UNIVERSITI TEKNOLOGI MARA

PREDICTION OF INDOOR AIR VENTILATION PERFORMANCE USING NONLINEAR AUTOREGRESSIVE NEURAL NETWORK IN KINDERGARTEN

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In the name of Allah, The Most Gracious, The Most Merciful.

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ABSTRACT

Introduction: Indoor air pollution has become one of major issues that cause health issues towards the building occupants especially people from the sensitive group such as elderly and younger children. However, indoor air pollutants can be removed by providing adequate ventilation towards the building. Effective and adequate ventilation can help to dilute and removed the pollutants and providing healthier air for the building occupants to breath. Adequacy of ventilation can be determined by measuring the concentration of carbon dioxide (CO_2) in the building as CO_2 is widely used as indicator for ventilation. **Method:** To determine the ventilation performance, a method of forecasting through modelling process using nonlinear autoregressive neural network (NARNN) is developed where CO_2 concentration data that collected from kindergarten is used construct and find the best fitted model with suitable number neurons and hidden layers. This model can help to predict the future concentration trend of CO_2 in kindergarten and determine the ventilation performance of the building. **Result:** The concentration of CO_2 in the building is decreasing through the operations hours indicating it has adequate ventilation. The dataset of CO_2 concentration is used to developed a prediction model which consist of artificial neural network (ANN) structure and a model with 1-9-1 structure with data division of 80:20 is the best fitted model for forecasting as it has high accuracy and highly relevant to be used for prediction as it has the nearest R-value near to one. **Conclusion:** Indoor air quality need a special attention by multiple authorities and organization especially the building that have younger children as occupants. Poor indoor air quality can risk the health of the occupants and disrupt the comfort of occupants on doing their activities in the building. Modelling technique is one of relevant and advance method to forecast the quality of a building as it can help to determine future concentration of pollutants in the indoor environment.

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Air pollution is defined to the release of pollutants into the air which the pollutants are detrimental to the human health and World Health Organization (WHO) stated that nine out of ten people currently breathe air that exceeds WHO's guidelines limits for pollutants especially people from low-income and middle-income countries (Jillian et. al, 2021). Indoor air pollution contributes greatly to human wellbeing as most people tend to spend around 90% of their time indoors, mainly in their home or in the workplace (Tran et al., 2020).

Indoor Air Quality (IAQ) is the air quality within and around any building or structures, especially as it relates to the health and comfort of building occupants and controlling the common pollutants indoor can help to reduce occupant risk of indoor health concern (USEPA, 2014). Indoor air pollution is a condition where the presence of chemical, biological and physical contamination in the air of indoor environment resulting in adverse health effects (OECD Statistics Directorate, 2022). With the increasing incidence of respiratory illness, health experts warn about the indoor air pollution hazard as several studies several studies show that air pollution are much higher than those in an urban outdoor environment (Bureau, 2017). Generally, indoor air pollution is generated from various of sources including tobacco smoke, building materials, fixtures, cleaning and hygiene products, air fresheners, computers, printers, cooking and other indoor activities and human itself is one of the sources of pollutants (Abu Mansor et. al, 2020). Poor indoor air quality can lead to multiple diseases and health problems such as chest pain, asthma, fatigue, throat irritation, headache, loss of