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Smart Emergency Detection Framework by IR4.0 for Safety Management among G7 Contractors: A Pilot Study

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Abstract: The Industrial Revolution 4.0 were positively demanded towards the direction of Construction 4.0 in Malaysia. In realizing the IR 4.0 technology towards Construction 4.0, the new mechanism known as Smart Emergency Detection Framework was developed to enhance the safety management at the construction site. Smart Emergency Detection Framework is the guideline reference to assist construction players in safety management that integrated with IR 4.0 technology for early emergency detection and potential hazard. The objectives of this research are the objectives are to evaluate the technical and navigational aspects of the online survey procedure and the instrument itself, and to validate the pilot study questionnaire. This study creates a new questionnaire with the goal of purposing the Smart Emergency Detection Framework. Content validity and linguistic analysis were carried out before the completion of the pilot study questionnaire. Then, the Google Form questionnaire was distributed via WhatsApp and email. Total of 32 respondents were obtained for the pilot study, after further finalize only 30 respondents were selected due to uncompleted responds. Based on the findings, the overall value of Cronbach Alpha for 112 items was 0.996, indicating a range of strong internal consistency that was reliable for the pilot study. In the context, all respondents were able to answer the research question and all the relevant element that concerning the respondent's feedback were identified. In conclusion, the pilot study assessment results will be based for additional clarification and improvement of the questionnaires before major data collection.

Keywords: Construction industry, emergency detection, IR 4.0, safety management, smart, pilot study

1. Introduction

Emergency detection is one of the emergency equipment or system that is important at the construction site. This system is provided for the early warning of evolving or prospective risks is required for prompt action, which includes mitigating measures, operational readiness, and rapid response. Information from early detection monitoring systems is crucial to minimizing the health, accidents, hazard, and other consequences of emergencies in the construction industry. In addition, emergency detection is tremendously demanding due to a healthy and safe environment for safety purposes (Aliyu *et al.*, 2011). Regardless, unexpected accidents at construction sites continue to occur, particularly during the

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construction in phase. According to the Department of Occupational Safety and Health, the construction industry has the highest total number of accidents and deaths (DOSH, 2020).

Nowadays, numerous IR 4.0 technologies have been identified as a reliable strategy for improving safety management. The term "Industrial Revolution 4.0" is associated with technological advancements that are fully automated and intelligent, capable of communicating autonomously, intelligent learning analysis, and intelligent decision-making among industry players (Piccarozzi *et al.*, 2018; Zhong *et al.*, 2017). The technologies such as Augmented Reality (AR), Virtual Reality (VR), Internet of Things (IoT) have been effectively applied, and the potential impacts have been altered to lessen the potential concerns. The goal of implementing new technology is to improve performance and effectiveness, which leads to better safety management (Zuhairy *et al.*, 2015).

This paper design and develop the new mechanism Smart Emergency Detection Framework by IR 4.0 for safety management. The queries on the Smart Emergency Detection Framework were created to improve safety management as part of the Industrial Revolution 4.0 technologies' transition to Construction 4.0. Smart Emergency Detection Framework is the guideline reference to assist construction players in safety management that integrated with IR 4.0 technology for early emergency detection and potential hazard. This mechanism is accompanied by a detailed description of key elements and requirements for IR 4.0 implementation in enhancing safety management performance at the construction site. The Smart Emergency Detection Framework is being developed as a new mechanism approach in safety management and will benefit the contractor for the future Construction 4.0. Therefore, the objectives are to evaluate the technical and navigational aspects of the online survey procedure and the instrument itself and to validate the pilot study questionnaire.

2. Literature Review

This section discusses an overview of the safety management framework, smart emergency detection framework design, and pilot study.

2.1 Overview on Safety Management Framework

In both developing and developed countries, the safety management framework has been identified as the benchmark for construction industry safety. Many studies have established the framework as the primary approach for reducing accidents and the resulting damage and loss to the company. The framework's implementation greatly aids in enhancing safety management by identifying numerous parts and requirements to produce a strategy solution. Creating an appropriate foundation for a safety management system helps to improve performance, quality, and safety, as well as customer happiness (Ramasamy *et al.*, 2016).

