

Information Technology for Transformation of Health and Safety

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Abstract

Information technology (IT) has a significant impact on health, safety, and the environment (HSE). However, this is still a broad or generic remark. Companies and professionals from many industries are now using new technology into their HSE practises. This is due to its demonstrated efficiency and dependability, which restrict human mistake by removing the human interface and enabling smart technology. Diverse corporations, like Saudi Aramco, engage in these various smart safety solutions as part of their digital transformation efforts to boost safety, decrease or eliminate dangers to their employees, and preserve company assets. These innovative technologies are being utilised to either avoid or lessen the chance of accidents occurring.

Keywords: - Health & Safety, Information Technology, Smart Technologies

INTRODUCTION

Companies are using new technology because they improve production, efficiency, and safety. It is important to highlight that current technological advancements can give considerable improvements to workplace health and safety practises. Digital technology and smart safety solutions are widely employed or are on the rise in the oil and

gas sector. It highlighted major digital technologies in the oil and gas business in an article titled Digital Technology Trends in the Oil and Gas Industry. The Internet of Things (IoT) and Electronic Monitoring, 3D Virtual Modeling, and Drone Technology were featured, as well as how they might be implemented. [1] And it is now clear that these new digital technologies are being employed with

health and safety as one of the grounds for installation in most oil and gas organisations. IT provides a wide range of safety solutions that can help to tackle key safety concerns and boost accident avoidance. Numerous accidents resulting in injury or fatalities have been avoided.

The implementation of modern IT solutions in safety as a preventative measure will help to reduce the industry's uneven incidence of worker injuries and deaths. These technologies can be used as the first line of defence to either protect or discover workplace risks, increasing survivability. Implementing these solutions in many industries is necessary to improve safety culture and performance.

Human mistake is frequently mentioned in various publications as one of the major contributing to or causes of accidents. [2]

According to a research conducted by the Health and Safety Executives (HSE), "it is believed that up to 80% of incidents may be ascribed, at least in part, to human acts or omissions." [3] According to an ARC Advisory Group study, operational or human error is the major reason in 42% of the occurrences [5], and a more complete or integrated IT solution strategy is

required if the industry is to make a breakthrough in increasing safety. One of the alternatives presented was a totally automated approach that eliminated all human variables [4].

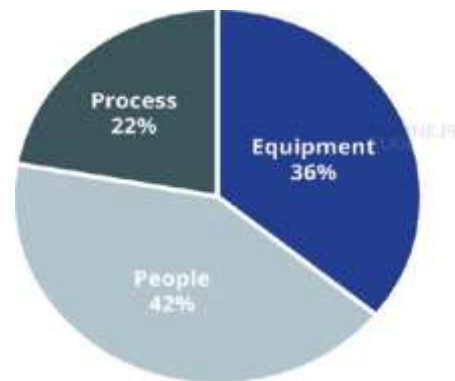


Fig. 1: Primary categories of causes for abnormal process events. [5]

It was determined that if the industry wants to achieve a breakthrough in increasing safety, a more complete or integrated IT solution strategy must be established. One of the alternatives presented was a fully automated approach that eliminates all human variables [5].

A survey of 102 people in the construction business was undertaken. As indicated in the table, all participants were given a list of the top possible advantages of the selected technology, as well as the proportion of replies for each benefit. [6] Here are a few technologies that have been widely used to increase safety.

BENEFITS OF TECHNOLOGIES USED FOR OSH MANAGEMENT	
Safety benefits of technology	No. (%) responses
Improve worker awareness of hazard	83 (81%)
Warn workers of workplace hazards	55 (54%)
Eliminate hazard during design	55 (54%)
Help visualize workplace hazards	55 (54%)
Enhance effectiveness of safety training	40 (39%)
Enhance incident investigation	39 (38%)
Isolate workers from hazard	35 (34%)
Facilitate injury reporting	36 (35%)
Improve safety planning	35 (34%)
Enhance communication between workers	33 (32%)
Improve safety inspections and monitoring	31 (30%)
Enhance near-miss reporting	26 (25%)
Note. n = 102	

Fig. 1: Benefits of Technologies Used for OSH Management, A. A. Karakhan et al., PSJ Dec 2021 p.23. [6]

Robotics and Drones

Robotics is widely employed in a variety of industries, including manufacturing, processing, and, in certain cases, the medical business. In 1959, George Devol and Joseph Engelberger created the first industrial robot. In 1961, Unimation, USA, installed the first industrial robot at General Motors.

