Kod Projek :	BITU 3923

UNIVERSITI TEKNIKAL MALAYSIA MELAKA
FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY

WORKSHOP 2
PROPOSAL FORM
[Incomplete form will be rejected]

A **TITLE OF PROPOSED PROJECT:** **GROUP NO:** 16

Tajuk projek yang dicadangkan : Automation of Risk Based Inspection utilizing Object Computer Recognition Technology and Artificial Intelligence Agents (AutoRBI)

B **DETAILS OF STUDENT** / *MAKLUMAT PELAJAR*

B(i)

No	Name of Student *Nama Pelajar*	Student matric no. *No. Matrik Pelajar*	E-mail Address *Alamat e-mel*
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B(ii) **Course:**
Kursus:

☐ BITC ☐ BITD ☐ BITE ☐ BITI ☐ BITM ■ BITS ☐ BITZ

C **PROJECT INFORMATION /** *MAKLUMAT PROJEK*

C(i) **Executive Summary of Project Proposal (maximum 300 words)**
(Please include the background of project, problem statements, objectives, scope and project significance from the project)

Ringkasan Cadangan Eksekutif Projek (maksima 300 patah perkataan)
(Meliputi latar belakang projek, penyataan masalah, objektif dan kepentingan projek)

*This project proposes the development of **AutoRBI (Automation of Risk-Based Inspection)** — a software system designed to modernize and automate the Risk-Based Inspection (RBI) process for industrial assets. The project addresses the inefficiencies and inconsistencies in the current manual RBI workflow, where engineers*

	spend significant time extracting equipment data from General Arrangement (GA) drawings, performing risk calculations, and preparing inspection plans in compliance with API 580 and API 581 standards. ***Background:*** *In industries such as oil & gas, petrochemicals, and power generation, Asset Integrity Management relies heavily on accurate and timely RBI assessments. However, existing RBI planning is hindered by time-consuming manual data handling, susceptibility to human errors, and inconsistent data interpretation. This hampers the effectiveness of integrity programs and limits scalability across industrial sites.* ***Problem Statements:*** 1. *Excessive time and effort are required for manual data extraction and report generation.* 2. *Human errors cause data inaccuracies and inconsistencies across RBI assessments.* 3. *RBI engineers spend more time on clerical tasks than on analysis and decision-making.* ***Objectives:*** 1. *To automate the extraction of asset and equipment data from GA drawings (PDF format) into a structured digital database using OCR, Computer Vision, and AI technologies.* 2. *To automate the generation of RBI risk assessments in compliance with API 581, ensuring consistent and accurate results.* 3. *To integrate automated inspection planning and reporting tools (e.g., PowerPoint generation) that streamline RBI documentation for both engineers and administrators.* ***Scope:*** *The system will include several modules — Data Extractor, Risk Assessor, Inspection Plan Generator, Dashboard & Analytics, and User Management (Login, Registration, Admin). The project targets RBI Teams and Administrators, providing them with an intelligent, user-friendly platform to manage RBI data, assessments, and reporting efficiently.* ***Project Significance:*** *AutoRBI aims to enhance efficiency, accuracy, and decision-making within RBI workflows. By leveraging AI and data automation, it reduces data processing time from days to hours, ensures compliance with API standards, and empowers engineers to focus on high-value analysis. Ultimately, the project contributes to improved plant safety, asset reliability, and operational sustainability.*
C(ii)	**Detailed proposal of project:** *Cadangan maklumat projek secara terperinci:* **(a) Project background including Introduction and Problem Statements** *Keterangan latar belakang projek termasuk pengenalan dan penyataan masalah.* ***1. Introduction*** *Asset Integrity Management is a critical discipline in process industries like oil & gas, petrochemicals, and power generation. Risk-Based Inspection (RBI), as defined by API standards 580 and 581, is a widely adopted methodology that optimizes inspection plans by focusing resources on equipment with the highest risk of failure.* *The initial phase of any RBI assessment involves the labour-intensive gathering of equipment data from technical drawings, a process that is currently manual. This bottleneck leads to delays, potential data entry errors, and inconsistencies in the subsequent risk analysis and inspection planning stages. Digital transformation of this workflow is essential to improve efficiency, reliability, and scalability of integrity management programs.*

2. Problem Statements

The current manual process for developing RBI inspection plans presents several significant challenges:

a. ***Inefficiency and Time Consumption****: RBI Engineers spend an inordinate amount of time manually reviewing PDF drawings, transcribing data into Excel spreadsheets, and formatting PowerPoint reports. This slows down the entire inspection planning cycle.*

b. ***Data Inaccuracy and Inconsistency****: Manual data extraction is susceptible to human error, leading to incorrect information in the asset register. Furthermore, different engineers may interpret or record data differently, resulting in inconsistent inputs for the risk assessment.*

c. ***Underutilization of Expertise****: Highly skilled RBI Engineers are forced to perform repetitive clerical tasks instead of focusing on complex analysis, damage mechanism review, and making critical decisions based on the risk output.*

(b) Objective (s) of the Project

Objektif Projek

The objectives of this project are developed based on the identified problems of inefficiency, human error, and underutilization of engineering expertise in the current manual Risk-Based Inspection (RBI) process. The proposed system aims to automate and streamline data handling, risk assessment, and inspection planning through the integration of AI and intelligent automation technologies.