The development of the framework can be seen as the previous researcher creating the framework in tandem with technological advancements. From the start, it is clear that the frameworks developed are solely focused on safety management, such as the framework for safety and quality management and the OSH management framework for workers (Ramasamy *et al.*, 2016; De Silva & Wimalaratne, 2012). To support safe facility management processes, the framework was designed with a prototype web-based construction project management system and a technology-based BIM application framework (Chan & Leung, 2004; Wetzel & Thabet, 2015). Currently, industry development is centered on the Fourth Industrial Revolution, as technologies evolve and their application potentials expand. As a result, in a safety management system, the smart system is used, which is a cyber-physical system framework (Jiang *et al.*, 2020).

Industrial Revolution 4.0 (IR 4.0) has boosted industry productivity output in developed countries' industries that created a more difficult and dangerous working environment. Industry 4.0 major goal is to improve automation and operational efficiency while also increasing effectiveness (Nagy *et al.*, 2018). The construction industry in industrialized nations has embraced safety as an important part of the regulatory framework in response to the increased safety requirements imposed by technological advances. In order to improve safety management, many smart emergency detection systems were developed, including a cloud-enabled safety monitoring system and a smart emergency detection and alerting system based on the Raspberry Pi 3 (RPi). Safety management framework has been found as the benchmark for construction industry safety in developing countries and developed countries. Many studies create the framework as the main solution to minimize accidents that corresponding damage on loss great loss to the company. Implementation of the framework immensely aids in improving safety management by determining several elements and requirements to create the strategies solution. Developing an ideal framework for a safety management system contributes to boosting the performance, quality, safety and ultimately customer satisfaction (Ramasamy *et al.*, 2016).

2.2 Smart Emergency Detection Framework Design

According to Liu *et al.* (2018), a framework is provided to enable the whole-process management of project structure safety. The conceptual framework must convey the study's broad perspective. The main instrument or equipment in this research study is smart emergency detection, which aims to improve safety management in the construction industry. Fig. 1 shows the conceptual framework design is based on past works of literature that have been evaluated.

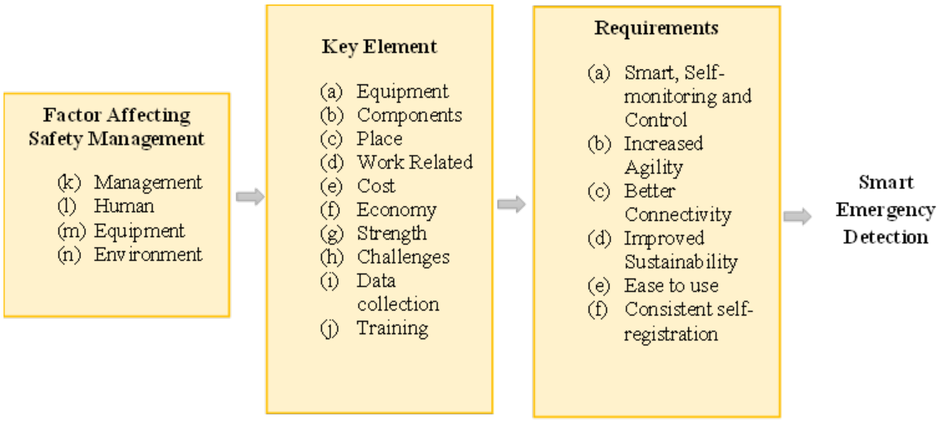

Fig. 1 - Context of the smart emergency detection framework

The proposed framework's core ideas are based on a literature review. The information on the research of emergency detection is collected from past studies database and link, management system fields. The majority of the researchers discovered that the element impacting safety performance is listed as one aspect in determining what part of the safety management to improve. As the safety planning cannot foresee when and where an accident will occur (Mihic *et al.*, 2019). Jaafar *et al.* (2017) claim that changing weather and hazardous working circumstances such as lighting, ventilation, and noise are causes for concern. In addition, inadequate site management in terms of layout, space, tidiness, and cleanliness must be addressed. Furthermore, numerous types of construction equipment and materials lead to occupational accidents and illnesses. As a result, the nature of construction activity tends to put employees' and tourists' encounters with dangerous equipment and the environment in jeopardy. Thus, four factors affecting safety management should be considered (management, human, equipment and environment).

