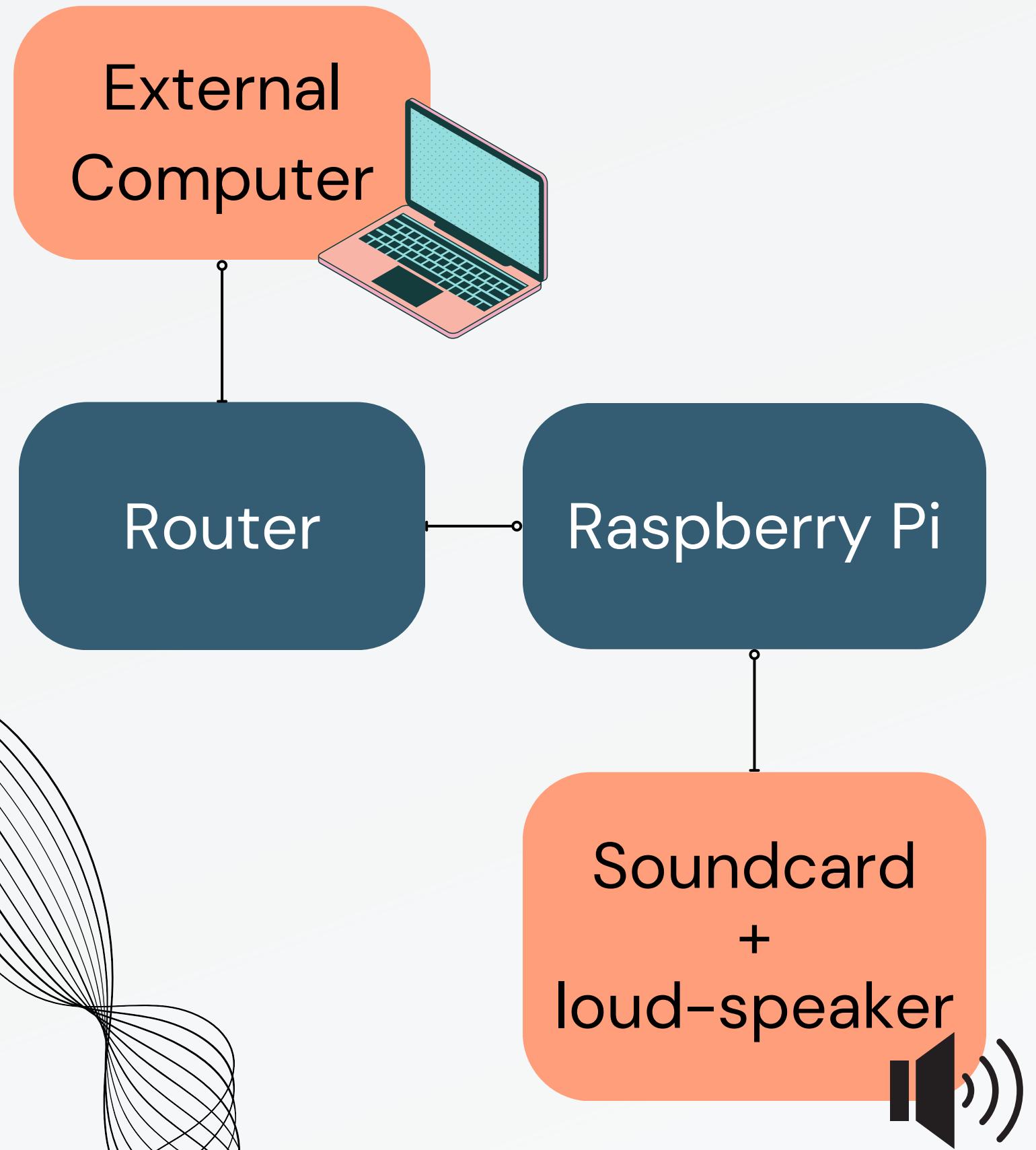
ARCHITECTURE DESIGN

Raspberry Pi

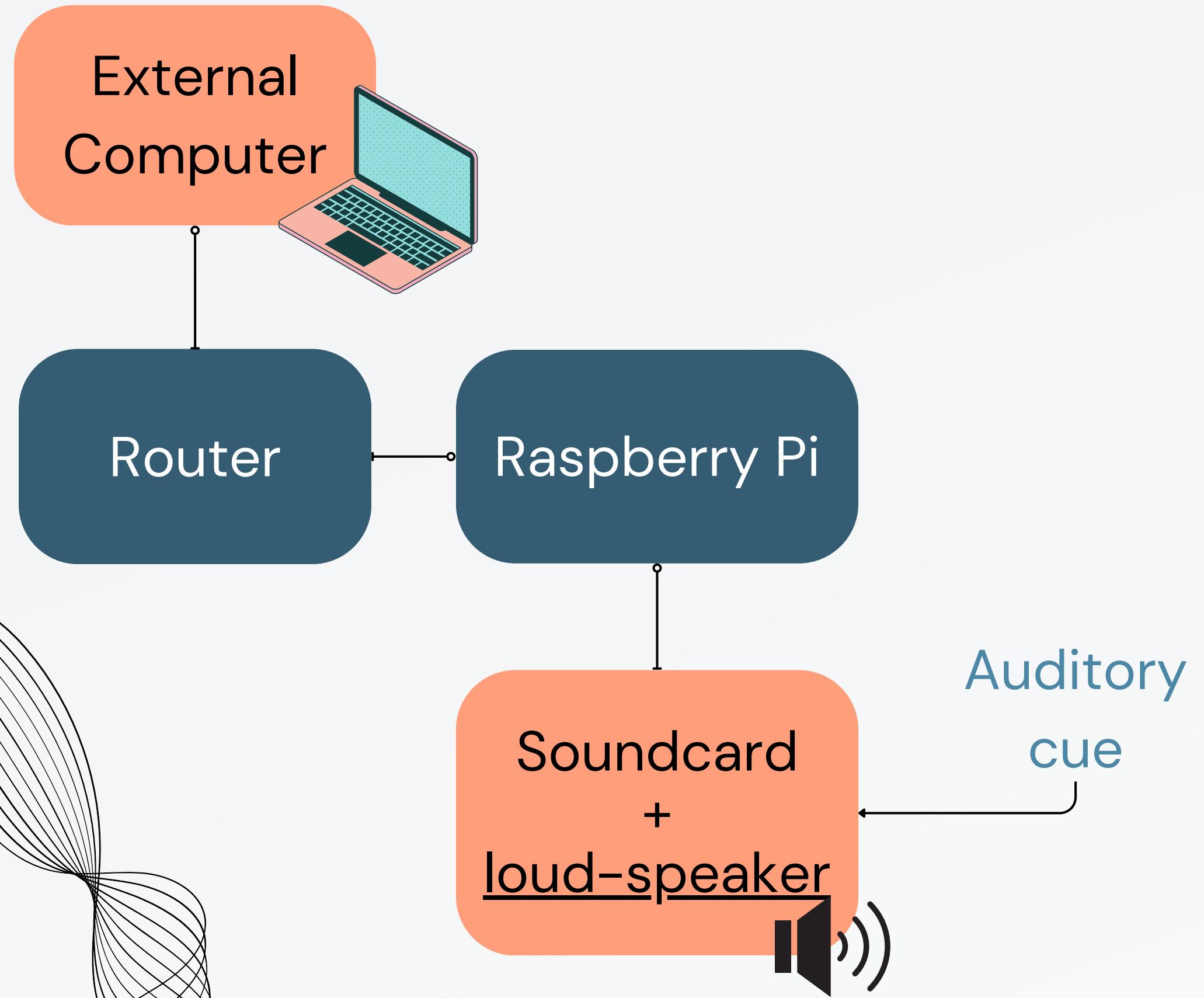
ARCHITECTURE DESIGN



