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## **USE OF INTELLIGENT ROBOTS IN CONSTRUCTION**

Smart robots are essential in construction today. They make work faster and safer. They do routine tasks like lifting heavy materials and cutting materials. This gives workers more time for creative tasks and lowers the risk of accidents. [1]

These robots can do precise work using AI and machine learning. This improves the quality of construction. Using them is also better for the environment. They use less energy and emit fewer harmful substances than traditional methods. [2]

Future studies should look at how to use smart robots in modern construction and how they affect the quality, efficiency, and safety of projects. [3]

### **Optimization**

If you use IoT sensors for remote monitoring of equipment health and combine them with the ability to analyze the movement and operation of construction machines, then you can significantly reduce equipment downtime, thereby minimizing machine maintenance costs and optimizing work productivity. The implementation of artificial intelligence technologies will make it possible to choose the most optimal option for planning work during construction due to the improvement of algorithms by the trial and error method of past projects. In addition, this analysis will allow to simulate the results of construction and the final layout for the period of delivery of the object, as well as to develop an effective distribution of materials on the sites. [4]

### **Predictive analysis**

At the stage of project development, computer programs can be trusted to calculate the occurrence of probable risks, the possibility of compliance with technological standards, as well as to simulate the reliability of the application of certain construction methods. Quality software will speed up the decision-making process for a project, and potentially save time and money troubleshooting potential problems. In addition, this type of analytical platform will help to speed up the testing of construction materials used, reducing the period of downtime at the facilities. Information for analytics is collected through sensors

installed on the equipment, processed and produces results both for real-time monitoring and for planning work at the next stages. [4]

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## 3D PRINTING HOMES IN THE 21ST CENTURY

In the 21st century, 3D printing technology has emerged as a promising innovation for building homes, offering a combination of design flexibility, functionality, cost-effectiveness, and environmental sustainability.

**Advantages of 3D-Printed Homes.** 3D-printed homes can combine design, functionality, low costs, and environmental concerns, offering an optimal combination of creative design and eco-friendly materials that can be built fast and at a substantially low cost. [1]

These structures have demonstrated resilience, as evidenced by ICON's 3D-printed homes in Mexico's Tabasco state, which remained mostly unaffected by a 7.4-magnitude earthquake.

The use of 3D printing technology for housing projects has been leveraged by organizations like US-based charity New Story, which has funded over 2,300 homes in Mexico, Bolivia, Haiti, and El Salvador. [1]

**Sustainable and Affordable Housing.** Companies like Saint Gobain Weber Beamix have been experimenting with 3D concrete printing technologies, leading to the development of milestones like the world's first printed commercial housing project, comprised of five homes that meet comfort and stringent construction requirements. [2]

The potential of 3D construction printing for affordable mass housing projects has been demonstrated through successful printed homes, although there are still challenges to overcome before 3D printing becomes the norm for mass housing. [2]

**Construction Efficiency and Cost Reduction.** 3D printing technology offers the potential for faster construction and cost reduction compared to conventional building methods. For example, concrete printing is faster and becoming cheaper than conventional wood-frame building, potentially addressing the affordable housing crisis. [3]

The use of 3D printing technology for home construction has the potential to drive down costs through efficient use of materials and automated labor, making it useful for emergency housing or to shelter the homeless. [4]