

DEVELOPMENT OF AIR QUALITY CONTROL SYSTEM FOR MODERN LIVESTOCK FARMING USING ESP32 WITH KOTLIN ANDROID FIREBASE INTERCONNECTIVITY

ABSTRACT

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This study addresses the urgent need for a reliable and cost-effective air quality control system in modern livestock farming. Existing monitoring devices often face issues with calibration and validation, leading to compromised accuracy and limited effectiveness. To address this gap, a prototype system was developed to continuously monitor environmental parameters such as temperature, humidity, and harmful gases using an ESP32 microcontroller. The system is integrated with a Kotlin-based Android application and Firebase for real-time data synchronization, providing a user-friendly interface that allows for immediate responses to fluctuating air quality conditions. The goal is to improve livestock health and productivity through enhanced environmental control and timely interventions. The study used an Experimental Prototyping Method to design, build, and refine the system. Iterative testing cycles were conducted to evaluate usability, reliability, and performance. Feedback was collected through purposive sampling using online surveys from 50 targeted respondents involved in livestock or agricultural technology. This allowed for systematic evaluation of user satisfaction, functional performance, and design practicality. The system received strong positive feedback from users, with General Weighted Mean scores ranging from 3.4 to 3.72 on a 4-point Likert scale. Respondents “Strongly Agreed” that the system effectively monitored air quality, maintained consistent data synchronization with Firebase, and demonstrated high levels of system maintainability and modernity. Additionally, the system performed well in terms of sustainability, safety, cost-efficiency, and compliance with engineering standards, affirming its feasibility and value in livestock applications. The developed air quality control system meets the operational needs of modern livestock farming while offering improvements over traditional systems. Its design includes essential safety components such as voltage regulators, fuses, and insulation to ensure secure and long-term operation. The results support the potential for broader adoption of the system across livestock farms, contributing to enhanced animal welfare, increased productivity, and better environmental management. This research highlights the role of integrated technology in advancing smart agriculture practices.

RECOMMENDED CITATION

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