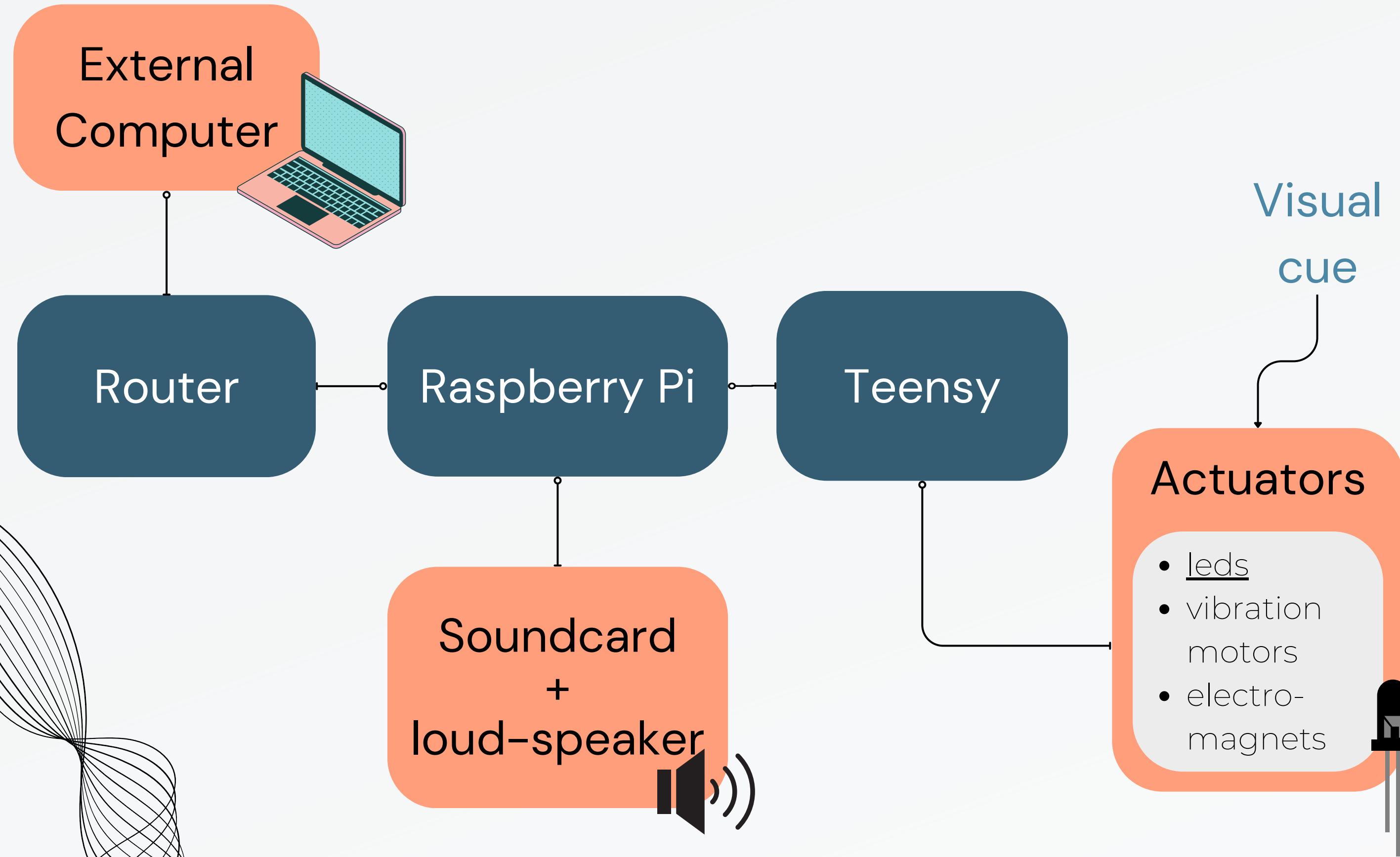
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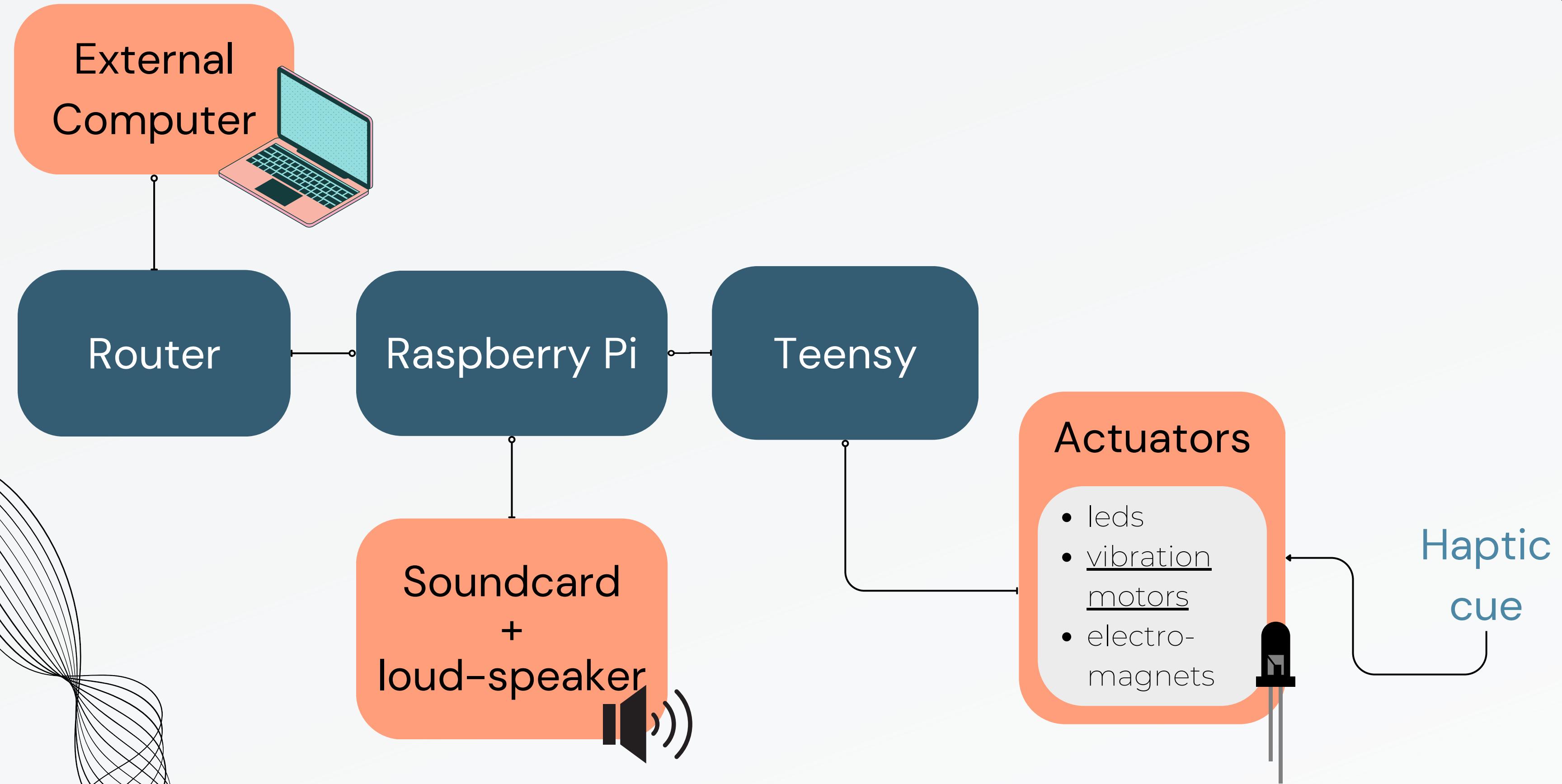
ARCHITECTURE DESIGN



