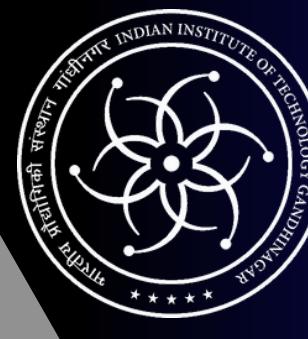


Sustainability Lab

AI and Sensing for Sustainability

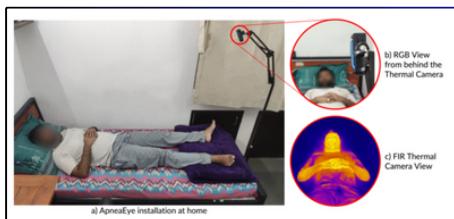


Professor Nipun Batra

sustainability-lab.github.io

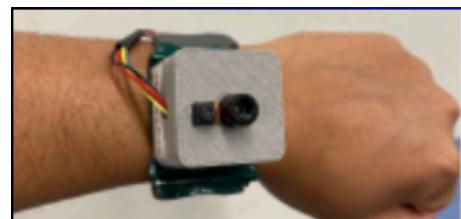
**Indian Institute of Technology
Gandhinagar**

Health



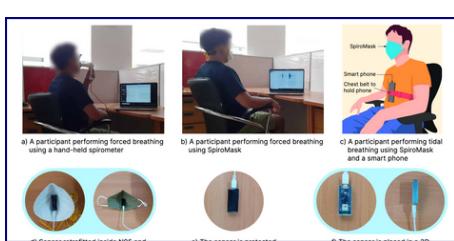
ApneaEye

A thermal camera-based, non-intrusive system to monitor Respiration signals during sleep.



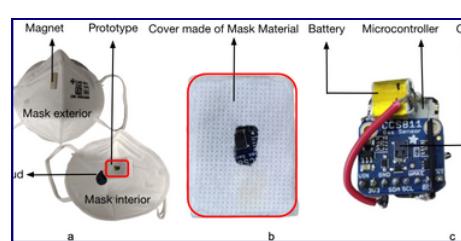
JoulesEye

A Thermal camera system that accurately estimates calorie expenditure during exercise by monitoring respiration rate.



SpiroMask

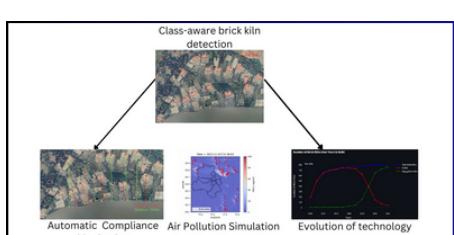
A smart mask with integrated microphones for accurate, non-invasive lung health monitoring.



Continuous Respiration Rate

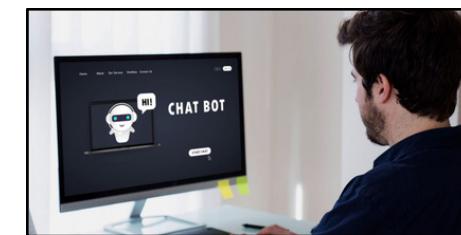
A CO₂ sensor in an N95 mask enables continuous respiration rate monitoring during walking and rest.

Air Quality



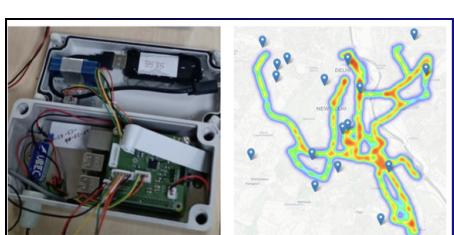
Space to Policy

A Scalable system that Automates Brick Kiln Detection with Geospatial Data



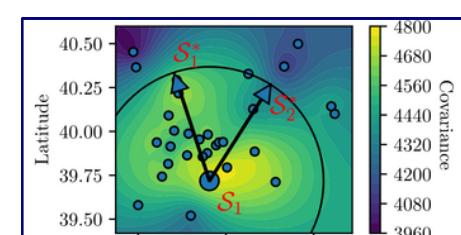
VayuBuddy

LLM-Powered Chatbot to Democratize Air Quality Insights for the masses.



