



SmartAttend Pro: Implementation of Biometric Attendance System with
Data Analytics, Payroll System, and Virtual Assistant for HR Management

UNDERGRADUATE THESIS

Submitted as one of the requirements to obtain

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FACULTY OF COMPUTER SCIENCE

INFORMATION TECHNOLOGY STUDY PROGRAM

CIKARANG

AUGUST 2025

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JULY, 2024

TABLE OF CONTENT

TABLE OF CONTENT

CHAPTER I PROPOSAL4

ABSTRACT

Manual human resource management systems in small and medium-sized enterprises (SMEs) present significant operational challenges, including attendance recording errors, payroll calculation inefficiencies, and fraud vulnerabilities such as "buddy punching." This thesis presents the development of SmartAttend Pro, an integrated IoT and AI-based attendance management system designed to address these challenges at Regatta Property, a representative SME facing typical HR management constraints.

The research methodology involved comprehensive analysis of existing manual processes, evaluation of alternative solutions, and implementation of a cost-effective integrated system utilizing ESP8266 microcontrollers, AS608 fingerprint scanners, and machine learning algorithms. The system architecture incorporates biometric authentication, real-time data synchronization, automated payroll processing, and predictive analytics using TensorFlow LSTM neural networks.

Key findings demonstrate significant improvements in operational efficiency through the elimination of manual attendance recording, reduction of payroll processing time from 2-3 days to automated real-time calculations, and implementation of streamlined approval workflows for leave, permit, and overtime requests. The system successfully integrates AI chatbot functionality using Google Dialogflow to reduce HR administrative burden and provides comprehensive analytics for strategic decision-making.

The implementation results show exceptional cost-effectiveness with a one-time investment of Rp 253,000 compared to cloud-based alternatives requiring ongoing subscriptions of Rp 5-15 million. Qualitative testing with 95 potential users achieved an overall satisfaction rating of 4.46/5.0 with 88.6% recommendation rate. The system demonstrates robust security features including JWT authentication, PBKDF2-SHA256 password encryption, and fingerprint hash encryption.

SmartAttend Pro transforms traditional HR management through automation, reducing human error, preventing attendance fraud, and providing intelligent insights for workforce planning. The system's modular design enables scalability and customization without vendor dependency, making it a sustainable solution for SMEs seeking digital transformation in human resource management. This research contributes to the body of knowledge on cost-effective IoT implementation in small business environments and demonstrates the practical application of AI technologies in HR optimization.

TABLE OF CONTENT

TABLE OF CONTENT.....	10
CHAPTER I PROPOSAL.....	12
1.1 Problem Formulation.....	12
1.2 Problem Constraint Analysis.....	14
1.3 Problem Functional Analysis.....	14
1.4 Solution Selection.....	15
1.5 Solution Usage Scenarios.....	17
1.6 Development Effort.....	18
CHAPTER II SPECIFICATION.....	21
2.1 Existing System and Proposed System.....	21
2.2 Global Description of The Product.....	22
2.3 Requirement Analysis.....	26
2.4 Functional Requirements.....	39
2.5 Non-Functional Requirement.....	42
2.6 Specification Testing.....	43
CHAPTER III DESIGN.....	45
3.1 Alternative Solution Design.....	45
3.2 Rational/Systematic Design.....	47
3.3 Hierarchical/Iterative Design.....	50
3.4 Verification Demonstration and Proof of Design Process.....	61
3.5 Standards Used.....	62
3.6 Implementation and Testing Plan.....	63
CHAPTER IV IMPLEMENTATION.....	65
4.1 Design Implementation.....	65
4.2 Database implementation based on the design.....	82
4.3 Product Display the Reference Material.....	86
4.4 Component Cost Analysis.....	94
4.5 Manual Guide.....	94
4.6 Video Demonstration.....	96
CHAPTER V TESTING.....	97
5.1 Restate the problem as stated in the F-100 document.....	97
5.2 Restate the specification stated In the F-200 document.....	97
5.3 Functional Testing.....	98
5.4 Qualitative Testing.....	103
5.5 Testing Other Specifications.....	104
5.6 A photo/recording of the test is shown in the document.....	107
REFERENCES.....	108