1. ***To automate the extraction and structuring of equipment and asset data*** *from General Arrangement (GA) drawings (PDF format) using Optical Character Recognition (OCR), Computer Vision, and Artificial Intelligence (AI) agents to eliminate manual data entry and reduce human errors.*
2. ***To develop an automated Risk Assessor module*** *that performs risk evaluations in accordance with API 580/581 standards, ensuring consistency, accuracy, and compliance across all RBI assessments.*
3. ***To integrate an intelligent Inspection Plan Generator and analytics dashboard*** *that automatically creates standardized inspection plans and provides data-driven insights, enabling faster decision-making and improved planning efficiency for RBI engineers and administrators.*

(c) Scope

Skop

1. *Module to be developed*
    - ***a. Data Extractor***
        - *i. Leveraging OpenCV,OCR,NLP for pdf/image for data extraction, usage of AI agent is also under consideration*
    - ***b. Extracted Data to Database Manager***
        - *i. A module that will handle storing and retrieval of data from the database*
        - *ii. It also provides an excel file of the data extracted on user request*
    - ***c. Risk Assessor***
        - *i. A module that automates the risk assessment according to API581 specification*
    - ***d. Inspection Plan PPT Generator***
        - *i. A module that generates the scheme of examination funneling into a powerpoint based on the risk assessment generated from the Risk Assessor*
    - ***e. Login Module***
        - *i. A module that allows multiple user to utilize the system without conflicting with other user's work*
    - ***f. Registration Module***
        - *i. A module that allows new user to create new accounts to access and utilize the system*

g. Admin Module

i. A module that provides a simple user account management CRUD functionalities, however instead of deleting user accounts it will Activate/Deactivate said accounts

h. Dashboard and Analytics Module

i. A module that provides interactive dashboards showing risk distribution (e.g., pie charts of High/Medium/Low risk assets).

i. RBI Report Module

i. A module that keep tracks of the status of planned/ongoing/successful inspection

j. Work History Module

i. A module that allows users to keep track of their previous activities such as a list of drawings that was uploaded, risk assessment of said drawings, as well as the Inspection Plan and reports related to said plan.

2. Target User

a. RBI Team
b. Admin

(d) Project Significance

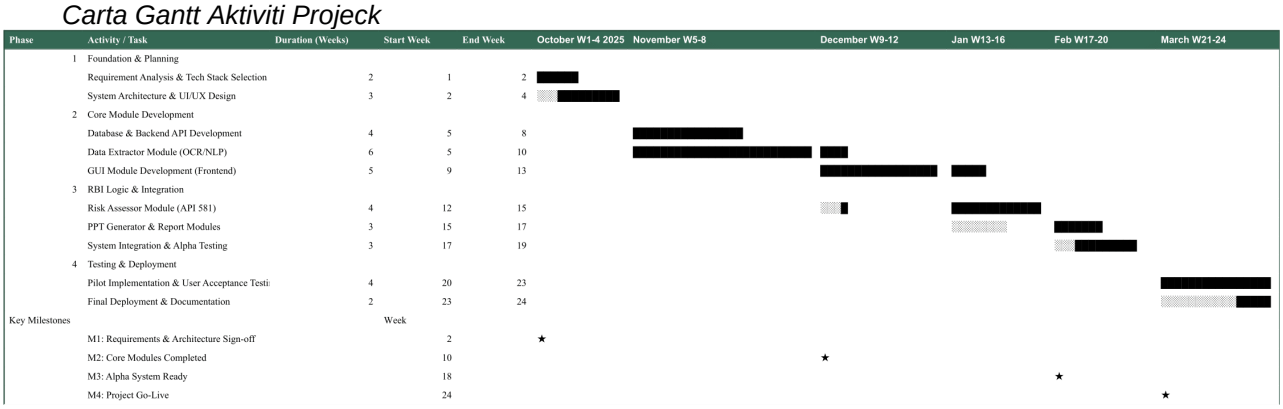
Kepentingan projek

1. Motivation and inspiration for the project.

*The **AutoRBI (Automation of Risk-Based Inspection)** system represents a transformative step toward digitalizing and optimizing the Risk-Based Inspection (RBI) process within industrial integrity management. The project's significance lies in its potential to solve key operational challenges — inefficiency, data inaccuracy, and underutilization of engineering expertise — through automation, AI integration, and intelligent data management.*

