

Indoor Air Quality Dataset with Activities of Daily Living in Low to Middle-income Communities

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DALTON

Activity and air pollution dataset with **D**istributed **A**ir qua**Li**Ty **m**ONitors

We release spatiotemporal measurements of air quality from 30 indoor sites over six months during the summer and winter seasons. The dataset has **89.1M samples**, totaling **13646 hours** of air quality data and **3957 activity annotations** from 24 participants among 46 occupants in the sites.

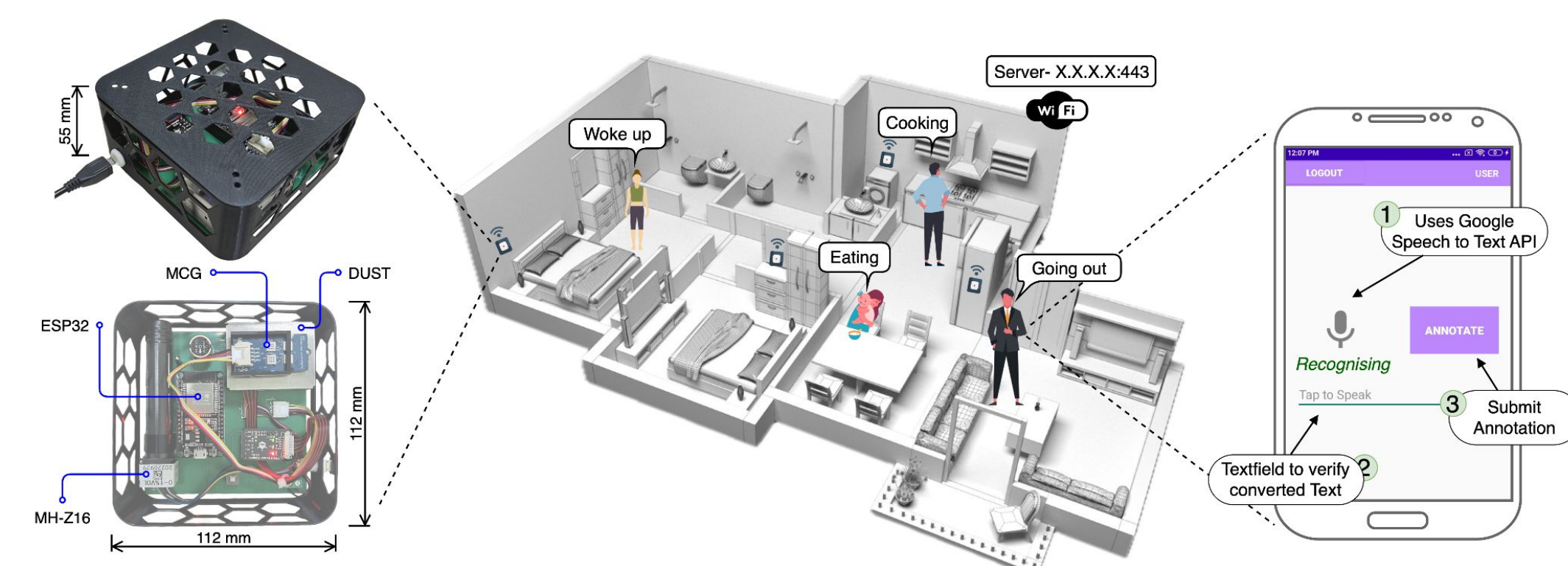
Unique features of the dataset are as follows:

- **Multi-device:** each site has multiple sensors deployed based on rooms
- **Indoor types:** studio apartments, classrooms, research lab, food canteens, and residential households
- **Frequent pollutants:** CO₂, VOC, PM₁, PM_{2.5}, PM₁₀, NO₂, C₂H₅OH, CO
- **Human annotations:** Real-time activity labels collected with Android app
- **Multi-city deployment:** Covers rural, suburban, and urban area in India
- **Dataset duration:** six-month long cross-seasonal data (Winter, Summer)