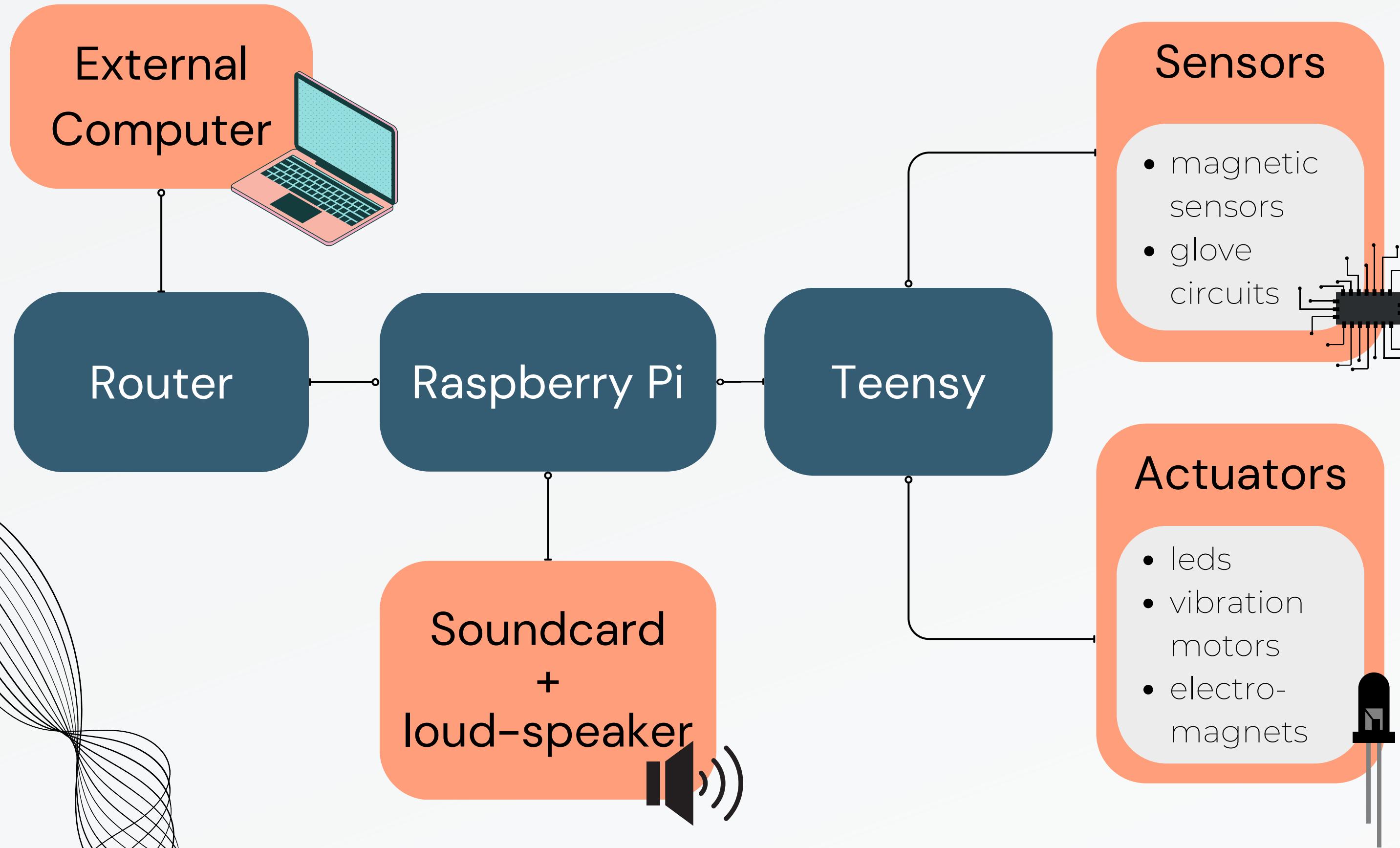
ARCHITECTURE DESIGN



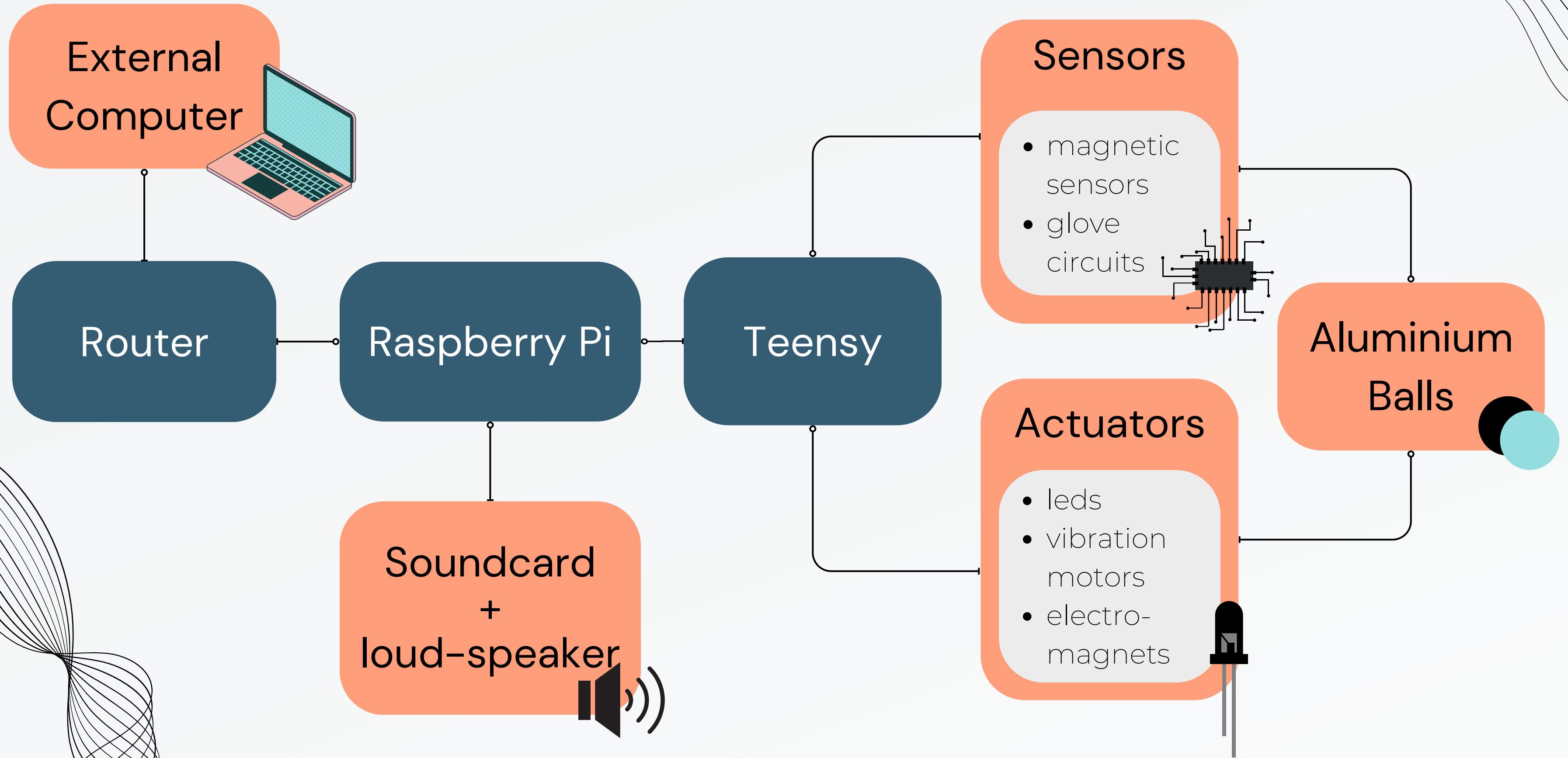
ARCHITECTURE DESIGN



ARCHITECTURE DESIGN

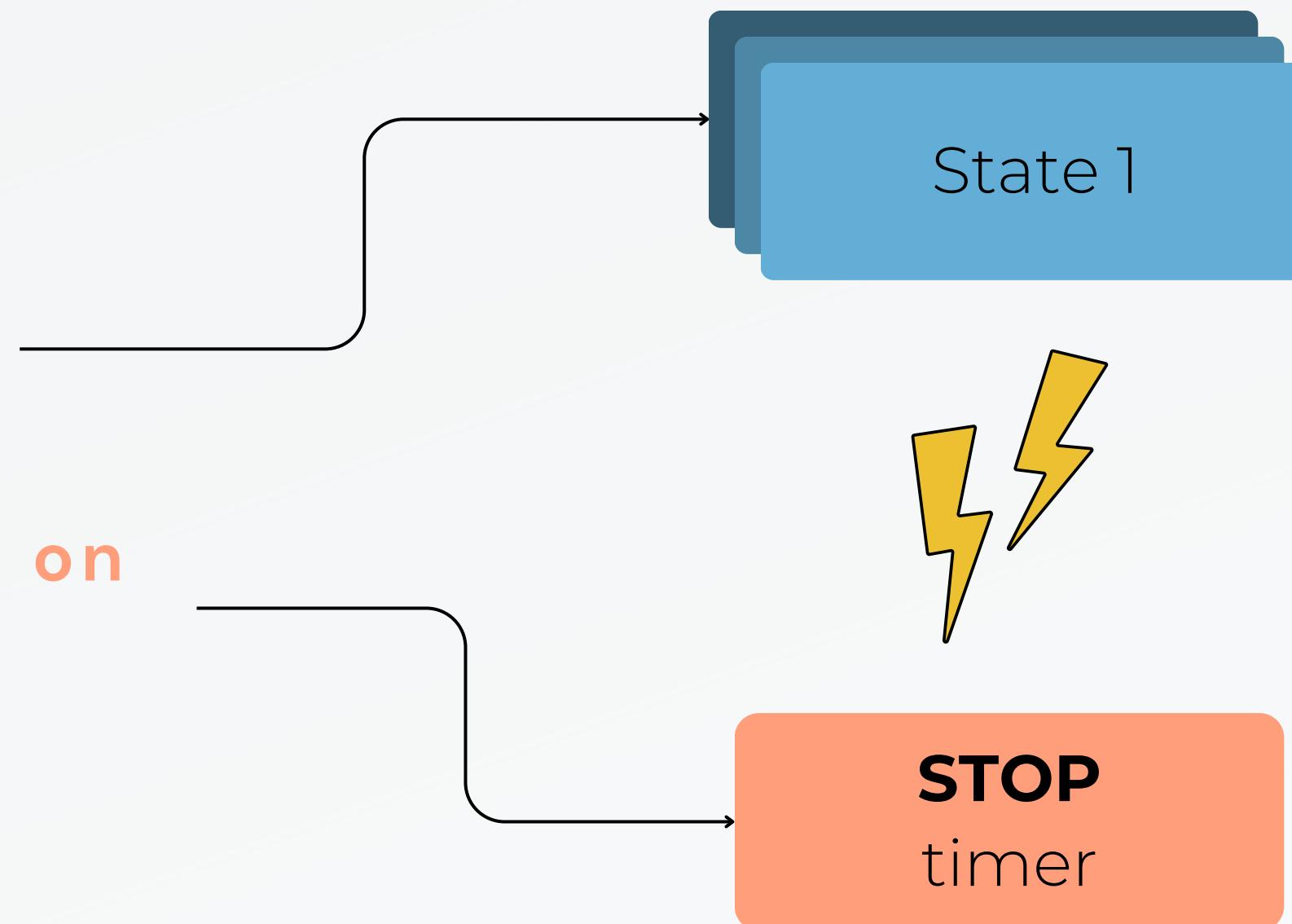


ARCHITECTURE DESIGN



TEENSY LOGIC

- Finite State Machine
- Interrupt (ISR) on ball catch

