Innovation Arabia 12

Proceedings

جامعة حمدان بن محمد الذكية
Hamdan Bin Mohammed Smart University

Artificial Intelligence Conference

Table of Contents

Chatbots and Intelligent Tutoring Systems: Paving New Learning Pathways through Artificial Intelligence

Souma M. Alhaj Ali
Hamdan Bin Mohammed Smart University, UAE.

Keywords

Artificial intelligence, Chatbots, Intelligent Tutoring Systems, Artificial Neural Network, Virtual Facilitators, Virtual tutors, Smart Learning, Adaptive Learning, Individualized learning, learning analytics

Abstract

The upswing in applying Artificial intelligence (AI) and advances in algorithms for artificial neural networks, deep learning, pattern recognition, natural language processing, and knowledge representation and reasoning promise great value to people and society. It is anticipated that AI will be embedded in all domains of smart cities, potential sectors include Transportation, Manufacturing, Construction, Aerospace, Finance, Defense, Healthcare, Entertainment, and Education.

The past fifteen years have seen considerable AI advances in education. AI applications are in wide use by educators and learners with some variation between K-12 schools and universities (Stanford University, 2016). Current applications of AI in education include:

- **Chatbots and Intelligent Tutoring Systems (ITS):** Chatbots and ITS and software have been developed to support and facilitate teaching and training that adapt to the needs of the individual learner for math, language, computer science and some other disciplines. Carnegie Learning's MATHia learning engine is utilizing AI to continually adjust to each student, making sophisticated pedagogical decisions, and delivering a personalized learning path with ongoing formative assessments. It delivers differentiated learning experiences that support students who are struggling, while challenging those who are ready for more (carnegielearning, 2018, Kerlyl et.al., 2007).
- **Digitized Content:** AI has been applied to allow learners to create their own custom lecture series, to break textbooks into manageable pieces of information, and to generate book and chapter specific summaries on the spot.
- **Automated Assessment:** AI has been applied to allow learners to create and evaluate simple practice tests, feature recognition capabilities in AI can be used to facilitate essay marking systems.
- **Learning Analytics:** Some universities utilize AI-driven learning analytics for understanding, predicting and enhancing learners' performance.
- **Student Services:** AI systems are available to support advising and registration, it is expected that such systems will become more efficient and will expand to other services.
- **Gamification, VR, and AR:** Gamification, Virtually Reality, and Augmented Reality had been applied in entertainment industry and other applications, it could be applied in education to enrich the learners experience and facilitate virtual experimentation.

This research investigates the application of chatbots and Intelligent Tutoring Systems in education. It aims to evaluate current applications of Chatbots and Intelligent Tutoring Systems in higher education and to propose a

model for their adoption in higher education to enhance learning, access, flexibility, and efficiency while facilitating personalization at scale.

References

1. Carnegielearning, 2018. MATHia Smarter software that actually teaches math, Retrieved December 2018, from https://www.carnegielearning.com/products/software-platform/mathia-learning-software/.
2. Kerlyl, A., Hall, P., and Bull S. 2007. Bringing Chatbots into education: Towards Natural Language Negotiation of Open Learner Models, Ellis R., Allen T., Tuson A. (eds) Applications and Innovations in Intelligent Systems XIV. SGAI 2006. Springer, London.
3. Stanford University, 2016. Artificial Intelligence and Life in 2030, Retrieved November 2018, from https://ai100.stanford.edu/sites/default/files/ai_100_report_0831fnl.pdf.

Exploring the possibilities of personalizing professional development through holography

Maya Al Hawary
UAE

Keywords

Professional Development, Personalized Learning, Augmented Reality, Hologram, Holography, Training.

Abstract

Personalized learning is the new wave of the 21st century. People are becoming more reliant on all kinds of personalized learning whether they are life coaches or personal trainers at the gym or even mentors who can be part of one's career journey. According to a recent study published, "the U.S. estimated market value for personal coaching was $955 million in 2015 and $1.02 billion in 2016, compared to $707 million in 2011" (Larosa, 2018). Larosa (2018) also believes that it is expected that "this market's value to reach $1.34 billion by 2022 — or a 6.7% average yearly growth rate from 2016 to 2022". Another area of concern for mastery are the mechanics of how this type of coaching i.e. personalized professional development can be conducted remotely and get the same personal interaction and collaboration effect as though the trainer is actually present. The research in hand explores the possibilities of continuous professional development using a virtual reality instrument such as holography to provide the closest experience possible to the real presence of a personal trainer.

Training is one of the most established spaces for talent management. With the rise of demanding millennials, companies need to rethink their approach to their return on investment and this only happens when they prioritizing the "individual" comes first. Most corporate entities today have to adapt their learning strategies to meet the demands of today's workforce. With the swift embracing of social collaboration on the different social media sites, and the recent technology developments, there seems a need for innovative training approaches to reach all employees any where in the world. In a recent 2017 study in the E-Learning Industry Journal, Andrew Peteoski states that Augmented Reality Games (ARG) are one of the most robust blended learning solutions because it is "a combination of mediums, game design, and immersive learning, not confined to one space or time. Augmented Reality Games (ARG) is a great way to introduce and immerse learning concepts into the company culture in as big or as small a way as needed". Virtual reality, augmented reality and/or holography can prove useful in all levels education including professional development for the corporate sector. Scholastic research reviews it in a way that sheds light and links it to theory of embodied cognition (Lakoff & Johnson,1999), "facilitating the interaction and understanding because augmented reality could give the human brain a sense of immersion" (Invitro, Spada, and De Paolis as cited in De Paolis & Mongelli 2015).

Research Questions:

1. What is personalized professional development i.e. personal training?
2. How has holography evolved historically to become a useful resource for learning?
3. How can holography enhance continuous professional development?

Internet of Things (IoT) - Amazon Web Services Strategy

Momena J. Cheema
Amazon Web Services, USA.

Keywords

Amazon Web Services (AWS); Internet of Things (IoT); Enterprise Resource Planning (ERP); Compatibility Across Devices (CAD).

Abstract

Internet of Things (IoT) devices are everywhere, allowing users to connect with other users and share data and information instantly. Still an ever-present major concern in IoT world is security of devices and services. In proposed presentation and research, the audience will learn about security risks eminent in IoT space; get acquainted to best practices for risk mitigation when building an IoT security strategy; and "What and how?" of IoT architectural security as developed by Amazon Web Services (AWS) for their global clients depending on their specific business needs; government and regulatory requirements and applicable national and international cyber laws.

The foundation of an effective IoT solution starts and ends with security. Since devices may send large amounts of sensitive data to several recipients and end users of IoT applications may also have the ability to directly control a device, yet the security must be a pervasive design requirement. IoT solutions should not only be designed with security in mind, but the security controls must permeate through every layer of the solution. System security in cloud environment is a dynamic phenomenon; IoT applications must be able to continuously model, monitor, and iterate on security best practices. This research was carried out using state-of-the-art tools and processes recommended by AWS in embedding security features at every layer and feature of applications.

The followings were the major findings of the research:

- In IoT; the attack surface is not entirely different than traditional web infrastructure, rather the lack of education and awareness around enabling appropriate IoT security measures,
- The pervasiveness of ubiquitous computing means that security vulnerabilities could lead to exploits that could result in financial and infrastructural waste, impact to data integrity, for example from a compromised control system for gasoline pipelines, electrical power grids or even thrust,
- Complimentary dynamics of IoT security throughout the lifecycle of a physical device and the constrained hardware for sensors, microcontrollers, actuators, and embedded libraries demand robust design for lateral and vertical scalability,

- If not configured properly, complimentary factors may limit the security capabilities each device can perform. With these additional dynamics, IoT solutions must continuously adapt their architecture, firmware, and software to stay ahead of the changing security landscape, and.

The research proposes that using a combination of services and applications by AWS, clients can maintain integrity and security of data in transit, during latency periods and at rest. When designing a cloud-based Enterprise Resource Planning (ERP) or E-Commerce system, a three to five years' time horizon is optimal for system life cycle. Several emerging technologies will continue to grow in capabilities and provide lot better collaboration and seamless integration.

Trajectory Prediction of Obstacles Moving with Irregular Velocity or Acceleration

Souma M. Alhaj Ali
Hamdan Bin Mohammed Smart University, UAE.

Keywords

Artificial Neural Network, Autonomous Navigation, Obstacle Avoidance, Unstructured Environment, Path Planning, Mobile Robots, Self-driving cars

Abstract

A navigation algorithm is the method that regulates the position of a vehicle, robot, or person and the route to a particular location or position, the navigation system should extract a representation of the external environment from the moving images and other sensory information that it receives to determine the next position. Navigation in an unstructured environment includes such challenges as obstacle avoidance, avoidance of hazards such as holes, boulders or dangerous locations, rough *terrain*, and the need to avoid other moving objects. Obstacles or objects along the path could be fixed or moving. Obstacles detection, path planning, and motion control are essential for autonomous navigation systems. Fixed obstacles are easier to be detected and avoided, however, unstructured environment also incorporate the existence of obstacles or objects moving with variable or irregular velocity or acceleration.

Research has been done on mobile robot navigation, Alhaj Ali and Hall (2002, 2004) developed an autonomous navigation system suitable for robot navigation in an outdoor unstructured environment with fixed obstacles using artificial neural networks, Chinag and Chiehyi Ding (2014) proposed a propose a robot navigation approach in dynamic environments using fuzzy logic and trajectory prediction table, Nurmaini and Putra (2012) proposed incorporating memory-based reasoning capabilities in autonomous navigation algorithm to enhance the mobile robot's performance where the robot's forthcoming decisions are affected by the current range inputs as well as its previous navigation experiences. Dadelahi, et al. (2013) proposed a path-motion planning method for autonomous mobile robot which move in unknown Dynamic environment, the environment may have moving obstacles of arbitrary shape.

This research investigates the development of an autonomous navigation algorithm using artificial neural network. The algorithm predicts the trajectory of obstacles moving with variable or irregular velocity or acceleration. The prediction algorithm was designed using a feed forward multi-layer neural network. To permit the widest exploration of the proposed algorithm, a simulation approach is followed. The significance of the research lies in its ability to be applied in various navigation and path planning application including autonomous robot navigation, self-driving cars, and in the development of games.

References

1. Alhaj Ali, S. and Hall, E. 2002. Technologies for autonomous operation in unstructured outdoor environments, Part 1: Navigation, Intelligent engineering systems through artificial neural networks, Vol. 12, pp. 57-62, ASME Press, New York, USA.

2. Alhaj Ali, S., Ghaffari, M., and Hall, E. 2004. Using a Digital Controller for a Neural Network Autonomous Navigation System for a Wheeled Mobile Robot , Intelligent Engineering Systems through Artificial Neural Networks, Vol. 14, ASME Press, New York, USA.

3. Cheng-hsiung Chinag, C. and Ding, C. 2014. Robot navigation in dynamic environments using fuzzy logic and trajectory prediction table, 2014 International Conference on Fuzzy Theory and Its Applications (iFUZZY2014), IEEE.

4. Nurmaini, S. and Putra, A. 2012. Intelligent Navigation in Unstructured Environment by using Memory-Based Reasoning in Embedded Mobile Robot, European Journal of Scientific Research, Vol. 72, No. 2, pp. 228-244.

5. Dadelahi, S., Motlagh, M. R. J., and Shahri, A. R. M. 2013. Obstacle Displacement Prediction for Robot Motion Planning and Velocity Changes, International Journal of Information and Electronics Engineering, Vol. 3, No. 3.

The use of artificial intelligence to predict the outcomes of elective percutaneous coronary intervention using clinical factors

Dr. Rabah Al abdi

Jordan University of Science and Technology, Jordan.

Keywords

Artificial Intelligence, Elective Percutaneous Coronary Intervention, Quality of Life, Elective Percutaneous Coronary

Abstract

The leading cause of morbidity and mortality worldwide is coronary artery disease (CAD). Percutaneous coronary interventions (PCI) are usually performed to treat CAD. While primary PCI is very urgent in patients with heart attack, elective PCI (ePCI) is also used in CAD patients to relieve symptoms that may be difficult to control with medication and to improve patients' health-related quality of life (HRQoL).

The aim of this study was to design models using admission clinical data to predict the impact of ePCI treatment, after six months, on patients' HRQoL

This prospective-cohort study was conducted among CAD patients who underwent ePCI in Jordan from January 2014 through May 2015. Six months after their ePCI procedures, HRQoL was assessed using improved MacNew quality of life following acute myocardial infarction (QLMI-2) questionnaire. Higher QLMI-2 scores indicate better health status. An ePCI procedure was considered 'Satisfactory' or 'Not-satisfactory' if QLMI-2 score was larger or smaller than the average QLMI-2 scores of all patients, respectively. Clinical and sociodemographic factors that could affect HRQoL after ePCI were collected from the medical records of the patients. Clinical data at admission included echocardiographic findings, laboratory results, and electrocardiograph readings. Logistic linear regression and four artificial intelligence (AI) classification algorithms were used to combine the prediction power of all clinical and sociodemographic factors in order to predict the outcome of ePCI. The used AI algorithms were Naïve Bayes, Multilayer Perceptron, Random forest, and Lazy K-star. The WEKA software was utilized for the prediction process. Classification performance was evaluated using the 10-fold cross-validation.

The study included 239 patients who underwent ePCI and responded to the QLMI-2 questionnaire. The mean age (± standard deviation) of the participants was 55.74 ± 11.84 years, 54.58 ± 11.37 years for male (n = 174), and 59.11 ± 12.49 years for female (n = 65). The average scores for HRQoL was 4.37 ± 1.09. The sensitivities of logistic regression, multilayer perceptron, Lazy K-Star, Naïve Bayes, and Random forest were 62.1%, 69.4%, 71.8%, 90.3%, and 95.2%, respectively. A predictive accuracy of 81.2% was achieved using Random forest.

Prediction of the outcome of ePCI after six months is possible based on data acquired on admission. AI algorithms outperformed logistic regression in predicting the outcome of ePCI after six months. The

models developed here can be used as decision-making tools to help determine if the outcome of an ePCI procedure will be satisfactory. The models will guide physicians on the identification of the efficacy of ePCI for individual patients, hence decreasing the rate of inappropriate ePCIs and reducing costs and complications.

A Machine Learning Approach for Data Analytics of Courses Learning Outcomes

Raed Abu Zitar
Ajman University, UAE.

Ammar Elhasan
Princess Sumaya University, Jordan.