"The world's first industrial robot was utilised on a manufacturing line at the GM Ternstedt facility in Trenton, NJ, where it manufactured door and window handles,

gearshift knobs, light fixtures, and other automobile interior components." [7] Robotics paired with automation and artificial intelligence can perform a wide range of tasks that are too difficult for humans. "Robots are already in our life." In the manufacturing industry, industrial robots are commonly utilised. Military and law enforcement agencies employ robots to aid them in perilous circumstances. Robots already play an important part in medicine. Robots are assisting surgeons in achieving more precision in the operating room by performing safer, less intrusive

procedures. Robots' future use will not be restricted to "operational" duties in production. [7] The usage of robots in the present generation of new sophisticated technologies dramatically minimises occupational injuries. Saudi Aramco currently employs field robots for inspections, firefighting, and other live-streamed activities.

Similarly, unmanned aerial vehicles, or "drones," are being used to lessen the danger that people must incur in order to complete particular activities. Drones, like other technology, provide additional hazards that may be avoided by engineering and administrative controls. Oil and gas corporations, such as Saudi Aramco, employ drones for specified and evaluated jobs such as surveys, inspections, emergency response live-streaming for monitoring, and so on.

Drones in the workplace have helped businesses to get access to hazardous areas that are too hot, cold, or small for employees to access. Drones can gather and distribute data on time, lowering the risk to workers. Drones are becoming more significant in the workplace, helping to prioritise health and safety.

Unmanned Aerial-Underwater Vehicle (UAUV)

Aside from drones and unmanned underwater vehicles, additional research and development efforts have been undertaken to merge both concepts into a single platform capable of flying in the air and sinking below, known as the Unmanned Aerial-Underwater Vehicle (UAUV). At least four (4) prototypes were created for the development of a UAUV multi-rotor configuration. [8] as seen in Figure 3 below. Such an idea, with its integrated technological approach, will be extremely valuable not only in business operations, but also in health and safety.

Safety is constantly concerned with preventing loss of life and keeping people safe from injury and danger. This technology will perform exactly what the term "safety" implies. It will eliminate or significantly minimise the dangers associated with diving activities. It can do tasks over a longer length of time than divers, who are only permitted underwater for a certain time owing to human bodily limits. Such technology will be used by Saudi Aramco for a variety of purposes, including offshore emergency response, spill emergency response, underwater installation inspections and surveying, data collecting, and other high-risk tasks.

