VOICE CONTROLLED DIGITAL ASSISTANTS: THE CHALLENGES THEY SOLVE IN THE CONSTRUCTION SECTOR



MAY 2023 © 2023 Contact Harald

Introduction

Some of the problems that impact the construction industry are unresolved remnants of previous poor practice. Others arise from technological advancements or as unexpected consequences of implemented solutions. While some successful resolutions to problems have transformed industry work practices for the better, a considerable number of historical issues faced by industry managers still remain.

This paper discusses many of those concerns and explores the impressive set of solutions an intelligent virtual agent brings to the construction industry.

Virtual agents are powered by conversational level artificial intelligence technology that has the ability to update, fetch and correlate data from a wide range of sources. They are significantly faster to use than many other project or construction management technologies while retaining the ability to integrate with - and improve upon - existing systems.

Immediate access to the relevant information that intelligent digital assistants can provide at the right time might well be a key deciding factor for the success of a project. It is, perhaps, even more crucial when applied to a fast-paced, ever-changing industry with tight or tightening margins.



$\mathbf{1}$

Voice controlled intelligent virtual agents offer significant improvements for worker efficiency, productivity and safety within the construction sector. Poor communication and the slow uptake of digitisation are often the source of construction project overruns¹

Voice controlled, intelligent digital assistants: Setting a new foundation for construction

ell-known consumer virtual assistants already in common use such as Siri, Google Assistant or Alexa are neither designed for nor suitable for the rigours of construction projects.

Recent advancements in natural language processing, and the underpinning machine learning technology, have shown that newly developed platforms and tools are ready to be optimised for many industries, especially construction. Unlike some of their consumer predecessors, their industrial counterparts are more accurate, faster when fetching and uploading data, and most importantly, extremely adaptable and customisable to a user's needs.

Research has highlighted that poor communication and the slow uptake of digitisation are significant reasons why construction projects struggle to finish within budget.^{1,2,3,4,5} Intelligent voice assistant technologies can solve these and other key industry problems in a variety of ways, as covered next.

Vital communication

Substandard communication and a lack of meaningful feedback negatively impacts creative thinking and reduces the desire to solve problems. An apathetic, resistant and subsequently agitated workforce triggers a reduction in collaboration which ultimately hampers productivity.⁶ Whether individually or combined, such significant downward pressures often result in project overruns.

A survey of communication issues in construction by Xie, Thorpe and Baldwin proved the point by ranking a large number of variables by their importance. Accuracy, completeness, timeliness, and barriers to communication (the flow of information) were the four most important factors. While that study analysed the design phase of construction, the study also stated that effective communication is critical to all stages of construction.⁷

An intelligent virtual digital assistant can help in the following ways:

Accuracy

Many factors bear on the level of accuracy when communicating information, inputting data or reporting.

Mistakes or delays arising from paper-based records or typed commands entered into a device can be easily negated with a voice assistant.

A direct, digital approach is more accurate and efficient than adding information to a document and then forwarding it on to administration staff, who may or may not understand the context, to then input the data into software.

Completeness

Due to the simplicity of communicating by voice with a constantly available digital assistant, there is a higher likelihood that forms will be completed promptly. Once completed they are forwarded to the project's software management platform, ready for automatic processing or analysis by relevant personnel.

Having up-to-date, complete information in real-time will enable managers and personnel to make informed decisions and reduce the need for reworks or unforeseen project rectification.

Timeliness

With immediate and constant access to a digital assistant, staff will receive reminder alerts to update their reports at a specific time, location or according to a predetermined condition.

Using a voice assistant via a telephone or two-way radio significantly reduces the delay or underreporting of risks commonly found with paper-based documentation. Real-time data uploads directly to your software platform.



Flow of information

Called by some as the 'lifeblood' of any project, communication is the cornerstone of successful project management, with written communication ranked as the most critical delivery tool.^{8,9} However, overreliance on paper documents to acquire, interpret and disseminate information can be problematic.

Additionally, because personnel often move about multiple sites, focused on the micro rather than the macro view of the project, information siloing can become prevalent. Such information blockages impact upon productivity.¹⁰

Furthermore, the fundamental role of feedback is critical within any communication loop.¹¹ Without either a reliable and/or trustable feedback loop, the relaying of information is more likely to be obstructed, with an increased potential for subsequent delays to the project's progress and, in extreme circumstances, might cause severe safety incidents.

