

# From Invisible to Actionable: Augmented Reality Interactions with Indoor CO<sub>2</sub>

Prasenjit Karmakar<sup>1</sup>, Manjeet Yadav<sup>2</sup>, Swayanshu Rout<sup>3</sup>, Swadhin Pradhan<sup>4</sup>, Sandip Chakraborty<sup>1</sup>

IIT Kharagpur<sup>1</sup>, IIT Jodhpur<sup>2</sup>, RGIPT<sup>3</sup>, India

Cisco Systems<sup>4</sup>, USA



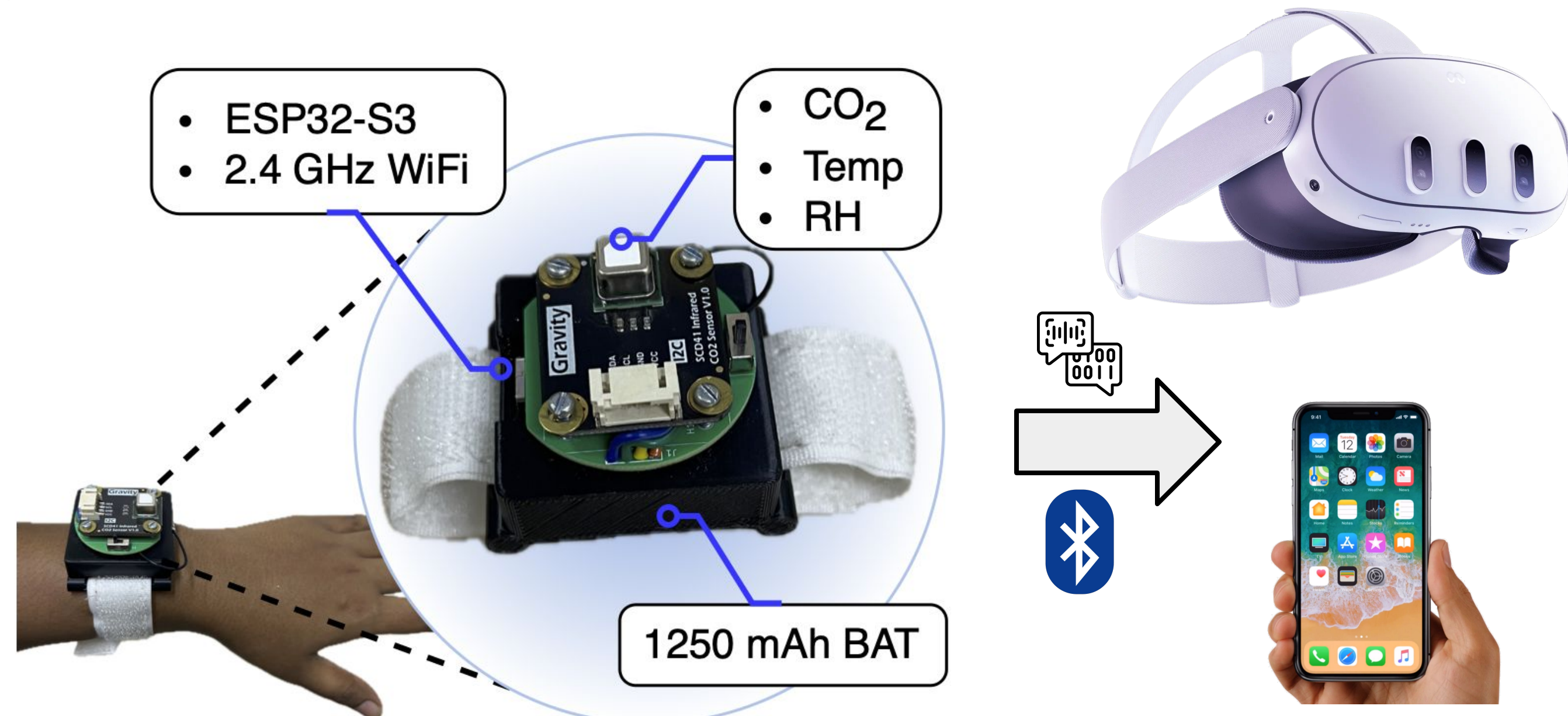
IIT Kharagpur  
PLATINUM JUBILEE



## 1. INTRODUCTION

- Indoor CO<sub>2</sub> bubbles grow **quasi-statically** [1] and form **persistent hotspots**, posing significant health risks due to its **odorless** and **colorless** nature.
- This work focuses on synergy of **AR** with **wearables** to design **situated interactions** with invisible pollutants.

