

A STUDY OF RISK FACTORS IN CONSTRUCTION AUTOMATION AND ROBOTICS

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Abstract— Construction automation and robotics research and development in the India is more than a decade old. A number of research institutions, universities, construction equipment manufacturers and construction engineering firms have been involved in these efforts. The main discussion in the paper is about how construction field demands the automation and robotics. However, a more intensive effort and dedication to automation concepts is needed to capitalize on the potential benefits of automation, particularly in the practicing engineering community and among the industry practitioners.

Keywords— Automation, intensive effort, construction equipments

1. INTRODUCTION

Automation is defined as a self-regulating process performed by using programmable machines to carry out series of tasks. Introducing the use of machines to a production process is called mechanization. Automation goes one step further and the process is not only supported by machines but these machines can work in accordance with a program that regulates the behavior of the machine.[1] The construction industry plays a significant influential role in national and global economies. The industry makes up 10% of GDP in developed countries, and more than 25 % in developing countries. However, the degree of automation in construction is far less than in other industries, such as manufacturing.[2] This results in both poor productivity and risky working conditions. In the situation as such the advancement of technology in recent years that have been found to be playing a major role across sectors such as manufacturing are finding their way into construction industry.[3] At times construction work is conducted under dangerous condition and situation, thus there is need for robotics to optimize equipment operation improve safety and quality of work Automation can be done in uniform brick laying, plastering of uniform thickness of ceilings, interior & exterior walls.

Automation can provide reduced labour dependability higher output and increased productivity, less variability, reduced human errors, greater control & consistency, safe working environment, flexibility etc. Construction automation has been described as the use of mechanical and electronic means in construction to achieve automatic operation or control to reduce potential exposure, time or effort while maintaining or improving quality.[4] Construction work is labor- intensive and is conducted in dangerous situations, also the work content and materials change frequently.[5] Automation and robotics applications are opportunities to solve such issues in construction industry. Robots are used widely to help human workers in construction sites.

2. EXISTING SYSTEM

Through their experiences, the Japanese construction companies have found that robotics technology has improved productivity, quality, safety, work conditions, environment, and reduced construction time, labor, hard work and costs. Productivity and quality in single-tasks robots has successfully being achieved when a specific work is repetitive. However, due to limitations of robots and the complex environment where construction industry is developed, additional work force is still necessary reducing productivity.

Disadvantages of Robots in the Construction Industry

Robots were bom from robots of the manufacturing industry. Therefore, many problems faced by industrial robots are similar to robots in the construction industry. Problems valid include among others [5]: a) robot mobility, b) weight and seize of robots, c) robot accuracy, d) robot operation, and e) external factors such as dispersion of projects, lack of repetition, dependability among workers, negative attitudes to change, fragmentation of the construction industry, and instability of the market.

3. PROPOSED SYSTEM

In automation construction, productivity promises to increase because of better integration among tasks. Reducing the hard work, robots improve in general safety in the work place. Because activities are confined within the building facility in automated building construction systems, noise and dust are reduced contributing to a healthier work environment. Although overall reduction in labor is not apparent, because it is still necessary to complete work inaccessible by robots, it is expected a reduction of labor using automated construction systems. Once the automated building construction system be refined and used more repeatedly, it is expected a reduction in construction time and costs. In the India, construction

companies continue to be reluctant in using construction robots. Architects and design engineers should address their efforts in designing structures and materials adaptable to the limited capabilities of robots and automated construction systems. Simplifying, mechanizing, and automating the construction process is the first step into order to put automated systems in the construction industry.

4. METHODOLOGY DATA COLLECTION

For this research paper a poll overview strategy (questionnaire survey method) has been considered to discover the impact of various attributes on construction automation in Indian construction sector. The method is utilized broadly in various worldwide research papers as talked about above in the writing audit. 24 qualities influencing construction profitability that were recognized from the writing audit and through individual meeting with industry specialists. Respondents were made a request to rate the chosen properties/elements influencing construction efficiency utilizing a Likert scale 1 to 5 (Rami Huges, 2014), the respondent represents the different type of professionals working or consulting in Indian construction sector through a fair and holistic approach to provide equal chance to all the stakeholders involved in the Indian construction industry. Heterogeneity in the example review was kept up by moving toward the gatherings of chosen respondents, those were speaking to the imperative parts of the Indian construction industry.

Method used to analyse the results of the questionnaire: For the questionnaire, the respondents were asked to rate the factors affecting construction productivity on a Likert scale of 1 to 5 as per their degree of impact and influence with respect to they observed to impacting construction productivity in the Indian context. The value given to the Likert scale rating is defined below:

1. No effect (or No opinion)
2. Less effect (No or minimal effect)
3. Minor effect (Minor problem)
4. Serious effect (Medium problem)
5. Very serious effect (major problem)

5. LITERATURE SURVEY

1. Khashayar Asadi, Hariharan Ramshankar, Harish Pullagurla, Aishwarya Bhandare, Suraj Shanbhag, Pooja Mehta, and Spondon Kundu in 2018 study on "Vision-based integrated mobile robotic system for real-time applications in construction". In this paper the researchers identified how to increase the degree of

automation and frequency of data collection for monitoring construction sites, that developed and/or examined mobile robotic applications in construction.

