ALMOHANDIS

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BAHRAIN SOCIETY OF ENGINEERS

Engineer Mariam Ahmed Jumaan

- 35 years of giving and achievements in the public sector.
- The first Arab woman to obtain an associate degree from the Institute of Engineering and Technology (IET) in the Middle East and North Africa.

EWA
هيئة الكهرباء والماء
Electricity & Water Authority

Smart Meter and Meter Data Management Project in EWA's distribution network

A Dual Functionality Line

Following & Obstacle Avoidance

Published by:

BAHRAIN SOCIETY OF ENGINEERS

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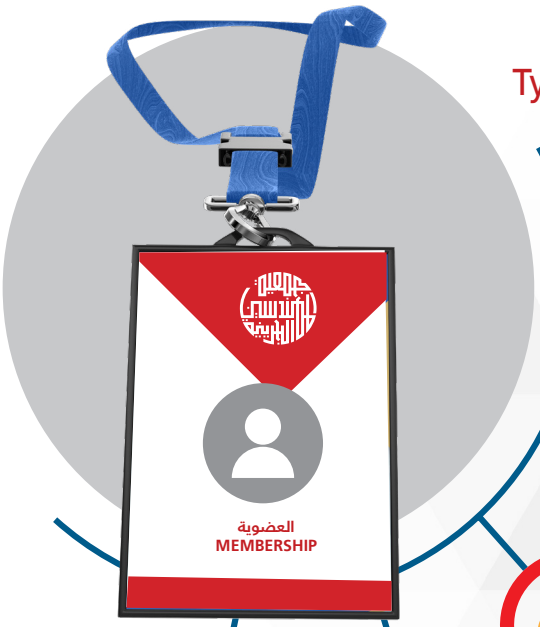
BAHRAIN SOCIETY OF ENGINEERS

أنواع العضوية
Types of Memberships



- زميل — Fellow
- عامل — Active Member
- خريج — Graduate
- طالب — Student
- مؤازر — Affiliate

المستندات المطلوبة
Required Documents

1. نسخة من شهادة البكالوريوس
   Copy of Degree Certificate
2. نسخة من كشف الدرجات
   Copy of Transcript
3. شهادات الخبرة
   Experience Certificates
4. صورة فوتوغرافية واحدة بمقاس 4 × 6 سم بخلفية بيضاء
   One Photograph size 4 x 6 cm with white background
5. نسخة من البطاقة الذكية
   Copy of ID / CPR
6. نسخة من جواز السفر
   Copy of Passport
7. شهادة التسجيل في الجامعة (للطلبة فقط)
   University Registration (Students only)

المستندات الإضافية (إن وجدت)
Additional Documents (If any)

1. نسخة من عضوية مجلس تنظيم مزاولة المهن الهندسية
   Copy of CRPEP Membership
2. نسخة من شهادة عضوية المعاهد
   Copy of Professional Institution Membership
3. خطاب تأكيد الوظيفة (لغير البحرينيين)
   Employer Acknowledgement Letter (fon Non-Bahrainis)

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Speech of the Editor-in-Chief

Dr. Isa Qamber

It well known to us that our generous association undertakes the tasks of advancing and educating engineering in various engineering branches, and this is what we see during the long journey - the journey of fifty years - which was celebrated in the year 2022. Through the publication of the Engineer magazine, part of these tasks is achieved, as we met in this issue with one of its members who enriched the engineering arena. Our meeting was with Engineer Mariam Ahmed Jumaan, who grew up in a family environment that supported science and knowledge. Engineer Maryam Jamaan has graduated in her professional career. She started as an engineer in the control center at the Ministry of Electricity and Water since she graduated in 1983 from McGill University in Canada. Then she rose to several positions in the ministry and other positions in the institutions of the Kingdom of Bahrain. These positions can be explored through the interview that took place with her in the pages of this issue.

As profile, the topic of the issue file was discussed, highlighting the smart meter project, and managing its data in the distribution network of the Electricity and Water Authority. To keep pace with developments in the current era, we are aware of what the Authority has done in replacing mechanical meters with smart meters. This step aims to achieve the strategic vision of the Authority, which is to raise the level of performance of government services towards the vision of the Government of the Kingdom of Bahrain. This step aims to achieve and create an integrated infrastructure towards this strategic goal of the Authority. This step is considered the first element in creating an interconnected technical chain aimed at providing integrated electronic services. When the Authority decided to do this, it set stages for implementing this project and appointed national cadres of engineers and technicians.

Climate change in our current era is considered a global issue, and it is one of the major challenges facing the world. In his article entitled "The Impact of Climate Change on the Kingdom of Bahrain," Eng. Ahmad Al Wahoosh addressed the general outlook on climate change, represented by the emission of gases (greenhouse gases) and deforestation. To address climate change concerns, the writer touched on the measures taken in the Kingdom of Bahrain to reduce the effects of this climate change. I used artificial intelligence to write this article in English, and it was translated into Arabic.

Dr. Hosni Al-Zubair, Associate Professor at the University of Bahrain, shed light, through his topic "Bacterial Nanocellulose Membranes - A Promising Technology in the Field of Water Purification," on the problem of access to potable water and human use. This problem is considered one of the major dilemmas facing the inhabitants of the Earth. The writer addressed the solution to eliminate this dilemma by addressing the efforts of scientists in the field of water purification using various technical methods, including reverse osmosis, nanofiltration, ultrafiltration, and microfiltration techniques.

The article by Dr. Mohammad bin Shams, who shed light on the consideration of natural gas as one of the tributaries of economic and cultural development in the Kingdom of Bahrain, as it is the main backbone of industries (Aluminum, Petrol, Petrochemicals, and other industries). The main goal of what the writer touched upon is to enrich the reader with an overview of the services that provided by companies through energy services, he touched on some examples in some countries and the incentives they provide to finance energy efficiency projects.

The article "The Impact of Globalization on the Cultural Sustainability of Traditional Marketplaces" written by Afaf Ebrahim. In the article, she talks about one of the most crucial components of a city is the traditional markets or souqs of different scales and service zones. Traditional markets showcase the community's way of life, culture, and legacy, strengthening ties with the local populace. In addition, the writer wrote that the process of connecting the economies, cultures, and peoples of the world is known as globalization. The concept of the article can be demonstrated through two examples of traditional marketplaces that went through renovations in the era of globalization, both named Al Qaisariya, one is located in Muharraq city, Bahrain, and the other in Al Hofuf in Saudi Arabia.

Dr. Zainab Mohammed Redha in her article entitled "Nanocellulose: Huge Potential in a Small Size" talks about the global awareness on the importance of using renewable materials as sustainable materials in replacement to the petroleum-based materials has led to tremendous research on their development and usage in different fields. The versatility of nanocellulose as a natural material presents the potential for a wide range of diverse applications due to their inherent characteristics. Also, converting wood and other natural resources into nanocellulose could create new wealth and returns, utilizing agricultural and industrial wastes could highly contribute to solving many environmental concerns.

Artificial Intelligence: An Indispensable Problem-solving Tool for Chemical/Biochemical Engineers is the topic written by Dr. Zakir Hossain. In his article, he talks about Artificial intelligence which enhances performance by reducing energy consumption, increasing process effectiveness, and mitigating weather-related effects. Artificial intelligence becoming a trustworthy element in the modeling toolbox of chemical/biochemical engineers. The applications of AI with chemical/biochemical-related data are still few.

An article wrote by Dr. Hamdy Alsayed & Eng. Safa Jamal under a title "Site Visits as the Best Learning Experience for the Engineering Students". The site visit by Dr. Hamdy Alsayed & Eng. Safa Jamal, where they wrote this article based on that. These visits are helping in communications with several construction companies which have been conducted to identify firms with project site visit opportunities for students of the Civil and Architectural Engineering Programs.

The student Mohammed Mahdi at the University of Northampton in collaboration with Gulf University who's supervised by Dr. Walid Elfezzani. The project was successfully completed for the CSY2015 Microprocessor Systems module and entitled "Sustainable Solutions Using Automated Irrigation to Optimize Plant Health and Water Usage". The project is under the umbrella of Sustainability and Development Makers Center, and it involves creating an advanced irrigation system that can automatically water plants based on their moisture levels. The student used Arduino, open-source electronics prototyping platform commonly used by hobbyists and professionals alike, where the programmed using C++. In addition, the main programming language for Arduino. The student project demonstrates the system can accurately measure soil moisture levels and provide the necessary nutrition to plants.

A Dual Functionality Line Following & Obstacle Avoidance project was successfully completed by the students Mohamed Mohsin, Hashem Abdellatif, and Qasim Yusuf. The project was supervised by Dr. Walid Abushiba and entitled "A Dual Functionality Line Following & Obstacle Avoidance Robot". The project investigates the realm of robotics, focusing on the development and innovation observed in a specific project. The project idea is concerned with being driven by an Arduino microcontroller, this robot represents an endeavor to enhance the adaptability and functionality of automated vehicles. The project's primary objective is to contribute to this narrative by creating a robot capable of seamlessly transitioning between line-following and obstacle-avoidance modes. The dual-functionality robot project stands as a statement about the ongoing innovation in robotics, contributing to the evolution of automated systems that redefine how we interact with technology in our daily lives.