A voice assistant provides these critical solutions:

Interacting with a voice assistant will prevent the need to decipher handwritten forms and reports so that filling out documentation is similar to a conversation with a trusted ally, as opposed to a tedious task.

Language barriers can cause significant breakdowns on a construction project. The natural language processing technology that powers assistants, enables them to understand and translate across multiple languages.

The voice assistant is an integrated component of the construction management software platform reducing information siloing, perhaps even making it obsolete.

Being rapidly connected to relevant personnel, either individually or in a conference scenario, will aid in maintaining the flow of information and vital feedback.

Having instant access to critical locations and evacuation plans (in multiple languages) significantly helps streamline processes in times of emergency or site orientation.



Without either a reliable and/or trustable feedback loop, the relaying of information is more likely to be obstructed.

How to navigate away from paper-based forms

pportunities to capture and analyse construction performance are hampered when paper documents are the primary 'source of truth'. Within digitisation and industry lag, paper-based forms and managing the subsequent paper trails are problematic.

Besides the obvious time delays when filling out paper forms, transcribing records from a handwritten form into a digital format for compliance and analysis is often error-prone and requires double handling of the same information. Moreover, change or variance orders and claims can become unwieldy to manage if paper documentation is over-relied upon.

Transitioning away from paper to digital formats is worthwhile. Yet, it is just the first step to streamlining operations. Given the multiple device types, small screens and the need for internet connectivity, filling out a form on a mobile device can be cumbersome and potentially dangerous while onsite.

However, by interacting with a voice assistant, the user can input data into digital documents, such as hazard reports, using voice in the same way they would have a conversation all the while being able to be aware of their surroundings. Similarly, accessing worker information in real-time, such as operators' licences or construction instructions, can be as easy and fast as a phone call to a single source.



Opportunities for improving worksite health and safety

Reporting is one of the cornerstones of construction worksite health and safety.¹² The failure to report plays a significant part in construction site accidents, injuries and fatalities. In accordance with Australian legislation, the safety data collected and the subsequent reports issued must be valid, relevant and reliable. Moreover, WHS reports need to be of sufficient quality and importance to warrant action should the need arise. The information provided should be benchmarkable and easily comprehended by the end user.¹³

According to the research, underreporting is driven by the following factors:

- 38% of participants were indifferent to the importance of reporting
- 37% were fearful of potential backlash
- 25% indicated that the processes of reporting was the critical problem^{14,15}



\checkmark

While legislation clearly defines reporting requirements, it may be surprising to learn WHS underreporting is rampant.

Around 31% of Australian workers do not always report incidents, which is 6% higher than the global statistics. Managers failed to register 21% of incidents in the workplace.¹⁴

The statistics (right) came from a broad research sample across nine industries (construction included). Given the high level of safety-critical incidence rates within the construction industry, it is a fair assumption that the data is reflective. Finding a solution to managing the indifference of employees reporting occurrences and/or their fear of potential backlash is a cultural issue not addressed via a voice assistant at this present moment. Yet the voice assistant does not attribute blame, instead it might provide positive reinforcement for the submission of the report. With basic worker training together with process improvement as a consequence of practice analysis the assistant has the potential to produce much improved outcomes.

Digital assistants streamline reporting

he ease of using voice commands to report on hazards, near misses and incidents, along with safe-work method statements and job hazard or risk analysis, makes this technology worthy of closer examination for integration into WHS systems and processes.

The burden of compliance management has become ever-more complex as worksite practices have evolved. Yet, using a digital assistant as the intermediary via a human friendly interface poses great opportunities for simplification.

Additionally, navigating a workforce with low literacy rates and a high proportion of non-native English speakers^{16,17} increases the number of challenges presented to managers and key decision makers. Intelligent assistants powered with natural language processing technology will remove many of those communication barriers due to its ever expanding multilingual capabilities.



Inventory and equipment management

Sound construction material and equipment management is critical to the execution of construction projects.¹ Without effective practices, managers are more likely to experience stock shortages and losses of equipment, which in turn can impact an already tight project deadline or its budget.

Controlling and protecting inventory such as PPE, construction materials or mechanical assets across one or more sites requires a well thought out trustable system. A voice assistant is not susceptible to peer negotiation nor manipulation.

Managing project costs while allowing for price fluctuations necessitates correct and up-to-date inventory information to prevent shutdowns, turnarounds, and/or outages.

