

ABSTRACT

Abstract of project presented to the Senate of Management & Science University in partial fulfilment of the requirements for the degree of Bachelor in Computer Science (Hons.).

DESIGN AND DEVELOPMENT OF A SMART INDOOR AIR QUALITY AND COGNITIVE PRODUCTIVITY MONITORING SYSTEM WITH IOT AND AI

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Indoor environmental quality significantly affects students' cognitive performance, learning comfort, and well-being. Poor air quality, temperature, humidity, and lighting can reduce concentration and productivity, while traditional reactive systems respond only after environmental conditions exceed set thresholds, resulting in delayed control and lower energy efficiency. This project presents a Smart Indoor Air Quality and Cognitive Productivity Monitoring System that integrates Internet of Things (IoT) and Artificial Intelligence (AI) to provide adaptive environmental monitoring and control.

The system uses an ESP32 microcontroller integrated with sensors to monitor CO₂, PM2.5, temperature, humidity, and light. Environmental data will be transmitted to a cloud server and displayed through a web-based dashboard for real-time monitoring. A Long Short-Term Memory (LSTM) model will be implemented to predict future environmental conditions based on historical data. These predictions will support proactive control of ventilation, HVAC, and lighting before environmental conditions deteriorate, improving comfort, productivity, and energy efficiency.

The system will be developed using the Agile methodology to support iterative improvements. Quantitative environmental data and qualitative user feedback will be used to determine appropriate comfort thresholds. System performance will be evaluated using prediction metrics including RMSE, MAE, and R-squared, along with integration and functionality testing. The proposed solution aims to provide an affordable and integrated smart environmental management system that combines IoT, cloud computing, and AI-based predictive analytics to improve user comfort, reduce energy consumption, and support sustainable smart educational facilities.