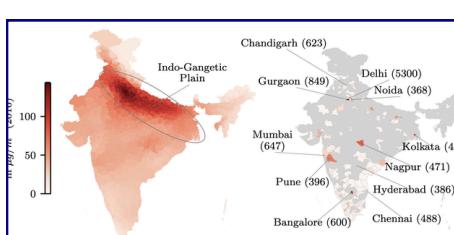
AIRDELHI

A novel mobile sensor based dataset for Delhi, enabling air pollution analysis and benchmarking.



Scalable AQ Inference

Gaussian processes method with advanced kernels for accurate air quality estimation



Samachar

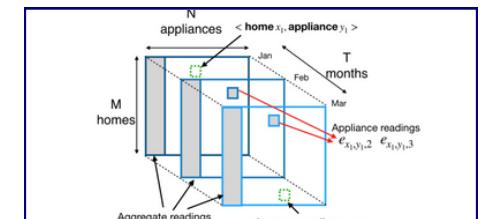
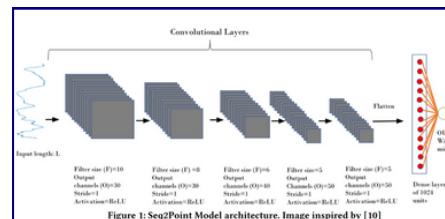
Reveals temporal and geographical biases in Indian media's air pollution coverage



Vartalaap

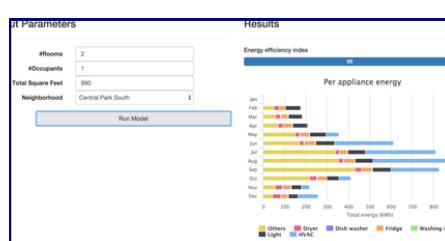
Analyzing public perception of air pollution in Delhi using Twitter data and NLP techniques.

Energy Analytics



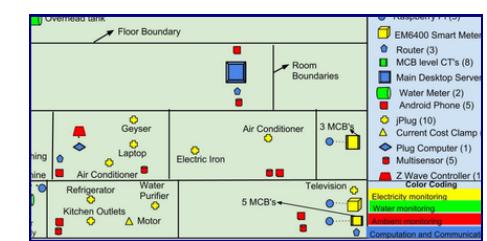
EdgeNILM

A multi-task learning approach to compress neural networks for efficient Non-Intrusive Load Monitoring (NILM).



Scalable Energy Breakdown

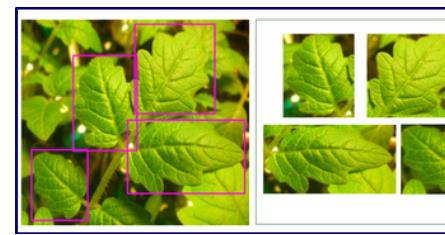
Matrix factorization method for energy breakdown in homes without requiring additional hardware installation



It's Different

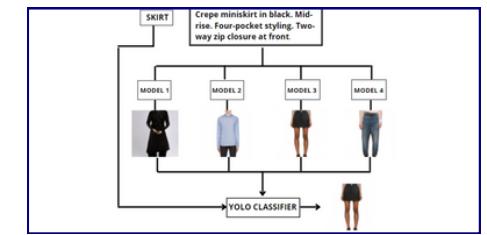
A sensor network deployment for monitoring energy, water, and ambient parameters in a Delhi home

Expositions



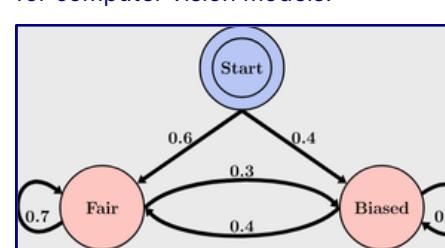
PlantDoc:

PlantDoc enables early plant disease detection using a curated dataset for computer vision models.



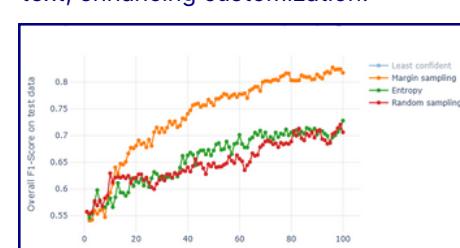
Vastra-GAN

A GAN-based model generates intricate Indian apparel designs from text, enhancing customization.