Keywords

Deep learning, CLOs, ADAMs, Machine Learning, Data Analysis

Abstract

This paper is about improvising a system that utilizes the existing capabilities of a courses learning outcomes assessment application called ADAMS (**A**ccreditation **D**ata **A**nalysis and **M**anagement **S**ystem). ADAMS can provide us with the data regarding the weaknesses and strength in specific learning outcomes or group of learning outcomes of a study course or group of courses in a study plan. The assessment will be based on given rubrics for every course. The outcomes of ADAMS will be processed to extract best features and then later used in training a deep learning neural network that can give the advice about the best approach to mitigate the weaknesses explored by ADAMS in the learning process. Three different categories of deep learning networks will be at least tried. Other machine learning methods could be compared with such as Support Vector Machines (SVM), Classifier Systems, and statistical methods. Comprehensive analysis will be done in separate sets for training and testing will be used. The goal is to have an intelligent automated system that gives advice, directions, and recommendations on how to amend the teaching process to maximize the degree of an academic program learning outcomes achievement. By assessing Course Learning Outcomes (CLO's) and mapping those to Program Learning Outcomes (PLO's) / Student Outcomes (SO's), we are able to aggregate both Formative and Summative student assessments to derive rubric assessments for program learning outcomes (PLO's).

We are collecting all assessments into an Oracle database and interfacing to them using a system that has been developed in .Net (C#) which enables us to retrieve performance reports for all or for a specific student outcome. For example, the system can provide a report showing the 'health status' of student outcomes as of the latest input assessments aggregated with previously collected assessments, thus showing weakest and strongest student outcomes, or it can 'drill down' on one individual student outcome and show the strongest and weakest courses that support this student outcome.

Leveraging course learning assessments to measure the performance of student outcomes is one layer of performance measures supported, however we can go further and use mappings between student outcomes and Ministry of Education/National Qualification Framework to measure student performance in relation to Emirati Qualification Framework elements.

The next stage utilizes Artificial Intelligence and Data Science algorithms to provide automation for the selection of remedial actions for specific student outcome attainment rates which can draw appropriate remedial actions from a set or pool of pre-approved remedial actions by the college and or Department.

The major contribution is to use deep learning technique in training a feed forward neural network to implement the remedial action. The idea here is to treat the outcomes of ADAMS as images that need recognition and use supervised accompanied with unsupervised methods to train the neural network. The kind of learning algorithm we will be using is called “Deep Learning”.

Challenges of Artificial Intelligence in Business Process Optimization

Abdullah Alghaithi
Hamdan Bin Mohammed Smart University, UAE.

Keywords

Artificial Intelligence, Business Operations, Analytics, AI Automation

Abstract

Artificial Intelligence is a revolutionary technology that is expected to bring a number of changes to business processes such as maximizing efficiencies and minimizing human involvement. However, it will bring disruptive changes and raise technical, economic and legal problems which must be considered in advance for the implementation of this technology to take full advantage of this technology.

Artificial Intelligence applications heavily depend on huge volumes of data to analyze behaviors and make smart decisions. This makes it vulnerable to serious issues like data-related bottlenecks, data breach, and identity theft and hence, corrupted data inputs could cause incorrect decision-making that in a business could entail huge financial losses. The business process implies the necessity of compliance and scheduling. For AI to be beneficial in achieving these aims, bottlenecks of access to data, whether in regard of permission or issues of timely availability, become an important issue. Security is an issue for all applications of AI. Malicious anti-competitive tactics may involve breaching data security and disrupt the accurate operation of AI or corruption of data that it uses. To what extent this applies to business processes is an area of study not given sufficient attention in past literature. As businesses become highly reliant on AI, it becomes necessary to ensure consistency, particularly for business process optimization. While backup of data and software systems may be straightforward, this may not be the case for AI. This is since AI is highly adaptive, and changes its analyses depending on updates to data, its own past insights and its self-updating algorithms. The risks of system failure and its mitigation with backup systems is not fully understood and requires investigation. Therefore, there is a need to feed AI systems with accurate & secured data to achieve high performance in automation.

Automation in business process requires a skilled workforce, with technical and analytic ability to understand and implement workflow, is a major challenge for organizations. There is a widespread shortage of workforce that retain the experience to properly maintain these dynamic data-driven based decision-making operations within their organizations.

With AI implementation, the main concern is trust on AI decisions due to lack of explain-ability, the decisions made by algorithms are the consequence of complex mathematical operations. The result of unverified analyses and actions may lead the business into a non-performing state and decides accountability in such condition is a challenge.

Photocatalytic Performance of Graphene-based TiO2 magnetic nanocomposites

Prof. Ali Hilal-Alnaqbi,
Abu Dhabi Polytechnic, UAE.

Dr. Sawsan Dagher
Abu Dhabi,Polytechnic, UAE.

Dr. Maisa Elgamal
UAEZayed University.

Dr. Ahmed Soliman
Dr. Mudasir Mohammed
Abu Dhabi Polytechnic, UAE.

Keywords

Graphene, Photocatalysts, TiO2, Magnetic Nanocomposite, Nanoparticles.

Abstract

Photocatalytic degradation is a widely used method for pollutants' removal, due to its low cost high efficiency, high removal rate, and suitability for wide applications. Nanoparticles (NPs) have various motivating features such as the enhanced phot-catalytic activity and optical properties, due to the large surface area and the electron confinement effects. The main drawback of using NPs as photocatalyst is their requirement for ultrafiltration for separation of the photocatalyst NPs from the treated wastewater at the end of the treatment processes. So, using magnetically separable NPs is essential. On the other hand, graphene is a promising modifier for photocatalysts, due to its unique properties. This carbon material exhibits excellent electrical, electronic, optical, biological and chemical properties, which contribute to its numerous applications in medicine, electronics, photonics, energy, sensors, environment, industry etc. A nanocomposite that combine the advantages of graphene materials, nano-size effects and magnetic properties in one composite is developed and its photocatalytic performance is evaluated. The nanocomposite is prepared by two stages; firstly, magnetic NPs (Fe3O4) are synthesized by co-precipitation method. Then, the Fe3O4 are coated with a thin layer of titanium dioxide (TiO2), using modified sol-gel method. Secondly, the synthesized Fe3O4/TiO2 NPs are attached to graphene by sonicating water and ethanol suspension of TiO2 with aqueous suspension of graphene in which polyvinyl pyrrolidone is used as surfactant. The prepared magnetic nanocomposite photocatalyst is characterized using the following techniques; FTIR, XRD, SEM and TEM. The photodegradation activity of the prepared magnetic nanocomposite is studied by adding the nanocomposite to an aqueous solution containing desired concentration of methylene blue dye at certain pH and temperature. After reaching the adsorption-desorption equilibrium among the nanocomposite and the dye in the dark, the solution is exposed to solar radiation to perform the photodegradation. The solution is sampled at certain time intervals. The concentration of the dye in the sample is determined by UV-Vis spectroscopy. The results showed an effective contact between TiO2 and graphene.

Fe3O4/TiO2-graphene showed higher photocatalytic activity compared to Fe3O4/TiO2. The important effects of graphene in the nanocomposite is described, in which UV light is absorbed by the TiO2, whereas visible and infrared light can be absorbed by graphene, creates electron-hole pairs, which are excited on the Fermi level of graphene (i.e., zero band-gap) with a high electron mobility between graphene and TiO2 due to the delocalized conjugated π-d electron of graphene, which effectively overpowers the recombination of the photo-generated electron-hole pairs in TiO2. The electrons and holes generate free radicals (e.g. hydroxyl radicals) able to undergo secondary reactions, that can transfer organic pollutant in water into CO2 and H2O. Finally, the nanocomposite can be collected from the media by a magnet to be used for another purification cycle. The results demonstrate that Fe3O4/TiO2-graphene nanocomposites are promising for environmental friendly applications such as wastewater and industrial effluents treatment.

Let’s Celebrate the Birth of “UAE AI Robot": Zayed Robot

Sandia Mohamed Ali Al-Melaih AlFzari
UAE.

Keywords

Artificial Intelligence AI, Mega Technology, Automation Jobs, Automating Tasks, Robot

Abstract

This research tries to provide an insight into the use of Artificial Intelligence (AI) in robotics by trying to answer many related questions such as: What is the role of AI in robotics? Why all robots do not meet our goals in all fields? Which country will lead the future of AI? What are the best companies? What other revolution that can be merged with AI to enhance our lives? What are the bros and cons of it? Which future jobs will demand more in next years? Which jobs will be eliminated?

The main purpose of this research is to try to solve the challenges faced by UAE to produce the AI Robot to meet its needs and to have a piece of cake in AI revenue? Although UAE provide one of best unique opportunities for all entrepreneurs to start their AI robot business, but it creates a huge gap between what UAE import and export in AI Robot!! What are the results? What will UAE get from that? What are the real obstacles that prevent UAE from achieving AI Strategy? Are there a lot of rival and dominate companies in the field? By study the market and figure out what we need to produce AI Robot, to do steps in UAE AI Strategy of 2071 before that time to be in the top and lead the future of AI revolution. The paper will present different type of AI robots and companies producing those robots? Where we can buy it? How much it is cost? Which landscape can be used in lives?

Finally, I recommend many suggestions and initiatives to assist my UAE to lead the future of producing AI Robot such as: to be part of education in schools not only universities? Buying from outside robot means buying the technology of producing not only financial product!! Part of producing technology should be in our country to learn from it? create link to future jobs from now, provide opportunities to learn about AI Robot to anyone who has desire to learn, no matter their background, also to encourage student to research and produce more papers about AI in both Arabic and English. UAE government should also make law and regulations about AI Robot ethics. Lastly, support startup companies and put rules to open company with local AI experts to learn more about this technology. What robot without AI!! It seems as a body without heart!! They are so related and complete each other.

The Educators' Role after AI

Wassim El-hajj
Hamdan Bin Mohammed Smart University, UAE.

Keywords

Artificial Intelligence, AI, blockchain, education, educators, teachers, intelligent tutoring system, machine learning.

Abstract

This paper will showcase how new disruptive technologies such as block-chain and artificial inelegance are changing the education sector by delivering economical and personalized education to a wider scope of learners that is accessible online or via smart devices. In addition to that, these new technologies will also help in speeding up administrative tasks and significantly reduce the time needed to completed traditional administrative routine tasks per learner, as well as outreaching to help learners on their future job prospects. A research study from e-School News revealed that the use of Artificial Intelligence in the education industry will rise by 47.5% by 2021.

The objective of this paper is to showcase examples from around the World on how the education sector is utilizing these new technologies in reshaping the future of education and its delivery methods. How it is used to speed up the administrative processes, (such as grading) for education institutions and educators.

As the adoption of these technologies is still in its early stages when it comes to applications related to the higher education sector in the Arab World, this paper is based on a qualitative research approach involving methods that include: desk-research, interviews with learners and relevant stakeholders, engaging in a specialist review and survey of literature and relevant research case studies.

In conclusion, the new emerging technologies such as AI will surely disrupt how the higher education sector will look at learning and teaching methods. It is time for higher education institutes to re-visit their functions, methods of delivery, and the roles educators play in delivering knowledge and guiding learners. In ODEM example, learners will provide their profile, needs, and test assessments, where then AI will use the calculated results to pair the learner(s) with the appropriate educator(s), resulting in ensuring the success of the learner(s) experience.

Introduction

This paper will showcase current examples of how new disruptive technologies such as block-chain and artificial intelligence are changing the education sector by delivering economical and personalized education to a wider range of learners and the convenience they bring being accessible online or via smart devices. In addition to on overview on how those new technologies will be helping in speeding up administrative tasks and significantly reducing the time needed to complete administrative routine tasks per learner, as well as outreaching to help learners on their future job prospects. A research study from e-School News revealed that the use of Artificial Intelligence in the education industry will rise by 47.5% by the year 2021.

Objective

The objective of this paper is to showcase examples from around the World on how the education sector is utilizing these new technologies in reshaping the future of education and its delivery methods, how it is used to speed up the administrative processes for education institutions and educators. And anticipates the future roles of educational institutes and educators in the short and long term perspectives which it seems will never be the same in the future and maybe not as essential as it is today with the advancement of artificial intelligence technologies and gadgets.

Methodology

As the adoption of these technologies is still in its early stages when it comes to applications related to the higher education sector in the Arab World, this paper is based on a qualitative research approach involving methods that include: desk-research, engaging in a specialist review and relevant articles, research, and case studies – see figure1.

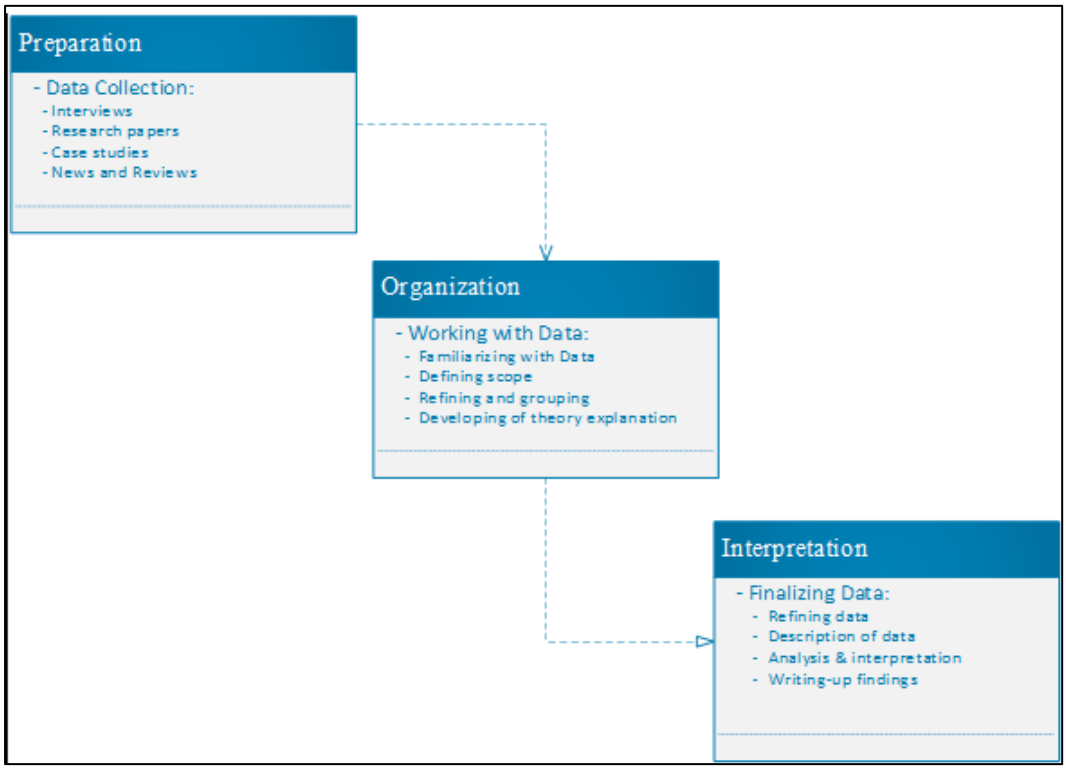


Figure 1. The proposed schema for the Research Design.

