CHAPTER II

REVIEW OF THE RELATED LITERATURE

In this chapter, we analyze the existing literature and studies that are relevant to our research on "ThesisTrack: An Algorithm-Driven Platform for Efficient Monitoring of Student Research Progress for CICT" These selected sources have been carefully assessed for their valuable insights and their potential to contribute to the development of our platform, enrich the study's foundation, and provide a more profound understanding of the issues at hand.

AI-driven Platforms for Document Structure Analysis

According to Pandey et al. (2023), their Intelligent Document Management System (IDMS) leverages NLP approach—combining computer vision-based text extraction with regular-expression parsing—to achieve high data-extraction accuracy (97% for medical invoices, 71% for Aadhar cards, and 79% for PAN cards). Based on these findings, integrating NLP techniques provides a robust foundation for automatically parsing and validating document structure, directly informing our thesis's focus on AI-powered structural completeness checks for thesis chapters.

According to Baviskar, Ahirrao, Potdar, and Kotecha (2021), AI-based techniques—combining computer vision and NLP—have strong potential to automate

information extraction from unstructured documents. Their systematic review highlights the urgent need for high-quality, layout-diverse datasets and robust validation methods to ensure reliable extraction. For instance, Sahu, Mishra, Verma, and Bharti (2021) developed an AI-based question paper analysis and generation system. The study highlights how AI-driven techniques can automate document analysis, a concept directly applicable to the structural completeness evaluation of thesis chapters in this study's proposed platform.

According to Munagandla, Dandyala, and Vadde (2024), AI-driven Research Proposal Systems (RPS) can automate routine administrative tasks—such as document validation, reviewer assignment, and deadline tracking. Based on their framework, predictive analytics on historical proposal data can forecast project impact and recommend improvements, thereby reducing review cycles and human bias.

Utilization of Agile Kanban in Web-based Systems

According to Wilmer Cunuhaay, Marco Estrada, Geovanny Silva, and Cristian Inca (2024), the application of Agile Kanban methodology in web-based systems, particularly for data management, has demonstrated significant potential in improving decision-making and operational efficiency. The Kanban methodology's collaborative and incremental approach was noted for its adaptability to change and capacity to deliver

constant value. The results validated the strength of the applied methodology and its alignment with the system's goals.

According to Toh, Subarmaniyan, and Abdul Majid (2021), a web-based Kanban application tailored for students significantly improves project management by visualizing tasks, enforcing WIP limits, and facilitating team collaboration. Based on user testing, the tool helped students track assignment progress, eliminate bottlenecks, and meet deadlines, demonstrating how accessible, online Kanban boards can enhance workflow transparency and on-time delivery in educational settings.

According to Kumari (2023), integrating Artificial Intelligence (AI) into Kanban systems significantly enhances task prioritization, real-time monitoring, and workflow efficiency, especially in fast-paced development settings. The study proposes that AI-driven analytics can proactively detect workflow bottlenecks and guide decision-making, which allows Agile teams to respond swiftly to changing priorities. This insight directly supports the core of the current research, which incorporates AI into a thesis tracking system to monitor progress and ensure timely completion of critical academic milestones.

According to Srujana and Swathi (2024), integrating artificial intelligence into traditional Kanban boards enhances project management efficiency by making workflows

more adaptive and intelligent. Their proposed system uses machine learning to forecast bottlenecks and suggest resource allocations, while natural language processing enables intuitive interactions and automated task updates. Based on their findings, the AI-enhanced Kanban board led to better task tracking, improved project timelines, optimized workload distribution, and increased user satisfaction.

According to Toh, Subarmaniyan, and Abdul Majid (2021), implementing a web-based Kanban tool among students led to unanimous support for applying project management methodologies to assignments. Their user acceptance testing confirmed that task visualization, work-in-progress limits, and task prioritization were key features that improved productivity, monitored progress, and ensured on-time completion. This substantiates the value of Kanban's core elements in any system.

According to Csernoch, Szűcs, and Máté (2024), digital education today largely follows a "push" paradigm—tool-centered and focused on content delivery through hardware and software—resulting in wasted effort and erroneous documents. They propose extending lean production's pull-system theory (specifically Kanban) to digital education, demonstrating through the design and testing of a real-world spreadsheet task how a Kanban pull system can enforce Just-in-Time principles, reduce data-processing inefficiencies, and cultivate deeper problem-solving skills among end users. Based on their analysis, adapting Kanban pull systems in educational workflows

can minimize digital waste, improve resource utilization, and guide learners through critical tasks—insights that directly support our platform's use of Kanban visualization to streamline thesis progress and reduce administrative overhead (Csernoch, Szűcs, & Máté, 2024).

AI-driven Platforms for Study Planning and Monitoring

In their work, Wagner et al. (2022) propose a combined approach that integrates process mining and rule-based AI for study planning and monitoring in higher education. According to their findings, process mining techniques are used to identify successful study paths and detect deviations from expected academic progress. This method, when combined with AI-based recommendations and conformance checks, provides a more data-driven approach to guiding students along their academic journey. Their system's insights into student study paths and the ability to detect potential academic violations align with the goals of our thesis monitoring platform, which also aims to give real-time feedback based on data and deviations from planned progress.

According to Hassi (2024), project managers possess a foundational understanding of AI and recognize its potential to automate routine tasks (like report generation), enhance risk management via predictive analytics, and optimize resource

allocation, thereby freeing managers to focus on leadership and creative problem-solving.