## 3. PROTOTYPE: COWEAR



- Wrist-Wearable : CoWear** measures carbon-dioxide at **1Hz** and share to peer devices over the low-power BLE.

## 2. HYPOTHESIS: AWARENESS TO ACTION

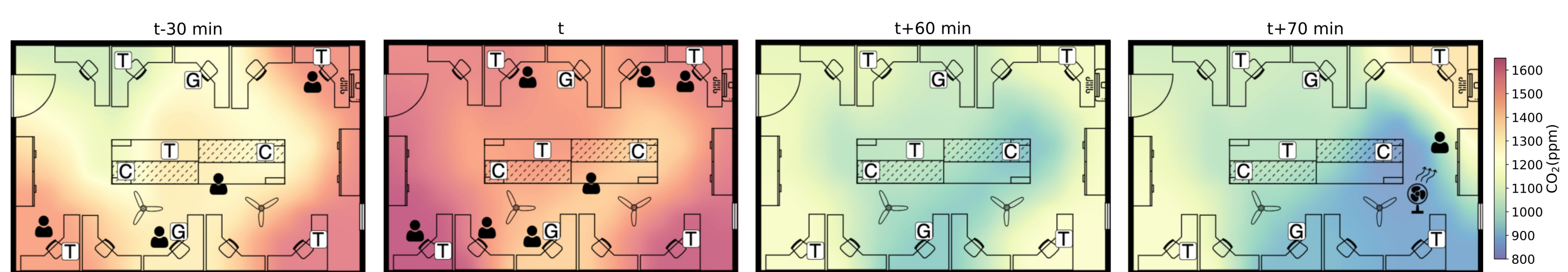
### Challenges

- People **think that CO<sub>2</sub> is harmful**. But only a few of them have actually measured indoor pollutants at least once. **Most don't have any clue**.
- Most of the people are **unable to mitigate** pollutants in their daily lives.

### What we hypothesize?

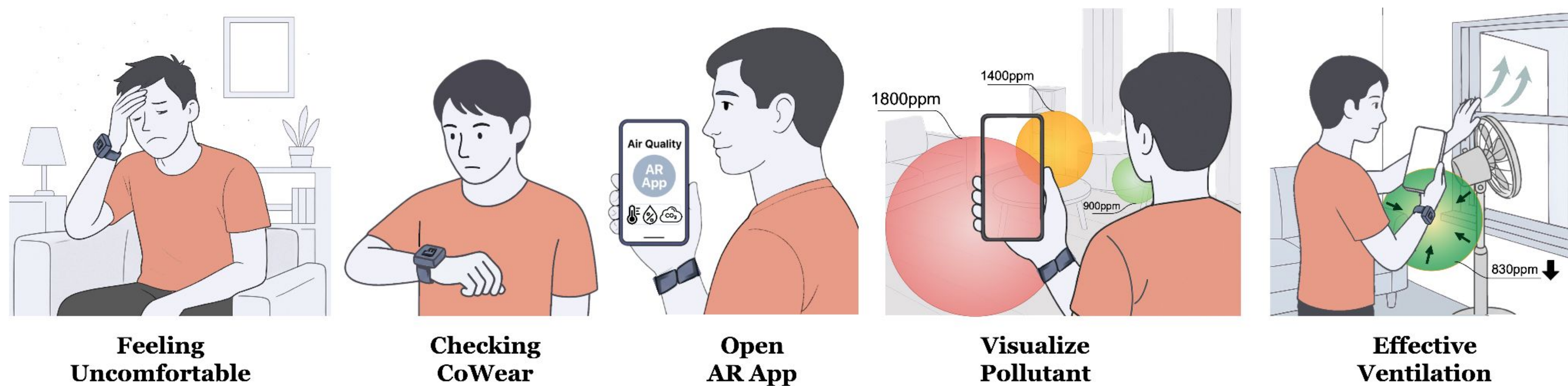
- H1.** Making CO<sub>2</sub> exposure **visible and situated** at a personal scale can improve **awareness** of effective preventive measures.
- H2.** **AR visuals** of CO<sub>2</sub> will nudge occupants toward **concrete actions**.