To establish what elements and requirements are desired for smart emergency detection, the main elements and requirements must be determined. To realize the phrase "Industry 4.0," the "SMART" system, which includes smart equipment, smart cities, smart factories, and so on, is reviewed to identify some important features. According to Johnsen (2018), the main aspect of analyzing systemic risks is to act as the scope and prioritizing of systems. When addressing applications relating to the research study, these primary features are quite important. Imkamp *et al.* (2016) show that sensor and measurement technology integration is a critical component of the cyber-physical production system (CPPS) and complicated production processes. The researcher clarifies that the technology selection is necessary to identify the design, operation, and any important aspect of the technology IR 4.0 on the future Smart Emergency Detection system. Furthermore, Industry 4.0 requires that technology become smarter, more efficient, safer, and more environmentally sustainable through the combination and integration of production technologies and devices, information and communication systems, data, and services in network infrastructures (Strozzi *et al.*, 2017).

In order to identify how smart the system is, the term "SMART SYSTEM" was discussed based on the previous researchers that had been implementing the smart system in several areas. Maeda (1994) defines the "SMART SYSTEM" as the integrated automated construction system which automates a wide range of construction procedures. Hence, the term of smart emergency detection framework by IR 4.0 technology implementation for safety management in the construction industry in this study can be defined as the embedded based smart technology which is automatically self-monitor or detection, interconnecting and decision making with the emergency response related environmental condition to provide the safety site condition. The conceptual framework of smart emergency detection is developed for safety management, which consists of safety management, IR 4.0 implementation (key element and requirement) that found necessary to the smart emergency detection system to enhance the safety management and encourage the construction players to utilize the Industrial Revolution 4.0. This study introduced the conceptual framework indicated "the flow process of the identifies the list of key elements and requirements that needed to be applied on the smart emergency detection for safety management". All the variables in the questionnaires will be tested by the pilot study to determine the research proposition of the questionnaire is sufficient for the responder and to comprehend the findings before main data collection is conducted.

2.2 Pilot Study

A pilot study can be described as "a small-scale of observations conducted to determine how and whether to conduct a full-scale project." Furthermore, pilot research is widely recommended by social science specialists to investigate a number of topics such as validity, reliability, instrument development, and early scale development (Johanson & Brooks, 2010; Lucko & Rojas, 2010; Neuman, 2011). The pilot study's goal is not only to guarantee that survey questions are properly administered, but also to ensure that the general purpose of the research instrument is functional, as well as to address issues about the validity, reliability, and purity of the scale evaluated. Besides, the pilot test is used to determine whether the research proposition of the questionnaire is sufficient for the responder to comprehend the findings and to eliminate questions that are likely to mislead in the main research project. A few benefits and indicators for conducting a pilot study have been highlighted by Connelly (2008) Cho & Kim (2015), and Neuman (2011) as shown in Table 1.

Table 1 - Benefits and indicators for conducting pilot study

List of Benefits
Aids in the definition of the research question
The adequacy of a research instrument/tool is evaluated.
Allows for the formulation of sampling and recruitment strategies.
Allows for the testing of the planned design.
Examines the viability of the study and identifies any problems
Provides preliminary information

The pilot study can thus be described as both a feasibility study and a pre-testing of instruments, on what the researcher is able to obtain for further improvement of the main data collection. All the items that were received through the pilot study then will be used in the current investigation. The results of the pilot study will be presented briefly, as the analysis obtained have a direct impact on the actual research. Thus, two specific objectives were highlighted in this research study as follows: (1) to evaluate the technical and navigational aspects of the online survey procedure and the instrument itself, and (2) to validate the questionnaire.

