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AI-Driven Clash Management in Large-Scale Residential Design

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PROFESSIONAL BACKGROUND

BIM Coordinator & Part II Architect
Reddy Architecture + Urbanism (2023-2025)

Digital Construction Management Technician
Digital Construction Technologies (2023)

Project Coordinator
NorDan Vinduer (2022-2023)

ACADEMIC BACKGROUND

Master's Degree in Applied BIM & Management
TU Dublin, Dublin – Ireland (2022-2025)

Exchange of Studies in Architecture & Urban Planning
La Coruña University, La Coruña – Spain (2020)

Honours Bachelor's Degree in Architecture & Urban Planning
São Paulo University (USP), São Paulo – Brazil (2016-2021)

Academic Literature Review

Clash Management is the process of avoiding, identifying, and resolving coordination issues within a project, facilitated in BIM through the use of federated models.

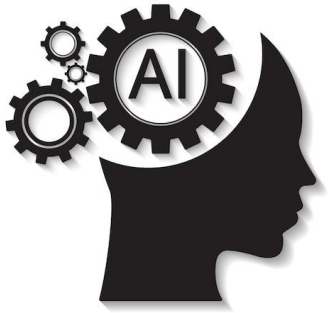
- Clash Avoidance
- Clash Detection
- Clash Resolution

Knowledge Gap: Lack of methods to simplify and optimise the BIM coordination processes conducted by design and BIM teams during the design stage

Pressing need for AI-driven workflows to be thoroughly investigated: *While data-driven insights can optimise the BIM process, there is limited expertise in identifying pathways and responsibilities for AI integration, as* ***most studies and practices focus on separate applications of BIM or AI*** *(Zhang et al., 2022)*.*

*Zhang, F., Chan, A.P.C., Darko, A., Chen, Z., Li, D., 2022. Integrated applications of building information modeling and artificial intelligence techniques in the AEC/FM industry. Autom. Constr. 139, 104289. https://doi.org/10.1016/j.autcon.2022.104289 [Accessed at 31/10/2025].

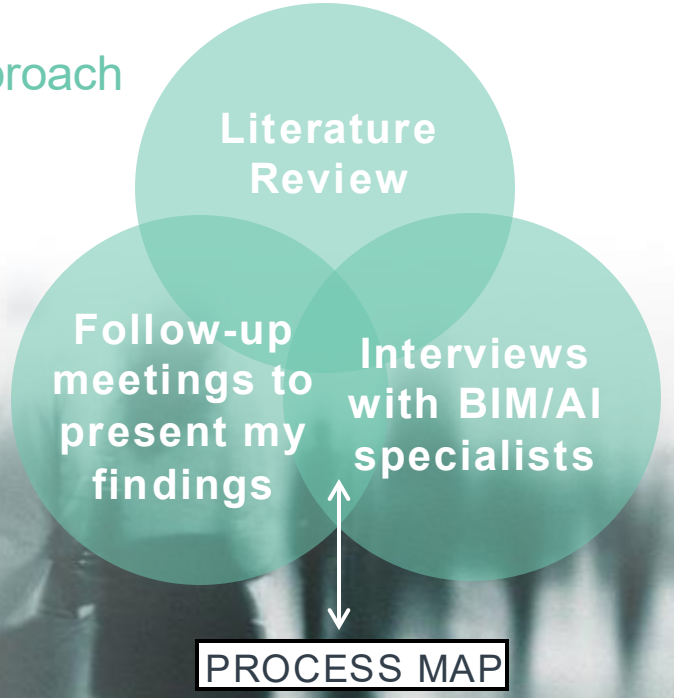
Purpose of the Research



To develop a process map that identifies pathways to integrate AI-based solutions to optimise clash management within large-scale residential design.

Methodology

Triangulated approach



RESEARCH FINDINGS

Clashes in large-scale residential projects
Existing Clash Management Workflows
Clash Management Inefficiencies
Pathways and tools for AI integration into clash management
Barriers to AI adoption

Clashes in large-scale residential projects

Common Clashes: MEP vs structure, Architecture vs MEP, MEP vs MEP

Problematic areas: Ceiling voids in corridors, basements & roofs

Clash management considered as highly beneficial for residential due to its standardisation - once one level is coordinated and all clashes are resolved, the same reference level can be copied to other levels

Existing Clash Management in BIM Workflows

MODELLING

Clash avoidance

Models shared on ACC/BIM 360
Enhanced Communication
BIM Coordinators/Managers share protocols, methods and procedures with the Design Team

CHECKING

Clash detection

Visual Federated Models check
Running Clash Detection Tests
Filtering and grouping clashes