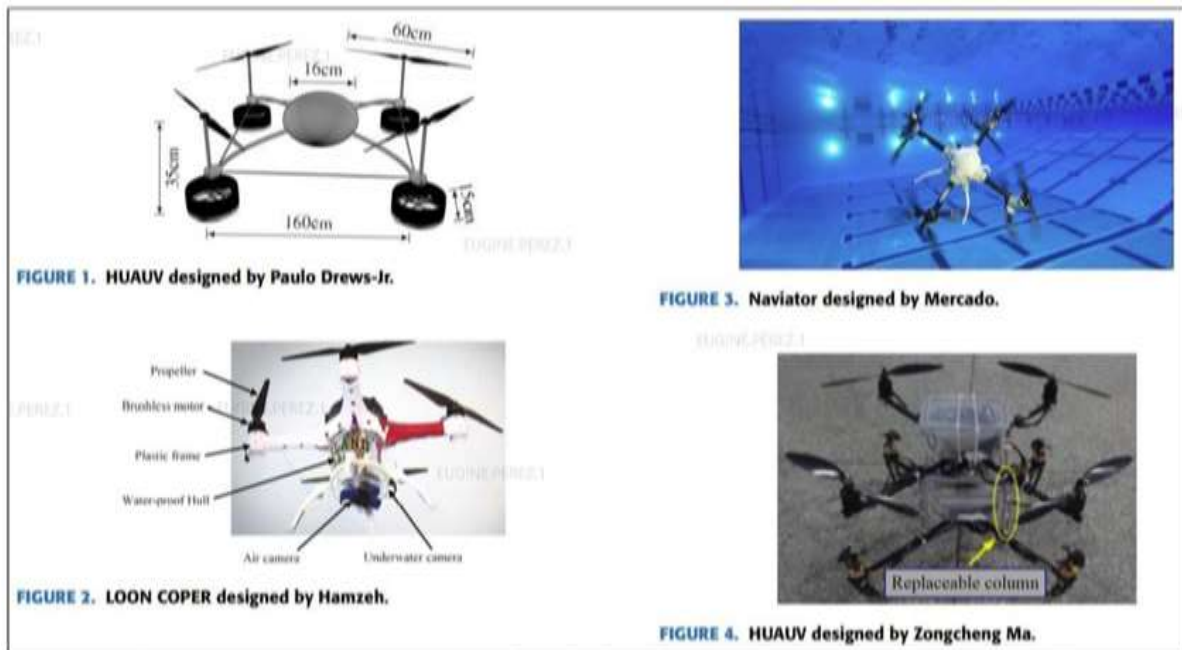


Fig. 2: From IEEE Access, Attitude and Altitude Control of UAV Based on INDI [8]

VIRTUAL REALITY (VR)

The benefit of virtual reality stems from the ability to simulate surroundings, which has shown to be quite effective for safety training. Virtual reality (VR) comes in three flavours: First, non-immersive VR systems are similar to traditional video games; second, semi-immersive VR systems are similar to typical flight simulators; and third, fully-immersive VR systems surround the wearer with a headset/goggles that provide the 3D display, removing the wearer from the physical environment and increasing the sense of presence within the VR environment. [9] The most significant advantage of introducing VR into your safety programme is that employees may learn while being completely safe. This

has a significant impact on both the reduction of injuries and the avoidance of equipment damage. This advantage is accompanied by a number of others, such as high-cost trainings, travel fees to attend trainings, time spent by the trainee and trainer, and perhaps expensive training materials. By immersing the student in an environment as near to the actual world as possible, virtual reality (VR) provides the greatest tools for accident reconstruction, training, and hazard identification. The combination of high-quality three-dimensional images, sound, and dynamics modelling creates a unique and compelling experience. [10] Saudi Aramco had been experimenting with several virtual reality system versions in a variety of applications, principally teaching. These

VR simulations have been upgraded and adapted to assure compliance with Saudi Aramco and international standards, led by the company's subject matter specialists.

Mobile Safety Apps

Several mobile applications emerged notably during the peak of the COVID-19 epidemic, when there were lockdowns and limitations all over the world. Some were created expressly for the public's health and safety. There have been smartphone applications created to track COVID-19 infections, providing warnings when a person is in areas with a high risk of COVID infection or has been in close contact to an infected people. There were also smartphone apps that kept track of and updated vaccination statuses, which had to be validated before entering institutions or companies. A mobile app has also been used to track the user's health. However, this is not where mobile app development began. One of the simplest methods to use technology to analyse, monitor, and enhance workplace safety is through smartphone apps. Current market apps allow workers and responsible staff to analyse jobs and perform safely. Here are just a handful of the Saudi Aramco mobile applications that enhance Safety or any component of its Safety Management System: The SafeTravel

solution is a digital trip management platform that meets the standards of journey management. It is intended to send out automated messages in the event of a late check-in or an emergency. It records drivers' journeys and facilitates constructive dialogue. Its capabilities has become stronger and more efficient as numerous systems were connected. SafeLife is another smartphone app that was created with the goal of making it easier to report occurrences, conduct safety inspections, and perform other functions. Saudi Aramco developed PM Mobility to provide a more accurate and effective method of doing preventative maintenance on sites and assets. It is a real-time maintenance management system with features that help users complete maintenance tasks more efficiently. This mobile app's goal and value include, but are not limited to, increasing employee productivity and safety; shortening the maintenance work cycle; fostering 360-degree views of operations; decreasing unexpected downtime; geo-enabling functional places and equipment; and more.

Video Conferencing

Although video conferencing has been around for a while, the COVID-19 epidemic saw a surge in the use of various

video conferencing systems. The use of several platforms, including Skype for Business, Microsoft Teams, Google Meet, Zoom, and other programmes, increased significantly. For example, in December 2019, Zoom had 10 million daily meeting attendees; by April 2020, that number had risen to almost 300 million. Similar problems with hundreds of millions of users were encountered by Google Meet and other providers. In addition, it is probable that video conferencing will be used even after the epidemic is over because, according to Gartner, just 25% of corporate meetings will be held in person by 2024. [11] Saudi Aramco had to review operational work activities and have them completed while working from home since not all operational tasks can be completed remotely and the company must completely implement all safety precautions for the health and safety of its most important asset, its people. Experts from Saudi Aramco sought to improve the video conferencing system's capabilities and even to guarantee stringent security measures. The challenges with video conferencing connectivity were addressed and remedied thanks to its modern infrastructure, including its 5G network and fibre optic (FO) connectivity, offering its consumers a better experience.