3. Methodology

Fig. 2 depicts the research methodology used in this study. The flow researcher methodology only indicated the process of the pilot study. Currently, the research process involves two steps. Step 1 in this study relates to the research formulation and review of the literature. This is where the framework's conceptualization was created. Step 2 describes the research instrument's planning and the primary data collection. In formulating the research instrument stage, the researcher focused on the development of the questionnaire, which was then used in a preliminary study, pilot study and questionnaires. Phase 3 will be continued after the data collection and analysis of the pilot test were evaluated and finalized for the main data collection.

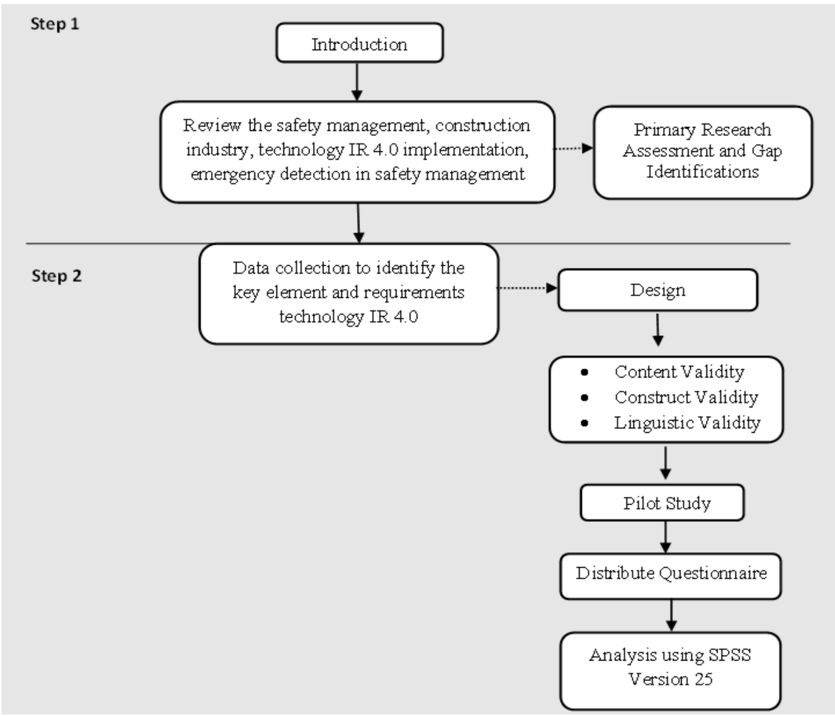

Fig. 2 - Flow of research methodology

3.1 Sample Size for Pilot Study

Prior to performing the major survey, pilot research frequently reveals ideas, approaches, and recommendations that were neglected. Existing literature Connelly (2008), suggests that a pilot study sample should be 10% of the larger parent study sample. Isaac and Michael (1995) proposed a range of 10–30 participants. According to Perneger *et al.* (2015), suggest that "30 respondents is a reasonable starting point for questionnaire pilot study. Hence, 30 respondents were selected as the target respondents through systematic random sampling based on G7 Company of the contractor were chosen to participate in the pilot study. The respondents were chosen with different representations from all variables for the criteria of the selected respondents.

3.2 Research Instruments and Procedure

Data were collected through a questionnaire (Google Form). The questionnaire for the pilot test consisting of five section questions was prepared after an extensive review of the literature. During the preparation of the questions, the validity of the questionnaire in this research undergoes 3 types of validation: content validity, construct validity, and linguistic validity. Content validity and construct validity involve 4 academic researchers that expert in the field of safety management. The linguistic validity involves 5 respondents comprised of site engineer, site safety supervisor, and project manager. All the feedback from the respondents was improved based on the items that had been commented on to finalize for the next step by conducting the pilot study.

