



Automated Man Power Allocation By Performance Analysis and Project Categorization For Construction Projects

24-25J-018





Team Members

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Introduction

- Manpower required in construction projects are in 2 types;
 1. Employees in the Company
Ex: Civil Engineers, Technical Officers, Surveyors etc.
 2. Laborers work in the site
Ex: Carpenters, Masons, Painters etc.
- Our client : MAGA Engineering PVT LTD
- Types of construction projects in MAGA;
 1. **Buildings**
 2. Highways & Bridges
 3. Water, wastewater
 4. Irrigation





Research Problem

"How does improper manpower allocation based on project managers' experience affect efficiency and project outcomes in the construction projects?"





Research Gap

Application Reference	Applicable for construction Projects	Web Application	KPI based manpower allocation	Project Categorization	Real time predictive analysis of project	Labor requirement Prediction
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Procore	✓	✓	✗	✗	✗	✗
Primavera P6	✓	✗	✗	✗	✗	✗
nPlan	✓	✓	✗	✓	✓	✗
BuildTrend	✓	✓	✗	✗	✗	✗
Project Pulse	✓	✓	✓	✓	✓	✓



Main Objective



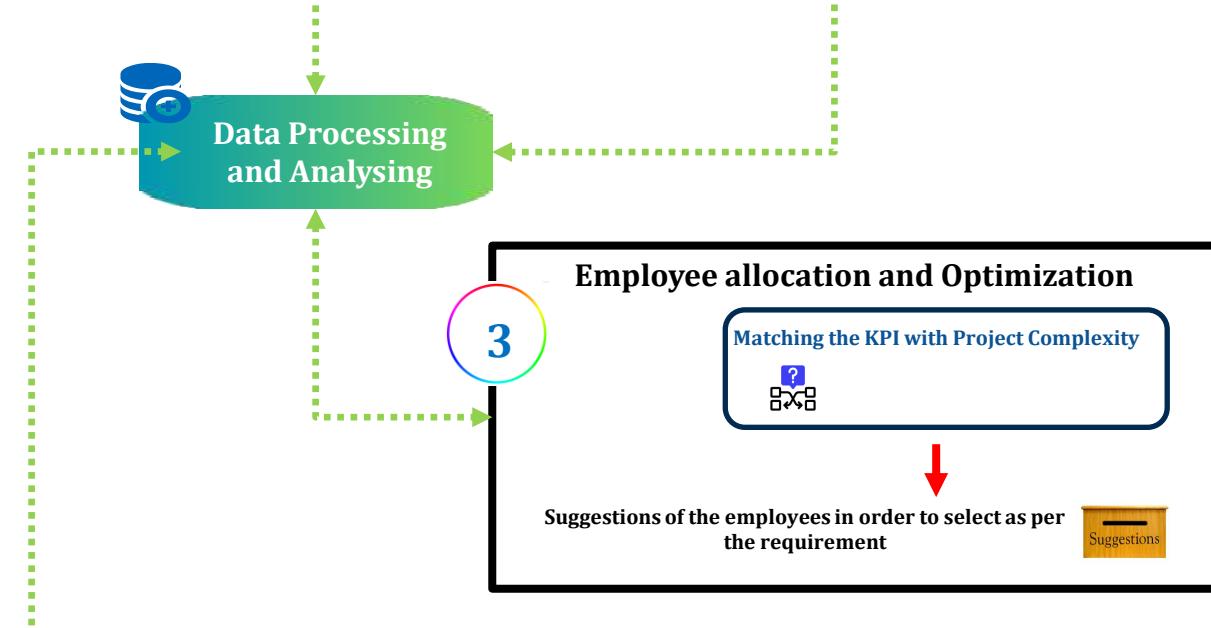
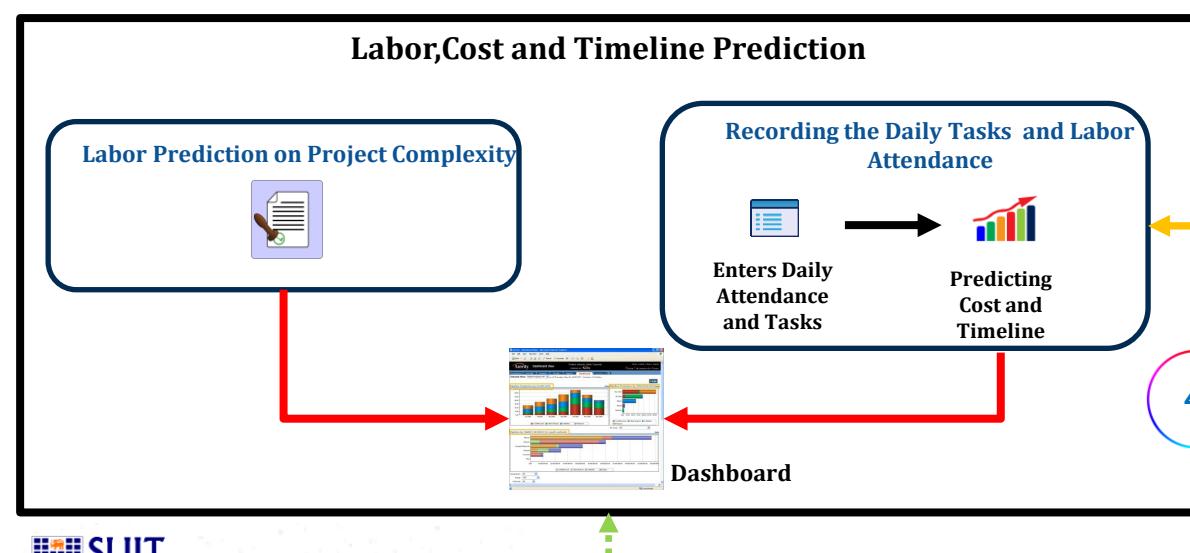
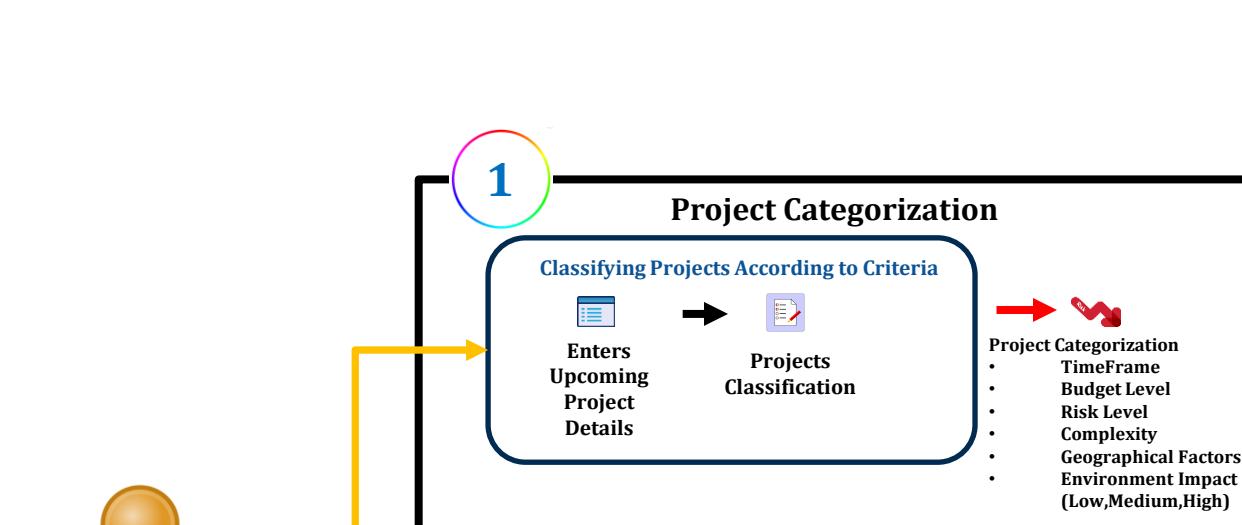
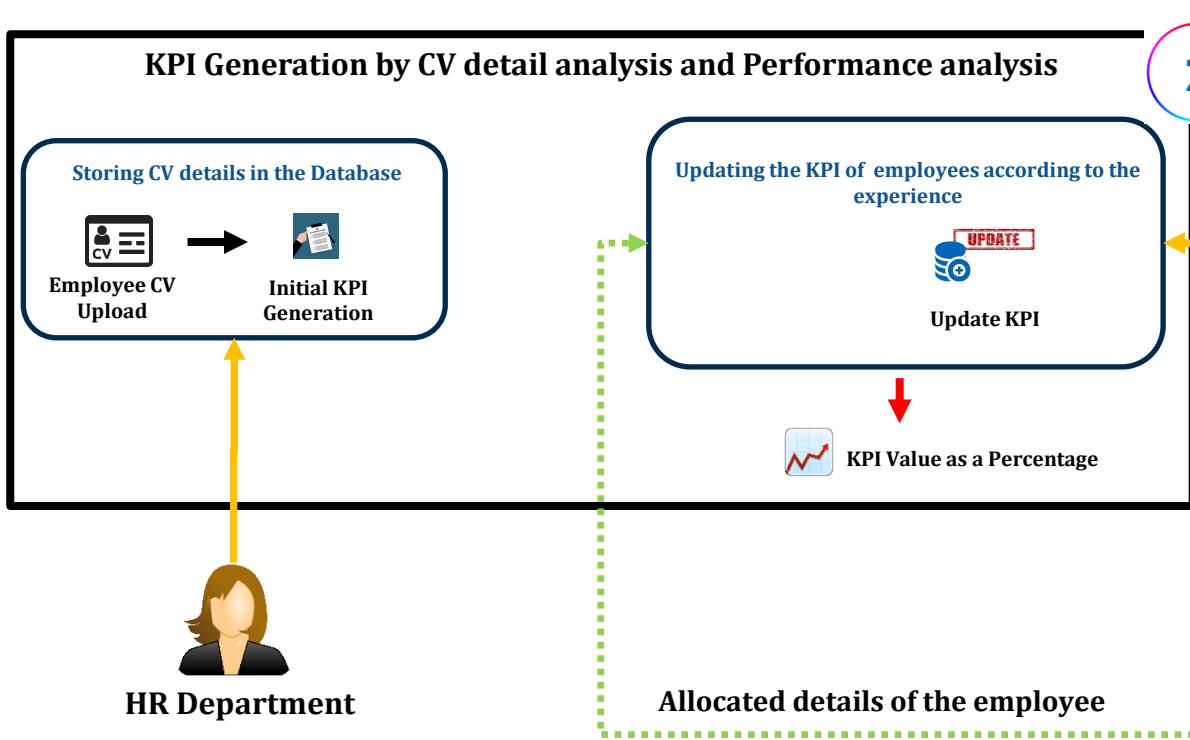
"Develop a system to generate employee KPIs based on experience and performance, categorize projects by complexity and risk, optimally allocate suitable employees, and predict the required number of laborers for future projects."

