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Hospital Surgery Scheduling Optimization System: Development and Application Based on Image Recognition and AI Algorithms

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Abstract

Operating rooms are the most expensive and critical medical resources in hospitals, and scheduling efficiency directly impacts patient waiting times, healthcare workforce burden, and overall hospital operational efficiency. However, most hospitals still manage surgical scheduling using paper or basic electronic forms, relying on manual interpretation and adjustments, which are not only time-consuming and labor-intensive but also prone to resource wastage and communication errors due to information inconsistencies or omissions. This study aims to develop a "Hospital Surgery Scheduling Optimization System" that integrates image and document recognition technology with scheduling algorithms. It automatically extracts room numbers, times, doctors, and surgical information from surgical scheduling photos, converts them into structured data, and proposes optimized operating room schedules while adhering to clinical and management constraints. The system provides a web interface for users to upload files, view results, and compare pre- and post-optimization schedules, ultimately outputting standardized scheduling reports to enhance operating room utilization and scheduling transparency, thereby achieving the goals of smart healthcare and digital process transformation. Preliminary results show that the system's OCR module achieves a field recognition accuracy rate of over 85% under medium-quality images, significantly reducing the manual input time by approximately 70%. The scheduling optimization algorithm improved operating room utilization from the original 65% to 85%, reduced daily overtime hours by 20-30%, and decreased surgical delay cases by 15% in simulated scenarios. Additionally, the system integrates a carbon emission estimation model, predicting a 10-15% reduction in the operating room carbon footprint post-optimization, demonstrating its potential for efficiency and sustainable healthcare. Future efforts will involve clinical validation to confirm the long-term benefits.

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Keywords
Operation room, scheduling, Optical Character Recognition; Machine learning, Carbon emission.

Biographies
Dr. Tsan-Wen Huang is a director of the Department of Orthopaedic Surgery at Jen-Ai Hospital and an associate professor at Chang Gung University. His expertise includes artificial knee and hip joint replacement surgery, artificial joint re-replacement surgery, osteoporosis prevention and treatment, and complex fracture treatment.

Dr. Shao-Jen Weng is currently a professor in the Department of Industrial Engineering and Enterprise Information at Tunghai University and serves as the Dean of the College of Interdisciplinary Innovation. Professor Weng's research areas encompass hospital system optimization, healthcare management, patient safety, industrial engineering applications, and emergency medical services. He was awarded the Outstanding Young Scholar Award by the Ministry of Science and Technology (NSTC) and served as the Director of the Healthcare Systems Consortium (HSC).

Dr. Yao-Te Tsai is an associate professor in the Department of Information Management at the National Kaohsiung University of Science and Technology. He also serves as the Secretary General of the Healthcare Systems Consortium (HSC). His research interests include healthcare management, information management and AI applications.

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