

# **Air Quality Monitoring Framework for Smart Buildings using Edge Computing and Fuzzy Logic**

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## **Abstract**

People can suffer from hypoxia when their bodies do not receive enough oxygen, typically from polluted air. Hypoxia is a dangerous condition, which can cause brain, liver, and critical organ damage, just minutes after symptoms start, while often mistaken for fatigue. One of the most common causes of hypoxia is breathing carbon monoxide (CO) or carbon dioxide (CO<sub>2</sub>). In this work, a Sugeno fuzzy logic-based hypoxia warning and protection IoT Model (HyPIM) is proposed for smart buildings. Internet of Things (IoT) gas sensors are key devices in ubiquitously sensing the presence of unwanted gas, by generating valuable and important data for decisions that are relayed to smart building systems. Furthermore, Edge computing is utilized to reduce service latency and enhance the responsiveness of the HyPIM system. Specifically, Edge computing would aid in speeding up system-reactions, to reduce gas intensity and request emergency responders if a dangerous situation for air quality arises locally. To increase its fault tolerance, this model reduces false-positive hypoxia detection by employing two authentication processes and enhances reliability by employing an algorithm to select the best available sensors. HyPIM has a Sugeno fuzzy logic rule for accurate analysis and decision-making and is evaluated using data that is randomly generated by MATLAB functions spanning the operational range of the tested sensors. The proposed HyPIM model achieved higher accuracy compared to a comparative model that used a Mamdani fuzzy logic system.