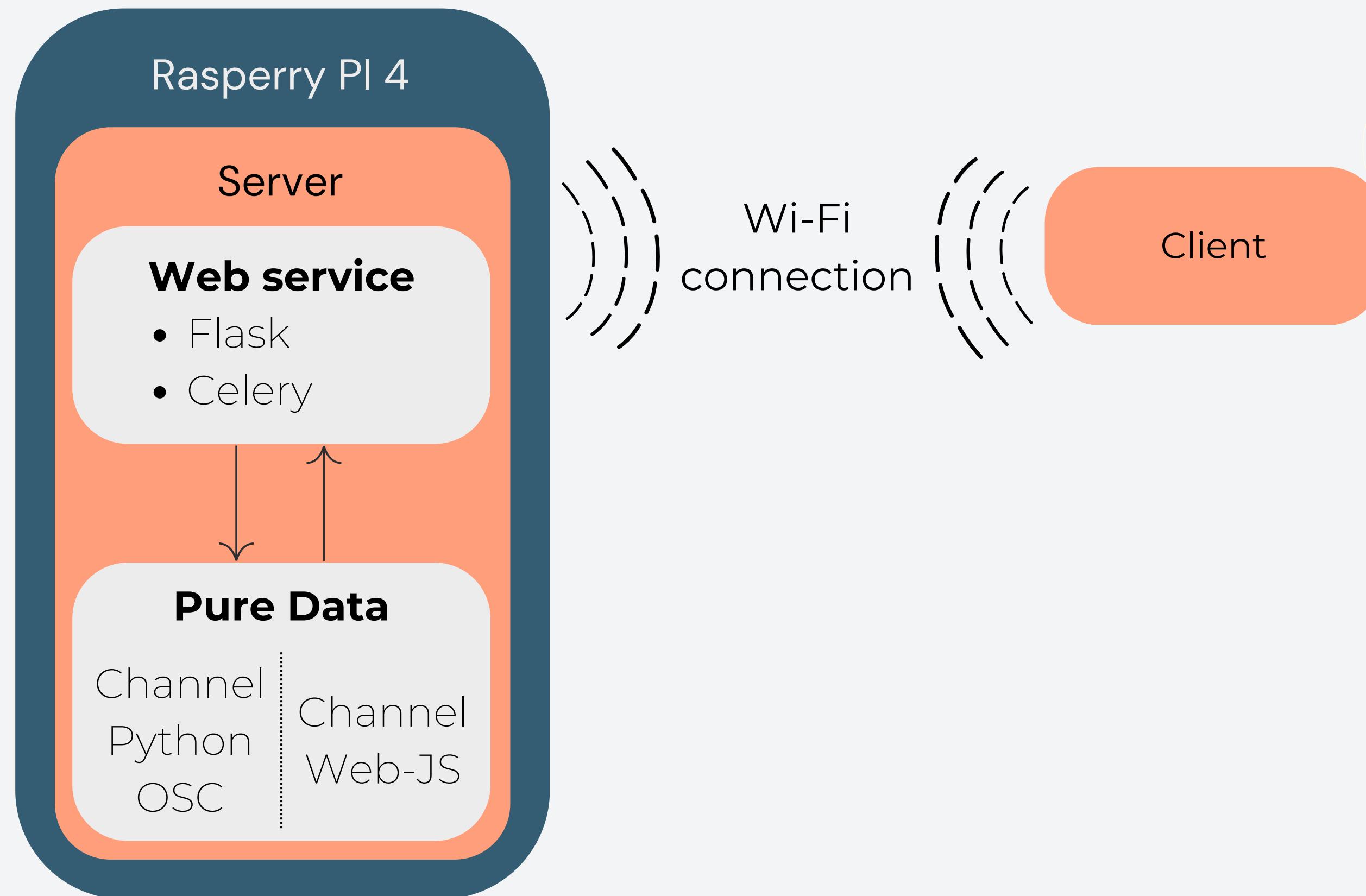


NETWORK STRUCTURE

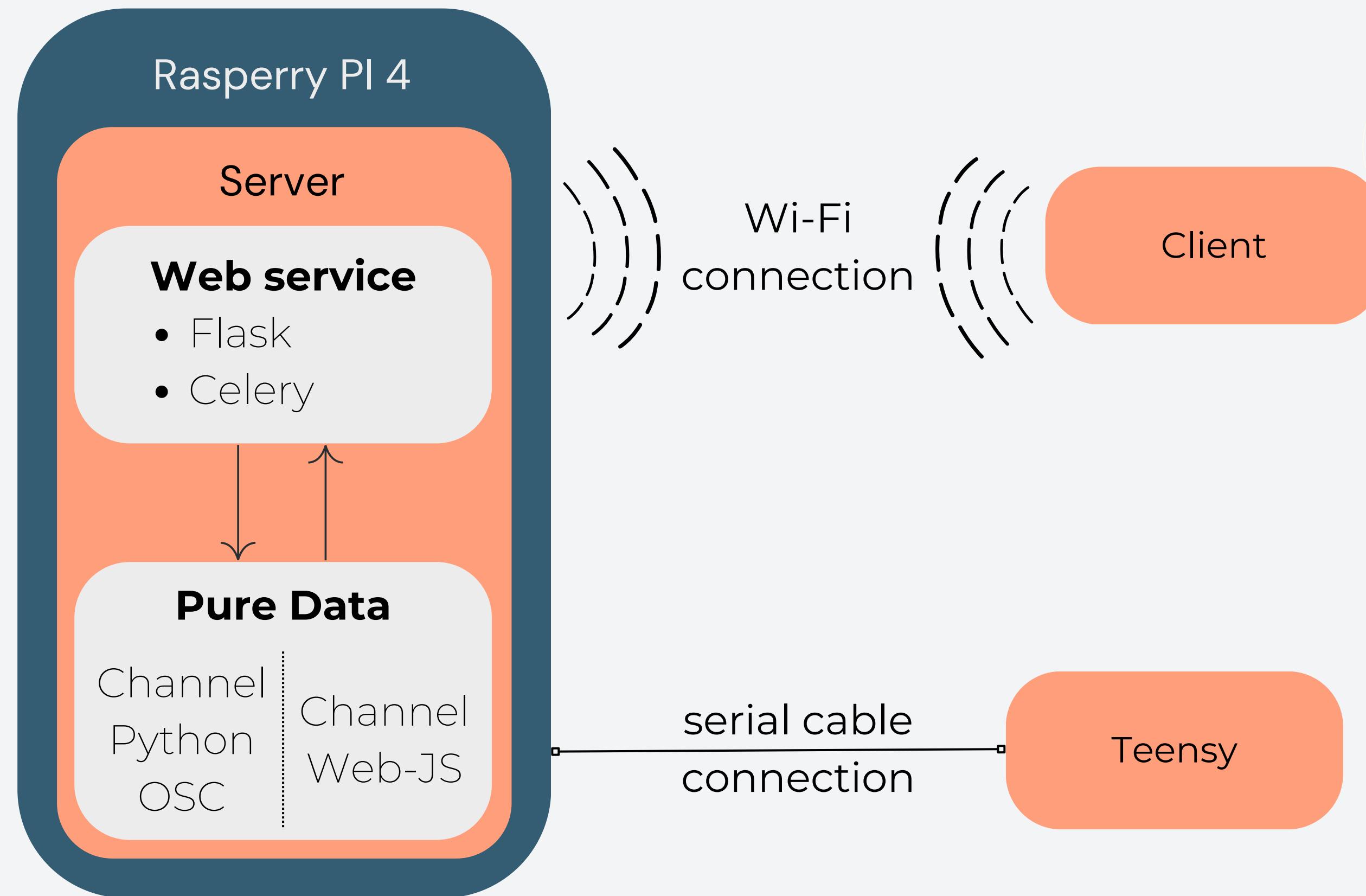


Client

NETWORK STRUCTURE



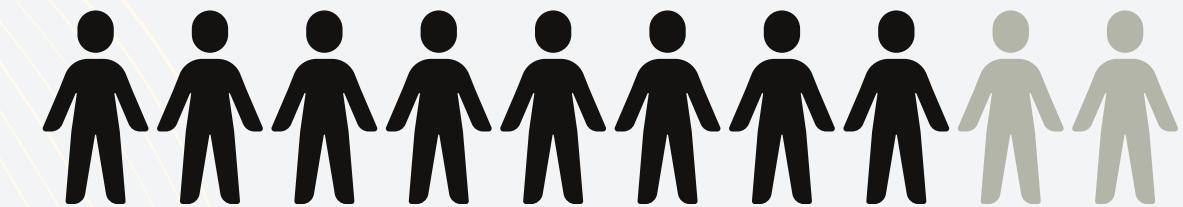
NETWORK STRUCTURE



RESULTS

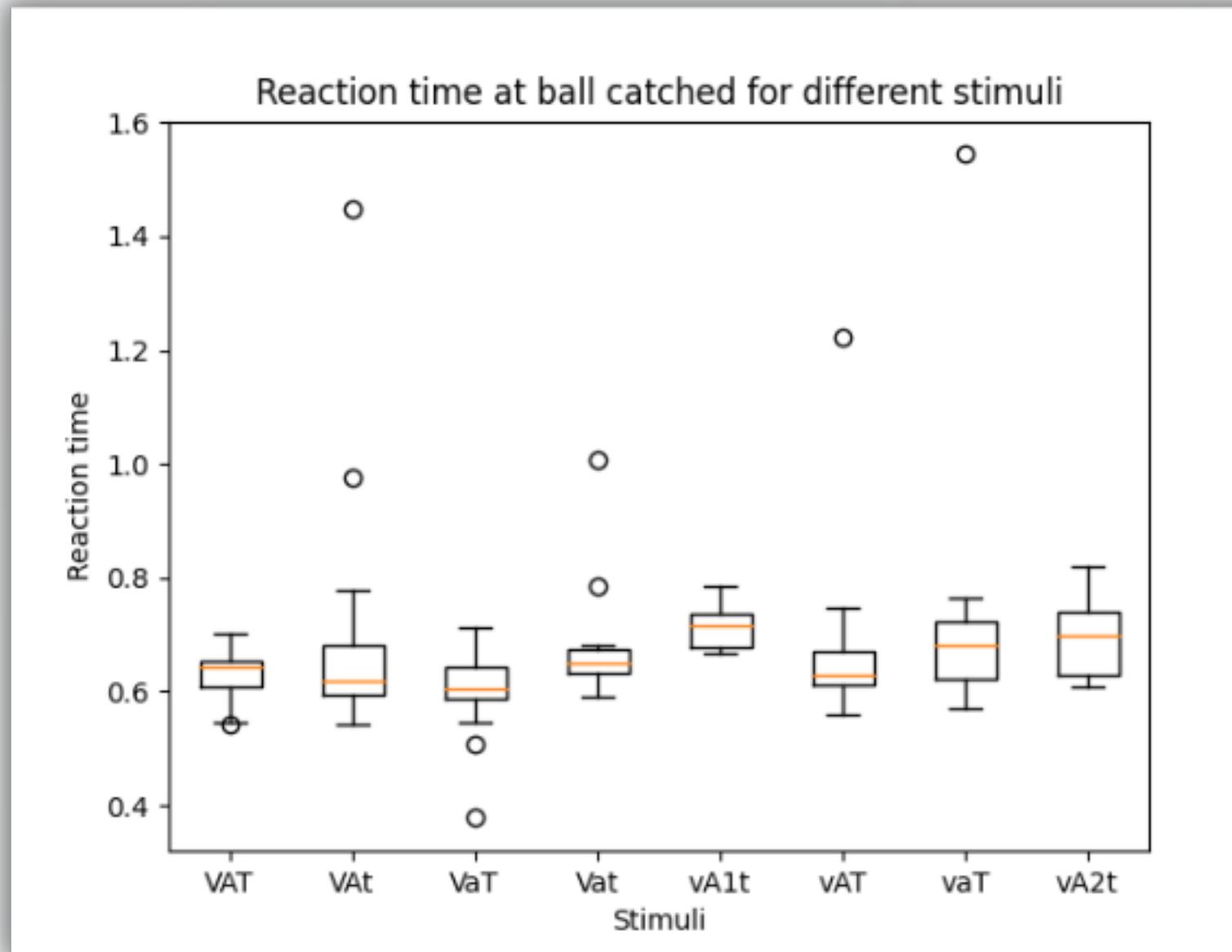
of our experiments

22 PARTICIPANTS



10 males and 12 females