Sub Objectives

- 1. Project Categorization.**
- 2. KPI Value generation by performance analysis and CV analysis.**
- 3. Employee allocation and Optimization.**
- 4. Prediction of labor, cost and timeline.**



KPI Generation by CV detail analysis and Performance analysis





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Project Categorization.



Research Gap

Application Reference	Automatic Classification	Applicable for construction projects	Risk Level Assessment	Complexity Analysis	Location/Environmental Impact Assessment	Budget Analysis	Time Frame Analysis
Procore	✗	✓	✗	✗	✗	✓	✗
Microsoft Project	✗	✓	✗	✓	✗	✓	✓
Smartsheet	✗	✓	✗	✓	✗	✓	✓
nPlan	✗	✓	✗	✗	✗	✗	✓
Trello	✗	✓	✗	✗	✗	✗	✗
Project Pulse	✓	✓	✓	✓	✓	✓	✓



Research Question

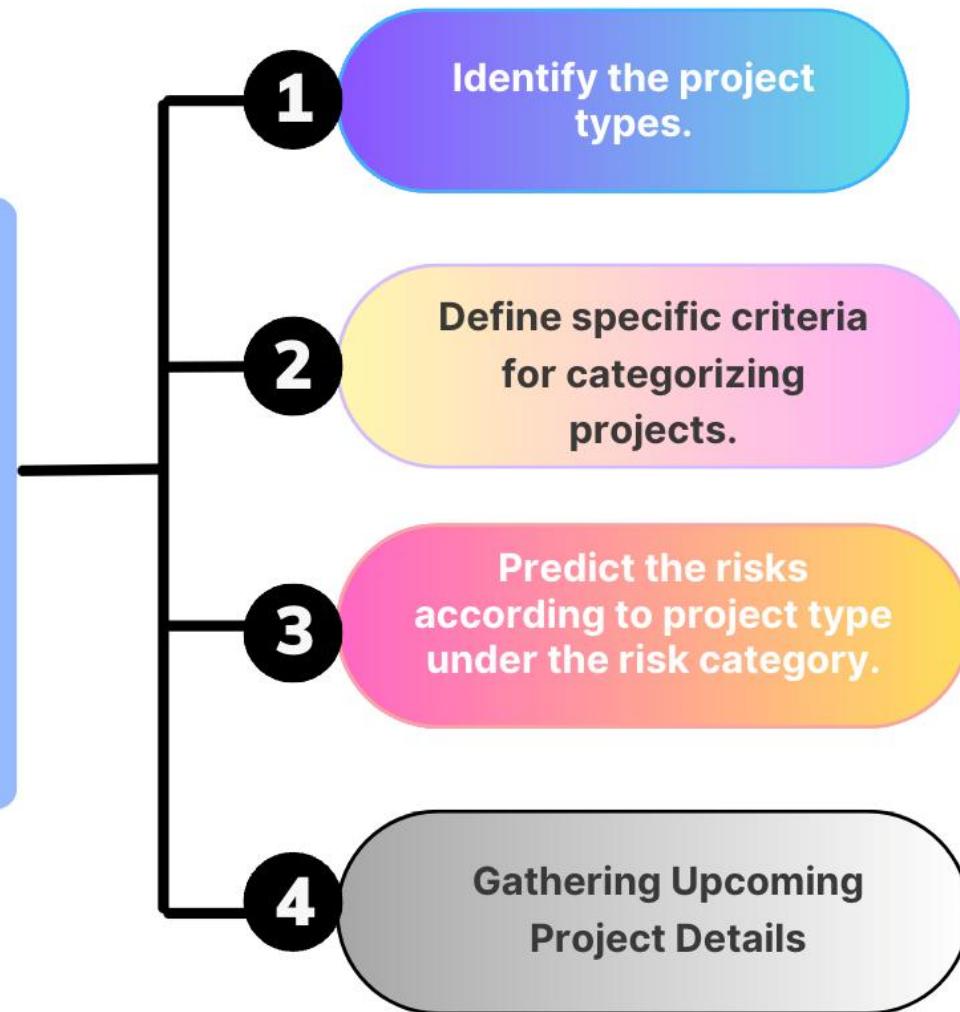


“How can construction projects be categorized based on key details and factors such as type, scope, objectives, location, budget, duration, risk level, complexity, geographical factors, and time frame?”



1

"Create a standardized method of categorization projects based on project type, risk level, complexity, location wise/geographical factors, budget level, time frame."