This study adopted a quantitative method as the research approach by survey, observations, and reviews of records or documents for quantifiable information (Nassaj, 2015). The questionnaire approach is a popular way for researchers in any field to acquire data. The researchers create a questionnaire with questions they are interested in and analyze the survey data gathered from questioning respondents. The questionnaire contains single-choice questions, multiple-choice questions, and Likert scale questions based on the five-Likert scale, "strongly disagree, disagree, neutral, agree, or strongly agree" (See Appendix A). Likert scale is selected in the research study because it is rooted in the aim of the research to understand the opinions/perceptions of participants related to the phenomenon of interest (Joshi *et al.*, 2015). The set of questionnaires is organized into FIVE (5) sections;

Section A: Respondent Demographics
Section B: IR 4.0 Technology Implementation in Safety Management
Section C: Factor Affect Safety Performances in Safety Management
Section D: Key Elements of IR 4.0 Technology Implementation in Smart Emergency Detection for Safety Management
Section E: Requirements of IR 4.0 Technology Implementation in Smart Emergency Detection for Safety Management

The pilot study questionnaire was distributed to G7 Company. The distribution of questionnaire via email, mobile chat (WhatsApp), and mobile (direct called) to encourage the respondents to participate in the pilot study. Following the completion of the pilot study, the data collected was examined using Cronbach Alpha. Each questionnaire item was analyzed using SPPS (Statistical Package for the Social Sciences). Taber (2018) indicated that the internal consistency reliability (Cronbach's alpha) value should be 0.70 or higher for a set of items to be considered a scale, but some use 0.75 or 0.80, and others as lenient as 0.60 that widely accepted by social science researcher. Then, the questionnaire was analyzed to identify the aspects that can be improved in the questionnaire; formatting, understanding of the questions asked in the questionnaire among respondents and level of difficulty of questions. The adjustment of the questionnaire was carried out on items that may confuse the respondent. Then, the questionnaire is reviewed and commented on to be improved for the main data collection.

4. Results and Discussion

The results and discussion are based on the data gathered from the pilot study. The findings include the respondent rate, demographic information and IR 4.0 technology implementation, observations on instrument and methodology, and Cronbach alpha analysis.

4.1 Respond Rate of Pilot Study

Table 2 shows the response rate of the pilot study questionnaire distributed 100%, received 40 %, and not received 60% respectively. It demonstrates that the number of respondents willing to participate and cooperate in the pilot study is lower. The overall number of respondents in this study is 32, and 2 of the respondent were deleted following additional analysis due to mistakes and incomplete answers. As a result, the total number of respondents finalized for the pilot study was only 30 as specified in the target respondents.

Table 2 - Respond rate for pilot study

Questionnaire	N	Percentage (%)
Questionnaire Distributed	80	100
Questionnaire Received	32	40
Questionnaire Not Received	48	60

4.2 Demographic Information and IR 4.0 Technology Implementation

This analysis presents the findings of Section A of the survey, which is information on the respondents' background. A total of 30 respondents were collected in the pilot test study. Table 4 shows the frequency and percentage of G7 contractors involved based on the position of the company, respondents age, respondent working experience, respondent working experience in technology, number of staff at construction staff and education. Table 5 indicated the construction type industry involvement and safety risk that had been experienced by respondents.

Table 4 - Information of respondents

Demographic Information		Frequency	Percentage (%)
Position in the company	Project Managers	3	10.0
	Site Engineers	7	23.3
	Site Supervisor	5	16.7
	Health and Safety Officer	9	30.0
	Others	6	20.0
Respondents Age	22-25	2	6.7
	26-30	13	43.3
	31-40	9	30.0
	41 and above	6	20.0
Respondents Working Experience	1-5	12	40.0
	6-10	6	20.0
	11-15	6	20.0
	16-20	3	10.0
Respondents Working Experience in Technology	1-5	20	66.7
	6-10	4	13.3
	11-15	3	10.0
	16-20	3	10.0
Number of staff involved at construction site	1-10	3	10.0
	11-50	11	36.7
	51-100	5	16.7
	101-250	2	6.7
	251-500	6	20.0
	500 and above	3	10.0
Education	Diploma	7	23.3
	Degree	19	63.3
	Master	4	13.3
	PHD	0	0

Table 5 - Information of respondents (Cont.)