REACTION TIME



independant variables: 8 different cues
dependant variable: **reaction time**

$p = 0.248$ (catch only)

$p = 0.289$ (catch and close catch)

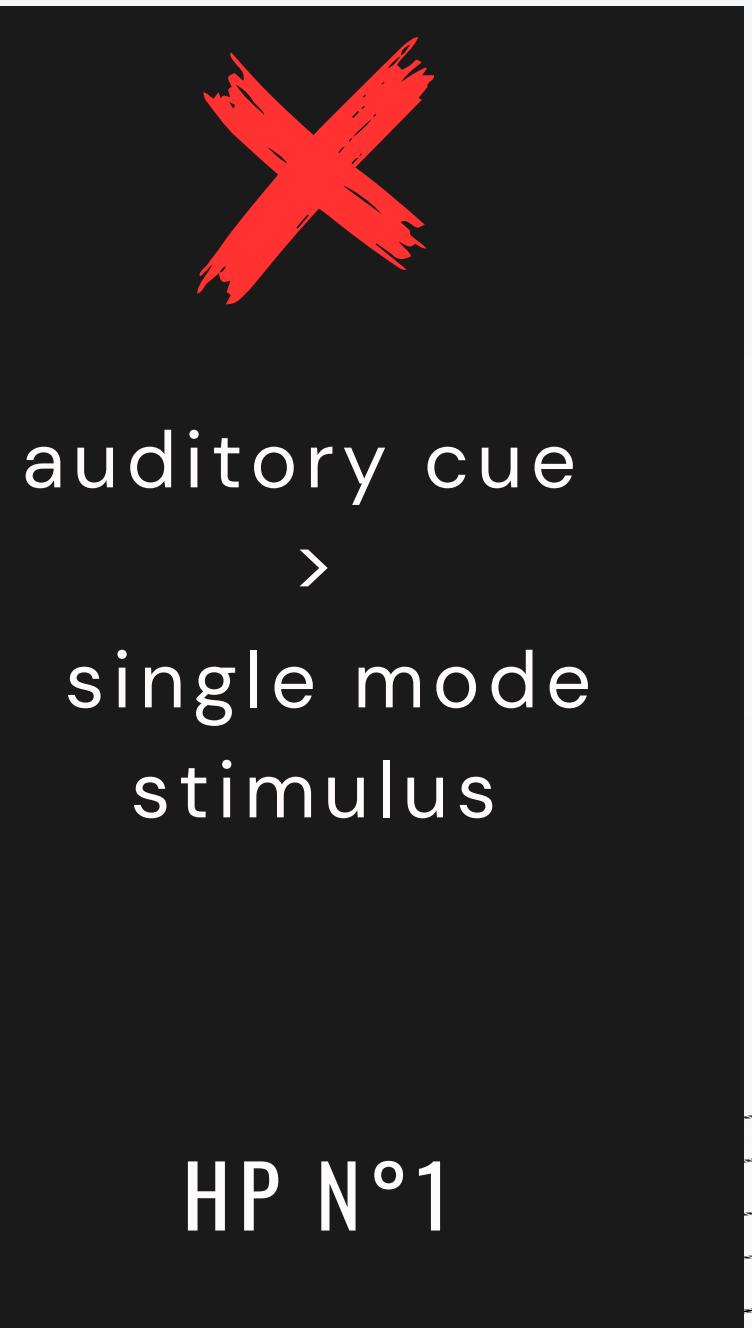
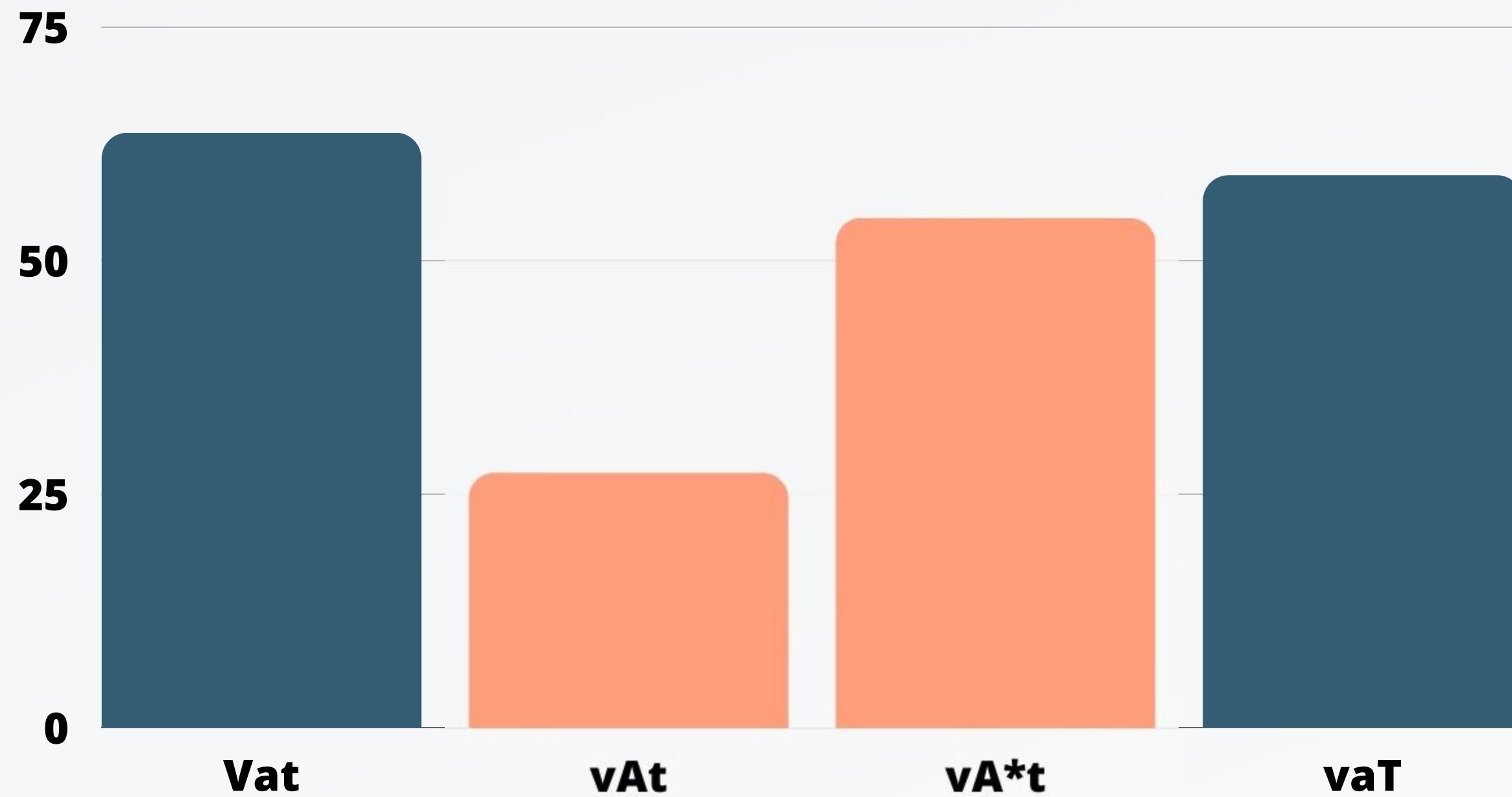
No statistically significative difference
between cues

