Breathe Smarter: Unlocking Intelligent Indoor Air Insights Using a Smart IoT Indoor Air Quality Monitor

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Individuals spend approximately 90% of their time indoors, so maintaining a good Indoor Air Quality (IAQ) is important. Fine particulate matter (PM2.5) is an essential component of IAQ, as these tiny particles can remain suspended in air and affect the respiratory system. Indoor PM2.5 levels can vary based on ventilation, indoor occupant activities, or Relative Humidity levels. This study investigated the relationship and variations in indoor PM2.5 and Relative Humidity in a residential setting at a constant temperature during different timings of the day. It also evaluated whether maintaining an indoor humidity between 40-45% using an ultrasonic humidifier reduces PM2.5 concentrations. Professional air monitors are expensive, which limits residential studies. This highlights the need for reliable, low-cost monitoring systems. A self-built Indoor Air Quality monitoring system was used to collect data over five days at 6:00 AM, 4:00 PM, and 9:00 PM. Data analysis showed that there were significant variations in Relative Humidity at a constant temperature during different timings of the day (p-value < 0.05), whereas, PM2.5 showed no significant difference (p-value > 0.05). A Pearson Correlation test revealed a weak relationship between humidity and PM2.5. When the same tests were repeated using an ultrasonic humidifier at 9:00 PM, reported PM2.5 values increased significantly from a mean of 49.88 to 133.68 micrograms per cubic meter (p-value < 0.0001). The increase occurred without visible haze, suggesting optical interference from suspended water droplets rather than true particulate pollution. These findings highlight limitations of consumer-grade optical PM sensors and emphasize careful interpretation of indoor air quality measurements under humid conditions.

Awards Won:
Fourth Award of $600