Demographic Information		Frequency	Percentage (%)
Construction type industry involvement	Residential Housing Construction	10	16.4
	Institutional and Commercial Building Construction	8	13.1
	Specialized Industrial Construction	3	4.9
	Infrastructure and Heavy Construction	16	26.2
	Government Project	14	23.0
	Private Project	10	16.4
Safety Risk	High	18	60.0
	Medium	18	60.0
	Low	5	16.7

Table 4 and Table 5 shows the analysis of the respondents indicated demographic information collected were distributed evenly as all the variable/item listed were selected in the pilot study. The questionnaire was administered over a two-month period, the respondents that participated included 3 (10.0%) Project Manager, 7 (23.3%) Site Engineer, 5 (16.7%) Site Supervisor, 9 (30.0%) Health and Safety Officer and 6 (20.0%) others (SHASSIC ASSESSOR, Project Departments, QAQC Engineer, Assistant Resident Engineer, Health and Safety Environment). With a total of 13 (43.3 %) responses, the majority of the respondents were between the ages of 26 and 30. The total number of respondents aged 31-40, 41 and up, and 22-25 years old were 9 (30.0 %), 6 (20.0 %), and 2 (6.7 %), respectively. Respondents have varying levels of professional experience and technological experience. A total of 12 (40.0 %) respondents have 1-5 years of work experience. There are 6 (20.0%) respondents with 6-10 years of work experience. Furthermore, 6 (20.0 %) among the respondents had 11-15 years of experience. Another 10.0 % of respondents had 16-20 years of work experience. This study makes use of IR 4.0 technology and supports the government incentive. In terms of working experience in technology among G7 contractors, the technological application is essential. A total of 20 (66.7%) respondents had prior work experience in technology. The respondents with 6-10 years of experience in technology, 11-15 years of experience, and 16-20 years of experience indicated a total of 4 (13.3 %), 3 (10.0 %), and 3 (10.0 %) accordingly.

The majority of the 11 (36.7%) respondents stated that the number of staff involved at the construction site is around 11-50 staff. A total of 6 (20.0%) respondents indicated 251-500 staff that were involved at the construction site. The respondents with the 51-100 staff, 1-10 staff, and 500 and above represent the percentage 5(16.7%) respondents, 3 (10.0%) respondents and 2 (6.7%) respondents, respectively. The respondents hold a variety of academic degrees. A total of 19 respondents had a bachelor's degree, accounting for 63.3 % of all respondents. Holding a total of 4 respondents, those with a master's degree account for 13.3 % of the total. 7 respondents have a diploma, accounting for 23.3 % of all responses, no Ph.D. holders responded to the pilot study. Therefore, the respondent's age, education and work experience gained from the respondents are important because it represents the competitiveness of respondents. Furthermore, the experience in technology involvement is able to identify the respondents that expertise in the technology. The number of staff involved at the construction site is essential to identify in order to control and manage the construction site. Table 5 shows the background on the type of construction and safety risk based on the respondents' experiences. The selection on the answer shows the respondents contribute to a variety of project and safety risks. Overall, the demographic information is accepted and there is no addition to the items listed by the respondents.

Fig. 3 visualize the findings of Section B of the survey, which is IR 4.0 technology implementation. The technology implementation was listed out based on the literature review. Table 6 shows the answer rate from the respondents for the Section B questions.

