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Artificial Intelligence in Construction Management

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ABSTRACT: We are in 21st century in which everything is digitalized and full of technologies. Artificial intelligence is used in many fields. The contemporary studies in creation industry are implementation of artificial intelligence in CEM. In this assignment we suggest artificial intelligence in construction management. As we realize dealing with a mega construction is greater difficult. In creation around 15 – 20 % of overall cost expenditure is going for construction managers (website online supervisor, cloth managers, safety managers). In this we going to apply drones, cameras, AIoT, clever robots, to research, supervise and manage the construction this can reduce the fee of general challenge and offers the accurate timeline of finishing.

KEYWORDS: Artificial Intelligence, Construction Management.

I. INTRODUCTION

Engineering and technology are two inseparable technologies with the modern engineering to achieve a higher life. Rapid increase and increased want of multifaceted technical programs induces us to preserve abreast regarding the electricity of numerous associated subjects in widespread and construction business mainly. The use of artificial intelligent (AI) has multiplied inside the discipline of production engineering and control in current years, primarily because of the potential of the generation for improving creation performance and efficiency. In order to reaching a complete expertise of the research of the research work in this problem, this paper consist of evaluate of existing literature on ai focusing on the ultimate decade.

The technology combinations of IoT and AI will trade creation for long time with new enterprise opportunities and revenue streams as well as new enterprise models and systems that take blessings of iot and ai competencies. Ai is expected to modify enterprise fashions in the development industry in areas together with logistics, customer relationship management, guide, workflow, automation and finance. Even more ai can assist in sensible situations for education, decreasing injuries and costly errors and making operations greater effectively. This can allow operators to higher use existing exertions sources, helping with the talent exertions scarcity. Thus, the digitalization within the construction industry provides opportunities to recognize large production initiatives within their time frame and finances limits. The top objective of the paper is implementation of new rising generation i.e. artificial intelligence in production industries and management.

Objective

1. Identification of management activities where AI is possible
2. Effective implementation of AI
3. Comparison of cost in AI based management and normal management

[1]Many researches have been going through artificial intelligence in construction engineering and management for nearly 10 years. More than 1000 of journals have been published in the name of automation in construction. In the aim to obtain a more comprehensive figure of performances both from a financial and non-financial point of view, the PMBOK knowledge area is proposed to be tailored into a balanced scorecard based performance measurement. The foundation of the strategic map is ‘learning or growth’ perspective, where improvement is necessary to increase the organization's internal ‘business process’ perspective.

[2]Artificial intelligence is expected to alter business models in the construction industry in areas including logistics, customer-relationship management, support, workflow automation, and finance.

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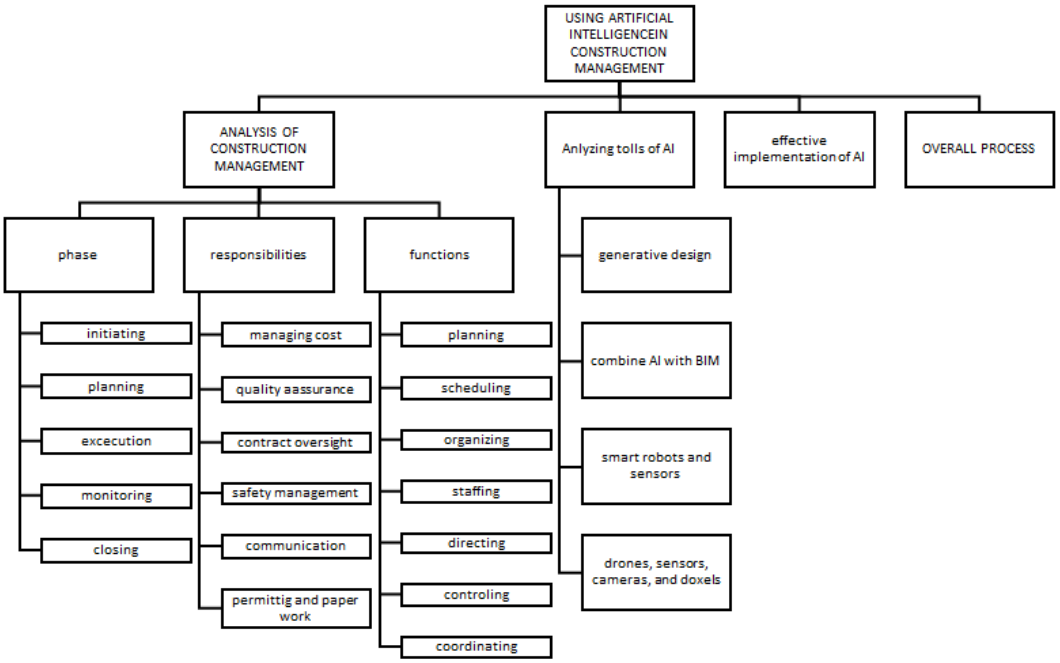
[3]Processes of operating machinery, modelling and estimating, and BIM are just a few of many fields in construction that stand to improve in production and efficiency with the use of AI, we prove that not only in of operating machinery, modelling and estimating, and BIM we can also use AI to supervise the site and t manage .
[5]The construction sector has been adopting technology for capturing data we use this capture data method to capture the data and analyse the date of the construction site with the help of cameras and drones.
[6]AI technologies have the potential to increase productivity by 40% and economic growth by 1.7% across 16 industries including construction. In construction we use AI to increase productivity as well as to manage and analyse. We have studied over more than 10 journals and we have picked up some points that help us to develop more in this project.

II. AI IN CONSTRUCTION MANAGEMENT



Construction management is the oversight of every aspect of building projects. Construction managers structure and facilitate budgets, set and maintain schedules, oversee on-site safety and make sure that everyone completes duties on time. Construction managers communicate with many people, including contractors, construction workers, architects, vendors and clients. They make sure that projects are completed safely, on time, within budget and to the client's specifications.

Construction management responsibilities
Construction management is in charge of building sites. Their responsibilities vary depending on the project and company, but here are some of their most common responsibilities:

1. Managing costs
Construction management is in charge of setting a budget and ensuring that they complete the project within their financial expectations.

2. Quality assurance
Construction managers make sure that subcontractors and contractors are completing their tasks completely and up to codes and regulations.

3. Contract oversight
These professionals ensure that contracts are fulfilled and that everyone involved in the contract is satisfied with the project. This could include giving time and financial quotes for changes that the client requests.

4. Safety management
Construction managers make sure to find and minimize hazards on construction sites for employee safety. They also ensure that team members carefully follow safety regulations and guidelines on site.

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5. Communication

As project leaders, construction managers are often the primary contact for everyone involved, and they ensure that everyone is informed about expectations and changes.

6. Permitting and paperwork

Construction management tracks and handles all the paperwork and permits required to have construction projects in compliance with federal, state and local regulations.

Construction management functions

Here are the functions of construction management:

1. **Planning:** A construction manager uses planning to optimize resource use, reduce conflicts and solve problems creatively.
2. **Scheduling:** Construction managers determine how much time the total project will take, tracking labor hours and how long each stage will take.
3. **Organizing:** Management professionals divide the construction project into departments and assign specific tasks to individual team members.
4. **Staffing:** An important function of construction managers is to ensure employees are assigned to departments and tasks that are best suited to them.
5. **Directing:** Construction managers train, support and correct employees so their tasks are completed entirely and correctly.
6. **Controlling:** They compare active achievements to the project plan and make adjustments to meet deadlines and objectives.
7. **Coordinating:** Construction managers make sure each department understands their role, what kind of help they can expect from each other and have clear communication about plan changes.

Construction management phases

Each project has different requirements, but here are the most common phases in construction management:

1. Initiating
2. Planning
3. Executing
4. Monitoring
5. Closing

1. Initiating

Once the company wins the bid, the construction manager designs a feasibility report. This document determines whether the project can be executed within a specific amount of time and budget. Once the stakeholders in the project agree that it is feasible, the construction manager writes a Project Initiation Document (PID). The PID outlines the scope of the project, team organization and goals.

2. Planning

In the next stage, the construction manager organizes the documentation and project structure. Here are the different types of documents that construction managers design during the planning phase:

i. Project management plan
ii. Scope document
iii. Work-breakdown structure (WBS)
iv. Risk management plan

3. Executing

During this phase, the physical construction begins. The construction manager oversees the schedule to make sure that every stage is completed safely, on time and within budget. The construction manager will organize meetings regularly to be sure that objectives are being met and what changes need to be made to budgets and schedules. They will also communicate progress to the client so they can provide input if needed.

4. Monitoring

Construction managers spend most of the project monitoring the safety of employees and measuring progress. As they monitor progress, they make adjustments to the timeline or objectives as needed. Construction projects are often long, complex endeavours and construction managers often make adjustments to the project plan to meet goals. They also monitor the quality of work to be sure that the contractors and subcontractors are meeting expectations.

5. Closing

The construction manager closes out the project by analysing if the team met the initial objectives and how closely they estimated the budget. They then compile a report to evaluate how well the project went and how to better estimate schedules and budgets in the future. In this phase, they also get feedback from the client to see if they can improve other aspects, like customer service or communication.

Artificial Intelligence:

Artificial intelligence (AI) is intelligence demonstrated by machines, unlike the natural

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intelligence displayed by humans and animals, which involves consciousness and emotionality.

Rise of AI in Construction

Rajagopal (2017) exhaustively described various processes those are making changes across various areas, including risk management, Schedule management, Subcontractor management, Construction site environmental monitoring, and Safety. As part of the BIM 360 project IQ team at Autodesk, he had the privilege to participate in Autodesk's foray in to ML for construction. Clavero (2018) mentioned AI utilizes computer processing to complete tasks that normally require human intelligence. However, it performs action with a greater level of accuracy & much quickly. Because of this capability, AI in CM is another tool in a contractor's digital tool box.

Works of AI

According to father of AI, McCarthy, it is the science and engineering of making intelligent machines, especially intelligent computer programs. AI is a way of making computer a computer controlled robot, or a software think intelligently. In the similar manner the intelligent human think. AI is a complied by sliding how human brain thinks, and how human learns decide, and work while trying to solve a problems of this study as a basis of developing intelligent software systems

Future of AI in Construction

Robotics, AI, and the Internet of Things can reduce building costs by up to 20 percent. Engineers can don virtual reality goggles and send mini-robots into buildings under construction. These robots use cameras to track the work as it progresses. AI is being used to plan the routing of electrical and plumbing systems in modern buildings. Companies are using AI to develop safety systems for worksites. AI is being used to track the real-time interactions of workers, machinery, and objects on the site and alert supervisors of potential safety issues, construction errors, and productivity issues.

Leaders at construction companies should prioritize investment based on areas where AI can have the most impact on their company's unique needs. Early movers will set the direction of the industry and benefit in the short and long term.

Implementation of AI

III. EXPERIMENTATION

This chapter deals with the data collected from real time construction of a hospital building at dindigul district. In this we analyse the data and we implement artificial intelligence in this project and to see the cost reduction of the project.

1. TOTAL PROJECT BUDGET: 5 Cr
2. TOTAL AREA: 4737 Sq.Ft
3. BUILDING AREA: 3968 Sq.Ft
4. BUILDING STORY: G+5
5. TIME TAKEN FOR DESIGNING: 1 Month
6. TIME TAKEN FOR ESTIMATION: 2 Days
7. NUMBER OF SUPERVISOR: 4
8. NUMBER OF SITE ENGINEERS: 1
9. NUMBER OF MATERIAL INCHARGE: 2
10. NUMBER OF SECURITY: 1
11. NUMBER OF PLAN INCHARGE: 2
12. PROJECT DURATION: 2 Years

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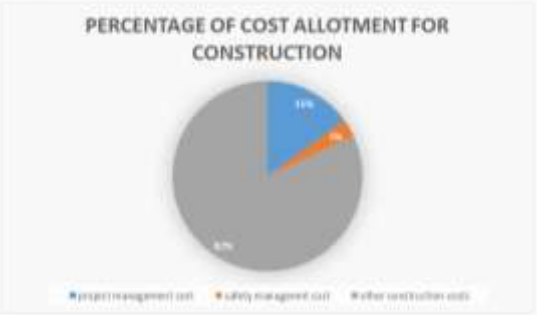

Percentage Allotted For Construction Management

TABULATION

Activity	No of men required	AI tools used	No of tools used
Designing	3	Generative design	1
Safety	2	cameras	2
Monitoring	4	Cameras, doxels	10,2
Material	2	Cameras	2
Plan monitoring	2	Doxels	1

Table 1

18% of construction management and safety management cost from total project is 90, 00,000□

DATA EVALUATION
DESIGNING

ACTIVITY	**NO OF MEN USED**	**Replaced with AI tool**
DRAFTSMAN	**1**	**Autodesk generative design**
DESIGN	**1**	
ARCHITECTURAL DESIGN	**1**	

Table 2

By using generative design we can reduce 3 men. We can reduce an architectural cost of around 1 lakhs. Autodesk generative design is a AI based software where we give our requirement to that software and it will design according to our needs. It is easy to use and we can save time.