## 4. WHY AR?: SITUATED VISUAL

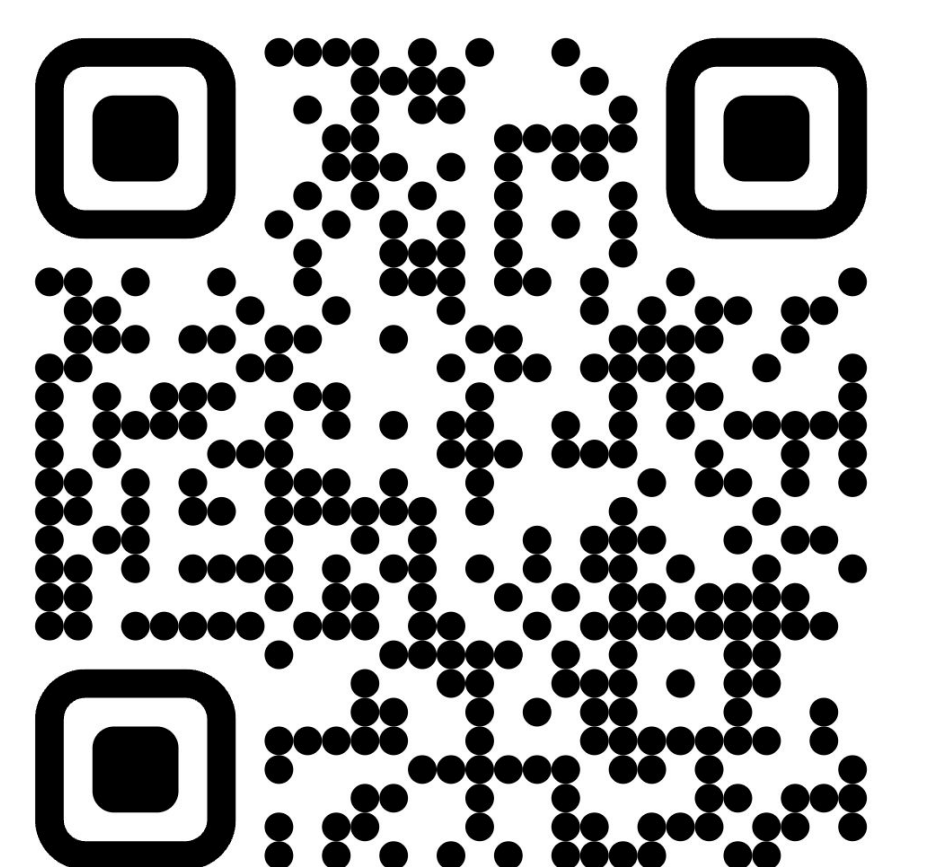


- We observe **CO<sub>2</sub>** accumulates and **gets trapped** in the room at different regions (see occupant's desks) **even after ventilating** for one hour.
- Targeted airflow** can help **ventilate** trapped CO<sub>2</sub> from these regions.

