



CAPSTONE PROJECT REPORT

Report 1 – Project Introduction

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I. Record of Changes

Date	A* M, D	In charge	Change Description
20-09-2025	A	Duong Minh Nhat	Initial draft of Project Introduction created. Added Project Overview.
26-09-2025	A	Dao Trong Duc	Added Project Background.
06-10-2025	A	Pham Dang Khoi	Added Major Features to Project Scopes & Limitations.
16-10-2025	A, M	Le Nhat Quang	Added NCCER to Existing Systems. Modified Major Features
22-10-2025	A	Duong Minh Nhat	Added ITI, CM Labs to Existing Systems. Added Business Opportunity and Software Product Vision
24-10-2025	A, M	LSSCTC Group	Added Limitations & Exclusion. Modified Major Features.

*A - Added M - Modified D - Deleted

II. Project Introduction

1. Overview

1.1 Project Information

- Project name: Learner Management and 3D Simulation System for Crane Training Center
- Project code: FA25SE097
- Group name: GFA25SE59
- Software type: Web App, Desktop App

1.2 Project Team

Full Name	Role	Email	Mobile
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2. Product Background

Crane operation training requires a combination of theoretical understanding and significant practical experience. Traditional training methods that rely exclusively on real cranes present several major challenges. These include high operational costs (fuel, maintenance, instructor time), limited availability of physical equipment for trainees, and most importantly, significant safety risks for beginners operating heavy machinery.

Training centers often struggle with the logistics of managing training schedules, effectively tracking the progress of numerous trainees, and ensuring a consistent quality of instruction. Furthermore, without modern simulation tools, trainees may lack sufficient and safe preparation before they are required to operate real, high-risk equipment. This situation leads to a demand for an integrated system that can streamline training center management while also providing a safe, realistic, and cost-effective 3D simulation environment to enhance learning efficiency and reduce operational risks.

3. Existing Systems

3.1 ITI (Industrial Training International)

Link 1: [ITI Simulator Capture](#)

Link 2: [ITI Courses](#)

ITI offers a complete ecosystem that combines its Learning Management System with a massive library of VR Crane Simulations. Performance metrics from the simulation (e.g., pass/fail, efficiency) are automatically fed back into the student's record in the LMS.

They offer a wide variety of scenarios and crane models. However, ITI Simulator relies on high-cost Virtual Reality (VR) hardware, which can be expensive to deploy to a large number of trainees simultaneously.

3.2 CM Labs Simulations (Vortex)

Link: [CM Labs Main Site](#)

CM Labs is a market leader in high-fidelity, physics-based simulation for heavy equipment. They are widely regarded for providing the most accurate simulation of crane physics and machine behavior. CM Labs support both normal setup and high-cost alternative.

However, they are not a complete LMS, and require training center to maintain a separate LMS integration. That leads to significant complexity and cost.

3.3 NCCER (National Center for Construction Education and Research)

Link: [NCCER Mobile Crane Course](#)

NCCER provides a standardized curriculum and a registry system (LMS) for managing craft training, assessments, and certifications, including for crane operators. This system is a leader in managing the theoretical and book-learning components of training.

However, NCCER is not integrated with any 3D Simulator, and highly relies on available devices. This creates a significant gap between theory and practice, introduces high safety risks for new trainees, and incurs high operational costs (fuel, machine wear, instructor time).

4. Business Opportunity

The heavy equipment training industry faces persistent operational and financial challenges. Training centers are constrained by the high operational costs of machine fuel and maintenance, significant safety risks for novice operators, and the low scalability of one-on-one physical instruction.

Concurrently, the administrative burden of managing trainee schedules, tracking theoretical progress, and logging practical results is a major logistical inefficiency.

There is a strong demand for a single, cost-effective system that can streamline workflows through a central web-based Learning Management System, while cutting the gap between theory and high-risk practice by providing a safe, low-cost, and repeatable 3D simulation environment.