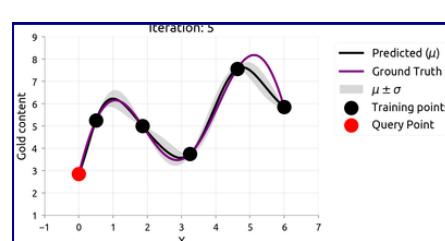
Exploring HMM

Explaining Hidden Markov Models, Markov Chains, with interactive visualizations



Active Learning: Visual Tour

Visualizing Active Learning for selecting most informative data point for machine learning models.



Exploring Bayesian Optimization

Visualizing Bayesian Optimization, its principles, techniques, and applications to simplify complex concepts.

LAB COMPUTATIONAL RESOURCES

The Lab features modern computational servers with up to **512GB RAM, 64 CPUs and Intel Xeon processors** for intensive computational tasks. The following are the high-end GPUs: **4xNVIDIA A100 (4x80 GB), 1xNVIDIA RTX A5000 (24GB), 2xRTX A4000 (2x16GB), 1xNVIDIA RTX A2000 and Titan XP**.

Sustainability Lab

AI and Sensing for Sustainability



Lab Webpage
sustainability-lab.github.io



Youtube Channel
Sustainability Lab IITGN



Nipun Batra is an Associate Professor of Computer Science at IIT Gandhinagar. He completed his postdoctoral research at the University of Virginia and earned his PhD from IIIT Delhi. His research group focuses on utilizing machine learning and sensing technologies to address computational sustainability challenges, particularly in smart buildings, air quality, and healthcare.

Prof. Nipun Batra

Awards won by Prof. Nipun Batra:

- Young Alumni Award from IIIT Delhi 2023
- Keynote talk at ACM COMPASS 2024 Doctoral Colloquium
- Best Graduate Presentation at ACM Sensys 2014 [A*] (first and only winner from India)
- Best demo award at ACM Buildsys [A]
- Excellence in Teaching Award by IIT Gandhinagar

Awards won by the lab students:

- PhD student Zeel Patel awarded Microsoft PhD fellowship 2024 (one in ten in India)
- PhD student Rishiraj Adhikary is a finalist in the ACM Ubicomp (A*) graduate award
- PhD student Rishiraj Adhikary selected for prestigious Lindau Laureate Program 2024
- PhD student Rishiraj Adhikary won the Fullbright Nehru visitationn fellowship (1 in 3 in STEM that year)
- MTech Student Ankita Jain won Gold Medal in Research in 2023 convocation (awarded to 1 MTech student in a batch across all departments)

Alumni Across the Globe

Caltech



UMASS
AMHERST

ORACLE

UNIVERSITY OF
ILLINOIS
URBANA-CHAMPAIGN



Microsoft
Research

UC San Diego

Carnegie
Mellon
University



Google DeepMind

Sponsors



Department of Science & Technology
Government of Gujarat



CoE in AI (MHRD)

MEDIA COVERAGE

Research scholar at IITGN develops device to overcome fitness monitoring limitations

The trial study was conducted in the SMASH lab of Carnegie Mellon University (CMU) in Pittsburgh, the United States, during Adhikary's stint as a Fulbright scholar between August 2022 and May 2023 where Prof Mayank Goel from the CMU and Prof Nipun Batra from IIT Gandhinagar were his advisors for this project.



IIT-Gn chatbot eases air pollution data

Chatbot developed by IIT-Gn leverages artificial intelligence to answer queries about air quality

Ahmedabad Mirror Bureau
Posts@ahmedabadmirror.com



Tue, 17 December 2024
<https://repaper.ahmedabadmirror.com/c/17530829>

VayuBuddy gives people a way to interact with air quality data in a user-friendly manner, empowering them to make informed decisions.

-Prof Nipun Batra,
Lead Researcher

between raw data and public understanding," says Prof Nipun Batra, a lead researcher on the project. He adds, "VayuBuddy gives people a way to interact with air quality data in a user-friendly manner, empowering them to make informed decisions."