Engineer Mariam Ahmed Jumaan

- She ranked second among Bahrain and first among girls in high school and was one of the first female scholarship students to study engineering in Canada.
- 35 years of giving and achievements in the public sector.
- The first Arab woman to obtain the status of Fellow (FIET) from the Institute of Engineering and Technology (IET) in the Middle East and North Africa.

Foundation

Engineer Mariam Ahmed Jumaan grew up in a home that supported education and believed in women's ability to excel and make a difference in the future of Bahrain. Her family played the most prominent role in supporting her educational and career accomplishments. From her early years, she attended the Sacred Heart School in Bahrain to receive her primary and intermediate education there. She then moved to Muharraq Girls' Secondary School, from which she graduated in second place among all Bahraini students and first among girls, marking her first steps towards academic excellence.

Her ambitions motivated her to embark on new experiences that would constantly provide her with new challenges, and her choice to major in Electrical Engineering was a testimony to this ambition.

Engineer Mariam Jumaan gradually progressed in her professional career, starting as an Electrical Engineer after her graduation in 1983, in the System Control Center in the Power Systems Studies Department in the then Ministry of Works, Power and Water. She then progressed to several positions in the Ministry until she became Director of Planning and Studies in the year 2002. Since then, several high-level official appointments have followed, a testament to the confidence of the Kingdom's leadership and their belief in the abilities of its distinguished Bahrainis.

In "Almohandis" magazine, we review the educational and professional career of Engineer Mariam Ahmed Jumaan, a journey that has been full of dedication and achievements and is considered a beacon for male and female engineers in Bahrain to emulate

His Majesty King Hamad Bin Isa Al Khalifa bestows the First Class Efficiency Medal to Engineer Mariam Ahmed Jumaan in 2015.

Academic History

Mariam Jumaan has always been a firm believer in the abilities of Bahraini women to excel in any field they choose and to achieve any goals they set for themselves. This belief has been a core guidance for her in her upbringing, as well as being key to her ambitions and the challenges she has set for herself.

Upon graduating second over Bahrain in her high school results, and first over all the female graduates, she was sent on a full scholarship by the Government of Bahrain to study Electrical Engineering at McGill University in Canada.

Mariam Jumaan was one of the first students to graduate from electrical engineering at the time, the field of engineering being very much a male dominated field of study. Upon graduating and achieving her Bachelors Degree in Electrical Engineering, she set a new challenge for herself and went on to study her Masters degree and specialized Power Engineering from the same University. At the time she was one of the first female engineers to specialize in this field, both in Bahrain and even in Canada.

Professional career

After her graduation in 1983 from Canada, she began her professional career in the main System Control Center of the electricity network, where one of her first accomplishments was developing the power systems model for the electricity network in Bahrain. She established for the first time in Bahrain, systems for detailed studies of

With His Royal Highness Prince Salman Bin Hamad Al Khalifa at the Bahrain grand prix (Formula 1) in 2016.

the stability of the electrical network, which later evolved into evaluating the stability of the network after connecting it to one of the largest electrical networks at the time, Aluminum Bahrain. Through these studies, the detailed aspects of operation of the interconnected network were identified, which in turn resulted in a significant reduction in costs in the operation of the two networks after connecting them via high-voltage electrical cables.

Engineer Mariam Jumaan progressed in different positions within the Ministry until she assumed the position of Director of the Planning and Studies Department in the period from 2002 to 2008. During this period she worked on planning and developing the High Voltage Electrical Transmission Network, as well as planning and developing the Water Transmission Network by managing activities related to the planning and studies for all electricity and water facilities. This included planning for Power and Water production Stations, as well as electricity and water transmission facilities in the Kingdom of Bahrain. She played a key and prominent role in the planning of the high-voltage electricity transmission networks (220 kV and 66 kV) in Bahrain.

Then came the appointment of Engineer Mariam Jumaan as Executive Director of Projects at the Economic Development Board during the period from 2008 to 2013. This represented a new experience for her that was not far off from her field of specialization in the management of big projects. However, the work in the Economic Development Board and the projects that she undertook gave her a different vantage point as the projects she was leading had a significant impact not on just one sector, but on developing the country's economy, enhancing its bright image, and achieving the national economic strategy and Vision 2030. Engineer Mariam Jumaan was responsible for following up on various and diverse works with 13 ministries and government agencies and coordinating with these agencies on the development and implementation of 45 strategic plans. This diverse and comprehensive role contributed to developing her strategic vision and gave her a broad outlook and expertise in the field of strategic planning.

The professional career of Engineer Mariam Jumaan is full of many facets and challenges that paved the way and opened the opportunity for her to highlight the role of Bahraini women and their excellence in all forums and positions. In 2013, she attained the position of Undersecretary Land Transportation and Post in the Ministry of Transportation and Telecommunications, where she was responsible for establishing and developing the land transport and postal sector. One of the key projects that Engineer Jumaan was responsible for during this period was the appointment of a new public transport operator in Bahrain to take over from the previous operator Cars, the project that came to be known as the Red Bus Project.

Engineer Mariam Jumaan has worked on many major strategic privatization projects implemented by the public sector over the fifteen years in

His Royal Highness Prince Khalifa bin Salman Al Khalifa, the late Prime Minister, receiving engineer Mariam Ahmed Jumaan, and His Excellency Shaikh Abdullah bin Salman Al Khalifa, the former Minister of Electricity and Water, appears.

her Executive roles. She led 4 major strategic privatization projects in various fields such as electricity and water generation, housing sector projects, and public transportation projects, which gave her extensive cumulative experience in providing financing solutions and financing public sector infrastructure projects in cooperation with the private sector.

On September 25, 2019, Engineer Mariam Jumaan further gained the confidence of the Kingdom's leadership after the Royal Order was issued by His Royal Highness Prime Minister Prince Khalifa bin Salman Al Khalifa appointing her as Chairman of the Council for Regulating the Practice of Engineering Professions. This appointment coincided with a critical period in the country's history during the Covid pandemic. During this period, the performance of many Bahraini engineering consulting institutions was negatively affected by the pandemic. Urgent action was therefore required by the Council for Regulating the Practice of Engineering Professions to re-evaluate the Practice of Engineering Professions Law No. (51) of 2014, and this resulted in the issuance of Decree Law (18), as well as the re-evaluation of and restructuring of the executive regulations to reflect the latest developments in the engineering professions, and which were issued later in 2023.

This intense work required coordination with all relevant parties, the most important of which were the engineering sector itself as well as the Bahrain Society of Engineers. Engineer Mariam Jumaan also took a major step in starting a project to convert all the council's operations to the electronic system, in accordance with the government's strategies for e-government, and includes interaction with all relevant parties through this system. The Council is currently implementing this project.

With Her Royal Highness Princess Sabeeka bint Ibrahim Al Khalifa as part of Engineer Mariam Ahmed Jumaan membership of the Supreme Council for Women.

Engineer Mariam Juman considers the Bahrain Society of Engineers a home for all male and female engineers in Bahrain, and testament to this is her association throughout her professional life with the Bahrain Society of Engineers. She joined the BSE immediately after her graduation and appreciates their pioneering role in Bahrain. She points out the importance of communicating and interacting with the Society and its activities and initiatives, noting that working with the BSE is considered vital for all engineers in various fields, as the Society is an important platform for support and exchange of knowledge and experiences among its members.

Engineer Mariam Jumaan believes in the ability of engineering graduates to work in any field other than the engineering specialization. Engineers possess the analytical abilities and thinking skills required in an Engineering context, as well as the strategic thinking and finding solutions in a creative manner outside the framework of stereotypical thinking. And this is clearly evident through her career wherein she has worked and excelled in several field other than the pure engineering realm.

On August 13, 2020, engineer Mariam Jumaan became the Chairman of the Board of Directors of the Telecommunications Regulatory Authority, through Decree No. (48) of 2020 restructuring the Board of Directors of the Telecommunications Regulatory Authority.

His Excellency Shaikh Khalid bin Abdullah Al Khalifa, Deputy Prime Minister, honors engineer Mariam Jumaan, during the country's celebrations of Bahraini Women's Day in 2017, which was dedicated to celebrating Bahraini women in the engineering sector.

The appointment of Engineer Mariam Jumaan as Chairman of the Board of Directors of the Telecommunications Regulatory Authority(TRA) is considered a new challenge in the field of Telecommunications Engineering, especially since the TRA represents a qualitative and distinguished shift in the progress of the telecommunications sector in the Kingdom of Bahrain and a true embodiment of the leadership's vision for the future of the sector.

Since her appointment to the Board of Directors of the Telecommunications Regulatory Authority in

Engineer Mariam Jumaan with His Excellency Shaikh Khalid bin Abdullah Al Khalifa, Deputy Prime Minister on the occasion of the opening of a mass transportation project.

His Excellency Shaikh Khalid bin Abdullah Al Khalifa, Deputy Prime Minister, during his reception of the Council for Regulating the Practice of Engineering Professions, headed by Engineer Mariam Ahmed Jumaan, in the presence of Engineer Issam bin Abdullah Khalaf, former Minister of Works.

2020, one of Engineer Jumaan's most important goals has been to maintain the Authority's achievements and successes as one of the top 20 regulatory bodies for the telecommunications sector at the international level and the most competitive and attractive to investments in the sector

Achievements

The career of engineer Mariam Jumaan is distinguished by many achievements, including her obtaining, in 2002, the status of Chartered Engineer from the Engineering Council in the UK. She was the first Bahraini Electrical Engineer to obtain this certification, a testament to her dedication and excellence in the field.