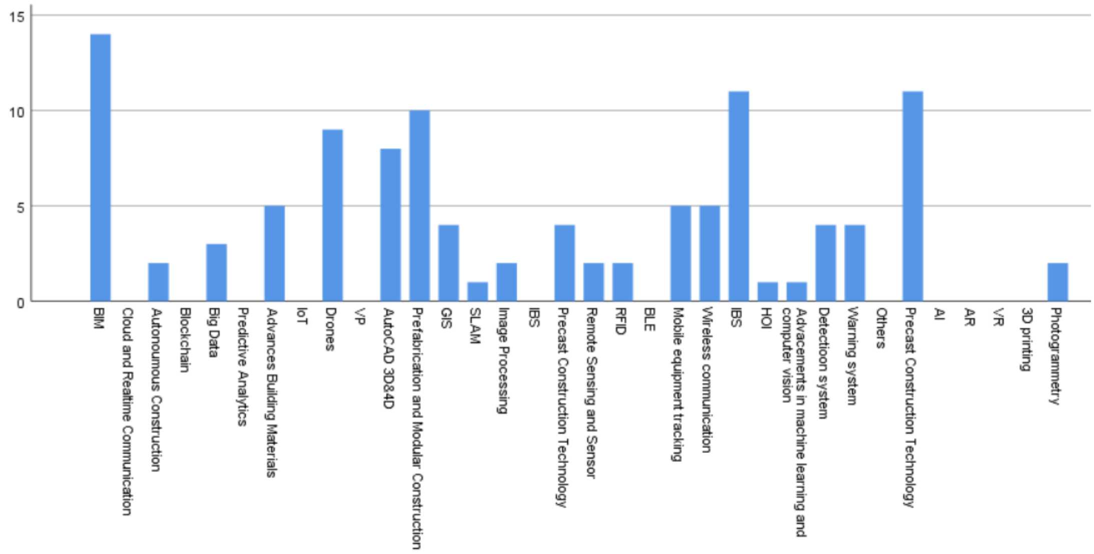

Fig. 3 - Technology that used in the construction industry

Table 6 - The characteristic of the selection answer on technology employed

Question	N	Percentage (%)
Answer more than 1	26	86.7
Answer less than 1	4	13.3
	30	100

The technology employed in the construction sector (see Fig.3), various technology implementation was selected by the respondent in these questions. However, it can be seen some of the technology is not selected by respondents. This questionnaire required multiple answers from the respondents. During the pilot test data collection, 3 of the respondents comment on the misleading questions that want further clarification and explanation for these questions. Table 6 indicated the answer of the selected technology, it shows that 4 of the respondents answer less than 1 of the technologies. Thus, further, simplicity and clarification are needed for these questions.

4.3 Observations on Instrument and Methodology

According to the survey instructions, the 112 questions should take about 10-15 minutes to complete. The respondent estimated that it took roughly 20 minutes to complete the questionnaire. As a result, changing the time to an average completion time of 20 minutes would yield an acceptable response rate among the targeted G7 firm population. Thus, survey instructions for the main study were altered to reflect that it could be finished in roughly 20 minutes.

The instrument has been revised. The pilot group was not asked to make formal recommendations about the survey's content or process, although participants did offer suggestions to improve the instrument. A few questions were re-ordered as a result of the pilot under personal, organization, and contextual variables. The survey body was revised to improve clarity and ease of completion by shortening questions whenever possible, converting the questions by simplified words. Besides, in order to embed as much flexibility as possible for the main data collection, the respondents will be able to modify the questionnaire, if they desired.

The respondent's email address was not checked before sending the link to the survey, the total of 20 responses to the invitation email indicated non-delivery, including several from automated work email addresses. Hence, the evaluation of the addresses was required for the main study in order to avoid utilizing government or other email addresses that seemed to be work addresses. It was also determined that people whose invitation emails were returned would be contacted by phone.

4.4 Reliability and Validity (Cronbach's Coefficient Alpha)

Cronbach's Coefficient Alpha was used to determine the reliability and validity of data based on the factors that cover Section B; IR 4.0 Technology Implementation in Safety Management, Section C: Factor Affecting Safety Performance, Section D: Key Element, and Section E: Requirement. By dividing the items into sections, all 112 items were analyzed to get the Cronbach's coefficient. Table 7 summarizes the test results.