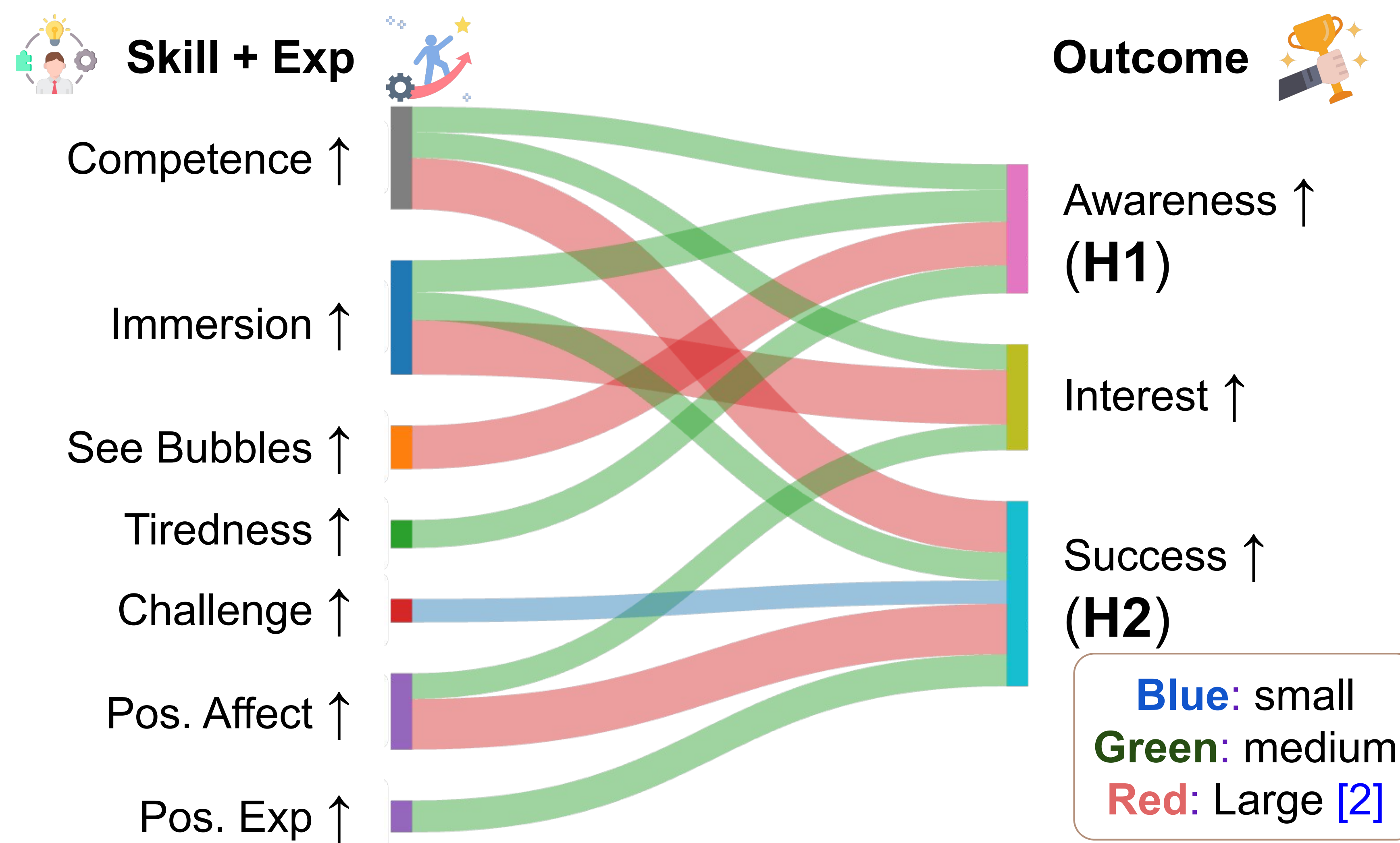
## 5. DESIGN: AR BUBBLES



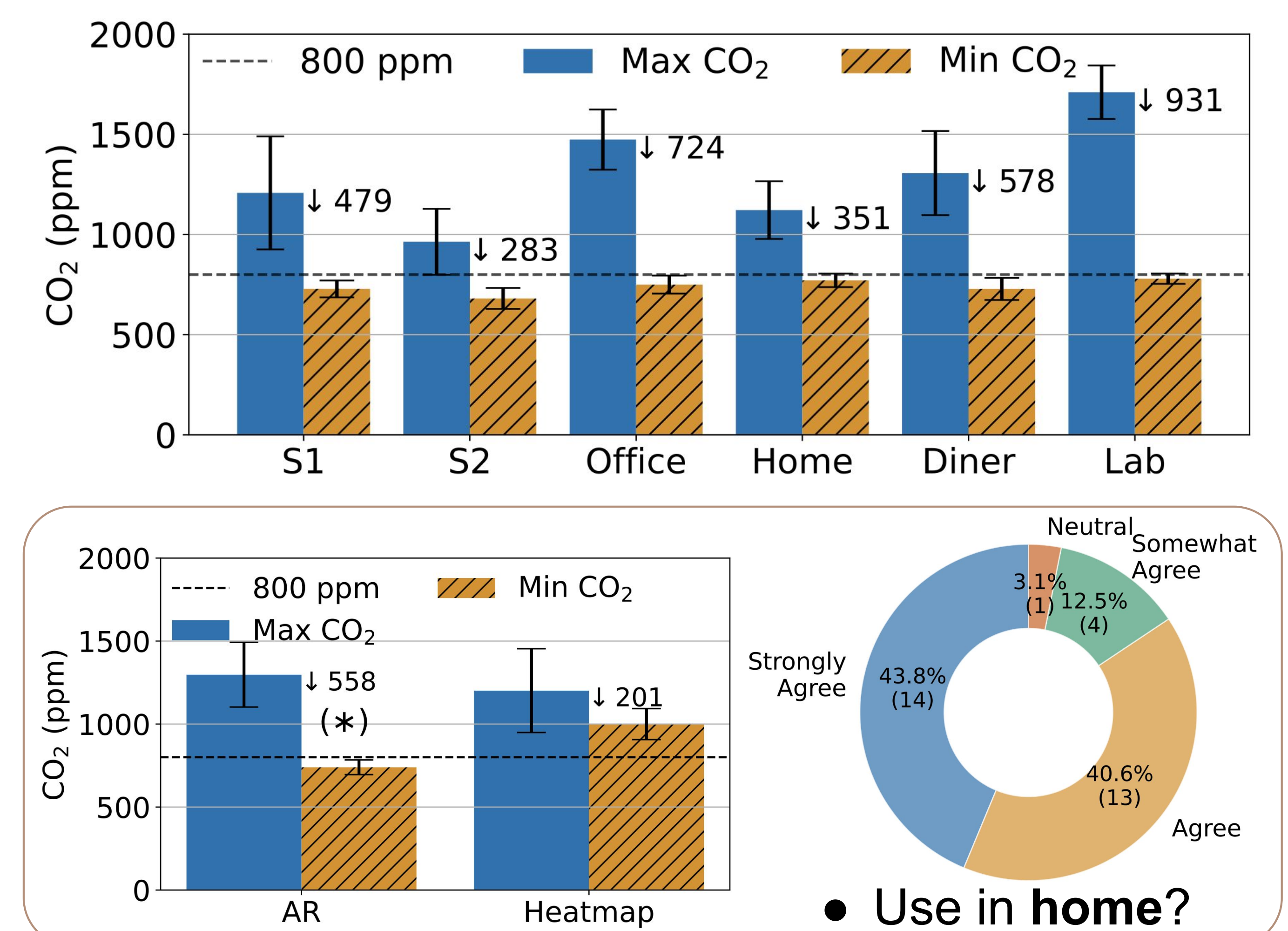
SHORT DEMO VIDEO



## 6. ASSOCIATION: USER EXPERIMENTS



## 7. RESULTS: EFFECTIVENESS



## REFERENCES

- Oscar R. Enríquez, Chao Sun, Detlef Lohse, Andrea Prosperetti, and Devaraj van der Meer, *The quasi-static growth of CO<sub>2</sub> bubbles*, Journal of fluid mechanics, 741, p.R1.
- Anna-Marie Ortloff, Florin Martius, Mischa Meier, Theo Raimbault, Lisa Geierhaas, and Matthew Smith, *Small, Medium, Large? A Meta-Study of Effect Sizes at CHI to Aid Interpretation of Effect Sizes and Power Calculation*, ACM CHI 2025

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