In 2009, Engineer Mariam Jumaan obtained the status of Fellow from the Institute of Engineering and Technology (FIET). Only five female engineers had obtained such a degree at that time in the Middle East, North Africa, and Southeast Asia. Jumaan was the first Arab woman to receive it. Obtaining this fellowship status is considered a major and important achievement for any engineer, and Engineer Mariam Jumaan considers it one of her most prominent career achievements as a Bahraini woman.

His Excellency the Undersecretary of the Ministry of Interior, Shaikh Nasser bin Abdulrahman Al Khalifa, opening of Traffic Week.

Engineer Mariam Ahmed Jumaan with members of the Board of Directors for the Regulation of the Practice of Engineering Professions, where she chaired the Board of Directors in the period 2019 - 2022.

In 2015, engineer Mariam Jumaan was awarded the First Class Medal of Efficiency during the Kingdom's national holiday celebrations. This honor reflects the Government's appreciation for her contributions and achievements in the field of engineering.

With the Supreme Council for Women

Engineer Mariam Jumaan's journey with the Women's Council may be the closest to her heart, as it was the culmination of all her achievements as a passionate Bahraini woman who fought with all her strength, faith, and ambition to create a

foothold for herself and her peers in various fields. The appreciation of Her Royal Highness Princess Sabeeka bint Ibrahim Al Khalifa for this dedicated journey, full of tangible achievements, undertaken by engineer Mariam Jumaan was culminated in her selection to be a member of the Supreme Council for Women over five consecutive terms, from 2010 until now.

In addition to being a member of the Supreme Council for Women, Engineer Mariam Jumaan is a member of the Her Royal Highness Princess Sabeeka bint Ibrahim Al Khalifa Award Committee for the Advancement of Bahraini Women at the Supreme Council for Women, and a member of the Women in Financial Technology Committee at the Supreme Council for Women. She believes that these representations imparts on her a huge responsibility, through which she has been keen to represent Bahraini women in a distinguished manner and present a positive image of their ability to contribute as essential partners in building and progressing the nation.

In addition to being a member of the Her Royal Highness Princess Sabeeka bint Ibrahim Al Khalifa Award Committee for the Advancement of Bahraini Women at the Supreme Council for Women, and a member of the Women in Financial Technology Committee at the Supreme Council for Women, engineer Mariam Jumaan was given a great responsibility, through which she was keen to represent Bahraini women in a distinguished manner and present a bright image of their ability to contribute as an essential partner in building and progressing the nation.

Fine art hobby and other aspects:

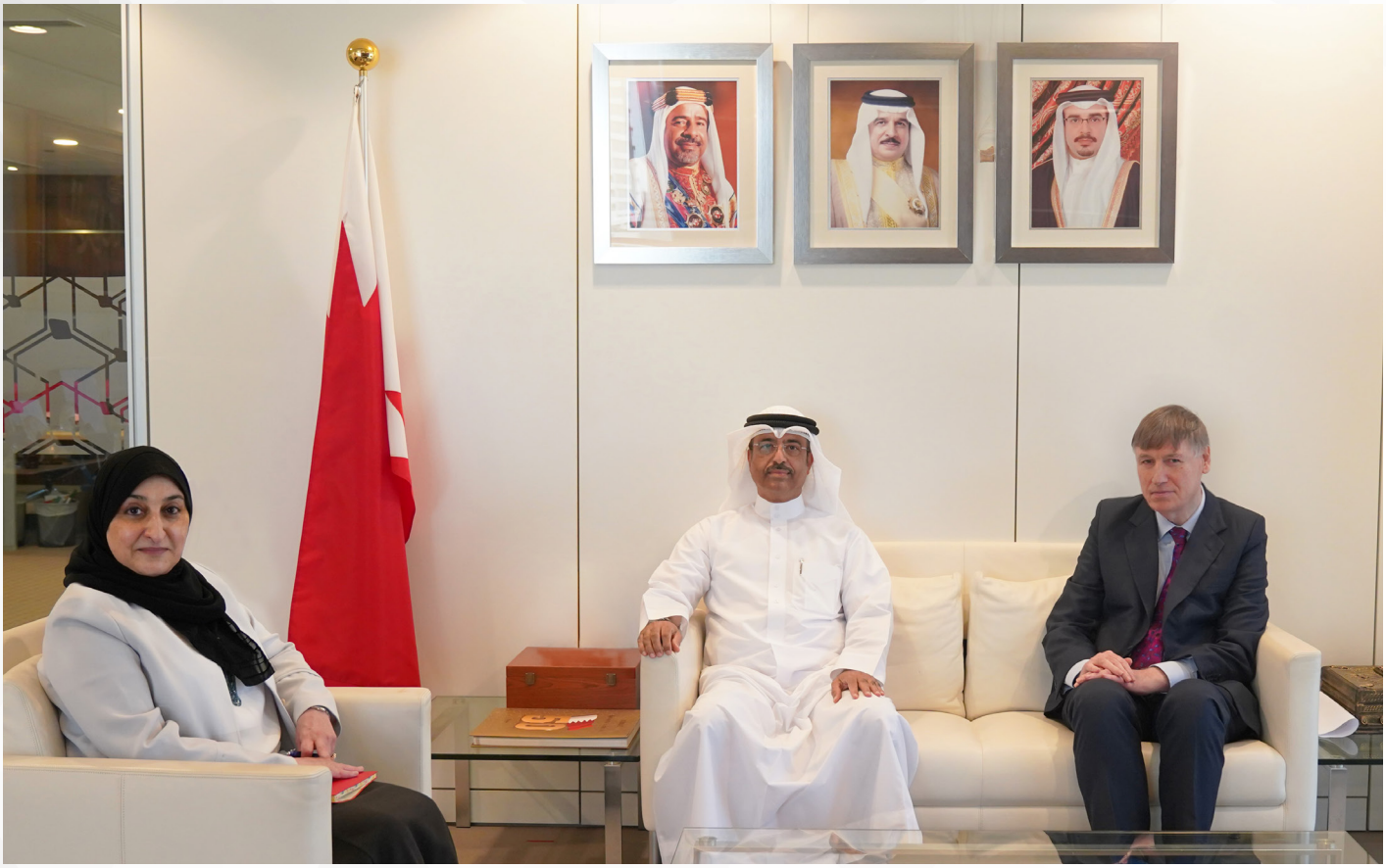
During her career full of achievements, which were marked by the determination and dedication of Bahraini women, one of the most important thing that mattered to engineer Mariam Jumaan, in addition to serving Bahrain and excelling in her assigned tasks, was building and supporting the teams of Bahraini youth that she had the privilege to work with, instilling in them the team spirit and a love of dedication and excellence and preparing

Engineer Mariam Jumaan, during a working visit to one of the power stations in Ireland.

the youth as the leaders of the future. This comes from her staunch belief in the importance of completing the process of giving back to the country that nurtured her and building the future of Bahrain.

Throughout this dedicated and distinguished journey, Engineer Mariam Jumaan believed in the importance of translating her words into actions and that a person must let his actions speak for him and express his values and principles. Her approach and style of communicating with everyone was essentially based on letting her actions and achievements showcase her critical and creative thinking. This has recently spilled over into her latest choice of her hobby of abstract art, and which she saw to be a reflection of an engineer's multiple visions for presenting a specific idea in a multitude of ways through her abstract and mixed media art work.

Engineer Mariam Jumaan is a role model and one of the distinguished Bahraini figures in the engineering field, as she has achieved many important achievements and gained appreciation and respect in her long and fruitful professional career.



His Excellency Mr. Mohammed bin Thamer Al Kaabi, Minister of Transport and Communications, receiving His Excellency Eng. Mariam Ahmed Jumaan, Chairman of the Board of Directors of the Telecommunications Regulatory Authority.

Engineer Mariam Jumaan, during her participation in one of the meetings of Her Royal Highness Princess Sabeeka bint Ibrahim Al Khalifa Award Committee.

Engineer Mariam Ahmed Jumaan delivers a speech during an external participation in the Global Women's Network event on the sidelines of the World Mobile Communications Conference in Barcelona, Spain.

Engineer Mariam Jumaan while chairing a meeting of the Board of Directors of the Telecommunications Regulatory Authority.

Summary Profile:

Her Excellency Engineer Mariam Ahmed Jumaan

Chairman of the Board of Directors of the Telecommunications Regulatory Authority

Qualification

• MSc in Electrical Engineering, McGill University, Canada (1983)

• Bachelor of Electrical Engineering, McGill University, Canada (1982)

Practical experience

• Chairperson of the Board of Directors of the Telecommunications Regulatory Authority (2020 - present).

• Chair of the Council for Regulating the Practice of Engineering Professions (2019-2022).

• Undersecretary of the Ministry of Transportation and Communications for Land Transport and Post (2013 - 2019).

• Executive Director of Projects at the Economic Development Board (2008 - 2013).

• Director of the Planning and Studies Department at the Ministry of Electricity and Water (2002 - 2008).

Membership

• Member of the Supreme Council for Women for five consecutive terms from (2010) until now.

• Member of the Board of Directors of the King Fahd Causeway Public Corporation (2020 - 2013).

• Fellow of the British Institute of Engineering and Technology (FIET) as the first Arab engineer in the Middle East and North Africa region to obtain this membership (since 2009).

• Member of the National Committee for Evaluating Academic Qualifications and Head of its Engineering Qualifications Evaluation Department for the period (2003 - 2013).