Specific & Sub Objectives





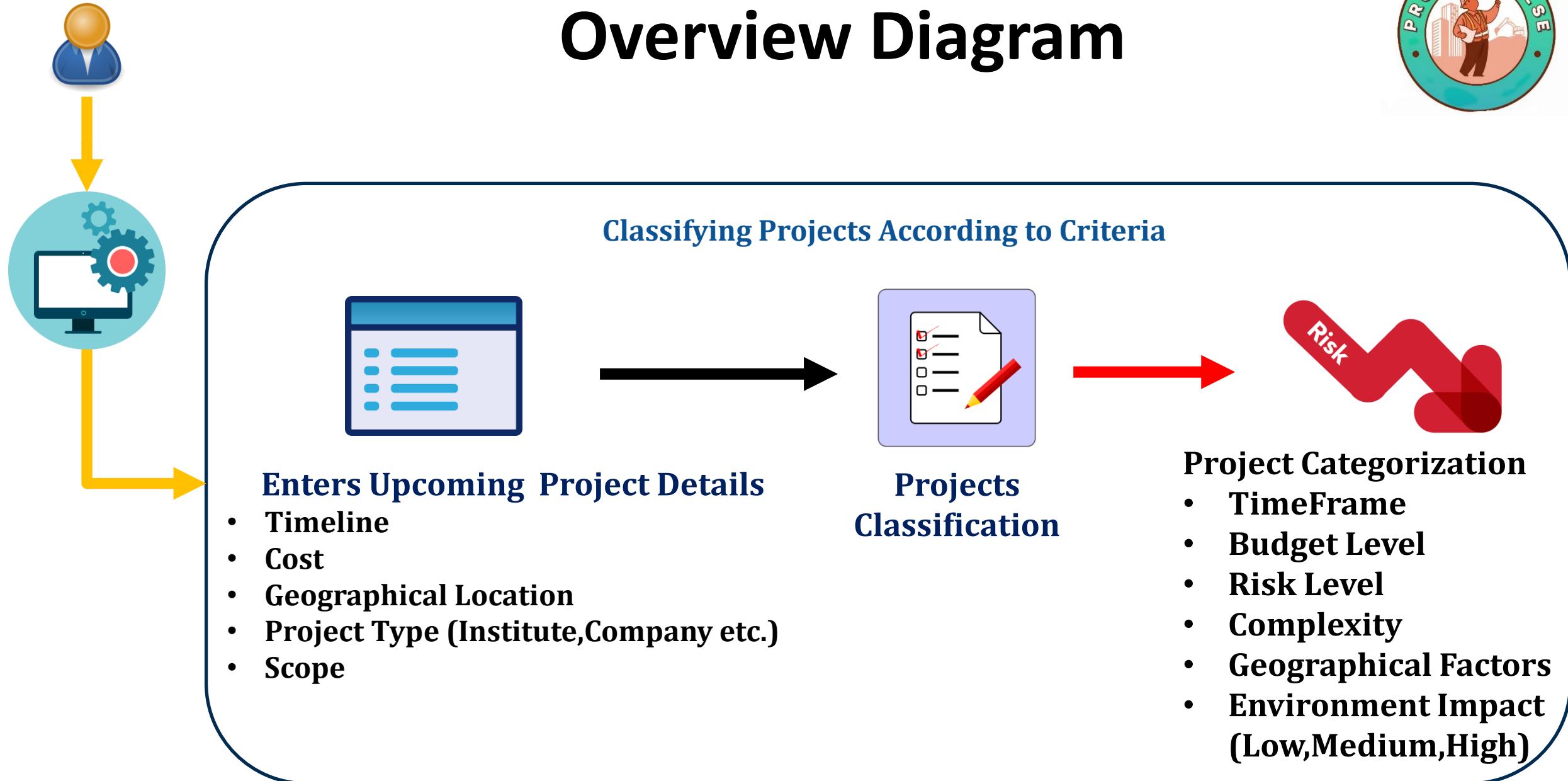
Methodology



- Overview Diagram
- System, Personnel, and Software Specification Requirement
- Technologies
- Data Gathering and Data Requirements
- Work Breakdown Structure(WBS)



Overview Diagram



System, Personnel, and Software Specification Requirements



Functional requirements

- Should be able to input the project details
- Should be able to categorize the project, based on project type, risk level, complexity, location wise/geographical factors, budget level, time frame
- Should be able to predict the risk according to project type



Non-Functional requirements

- User-Friendly interface
- Application should be reliable.
- Results have higher accuracy.
- Results should be more efficient.

Software Requirements

- Python
- Visual Code
- Node
- MYSQL



Personnel Requirements



- Mr. Darshana Senevirathne (A Project Manager at MAGA Engineering)
- MAGA Engineering PVT Ltd



Technologies

Technologies

- HTML
- CSS
- Python
- Tensor Flow
- MYSQL

Techniques & Algorithms

- Rule-Based System
- Decision Tree



Data Gathering and Data Requirements

Data Source : MAGA Engineering Pvt Ltd.

Required datasets are;



1. Past Project Details

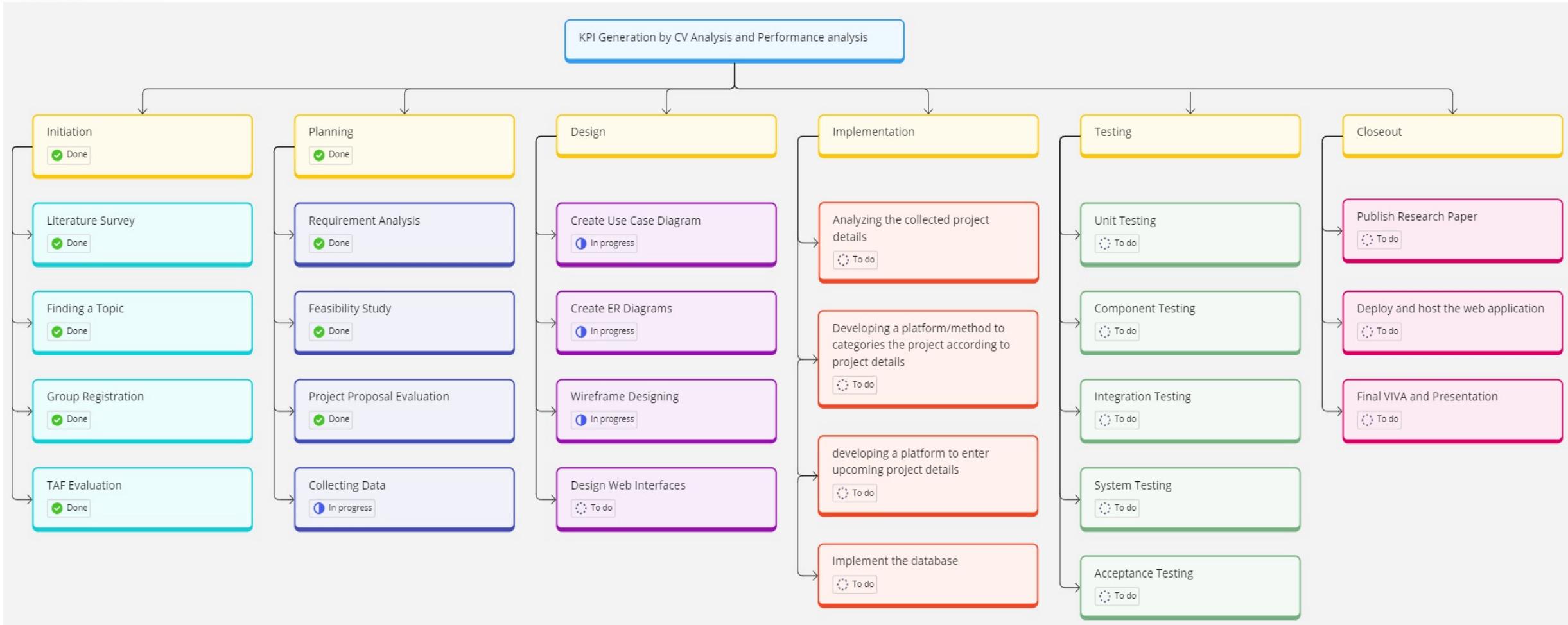
**Time,Cost,Scope,Geographical Location, Objectives,
Project Type**

2. Risk and Complexity measuring methods





Work Breakdown Structure (WBS)



REFERENCES

- [1] John Macealois, "Understanding the 7 Construction Project Types", <https://www.workyard.com/construction-management/construction-project-types>, May 2024 (accessed July. 2024) pp. 11,14.
- [2] M. Safa, A. Sabet, "Classification of Construction Projects",
<https://core.ac.uk/download/pdf/144150314.pdf>, May 2015 (accessed July. 2024) pp. 11,14.