5. Software Product Vision

For crane training centers seeking to modernize their curriculum, enhance safety, and reduce operational costs, LSSCTC is an integrated software suite that provides a unified system for both theoretical and practical training.

The system combines a comprehensive web-based LMS for managing courses, users, and progress, with an accessible desktop 3D simulation application for hands-on practice. This approach empowers training centers to deliver a scalable and cost-effective program that improves trainee preparedness and safety, while simultaneously providing administrators and instructors with a centralized tool to manage the learning lifecycle.

6. Project Scope & Limitations

6.1 Major Features

6.1.1 Web Application for Admin

FE-01: Login/Logout.

FE-02: Manage personal profile: view profile, update profile, change password.

FE-03: Manage user account: view user account, add user account, deactivate user account.

FE-04: Manage program: view program, add new program, update program, assign course for program.

FE-05: Manage course: view course, add new course, update course.

FE-07: Manage class: view class, add new class for specific course, update class, assign instructor.

FE-08: Manage simulation timeslot: view slot, add new slot, update slot, assign practice to slot.

6.1.2 Web Application for Simulation Manager

FE-09: Manage personal profile: view profile, update profile, change password.

FE-10: Manage simulation component: view component, add new component, update component.

FE-11: Manage simulation task: view action, add new action, update action.

FE-12: Manage simulation practice: view practice, add new practice, update practice.

6.1.3 Web Application for Instructor

FE-13: Login/Logout.

FE-14: Manage personal profile: view profile, update profile, change password.

FE-15: Manage class member: view member, add new member.

FE-16: Manage class section: view section, add new section, update section.

FE-17: Manage learning material: view material, add new material, update material, assign material to section.

FE-18: Manage quiz: view quiz, add new quiz, update quiz, assign quiz to section.

FE-19: View list practices, and can assign practices to class section.

FE-20: View trainee result on quizzes and practices, and can provide direct feedback.

FE-21: View trainee overall performance in class, and can confirm pass or fail result for each trainee in class.

FE-22: Manage final exam: setup Theory Exam, Simulation Exam, Practical Exam.

FE-23: Take attendance.

6.1.4 Web Application for Trainee

FE-24: Login/Logout.

FE-25: Manage personal profile: view profile, update profile, change password.

FE-26: View available programs, courses, classes, and can make enrollment.

FE-27: View class syllabus and sections.

FE-28: View learning material assigned to class section, and can access or download material.

FE-29: View quizzes assigned to class section, and can make attempt or view recorded results.

FE-30: View practices assigned to class section, and can view recorded results.

FE-31: Take final exam

6.1.5 3D Simulation Application for Trainee (Desktop)

SI-01: Login/Logout.

SI-02: View list practices in which trainee is assigned to, and can select a practice to make new attempt.

SI-03: View simulation guides and settings.

SI-04: View practice steps and step details (including target components, target actions, expected outcome).

SI-05: View simulation components, and can make action (inspect definition, lift, rotate).

SI-06: View step result and warning message when committing an error.

SI-07: View post-practice result (time, completion status).

6.2 Limitations & Exclusions

Limitations:

LI-01: Simulation Platform: The 3D Simulation Application (6.1.5) is a desktop-only application (Windows/Linux/macOS) and is not accessible via web browser or mobile device.

LI-02: Simulation Scope: The simulation practice does not perfectly represent real-world crane models and physics.

LI-03: Content Management: The system provides feature to manage program content and simulation settings, but it does not include creating core assets and scripts inside simulation environment.

Exclusions:

EX-01: Payment and Billing: The system does not support any payment processing or billing features.

EX-02: Communication: The system does not support comments, live chat or discussion forum. Feedback feature is private.

EX-03: Final Examination: The system is a training and preparedness tool, not a final certification authority. All official, final examinations (the hands-on, practical test with real crane vehicle, in-person written exams) are conducted offline and are outside the scope of this system.

EX-04: Course Certificate: The system issues Certificate of Training / Certificate of Completion to validate that a trainee has finished a course within the training center. The issuance does not connect to, or submit result to, any government and regulatory body.