• A Chartered Engineer registered with the British Engineering Council since (2002).

Honors and awards

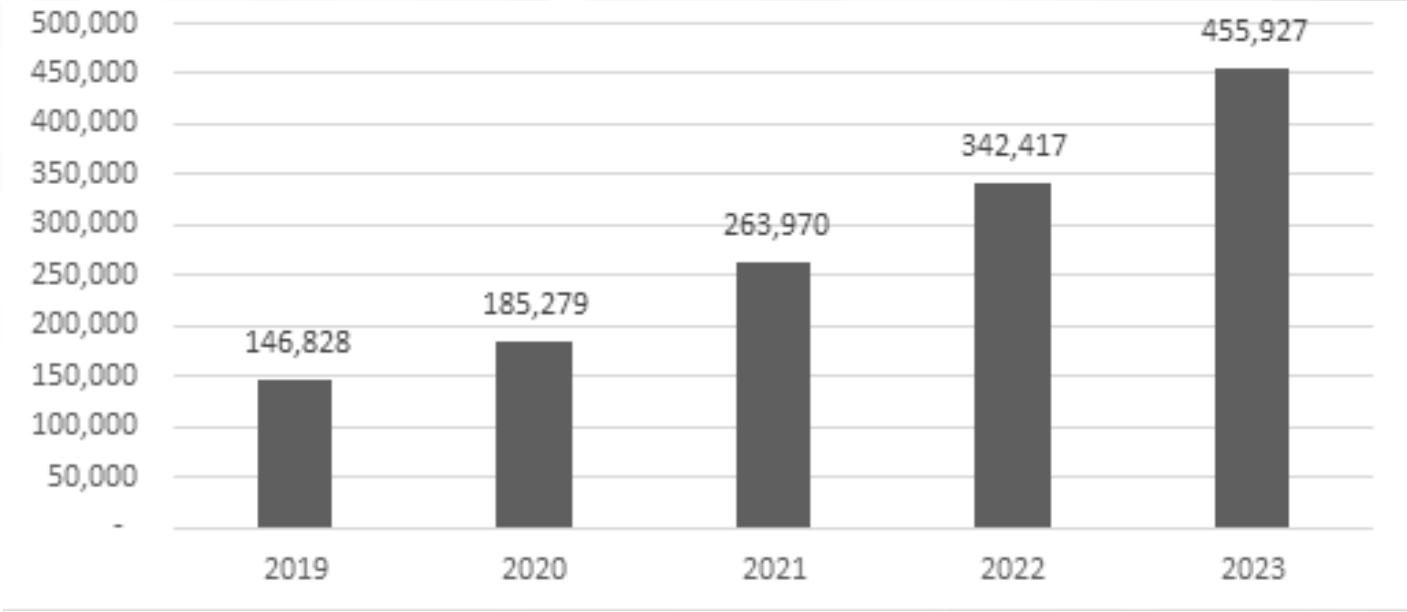
• Obtained the First Class Efficiency Medal (2015).

Profile

Smart Meter Project and Meter Data Management Project in the Electricity and Water Authority's distribution network

Introduction:

Meters are considered the first link and link between the Electricity and Water Authority and its subscribers, and they are relied upon primarily to ensure the integrity of the billing process, ensuring the accuracy of bills and their value based on the accuracy of the readings recorded through these meters. Therefore, any development and modernization program carried out by the Authority must include meters, by ensuring that they keep pace with the latest modern technologies and to ensure their optimal use.



A graph showing the number of meters installed in the last five years (2019 - 2023).

Strategic objective:

The Electricity and Water Authority considers customer satisfaction as the first axis for evaluating the performance of its services. Therefore, the Electricity and Water Authority seeks to raise the level of services provided to its subscribers through continuous development of its services by facilitating and accelerating the process of achieving them with the highest levels of quality. Therefore, a

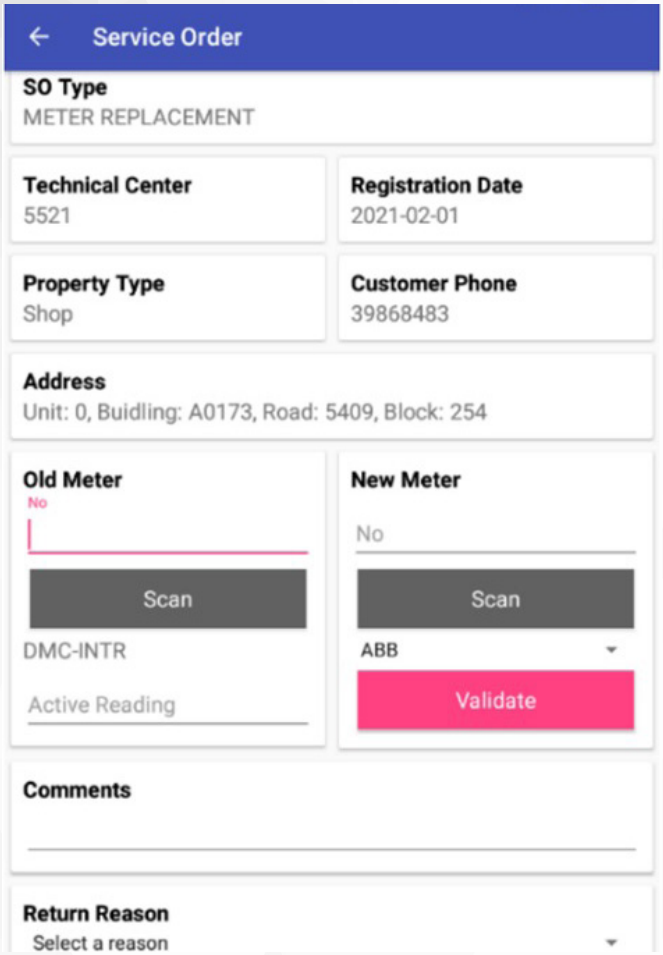


Figure 1: Replacement of Electric Meters

set of initiatives have been adopted to ensure the achievement of this goal, and the smart meter project is considered An important step to reach an integrated smart network

The strategic objective of the project:

The smart meter project aims to create an integrated infrastructure that begins with the installation of certified smart meters with high international specifications that support the most important advanced technical features in this field, to be the first element in the formation of an interconnected technical chain that provides integrated electronic services that improve the subscriber's experience by providing new services characterized by Easily and quickly.

Smart meters and their systems that collect data remotely provide a package of modern technical features that support operation, maintenance and planning processes by linking them to relevant information systems, such as outage systems and electronic maps, not to mention their ability to deliver outage information before receiving complaints from subscribers

Implementation stages:

The Electricity and Water Authority implemented the smart meter project in several stages to ensure the smooth flow of the project and achieve the required goals with the lowest financial costs and the latest technical technologies, in addition to following a policy of gradual implementation and investing in the young Bahraini human element by handing over the management of operations in this project. The steps for implementing the project are summarized in the following points:

a. Designing an integrated technical laboratory for testing meters:

The Electricity and Water Authority attaches utmost importance to ensuring the safety of meters. Therefore, the Electricity and Water Authority requires the supplying factories to conduct specific routine tests according to international specifications for each meter separately. It also re-examines 100% for meters that operate with current transformers and 10% for single and triple meters. The phases of the total meters in each tender are conducted in the Authority's laboratories, which are fully equipped with the latest testing devices and managed by Bahraini technicians specialized in this process. It is considered the first step to ensure the accuracy and quality of smart meters before installation.