Personalized Education

The academic world is becoming more personalized and convenient for learners thanks to recent advancements in artificial intelligence (AI). New technologies in general has numerous applications that are changing the way education is delivered, making it more accessible to learners equipped with computers or smart devices, without the need to attend physical classes. Learners aren't the only ones who are benefiting, as AI is also helping to automate administrative tasks which will reduce the time spent on routine tasks and help in increasing the time spent with individual learners resulting in a more personalized experience to them during their education journey.

Kurt VanLehn described what he called “student diagnosis module”, where the outcomes from this module are used to advance the curriculum and enhance student advising service. He describes this issues in terms of three dimensions:

(a) Improving the bandwidth of available knowledge about the student.

(b) Distinctly identifying types of knowledge to be learned.

(c) *Assessing differences between students and experts.*

(Martha & Jeffrey, 1988).

In this paper we will just look at the first point that had the challenge of the bandwidth of the diagnostic program, where most programs only looked on the low end of the information band, which is just students’ answering questions.

Examples of implementation

Automating administrative tasks

When it comes to administrative tasks using AI in grading exams, evaluating essays and homework can greatly reduce the time needed by faculty members and teachers to perform the tasks. Gradually with time and more advanced AI solutions the role of those faculty members and teachers will change to be more focused on planning lessons, creating customized content, and on one to one time with students. Admissions processes can also be automated reducing the workload on staff by utilizing chatbots to answer learners’ common and frequently asked questions related to admission and registration processes and requirements.

In Derry & Lajoie (1993) edited volume there are many chapters that challenges the role of the tutor, the student modeling and Artificial Intelligence in educational computer programs. Their proposed alternative is not something new, but rather a specific view on the role of the computer in education; as a cognitive tool that should take over the burden of lower order tasks which will allow faculty members (or staff) to concentrate on the more important tasks (Salomon, 1993).

In contrast, Barnard and Sandberg (1994) differentiated six entities with which the learner interacts and that characterize an open learning environment from the point of view of the learner, which are: tutor, monitor, fellow learner, learning material, information sources and tools. The challenge here is to find a way to support students in various setups that affect their learning in specific ways. For example, the tutor task may be performed by a human tutor or by a computer tutor, information sources may be found in books and other documentation or in information databases, while different entities enrich the learning experience such as the learning tools being used and the interaction with fellow-students.

Therefore, we can claim that, *"the artificial-intelligence tutor will become a valuable assistant, providing the individualized instruction that a teacher with 20 or more pupils does not have the time for. Learning can take place at the student’s pace."* (Hines, 1996, pp. 9-10).

Now to develop such an intelligent system the professional societies, such as the Association for Computing Machinery (ACM), have established codes of ethics that can be used to the development of Artificial intelligence (AI) educational systems (Anderson, 1993). From those Code of Ethics, the

following are the "general moral imperatives" that can all be applied to the development of AI systems for education.

The General Moral Imperatives (excerpts from the ACM Code of Ethics):

1.1 Contribute to society and human well-being

1.2 Avoid harm to others

1.3 Be honest and trustworthy

1.4 Be fair to take action not to discriminate

1.5 Honor property rights including copyrights and patents

1.6 Give proper credit for intellectual property

1.7 Respect the privacy of others

1.8 Honor confidentiality.

In this case, the vendor would be the solution provider that develops the AI software. The client here will be the school or university that buys the developed software. The users are the students. “In the future, clients and users for educational software might merge, as adults manage their own lifelong learning” (Anderson et al., 1993, p. 101).

From another perspective, Aiken, R. and Epstein, R. proposed two fundamental meta-principles as a basic philosophical foundation for any artificial intelligence system in education, which are as follows:

- The Negative Meta-Principle for the Artificial Intelligence in Education technology “should not diminish the student along any of the fundamental dimensions of human being”.
- The Positive Meta-Principle for Artificial Intelligence in Education technology “should augment the student along at least one of the fundamental dimensions of human being (Ethical, Aesthetic, Social, Intellectual, Physical, Psychological)”.

Derived from the previous two meta-principles, it is worth mentioning the following ten principles in order to raise the awareness of researchers in designing educational systems:

1. Design systems that encourage and do not demoralize the user.
2. Encourage collaborative learning and the building of healthy human interactions.
3. Support the development of positive character traits
4. Avoid information overload
5. Build environments that promote inquisitiveness and curiosity and that encourage students to learn and explore.
6. Consider ergonomic features to avoid injuries such as eyestrain, repetitive strain injuries, back problems, etc.

7. Develop systems that give teachers new and creative roles that might not have been possible before the use of technology. Systems should not attempt to replace the teacher
8. . Respect differences in cultural values; avoid "cultural imperialism"
9. Accommodate diversity and acknowledge that students might have different learning styles and skill levels.
10. Avoid glorifying the use of computer systems thereby diminishing the human role and the human potential for learning and growth. (Aiken, R. M., & Epstein, R. G. 2000. pp.172-173).

Guided by the previous principles, the following pages will showcase examples of how Artificial Intelligence is being implemented and used in developing different applications and systems for the advancement of education and related delivery methods.

ODEM.io

On-Demand Education Marketplace (ODEM) which is built on the Ethereum blockchain is tackling the challenge of the high cost, and the mountains of debt associated with quality education. Via their platform, learners are empowered to collaborate with top universities' professors "to create customized educational experiences, part of a life-long process of keeping skills relevant *in fast-changing job markets.*"

> By deploying AI/Machine learning testing and assessment, learners will provide their profile, needs, and test assessments. The AI will use the calculated results to pair the learner(s) with the appropriate educator(s), resulting in ensuring the success of the learner(s) experience.
>
> Now from the financial side, the ODEM blockchain-based financial ecosystem will help learners traveling from abroad and who do not have access to traditional banks to transfer value within that ecosystem which will reduce the financial barriers for learners, if they had to use the traditional banking system

Finally, through "*a distributed ledger of all transactions (both financial and education accreditation), the system provides full transparency of the entire planning and transaction of the students' educational needs and experiences*." (https://support.odem.io/hc/en-us/sections/115000917711-FAQs, 2017). This will give learners more control on the costs of education, to negotiate and customize the right setup for delivery of service, and to choose the suitable educational solution for their needs.

MyTutor

MyTutor, is an online tutoring site, that was developed in collaboration with University College London's (UCL) Institute of Education, and is an AI-powered system used to simplify the process of matching students with the right tutors.

Parents will be asked a series of questions about their child's personality: whether they are creative, logical, confidence, anxious and so on. The collected answers are then processed by an algorithm that matches the students with the appropriate tutor based on those parameters. CEO James Grant, co-founder of MyTutor, stated that building a "strong rapport" between a tutor and student is crucial for

academic success. (https://www.telegraph.co.uk/education/2017/09/08/tutor-future-scientists-develop-algorithm-match-pupils-tutors/, 2017).

Brainly

Brainly is a global online learning community where students are able to post academic questions for community members to offer solutions. The platform uses machine learning algorithms to match posted questions with content experts. The human moderators' role will be just to oversight and monitor the quality of solutions provided by community members.

"The whole point of Brainly is to use data and technology to focus the attention on a very precise and specific problem. …… We want to use machine learning to create a fully personalized learning path, to identify precisely where a student is stuck or confused or unclear, then hone in on that one specific problem and find a solution." -Professor Chirag Shah of Rutgers University, (March 2017)

e-learning Planning

As represented in Figure 2, teachers (being course designers) define the course by creating new Learning Objectives (LO) or updating existing LOs that are available in the repository. After that an automatic translator compiles all this information as a Planning Domain Definition Language (PDDL). When the planner generates a plan (i.e. learning route), it can be validated by a teacher and stored in the library. Finally, uploading the information and necessary materials to the Learning Management System (LMS) to grant students the required access.

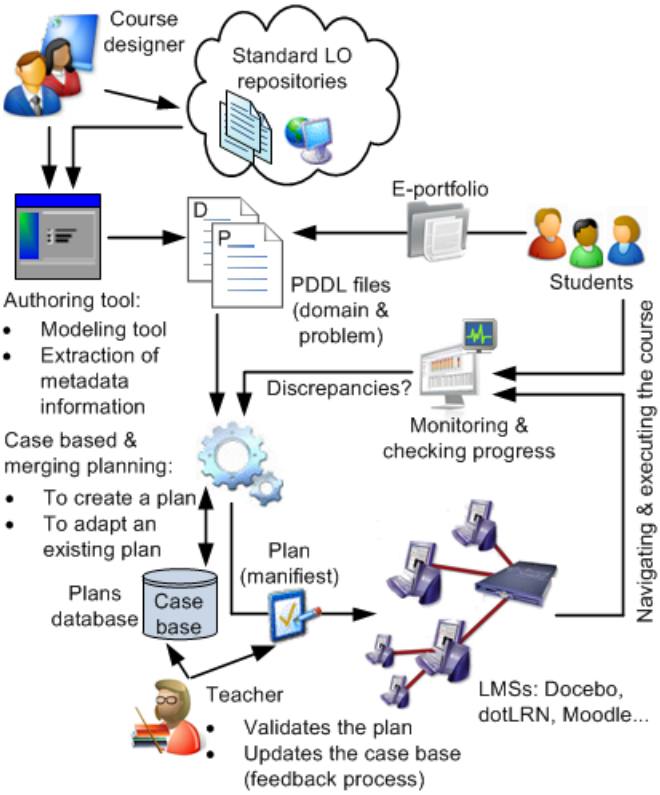


Figure 2: Architecture of myPTutor for using planning in an e-learning setting. More can be found in http://servergrps.dsic.upv.es/myptutor.

Concluding Remarks

The new emerging technologies such as Artificial Intelligence (AI) will surely disrupt the learning and teaching methods that are used, and will dramatically change the role of teachers and educators. It is time for higher education institutes to re-visit their functions, methods of delivery, and the roles their faculty members play in delivering knowledge and guiding learners. In our ODEM example, learners need only to provide their profile, needs, and test assessments, where then AI will use the calculated results to pair the learner(s) with the appropriate educator(s), resulting in ensuring the success of the learner(s) experience and a smooth knowledge accomplishment.

A 2016 report on education published by the World Economic Forum suggests that machine learning is among the technological developments that have a strong potential for personalizing education and improving social learning.

Machine learning has the potential to become increasingly useful to handle big data and to provide tutors with useful feedback as more students accessing smart learning tools.

In my views the role of educators will shift in the short term (3-5 years) from personally delivering education, to a more strategic role of planning courses, creating educational content, overviewing the progress of individual students and providing each one of them with adequate guidance. On a longer outlook, as machine learning advances and becomes more sophisticated, with the support of AI gadgets, students will have direct access to a customized educational path specific to their personal interest and future ambitions, without being dependent on formal educational methods or educators!

References

1. Aiken, R. M., and Epstein, R. G. (2000). Ethical guidelines for AI in education: Starting a conversation. [online] International Journal of Artificial Intelligence in Education, 11, 163-176. Available at: http://www.iaied.org/pub/1023/file/1023_paper.pdf [Accessed 10 Jan.2019].
2. Aiken, R. M. (1989). The Impact of Artificial Intelligence on Education: Opening New Windows. in Proceedings of CEPES-UNESCO International Symposium on Artificial Intelligence in Higher Education, Prague, 1989, Springer-Verlag,
3. Baker, M. J. (2000). The roles of models in Artificial Intelligence and Education research: a prospective view. Journal of Artificial Intelligence and Education, 11, 122-143.
4. Brainly. (2018). [online] Available at: https://brainly.co/about.html [Accessed 6 Jan.2019].
5. FAQs-ODEM. [ONLINE] Available at: https://support.odem.io/hc/en-us/sections/115000917711-FAQs. [Accessed 28 January 2018].
6. Garrido, A., Morales, L., & Serina, I. (2012). Using AI Planning to Enhance E-Learning Processes. In *ICAPS*.
7. Industry agenda. (2016). New Vision for Education: Fostering Social and Emotional Learning through Technology. REF 040316. [online] Boston: World Economic Forum,

Available at: http://www3.weforum.org/docs/WEF_New_Vision_for_Education.pdf [Accessed 6 Jan.2019].

8. Polson, M. and Richardson, J. (1988). Foundations of Intelligent Tutoring Systems. 1st ed. [ebook] New Jersey: Lawrence Erlbaum Associates, Inc. Publishers, pp5. Available at: https://books.google.ae/books?hl=ar&lr=&id=yDm-6Xdtz_MC&oi=fnd&pg=PA1&dq=artificial+intelligence+and+education+%22tutoring+systems%22&ots=iQasEBupE4&sig=x9AHD6RJTrZ7CIXAhqgtfjoRV4Y&redir_esc=y#v=onepage&q=artificial%20intelligence%20and%20education%20%22tutoring%20systems%22&f=false [Accessed: 20 Dec. 2018].
9. Sennaar, K. (2018). The Artificial Intelligence Tutor – The Current Possibilities of Smart Virtual Learning. [online] Availablr at: https://emerj.com/ai-sector-overviews/artificial-intelligence-tutor-current-possibilities-smart-virtual-learning/ [Accessed 6 Jan. 2019].
10. Utermohlen K. (2018). 4 Ways AI is Changing the Education Industry. Towards Data Science, [online]. Available at: https://towardsdatascience.com/4-ways-ai-is-changing-the-education-industry-b473c5d2c706 [Accessed 8 Jan.2018].

Additional References

1. Brusilovsky, P., and Vassileva, J. 2003. Course sequencing techniques for large-scale web-based education. International Journal Continuing Engineering Education and Lifelong
2. Learning 13(1/2):75–94.
3. Castillo, L.; Morales, L.; Gonzalez-Ferrer, A.; Fdez-Olivares, J.; Borrajo, D.; and Onaindia, E. (2010). Automatic generation of temporal planning domains for e-learning. Journal of Scheduling 13(4):347–362.
4. Fox, M.; Gerevini, A.; Long, D.; and Serina, I. (2006). Plan stability: Replanning versus plan repair. In Proc. 16th Int. Conference on Automated Planning and Scheduling (ICAPS-2006), 212–221. AAAI Press.
5. Garrido, A.; Onaindia, E.; Morales, L.; Castillo, L.; Fernandez, S.; and Borrajo, D. (2009). Modeling e-learning activities in automated planning. In Proceedings of the 3rd International Competition on Knowledge Engineering for Planning and Scheduling (ICKEPS-ICAPS 2009), 18–27.
6. Garrido, A.; Fernandez, S.; Morales, L.; Onaindia, E.; Borrajo, D.; and Castillo, L. (2012).
7. On the automatic compilation of e-learning models to planning. The Knowledge Engineering Review In press.

