

Project ID:

24-25J-018

1. Topic (12 words max)

Automated manpower allocation by Performance analysis and Project Categorization in Construction projects

2. Research group the project belongs to

Software Systems & Technologies (SST)

3. Research area the project belongs to

Business Intelligence and Analytics (BIA)

4. If a continuation of a previous project:

Project ID	
Year	

5. Brief description of the research problem including references (200 – 500 words max) – references not included in word count.

There are several obstacles that businesses in the growing construction sector must overcome, especially when it comes to staffing. Efficient resource management is essential for preserving schedules and quality standards in a variety of projects, from large infrastructure projects like bridges and highways to residential building projects. Ineffective personnel allocation causes delays and higher expenses for many construction companies. [2] [4]

We have decided to concentrate our research on MAGA Engineering to retrieve the datasets required for our research. When considering the allocation of staff and laborers for a particular project it is based on the experience of the project manager. So due to that there has been inefficiencies occurred due to improper resource allocation. Some of them are,

1. Allocating the staff which have no experiences in the relevant field.
2. Allocating the excess number laborers than the required which may cause less profits.
3. Allocating the lesser number of laborers than the required which may cause the project behind the schedule.

MAGA Engineering has 4 main different projects as,

1. Buildings
2. Highways & Bridges
3. Water, wastewater
4. Irrigation

Among those we mainly focusing only on buildings category. Through this research, we intend to develop a systematic approach to manpower allocation that can be applied not only within MAGA Engineering but also serve as a model for the broader construction industry. [1]

For that we have divided our project in to 4 sub tasks. Following are the sub task and their purposes.,

1. Project Categorization - To identify project nature
2. KPI Generation by CV analysis - To rate the employee according to their performance.
3. Staff Allocation and Optimization - To match the project nature and the most qualified employee
4. Prediction of required labor count - To predict the number of laborers required according to the project nature.

Mainly under the function of "Project Categorization" involves gathering information on all projects, including scope, timelines, milestones, and requirements. Projects are classified according to various categories such as project types, risk levels, complexity, budget levels, timeframes, geographical factors, and environmental impact.

In KPI generation by CV analysis, CVs are stored in the company databases once the employee is recruited and from that moment a KPI is generated based on the skills and qualifications in the CV according to predefined criteria provided by MAGA. The employee is able to update their experiences with the project details they are working to upgrade their KPIs.

Matching KPI value of the employees according to the project categorization is the main part of the staff allocation and optimization process, which makes use of the outcomes of above-mentioned subtasks 1 and 2. [3]

As the construction companies are not storing the CV details of the laborers, in this project we are only predicting the number of laborers required for the relevant project. According to the results from the project categorization the labor count is predicted in an optimized way based on the historical data related to similar projects to mitigate the inefficiencies of labor allocation.

References

- [1] M. E. P. LTD, "MAGA Engineering," MAGA, [Online]. Available: <https://www.maga.lk/>. [Accessed 17 06 2024].
- [2] R. Paper, "→ Manpower Forecasting Models in the Construction Industry: A Systematic Review <https://www.emerald.com/insight/content/doi/10.1108/ECAM-05-2020-0351/full/html>".
- [3] R. Paper, "→ Duration and Labor Resource Optimization for Construction Projects—A Conditional-Value-at-Risk-Based Analysis".
- [4] <https://www.mdpi.com/2075-5309/14/2/553>. [Online]. Available: <https://www.mdpi.com/2075-5309/14/2/553>. [Accessed 19 06 2024].