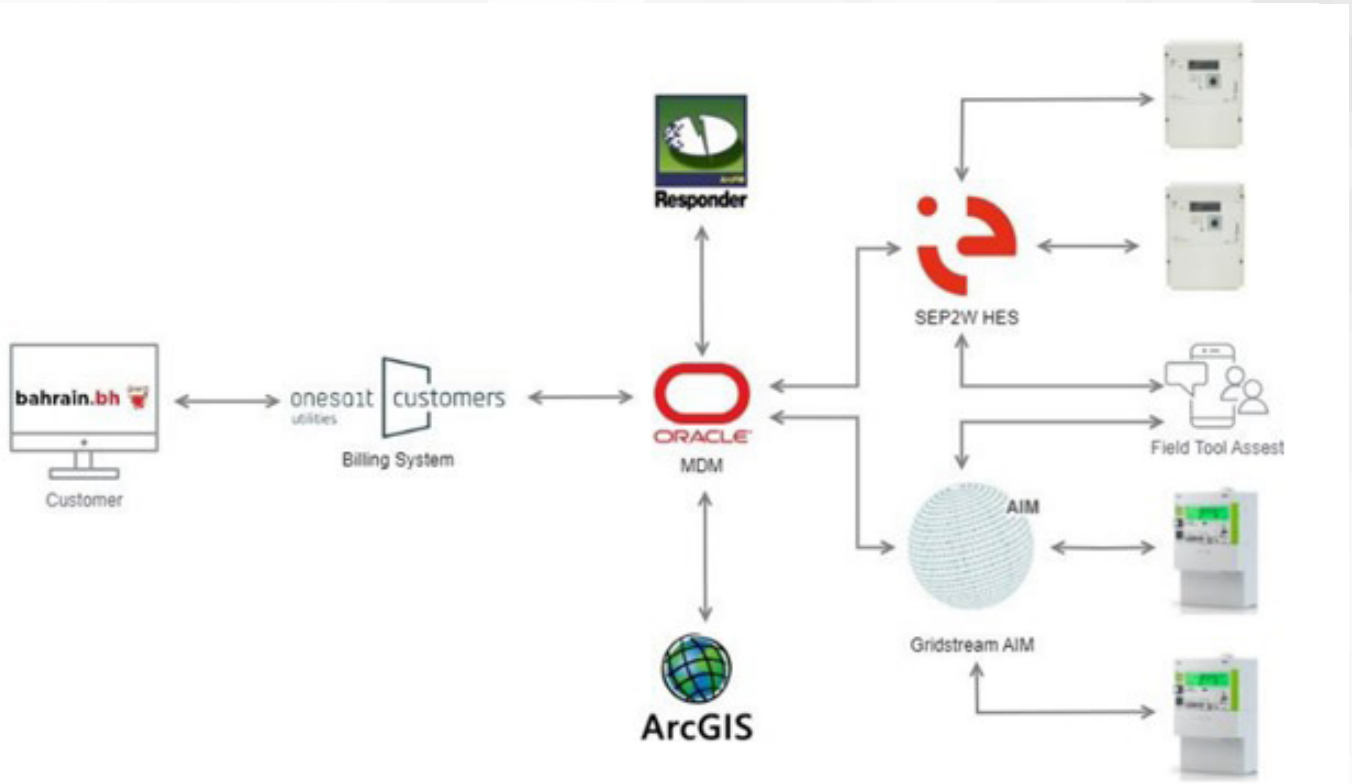


Figure 2: Connecting the Smart Meter Data to Several Systems

B. Approval and testing of meters:

The Authority has set standards for accrediting smart meters, which begins with the qualification process by measuring the factory's capabilities to provide meters that conform to the required standards and specifications, followed by the process of delivering a model that undergoes an examination process that includes the accuracy of energy measurement and conformity of operational features to the specifications. The accreditation process concludes with the installation of trial meters on site, in which the meter's performance is monitored and re-examined after completing the trial period

C. Establish a time plan for replacement operations:

The Electricity and Water Authority has formed an integrated technical team that prepares a plan to limit the number of meters targeted for replacement. A time plan has been developed that is compatible with the allocated budgets, the absorptive capacity of the work team, and the number of those qualified to work on the project in conjunction with receiving meter shipments

D. Developing systems to monitor meters:

During its projects, the Electricity and Water Authority continuously evaluates the challenges and difficulties facing the work team on a regular basis in order to be able to solve them. The most important difficulty in the early stages of the project was the slow replacement process. To speed up the pace of replacement, the work team coordinated with information systems and built an internal smartphone application. And with Bahraini cadres, without referring to external institutions, as this step had a significant impact in accelerating the pace of replacement and documenting all replacement cases correctly

E. Linking smart meter data to other systems:

The Authority has prepared several stages for smart

meters, some of which have been completed and the other is in the implementation phase, where it began by replacing mechanical meters with smart meters with different communication technologies such as 2G/3G/4G until it reached the latest technology used in this field, which is the "Internet of Things" technology. -NB-IoT This is considered the first stage, as the meters send their data to the smart meter systems (HES), which have high capabilities in managing smart meters. The development process continued to link all meter systems to one system that performs automated auditing operations and links smart meter data and notifications to other systems such as the billing system and the information system. Geographic and outage system, in addition to coordinating with the e-government to link its services with the billing system to be an integrated automated chain that provides reliable, high-quality service in record time, thus improving the subscribers' experience.

The role of national cadres:

The Authority was keen, in general in various projects, and in particular in this project, to place national cadres of engineers and technicians at the forefront of the project, as the tasks of managing all operational processes in addition to development operations were assigned to young Bahraini cadres who were qualified to be another class ready for the advancement of future national projects. Among the tasks assigned to him are:

- Implementing the project and managing its workflow within the scope of the work plan, while adhering to requirements and achieving high quality in accordance with international standards.
- Preparing the necessary periodic reports to highlight the progress of the schedule plan related to the replacement process.
- Supervising the project in terms of the level of progress and ensuring the quality of the meters and the safety of their installation.
- Qualifying employees to work on smart meter systems to ensure efficient workflow and overall benefit from the project.
- Supervising data linking operations between various systems to achieve the required goals.
- Periodic review of the latest technologies and systems in the field of smart meters to develop the system on a regular basis

Challenges and difficulties:

The smart meter project faced many challenges and difficulties, as the authority began reviewing other experiments and conducting many tests and visits, in which it relied on Bahraini cadres to study all available ways to develop the network and transform it into a smart network. After the experiments that took place from the year 2012 until 2018, the Authority decided to establish the operational status of the project and the follow-up plan, which consisted of replacing the meters with smart meters from the year 2019 until 2021. However, the Corona pandemic caused a delay in the manufacturing, shipping and replacement operations so that the plan was changed until 2023. The points mentioned below are considered One of the most important challenges that the project faced during the implementation period:

- Slow replacement processes in the early stages of the project due to the lack of smart applications for monitoring meters.
- Difficulty in choosing communication technologies between meters and their systems due to the rapid

change in the technologies used in them.

• Difficulty obtaining the necessary approvals and convincing some subscribers of the necessity of replacing meters.

• The difficulty of ensuring that all meters are kept 100% connected to the automated systems on an ongoing basis without interruption, allowing access to the meter at the time of need.

• The project consists of several stages, which increases the difficulty of achieving the desired goals quickly.

Meter Data Management:

The Electricity and Water Authority in the Kingdom of Bahrain is one of the first utilities in the region to recognize the importance of the Digital Utility Transformation that started to take place years ago across several industries. This enabled EWA to manage the changes and challenges that are sweeping the energy sector.

Along this direction, EWA invested in reinforcing and automating its electricity and water networks and deploying a set of advanced Enterprise IT solutions (such as Customer Services System to manage customer information, relationship and billing, Work Management System to streamline the different jobs and activities, Enterprise Geographical Information System (EGIS) to manage the location and topology of Electricity and Water Assets, Outage Management System to manage planned and emergency outages, Advanced Distribution Management System to operate and maintain the Medium Voltage Network, Energy Management System to cater for the Transmission Network…) all for a successful Digital Utility Transformation and Smart Grid Rollout.

Moreover, EWA embarked on a massive Advanced Metering Infrastructure (AMI) project to replace all conventional water and electricity meters by smart meters. EWA plans to take full advantage of the AMI investment by enhancing operational efficiency and empowering its customers. In this regard, and to unlock the full benefits of the AMI Network, EWA implemented a Meter Data Management (MDM from Oracle) that serves as the heartbeat of the Smart Grid and allows EWA to enable advanced AMI features such as Remote Connect/Disconnect Operations, Automated & Trusted Meter Reading Services, Utility Revenue Protection, and much more.