8. Garrido, A.; Onaindia, E.; and Sapena, O. (2008). Planning and scheduling in an e-learning environment. a constraint programming-based approach. Engineering Applications of Artificial Intelligence 21(5):733–743.

9. Gerevini, A., and Serina, I. (1999). Fast planning through greedy action graphs. In Proc. 16th Nat. Conference of the American Association for AI (AAAI-99), 503–510. AAAI Press.

10. Idris, N.; Yusof, N.; and Saad, P. (2009). Adaptive course sequencing for personalization of learning path using neural network. Int. J. Advance. Soft Comput. Appl. 1(1):49–61.

11. Kontopoulos, E.; Vrakas, D.; Kokkoras, F.; Bassiliades, N. and Vlahavas, I. (2008).

12. An ontology-based planning system for e-course generation. Expert Systems with Applications 35(1-2):398–406.

13. Leake, D. (1996). Case-Based Reasoning. Cambridge, Massachusetts: The MIT Press.

14. Limongelli, C.; Sciarrone, F.; Temperini, M.; and Vaste, G. (2009). Adaptive learning with the LS-PLAN system: a field evaluation. IEEE Transactions on Learning Technologies 2(3):203–215.

15. Martinez, F.; Magoulas, G.; Chen, S.; and Macredie, R. (2004). Recent soft computing approaches to user modeling in adaptive hypermedia. In Proceedings of Adaptive Hypermedia (AH'04), LNCS 3137, 104–114.

16. Polsani, P. (2003). Use and abuse of reusable learning objects. Journal of Digital Information 3(4). Available at: http://journals.tdl.org/jodi/article/view/89/88 [accessed 7 Jan. 2019].

17. Smyth, B., and McKenna, E. (2001). Competence models and the maintenance problem. Computational Intelligence 17(2):235–249.

18. Ullrich, C., and Melis, E. 2009. Pedagogically founded courseware generation based on HTN-planning. Expert Systems with Applications 36(5):9319–9332.

19. Yang, Q.; Nau, D.; and Hendler, J. 1992. Merging separately generated plans with restricted interactions. Computational Intelligence 8(4):648–676.

Add on Intelligence for enhancing the sustainability of future human life

Yaseen Abdul Kader Tahir Magdoom Mydeen
Dubai Electricity & Water Authority, UAE.

Co-Author/Advisor

Matar Suhail Salem Al Mehairi
Dubai Electricity & Water Authority, UAE.

Keywords

Human-AI Combination, Extended Intelligence, Embedding Multiple Intelligence, Add on Intelligence, Semi Automation

Abstract

Technological development are in rapid growth now a day and will surpass to exponential level of growth in future. Priority in this technological development age is mainly given for machines development that to mimic human intelligence. On the other hand, human capacities development to match up with this is a big question mark.

Hence, there is a chance of huge threat for human in the future such as job loss situation, social/security threats by empowering the machines through fully automated machines systems without human intervention, etc.,

Other possible Risks are:

- AI is capable of performing tasks that would once have required intensive human labor. It may fill human places for the jobs. Even though at this stage of AI technologies, which is called weak AI, it is assumed to affect more on unskilled workers/labors.
- It may go destruction mode if malfunctioned automatically. Another Concern is the dangers autonomous weapons might have with an individual or government that does not value human life. Once deployed, they will likely be difficult to dismantle or combat.
- AI is going forward for more mimicking human intelligence, in such cases human values will decrease further.
- By spreading propaganda to individuals identified through algorithms and personal data, AI can target them and spread whatever information they like, in whatever format they will find most convincing—fact or fiction
- Invasion of privacy can quickly turn to social oppression.
- Goals may be accomplished with ethical breach if not coded properly.it may lead to social, economic damages.
- Since machines can collect, track and analyze so much about you, it is very possible for those machines to use that information against you.

On other hand, there are traditional theories exists on human intelligence such as; According, Gardner's MI theory differentiates human intelligence into specific 'modalities', rather than seeing intelligence as dominated by a single general ability. Another concept from the book the innovator's DNA states that, Innovative entrepreneurs have something called creative intelligence

As it is high time to prepare, develop, and enhance human intelligence & capabilities through add on intelligence & capabilities in to the existing human intelligence in order to proliferate human as a superior intelligence over machine /artificial intelligence, it could be achieved through conceptualizing traditional theories such as Multiple intelligence theory, innovator's DNA theory for the identification of human intelligence levels and inhibiting add on intelligence in to Human existing intelligence through some of the modern technologies such as artificial intelligence, deep learning, advanced materials, etc.,

This paper aims to show that a human-AI combination will perform better than humans and AI working alone. "no man is better than a machine for some tasks, "no machine is better than a man with a machine" (Paul Tudor Jones).

Introduction

Starting from smart systems/interfaces/applications, modern communication system developments, advanced materials, machine/deep learning technology, algorithm/data analytics, artificial intelligence technologies, block chain, quantum computing, etc., the technological development leads to deliver the current & future needs of business, society, government, etc., It is clear evident that the technological growth could not be stopped due to global connect in business opportunities, global competitiveness, social/environmental challenges, etc.,

On the other hand, it is posing a great challenge for human that human is in a must win condition over machines through enhancing the existing human intelligence/capabilities. The existing governance/systems are in initial stage in this area and much to mature in the same. So the concept here is that, the growth of AI and the human intelligence growth as superior intelligence shall be developed in parallel.

According, Gardner's MI theory differentiates human intelligence into specific 'modalities', rather than seeing intelligence as dominated by a single general ability. Another concept from the book the innovator's DNA states that, Innovative entrepreneurs have something called creative intelligence, which enables discovery yet differs from other types of intelligence (as suggested by Howard Gardner's theory of multiple intelligences). It is more than the cognitive skill of being right-brained. Innovators engage both sides of the brain as they leverage the five discovery skills to create new ideas.

Both the theories provides approach that would help in identifying an individuals level of existing intelligence & capabilities. Considering this as a reference requirements, add on intelligence/capabilities shall be built in to the existing human intelligence/capabilities through modern technologies such as artificial intelligence, deep learning, advanced materials, robots, etc.

Literature Review

1. Howard Gardner's Multiple Intelligence Theory:

According to Gardner, an intelligence is "a bio psychological potential to process information that can be activated in a cultural setting to solve problems or create products that are of value in a culture."

Howard Gardner's Multiple Intelligence Theory was first published in Howard Gardner's book, Frames Of Mind (1983), and quickly became established as a classical model by which to understand and teach many aspects of human intelligence, learning style, personality and behavior - in education and industry.

Howard Gardner initially developed his ideas and theory on multiple intelligences as a contribution to psychology, however Gardner's theory was soon embraced by education, teaching and training communities, for whom the appeal was immediate and irresistible - a sure sign that Gardner had created a classic reference work and learning model.

The theory of multiple intelligences differentiates human intelligence into specific 'modalities', rather than seeing intelligence as dominated by a single general ability. Howard Gardner proposed this model in his 1983 book Frames of Mind: The Theory of Multiple Intelligences. According to the theory, an intelligence 'modality' must fulfill eight criteria:

- Potential for brain isolation by brain damage,
- Place in evolutionary history,
- Presence of core operations,
- Susceptibility to encoding (symbolic expression),
- A distinct developmental progression,
- The existence of savants, prodigies and other exceptional people,
- Support from experimental psychology, and
- Support from psychometric findings.

Gardner proposed seven abilities that he held to meet these criteria:

- Musical-rhythmic,
- Visual-spatial,
- Verbal-linguistic,
- Logical-mathematical,
- Bodily-kinesthetic,
- Interpersonal,
- Intrapersonal.

He later suggested that existential and moral intelligences may also be worthy of inclusion.

Although the distinction between intelligences has been set out in great detail, Gardner opposes the idea of labeling learners to a specific intelligence. Gardner maintains that his theory should "empower learners", not restrict them to one modality of learning.

According to Gardner, an intelligence is "a bio psychological potential to process information that can be activated in a cultural setting to solve problems or create products that are of value in a culture."

According to a 2006 study, each of the domains proposed by Gardner involves a blend of the general g factor, cognitive abilities other than g, and, in some cases, non-cognitive abilities or personality characteristics.

Intelligence modalities are detailed as under;

Musicality: Musical-rhythmic and harmonic-This area has to do with sensitivity to sounds, rhythms, tones, and music. People with a high musical intelligence normally have good pitch and may even have absolute pitch, and are able to sing, play musical instruments, and compose music. They have sensitivity to rhythm, pitch, meter, tone, melody or timbre.

Spatial intelligence (psychology):Visual-spatial-This area deals with spatial judgment and the ability to visualize with the mind's eye. Spatial ability is one of the three factors beneath g in the hierarchical model of intelligence.

Linguistic intelligence: Verbal-linguistic-People with high verbal-linguistic intelligence display a facility with words and languages. They are typically good at reading, writing, telling stories and memorizing words along with dates. Verbal ability is one of the most g-loaded abilities. This type of intelligence is measured with the Verbal IQ in WAIS-IV.

Reason: Logical-mathematical-This area has to do with logic, abstractions, reasoning, numbers and critical thinking. This also has to do with having the capacity to understand the underlying principles of some kind of causal system. Logical reasoning is closely linked to fluid intelligence and to general intelligence (g factor).

Gross motor skill and Fine motor skill: Bodily-kinesthetic-The core elements of the bodily-kinesthetic intelligence are control of one's bodily motions and the capacity to handle objects skillfully. Gardner elaborates to say that this also includes a sense of timing, a clear sense of the goal of a physical action, along with the ability to train responses. People who have high bodily-kinesthetic intelligence should be generally good at physical activities such as sports, dance, acting, and making things. Gardner believes that careers that suit those with high bodily-kinesthetic intelligence include: athletes, dancers, musicians, actors, builders, police officers, and soldiers. Although these careers can be duplicated through virtual simulation, they will not produce the actual physical learning that is needed in this intelligence.

Social skills: Interpersonal-In theory, individuals who have high interpersonal intelligence are characterized by their sensitivity to others' moods, feelings, temperaments, motivations, and their ability to cooperate in order to work as part of a group. Those with high interpersonal intelligence communicate effectively and empathize easily with others, and may be either leaders or followers. They often enjoy discussion and debate." Gardner has equated this with emotional intelligence of Goleman. Gardner believes that careers that suit those with high interpersonal intelligence include sales persons, politicians, managers, teachers, lecturers, counselors and social workers.

Introspection: Intrapersonal-This area has to do with introspective and self-reflective capacities. This refers to having a deep understanding of the self; what one's strengths or weaknesses are, what makes one unique, being able to predict one's own reactions or emotions.

Naturalistic-Not part of Gardner's original seven, naturalistic intelligence was proposed by him in 1995. "If I were to rewrite Frames of Mind today, I would probably add an eighth intelligence – the intelligence of the naturalist. It seems to me that the individual who is readily able to recognize flora and fauna, to make other consequential distinctions in the natural world, and to use this ability productively (in hunting, in farming, in biological science) is exercising an important intelligence and one that is not adequately encompassed in the current list." This area has to do with nurturing and relating information to one's natural surroundings. Examples include classifying natural forms such as animal and plant species and rocks and mountain types. This ability was clearly of value in our evolutionary past as hunters, gatherers, and farmers; it continues to be central in such roles as botanist or chef. This sort of ecological receptiveness is deeply rooted in a "sensitive, ethical, and holistic understanding" of the world and its complexities – including the role of humanity within the greater ecosphere.

2. The innovators DNA:

In this article, Dyer, of Brigham Young University; Gregersen, of Insead; and Christensen, of Harvard Business School, reveal how innovative entrepreneurs differ from typical executives.

Most of us stand in awe of the work of visionary entrepreneurs such as Apple's Steve Jobs, Amazon's Jeff Bezos, eBay's Pierre Omidyar, and P&G's A.G. Lafley. How do these individuals come up with groundbreaking new ideas?

Their study demonstrates that five "discovery skills" distinguish the most creative executives: Associating helps them discover new directions by making connections among seemingly unrelated questions, problems, or ideas. Questioning allows innovators to break out of the status quo and consider new ideas. Through observing, innovators carefully and consistently look out for small behavioral details—in the activities of customers, suppliers, and other companies—to gain insights about new ways of doing things. In experimenting, they relentlessly try on new experiences and explore the world. And through networking with diverse individuals from an array of backgrounds, they gain radically different perspectives.

The Idea in Brief

The habits of Steve Jobs, Jeff Bezos, and other innovative CEOs reveal much about the underpinnings of their creative thinking. Research shows that five discovery skills distinguish the most innovative entrepreneurs from other executives (i.e) associating, questioning, observing, experimenting, and networking. We found that innovative entrepreneurs (who are also CEOs) spend 50% more time on these discovery activities than do CEOs with no track record for innovation. Together, these skills make up what we call the innovator's DNA. And the good news is, if you're not born with it, you can cultivate it.

What Makes Innovators Different?

Innovative entrepreneurs have something called creative intelligence, which enables discovery yet differs from other types of intelligence (as suggested by Howard Gardner's theory of multiple intelligences). It is more than the cognitive skill of being right-brained. Innovators engage both sides of the brain as they leverage the five discovery skills to create new ideas.

In thinking about how these skills work together, we've found it useful to apply the metaphor of DNA. Associating is like the backbone structure of DNA's double helix; four patterns of action (questioning, observing, experimenting, and networking) wind around this backbone, helping to cultivate new insights. And just as each person's physical DNA is unique, each individual we studied had a unique innovator's DNA for generating breakthrough business ideas.

Innovative entrepreneurs acquired and honed their innovation skills precisely this way. Let's look at the skills in detail.