2. Jonas Buchli, Markus Giffthaler, Nitish Kumar, Manuel Lussi, Timothy Sandy, Kathrin Dörfler, Norman Hack in 2018

study on "Digital in situ fabrication - Challenges and opportunities for robotic in situ fabrication in architecture, construction, and beyond" introduced the problem of digital in situ fabrication as both a significant challenge and a huge opportunity. The discussion with an example of a robotically-fabricated digital concrete wall finds that solving in situ fabrication constitutes an inherently multidisciplinary challenge.

3. E. Lublasser, T. Adams, A. Vollpracht, S. Brell-Cokcan in 2018 study on "Robotic application of foam concrete onto bare wall elements". In this paper they introduced the concept of a mono-material thermal insulation system based on an easily reusable as well as highly insulating mineral material and investigated the application of foam concrete using different foam concrete densities according to the layers functions.

4. V. R. Prasath Kumar, M. Balasubramanian and S. Jagadish Raj in 2016 study on "robotics in construction industry". In this paper they analyse the efficiency usefulness of automation and robotics in construction, to measure cost effectiveness of automation in comparison to manual work practices and to improve safety and quality standards in construction using automation by adopting the methods such as value estimation, payback period, return on investment and straight line method.

6. AUTOMATION AND ROBOTICS IN CONSTRUCTION INDUSTRY NEED FOR ROBOTS

Fast changing, field-based, project-oriented industries like construction are severely handicapped by their lack of accurate, timely and systematic technical, cost and production data from ongoing operations. Meanwhile, technologies have evolved that can not only monitor the ongoing operation of manufacturing facilities and collect operational and passenger volume data from transit systems, but can monitor vehicle operations characteristics, transit high resolution video images.

Factors Affecting Production Efficiency The computation of the production efficiency factors depends upon numerous variables which affect workers productivity in actual job conditions at the project site. These variables vary from project to project, and over place and time. Some of the typical factors affecting the workers production efficiency are given in following:

- Work Complexity
- Repetition of Work
- Equipment-Intensive Tasks
- Climatic and Weather Conditions
- Labor Availability
- Scheduling Direct Workers
- Adjustment for Daily Manpower Requirement
- Selecting Construction Equipment
- Equipment Output Capability

7. RESULT AND DISCUSSION

The collected datasets are calibrated using MATLAB tool. Based on the analysis from the collected datasets the algorithm evaluates the importance and necessity of the robotics and automation in the Construction field.

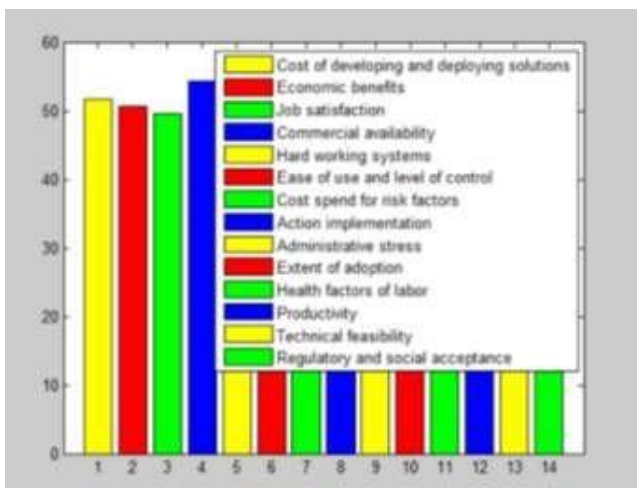


Fig a): Analysis Report using MALTAB

Fig b): Result after calibration using MALTAB

Here it proves the Technical feasibility is necessary if the hard-working prediction is higher from the collected dataset.

8. CONCLUSION

In this project, various aspects of automation in construction industry including the advantages and

disadvantages of using robots at site, the challenges faced by using robots, the various risks associated with it are consider. I also checked the methods of preparing the questionnaire considering various factors associated with it. Thus, I came to a conclusion of preparing a questionnaire and this approach demonstrates a decentralized, autonomous, flexible, simple, and adaptive approach to construction. Therefore, construction robotics has been a very hot research area in the construction industry. In contrast, a robotic system that would operate with no need for detailed pre- planning would be less technologically demanding and may, therefore, be easily developed during early stages of robotics integration into the construction field.

9. SCOPE FOR FUTURE ENHANCEMENT

In future following enhancements can be made:

- Preparing a questionnaire by surveying various construction sites that are influenced by the considered factors by using or likely to use robots at their site.
- The evaluation of performance and standards of questionnaire prepared during the project.

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