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KPI Generation by Performance analysis and CV analysis.



Research Gap

Application Reference	Applicable for construction projects	Performance Update	CV Upload	Real Time Integration with performance	KPI Generation
SAP Success Factor	✓	✗	✓	✗	✓
Workday	✓	✗	✓	✗	✓
BambooHR	✓	✗	✓	✗	✓
Procore	✓	✗	✓	✗	✓
Project Pulse	✓	✓	✓	✓	✓



Research Question

“How can the challenges of managing physical CVs and using outdated KPIs be addressed to improve decision-making in employee management?”



Specific Objective

“ The goal is to generate accurate KPIs based on predefined criteria (Performance, Competencies, Additional Criteria) and provide real-time KPI results for better decision-making. ”

Sub Objectives



Developing a upload portal to upload CVs.



Developing a portal to update employees' project work.



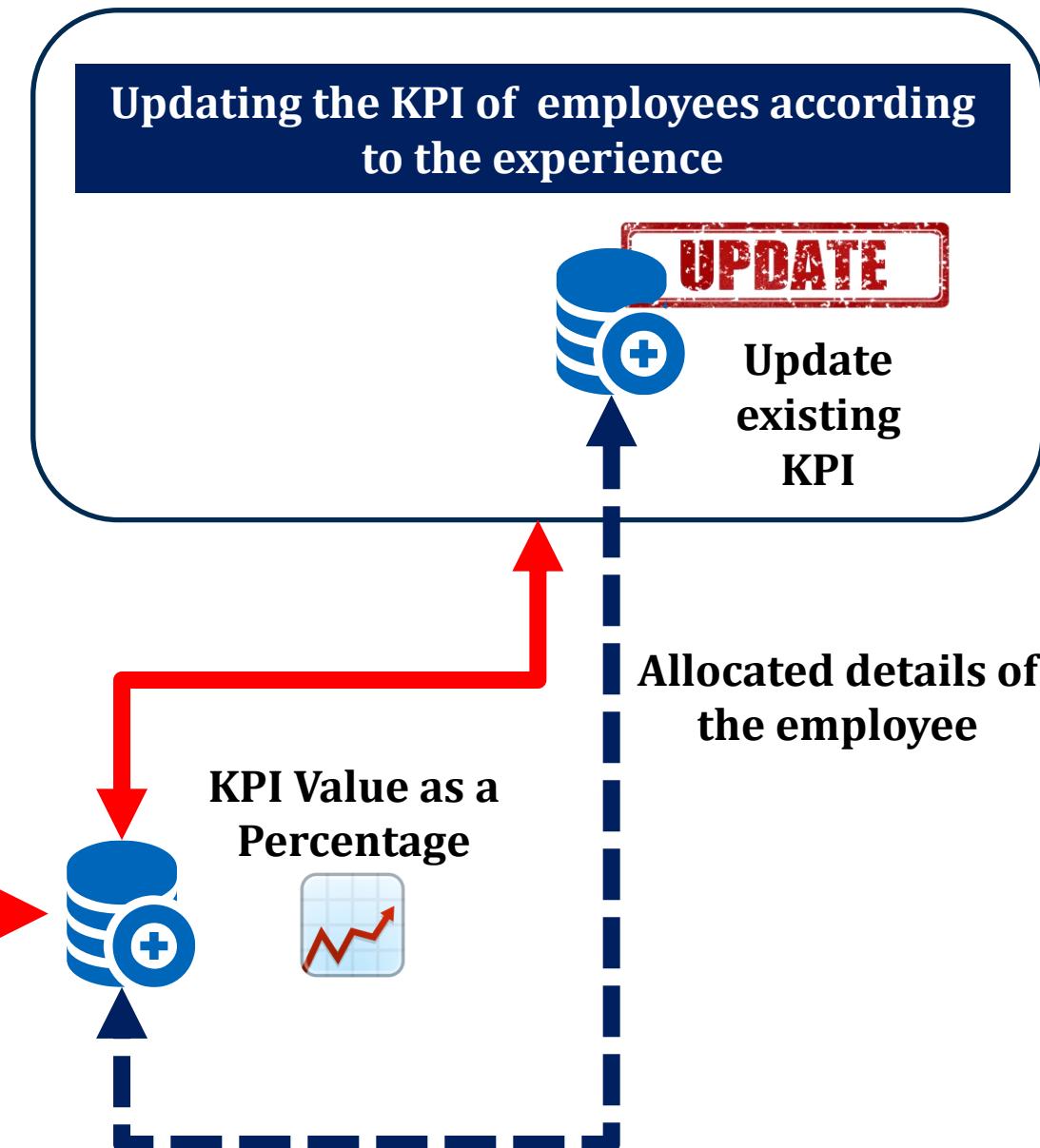
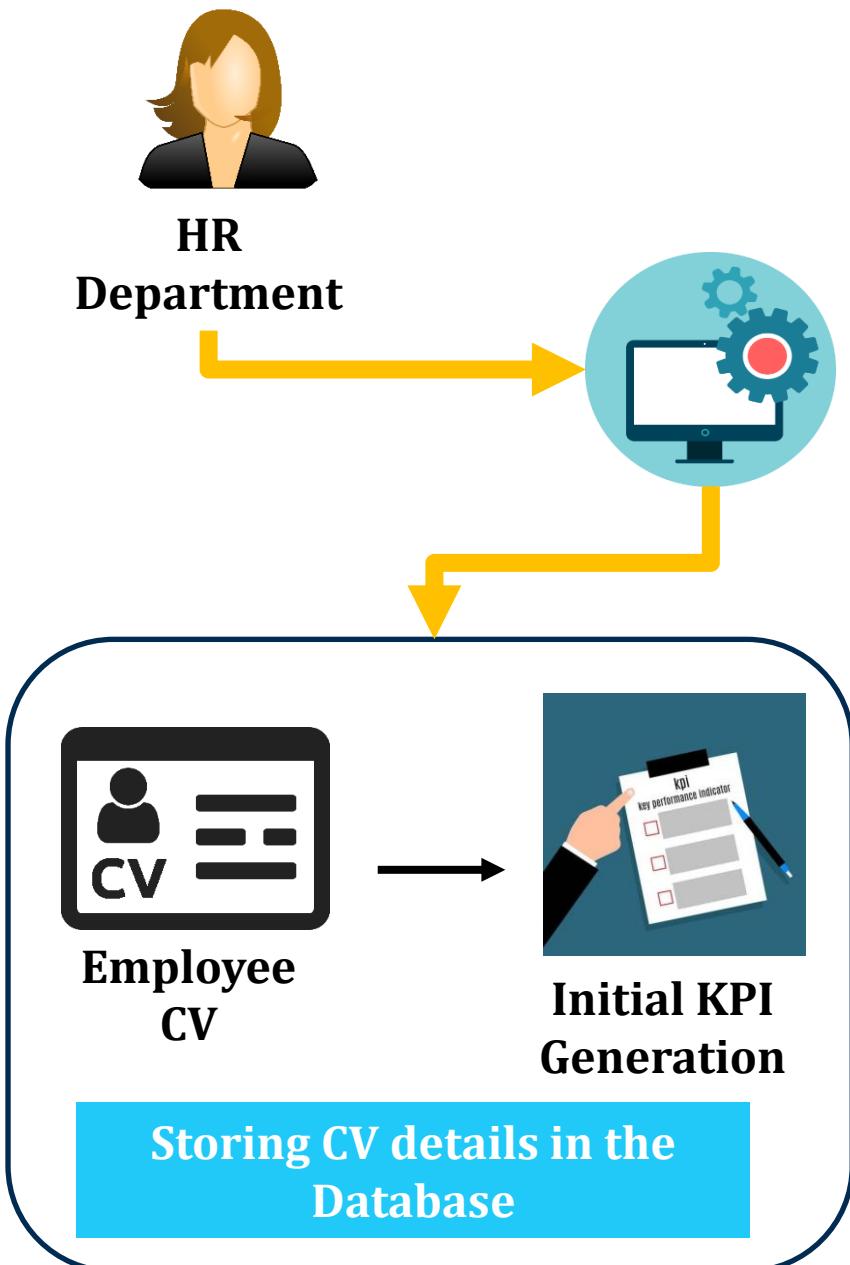
Developing to calculate KPI percentage for generated KPI and given project details.