Discovery Skill 1: Associating-Associating, or the ability to successfully connect seemingly unrelated questions, problems, or ideas from different fields, is central to the innovator's DNA. To grasp how associating works, it is important to understand how the brain operates. The brain doesn't store information like a dictionary, where you can find the word "theater" under the letter "T." Instead, it associates the word "theater" with any number of experiences from our lives. Some of these are logical ("West End" or "intermission"), while others may be less obvious (perhaps "anxiety," from a botched performance in high school). The more diverse our experience and knowledge, the more connections the brain can make. Fresh inputs trigger new associations; for some, these lead to novel ideas. As Steve Jobs has frequently observed, "Creativity is connecting things." The world's most innovative companies prosper by capitalizing on the divergent associations of their founders, executives, and employees. For example, Pierre Omidyar launched eBay in 1996 after linking three unconnected dots: (1) a fascination with creating more-efficient markets, after having been shut out from a hot internet company's IPO in the mid-1990s; (2) his fiancée's desire to locate hard-to-find collectible Pez dispensers; and (3) the ineffectiveness of local classified ads in locating such items. Likewise, Steve Jobs is able to generate idea after idea because he has spent a lifetime exploring new and unrelated things—the art of calligraphy, meditation practices in an Indian ashram, the fine details of a Mercedes-Benz. Associating is like a mental muscle that can grow stronger by using the other discovery skills. As innovators engage in those behaviors, they build their ability to generate ideas that can be recombined in new ways. The more frequently people in our study attempted to understand, categorize, and store new knowledge, the more easily their brains could naturally and consistently make, store, and recombine associations.

Discovery Skill 2: Questioning-More than 50 years ago, Peter Drucker described the power of provocative questions. "The important and difficult job is never to find the right answers, it is to find the right question," he wrote. Innovators constantly ask questions that challenge common wisdom or, as Tata Group chairman Ratan Tata puts it, "question the unquestionable." Meg Whitman, former CEO of eBay, has worked directly with a number of innovative entrepreneurs, including the founders of eBay, PayPal, and Skype. "They get a kick out of screwing up the status quo," she told us. "They can't bear it. So they spend a tremendous amount of time thinking about how to change the world. And as they brainstorm, they like to ask: 'If we did this, what would happen?' Most of the innovative entrepreneurs could remember the specific questions they were asking at the time they had the inspiration for a new venture. Michael Dell, for instance, told that his idea for founding Dell Computer sprang from his asking why a computer cost five times as much as the sum of its parts. "I would take computers apart…and would observe that $600 worth of parts were sold for $3,000." In chewing over the question, he hit on his revolutionary business model. To question effectively, innovative entrepreneurs do the following: Ask "Why?" and "Why not?" and "What if?" Most managers focus on understanding how to make existing processes—the status quo—work a little better ("How can we improve widget sales in Taiwan?"). Innovative entrepreneurs, on the other hand, are much more likely to challenge assumptions ("If we cut the size or weight of the widget in half, how would that change

the value proposition it offers?"). Imagine opposites-In his book The Opposable Mind, Roger Martin writes that innovative thinkers have "the capacity to hold two diametrically opposing ideas in their heads." He explains, "Without panicking or simply settling for one alternative or the other, they're able to produce a synthesis that is superior to either opposing idea." Innovative entrepreneurs like to play devil's advocate. "My learning process has always been about disagreeing with what I'm being told and taking the opposite position, and pushing others to really justify themselves," Pierre Omidyar. Embrace constraints-Most of us impose constraints on our thinking only when forced to deal with real-world limitations, such as resource allocations or technology restrictions. Ironically, great questions actively impose constraints on our thinking and serve as a catalyst for out-of-the-box insights. (In fact, one of Google's nine innovation principles is "Creativity loves constraint.")

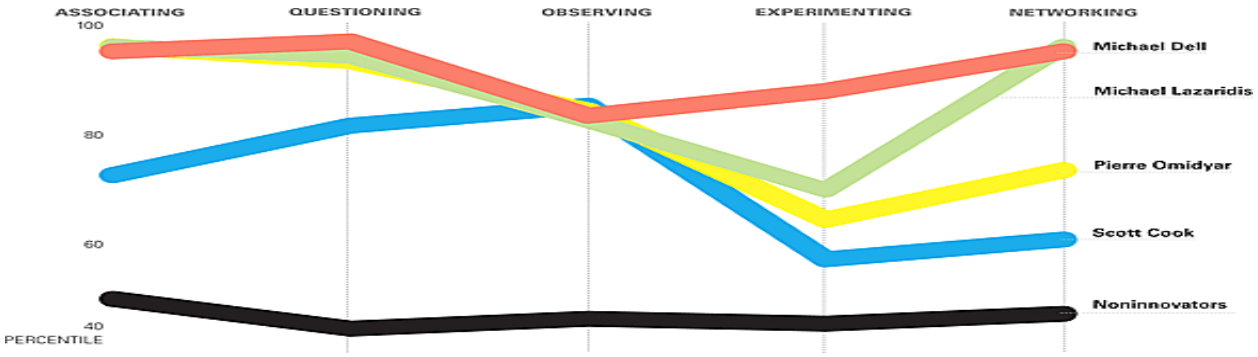
Discovery Skill 3: Observing- this driven executives produce uncommon business ideas by scrutinizing common phenomena, particularly the behavior of potential customers. In observing others, they act like anthropologists and social scientists. Intuit founder Scott Cook hit on the idea for Quicken financial software after two key observations. First he watched his wife's frustration as she struggled to keep track of their finances. "Often the surprises that lead to new business ideas come from watching other people work and live their normal lives," Cook explained. "You see something and ask, 'Why do they do that? That doesn't make sense.'" Then a buddy got him a sneak peek at the Apple Lisa before it launched. Immediately after leaving Apple headquarters, Cook drove to the nearest restaurant to write down everything he had noticed about the Lisa. His observations prompted insights such as building the graphical user interface to look just like its real-world counterpart (a checkbook, for example), making it easy for people to use it. So Cook set about solving his wife's problem and grabbed 50% of the market for financial software in the first year. Innovators carefully, intentionally, and consistently look out for small behavioral details—in the activities of customers, suppliers, and other companies—in order to gain insights about new ways of doing things. Ratan Tata got the inspiration that led to the world's cheapest car by observing the plight of a family of four packed onto a single motorized scooter. After years of product development, Tata Group launched in 2009 the $2,500 Nano using a modular production method that may disrupt the entire automobile distribution system in India. Observers try all sorts of techniques to see the world in a different light. Akio Toyoda regularly practices Toyota's philosophy of genchi genbutsu—"going to the spot and seeing for yourself." Frequent direct observation is baked into the Toyota culture.

Discovery Skill 4: Experimenting-When we think of experiments, we think of scientists in white coats or of great inventors like Thomas Edison. Like scientists, innovative entrepreneurs actively try out new ideas by creating prototypes and launching pilots. (As Edison said, "I haven't failed. I've simply found 10,000 ways that do not work.") The world is their laboratory. Unlike observers, who intensely watch the world, experimenters construct interactive experiences and try to provoke unorthodox responses to see what insights emerge. The innovative entrepreneurs all engaged in some form of active experimentation, whether it was intellectual exploration (Michael Lazaridis mulling over the theory of relativity in high school), physical tinkering (Jeff Bezos taking apart his crib as a toddler or Steve Jobs disassembling a Sony Walkman), or engagement in new surroundings (Starbucks founder Howard Shultz roaming Italy visiting coffee bars). As executives of innovative enterprises, they make experimentation central to everything they do. Bezos's online bookstore didn't stay where it was after its initial success; it morphed into an online discount retailer, selling a full line of products from toys to TVs to home appliances. The electronic reader Kindle is an experiment that is now transforming Amazon from an online retailer to an innovative electronics manufacturer. Bezos sees experimentation as so critical to innovation that he has institutionalized it at Amazon. "I encourage our employees to go

down blind alleys and experiment," Bezos says. "If we can get processes decentralized so that we can do a lot of experiments without it being very costly, we'll get a lot more innovation." Scott Cook, too, stresses the importance of creating a culture that fosters experimentation. "Our culture opens us to allowing lots of failures while harvesting the learning," "It's what separates an innovation culture from a normal corporate culture."

Discovery Skill 5: Networking-Devoting time and energy to finding and testing ideas through a network of diverse individuals gives innovators a radically different perspective. Unlike most executives—who network to access resources, to sell themselves or their companies, or to boost their careers—innovative entrepreneurs go out of their way to meet people with different kinds of ideas and perspectives to extend their own knowledge domains. To this end, they make a conscious effort to visit other countries and meet people from other walks of life. They also attend idea conferences such as Technology, Entertainment, and Design (TED), Davos, and the Aspen Ideas Festival. Such conferences draw together artists, entrepreneurs, academics, politicians, adventurers, scientists, and thinkers from all over the world, who come to present their newest ideas, passions, and projects. Michael Lazaridis, the founder of Research In Motion, notes that the inspiration for the original BlackBerry occurred at a conference in 1987. A speaker was describing a wireless data system that had been designed for Coke; it allowed vending machines to send a signal when they needed refilling. "That's when it hit me," Lazaridis recalls. "I remembered what my teacher said in high school: 'Don't get too caught up with computers because the person that puts wireless technology and computers together is going to make a big difference.'" David Neeleman came up with key ideas for JetBlue—such as satellite TV at every seat and at-home reservationists—through networking at conferences and elsewhere. Kent Bowen, the founding scientist of CPS technologies (maker of an innovative ceramic composite), hung the following credo in every office of his start-up: "The insights required to solve many of our most challenging problems come from outside our industry and scientific field. We must aggressively and proudly incorporate into our work findings and advances which were not invented here." Scientists from CPS have solved numerous complex problems by talking with people in other fields. One expert from Polaroid with in-depth knowledge of film technology knew how to make the ceramic composite stronger. Experts in sperm-freezing technology knew how to prevent ice crystal growth on cells during freezing, a technique that CPS applied to its manufacturing process with stunning success.

How Innovators Stack Up-This chart shows how four well-known innovative entrepreneurs rank on each of the discovery skills. All our high-profile innovators scored above the 80th percentile on questioning, yet each combined the discovery skills uniquely to forge new insights.



Why do innovators question, observe, experiment, and network more than typical executives? what motivates them, it is discovered two common themes: (1) They actively desire to change the status quo, and (2) they regularly take risks to make that change happen. consistency of language that innovators use to describe their motives. Jeff Bezos wants to "make history," Steve Jobs to "put a ding in the universe," Skype cofounder Niklas Zennström to "be disruptive, but in the cause of making the world a better place." These innovators steer entirely clear of a common cognitive bias called the status quo bias—the tendency to prefer an existing state of affairs to alternative ones. Embracing a mission for change makes it much easier to take risks and make mistakes. For most of the innovative entrepreneurs, mistakes are nothing to be ashamed of; in fact, they are expected as a cost of doing business. "If the people running Amazon.com don't make some significant mistakes," explained Bezos, "then we won't be doing a good job for our shareholders because we won't be swinging for the fences." In short, innovators rely on their "courage to innovate"—an active bias against the status quo and an unflinching willingness to take risks—to transform ideas into powerful impact.

As innovators actively engage in the discovery skills, they become defined by them. They grow increasingly confident of their creative abilities. For A.G. Lafley, innovation is the central job of every leader, regardless of the place he or she occupies on the organizational chart. But what if you—like most executives—don't see yourself or those on your team as particularly innovative? Though innovative thinking may be innate to some, it can also be developed and strengthened through practice. This requires putting aside time for you and your team to actively cultivate more creative ideas. The most important skill to practice is questioning. Asking "Why" and "Why not" can help turbocharge the other discovery skills. Ask questions that both impose and eliminate constraints; this will help you see a problem or opportunity from a different angle. Try spending 15 to 30 minutes each day writing down 10 new questions that challenge the status quo in your company or industry. To sharpen observational skills, watch how certain customers experience a product or service in their natural environment. To strengthen experimentation, at both the individual and organizational levels, consciously approach work and life with a hypothesis-testing mind-set. Attend seminars or executive education courses on topics outside your area of expertise; take apart a product or process that interests you; read books that purport to identify emerging trends. Develop new hypotheses from the knowledge you've acquired and test them in the search for new products or processes. Find ways to institutionalize frequent, small experiments at all levels of the organization. Openly acknowledging that learning through failure is valuable goes a long way toward building an innovative culture. Try spending 15 to 30 minutes each day writing down questions that challenge the status quo in your company. To improve networking skills, contact the five most creative people and ask them to share what they do to stimulate creative thinking. They may be willing to act as your creative mentors. holding regular idea lunches at which meeting a few new people from diverse functions, companies, industries, or countries. Innovative entrepreneurship is not a genetic predisposition, it is an active endeavor. Apple's slogan "Think Different" is inspiring but incomplete. We found that innovators must consistently act different to think different. By understanding, reinforcing, and modeling the innovator's DNA, companies can find ways to more successfully develop the creative spark in everyone.

3. https://futureoflife.org/background/benefits-risks-of-artificial-intelligence/?cn-reloaded=1&cn-reloaded=1

Most researchers agree that a super intelligent AI is unlikely to exhibit human emotions like love or hate, and that there is no reason to expect AI to become intentionally benevolent or malevolent. Instead, when considering how AI might become a risk, experts think two scenarios most likely:

The AI is programmed to do something devastating: Autonomous weapons are artificial intelligence systems that are programmed to kill. In the hands of the wrong person, these weapons could easily cause mass casualties. Moreover, an AI arms race could inadvertently lead to an AI war that also results in mass casualties. To avoid being thwarted by the enemy, these weapons would be designed to be extremely difficult to simply "turn off," so humans could plausibly lose control of such a situation. This risk is one that's present even with narrow AI, but grows as levels of AI intelligence and autonomy increase.

The AI is programmed to do something beneficial, but it develops a destructive method for achieving its goal: This can happen whenever we fail to fully align the AI's goals with ours, which is strikingly difficult. If you ask an obedient intelligent car to take you to the airport as fast as possible, it might get you there chased by helicopters and covered in vomit, doing not what you wanted but literally what you asked for. If a super intelligent system is tasked with a ambitious geoengineering project, it might wreak havoc with our ecosystem as a side effect, and view human attempts to stop it as a threat to be met.