Today, EWA users have access to a robust smart

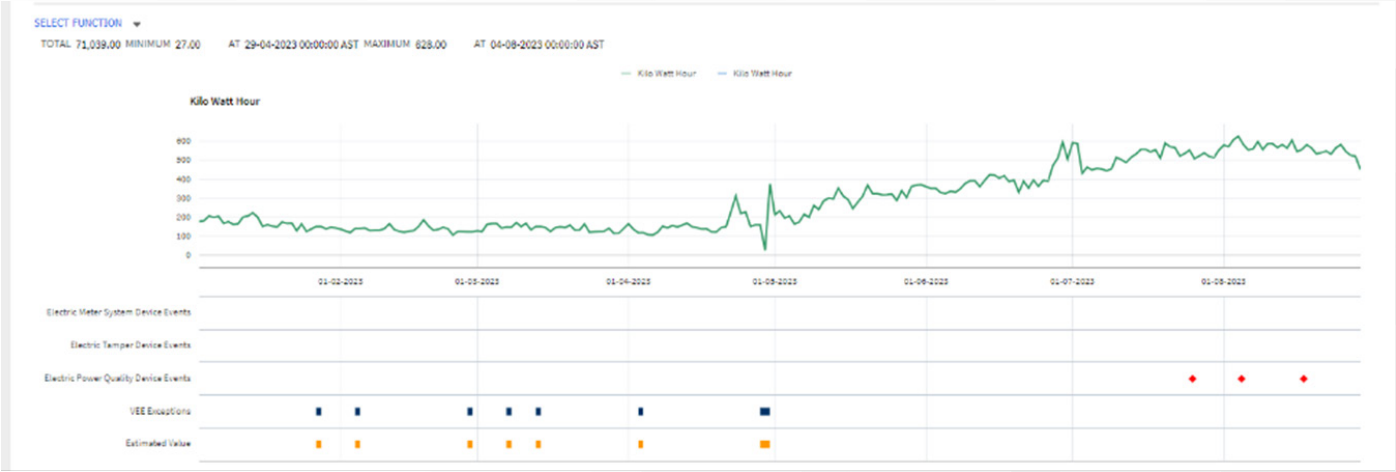


Figure 3: Solution of EWA through the management program

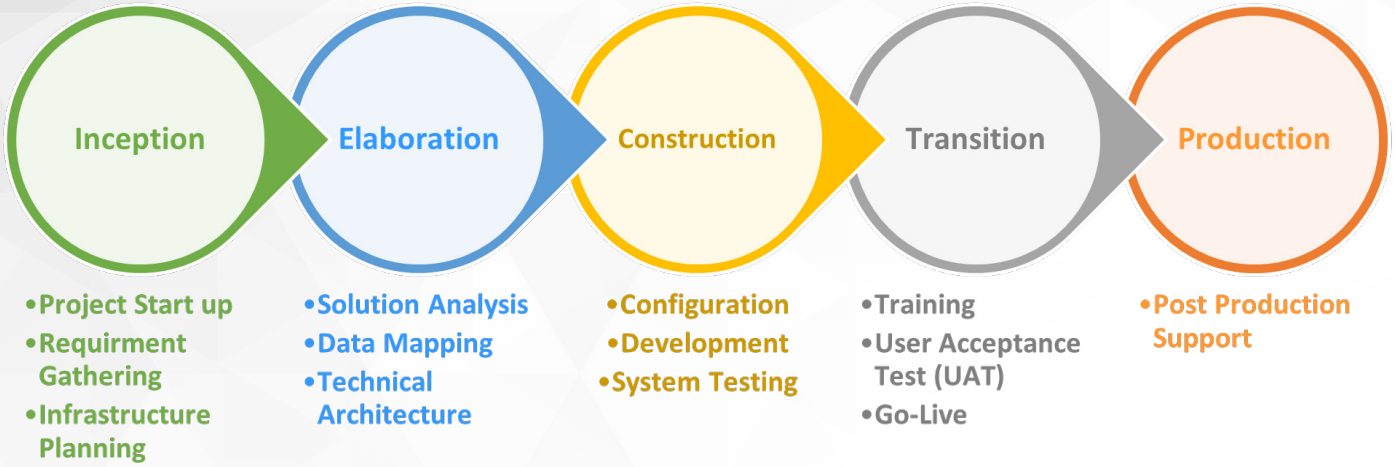


Figure 4: Oracle Unified Method

Meter Data Management (MDM) system designed to effectively handle the rapid increase in the count of installed smart meters. This system is equally geared towards facilitating the achievement of the business objectives outlined in the following sections.

Project Objectives:

The Meter Data Management System (MDM) is a crucial component of the Digital Utility Platform that helps transform the business by integrating the smart meters' data into the entire metering value chain. The MDM is mandatory to unlock the actual Advanced Metering Infrastructure (AMI) benefits covering Remote Operations, Billing, Customer Engagement, Load Forecast, Revenue Protection, Power Quality, Equipment Load Management, and many others. For example, EWA can identify and reinforce overloaded transformers by aggregating the measurements from downstream meters to avoid unplanned outages. Not to mention other objectives that the MDM can meet through its core functionalities such as:

• Reconciling in a single environment the massive number of measurements/events collected from smart meters and through multiple Head-End-Systems (HES).

• Maintaining the data availability by storing it in a scalable and fully redundant environment tailored for such activities.

• Validating, Editing, and Estimating (VEE) the measurements to ensure accuracy and completeness.

• Performing data correlations and analytics to issue exceptions and service orders supporting the overall device management activities.

• Aggregating smart meter data over upstream equipment, geographic, and district areas to support network management activities, including Power Flow Analysis, Network Modeling, and Non-Revenue Water (NRW).

• Calculating complex usage or billing determinants to support utility-advanced revenue collection strategies.

• Providing a platform for data sharing with other Enterprise Solutions such as Customer Relationship Management (CRM) and Advanced Distribution Management Systems (ADMS).

Project Implementation:

EWA's Meter Data Management (MDM) project was implemented using Oracle's Advanced Metering Solution (AMS) Technology and Oracle' Unified Methodology (OUM). The project progressed in multiple phases of Inceptions, Elaboration, Construction, Transition, and Production.

Project Challenges:

Despite its substantial advantages, the implementation of the MDM system posed its share of challenges. EWA's team identified several risks, primarily tied to the integration of the MDM with other existing solutions within EWA. These solutions include the metering Head-End-Systems (HES), Customer Relationship Management System (CRM), Geographic Information System (GIS), and Outage Management System (OMS).

EWA mitigated the integration risk by following the below strategy:

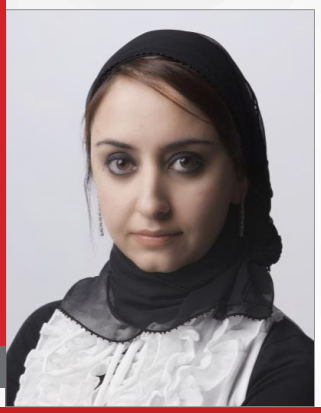
- EWA Selected a technology vendor who can customize and deploy the custom adapters necessary to establish the integration with minimal changes to the connected systems.
- Carefully identified and designed the integration requirements taking into consideration the nature and the options available in the integrated systems.
- Reduced the number of required integrations by selecting a solution that can cover the business requirements without a third party.
- Avoided complexity by adapting the integration design to meet the business requirements without gold-plating.

Bahraini Engineer Role

The role of Bahraini engineers in Meter Data Management (MDM) is crucial in ensuring efficient and accurate collection, validation, storage, and analysis of meter data. Some key responsibilities and contributions of Bahraini engineers in MDM are as follow:

- Play a vital role in the implementation of MDM systems. They are involved in the design, configuration, and integration of the MDM software with other systems.
- Responsible for validating and ensuring the quality of meter data.
- In charge of the maintenance, monitoring, and troubleshooting of MDM systems. They ensure system availability, performance, and security. In case of any issues or failures, they diagnose problems and implement corrective actions to minimize downtime and ensure data integrity.
- Contribute to the continuous improvement of MDM processes and systems. They identify opportunities for automation, optimization, and innovation to enhance data collection efficiency, reduce costs, and improve overall operational effectiveness.

By fulfilling these roles and responsibilities, Bahraini engineers contribute to the smooth functioning of Meter Data Management systems, leading to accurate and effective energy management, and improved customer service in the energy sector.



The Impact of Globalization on the Cultural Sustainability of Traditional Marketplaces

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Most Middle Eastern nations have adopted contemporary design since the turn of the 20th century, paying little attention to regional architectural distinctiveness. More efforts have been made to include regional and local architecture since the 1960s. However, they choose to ignore the fact that these nations are multiethnic. The main reason for this condition is that the dominant cultural groups in these nations determine how to create the current local architectural identity. When the contemporary design in architecture spread in the region and influenced the local architecture characterized by simple shapes, clean lines, and emphasized functionality, it changed the essence of the local architectural features which in turn received many mixed opinions and criticism, between admiration of the innovative approach, and resistance of acceptance of the new image given to the architecture of the places which they found to be far from the local cultural identity.

To understand this perception and find the factors affecting the globalization interpretation in the cultural built environment, we need to understand the true meaning of globalization and what impact is expected on the cultural sustainability of the transformed local marketplaces from traditional to contemporary design.

Traditional Marketplace and Cultural Identity.

One of the most crucial components of a city is the traditional markets or souqs of different scales and service zones. Since the beginning of time, these areas have been crucial in serving as a hub for trade, business, entertainment, and social interaction. Traditional markets showcase the community's way of life, culture, and legacy, strengthening ties with the local populace. These traditional marketplaces include a vast network of social organizations in addition to their economic duties, including mosques, guilds, bathhouses, religious schools, and religious circles. In addition to serving as social gathering places. These places have a distinctive vibe, and local vendors, shoppers, passersby, and people walking around go there often. Their genius loci, or "collective spirit of place," makes them desirable stops for travelers to make and locations to stay. They frequently serve as the focal point of cultural heritage and historic preservation projects in rapidly growing communities.

When it comes to growth and creating a link between the locals' strong sense of place and contemporary design that tries to improve continuously while honoring social, cultural, and historical features, it is difficult to decide what direction to pursue. The adaptation of foreign content and the infiltration of global ideologies into local communities can have an impact. The development of urban centers and commercial districts is essential in deciding how the social, cultural, and economic fabric of a city will be.