CATCH

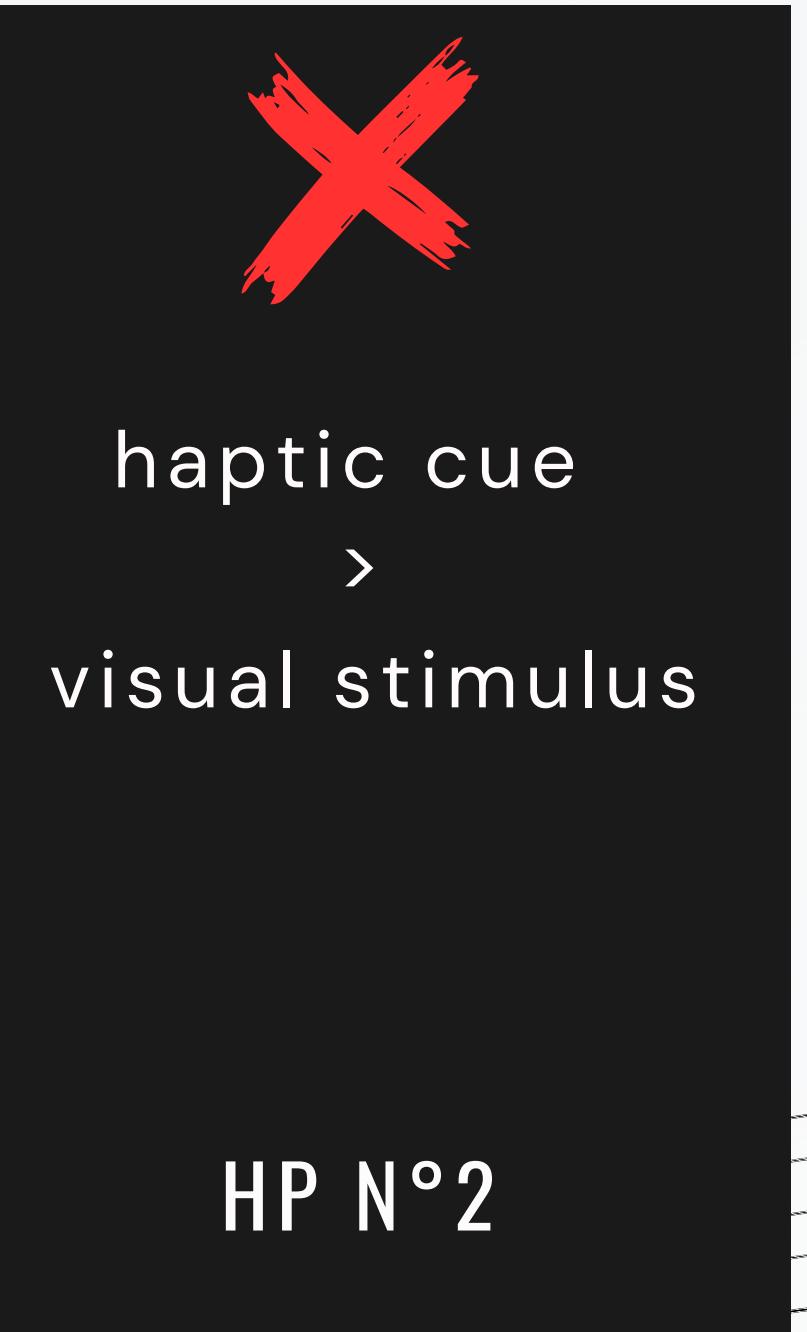
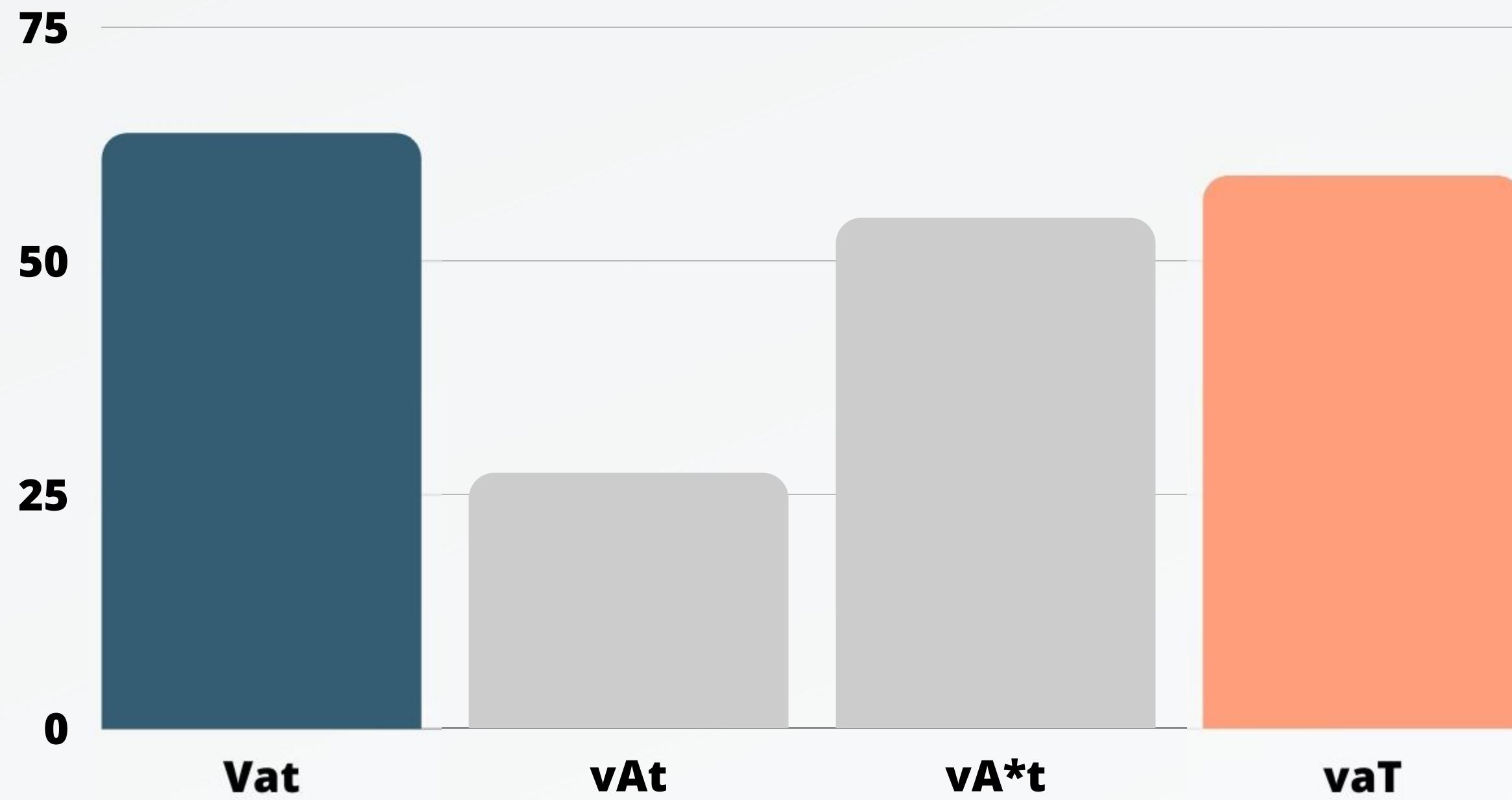
CATCH:
the user was able to grasp the ball before it
thouched the ground