4. A Vision for Responsible Participant Design:

The IEEE Standards Association (IEEE-SA) and the MIT Media Lab are joining forces to launch a global Council on Extended Intelligence (CXI) composed of individuals who agree on the following:

One of the most powerful narratives of modern times is the story of scientific and technological progress. While our future will undoubtedly be shaped by the use of existing and emerging technologies – in particular, of autonomous and intelligent systems (A/IS) – there is no guarantee that progress defined by "the next" is beneficial. Growth for humanity's future should not be defined by reductionist ideas of speed or size alone but as the holistic evolution of our species in positive alignment with the environmental and other systems comprising the modern algorithmic world. We believe all systems must be responsibly created to best utilize science and technology for tangible social and ethical progress. Individuals, businesses and communities involved in the development and deployment of autonomous and intelligent technologies should mitigate predictable risks at the inception and design phase and not as an afterthought. This will help ensure these systems are created in such a way that their outcomes are beneficial to society, culture and the environment. Autonomous and intelligent technologies also need to be created via participatory design, where systems thinking can help us avoid repeating past failures stemming from attempts to control and govern the complex-adaptive systems we are part of. Responsible living with or in the systems we are part of requires an awareness of the constrictive paradigms we operate in today. Our future practices will be shaped by our individual and collective imaginations and by the stories we tell about who we are and what we desire, for ourselves and the societies in which we live. These stories must move beyond the "us versus them" media mentality pitting humans against machines. Autonomous and intelligent technologies have the potential to enhance our personal and social skills; they are much more fully integrated and less discrete than the term "artificial intelligence" implies. And while this process may enlarge our cognitive intelligence or make certain individuals or groups more powerful, it does not necessarily make our systems more stable or socially beneficial. This is why: "Instead of thinking about machine intelligence in terms of humans vs. machines, we should consider the system that integrates humans and machines—not artificial intelligence, but extended intelligence. Instead of trying to control or design or even understand systems, it is more important to design systems that participate as responsible, aware and robust elements of even more complex systems. And we must question and adapt our own purpose and sensibilities as designers and components of the system for a much more humble approach: Humility

over Control." We cannot create sound governance for autonomous and intelligent systems in the Algorithmic Age while utilizing reductionist methodologies. By proliferating the ideals of responsible participant design, data symmetry and metrics of economic prosperity prioritizing people and the planet over profit and productivity, The Council on Extended Intelligence will work to transform reductionist thinking of the past to prepare for a flourishing future.

Research Methodology

The knowledge gained from Books, training, discussion with relevant experts of various fields, attending events/forums, social media, internet, desktop research, etc.

Findings

The risk of AI posing threats to future human life is an assumption. However, probability of such situation may arrive in near time due to the exponential growth of technological development.

Possible Risks of AI are detailed as under;

- AI is capable of performing tasks that would once have required intensive human labor. It may fill human places for the jobs. Even though at this stage of AI technologies, which is called weak AI, it is assumed to affect more on unskilled workers/labors.
- It may go destruction mode if malfunctioned automatically. Another Concern is the dangers autonomous weapons might have with an individual or government that doesn't value human life. Once deployed, they will likely be difficult to dismantle or combat.
- AI is going forward for more mimicking human intelligence, in such cases human values will decrease further.
- By spreading propaganda to individuals identified through algorithms and personal data, AI can target them and spread whatever information they like, in whatever format they will find most convincing—fact or fiction
- Invasion of privacy can quickly turn to social oppression.
- Goals may be accomplished with ethical breach if not coded properly.it may lead to social, economic damages.
- Since machines can collect, track and analyze so much about you, it's very possible for those machines to use that information against you.
- For example, it is believed that Facebook's newsfeed algorithm influenced an election outcome that affected geopolitics.
- When machine intelligence exceeds our ability to understand it, or it becomes superior intelligence, we should take care to not blindly follow its recommendation and absolve ourselves of all responsibility.
- Phishing scams could get even worse

- Hackers start using AI like financial firms
- Fake news and propaganda is only going to get worse
- Fears of a robot apocalypse mask the actual problems that we face by increasingly letting our lives be run by algorithms
- The two main concerns that the fear-mongers raise are around AI leading to job losses in the society and AI going rogue and taking control of the human race.

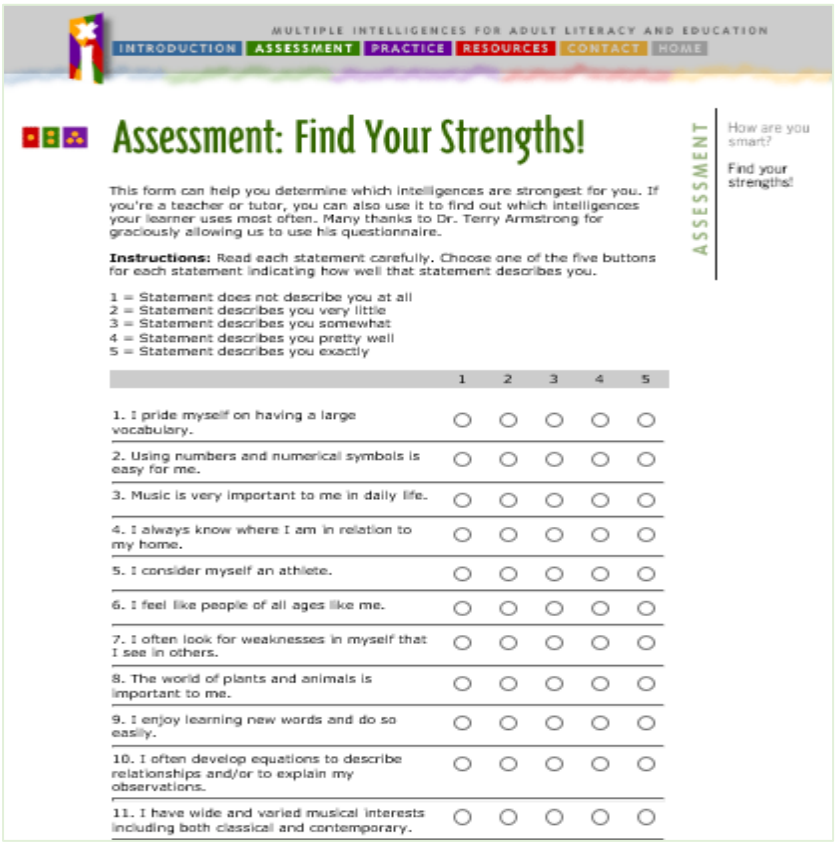
This is the stage we have to incorporate some of the traditional theories to inhibit in to latest technologies in order to advance human capabilities & intelligence against machines.

Traditional theories as described in the literature review such as gardeners multiple intelligence, innovators DNA could be base for identifying the human intelligence & capabilities levels and add on intelligence could be inhibited with the advanced technologies such as artificial intelligence, deep learning, advanced materials, etc.,

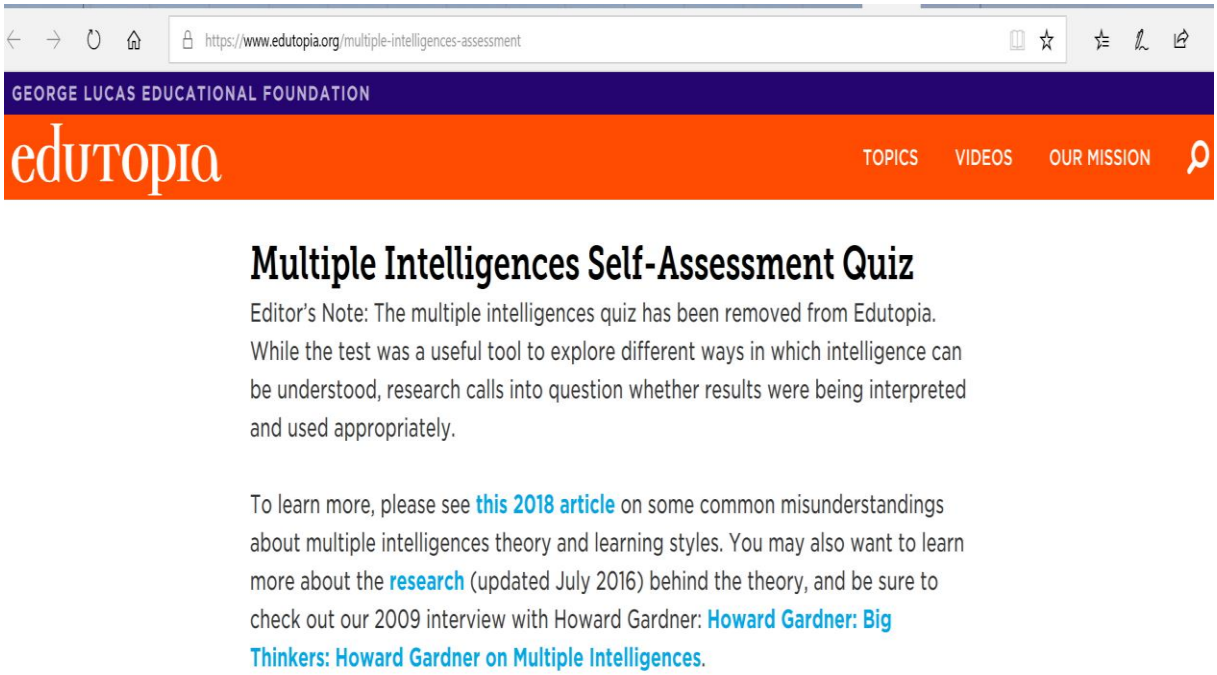
There are traditional tests available as detailed below for identification of human intelligence level as per garderners MI theory & innovators DNA method.

Any individual can assess their intelligence level against garders multiple intelligence theory. The test sample questions are appended as below;

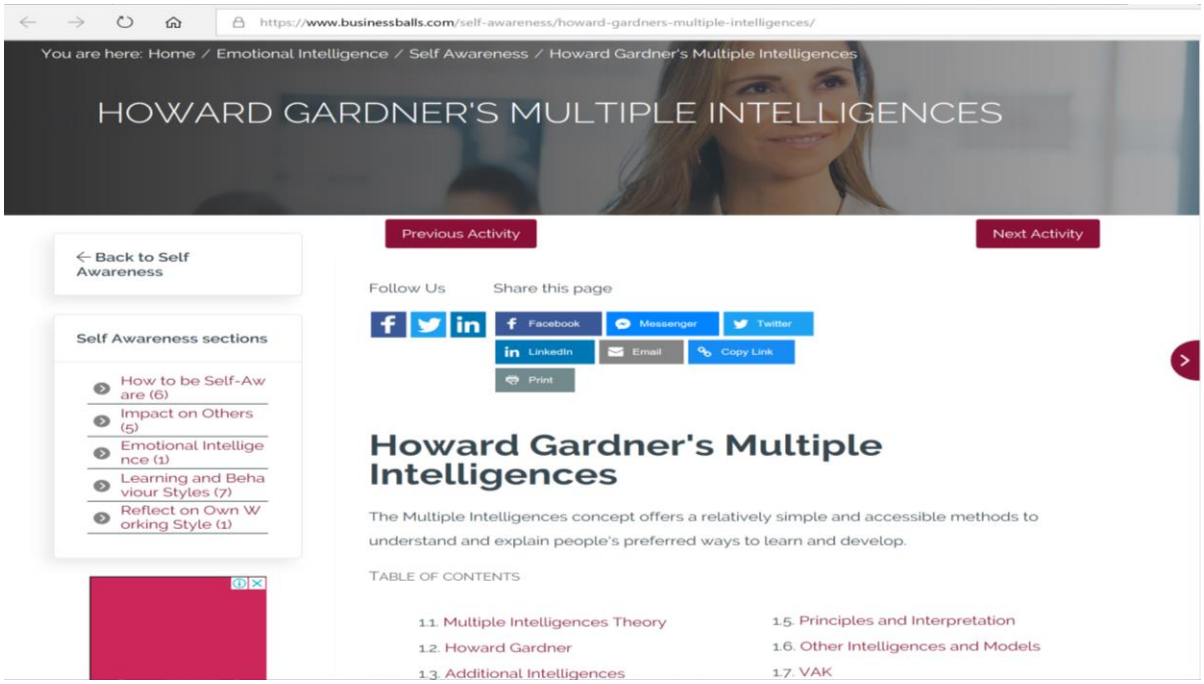
http://literacynet.org/mi/assessment/findyourstrengths.html



https://www.edutopia.org/multiple-intelligences-assessment

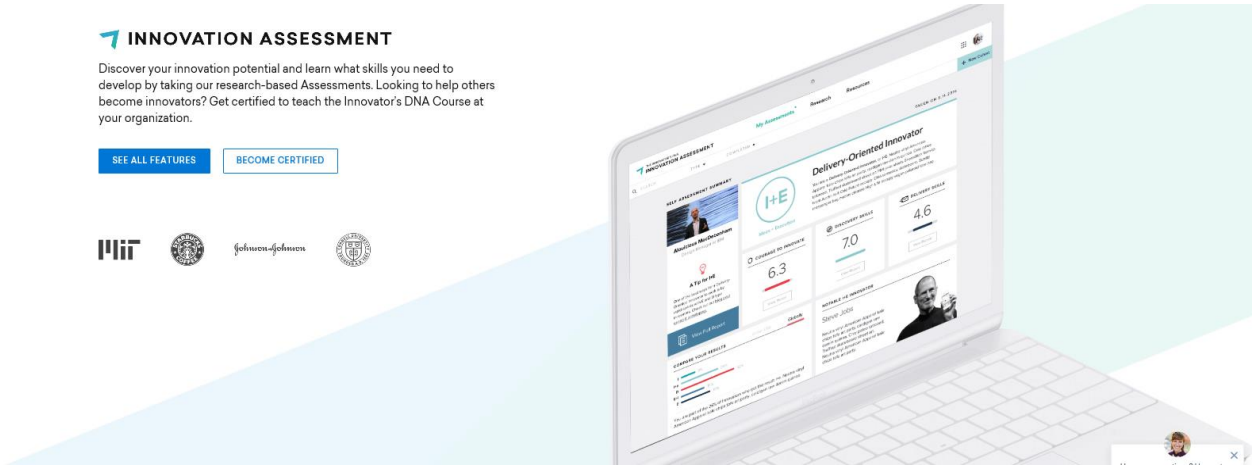


https://www.businessballs.com/self-awareness/howard-gardners-multiple-intelligences/



As part of capabilities, human capabilities can be tested with another connectedness called innovators DNA test. As human capabilities require more innovative skills further to Garderners test, innovators DNA test could be done which is described as below

https://www.innovatorsdna.com/



POMAT Chart

The POMAT Chart

INTELLIGENCES	POMAT				
	Procedure	Objective	Materials	Assessment	Technology
Verbal					
Logical	✓	✓	✓	✓	✓
Visual	✓		✓		✓
Kinesthetic	✓	✓	✓		✓
Musical					
Intrapersonal				✓	
Interpersonal	✓				
Naturalist	✓			✓	
Existential					
NOTES	Organizing, building, measuring, problem solving, working in groups	Problem solving and building	Hand tools, rulers, balsa wood, nails, screws, safety goggles, information books, paper, pencils	Driving 12-pound remote control truck over bridge; identifying the best bridge designs	Hand tools, rulers, nails, screws, remote control trucks

Development of add on intelligence programs stages includes but not limited to;

- Government Centre for identifying the need for the purpose the Human to surpass Machines.
- Applying Multiple Intelligence/Innovators DNA theory to identifying the Gap and required intelligence.
- Developing Required Interfaces through electronic chips, advanced materials, sensors, actuators, artificial limp, etc.,
- Choosing & Developing the required technology such as AI, Machine/Deep Learning, Block Chain, Quantum Computing, Bots, etc.,
- Creating new Add on Intelligence & Capabilities for the Human.