Methodology



- Overview Diagram
- System, Personnel, and Software Specification Requirement
- Technologies
- Data Gathering and Data Requirements
- Work Breakdown Structure(WBS)



System, Personnel, and Software Specification Requirements

Functional Requirements

- Automating the employee CV upload.
- Generate KPIs according to the designation and criteria provided by MAGA.
- Calculate KPI values after entering the worked project details by the employees.
- Creating a upload portal to upload CVs.
- Creating a dashboard to view KPI values.



Non- Functional Requirements

- User-Friendly interface
- Application should be reliable
- Higher accuracy of results
- Results should be more efficient



Software Requirements

- Python
- Visual Code
- MYSQL



Personnel Requirements

- Mr.Darshana Senevirathne (A Project Manger at MAGA Engineering)
- MAGA Engineering PVT Ltd
- HR Department of MAGA Engineering Pvt Ltfd





Technologies

Technologies

- HTML
- CSS
- Python
- NLP Tools
- MYSQL



Techniques & Algorithms

- Text Processing Techniques



Data Gathering and Data Requirements

Main Data Source : MAGA Pvt Ltd.

Required datasets are;



1. KPI defining criteria

Performance - 60%

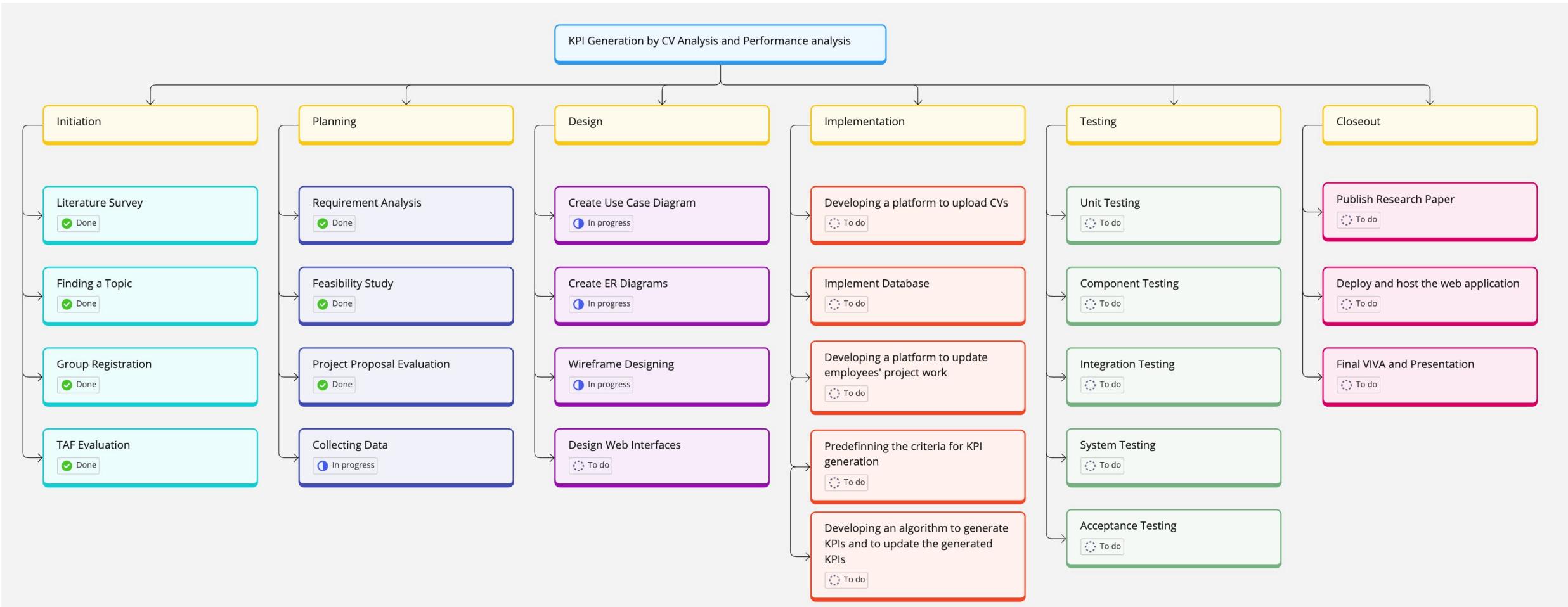
Competencies (Knowledge,Skills) -20%

Additional Criteria (Seniority and years of service) -
20%

2. Employee CV details of each employee category



Work Breakdown Structure (WBS)



REFERENCES

- [1] A. Anand, "Ijiraset," [Online]. Available: <https://www.ijraset.com/research-paper/cv-analysis-using-machine-learning>. [Accessed 25 07 2024].
- [2] V. Jagwani, "Arvix," [Online]. Available: <https://arxiv.org/pdf/2307.15752.pdf>. [Accessed 25 07 2024].
- [3] H. A. Purba, "Research Gate," [Online]. Available: https://www.researchgate.net/publication/344493860_KEY_PERFORMANCE_INDICATORS_A_SYSTEMATIC_LITERATURE REVIEW. [Accessed 26 07 2024].
- [4] L. Pinilla, "MDPI," [Online]. Available: <https://www.mdpi.com/2071-1050/12/15/5977>. [Accessed 27 07 2024].
- [5] MAGA, "MAGA," [Online]. Available: <https://www.maga.lk/>. [Accessed 24 07 2024].





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Employee Allocation and Optimization.



Research Gap

Application Reference	Web Application	Applicable for construction projects	KPI-based manpower allocation	Employee requirement prediction	Employee allocation and optimization
Procore	✓	✓	✗	✗	✗
Primavera P6	✗	✓	✗	✗	✗
BuildTrend	✓	✓	✗	✗	✗
ALICE Technologies	✓	✓	✓	✓	✗
PlanGrid	✓	✓	✓	✓	✗
Project Pulse	✓	✓	✓	✓	✓



Research Question

“How can employee allocation by project managers, which is often based on experience, be improved to reduce inefficiencies and address employee management issues?”



Specific Objective

“Develop a systematic approach for allocating employees to categorized construction projects using Key Performance Indicators (KPIs) to improve project efficiency and outcomes.”

Gather outcomes of component 1 and 2 such as project categorization result and generated KPI.

Develop a model for matching employees to projects using the identified KPIs.

Optimize the outcome of this component

Validate the model with historical data and real-world scenarios.

