# ABSTRACT

Asthma is a chronic respiratory disorder widely experienced worldwide and can lead to decreased quality of life or even death if not detected early. Exhaled gases such as carbon monoxide (CO) and carbon dioxide ($CO_2$) have potential as indicators of respiratory disorders. This study aims to design and develop a smart mask prototype capable of early detection of asthma risk by monitoring CO and $CO_2$ levels in exhaled breath in real-time. The system is designed using MQ-7 and SCD40 sensors integrated with an ESP32 microcontroller. Measurement data are analyzed using a threshold-based classification approach. CO levels are categorized into three classes: normal (<2.5 PPM), alert (2.5–5.9 PPM), and danger (≥6 PPM), while $CO_2$ changes ≥600 PPM are used as an indicator of potential respiratory disturbances. Measurement results are displayed directly on an LCD. Calibration results show that the MQ-7 sensor has an average accuracy of 86.62%, while the SCD40 sensor reaches 93.76%. The system has been tested with various breathing patterns and can consistently distinguish respiratory responses. This prototype functions as a portable, non-invasive, and efficient early monitoring system to support real-time detection of asthma symptoms.



**Keywords: Asthma, Non-Invasive, Gas Sensor, Early Detection**