To handle those issues, construction management software platforms are part of the standard workflow for many project managers. Despite the positives of such software, managers still find they spend an unnecessary amount of time in the office rather than out on-site. The time wasted moving between site locations or waiting to be able to access up-to-date information can lead to unnecessary costs.

Additionally, when onsite, scrolling or searching through an app on a device reduces the awareness of one's surroundings and may pose safety concerns.

Yet, with the integration of a voice assistant, teams are able to receive alerts as well as retrieve, receive and update critical and time-sensitive information. Where the digital virtual assistant is voice-powered, the experience is notably faster than scrolling through an app or following threads on 'WhatsApp'.



 \checkmark

Real-time insights into the whereabouts of equipment, stock levels, and their usage are vital for project success.

Beyond knowing where equipment is located

he benefits of a voice controlled digital assistant go far beyond knowing the location of equipment.

Assistants can, for example, proactively alert teams when equipment is offline or in for repair and remove the equipment from availability lists.

Workers can update your management software if an item is faulty, damaged or broken. They can upload photos, make notes and send the data via the digital assistant to a software platform.

From there, the digital assistant can update any asset management systems, notify the relevant repair personnel (or supplier) and send you a series of notifications to keep you abreast of the progress.18 That process can be wholly automated, saving a considerable amount of time and money.

Digital virtual assistants offer practical improvements to support maximum machine and equipment up-time. The multiple benefits of robust predictive maintenance programs¹⁹ can be further enhanced by using voice-enabled assistants.







Conclusion

promising solution that will support construction managers and personnel is available with an AI voice assistant. While the technology cannot solve all the issues discussed, such as all aspects of cultural drivers of OH&S underreporting, it can perhaps alter the trajectory of the problem and produce better results than current systems.

In addition, the technology can counteract the problems that arise from paper-based documentation, poor on-site communication and process bottlenecks Given the rapid uptake of software-based site management tools over recent years and how easily voice assistants can be integrated into these platforms, construction may well be on the verge of a digital revolution.

Potentials for the future

Rapid advancements in artificial intelligence provide promising opportunities in hazard prediction - considered the 'holy grail' of OH&S professionals globally.

The technology can quickly and accurately scan unstructured data and offer structured outputs to use in statistical models, which OH&S managers can use to prevent incidents before they occur.²⁰

Combining this 'intelligence' with current offerings provided by voice powered digital assistants can significantly reduce near misses, injuries and fatalities, in tandem with impressive productivity enhancements.

References

- Gamil, Y, Rahman, I & Nagapan, S 2019, 'Investigating the effect of poor communication in terms of cost and time overruns in the construction industry', International Journal of Construction Supply Chain Management, vol. 9, no. 2, pp. 94–106, viewed 17 June 2022, https://pdfs.semanticscholar.org/d985/c811ac9f5bb12942b833c8b535011eea3389.pdf>.
- Aljohani, A, Ahiaga-Dagbui, D & Moore, D 2017, 'Construction Projects Cost Overrun: What Does the Literature Tell Us?', International Journal of Innovation, Management and Technology, vol. 8, no. 2, pp. 137–143, viewed 16 June 2022, <http://www.ijimt.org/vol8/717-MP0022.pdf>.
- Lind, H & Brunes, F 2014, 'Policies to Avoid Cost Overruns in Infrastructure Projects: Critical Evaluation and Recommendations', Construction Economics and Building, vol. 14, no. 3, pp. 74–85, viewed 17 June 2022, <https:// www.researchgate.net/publication/287513068_Policies_ to_Avoid_Cost_Overruns_in_Infrastructure_Projects_ Critical_Evaluation_and_Recommendations>.
- Agarwal, R, Chandrasekaran, S & Sridhar, M 2016, Imagining construction's digital future | McKinsey, www. mckinsey.com, viewed 17 June 2022, <https://www. mckinsey.com/business-functions/operations/ourinsights/imagining-constructions-digital-future>.
- Kenny, W & Vanissorn, V 2012, 'A study of the factors affecting construction time in Western Australia', Scientific Research and Essays, vol. 7, no. 40, pp. 3390–3398, viewed 17 June 2022, <https://www.readcube.com/articles/10.5897%2Fsre12.138>.
- 6. Gamiljj, Y & Abd Rahman, I 2021, 'Studying the relationship between causes and effects of poor communication in construction projects using PLS-SEM approach', Journal of Facilities Management, vol. ahead-of-print, no. aheadof-print, viewed 17 June 2022, <https://www.researchgate. net/publication/357649900_Studying_the_relationship_ between_causes_and_effects_of_poor_communication_ in_construction_projects_using_PLS-SEM_approach_ Causes_and_effects_of_poor_communication>.
- Xie, X, Thorpe, T & Baldwin, A 2000, 'A survey of communication issues in construction design', Glasgow Caledonian University. Association of Researchers in Construction Management, vol. 2, pp. 771–80, viewed 17 June 2022, <https://www.arcom.ac.uk/-docs/proceedings/ ar2000-771-780_Xie_Thorpe_and_Baldwin.pdf>.
- Zulch, B 2014, 'Communication: The Foundation of Project Management', Procedia Technology, vol. 16, pp. 1000– 1009, viewed 16 June 2022, https://www.sciencedirect.com/science/article/pii/S2212017314002813>.
- Sethi, D, Seth, M & Lecturer, S 2010, 'Interpersonal Communication: Lifeblood of an Organization', The IUP Journal of Soft Skills, viewed 16 June 2022, https://iims.uthscsa.edu/ sites/iims/files/Novel/communication/Communication-5.pdf>.
- Driscoll, RJ 2017, Why Does the Construction Industry Love Silos? | Richard J. Driscoll, Consulting Engineer, richardjdriscoll. com, viewed 17 June 2022, https://www.richardjdriscoll. com/2017/09/why-does-the-construction-industry-love-silos/>.
- Talukhaba, A, Mutunga, T & Miruka, CO 2011, 'Indicators of effective communication models in remote projects', International Journal of Project Organisation and Management, vol. 3, no. 2, p. 127.