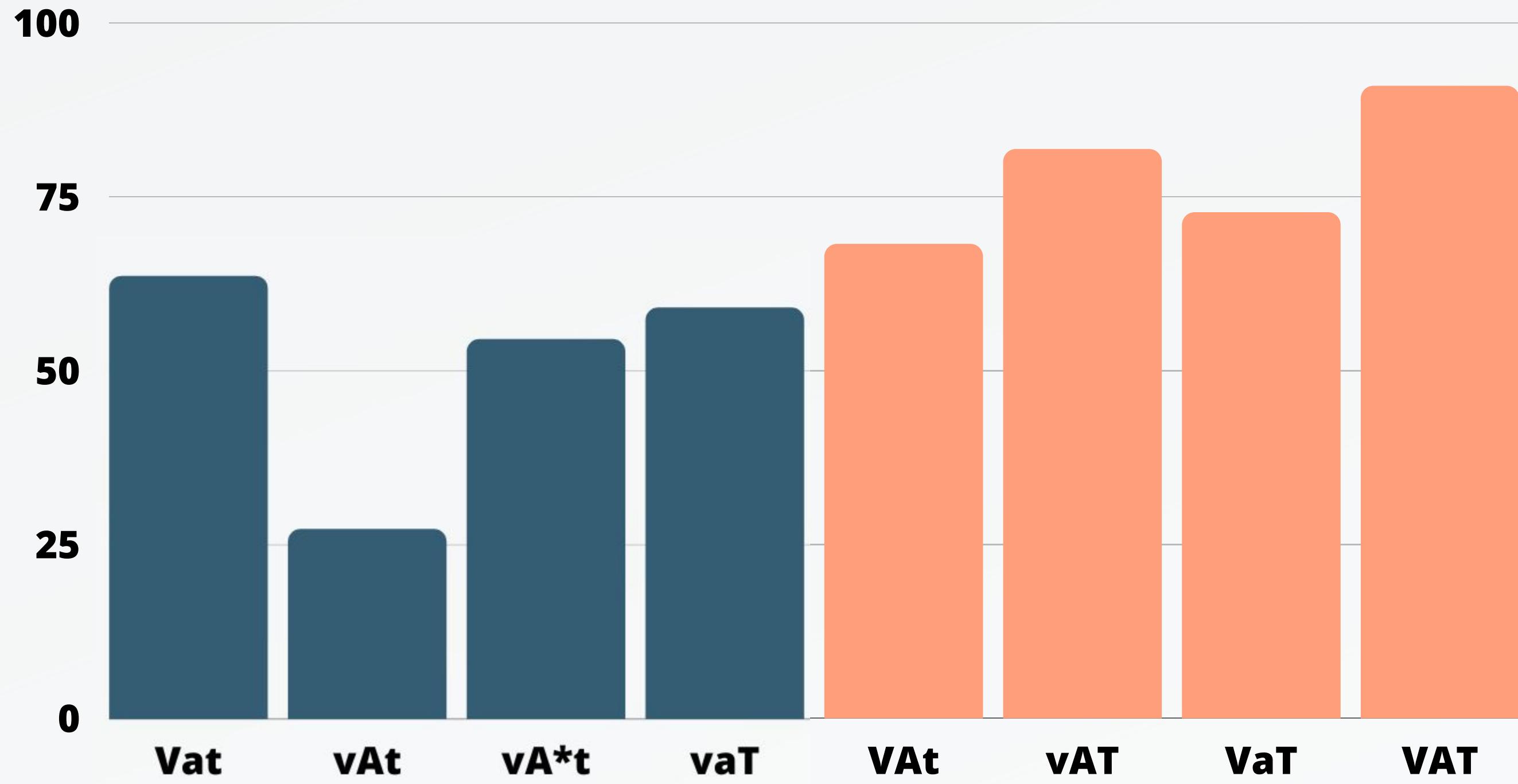
CATCH



CATCH

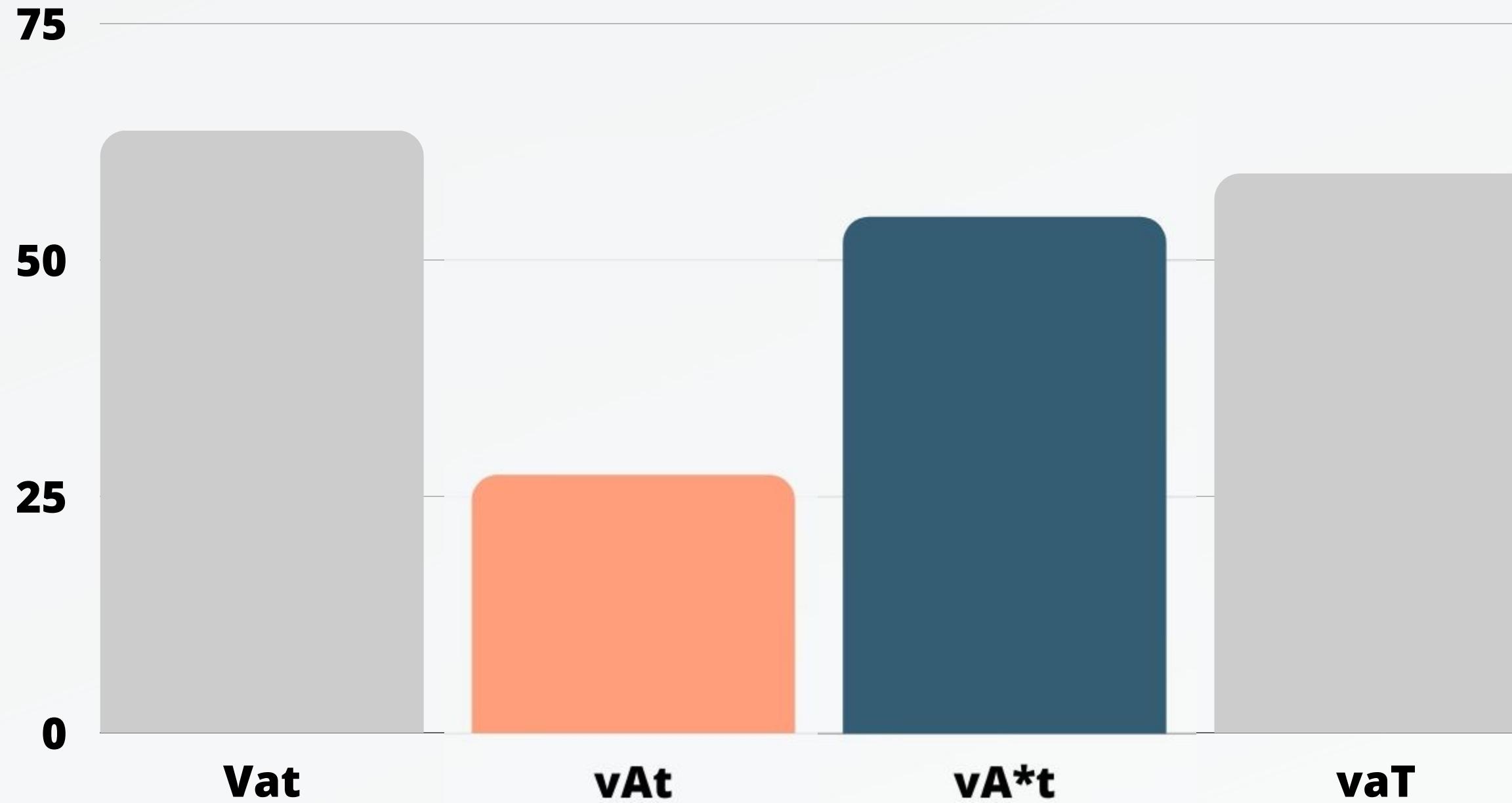


CATCH



✓
multimodal
>
single mode
HP N°3

CATCH



X
fast attack
audio
>
slow attack
audio
HP N°4

HYPOTHESIS



auditory cue
>
single mode
stimulus

HP N°1



haptic cue
>
visual stimulus

HP N°2



multimodal
>
single mode

HP N°3



fast attack
audio
>
slow attack
audio

HP N°4

HYPOTHESIS

mean position: 3.5 / 8
A before A*: 16 / 22

mean position: 4.9 / 8
A* before A: 6 / 22

X
fast attack
audio
>
slow attack
audio
HP N°4

SUBJECTIVE RESPONSE

Self-assessment manikin

7.23/₉

valence
mean

5.90/₉

arousal
mean

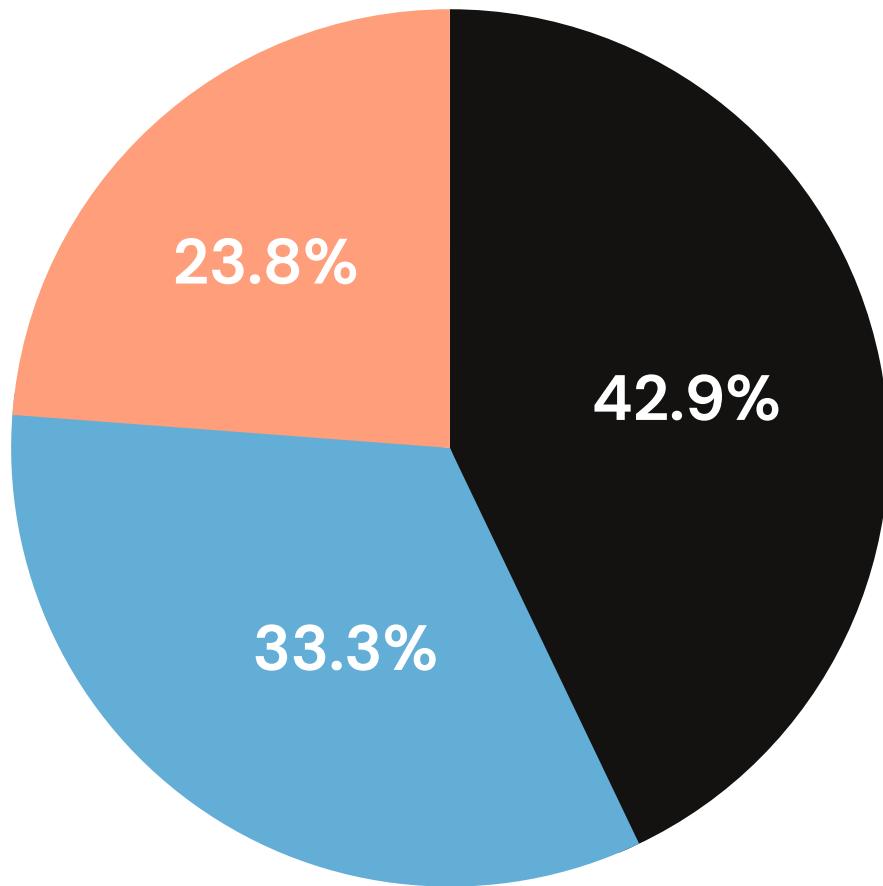
5.19/₉

dominance
mean

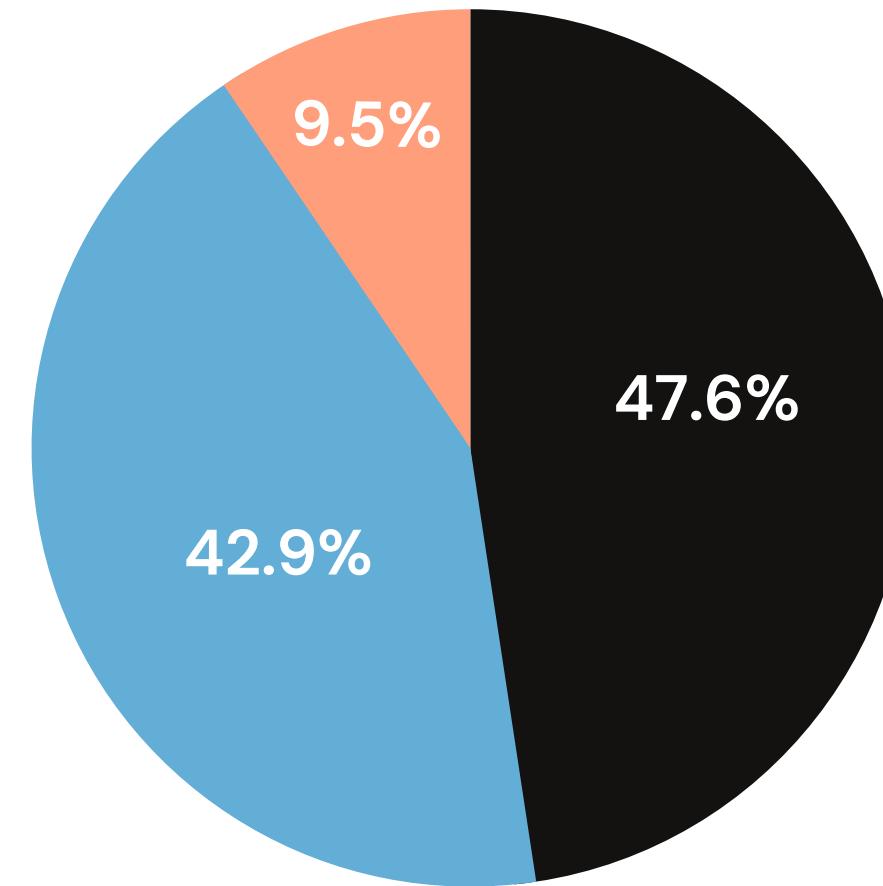
80.81

average
SUS Score

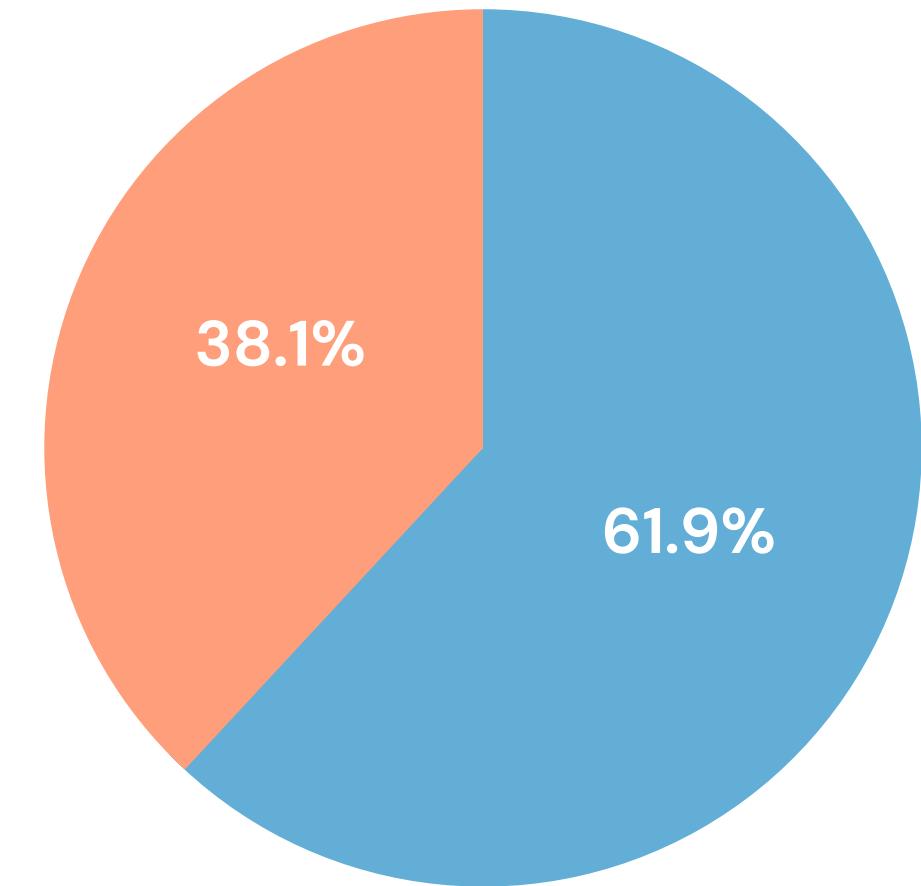
SUBJECTIVE RESPONSE



- Tactile Cue (Vibration)
- Auditory Cue (Sound)
- Visual Cue (Leds)



- Visual + Tactile Cue
- Auditory + Tactile Cue
- Visual + Auditory Cue

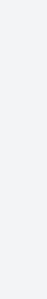


- Single modal Cues
- Multi modal Cues

LIMITATIONS

Teensy – Raspberry Pi
connection

Occasional failure



A specific
protocol was developed

Gloves

Homemade
thus
very fragile

LIMITATIONS

Initial positioning
of hands

Solution: place
bigger magnets in
the gloves

Catch – feedback
delay

Not perceived as an
issue by the
participants

CONCLUSION

In the future, it could be interesting to test our system with a **bigger group of people**, to have more reliable and statistically significant results. Furthermore, trying **other stimuli** could offer other perspectives and change the results of the different modalities.

**THANK YOU
FOR THE
ATTENTION**

Any question?