SOLVING

Clash Resolution

BIM Coordination Meetings - Clashes presented by BIM specialists to design teams weekly or bi-weekly
Resolution strategy

irrelevant clashes presented in meetings

poor models QA checks

modelling errors

manual report creation

lack of lessons learned

manual clash review

models not available from all disciplines

COORDINATION INEFFICIENCES

delayed models share

BIM procedures not followed

low-quality design models

lack of engagement

coordination using outdated models

inexperienced modelling staff

late client decision

modelling inconsistencies against drawings

time-consuming clash detection

inexperienced BIM staff

Tools and Techniques for AI integration into clash management workflows

Machine Learning

Trained systems to discover patterns in data sets from previous similar projects

Knowledge-based rules

Pre-defined rules created by experts based on their previous knowledge

Genetic Algorithms

Algorithm that mimics the mechanism of natural selection where strong individuals survive and weak die - only promising solutions would survive

Natural Language Processing

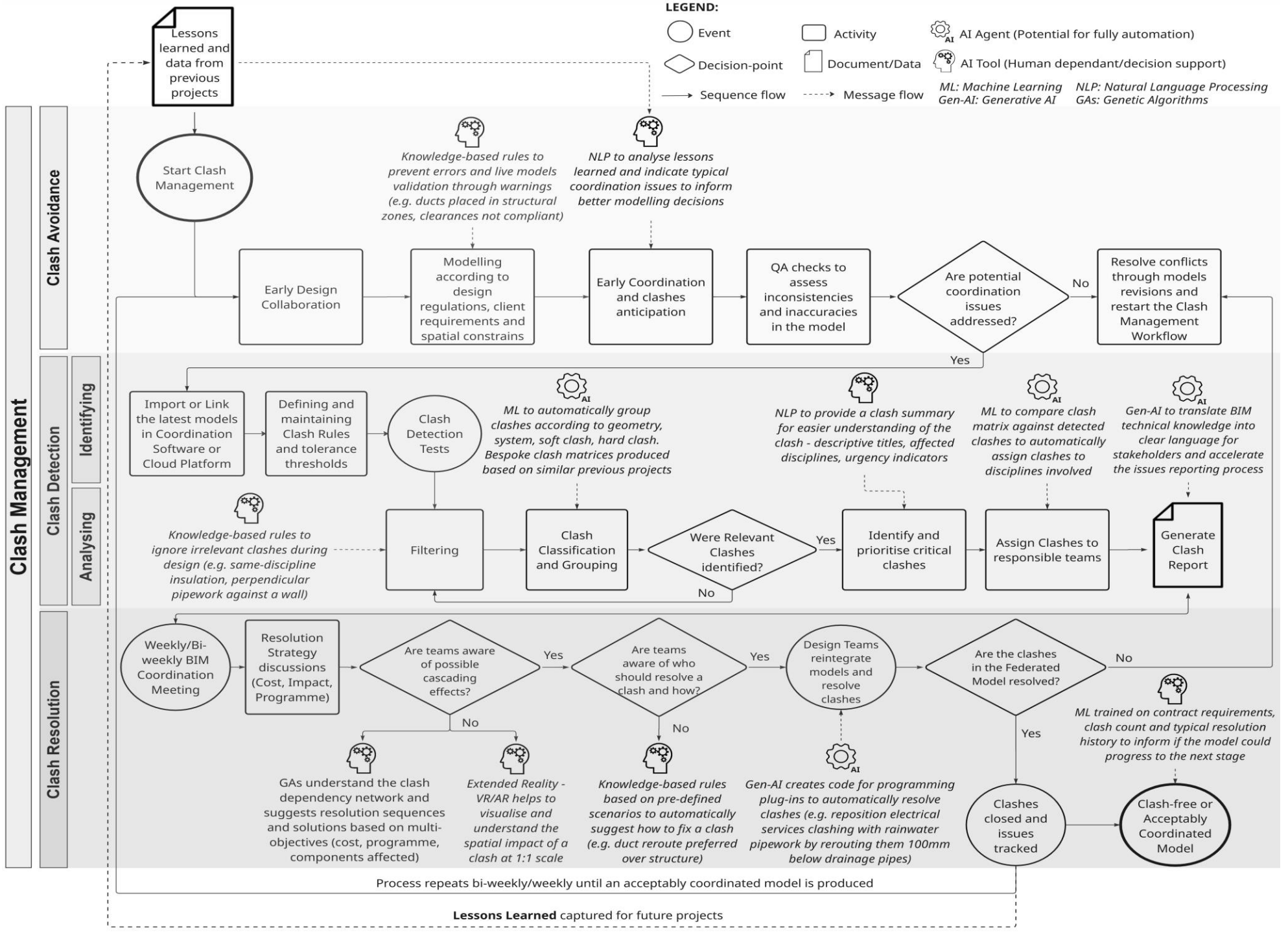
Drives computers to process, explore, interpret, and produce language-related data in the form of text