- Salguero-Caparrós, F, Pardo-Ferreira, MC, Martínez-Rojas, M & Rubio-Romero, JC 2020, 'Management of legal compliance in occupational health and safety. A literature review', Safety Science, vol. 121, pp. 111–118, viewed 17 June 2022,<https://www. sciencedirect.com/science/article/pii/S0925753519303327>.
- 13. O'Neill, S, Martinov-Bennie, N & Cheung, A 2013, Issues In The Measurement And Reporting Of Work Health And Safety Performance: A Review, Safework Australia, viewed 17 June 2022, https://www.safeworkaustralia. gov.au/system/files/documents/1703/issuesmeasurement-reporting-whs-performance.pdf>.
- Sentis 2018, Underreporting of Safety Incidents in the Workplace, sentic.com.au, viewed 17 June 2022, https://sentis.com. au/resources/workplace-safety-incident-reporting>.
- NSCA 2018, NSCA Foundation, www.nscafoundation.org. au, viewed 17 June 2022, https://www.nscafoundation.org. org.au/news-item/1761/new-study-uncovers-the-drivers-for-underreporting-safety-incidents>.
- O'Neill, C, Gopaldasani, V & Coman, R 2022, 'Factors that influence the effective use of safe work method statements for high-risk construction work in Australia

 A literature review', Safety Science, vol. 147, p. 105628, viewed 17 June 2022, https://www.sciencedirect.com/ science/article/abs/pii/S0925753521004689>.
- Saha, S, Perera, S & Murphy, R 2017, 'Investigation into workplace health and safety issues within the Australian commercial construction industry's migrant workforce', dl.lib.uom.lk, viewed 17 June 2022, <http://dl.lib.uom.lk/handle/123/17311?show=full>.
- Wellsandt, S, Klein, K, Hribernik, K, Lewandowski, M, Bousdekis, A, Mentzas, G & Thoben, K-D 2022, 'Hybridaugmented intelligence in predictive maintenance with digital intelligent assistants', Annual Reviews in Control, vol. 53, viewed 18 April 2022,<https://www.sciencedirect.com/ science/article/pii/S1367578822000165?via%3Dihub>.
- R. Keith Mobley 2001, Plant engineer's handbook, 1st edn, Butterworth-Heinemann, Boston, viewed 16 June 2022, https://www.elsevier.com/books/plantengineers-handbook/mobley/978-0-7506-7328-0>.
- Tixier, AJ-P., Hallowell, MR, Rajagopalan, B & Bowman, D 2016, 'Automated content analysis for construction safety: A natural language processing system to extract precursors and outcomes from unstructured injury reports', Automation in Construction, vol. 62, pp. 45–56, viewed 17 June 2022.

For more information visit **askharry.it**

 Australia
 (02) 7208 5391

 USA
 +1 (252) 838-5250

 Email
 harry@contactharald.com