Al Qaisariya Souq, Muharraq city, Bahrain. Courtesy Studio Anne Holtrop

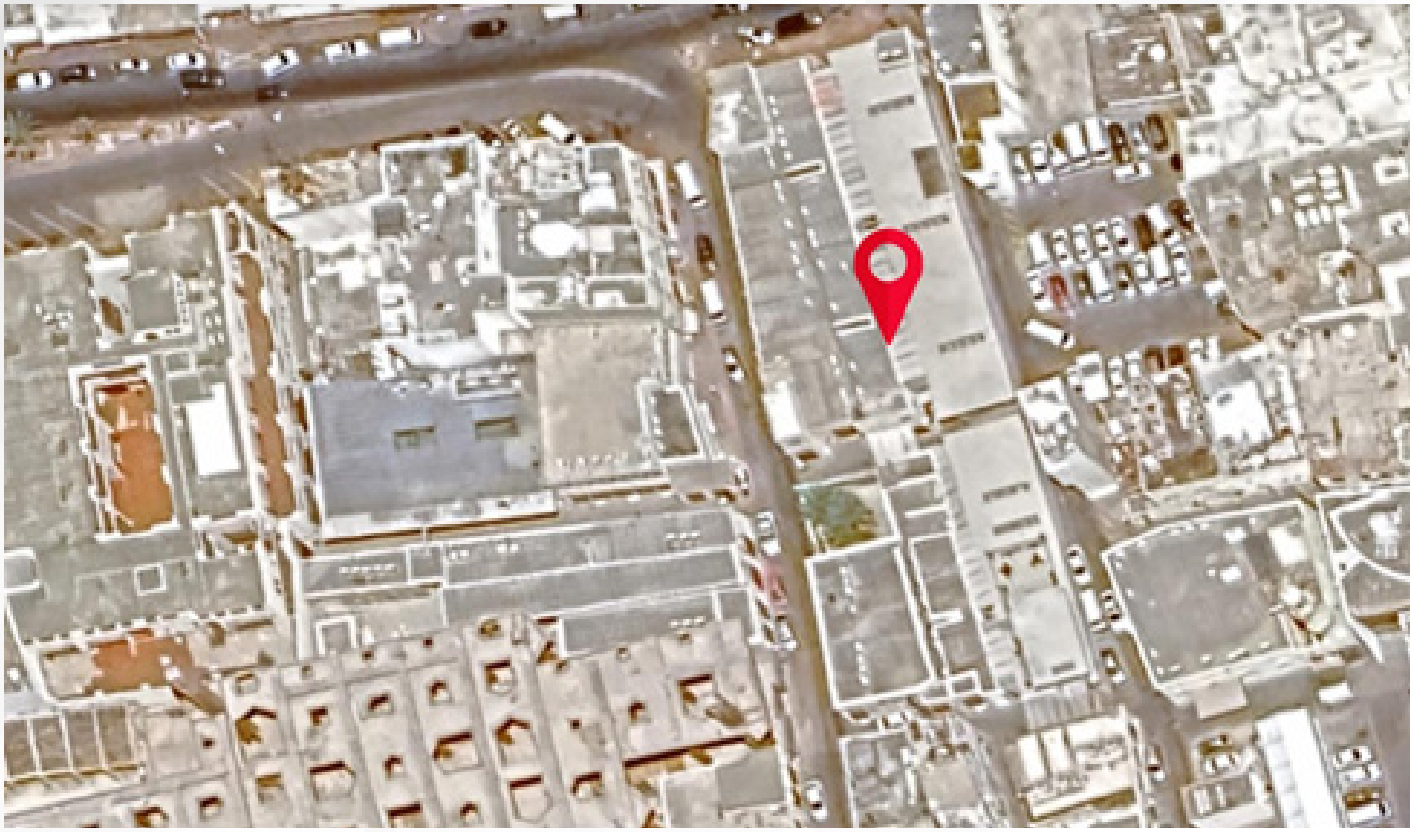
Globalization and Its Impact on Cultural Sustainability

The process of connecting the economies, cultures, and peoples of the world is known as globalization. Many beliefs and values are losing their originality as a result of this interconnection among the various countries of the world. Globalization is thus a dynamic process that has varying effects on different civilizations worldwide. It crosses cultural barriers, and as a result, Foreign beliefs and values are disseminated throughout the world.

Inserting globalization into local society without respecting or considering the local culture or community principles is perceived as a threat. Cultural identities have historically been seen to suffer from globalization. From this vantage point, cultural identity is allegedly being destroyed by foreign homogenized products.

Globalization has accelerated the standardization of interior and architectural design. Cities have altered, as have spatial patterns, and the built environment has been influenced. This homogeneity has been isolating people from the built environment by producing equivalent built environments. On the other hand, architecture that fits its environment adds significance to a building. Conversations between the user and the architecture involve both parties' interactions with the outside world. The past must be maintained, understood, and addressed in light of the present circumstance. These turn into catalysts that open up spaces for user interaction and connection with the built environment.

Globalization has affected local architecture in terms of cultural values reflection, materiality, and use of technology, in addition to bringing new trends and design features to many regions of the world. In many instances, the effects of globalization have resulted in the homogenization of architectural styles, with more universal, worldwide styles replacing regional traditions. For instance, old buildings are being torn down to make room for modernist or postmodernist structures in numerous cities around the developing world. This may result in the erasure of regional architectural traditions and the loss of cultural heritage.



Al Qaisariya souq map, Bahrain. Courtesy Google Earth

The difficult problem is how to implement a specific architectural style while also considering the local identity within a specific context made up of its local, natural, and cultural aspects. The fundamental idea behind this approach is to stop architectural identity from being just a finished good rather than a dynamic process. Architectural spaces can be categorized either on their form or their usage, but not both. The rationale for this is that many kinds of architectural forms, and vice versa, can be used to accomplish a particular function. In traditional architecture, the local culture determines the kind of architectural space that can fit a specific purpose and why. An architectural location gains the local cultural significance of this relationship, which also makes it the same. Understanding the architecture's overall relationships with its local environment is necessary for this.

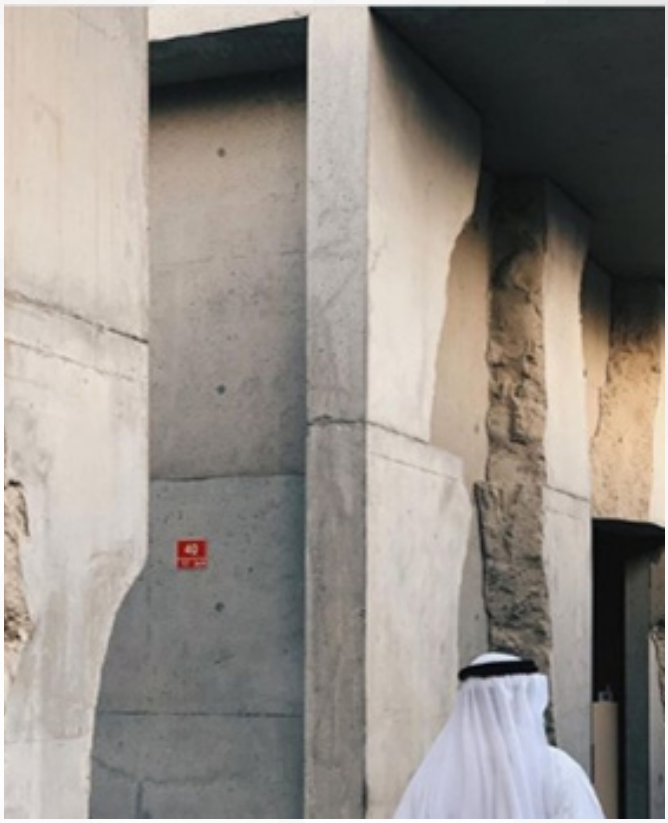
This concept can be demonstrated through two examples of traditional marketplaces that went through renovations in the era of globalization, both named Al Qaisariya, one is located in Muharraq city, Bahrain, and the other in Al Hofuf in Saudi Arabia. The interpretation of the traditional architectural forms in these two marketplaces has taken different approaches.

The Bahraini example, Souq AlQaisaiya, is located in Bahrain's historic capital city, Muharraq city, which was booming in the 19th century. It was the hub of the global pearl trade at the time, bridging many trade routes and dominating in a range of industries, from boat building to pearl diving. With the oil boom of the 1930s, Muharraq was populated with foreign laborers and Bahraini families relocated inland. This resulted in many changes in the appearance of Muharraq's architecture with the influence of multi-culture occupancy.

In Muharraq, buildings are still constructed using traditional coral houses with large courtyards and frequent wind towers. The Bahrain Authority for Culture and Antiquities (BACA) has been working to save and preserve the city's original architectural design for many years.

Souq AlQaisaiya is one of Muharraq's oldest sections that once included stores selling everything from spices and teas to pearls and other jewelry making it a social destination for the people living in Muharraq and the visitors. The effort was focused on renovating old townhouses and the renowned Souq Al Qaysariya in the 1990s.

Al Qaisariya Souq, Bahrain. Courtesy Studio Anne Holtrop



Al Qaisariya Souq, Bahrain. The concrete walls. Image by @theobaf

A 2019 report on the revitalization of Muharraq mentioned that the development is "compatible with the ancient fabric of the souq and utilizes passive cooling methods" as part of the souq's rehabilitation which started in 2010.

According to the project's architects, Studio Anne Holtrop, who have offices in Muharraq and Amsterdam, their efforts were concentrated on the restoration and upkeep of the historic buildings at Souq Al Qaysariya and Amarat Fahkro. Additionally, old building methods and materials were being employed to construct new structures.

Holtrop approach in this project did not involve nostalgia, choosing a far less regimented alternative, and argued that non-referential architecture is more compelling and up to date. Through a brutal concept, they used concrete parts that are cast with "unconstrained" sand borders making amorphous edges, emphasizing the forms of the coral stone slabs that can be seen in the old constructions. The ultimate objective of this approach is to carefully rebuild the area using much the same architectural methods as in the 1800s, aiming to revive the souq as a vibrant site with local stores and cafes. Holtrop restored the demolished and ruined shops and reconstructed buildings using new techniques of moulding and concrete materials. This new design contrasted with the old traditional shops style and the coral stone materials they were made from, which emphasized the character of both designs, the traditional and modern.

According to Holtrop, what transpires is up for interpretation: the development from intuition through a process of refining to a finished structure that alludes to the spirit of location. However, there was opposition to this strategy because it went beyond reflecting the spirit that formerly bound the locals to the area. Many believe it to be missing the old souq's cultural identity.

In the other project, Al Qaisariya in Saudi Arabia, the renovation took a different approach than what was applied by Holtrop in Muharraq Souq.

