BreathInSight: Multi-Sensor Lung Health Analyzer for Early Detection of Respiratory Conditions

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As seen in recent trends, lung diseases affect over 500 million people worldwide, killing over 10 million people a year. As a method for early detection, this project aimed to design and test an affordable, non-invasive device capable of detecting lung diseases at a developmental stage using novel multi-sensor and biomarker profiling techniques.The device was built by combining three advanced gas-sensing technologies, namely volatile organic compounds (VOC) , NOx, and Flow Rate (all of which have researched correlations with respiratory diseases), attached to a Raspberry Pi, which was used for data processing. To further save space and cost, a custom PCB was designed for the device. These components were fit into a custom 3D-printed shell. To test the device, two groups of patients (one clinically diagnosed with asthma and the other not diagnosed) were told to blow into the mouthpiece of the device. The device then outputted a diagnosis, which was then compared to the clinical diagnosis. In the testing phase, the device displayed a 100% accuracy in detecting asthma on the sample size of 18 patients. By creating a confusion matrix, a true positive and true negative rate of 100% was calculated, deeming the device to be the most accurate it could be.This study showed that the novel device constructed had a very high accuracy in detecting lung diseases, providing a cheap alternative to current methods for detection. This research can be implemented in the world by mass-producing and distributing the device to remote and low-resource areas.

Awards Won: