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A Review on Emerging Applications of Artificial Intelligence in Civil Engineering

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Abstract
Civil engineering began with solving problems that were faced by society. Initially, it focused on the implementation of physical and mathematical concepts to solve the problems technically and create engineering solutions. The ancient, medieval, and modern history of civil engineering, implementing new ideas, techniques, and tools to solve real-time problems through AI. These new techniques have created an impact on civil engineering. AI attempts to construct and make operations reasonably simple and precise. Its Trailblazing modeling techniques help crack many complex problems and assist as an analytical tool for diagnosing the results. Machine learning is an application of AI, where a computer uses intelligence to act as a human to accomplish tasks during the process of mathematical models of data that enables a computer to learn and perform on its own experience without any instructions. However, there are no broad appraisals or explanations regarding their applications, so this study focuses on the ethical aspects of their applications, like their predominant role in enhancing the construction industry, geotechnical, watershed management, and transportation fields summarizes it hallow side.

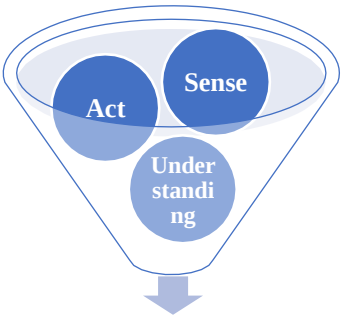
Keywords: Artificial intelligence, Construction, Ethical aspects, technology, machine learning, transportation, geotechnical engineering.

1. Introduction

The study of AI cropped up in 1956 at Dartmouth College at a workshop and the term AI was pronounced by John McCarthy [1], who was known to be the father of this field. Artificial intelligence is a branch of computer science, tangled in the research, design, and application of intelligent computers.

Fig.1 Applications of AI in Civil Engineering.

Fig.1, AI is a way of making software reflect intelligently or making a computer-controlled robot similar to human intelligence. AI includes a computer, control, cybernetics, linguistics, neuroscience, psychology, and philosophy disciplines. AI is an existing use in our day-to-day lives, such as modified ads, virtual assistants, autonomous driving, etc. As could be expected, AI methodologies are beinghighly used and applied in engineering fields, including civil and structural engineering.



Artificial Engineering
Fig.2 Division of Artificial Intelligence.

In simple AI is divided into sense, understanding, and act as shown in Fig.2. Sense includes vision andaudio processing AI technologies, understanding includes Language processing and picturizing knowledge, [2] similarly act comprise of machine learning and skillful systems each of them has its own explanatory solutions. AI models in civil engineering are used in construction projects for accuracy, cheaper, and less disruption. In modern constructions, artificial intelligence is being used in planning the routing of electrical and plumbing systems and it is also being applied to track real-time interactions between workers, machinery, and items on the job site and impressively for supervisors in giving the perspective of safety hazards, construction errors, and productivity concerns. Replicating intelligence makes it easier for those who engross in the growth of the business by making it more sensible. It gives unrestricted steps in a structural design by making it an appealing field of work.

Artificial intelligence will play a vital role in driving civil engineering along the route of automation, digitalization, and intelligence for reliable performance by connecting both onsite and

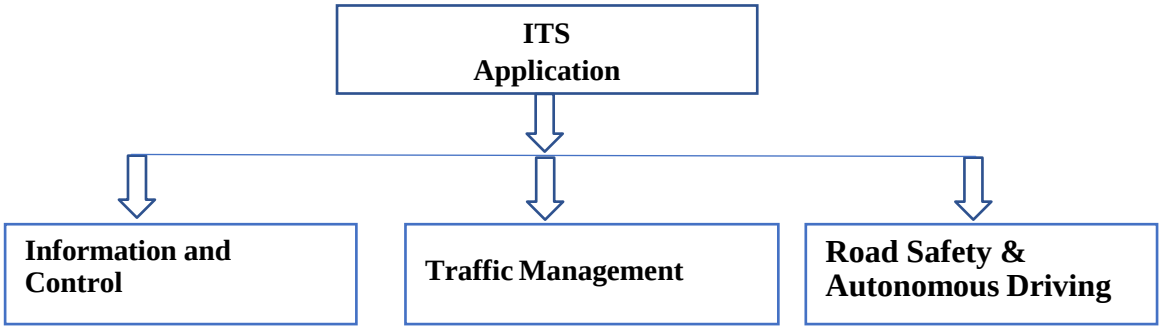
digital constructions. Subsequently, it has been a far-reaching subject after years of advancement and this can be used in numerous fields. In a nutshell, the idea of AI can be described as a combination of logical and reasoning skills that often lack ethics [3-4]. However, when technology combines with human instinct or ethical principles, it may ultimately be the finest environment for mankind to live in, particularly in civil engineering, where we not only construct buildings but also guarantee the safety and trust of the human race. Hence the goal of this research is to increase our understanding of the ethical notions underlying artificial intelligence (AI). It is an ideological approach to future applications of AI in the field of civil engineering that are more effective when they are ethical and it is grounded only based on observations and advancements gathered from several secondary sources in order to drive an understanding of the ethical concepts of AI.

We have yet to witness its long-term evolution, whether it will guide humanity toward making our planeta better place to live or one full of catastrophe. Every technology has benefits and drawbacks, but for a technology to succeed in the market, benefits must always outweigh the drawbacks [5]. However, with artificial intelligence, we are still unsure of whether long-term benefits will always continue to outweighshort-term drawbacks. On the other hand, if we take a look around, we appear to welcome the change that technology is bringing, whether it be a smart house, smart materials, advanced software, robots, Industry, or autonomous vehicles. Additionally, AI-based solutions are effective substitutes for testing when determining engineering design parameters, resulting in significant savings in terms of the time and effort required by humans for trials [6-7] Moreover, AI can speed up decision-making, reduce error rates, and improve computing efficiency. Machine learning is one of the various AI methods.

It claims that Autonomous transportation powered by artificial intelligence, for instance, could help to eliminate the human errors that are responsible for many traffic accidents [8]. The unforeseen repercussions and misuse, like cyberattacks and biased transportation decisions, come along with these opportunities, though. Additionally, there are implications for employment and moral dilemmas regarding accountability for the judgments made by artificial intelligence in the workplace

In the recent three decades [9] Researchers in geotechnical engineering have become interested in AI based modeling techniques as a potential replacement. The following benefits of adopting AI techniques: AI methods can accurately predict even when physical relationships between parameters are unknown (ii) AI techniques can be used to predict, monitor, select, detect, and identify in a variety of contexts; and (iii) AI tools can be used to model complex and nonlinear processes without making any initial assumptions about the relationship between input and output variables.

The study conducted by Hamida et al, [10] categorizes the numerous Intelligent Transport System applications into four primary categories, as shown below in Fig. 3.



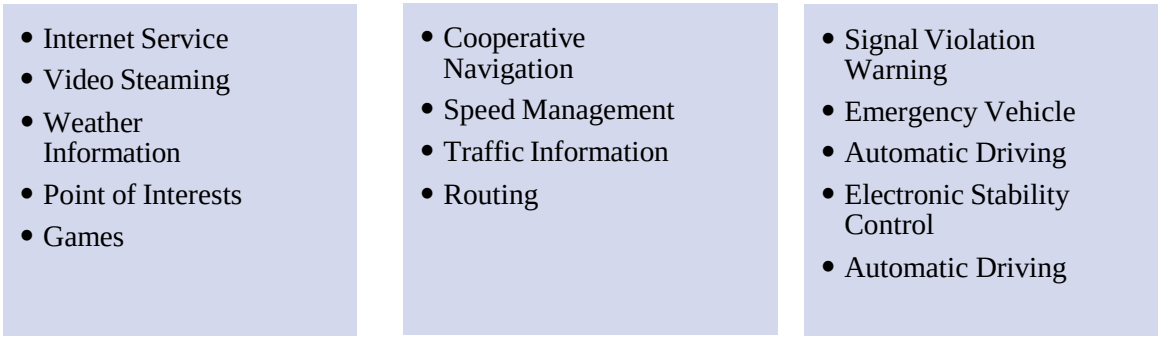


Fig.3 Classification of ITS Application

In order to increase a car's utility and ensure driver safety and improved public transportation, these applications gather data from the vehicle. Applications for Intelligent Transportation Systems (ITS) are data producers that help government decision-makers manage public spaces more effectively. Some of the applications are concerned with improving driver experience, passenger comfort, and effective road management.

Artificial neural networks are practical instruments that have been successfully used to solve a variety of signal-processing issues. In terms of signal processing, their capacity to continuously adjust to new data enables them to follow changes in a signal over time, and their capacity to learn from random, noisydata enables them to resolve issues that some traditional statistical techniques are unable to handle satisfactorily. Ajith Abraham outlined [11] the core ideas behind neural network modeling and provided examples of some of the most widely applied neural network structures.

Application of deep learning neural network to identify collision load conditions based on permanent plastic deformation of shell structures[12] is an article to identify the impact load conditions of shell structures based on their final state of damage or inelastic deformation, they have created a revolutionary deep learning inverse solution or identification approach. The engineering failure analysis inverse problem can be solved using this artificial intelligence method, which is based on the final material and structural damage state and permanent plastic deformation. More specifically, depending on the final permanent plastic deformation distribution of the shell structure that is being studied, the machine learning inverse problem solver may offer a workable solution to define failure load parameters and conditions and have shown that the impact of dynamic loading condition and a "practically unique" static loading condition for a hemispherical shell structure can both be accurately identified by the proposed deep learning method using the permanent plastic deformation following the impact event as the forensic signatures. A powerful tool for forensically diagnosing, determining, and identifying damage loading conditions for engineering structures in a variety of accidental failure events, such as car accidents, pressure vessel failures, or collapses of thin-walled infrastructure structures, may be offered by the data-driven-based method developed in this work. The machine learning inverse problem solution created in this research could have an effect on how failure analyses of forensic materials and structures based on final permanent plastic deformations are conducted in general.

Bernd Carsten Stahl, [13] talks about the moral concerns that the creation, application, and use of AI raise. The Sherpa project's conclusions are presented after a summary of the (ethical) advantages

of AI is given. This project used case studies and a Delphi study to determine what individuals thought were ethical difficulties. These are described using the preceding classification of AI technology. The ethical concerns brought on by machine learning, artificial general intelligence, and larger sociotechnical systems that incorporate AI are all described in great detail.

Kailas G Nath [14] mentioned that when testing is not an option, artificial intelligence (AI) can be successfully applied as a crucial game changer in the field of structural engineering to establish engineering design parameters. Even with the immense adaptability that AI possesses, it is unlikely that, at least in the near future, AI will be deemed to permanently replace human involvement because it cannot account for the logic that is uniquely human in possession. The purpose of it, on the other hand, is to act as touchwood and support those working in the field of structural engineering as they expand their workflow. Modern AI systems have sophisticated and deep-learning algorithms, which offer engineers well-defined platforms and are worthy of investment.

The ethics of AI and robotics have received a lot of press attention recently, [15] which helps the field's research but also runs the risk of undermining it because the media frequently presents the topics under discussion as if they are merely predictions of what the future will bring in terms of technology and as if we already know what would be most ethical and how to achieve that. It would be necessary for us to not always be able to determine the morally correct course of action for a problem to qualify as an ethical AI dilemma. In this view, losing a job, stealing, or using AI to kill someone is not an ethical issue; the issue is whether these things are acceptable in particular situations. The article. "Ethics of Artificial Intelligence and Robotics" focuses on actual ethical issues for which we do not immediately have solutions.

Systems, machines,[16] and algorithms powered by artificial intelligence (AI) that perform cognitive tasks raise a wide range of ethical questions. These include making sure that the development of AI does not cause any direct or indirect harm to people or the larger environment that we all share. The moral status of AI and the development of AI that is more intelligent than humans raise further ethical issues. The latter topics are not covered in this study. There are two main viewpoints in this study. First, challenges with managing huge, complicated projects and using AI's predictive capabilities, particularly machine learning. Second, from the perspective of civil engineering, where AI might be used for designand other optimizations.

Artificial Intelligence in the Construction Industry: Main Development Trajectories and Future Outlook [17]. In order to determine the primary development trajectories of AI technologies in the construction industry and to suggest potential directions in which AI technologies can be further applied to promote advancement in architectural design, engineering design, and construction services, this study analyzed 587 articles published between 1989 and 2021.

2. AI in Transportation Engineering

In order to address constant flocculating issues, AI techniques were initially employed in the field of transportation engineering. Numerous characteristics of the transportation industry make it amenable to AI-based solutions. First, transportation-related issues frequently require both qualitative and quantitative data. The combination of expert and FS is a logical choice in transportation because we frequently have to deal with qualitative data. Secondly, the systems we deal with in transportation are frequently those whose behavior is difficult to predict using standard methods, either because the interactions between the various system components are not well known or because there is a great deal of uncertainty resulting from the human component of the

system[18]. Building empirical models based on observable data may be the only option left for such complicated systems. Further transportation issues frequently result in difficult optimization issues that are difficult to resolve using conventional mathematical programming techniques, either due to the relationships being difficult to specify analytically or due to the size of the issue and its computational intractability.

2.1 AI Networking in Transporting

The Network Design Problem (NDP) includes designing the best road system for transportation planning. Modern research is more interested in emerging massive amounts of data with sophisticated algorithms since machine learning can identify patterns in the data. On a synthetic network, they compared the effectiveness of GA and SA algorithms and this outcome shows that GA yields superior outcomes to SA while requiring less computational effort. But for a Continuous NDP problem, the model taken into account in this research was a single-level linear model.

Since their application to the transportation industry, AI techniques have drawn a variety of criticisms. A significant barrier to AI is the idea that ANNs are a "black box." In other words, the relationship between the input and the output is established without any understanding of the system's internal calculations. Additionally, it was believed that ANNs might generalize in situations where some data from the data sets is missing. However, research has developed a hybrid approach to address this issue that overcomes this constraint by fusing neural networks with other conventional techniques and other AI tools. However, it is thought that this need for hybridization, particularly in multi-scenario situations, to increase performance is a general problem. Reaching the best possible solution for the raster algorithms AI tools (like GA and ACO) is another restriction. In contrast to applying AI raster algorithms, mathematical calculation approaches can offer a true grasp of the fundamental structure of the issue and the nature of the resolution. However, the quick analytical findings produced by these algorithms are preferable to no solutions in difficult optimization issues where it is unfeasible to employ conventional mathematical procedures. Additionally, the aforementioned studies show that these algorithms typically arrive at a good result. To find the best answers and gain a greater understanding of the issue, the parameters and assumptions must be changed and the model must be run more than once. The bias present in the training data which, in most cases, is checked by humans who might introduce bias and errors in labeling is another drawback. The computation Complexity of AI Algorithms is another limitation which not to be forgotten.

2.2 AI in Railways

Despite being the third-largest railway network in the world, it uses modern technology, and because of its immense size, the railway system needs a variety of components to work together harmoniously in order for it to function properly. Furthermore, even a slight network malfunction could disrupt plans and cause trouble for thousands of users. As a result, in order to accomplish the task in real-time and improve the system's functionality, Indian Railways had to put in place a consolidated system that relieson automation.

Intelligent train automation is one of the most prominent examples of AI's application in rail technologyand its contribution to train automation (ATO). The train control system assumes control of operationsunder ATO, with variable degrees of autonomy, from the driver. Today, AI can exploit the strength of data generated by sensors mounted on trains or infrastructure elements to gather information at the appropriate time and suggest maintenance and safety actions.

The Indian Railways is using artificial intelligence to remotely check the system's condition in an effort to increase train operations that are safe and decrease the likelihood of signals breaking [19]. This innovative solution will assist detect breakdowns and obtain real-time information with the aid of AI because the signaling system is the foundation and one of the most important systems for railroad operations.

Prior to assuming the post of CEO, Hania served as the Head of Technology Research and Development (R&D). He chose to embrace AI while concentrating on improving Rail Vision's technological capabilities. This is so that machines can digest information and decide based on logic and reasoning, as opposed to computer vision, which is unable to mimic intelligent human behavior. Based on the data it gets and taking into account a wider range of variables, it may decide the best possible result.

Any obstruction in the way can be found with the aid of sensors, lasers, and cameras. This aids in making the split-second decisions that cause an abrupt stop of an AI-assisted tram. Although it is still in development, it undoubtedly has a lot to offer the larger autonomous vehicle sector, which is expanding quickly. Let's assume, in order to better comprehend this strategy, that the central server for managing and monitoring traffic for the entire railway section is located in an operation control center, as indicated in Fig. 4 below. [20]Through onboard sensors and antennae, the train receives location and signal information from the radio balize installed on the track.

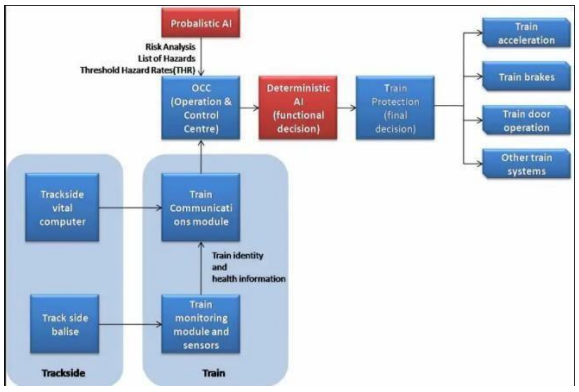


Fig.4 A Possible way for AI-based Train Operation Control

An AI-based train monitoring module transmits this data and the train's condition to the communication module. Additionally, this module obtains track-based data from the trackside processor and transmits it to the [21-22] OCC, such as information about a track failure or an obstruction in the path. On the other hand, the OCC also receives the results of risk analysis from the probabilistic AI modules (as previously stated) and feeds the total data to the deterministic AI algorithms to produce a final judgment. The result is displayed on the train driver's screen, and an automatic, immediate response such as accelerating, braking, closing or opening doors is the result.

In order to determine whether there are any individuals in the tunnel, their precise location, the movement of the train, etc., AI surveillance can aid in this situation. For example, the system can monitor the train's speed and direction of travel inside the tunnels and alert authorities if the train deviates from the permitted speeds or stops entirely there. Additionally, it may detect any theft or object removal that might endanger the [23-24] security of train movements in the region being watched. Video cameras can recognize an incident if there is smoke or fire and can inform security staff to stop the fire from getting out of control.

3. AI in Geotechnical Engineering

Geotechnical engineering is concerned with the utilization of soils and rocks in engineering structures. In material modeling, soils and rocks naturally display complicated behaviors and a high level of uncertainty. Over the past three decades, more researchers in the field of geotechnical engineering have developed and deployed artificial intelligence (AI) techniques. These techniques have been deemed successful because they can anticipate intricate nonlinear interactions. There are nine major fields where the use of AI methods is prevalent, including frozen soils and soil thermal properties, rock mechanics, subgrade soil and pavements, landslides and soil liquefaction, slope stability, shallow and pile foundations, tunneling and tunnel boring machines, dams, and unsaturated soils. With 52% of studies relying on it, Artificial Neural Network (ANN) emerged as the most popular and favoured AI method. FIS, ANFIS, SVM, LSTM, CNN, ResNet, and GAN were also employed, but to a lesser extent [25]. The investigation demonstrates that the quantity, type, and choice of input factors affect the success and accuracy of AI applications.

3.1 Artificial Intelligence in GIS

One of the most effective ways of application of AI in geotechnics is AI GIS. Even if GIS is a strong technology with large data sets and many different AI applications, artificial intelligence offers cutting edge techniques for GIS projects. A combination of artificial intelligence (AI) technology with various GIS procedures, such as spatial data analysis algorithms (GeoAI), as well as a number of AI and GIS enabled technologies, make up AI GIS. In recent years, geoscience research and application have increasingly centered on AI GIS. It is effective to address the existing intelligent problem of [26-27] GIS systemsby using AI GIS to improve and sustain the following stage of the evolution of GIS technology systems. Computer vision extraction of geographic information from satellite imaging photos and videos was first realized by AI GIS. Additionally, the development of AI technologies like voice recognition and speech synthesis will provide increased empowerment.

Not only that AI GIS is used in water management and soil moisture. Artificial intelligence (AI)-based water management systems have enhanced crop management and crop health monitoring, prevented waterlogging issues, contributed to sustained output increases and enhanced farming methods globally. With the world's population expanding and the demand for food items rising, there is a pressing need tostrengthen the food supply. For agricultural production fields around the world, the passive SMOS and other microwave [28-29] satellite sensors register the signals that radiate from the Earth's surface and provide real-time data on water availability, soil conditions, and crop health. Because water damage to crops and other vegetation can be very expensive to repair, this passive microwave device detects waterlogging and irrigation issues through clouds and at night.

AI also helps to save water by monitoring, it can measure data, analyze, learn and deduce. AI techniques such as machine learning and predictive analysis are used to monitor, analyze and control
performance [30-31]. Collected data can be used to Track trends and reduce the risk of water shortage, Identify anomalies, Forecast demand and Predict events, Avoid water loss, maintain a stable water supply, Sewer management and Cut water usage.

AI can help solve the water crisis by providing tools and techniques. We use low-cost AI-powered sensors to monitor and manage water everywhere. [32] People are fighting for basic survival. We should begin developing these AI-powered intelligent machines to address global issues. AI has all

of the answers; we just need to apply it correctly to solve the water scarcity problem. Researchers are using artificial intelligence to create a dependable, sustainable, and resilient water infrastructure.

3.2 Artificial Intelligence in Soil Mechanics

Researchers claim that the latter method provides a clearer picture of the results for the maximum dry density [33-35] and unconfined compressive strength of cement-stabilized soil. Liquidity limit, moisture content, cement content, plasticity index, and percentages of sand, gravel, and clay are among the study'sinputs. Measurements of the slump of ready-mix concrete can also be made using artificial neural networks and genetic modeling. The study technique makes use of artificial neural networks' capacity for approximation.

In terms of rock mechanics, an ADM-System can be utilized to determine an appropriate tunnel supporting system, for example. The task or issue can be described as a search that, at the conclusion ofthe decision-making process, yields the best system for supporting tunnels. The judgments may be based on information particular to the problem or factors like the geotechnical and geological characteristics of the location or the state of the subsurface water.

ADM- System involves the following:

- Intelligent systems and robotics, such as autonomous vehicles; Smart Things, such as voice orpattern recognition
- Drone environmental observations or combat vehicles
- Simulated works, such as those used in games and virtual worlds
- Concept mining, data mining, and text mining are used for big data analysis, document search,and machine translation.
- Intelligent agents are applied in observation systems of intricate technological networks andmanufacturing facilities as analysis tools for model calibration and optimization.

Despite the high expense of adopting AI, there appear to be fewer restrictions, and it has demonstrated its ability in geotechnical Engineering.

4. AI in Construction Industry

Al can be used in the vast majority of areas, and they are frequently used to conduct research and develop applications to complete time-efficient jobs.[36-37]As it includes areas like Design, Construction, and options to settle the barrier path, computerized reasoning presents structural architects with a fantastic possibility. It will be helpful in fields like data analysis and data selection to increase value, reduce cost, and improve the effectiveness of interactions.

4.1 Software Approach

BIM is one of those smart sophisticated technologies which works beyond 3D modeling and building design, [38]. Building Information Modelling has significantly impacted the construction process. BIM systems now play a role in every step of the building process, from design to production to project management to handover after a job is finished.

Artificial intelligence is already being used by BIM software providers to increase the effectiveness and potential of their programs. [39-40] Today's BIM software uses machine learning to identify trends in data, learn from the data, and draw conclusions about how to automate and enhance the

model creation process. We'll keep using AI to help users with labor-intensive and precise activities so they can concentrate on crucial design decisions.

Construction has always had a productivity problem, which has caused the sector to grow far more slowly than any other. Artificial intelligence is beginning to give the impression that it might be the solution to the problems we've previously encountered. With the help of artificial intelligence, a user can enter design criteria or a set of "rules" into a system to help the computer produce the best possible result for your needs. This can be used to build floor plan drawings, site footprints, and more in BIM. These plans are all interconnected, so if you alter the site footprint measurements during the process, for example, your machine will exactly know how to adapt all other aspects of the design to achieve thehighest level of accuracy throughout the project.

4.2 Robot as Workmen

Costs associated with construction can be cut by over 20 using robotics, AI, and the internet of effects. Masterminds can shoot bitsy robots into recently constructed structures while wearing virtual reality goggles. These robots follow the task as its done using cameras. The link between technology and the construction industry is complex, and the use of autonomous robots is likely the area where this complexity is most apparent. [41-42] Construction companies have very limited flexibility when it comes to employee deployment due to their labour forces being overstretched. Any change in their workers' availability can set off a series of events that cause the schedule for the entire project to be altered. Companies have more flexibility in how their labour resources are allocated when using autonomous robots as a supplement to their workforce, which makes it simpler to adjust to unforeseen absences. Companies deploying autonomous robots can quickly adjust resources to fulfill requests for priorities or tasks to change during a project. When necessary, autonomous machinery can take over more labor-intensive tasks while human workers are reassigned to other tasks. A construction company's staff can benefit from some much-needed flexibility by adding an autonomous worker.

4.3 Decision Making

AI is being used by businesses to produce plant safety results. In order to make decisions on whether touse a conventional model or make modifications to the current model for a specific project, Neuro Modex, a Neural Network System for Modular Construction Decision Making, is used.

This decision-making approach relies on a few characteristics that are dependent on the following fundamental five disciplines:

1. Risk management in Project
2. Characteristics of Project
3. Availability of Labour
4. Relation between Environment and Organization
5. Location of Project.

The data for the neural network used to generate this specific model was gathered from a variety of engineering and construction businesses as well as from several environmental industries. From the initial design phase until the final handover to the client, the construction project is managed by the construction management system. In the process of fusing a final acceptable product, the initial model designing procedure is crucial. The use of neural networks predicts a better initial design, which coversa number of significant fields in the construction industry, including calculations and

determination of concrete mix grade, load calculations, determination of the tensile reinforcement generate plans at various stages of a project, including the description of the project management activities performed and their benefits anddrawbacks, as well as how to identify and incorporate the developing actions into the project plan. [43]Bridge design and analysis, frame and structure design and analysis, pipe constructions, plate structures, transmission towers, and concrete properties of particular types of concrete are a few significant uses.

The process of carrying out a damage detection and characterization strategy for designed buildings and structures is known as structural health monitoring. Development of Statistical Models, Data Feature Extraction, [44-45] Operational Evaluation, and Health Monitoring are all processes that are involved. Assessment of post-earthquake structural integrity, monitoring of structures impacted by external factors, the rise in maintenance needs rather than a decline in construction needs, the transition to performance-based design, performance improvement of an existing structure, and feedback loops to improve the future design based on experience are some of the goals of SHM. To accomplish the aforementioned stative aims, numerous sensors and dampers have been built and put in the structures with the aid of AI. The method employed in SHM is referred to as a model-driven approach, which emphasizes the numerical.

4.5 Automated Machine

Fig. 5, Hadrian X is an automated bricklaying machine and is the first mobile robotic block laying machine and system in the world, producing far less waste than conventional construction methods while significantly increasing site safety, and can construct a house's walls in situ in as little as a day. It builds block structures from 3D CAD models quickly and accurately. To increase the effectiveness of residential buildings, special optimization software turns wall designs into block placements and minimizes handling and waste of block products. From the architect to the finishing trades, every supplier involved in the construction of a home will access the same data source, allowing for the simultaneous manufacturing of goods.

Fig.5 Hadrian X.

The highly precise Dynamic Stabilization Technology TM (DSTTM) system continuously modifies thelocation of a robot's end effector to guarantee that it is always held steadily at the proper spot in three dimensional space. Robots may work outside in unstable, unpredictable situations and complete customjobs when FBR's DSTTM is used in conjunction with FBR's proprietary software. It claims to lay up to1000 bricks an hour and just an hour of Hadrian X is equal to two days' work of a human laborer.

5. Ethical Interpretation

We have been focusing on whether we can develop Al so far, but we also need to think about if we should. Workers in the field would have a moral obligation to refocus their research if the impacts of Al technology were more likely to be harmful than beneficial. [46]AI is an extremely powerful technology, which is easily reachable to a person with a computer and access to the Internet. Hence some people arearguing that strict ethical standards should be introduced due to the combination of power and accessibility. Creating and implementing safeguards to reduce the likelihood of purposeful exploitationand unintentional misuse is difficult to argue against [47].

What's even great is that we're always upgrading the technology to raise the caliber of performance! Let's shape the future rather than be anxious about it. Let's welcome the change rather than dread it. We must not reject what can make us smarter because we are the most intelligent species, who created the magnificent AI technology itself, and if we could actually incorporate ethical instinct into AI, we can make an effective civil engineering arena.

5.1 People lose their automation.

Automation may result in employment losses for people. Computers in general, and specific AI programs in particular, have become essential to the modern industrial economy. AI inspires the development of new computer technologies and industrial robots that require fewer human workers. Consequently, it has a detrimental effect on the labor market. One could argue that these AI programs have eliminated thousands of jobs, but in reality, if you removed the AI programs, these occupations would no longer exist because hiring people would increase transaction costs beyond what is reasonable.