"Our aim was to reduce the gap

between raw data and public understanding," says Prof Nipun Batra, a lead researcher on the project. He adds, "VayuBuddy gives people a way to interact with air quality data in a user-friendly manner, empowering them to make informed decisions."

"Why VayuBuddy matters

VayuBuddy matters because air quality is important as pollution affects not just health but all aspects of human life. Dr Sarath Guttikunda, air quality expert and collaborator, highlights

the broader implications: "Air pollution is a shared challenge, and tools like VayuBuddy can foster collective awareness and action. When people see clear, localized data, they're more likely to advocate for cleaner policies."

VayuBuddy is a versatile tool

VayuBuddy is designed to be useful for its ability to generate insights tailored to various stakeholders. Policymakers can track compliance with air quality standards, parents can evaluate their

children's exposure levels, journalists can report trends using graphical charts, and researchers can use the data to study the broader implications of air pollution on society.

IIT-Gn researchers devise mask to measure lung health

SpiroMask assesses lung health parameters using microphone, derives vital statistics and monitors rate of respiration to spot and treat disease in its early stages

Ahmedabad Mirror Bureau
Posts@ahmedabadmirror.in



"Our aim was to overcome the limitations in lung function monitoring or diagnose lung health by just wearing a mask," says Prof. Nipun Batra, a lead researcher at IIT-Gn. Along with institutions from US has devised a SpiroMask, a novel respiratory system that estimates forced and tidal breathing to assess lung health parameters using a microphone. The device measures the rate of respiration, derive vital lung parameters and continuously monitors respiratory rate to detect any abnormalities.

From Spironet, "he said.

Rs 2,500

against a Rs 40,000 Spirometer.

As a majority of people

visit clinics for treatment

when symptoms aggravate, detecting lung health early can help them from worsen.

Currently, the team analyzes the

Sustainability Lab

AI and Sensing for Sustainability



sustainability-lab.github.io



Nipun Batra is an Associate Professor of Computer Science at IIT Gandhinagar. He completed his postdoctoral research at the University of Virginia and earned his PhD from IIIT Delhi. His research group focuses on utilizing machine learning and sensing technologies to address computational sustainability challenges, particularly in smart buildings, air quality, and healthcare.

Prof. Nipun Batra

Awards won by Prof. Nipun Batra:

- Young alumni award from IIIT Delhi 2023
- Keynote talk at ACM COMPASS 2024 Doctoral Colloquium
- Best Graduate Presentation at ACM Sensys 2014 [A*] (first and only winner from India)
- Best demo award at ACM Buildsys [A]
- Excellence in Teaching Award by IIT Gandhinagar

Awards won by his students:

- PhD student Zeel Patel awarded Microsoft PhD fellowship 2024 (one in ten in India)
- PhD student Rishiraj Adhikary is a finalist in the ACM UBICOMP (A*) graduate award
- PhD student Rishiraj Adhikary selected for prestigious Lindau Laureate Program 2024
- PhD student Rishiraj Adhikary won the Fullbright Nehru visitationn fellowship (1 in 3 in STEM that year)
- MTech Student Ankita Jain won Gold Medal in Research in 2023 convocation (awarded to 1 MTech student in a batch across all departments)

Alumni Across the Globe

Caltech



UMASS
AMHERST

ORACLE

UNIVERSITY OF
ILLINOIS
URBANA-CHAMPAIGN



Microsoft
Research

UC San Diego



Carnegie
Mellon
University

Google DeepMind

Sponsors



CoE in AI (MHRD)

Team



Rishiraj Adhikary



Zeel Patel



Rishabh Mondal



Ayush Shrivastva



Ujjwal Gupta



Tanu Tiwari



Meenakshi Prakash



Poornima Bhatia



Prince Kumar



Shataxi Dubey



Abhay Pisharodi



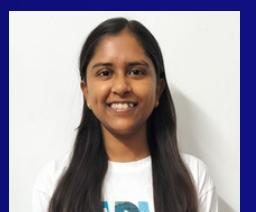
Abhyudaya Nair



Diya Thakor



Vinayak Rana



Suruchi Hardaha