6. Brief description of the nature of the solution including a conceptual diagram (250 words max)

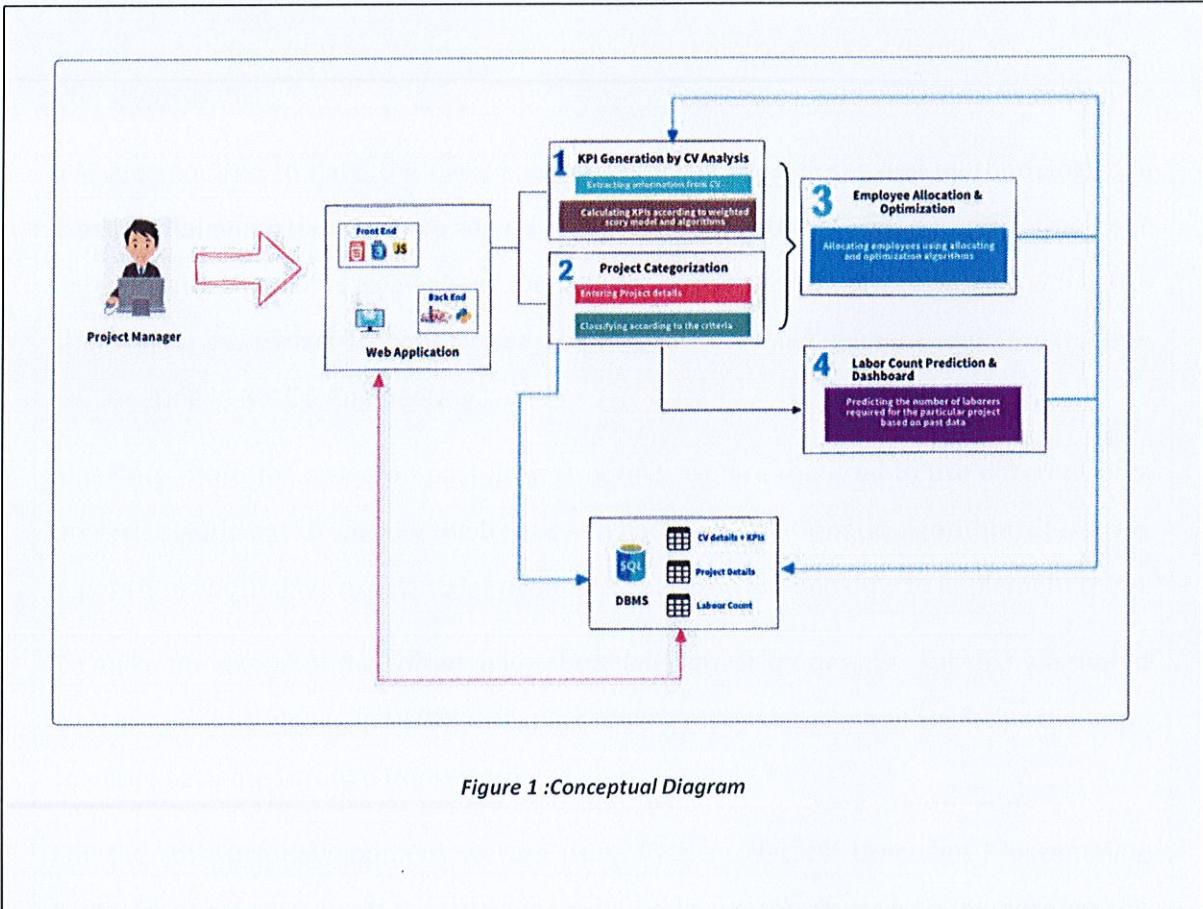
We are about to develop a web application for the above problems mentioned in section 5 above. This application is used by the project manager for building projects, to select the most suitable human resources for their vacant or upcoming project.

When a project is taken by the company, the assigned project manager enters the project details (Location, required staff and their qualifications, cost), then that particular project is categorized and the complexity is measured as high, medium, or low.

When an employee is recruited for the company that particular employee's CV details are stored in the database. Once the CV details are entered KPIs are generated according to the CV. The recruited employees should be able to update their experiences according to that KPIs are updated.

According to the KPI values and according to the complexity the staff members under Management, Engineering & Construction, Technical Support, Quantity Surveying and costing, Finance, Administration, Procurement, Inventory and Security personnel categories as required for the project are allocated using allocation and optimization algorithms.

Then according to the complexity of the project the required labor count is predicted based on the past project labor details and created labor histogram for the particular project. And also, the project manager can record the daily attendance of the labors and according to the attendance the cost, timeline will be predicted through the dashboard.



7. Brief description of specialized domain expertise, knowledge, and data requirements
(300 words max)

We are required to have the basic knowledge in the procedures and methodologies in construction industry. We have gained those from our external supervisor Mr. Darshana Seneviratne who works as a project manager in MAGA engineering. Going forward with the project we expect to contact the employees from management and construction engineering in MAGA Engineering.

Since our project is based on past project details, we are required to use different data analysis algorithms to identify the trends and patterns. (Ex: Genetic algorithm, Clustering Algorithm) For that we expect to learn about the algorithms and how to implement them.

To make the design of the software we should design UI/UX designs. For that we should have proper knowledge in UI/UX designing tools. Proper designing of UIs helps the users to easily navigate through the system.

For the software development we are using Python, Natural Language Programming tools. To enhance our software development skills, we required to study more on the programming languages while developing the software.

The datasets required to our project can be retrieved from the database of MAGA Engineering and it has been confirmed by our external supervisor Mr. Darshana Seneviratne. The data requirements for each function are as below.

Function Name	Data Required
Project Categorization	Past project details (Time, Budget, Scope, Objectives, Milestones) Risk and Complexity measuring criteria.
KPI Generation by CV analysis	KPI defining criteria. (Performance criteria ,Competencies(Knowledge & Skills , Additional qualifications) Employee CV details of each employee category. Employee categories required for a project.
Staff Allocation and Optimization	KPI value of the employees and project categorization result. Past employee details allocated for the projects.
Prediction of required labor count	Budget, Timelines and Number of employees of the past projects. Project Categorization Results. Labour Categories required for a project. Labor Histogram details.

IT4010 – Research Project - 2024
Topic Assessment Form

8. Objectives and Novelty
Main Objective

To automatically allocate manpower by generating KPIs from CV analysis and Performance analysis to work in different projects in the company and predicting labor count.