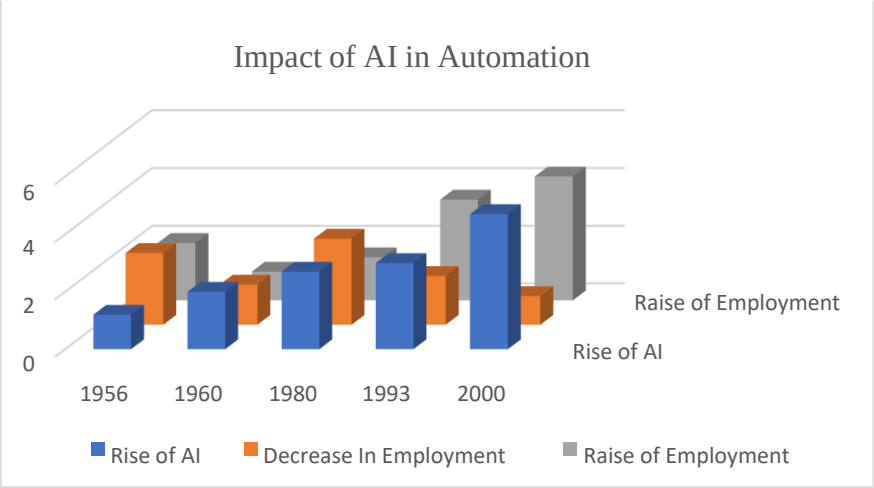


Fig.6 Impact of AI in automation.

The above graph Fig.6 shows how AI emerged impacting automation on a scale of 5. Automation through information technology in general and Al, in particular, has so far produced more employment than it has destroyed, and these new positions are more fascinating and well paying. Loss of jobs is less of an issue now because the canonical Al program is an "intelligent agent" created to help a human.

However, some researchers believe that the best objective for AI is to complete the task. In considering the AAAI's 25th anniversary.[48] The development of a robot with human-level intelligence that could pass the employment test rather than the Turing Test—a robot that couldlearn

to perform any of a variety of jobs—was the challenge posed by Nils Nilsson in 2005. It's possible that in the future, even the unemployed may manage their own team of robot employees despite there being a high unemployment rate. Since this sector is still developing, there does not appear to be a recognized standard approach or product.

5.2 People might lose their Uniqueness

It's possible for people to lose their sense of identity, Comparing human response to computer power. The creator of the ELIZA program, Weizenbaum [49], identifies a few dangers that Al may offer to a civilization. Imagine having to coexist with a robotic, intelligent computer whose program constantly seeks to undermine human intelligence in an effort to undermine human self-worth. Machines lack ethics, hence they can never rule the human race. Furthermore, no computer is that powerful without human guidance; a machine only becomes intelligent when it joins forces with human intelligence.

5.3 AI might lead to undesirable ends

No matter what aspect of human life it affects—life, transportation, water, land, or the environment—civil engineering is always crucial. AI will undoubtedly perform more accurately and produce flawless results for a structure, but it lacks human sensibility and responding stimuli, which AI cannot have without guidance or programming. Elon Musk at a National Governors Association gathering in 2017[50], has also stated that artificial intelligence is “the scariest problem" an invention that could pose an unappreciated "fundamental existential risk for human civilization." Undoubtedly AI can bring um imaginable risk without proper programming in the civil engineering field

5.4 AI is more Costly

The application of AI in the fields of civil engineering is not as easy as it seemed to be and AI is used only by organizations that can afford its implementation and maintenance costs. Incorporating robots and other complex machines are expensive.

6. Conclusion

Generally, humans are upgrading technology to prove their caliber in handling Al technology by shaping the future. The invention of Al technologies is most applicable in civil engineering. The following conclusions are from this study.

- In a nutshell, Artificial Intelligence is the collaboration of human intelligence with a computer algorithm that reluctantly has no soulful response which is crucial in civil engineering.
- Future applications of artificial intelligence will surely make life easier for people and might even motivate them to develop new skills.
- Prediction and risk management are just two civil engineering areas where artificial intelligence has been successfully used.
- Initial establishment is expensive, but it will ultimately lower the cost of construction.
- The development, upkeep, and administration of various civil infrastructure components benefit from the use of artificial intelligence in civil engineering.

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