Smart Robot to Purify, Humidify, and Disinfect the Air for Even Distribution

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Maintaining optimal indoor air quality (IAQ) and humidity is a critical aspect of improving overall health. Low IAQ leads to respiratory illnesses, while low humidity causes dehydration and dryness. To a limited extent, stationary air purifiers and humidifiers address the issues of low humidity and IAQ. I experimented with multiple humidity sensors (hygrometers) placed throughout a room that showed a standalone humidifier could not distribute humidity evenly within the space. I solved the uneven distribution issue with a smart moving robot containing an air purifier, humidifier, and Ultraviolet C (UVC) lamp. The UVC lamp disinfects air by killing most bacteria as well as viruses such as COVID-19 This is highly applicable in light of the recent COVID-19 pandemic. My custom-built robot uses a Raspberry Pi, a camera, and sensors to detect air quality and humidity. The robot and the air handling system were modeled in Computer-Aided Design (CAD) and analyzed with Computational Fluid Dynamics (CFD) to find the various components' optimal design. I built the robot on a wooden platform that contains the electronics, air purifier, UVC lamp, and humidifier system. The robot was programmed to navigate a room until it detects dry air to humidify and polluted air to purify. I created an AI-based object detection algorithm with TensorFlow Lite to detect people. If the robot detects people, it disinfects the air in that area for a longer period of time. My experiment shows that the robot was able to humidify a room more evenly than a standalone humidifier.

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