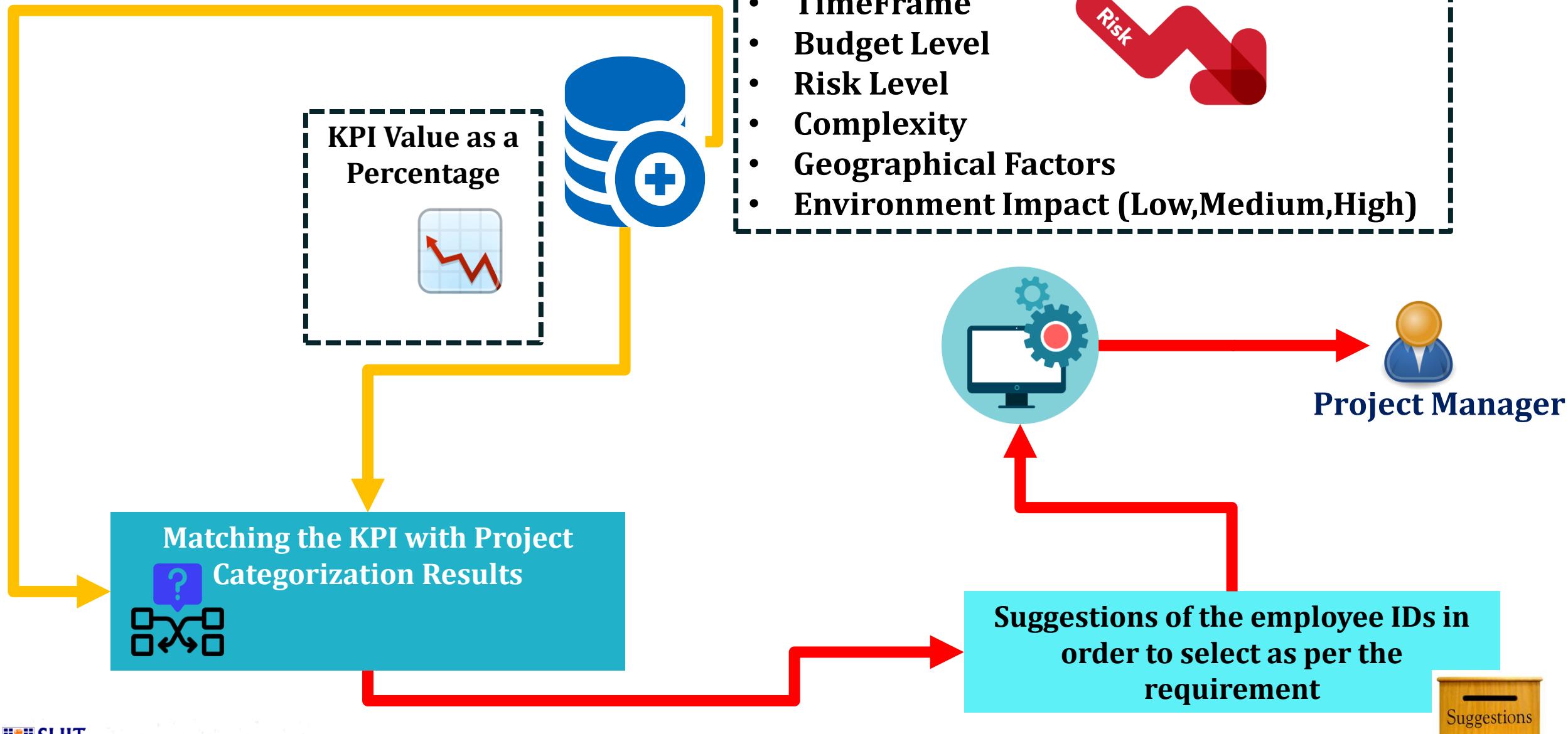


Methodology



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Overview Diagram





System, Personnel, and Software Specification Requirements

Functional Requirements

- Matching the most appropriate employees according to the project categorization based on KPI value.
- Displaying the suggestions of the matching employees.
- Employee allocation should be done in an optimized way.



Non- Functional Requirements

- User-Friendly interface
- Application should be reliable
- Higher accuracy of results
- Results should be more efficient

Software Requirements

- Python
- Visual Code
- Node
- MYSQL

Personnel Requirements

- Mr.Darshana Senevirathne (A Project Manager at MAGA Engineering)
- MAGA Engineering PVT Ltd





Technologies

Technologies

- HTML
- CSS
- Python
- Tensor Flow
- MYSQL

Techniques & Algorithms

- Bipartite Matching
- Genetic Algorithms



Data Gathering and Data Requirements

Main Data Source : MAGA Pvt Ltd.



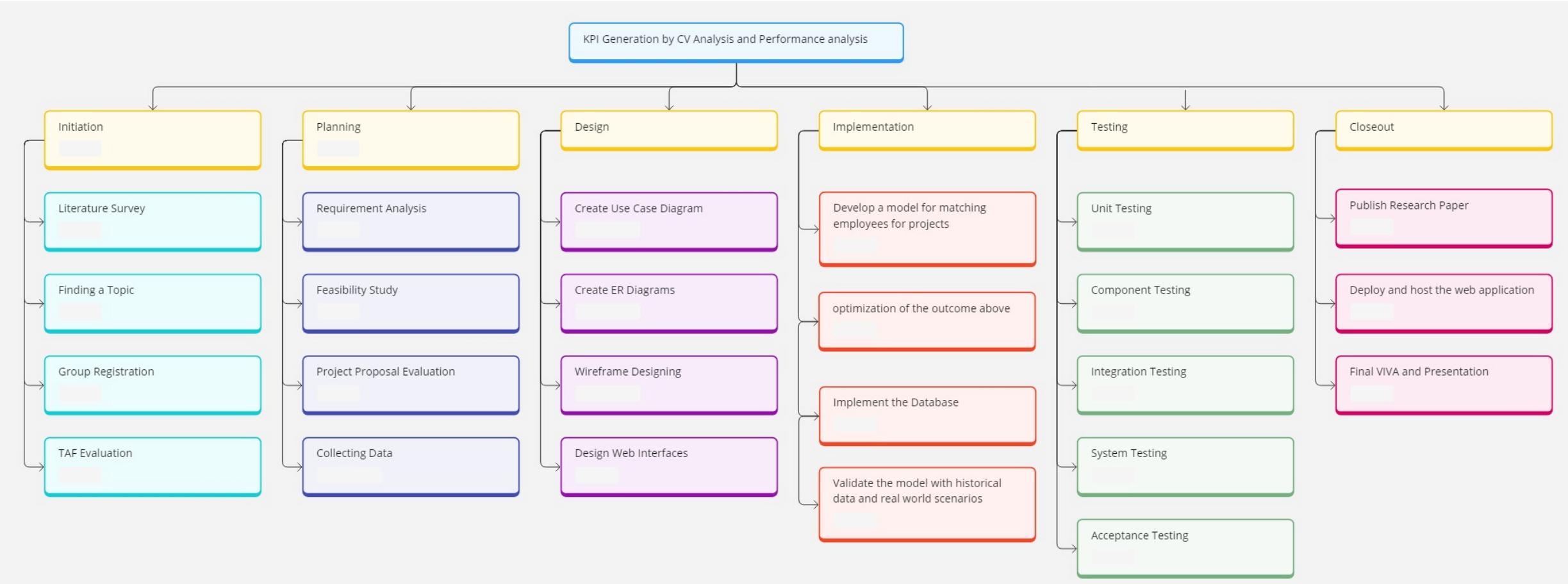
Required datasets are;

1. Number of employees worked in certain projects.
2. Employee categories required for different projects.





Work Breakdown Structure (WBS)





REFERENCES

- [₁] TaskTag, "MEDIUM," [Online]. Available: <https://tasktagapp.medium.com/resource-allocation-in-construction-strategies-for-optimal-performance-e05bf5270b00>. [Accessed 31 07 2024].
- [₂] K.-L. Lin, "researchgate," [Online]. Available:
[₁] https://www.researchgate.net/publication/245298399_Human_Resource_Allocation_for_Remote_Construction_Projects. [Accessed 31 07 2024].
- [₃] "MAGA," [Online]. Available: <https://www.maga.lk/>. [Accessed 15 6 2024].
- [₄] J. Amin and Hafnidar A. Rani, "researchgate," [Online]. Available:
[₁] https://www.researchgate.net/publication/380537686_Optimizing_Human_Resource_Allocation_in_Construction_Projects_A_Case_Study. [Accessed 3 7 2024].