Member Name	Sub Objective	Tasks	Novelty
Perera K.M	Categorize the projects by entering the project details such as location, type, cost, timeline.	<ul style="list-style-type: none"> • Gather project information. • Classify the projects. <p>Ex:</p> <p>Risk Level: Low Risk, Medium Risk, High Risk</p> <p>Time Frame: Short-Term Projects, Medium-Term Projects, Long-Term Projects</p> <p>Project Complexity: Simple Projects, Moderately Complex Projects, Highly Complex Projects,</p> <p>Budget Levels: Low Budget, Moderate Budget, High Budget,</p>	<p>Generate risks according to the project type.</p> <p>Ex:</p> <p>When we are building a hotel on the mountainside (ex: Nuwara Eliya), we can face different risks according to this project, as follows:</p> <ul style="list-style-type: none"> • Weather and Environmental Conditions. • Water Management

	Geographical Factors: Urban Projects, Rural Projects, Remote Projects Environmental Impact: Low Impact, Medium Impact, High Impact	Using the rule-based algorithms the risks are generated. Developing an algorithm to categorize projects based on past project details. assign. Isuranga K.M.S Generate KPI value for employees according to the experiences and the performances in the CV. <ul style="list-style-type: none"> • Develop functions to calculate KPIs. • Extract information from uploaded CV. • Insert past Project information done by employees. • Calling functions to calculate KPIs by getting extracted CV data and project information. • Integration of functions to the user interface. Ex: 1. Performance - 60%
--	---	--

	<p>2. Competencies (Knowledge & Skills) - 20%</p> <p>3. Additional criteria (Seniority, years of service, educational qualifications)- 20%</p> <p>Devashika R.P.P. A</p> <p>Allocate employees to the categorized projects based on the generated KPI.</p> <ul style="list-style-type: none"> According to the outcomes of above two functions project categorization analysis data and KPI generation from CV analysis, developing a matching algorithm to find the most suitable employee in the company for the particular projects. Use of optimization algorithms. <p>Displaying suggestions of most suitable employees for a project by developing an algorithm to match employee KPI and Project categorization.</p> <p>Ex: Defining the KPI value ranges according to the project type according to the project complexity and employee category.</p>
--	---

Munagama M.K.H	Create a labour dashboard and predict the approximate labour count relevant to the project details. Predict the project timeline, cost and labour count based on the daily performance/attendance of labours.	<ul style="list-style-type: none"> • Estimating the labor count required for the project using past project details. • Daily attendance recording. • Predicting the cost, timeline and labour count required. • Visual Representation by graphs. 	<ul style="list-style-type: none"> • To predict the cost, timeline and labour count time series analysis, clustering algorithms and classification algorithms are used. • Labor dashboard to determine the status of the project up to date. <p>Ex:</p> <p>Is the project ahead the schedule, behind the schedule, over budgeted or behind the budget up to the date.</p>

IT4010 – Research Project - 2024
Topic Assessment Form



9. Supervisor checklist

- a) Does the chosen research topic possess a comprehensive scope suitable for a final-year project?

Yes	<input checked="" type="checkbox"/>	No	<input type="checkbox"/>
-----	-------------------------------------	----	--------------------------

- b) Does the proposed topic exhibit novelty?

Yes	<input checked="" type="checkbox"/>	No	<input type="checkbox"/>
-----	-------------------------------------	----	--------------------------

- c) Do you believe they have the capability to successfully execute the proposed project?

Yes	<input checked="" type="checkbox"/>	No	<input type="checkbox"/>
-----	-------------------------------------	----	--------------------------

- d) Do the proposed sub-objectives reflect the students' areas of specialization?

Yes	<input checked="" type="checkbox"/>	No	<input type="checkbox"/>
-----	-------------------------------------	----	--------------------------

- e) Supervisor's Evaluation and Recommendation for the Research topic:

Please Address the given Comments
in the reviewed document.

10. Supervisor details

	Title	First Name	Last Name	Signature
Supervisor	Mrs.	Buddhima	Attanayaka	
Co-Supervisor	Mrs.	Narmada	Gamage	
External Supervisor	Mr.	Darshana	Senevirathne	

Summary of external supervisor's (if any) experience and expertise

Mr. Darshana is an over 10 year experienced employee at MAGA engineering. Currently Serving as a Project Manager.

This part is to be filled by the Topic Screening Panel members.

Acceptable: Mark>Select as necessary

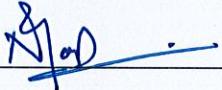
Topic Assessment Accepted	<input checked="" type="checkbox"/>
Topic Assessment Accepted with minor changes (should be followed up by the supervisor)*	
Topic Assessment to be Resubmitted with major changes*	
Topic Assessment Rejected. Topic must be changed	

* Detailed comments given below

Comments

Have a clear understanding of the project.

The Review Panel Details

Member's Name	Signature
Chathurangika Kahandawalaachchi	
Baddina Aththanayake	
Nomada Gamage	

***Important:**

1. According to the comments given by the panel, make the necessary modifications and get the approval by the **Supervisor** or the **Same Panel**.
2. If the project topic is rejected, identify a new topic, and follow the same procedure until the topic is approved by the assessment panel.