Table 7 - Value of Cronbach's Alpha

Factor	No. Item	Cronbach's Alpha	Comment
IR 4.0 Technology Implementation in Safety Management	14	0.983	Excellent
Factor Affecting Safety Performance	29	0.985	Excellent
Key Element	48	0.991	Excellent
Requirement	21	0.985	Excellent
Overall	112	0.996	Excellent

In this case, the value of Cronbach's Alpha for IR 4.0 technology implementation in safety management, factors affecting safety performance, key element and requirement were found to be 0.983, 0.985, 0.991 and 0.985, respectively which are greater than 0.75 for reliability. The test indicates that the data under study is reliable for analysis. Based on the results of overall Cronbach Alpha for 112 items, the value indicated 0.996 and still the range of the high internal consistency. Based on the pilot study results, there is no elimination of the variable listed. All the items can be further used for the main data collection.

5. Conclusion

A total of 30 respondents responded in the given time frame, of which one refused to give consent. All the respondents are able to answer the research question in the context. The following issues were noticed with regard to the respondent's feedback:

(i) A question was not answered by more than 48 respondents. Some of the respondents may not be reminded of their participation in the pilot test.
(ii) Some of the respondents were unable to open the link of the Google Form due to the technical problem
(iii) One question in Section B had a minor lack of clarity in the responses.
(iv) There was an unpredictable period of waiting for individual responses.
(v) Survey instructions for the main study were altered to reflect an evaluation of the addresses was required for the main study

Accordingly, relevant corrections were made to the questionnaire, including simplifying the questions and clarifying the misunderstanding of the question, taking further notice for problems occur during the pilot study to improve the next main data collection. To determine the validity and reliability of the survey questionnaire questions, a total of 30 respondents from G7 Company of the contractor involved in the safety construction industry, are selected as the target respondents for the pilot study. After returning the pilot study questionnaires, the results showed that the main data collection questionnaire is simple to comprehend and the instructions are simple to follow by respondents in terms of content, language, and design, allowing respondents to understand and reply easily and discreetly. The value of Cronbach's Alpha is greater than 0.75 for reliability and the data under study is reliable for analysis. To develop the smart emergency detection framework by IR 4.0 for safety management, the conceptual framework needs to improve the safety management, key elements and requirement of the management techniques/tools being developed and used worldwide. The next stage will be discussed on the main data collection.

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Appendix A: Sample Questionnaire

Please read a description the IR 4.0 technology implementation in safety management and rate based on your perception.						
IR 4.0 Technology Implementation in Safety Management						
Likert scale: 1=Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly Agree						
		1	***2***	***3***	***4***	***5***
1.	Improve identification of field safety risks					
2.	Increases risk recognition capacity to workers					
3.	Enhances the real-time communication for the safety purpose					
4.	Automatic hazard detection at workplace					
5.	Increase situational awareness to workers					
6.	Increase situational awareness on equipment operators					
7.	Increase situational awareness on decision makers on site					
8.	Safety risks detection before and during the construction process					
9.	Provide preventive measures and timely decisions					
10.	Emerging knowledge on IR 4.0 based occupational accident					
11.	Improving the accuracy of emergency detection					
12.	Beneficial in terms of information sharing					
13.	Improves the efficiency of emergency response					
14.	Management benefits of the safety performances					
SECTION C: FACTOR AFFECT SAFETY PERFORMANCES IN SAFETY MANAGEMENT						
Please read a description of factor affect safety performance and rate based on your perception.						
Likert scale: 1=Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly Agree						
		1	***2***	***3***	***4***	***5***
Management						
1.	Safety inspection					
2.	Technology implementation in safety management					
3.	Safety incentive					
4.	Safety penalties					
5.	Safety meeting					
6.	Organization safety policy					
7.	Labour turnover rates					
8.	Safety training and awareness					

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