1. ***Enhanced Efficiency and Productivity:***
   By automating data extraction, risk assessment, and inspection plan generation, the system drastically reduces the time required to complete RBI processes—from several days to just a few hours. This enables RBI teams to handle larger volumes of assessments without compromising quality.
2. ***Improved Accuracy and Compliance:***
   The automation of data extraction and risk calculation ensures consistent and error-free assessments, eliminating discrepancies caused by human error. Compliance with API 580/581 standards is built directly into the system, strengthening regulatory alignment and corporate governance.
3. ***Empowered Engineering Teams:***
   The system allows RBI engineers to focus on technical analysis, damage mechanism review, and strategic decision-making rather than repetitive clerical tasks. This shift increases job satisfaction, knowledge application, and the overall quality of risk evaluations.
4. ***Data-Driven Decision Support:***
   Integrated dashboards and analytics modules provide real-time insights into asset risk profiles, enabling management to make better-informed maintenance and budgeting decisions, thus enhancing plant reliability and safety.
5. ***Scalability and Knowledge Retention:***
   By codifying RBI processes into a centralized digital platform, AutoRBI preserves corporate expertise and facilitates training for new engineers. It also allows the RBI program to be easily scaled across multiple industrial sites.
6. ***Target Users – RBI Team and Administrator:***
   *The system primarily serves **RBI Teams**, who perform technical assessments, and **Administrators**, who oversee user management, data access, and system operations. Together, they benefit from a unified, intelligent platform that promotes efficiency, collaboration, and data integrity.*

(e) Gantt Chart of Project Activities
Carta Gantt Aktiviti Projeck



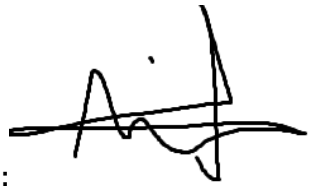
Phase		Activity / Task	Duration (Weeks)	Start Week	End Week
	1	Foundation & Planning			
		Requirement Analysis & Tech Stack Selection	2	1	2
		System Architecture & UI/UX Design	3	2	4
	2	Core Module Development			
		Database & Backend API Development	4	5	8
		Data Extractor Module (OCR/NLP)	6	5	10
		GUI Module Development (Frontend)	5	9	13
	3	RBI Logic & Integration			
		Risk Assessor Module (API 581)	4	12	15
		PPT Generator & Report Modules	3	15	17
		System Integration & Alpha Testing	3	17	19
	4	Testing & Deployment			
		Pilot Implementation & User Acceptance Testi	4	20	23
		Final Deployment & Documentation	2	23	24
Key Milestones				Week	
		M1: Requirements & Architecture Sign-off		2	
		M2: Core Modules Completed		10	
		M3: Alpha System Ready		18	
		M4: Project Go-Live		24	

D **ACCESS TO EQUIPMENT AND MATERIAL (PLEASE LIST IN DETAIL) /** *KEMUDAHAN SEDIA ADA UNTUK KEGUNAAN BAGI PROJEK INI (SILA SENARAIKAN DENGAN TERPERINCI)*

University *Universiti*	**Other Sources or Places** *Lain-lain tempat/sumber*

Software and hardware:
Programming Language
• *Python 3.13.5*
Libraries
• *Object Computer Recognition*
  ◦ *PIL*
  ◦ *opencv*
  ◦ *pillow*
  ◦ *pytesseract*
• *AI Agent(Claude Haiku 4.5, 1USD per million input tokens and 5USD per million output tokens,minimum of 5USD credit for initial API key generation)*
  ◦ *langchain*
  ◦ *langchain-community*
  ◦ *langchain-anthropic*
  ◦ *python-dotenv*
  ◦ *pydantic*
○ *GUI*
  ◦ *tkinter*
Database
• *PostgreSQL*
Hardware
• *Windows and MacOS laptop/Desktop*	

E **Declaration by student/** *Akuan Pelajar*

	Date : 19/10/2025 *Tarikh :* **Student's Signature :** *Tandatangan Pelajar :*  *Muhammad Amin bin Abd Rahman*
F	**Recommended by the Supervisor** *Perakuan oleh Penyelia*
	Please tick (√) in the appropriate box *Sila tandakan (√) dalam kotak yang berkenaan* **Recommended:** *Diperakukan:* ☐ ***A.*** **Highly Recommended** *Sangat Disokong* ☑ **B. Recommended** *Disokong* ☐ **C. Not Recommended (Please specify reason)** *Tidak Disokong (Sila Nyatakan Sebab)* **General Comments:** *Ulasan umum:* **This project proposes the development of automated and streamlined data handling, risk assessment, and inspection planning through the integration of AI and intelligent automation technologies that comply with API 580 and API 581 standards, which will provide data analysis and performance insights for the decision-makers.** **Supervisor's Name:** **Ts. DR. MAILASAN A/L JAYAKRISHNAN** *Nama Penyelia:* *Tandatangan:*  **Signature:** **Date:** **23/10/2025** *Tarikh:*
G	**Comments/ Feedbacks from the Committee of Workshop 2** *Komen/ Maklumbalas daripada Ahli Jawantankuasa Bengkel 2*