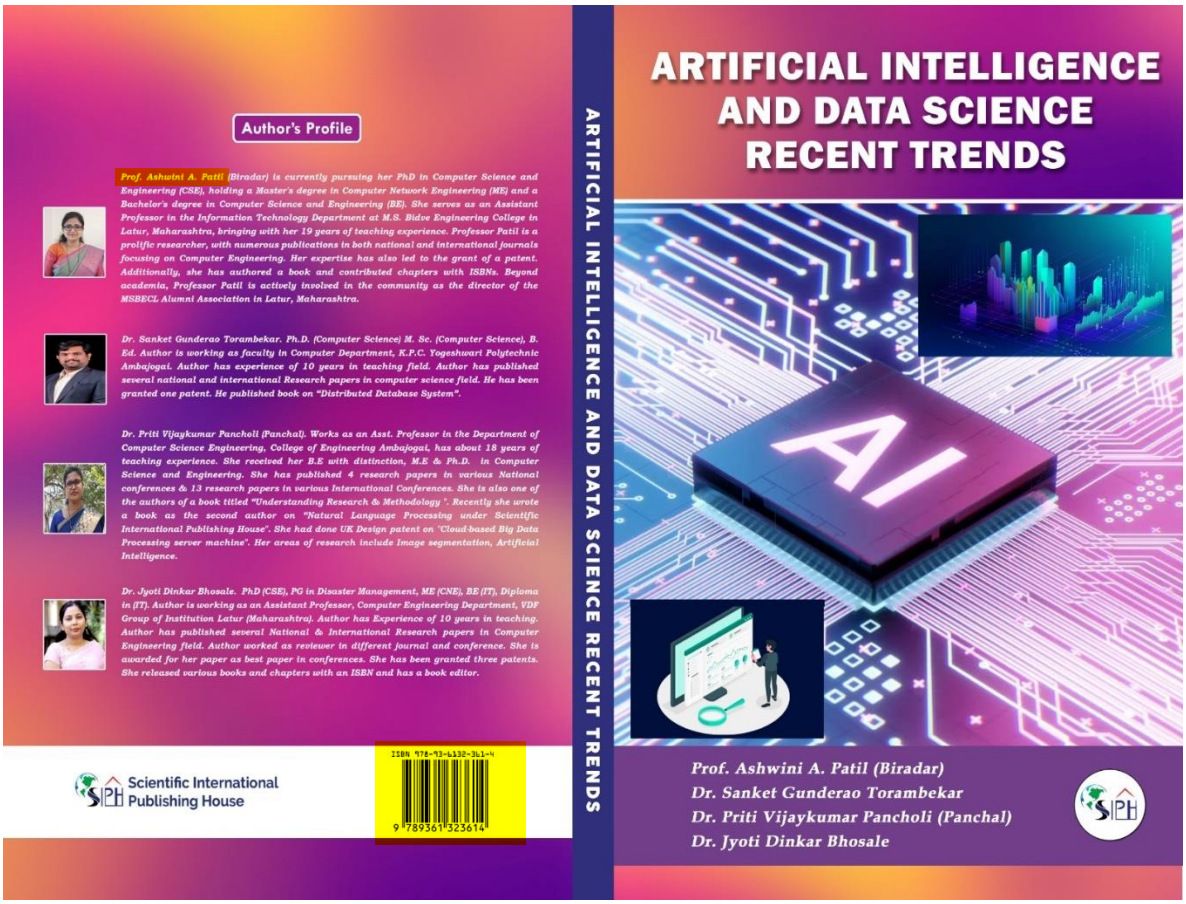
# Artificial Intelligence and Data science recent Trends




# ARTIFICIAL INTELLIGENCE AND DATA SCIENCE RECENT TRENDS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# Contents-Electrical Engineering

# A Fuzzy based Approach for Battery Controller for Microgrid

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**Abstract**— This paper presents a fuzzy-based approach for designing a charging-discharging controller for lithium-ion batteries in microgrid applications. The goal is to enhance the efficiency and performance of battery systems within microgrids. The proposed controller utilizes fuzzy logic techniques to handle uncertainties and imprecise information, providing robust and adaptive control in real-time scenarios. The controller's fuzzy rules consider factors such as battery state of charge, load demand, and renewable energy availability to determine optimal charging and discharging strategies. Simulation results demonstrate the effectiveness of the fuzzy-based controller in improving battery utilization, ensuring stable microgrid operation, and enhancing overall system performance. This research contributes to the advancement of battery control strategies in microgrids, promoting more efficient and sustainable energy management systems.

***Keywords***— fuzzy logic, charging-discharging controller, lithium-ion battery, microgrid applications, efficiency, performance, robust control, adaptive control, battery state of charge, load demand, renewable energy, optimal strategies, simulation results, system performance, energy management.

## I. INTRODUCTION

Lithium-ion batteries have become increasingly popular forenergy storage in microgrid applications due to their high energy density, long cycle life, and fast charging capabilities. Effective control of these batteries is essential to ensure efficient utilization and reliable operation within microgrid systems. However, traditional control methods like proportional-integral-derivative (PID) control often struggle to handle the uncertainties and dynamic nature of microgrid environments [1-3]. To address these challenges, fuzzy logic control has emerged as a promising alternative due to its abilityto handle imprecise and uncertain information.

The main objective of this research is to develop a charging-discharging controller for lithium-ion batteries in microgrid applications using a fuzzy-based approach. Fuzzy logic control offers advantages such as adaptability, robustness, and flexibility, making it well-suited for dynamic and complex microgrid scenarios. By incorporating fuzzy logic techniques, the controller can effectively handle uncertainties arising from variations in renewable energy availability, fluctuating load demand, and battery state of charge (SOC) fluctuations. [3-6]

The proposed fuzzy-based controller aims to optimize the charging and discharging strategies of the lithium-ion battery, considering multiple factors that influence battery performanceand microgrid operation. These factors include the current SOCof the battery, the demand for electrical energy from the microgrid, and the availability of renewable energy sources. The fuzzy rules embedded in the controller are carefully designed to adaptively adjust the battery charging and discharging rates based on real-time system conditions [7-8].

Simulation studies are conducted to evaluate theperformance of the proposed fuzzy-based controller comparedto traditional control methods. The simulation results demonstrate the superiority of the fuzzy-based approach in terms of battery utilization, microgrid stability, and overall system performance. The findings of this research contribute to the advancement of battery control strategies in microgridapplications, aiming to enhance the efficiency and sustainability of