Novel Automated Carbon Monoxide Forecasting, Dead-Zone Detection, and Ventilation System for Homes

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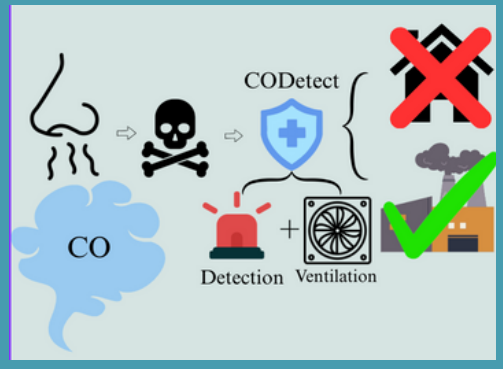
Graphical Abstract



Problem Statement

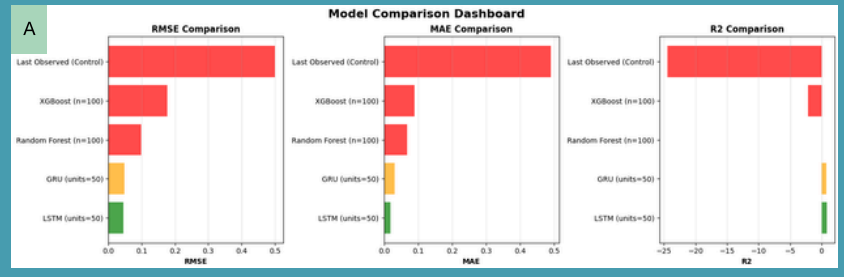
Current residential carbon monoxide prevention systems fail to automatically monitor and ventilate CO.

Engineering Need

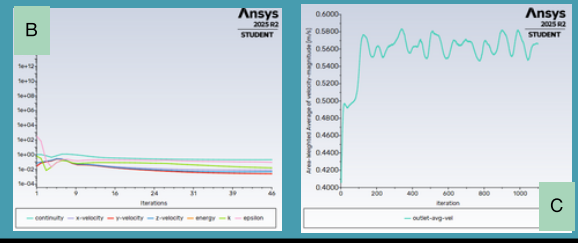
Smart safety system that predicts CO levels and dynamically optimizes air quality.

CODetect has a positive effect on residential carbon monoxide detection and ventilation

Data + Analysis



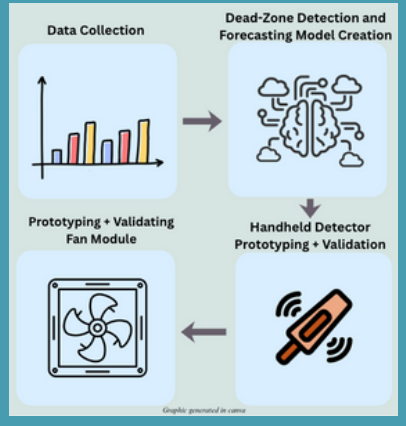
Comparison of different models when trained on dead-zone and non-dead zone data



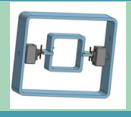
Plot of Area-Weighted Average of fan velocity over iterations.

Final System: Handheld detector + home ventilation system

Methodology

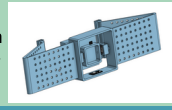


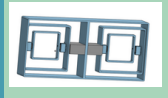
Ventilation System Design Iterations



Design 1: Fan module that rotates up and down

Design 2: Self-attaching fan module with fume extractor





Design 3: Dual-mode ventilation system for air recirculation

Interpretations and Conclusion

- Figure A's graphs show how well LSTM perform against other models and baseline (LOCP) when forecasting CO levels and detecting dead zones from pressure, temperature, and humidity
- Plot of Area-Weighted Average of fan velocity over iterations. From this, volumetric flow rate was calculated and then converted to ACH. Obtained an ACH of 15 compared to the average ACH of 2.

CODetect resulted in a forecasting and dead-zone detection accuracy of **95%** while increasing the ACH (ventilation) by nearly **90%**