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Labor, cost and timeline prediction.



Research Gap

Application Reference	Applicable for construction projects	User Focused Dashboards	Labor requirement prediction	Predict timeline and budget variations	Tracking daily logs and attendance
Procore	✓	✓	✗	✗	✓
ALICE Technologies	✓	✓	✓	✗	✗
nPlan	✓	✓	✗	✓	✗
LaborChart	✓	✓	✗	✗	✗
PlanGrid	✓	✓	✗	✗	✓
Project Pulse	✓	✓	✓	✓	✓



Research Question

“How can the inefficiencies in labor allocation, irregular attendance affects the cost and timeline in construction projects?”



Sub Objectives

Specific Objective

To predict the labor count required for upcoming projects based on project categorization and to forecast the project timeline and cost during its progression.

1

2

3

4

Analyzing past project details.

Training the system according to the past project details.

Creating a platform to update the daily labor count and completed tasks.

Predicting the realtime status of the projects.



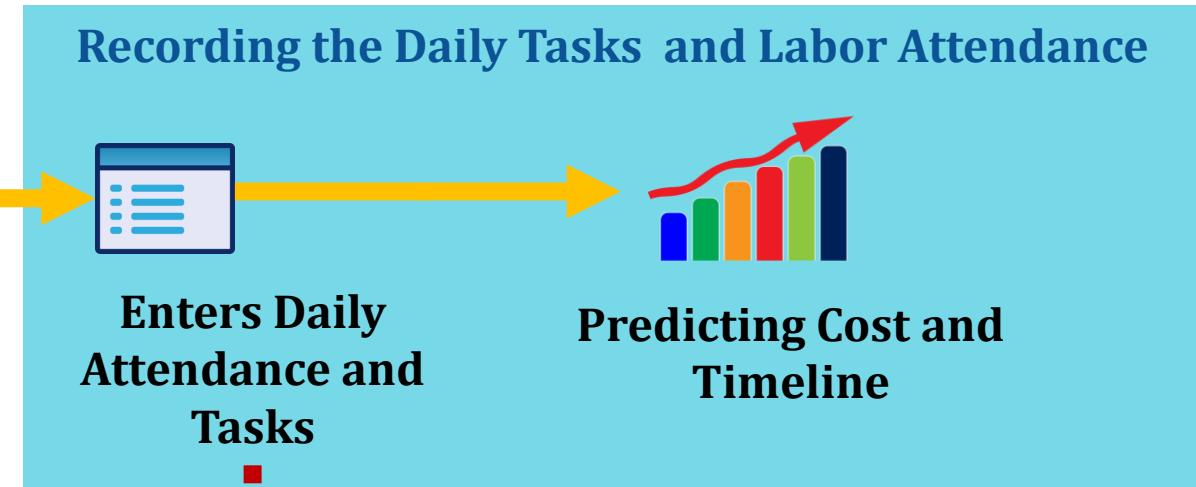
Methodology



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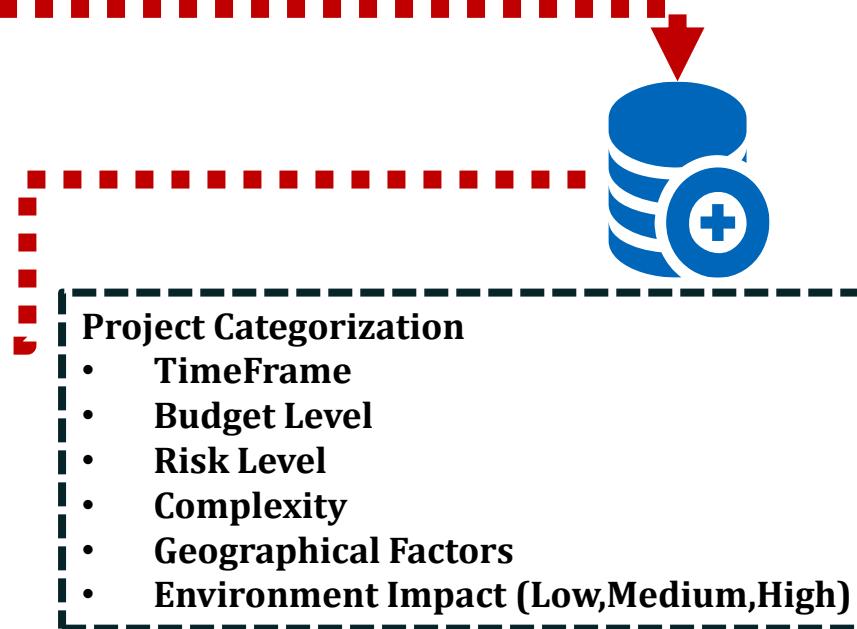
Overview Diagram

Project Manager

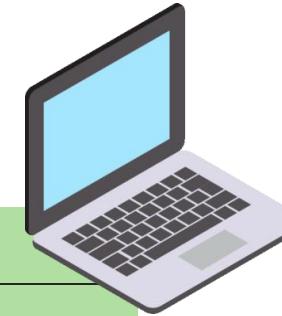


Dashboard

Labor Prediction on Project Categorization



System, Personnel, and Software Specification Requirements



Functional Requirements

- Predicting the number of laborers for the particular project.
- Providing a platform to enter the completed tasks of the project.
- Providing a platform to enter the daily attendance of the employees.
- Predicting the real time status of the project according to the progression.
- Creating a dashboard to display the cost & timeline predictions.



Non- Functional Requirements

- Interfaces should be User-friendly
- The application should be reliable
- Higher accuracy of results
- Results should be more efficient

Software Requirements

- Python
- Visual Code
- PowerBi
- MYSQL



Personnel Requirements

- Mr.Darshana Senevirathne (A Project Manger at MAGA Engineering)
- MAGA Engineering PVT Ltd