According to Tan, Chen, and Yeo (2021), the PRMS's AI-driven tracking automates the monitoring of report deadlines and project statuses, sending timely reminders to investigators and ensuring no submissions are overlooked. Based on user feedback, this continuous, automated oversight reduces manual follow-up, maintains consistent progress visibility, and frees administrators to focus on analysis rather than logistics—a capability directly applicable to our thesis tracker's need for automated deadline alerts and progress monitoring.

The Emergent Role of Artificial Intelligence, Natural Language Processing, and Large Language Models in Higher Education and Research.

According to Treve (2024), the integration of artificial intelligence (AI) tools in educational environments significantly boosts student engagement, academic achievement, and creative thinking. The study demonstrated measurable improvements in student performance — with engagement increasing by up to 23%, GPA rising between 9% and 14%, and innovative thinking levels surging from 44% to 57%. These findings reinforce the importance of personalized learning systems. Treve highlights that AI's influence extends beyond content delivery to reshaping educational philosophy,

promoting a shift from traditional “one-size-fits-all” teaching toward highly individualized and responsive instruction. This aligns with the objective of thesis monitoring systems to provide tailored support, ensure student progress, and cultivate 21st-century skills like creativity and critical thinking.

According to Tariq Alqahtani, Hisham A. Badreldin, and Mohammed Alrashed (2023), artificial intelligence (AI), natural language processing (NLP), and large language models (LLMs) have rapidly emerged as transformative tools in higher education and academic research. Their study emphasizes how AI and NLP, empowered by advanced algorithms and data-driven systems, are revolutionizing traditional research methods and content dissemination. These technologies automate several manual academic tasks such as data collection, information analysis, and content generation. Moreover, they provide innovative ways to enhance academic communication, support evidence-based decision-making, and foster deeper engagement among students and educators in digital learning environments.

According to Martin and Hood (2023), Natural Language Processing (NLP) can enhance literature reviews by increasing their depth and breadth while reducing human effort, bias, and error. Their study showed that a strong NLP engine matched human reviewers with 100% accuracy, demonstrating its value in tasks like screening, extracting, and summarizing research content. This highlights the potential of NLP in

systems designed for thesis relevance checking and research support. Gerard Martínez García (2023) adds to this discourse, His study emphasizes the increasing complexity of modern projects and the potential of AI-powered tools like Notion AI to optimize workflows, coordinate teams, and enhance task management. The research further details the historical evolution of AI—from symbolic logic in the 1950s to modern deep learning architectures—showcasing how its current capabilities, including content generation and natural language understanding, can be repurposed to improve digital project coordination systems, such as thesis tracking platforms.

According to Ye, Hu, Nassehi, Ji, and Ni (2024), a context-aware system must clearly define (a) what information is needed, (b) when it should be provided, (c) who the recipient is, and (d) how it is delivered. Extrapolating to thesis supervision, our platform must generate an AI-suggested completeness score immediately upon chapter upload, direct it to the correct user role—student or advisor—and display it via intuitive dashboard notifications or Kanban cards to streamline the review process (Ye et al., 2024).

As proposed by Savitha, Gopika, Jayaprakash, and Lashman (2025), an AI-driven academic achievement tracking system can streamline educational recordkeeping while enhancing personalized learning pathways. The system they developed consolidates student and faculty academic data. It utilizes hybrid recommendation algorithms,

combining content-based and collaborative filtering, to generate tailored suggestions for courses and projects based on users' skill sets and academic histories.

According to Yue Kang, Zhao Cai, Chee-Wee Tan, Qian Huang, and Hefu Liu (2023), Natural language Processing (NLP) is increasingly significant in management research due to the ability it has to automatically analyze and interpret human speech. Despite its growing application in management studies, the literature on NLP's use in this context is limited. The study emphasizes how NLP has revolutionized business practices and management theories, highlighting its utility in domains like sentiment analysis, machine learning, and information extraction from textual datasets.

Improving The Progress Monitoring Task of Agile Kanban

According to Alaidaros, Omar, and Romli (2020), the Agile Kanban methodology exhibits weaknesses in progress monitoring, particularly in controlling, tracking, and visualizing workflow progress. To address this, the authors proposed an enhanced theoretical framework that improves Kanban's progress monitoring by focusing on three key areas: progress tracking, limiting work-in-progress (WIP), and progress visualization. Based on their exploratory study and expert validation, the framework provides practical guidance for improving software project monitoring and increasing success rates in Agile environments.

Synthesis of the Study

The gathered literature provides substantial support for the development of an algorithm-driven platform for thesis progress monitoring. Research demonstrates that AI technologies can effectively evaluate document structure and extract essential information from academic papers, which is directly applicable to thesis chapter assessment. Studies examining Agile Kanban methodology reveal its effectiveness when enhanced with artificial intelligence, offering improved task visualization and workflow management particularly beneficial in academic contexts.

The research also confirms that AI-powered academic systems successfully automate monitoring tasks like deadline tracking and requirement verification while delivering personalized guidance. By integrating these technological approaches, the proposed platform can assess thesis completeness through AI analysis, visualize progress via Kanban boards, and implement automated notifications for timely milestone completion. This addresses the current need for more efficient thesis supervision tools in higher education institutions