Annotating Activities of Daily Living

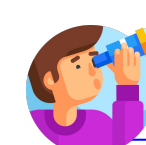
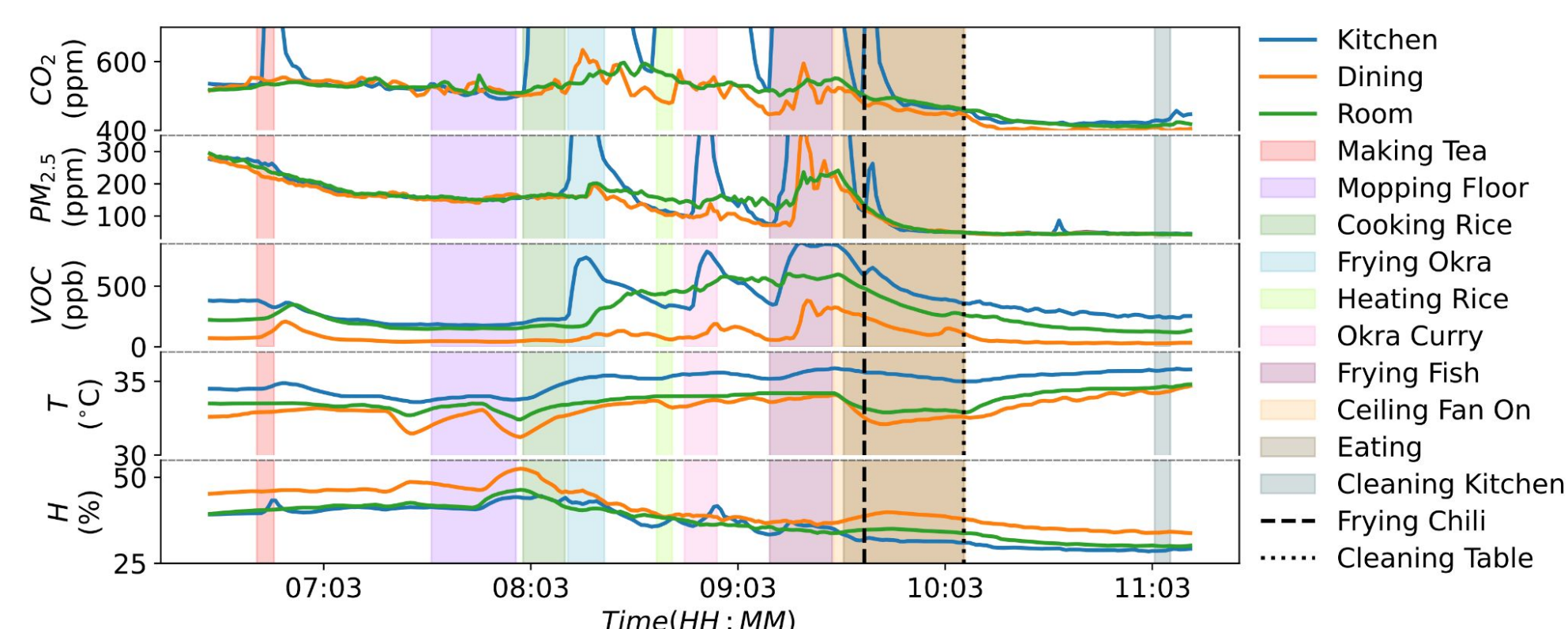
Multi-device deployment and activity annotation process

We deployed multiple air quality sensors in a household that are utilizing the house's WiFi network to send pollutant readings to the cloud. Moreover, the occupants actively participate in the study by providing activity and event context (i.e., cooking, eating, etc.) via the easy-to-use speech-to-text vocalAnnot Android application. **The table summarizes the deployment.**

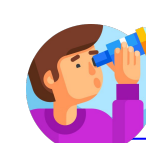
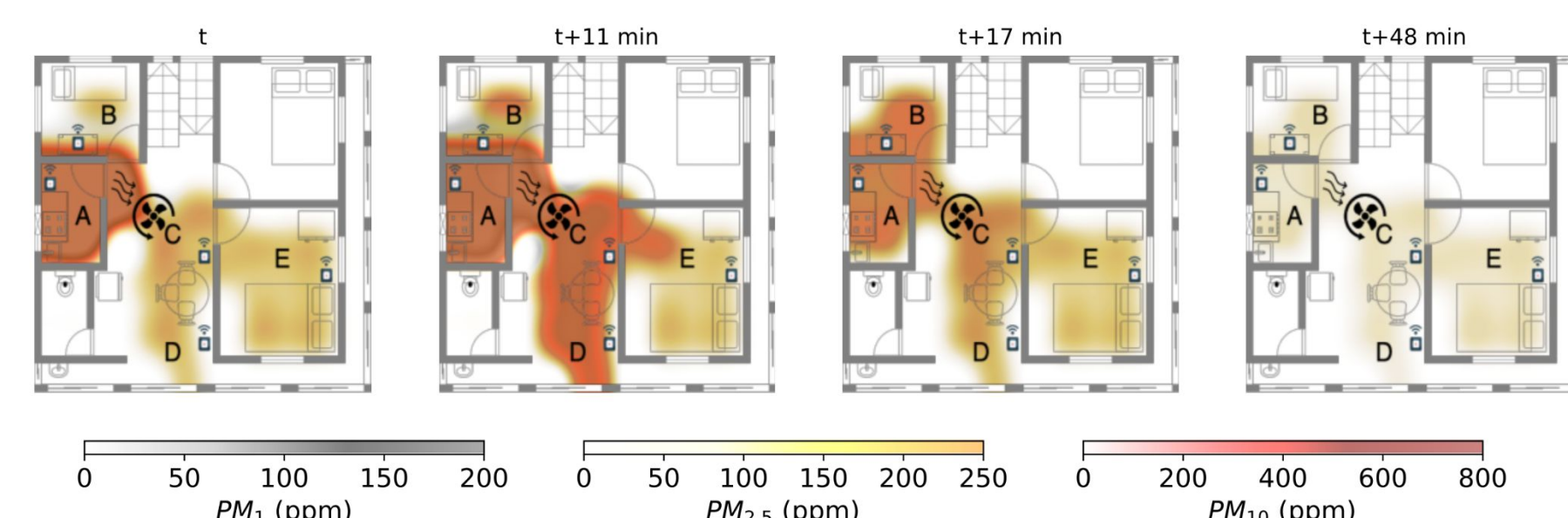