Technologies

- HTML
- CSS
- Python
- Tensor Flow
- MYSQL
- PowerBi



Technologies

Techniques & Algorithms

- Regression Model
- Time Series Forecasting
- Project Management Techniques





Data Gathering and Data Requirements

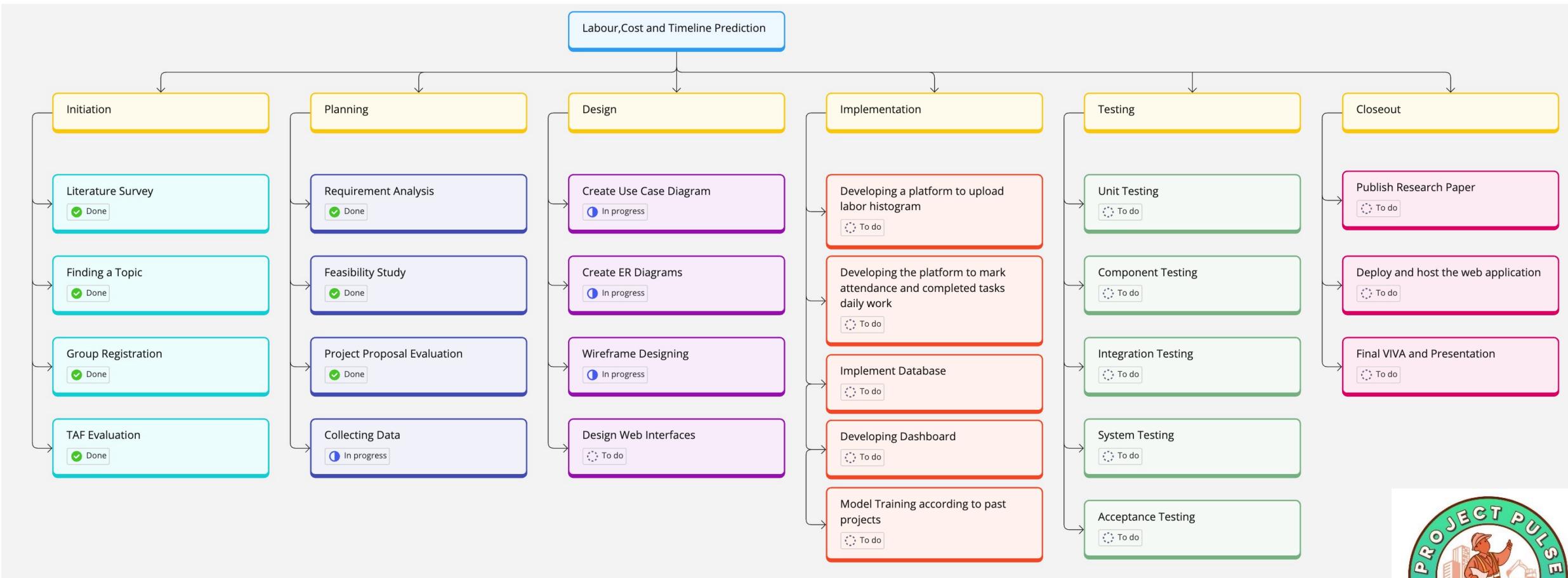
Main Data Source : MAGA Pvt Ltd.

Required datasets are;

1. Budget ,Timeline and Number of labours worked at the past project.
2. Labor categories required for the projects.
3. Labor histogram details of each project.



Work Breakdown Structure (WBS)



REFERENCES

- [1] S. Direct, "Science Direct," [Online]. Available:
<https://wwwsciencedirect..com/science/article/pii/S258993332001434>. [Accessed 24 07 2024].
- [2] Y. H. Yang, "Science Gate," [Online]. Available:
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- [3] A. Z. Zara Kahavandi, "Science Gate," [Online]. Available:
<https://www.sciencegate.app/app/document/download#10.28991/cej-2019-03091362>. [Accessed 25 07 2024].
- [4] S.-W. Whang, "Science Gate," [Online]. Available:
<https://www.sciencegate.app/app/document/download#10.28991/cej-2019-03091362>. [Accessed 26 07 2024].
- [5] Z. Smith, "Research Gate," [Online]. Available:
https://www.researchgate.net/publication/382596196_COMPARATIVE_ANALYSIS_OF_BIG_DATA-DRIVEN_DECISION MAKING_IN_PROJECT_MANAGEMENT. [Accessed 27 07 2024].
- [6] M. Engineering, "MAGA," [Online]. Available: <https://www.maga.lk/>. [Accessed 24 07 2024].

Commercialization Information

Common Version

- Initial KPI generation by CV Upload.
- Updating the performance of employees.
- Project categorization on Time Frame and Geographical factors.

Premium Version

- Updated KPI Values.
- Project Categorization on risk and complexity.
- Most appropriate employee suggestions.
- Labour,Cost and timeline predictions.

Market Place

- No need of advanced knowledge in technology.
- No age limit for users.

Target Audience

- Construction companies and contractors.
- Project Managers.



**Subscription Fee
(Monthly/Anually)**



Business Canvas Model for MAGA Engineering's Systematic Manpower Allocation System



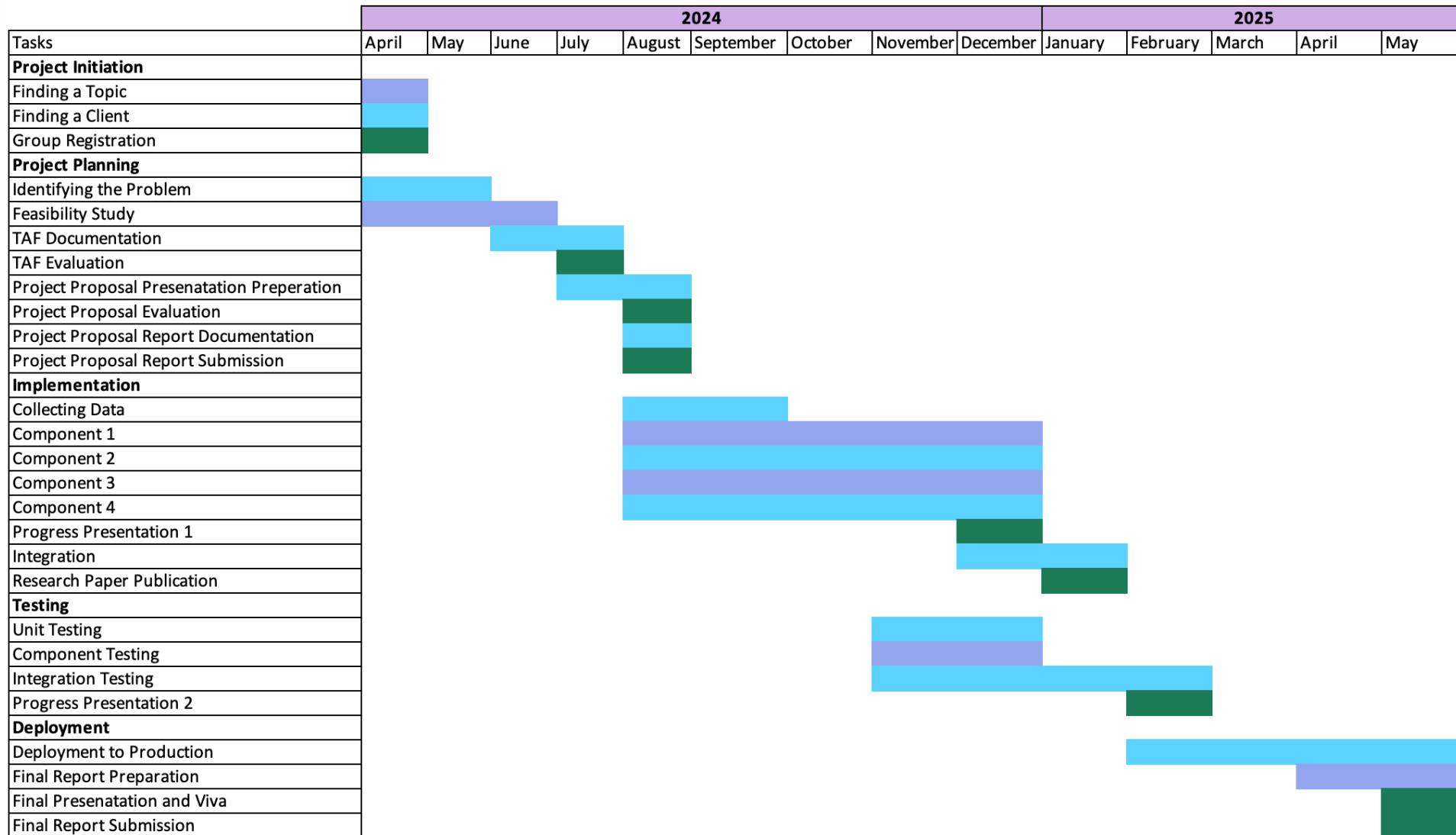


Budget

Budget Item	Cost
Transportation Cost	15,000.00
Paper Cost	7,000.00
Research paper publish	60,000.00
Internet Services and telecommunication	10,000.00
Implementation Cost	45,000.00
Total Cost	137,000.00



Gantt Chart







Thank You