One of the use case example is described as under;

One of the threat posing by AI is job loss for the unskilled labors due to increased amount of automation/bots/robots with AI. Now, what will happen to such huge amount of labor force. Here it is the time the government to make policies for the labor protection and the policies will govern with the approaches. The approaches to include the test for the identification of intelligence level of labors

through the traditional Garderner's MI theory to identify for the gaps in intelligence and government to make plans for the add on intelligence through modern technologies to them. For an example labors could be added with the bodily kinesthetic intelligence embedding through sensors, robotics arms, etc., so instead of going for full automation with other social/security threats, we may go for semi automation through add on intelligence for labor force.

Another use case example is described as under;

We may leave the repetitive jobs/tasks to the machines as human are born with capability of creativity. In such case, human's creativity to be enhanced with add on intelligence by identifying the gaps through innovators DNA method and add on intelligence through electronics chips & sensors. So that, human could not do blindly believe on fully automated AI systems and they will have new intelligence/capabilities to check the machines results and to rule the world through super intelligence.

So here the point is that the futuristic technological development should have the complete design & vision as human centric not as machine centric. The current AI scope can be relooked & reshaped to turn around from machine centric to human centric based human-machine systems. The advanced development systems/apps towards empowering the machines could be used to further empower the human than machines. Example creating a chat bot during unavailability of human is essential wherein creating complete mimic of human is sometime leads to thinking as luxury. However, the advanced efforts/coding/apps/systems taken to mimic human intelligence can be reprocessed to inhibit in to human whichever required such as memory storage, advanced processing, speed, durability, etc.

Implication for Future Research

It can be tested & implemented for the purpose of;

1. To empower human to make them as super intelligence, knowledge intelligence
2. To support physical & mental disabilities through add on intelligence & capabilities.
3. To Support Elders for the life saving purposes
4. To Support well being of human i) one of its kind that is addiction to bad behaviors, ii) Disease due to improper food intake, environmental conditions, etc.,
5. To Support kids which is require complete educational reformation.
6. To Support women well being in the aspect of safety & protection.

All above applications can be done through;

- Identification of gaps through MI theory/innovators DNA test.
- Connecting electronics to human neurons to augment the brain and our nervous system.
- Using machine learning to understand brains and to leverage that knowledge to enhance required individual as an add on intelligence.
- Developing humans and machine interfaces.
- Developing wearable interfaces, Sensors and actuators.

References

1. Howard Gardner's Multiple Intelligence Theory published in Howard Gardner's book, Frames Of Mind (1983).
2. The Innovator's DNA by Jeffrey H. Dyer, Hal Gregersen, and Clayton M. Christensen
3. https://globalcxi.org/#vision
4. https://futureoflife.org/background/benefits-risks-of-artificial-intelligence/?cn-reloaded=1&cn-reloaded=1
5. http://fortune.com/2018/02/21/artificial-intelligence-oxford-cambridge-report/
6. https://hbr.org/2009/12/the-innovators-dna
7. ^ *Gilman, Lynn (2012) [2008].* "The Theory of Multiple Intelligences". *Indiana University. Archived from* the original *on 25 November 2012*. Retrieved 14 November 2012.
8. http://literacynet.org/mi/assessment/findyourstrengths.html
9. https://www.businessballs.com/self-awareness/howard-gardners-multiple-intelligences/
10. https://www.businessballs.com/self-awareness/howard-gardners-multiple-intelligences/
11. https://www.innovatorsdna.com/
12. Multiple Intelligences and Instructional Technology By Walter McKenzie

Intelligent Self-Alarm Device

Aisha Ahmed Khalfan Alyileili
Canadian University Dubai, UAE.

Keywords

Intelligent self-alarm, Smart City, Public Safety

Abstract

The intelligent self-alarm system is an ideal solution to eliminate fire before it occurs, which is one of the most important priorities of the UAE and its aspirations to preserve the human element and the development of smart cities. UAE is intensifying these efforts to explore the future and find a radical solution to this phenomenon which cause a lot of physical and human losses. This imagine of how the intelligent self-alarm device will be look like is expected will be present in future within approximately by 5-10 years as envisaged by UAE to innovate the future. The objective of this paper is to explore the future of smart self-alarm system, which is shown today in the form of a warning device only. The intelligent self-alarm device, which will be highly sensitive to measure the components of the three fire triangle (heat, oxygen, and fuel), this device measures the three components, which must be balanced in a particular place. For example, if the oxygen level in a room is high with increasing in temperature and fuel, the device releases carbon dioxide to prevent the reaction of these three substances with each other and prevent ignition of fire. In addition to providing an initial study on the impact of the entry of this technology and measuring the impact of their uses socially, technologically, economically, environmentally, politically and its positive and negative effects of each and that have been simplified in the future wheel. To provide a good idea for a sustainable green future these effects were analyzed on SWOT Analysis form to measure strengthens weaknesses, opportunities, and threats. To measure these points and to stick to its strengths and improve the weaknesses ones, and to exploit opportunities to benefit from them and to develop scenarios to face their potential challenges. The method used to predict the future of intelligent self-alarm device is to create a model for the future image of this system and determine its exact characteristics such as determining the accuracy and sensitivity of the device to be able to identify the concentration of each fire triangle element and to determine the exact amount of needed material to be released to avoid fire ignition. All this accurate information needs high sensitivity devices that are carefully programmed to provide high quality service that safe public life. The most important results of this intelligent self-alarm device are that it will preserve the lives of people by preventing sudden fires, as well as maintains the government effort and time to extinguish the simple fires, and will give the public more sense of security and safety.

Introduction

Fire is a chemical reaction that occurs as a result of rapid oxidation of three substances that are required to be located somewhere to cause the fire, namely: oxygen, heat, fuel. This report firstly will discuss the fire types, methods used to limit them, UAE efforts to deal with them, and the current alarm system, which is limited to sending voice and light alerts, which only used to alert individuals to the presence of fire in a given location. Secondly it will discuss an innovative solution for the intelligent self-alarm system, the mechanism used to reduce these fires and eliminate them even before the start. For further safety, they may connected to mobile devices for individuals or the owner of the housing, as well as to

the civil defense teams to send alerts when the actual fire. The idea of this research came from GPS CHEMOIL Company where they surround petrochemicals tanks with water pipes in case of fire these pipes will push water to try cooling this tank and prevent transfer it to the near tanks.

Methodology

This study is based on secondary data collected from articles, research papers, English and Arabic Books related to Fire types, alarm system, and Efforts to reducing its losses. The data was verified and extracted from reputable sources like the Ministry of Interior website, and their utilization would help us understand and analysis the principle data. This research is based more on the skills gained from the study of Diploma in Innovation and Governmental Accelerators presented by Hamdan Bin Mohammed Smart University. And websites used only to gather some basic public information.

Literature Review

Fire pyramid consists of three main components: oxygen, heat, and fuel. Oxygen: a gas that is present in the air and is the oxidizing factor in most fires and is similar in all places and all conditions, whether pressed or normal. Air contains 21% of the oxygen and to ignite the material should not be less than the proportion of oxygen in the vicinity of the fire about 14%. Heat: can get it in nature in various forms such as heat radiation from sunbeam, candle, spark, friction, and electrical energy. Fuel: It is flammable material, whatever its nature and configured, and comes in three forms: solid like wood, paper, cloth, etc., liquid and semi-liquid such as grease of all kinds, oils, gasoline, alcohol, etc., or gas such as butane, ethylene, methane, etc.

When the flammable material is oxidized and coupled with oxygen at a certain temperature, this will cause chemical reactions to form, which in turn will ignite the fire.

The causes of these fires may vary between human causes and natural causes (which are caused by natural factors that have no human input).

- Human Causes: That caused by either the human or either negligence
- Natural Causes: Such as fires caused by lightning, or friction for example

Natural causes can’t be controlled or predicted by God's command and unexpected occurrence, while the human causes can be avoided or minimized by the establishment of some precautionary and preventive requirements.

Fire-Fighting

Table 1. Fire Types and Suitable Fire-Fighting Methods.

Fire Type	Suitable Fire-Fighting Methods

Class A Common Solids	Water , Foam
Class B Flammable Liquids	Foam , Carbon Dioxide
Class C Gases Fire	Oxygen
Class D Metals Fire	Dry Powder
Class E Electrical Fires	Carbon Dioxide

Table1, summarize fire types and methods used to extinguish them vary which depends on the materials and the reactants that cause the fire. Studies have agreed to classify fires in four categories:

- Class A: fires involve solid materials of an organic nature such as wood, paper, cloth, rubber and plastics that do not melt.
- Class B: fires involve liquids. They include petrol, diesel, thinners, oils, paints, wax, cooking fat and plastics that melt.
- Class C: fires involve electricity.
- Class D: fires involve flammable metals such as magnesium, aluminum, titanium, sodium and potassium.
- Class E: fires involving live electrical apparatus.

Each category has a different fire-fighting method, as the suitable method for Class A is the water to isolate fire from burnt materials of cloth or wood for example. While for Class B flammable liquids fires can be used Foams and Carbon Dioxide. For Gases fires Class C, the suitable method to put it out is using oxygen extinguishers. Class D Metals fires can be used dry powder, and for Class E Electrical fires the best method is Carbon Dioxide extinguishers.

Normal Alarm System

It's a device that triggers a warning in the event of a fire to alert individuals in order to evacuate the area or a certain building. The main purpose of the fire alarm system is the speed of response to the fire and then turns this early response to an audio and visual signal to alert the individual or group of individuals in the building or place or the relief or fire station that there is a fire in its early stages. This device is only for warning and it helps reduce losses due to early detection of fire.

UAE Efforts

The UAE sets strict rules for the approval of building permits, which are concerned with security and safety requirements for improvement places such as commercial malls, hospitals, schools and universities where the addition of emergency and safety exits is adopted. They are also required to provide staffs to monitor and maintain these devices periodically. Recently launched HASSANTUK initiative, which aims to guide people to register their houses and connect the alarms in these buildings with control center, which takes 120 minutes to detect the fire, its type, and determine the location to send civil defense to deal with it. The UAE also seeks to encourage and attract innovations to improve

the level of cities and develop them into smart cities through the launch of initiatives and programs such as the initiative of one million Arab Programmer as well as the Innovation Arabia conference.

Innovation Solution

With the developments witnessed by the United Arab Emirates and based on the vision of the UAE 2031 to transform it into a smart country to improve public services and its sustainability, an innovative solution must be reached with highly efficiency and with its positive effects on the country and society, which can be simplified in the Intelligent Self-Alarm Device. It is a high sensitivity device that measures the level of the three components of the fire triangle (oxygen, heat, and fuel) and the possibility of a fire, where if the high probability of fire; this device will releasing quickly material may reduce this possibility. The mechanism of this device, what material it can launch, when and how, all these details will be discussed in Section 3.4 Mechanism.

Intelligent self-alarm device Processing Flow Chart

Figure1, present flow chart about the device processing and all the possibilities that can occur. The first four possibilities are either high heat only, high oxygen rate only, or high concentration of the substance only, or all three elements in their normal state. These conditions do not pose a risk or possibility of fire even if a simple probability. This is because none of the three materials are likely to react, so the possibility of the fire is completely excluded. But for the fifth to seventh conditions, the probability of the fire is moderate due to the rise of two main elements to ignite the fire, and in this case do not have to worry because the third element is present at a normal rate, which will not react and its existence will not pose a danger or cause a fire except in only one case, if its increasing rate is rapid and abnormal. While the last case, which is considered very dangerous, is the high rate of the three substances above the normal range, so the probability of the fire is very large and show the usefulness of the Intelligent Self-Alarm Device to intervene and determine which of the three materials with a higher concentration than the rest. For example, if the oxygen rate is greater than the rest, the device will release carbon dioxide in a precise amount, which aims to achieve balance and to restore the level of oxygen to the acceptable rate and prevents interaction. In case of the temperature is the highest, the device will cool the place and ventilation to eliminate any possibility of the fire. As for fuel, it may be somewhat complicated, or its quality may hinder its level of concentration. For example, it may be wood or solid materials. Even if identified for example, if they are identified as petrochemicals and have a high concentration, it is not possible to launch an opposite material to achieve equilibrium. So it may better to rely more on oxygen and heat concentration and deal with them.