Dataset Offers Crucial Pollution Dynamics

Impact of indoor activities, ventilation, airflow and floorplan



We observe that **long-term frying** (e.g., fish) significantly **elevates PM_{2.5} and VOC levels** that transcend to nearby rooms. Pollutants from **boiling, heating, or short-term frying** remain **contained near the source**. **Cleaning and mopping increase the relative humidity.**



Kitchen emits pollutants from t to t + 11 minutes. **PM₁, PM_{2.5}, VOC, ethanol spread aggressively** due to swirling **airflow from the ceiling fan**.

ML Applications & Benchmarks

Potential applications for environmentalists and ML enthusiasts



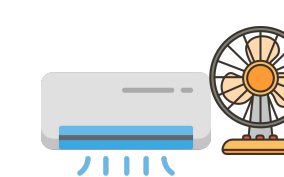
Pollution Source Identification and Activity Monitoring: Records instances of pollution patterns with specific activities, aiding in source and activity classification.



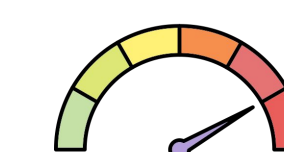
Analyse Spreading and Accumulation due to Floor Plans: Study pollutant spread and accumulation in varied room structures and floor plans.



Design Future Healthy Indoors: Identify features to mitigate pollution spread for designing healthier indoor designs.



Smart Device Control: Design control policies for ACs, exhausts, air purifiers, and other ventilation devices.



We observe **97.7%** F1-score in classifying **8 activities** (i.e., AC on/off, Fan on/off, Eating, Gathering, Enter, and Exit) and **98.3%** F1-score in classifying **11 food items** in a domestic kitchen. See **Appendix B.2** of the paper for more details.

Checkout Our Prior Research

Karmakar, P., Pradhan, S. and Chakraborty, S., 2024, September. Exploiting Air Quality Monitors to Perform Indoor Surveillance: Academic Setting. In *Adjunct Proceedings of the 26th International Conference on Mobile Human-Computer Interaction* (pp. 1-6).

Karmakar, P., Pradhan, S. and Chakraborty, S., 2024. Exploring Indoor Air Quality Dynamics in Developing Nations: A Perspective from India. In *ACM Journal on Computing and Sustainable Societies*, 2(3), pp.1-40.

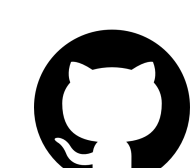


City	Name	Type	Site		Occupants			Ventilation			Air Condition		Cooking Medium		
			Site Type	# Sites	Female (%)	Income	Window	Vent-slit	Fan	W	S	LPG	Microwave	Kerosene	
Bankura	Durgapur	Kolkata	Rural	2	50	Low	✓	✓	✓	✗	✗	✓	✗	✓	
			Suburban	2	50	Middle	✓	✓	✓	✗	✓	✓	✗	✗	
			Urban	4	44	Middle	✓	✓	✓	✓	✓	✓	✓	✗	
Kharagpur	Suburban	Suburban	Household (H1-H13)	5	60	Middle	✓	✓	✓	✓	✓	✓	✓	✗	
			Apartment (A1-A8)	8	33	Low	✓	✗	✓	✗	✗	-	-	✗	
			Food Canteen (F1-F2)	2	50	Middle	✗	✓	✓	✗	✗	✓	✗	✗	
			Research Lab (R1-R5)	5	11	Low	✗	✗	✓	✓	✓	-	-	-	
			Classroom (C1-C2)	2	-	-	✗	✗	✓	✗	✓	-	-		

Contact Us



UbiNet



<https://github.com/prasenjit52282/dalton-dataset>



<https://ubinet-iitkgp.github.io/ubinet/pages/DALTON>



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