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SITE MONITORING

ACTIVITY	LABOR AND QUANTITY REQIREMENT	MONITORING	AI based monitoring	Number of AI tools used
Excavation depth upto 1.5m	Mason:1 Male coolie:5 Female coolie: 4	SITE SUPERVISOR	CAMERA	2
Soil backfilling $10m^3$	Male coolie:2 Female coolie: 3		CAMERA	2
Plain cement concrete $1m^3$	Mason:1 Male coolie:1 Female coolie:1 Foremen: 1		CAMERA	2
Reinforced concrete cement $1m^3$	Mason:1 Male coolie:1 Female coolie:1 Foremen: 1		CAMERA	2
Formwork 11.16 sq.m	Carpenter:3 Foremen:1 Helper: 2	SITE SUPERVISOR	CAMERA	2
Brick masonry $1m^3$	Mason:1 Male coolie:1 Female coolie:1 watermen: 1		CAMERA	2
Half brick masonry	Mason:1 Male coolie:1		DOXELS	1

Table 3

	Female coolie:1 watermen: 1			
Solid block masonry	Mason:3 Male coolie:2 Female coolie:2 Foremen: 1			
Concrete floor 25mm thick 10sqm	Mason:1 Male coolie:1 Female coolie:1	SITE SUPERVISOR	DOXELS	1
Plastering works 10sqm 12mm thick	Mason:1 Male coolie:2 Female coolie:2 Waterman:1			
Tiles laying	Mason:1 Male coolie:1 Watermen:1	SITE SUPERVISOR		
Painting	Pinter :1 Helper:1			
Material analyzing		Material incharge	Camera	2
Plan monitoring		Plan supervisor	doxel	1

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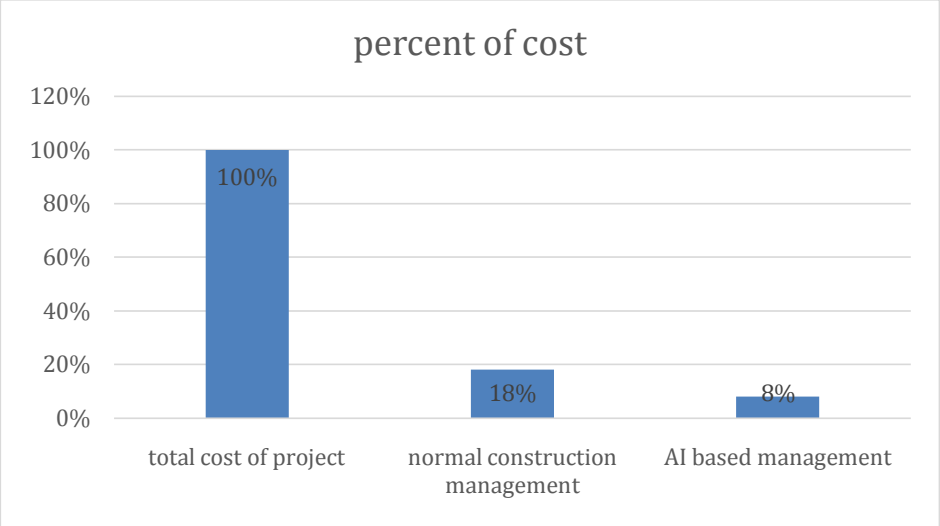
IV. OBESERVATIONS FROM THE DATAS COLLECTED AND EVALUATED FROM REAL TIME

The salary for a single supervisor, single material incharge, plan incharge = □ 10,000
This project will finish in 2 years therefore,24 months = 24×□10,000 = □ 2,40,000
Hence, there are 14 supervisors and 2 material incharge and 2 plan incharge
Therefore,the total supervisors and incharge salary = (14+2+2) × (2,30,000) =□ 36,80,000
Thus total project management cost include □ 36,80,000 + other management costs.
Total no of cameras used: 14
Number of DOXELS used: 3
Cost for a single AI camera (min): □5000
Total cost for cameras = 5000×14 = □70,000
Cost for single doxel= □1,00,000
Total cost for doxels= 1,00,000×3 = □3,00,000
Cost for AI software creating: 2 lakhs
Total cost for AI used construction management = □5,70,000
This cost may go at the most maximum of 10 lakhs
Hence, the total cost percentage of AI used construction management is approximately 5-10% of the total cost this percent is lesser than the total supervisors and incharge salary.



V. CONCLUSION

The main aim of the project is to reduce cost and time of the project management by upgrading the technologies with artificial intelligence. Hence from the above data's calculated we can conclude that artificial intelligence can reduce cost, manpower, gives accurate details and save time. Though the initial expenditure of artificial intelligence may costly but it's a onetime investment for a while. We can make money by lending it to other construction industries.

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