Artificial Intelligence (Ai)

In the field of health and safety, artificial intelligence is currently used as a proactive tool for predictive analysis. The capacity of AI to instantly analyse very vast volumes of data and provide factual proof from calculations and analyses that would take people many hours or days to complete is one of the technology's most beneficial features. The value of using AI to comprehend and analyse trends will increase. In order to make sure that everyone has access to the relevant information at the right time, AI may also be used to oversee safety initiatives. When correctly implemented, artificial intelligence (AI) may assist employees in responding to risks more quickly by identifying trends and warning indications. When workplace risks or risky behaviours are recognised or detected, artificial intelligence gives early warning. risks that occasionally escape the human sight. With AI, even safety instruction may be improved. Identifying shortcomings and ensuring that training is being offered to the appropriate individuals at the appropriate time may be accomplished by analysing training gaps throughout the whole organisation. When AI is incorporated into software or other IT solutions, it may significantly modify and

enhance things, which is advantageous for businesses, employees, and even assets.

Location Devices, Sensors & RFIDS

These devices are helpful in different industries, including construction. Construction sites can sometimes become complex due to the movement of heavy equipment, workers, and the existing condition of the surrounding area, like excavations. When location devices, sensors, and RFIDs are put together and programmed in a way that provides early warning detection, tracking, and monitoring, they basically become proactive tools that prevent the occurrence of incidents. Often, these devices are installed in workers' clothing or PPEs. One example of sensors and RFIDs utilized in Saudi Aramco are the Heavy Equipment Proximity Sensors and Worker's RFID Tags.

Heavy machinery is equipped with these sensors and a camera to identify adjacent RFID-tagged personnel. As a result, heavy machinery starts to operate and the operators receive an auditory and visual alert. Another illustration is an integrated environmental sensor that can detect heat, chemicals, and monitor gases using UV light. This will make it easier to keep an eye on a worker's physical well-being and

safety when they are operating in risky circumstances. The outdoor temperature in Saudi Arabia can get to 50 °C.

Monitoring a worker's physical health in such a setting is essential for avoiding heat-related diseases. When workers are working outside in severe weather, cold clothing and vests are composed of sensors that track the user's body temperature, sweat, and humidity levels. The information is being supplied to ensure the safety and physical health of the personnel. For instance, if an employee's body temperature is dangerously high or low, they might be asked to leave the workplace right away and go to the hospital.

SMART PPE

Using intelligent personal protection equipment (PPE) may boost productivity, save expenses, and avoid workplace accidents. Any type of personal protection equipment that is internet-connected and capable of delivering real-time safety information qualifies. Through the data gathered, which is used to deliver notifications to change internal and external situations, it seeks to lower employee exposure to risk. Because smart PPE reporting is effective in real-time, the accountable party may identify the precise moment when a worker trips, falls, loses

their balance, or carries too much weight. Two-way communication between the employees and their coordinators or supervisors is made possible by smart glasses. Additionally, it may communicate crucial data, such video and audio recordings, to support their safety while operating on the site.

Smart helmets have a variety of sensors that measure the wearer's temperature, blood oxygen levels, brain activity, and heart rate in order to protect them. The information is collected and saved in real-time, giving management crucial knowledge to alert them to situations when an employee may be too exhausted or unfocused to carry out responsibilities properly. Additionally, it may let users access crucial information via their visor. allowing workers to perform other manual activities hands-free rather than balancing while carrying tablets or clipboards, making it safer for them to do so.

CONCLUSION

In fact, technology has dramatically improved how things are done on a daily basis. Based on the findings of several studies, there has been an overall improvement in productivity and communication, particularly the quick access to crucial information, which has

made decision-making more simpler and more accurate. The incredible technology of today will enhance overall human health and safety from a safety perspective. The automation of HSE processes and integration with carefully chosen and properly assessed IT systems and/or digital technologies enhance company safety performance, increase organisational efficiency, and prevent or reduce accidents that could result in injuries, loss of life, and property damage, as shown by all these IT solutions and constantly evolving technologies. Similar to the significance of IT infrastructures, it is important to note that cyber security is crucial to the effective and secure use of these cutting-edge technology.

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