Extended Reality (VR/AR)

Immersive technologies that blend the physical and digital world to create new environments and support 1:1 scale visualisation

OUTCOME
PROCESS MAP

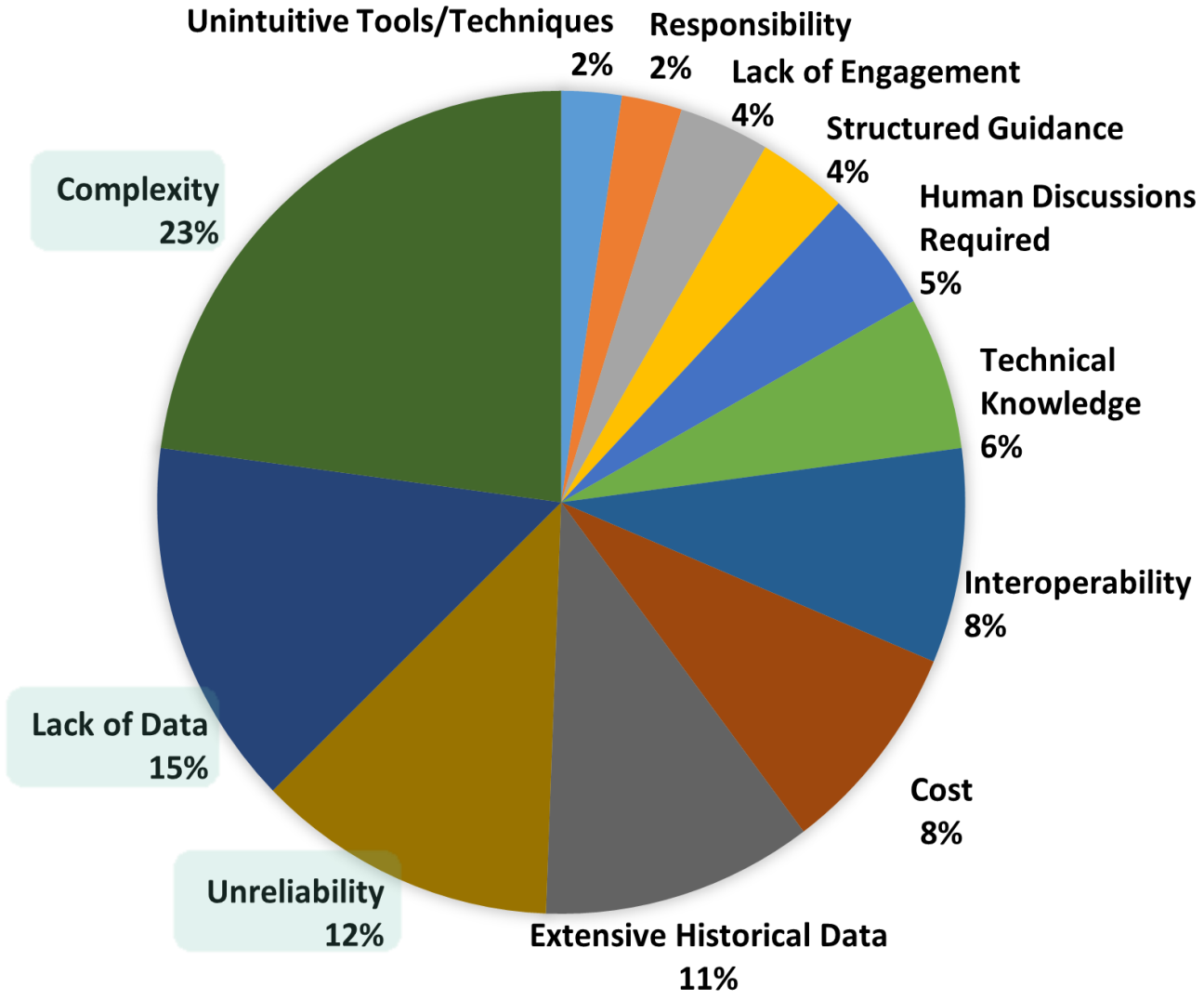
Pathways for AI integration into clash management workflows



Framework developed by the researcher and further refined by industry professionals in follow-up meetings.

Barriers to AI adoption

Data collected from interviews with professionals based in Ireland and the United Kingdom (2025)



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Thank you