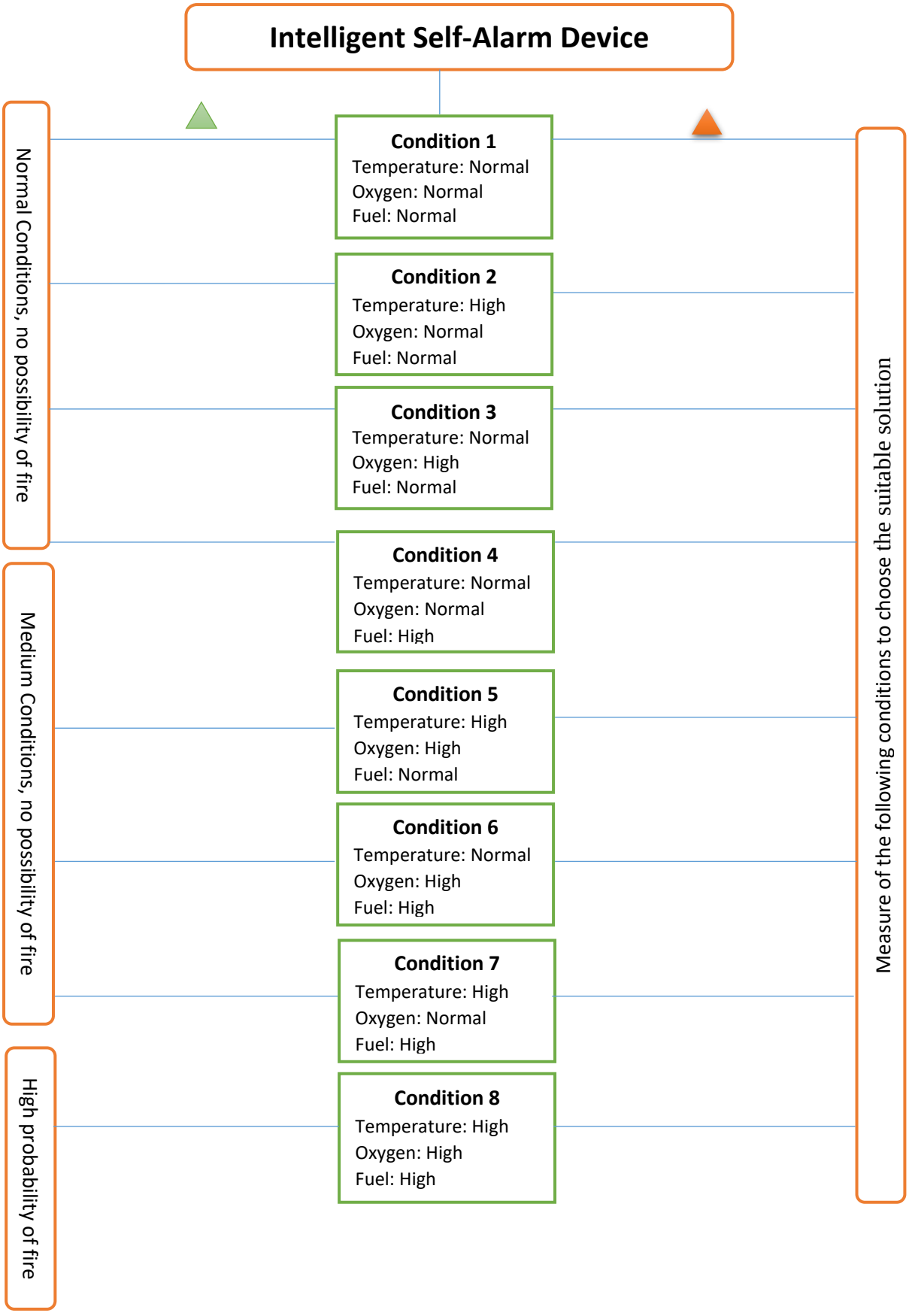


Figure 1. Intelligent Self-Alarm Device Processing Flow Chart.

Alarm Design

Figure 2, a simple diagram about how the alarm is look like. The design of the external device consists of two adjacent layers with a rectangular shape. The first layer contains three cylindrical outputs in a parallel way with a circular base of both directions in the horizontal position. Estimated initial dimensions are 60 cm length, 40 cm width, and 15 cm height.

The second layer consists of a high sensitivity device divided into 3 parts, one measuring the temperature, part measuring oxygen, and part measuring the fuel. Size of this layer is approximately 15% of the size of the first layer and is placed on the left side of the device, at a distance of 45 cm from the front. Its estimated length is 9 cm, 6 cm for the width, and 2.25 cm for the height.

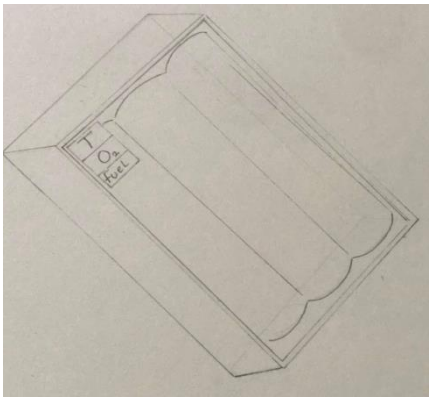


Figure 2. Alarm Design.

Mechanism

This device is connected to the water tank for the building to be ready to provide a quantity of water when needed; in addition to put a tank on the outer ceiling of the room contains a certain amount of calculated foam and CO2 in addition to the fan engine. The first layer contains three exits or tubes:

Water Tube: Water flow rate and the quantity to be released at the needed time shall be taken into account and the absorptive capacity.

Air Tube: Consider the size of the fan on both sides with its rotation rate and the possibility of cooling it to a closed place in a short time.

CO2 and Foam Tube: Take into consideration the method of launching it and the work of pointed ends and netting, for example.

If the probability of a fire is too large, the most concentrated material will be identified and an opposite substance will be fired. For example, if the temperature is more concentrated, the place is cooled by the air tube. To upgrade the safety level, this device is connected to a control room to be followed closely and to determine if it needs any emergency maintenance as well as to send quickly warning in case of fire. In addition to connect it with mobile devices to the house owners to send alarms in case of actual fire.

Implications for Future Research

Implications of the introduction of artificial intelligence techniques on smart cities technology over the 5 to 10 years can be positively or negative impact for using Intelligent Self-Alarm Device. Prediction tools can be estimated because of creation the Artificial Intelligence Ministry, which will increase creativity and attract students and individuals to present their innovation ideas. Also UAE always encourage programmatic and industrial disciplines as it launched the initiative of the One Million Arab Programmers. Table 2, summarize all positive and negative possibilities and scenarios can be happened while adopt this device and it's useful to be fully prepared to face any potential danger in future. As same as for table 3, its present all important impacts whether in social trends, economy, environmental, technology, or nether politically impact.

Table 2. Impact, Possibilities, and Scenarios on Smart Cities.

Prediction Tool	Duration	Possibilities	Scenarios
Creation of the Ministry of Artificial Intelligence	10 Years	Vaporization of normal daily activities	Causing device confusion
Launch of the initiative of one million Arab programmers		Because of the hot weather of UAE, may give notice of high temperature (While it's in a normal conditions)	
Encourage programmatic and industrial disciplines		Fuel like solids, wood, or clothes concentration can't be measured or its presence is normal Achieving the desired balance of the fire triangle components Speed of dealing with fire and its elimination	Can't be determined and does it cause danger or not Avoid fire before it occurs Reduce property and life losses

Table 3. Possible Impacts.

Socially	**Technology**
- Stability and social security, there is no need to fear sudden fires - Increase confidence in government institutions and their capabilities	- Positive step to build and develop smart cities - Attract students and encourage them to connect the disciplines of IT, Mechanics, and Artificial Intelligence specializations
Economically	**Environmentally**

- Attract tourists to a sophisticated and intelligent country with security stability - Exporting technology and knowledge	- Reduce fires and their residues - Increase the power consumption of these devices - Increase thermal emissions
Politically	
- Increase international cooperation by exporting technology and knowledge - Security breaches that may cause local security confusion	

Future Wheel

Figure 3, present Future Wheel for Intelligent Self-Alarm Device for both negative and positive impact. Positively it could prevent fires occurs or speed of its response which will reduce the losses and it will save lives and properties and increasing security and safety between the public. For exporting technology, UAE will be an ideal country to be followed by other countries for taking experience from them. While negative effects can't be ignored as it will raise releasing thermal emissions which can be used to generate some energy. Another negative effect is the excessive energy consumption which can be minimized by using emissions of the same device and stored to generate the energy needed to operate it. While for the fear of wasting water, the device has to be designed in high sensitive to predict and use the water in a specific quantity when needed.

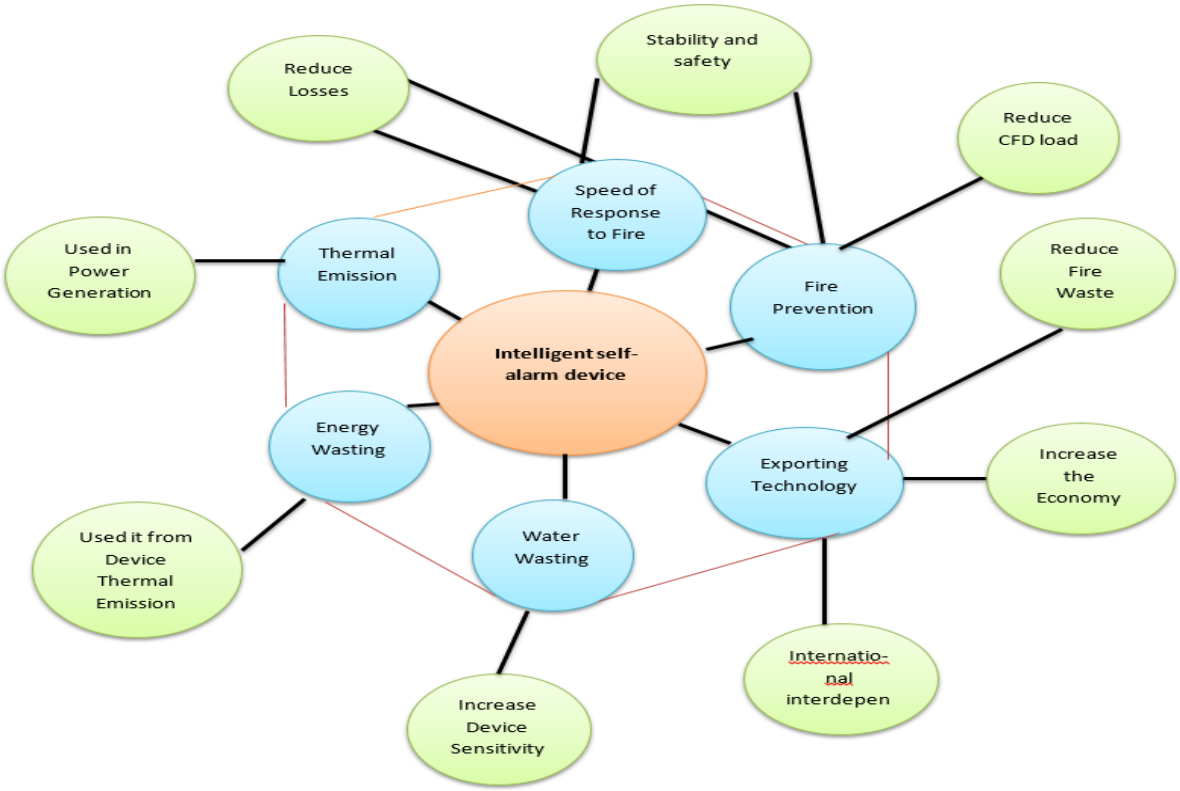


Figure 3. Future Wheel for Intelligent Self-Alarm Device.

SWOT Analysis

Strengths	**Weakness**
- Stability and social security, there is no need to fear sudden fires - Increase confidence in government institutions and their capabilities - Positive step to build and develop smart cities - Reduce fires and their residues	- Increase the power consumption of these devices - Increase thermal emissions - Security breaches that may cause local security confusion - Water wasting if it's used at the wrong time - Device is ineffective if it is not maintained and make sure of all supplies are safe
Opportunities	**Threats**
- Attract students and encourage them to connect the disciplines of IT, Mechanics, and Artificial Intelligence specializations to support innovation - Attract tourists to a sophisticated and intelligent country with security stability - Exporting technology and knowledge - Increase international cooperation by exporting technology and knowledge - Include it within buildings safety requirements to minimize fire losses	- Maintenance needs to ensure its effectiveness over the time - Develop device operation mechanism to be able to determine the location of the fire accurately in case it occurs and direct the tube to put out the right angle

Results

- Fire losses will decrease and property and lives will be saved
- Will reduce fire reports and reduce the load on civil defense departments, because the device will prevent ignite the fire from the beginning mainly
- Will contribute to transforming UAE into a smart country where an innovative and simple solution will be used to reduce a major problem

- Will raise UAE place scientifically and technically because it will eliminate the serious problem faced by many communities, which will make them role models for other countries
- Providing security and stability, there is no need to fear sudden fires

Limitations

- The hot UAE climate may cause some confusion to the device. The temperature may be very high and the oxygen content is high in a particular place. The risk of fire is medium, according to the preliminary study. While in reality these conditions are normal
- Fuel may be solid, wood or cloth, for example, the device will not be able to determine its concentration, or in other cases such as petrochemical tanks, these materials may be very concentrated, while in fact these conditions are normal and there is no possibility of fire
- If the fire type is Class E electrical fires, water releasing or place cooling may cause the fire to worsen
- Use home appliances like incense on a daily basis. The rise in smoke may give a first warning of the fire, but in reality it is normal

Recommendations

- Temperature measurement part, preferably to be added to measure external and internal temperature at the same time to compare whether it is normal or above normal
- Device has to be connected to the electricity meter in housing to be cut off if needed. This is useful to control Class E electrical fires
- Design the sensitivity of the device to distinguish if the smoke is harmful or useful. It is useful to distinguish the fumes of daily activities from harmful fumes
- To upgrade safety, this device is connected to the house owners phones to alert them as well as civil defense departments
- Periodic maintenance of these devices (every six months) and linked to a unified system to monitor their effectiveness

Conclusions

Intelligent Self-Alert device is a quantum leap in development smart cities that helps to raise the level of safety of individuals and groups by using artificial intelligence to measure the probability of fire and try to prevent it by separating the three components of fire triangle. A preliminary study of the strengths, weaknesses, probabilities and scenarios expected to be carried out in order to predict the future of the device and its effectiveness within some limitations taking into account the UAE hot climate, daily activities that cause the emission of some fumes, and also should not ignore the electronic fires that

require the isolation of electricity to be able to put out the fire. The results were as follows: providing security and stability, fire losses will decrease and property and lives will be saved, fire reports will reduce which will reduce the load on civil defense departments. Therefore some recommendations can make some sense for improving this device such as: for the temperature measurement part, preferably to be added to measure external and internal temperature at the same time to compare whether it is normal or above normal, device has to be connected to the electricity meter in the house to be cut off if needed. This is useful to control Class E electrical fires, design the sensitivity of the device to distinguish if the smoke is harmful or useful. It is useful to distinguish the fumes of daily activities from harmful fumes, to upgrade safety; this device is connected to the house owner's phones to alert them as well as civil defense departments, and periodic maintenance of these devices (every six months) and linked to a unified system to monitor their effectiveness. All these recommendations will make the most usefulness of the device.

References

1. Applied Science. Retrieved December 8, 2019 from http://resources.hwb.wales.gov.uk/VTC/ngfl/science/103_new/asc1/firetype.htm

2. GULF PETROL SUPPLIES - GPS-. UAE. Retrieved January 12, 2019 from http://www.fng.ae/gps-chemoil

3. HASSANTUK. United Arab Emirates Ministry of Interior. Retrieved January 10, 2019 fromhttps://building.moi.gov.ae/enUS/?utm_source=firealarmsys_en_googles&utm_campaign=firealarmsys_en_googles&utm_medium=firealarmsys_en_googles

4. MARSDEN FIRE SAFETY 2017. Retrieved December 20, 2019 from https://www.marsden-fire-safety.co.uk/resources/fire-extinguishers