Al Qaisariya is one of the most well-known ancient markets in the Kingdom of Saudi Arabia is located in the Al-Rifaa neighborhood of Al-Hofuf city, which is home to several historical structures such as palaces, towers, mosques, and traditional marketplaces. The market was constructed in 1822 AD/1238 AH, and historians claim that King Abdul Aziz bin Abdul Rahman Al Saud had it

Al Qaisariya Souq, Al-Hufof, Saudi Arabia. Courtesy Visitsaudi.com

completely renovated in 1334 AH (may God have mercy on him).

The souq consists of More than 422 shops, which stands out for its architectural patterns of walled corridors and raised roofing. Visitors can walk through the market with sufficient airflow and natural light, which helps them better understand the rich history of the local traditional architecture of the Eastern Province of Saudi Arabia. The market's businesses had Dakas, or terraces, to shield them from rain and water in the streets as well as to give tourists and customers a place to sit and take their time perusing the goods.

The souq was restored after it was damaged by a big fire in 2001. The restoration was done using modern techniques and sustainable materials and finishes, yet kept the spirit of the old marketplace demonstrated in the activities and the small details of each shop engaging the shoppers with the shops such as placing the "kabnaks," on the entrances of the shops, two of which are placed on the ground for the shop owner to sit on and use as drawers for holding coffee and rice. These aspects made the people connect to the new Al Qaisariyah Souq through the nostalgic ambiance in these traditional places, making it one of the main elements of success in reviving the old souq and maintaining the cultural sustainability that was the project's key objective.

Conclusion:

Protecting identity implies standing up for the customs, conflicts, and tendencies that define a community. Humans develop sustainable lifestyles as a result of this and their cultural heritage. The adaptation of foreign content and the infiltration of global ideologies into the local community can impact a place's cultural identity, which is thought to reflect the way of life of the people who live there. Through the examples of both Bahriani and Saudi AL Qaisariya souqs presented in this article, we can observe thbee different interpretations of globalization through different architectural design approaches. Both were restored using modern techniques, yet each had a different impact on the cultural perception of the traditional souq that was restored. From this vantage point, a foreign homogeneous design approach can either sustain or destroy the cultural identity if not implemented wisely by the designer. Cultural identities have long been viewed as being negatively impacted by globalization. This is believed to be because of encouraging standardization in interior and exterior design. Cities have changed, as have spatial patterns, and it has influenced the built

The shops of Al Qaisariya Souq, Al-Hufof, Saudi Arabia. Courtesy Arablocal.com

environment. This homogeneity has been distancing man from the constructed world by producing similar built surroundings. Conversations between the user and the architecture involve both parties' interactions with the outside world. The need to preserve, analyze, and respond to the past.

Many researchers struggle to create a balance between old and new and preserve their identities and capacities in the modern world. Different societies must constantly update their traditions and sense of self to adapt to global changes. The advancement of their civilizations must be coordinated with the advancement of technology. It is true that modernity causes the decline of many aspects of traditional life; However, it also creates opportunities and represents a significant step forward for society as a whole.

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The Influence of Climate Change on the Kingdom of Bahrain

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I. Introduction

Climate change is a global issue that poses significant challenges to countries worldwide. The Kingdom of Bahrain, a small island nation in the Arabian Gulf, is particularly vulnerable to the impacts of climate change due to its unique characteristics and geographical location. This essay aims to provide an overview of climate change, explore Bahrain's vulnerability assessment, examine mitigation and adaptation strategies implemented by the country, present case studies or examples illustrating climate change effects on different sectors in Bahrain, and conclude with emphasizing the importance of addressing this issue for environmental sustainability and socio-economic stability.

II. Overview of Climate Change

Climate change refers to long-term shifts in weather patterns caused primarily by human activities such as greenhouse gas emissions and deforestation. These activities contribute to rising temperatures globally, leading to numerous consequences including sea-level rise, more frequent extreme weather events like hurricanes or droughts, changes in precipitation patterns, and disruptions in ecosystems.

III. Vulnerability Assessment for Bahrain

Bahrain's geographical location in the Arabian Gulf makes it susceptible to several climate-related risks. It is a low-lying island nation with an average elevation of only 10 meters above sea level. Rising sea levels pose a significant threat to coastal areas, increasing the potential for erosion and flooding that could damage infrastructure and displace communities.

Additionally, Bahrain relies heavily on desalination plants for freshwater due to limited natural water resources such as rivers or lakes. Climate change-induced factors like increased evaporation rates can intensify water scarcity issues faced by the country.

IV. Mitigation Strategies in Bahrain

Recognizing the urgency of addressing climate change concerns, Bahrain has taken measures towards mitigating its effects through various initiatives:

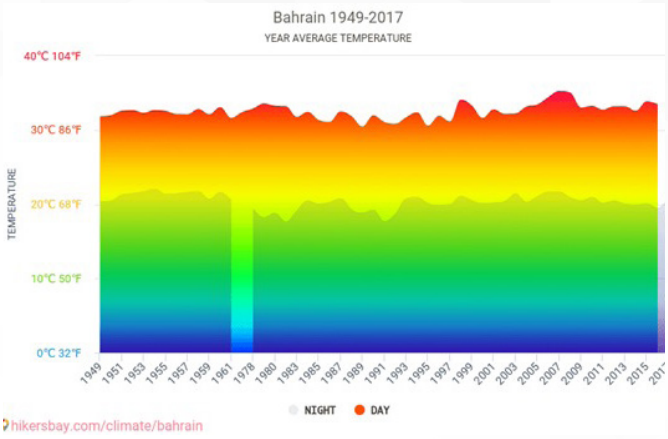
1) Renewable Energy Projects: The government has invested significantly in renewable energy sources like solar power generation facilities and wind farms as part of its efforts to reduce reliance on fossil fuels while promoting clean energy alternatives.

2) Energy Efficiency Programs: Bahrain aims to enhance energy efficiency in its buildings, industries, and transportation sectors. Implementing energy-saving measures and encouraging the use of energy-efficient technologies can help reduce greenhouse gas emissions.

3) Sustainable Urban Planning Practices: The country is embracing sustainable urban planning principles to create more environmentally-friendly cities that prioritize green spaces, promote public transportation, and implement efficient waste management systems.

V. Adaptation Strategies in Bahrain

To cope with the impacts of climate change effectively,



Average temperatures in Bahrain during the day and at night (1949 – 2017)

The impact of low rainfall in Bahrain on water source

Bahrain has implemented several adaptation strategies:

1) Infrastructure Improvements: Building seawalls and protective barriers can mitigate coastal erosion and minimize flooding risks along vulnerable coastlines.

2) Water Management Techniques: Bahrain promotes water conservation by implementing wastewater recycling systems for non-potable purposes like irrigation or industrial uses. Such techniques help alleviate pressure on freshwater resources while ensuring sustainable water management practices.

3) Agricultural Adaptations: Given the potential for increased drought conditions due to climate change, Bahrain is actively exploring agricultural practices that include the cultivation of drought-resistant crops or innovative farming techniques such as hydroponics or vertical farming.

VI. Case Studies or Examples

The effects of climate change are already being felt in various sectors within Bahrain:

1) Agriculture Sector: Rising temperatures and changing precipitation patterns have impacted traditional farming practices in Bahrain. Farmers are adopting new strategies like drip irrigation methods or transitioning to less water-intensive crops to adapt to these changing conditions successfully.

2) Tourism Industry: Climate change-related issues such as beach erosion threaten the tourism sector in Bahrain, which heavily relies on its pristine beaches as attractions. To counteract this problem, initiatives like artificial reef construction have been undertaken to protect beaches from erosion while also promoting marine biodiversity.

VII. Conclusion

Climate change poses significant challenges for the Kingdom of Bahrain due to its vulnerability as a low-lying island nation highly dependent on desalinated water sources. However, through mitigation efforts focusing on renewable energy projects, energy efficiency programs, and sustainable urban planning practices, Bahrain is making strides towards reducing its environmental impact. Adaptation strategies such as infrastructure improvements, water management techniques, and agricultural adaptations are also being implemented to cope with the impacts of climate change effectively.

It is crucial for Bahrain to continue addressing climate change issues for both environmental sustainability and socio-economic stability. By prioritizing these efforts and learning from case studies or examples within sectors like agriculture and tourism, Bahrain can navigate the challenges posed by climate change while promoting a resilient future for its citizens.

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Nanocellulose: Huge Potential in a Small Size

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Overview:

The current rise in the global awareness on the importance of using renewable materials as sustainable materials in replacement to the petroleum-based materials has led to tremendous research on their development and usage in different fields. Materials like cellulose, chitosan, starch, and soy protein have been used to make diverse products. The use of such materials is very important for carbon dioxide capture which has a great impact on reducing global warming. Of the renewable materials, cellulose had gained special attention in various domestic and industrial applications. Being environmentally friendly and due to its availability, low cost, biocompatibility as well as biodegradability, cellulose is considered as the most common polymer with annual biomass production of about 1.5 trillion tons.

With the aid of nanotechnology, nanocellulose emerged to be one of the fascinating materials in virous fields including energy, environmental remediation, membrane technologies and biomedical applications. Along with the important cellulose properties, nanocelluloses appeared to have unique properties of nanoscale materials.

Properties:

Nanocellulose material at this scale combines the properties of the bulk cellulose material such as high strength, hydrophilicity, and being nontoxic, along with the inherent unique properties of nano size. Due to high surface to volume ratio at nano scale, nanocellulose possesses special features like high tensile strength and stiffness, high modulus of elasticity, excellent optical properties, good electrical and thermal properties, low density and high flexibility. In addition, through chemical modification, nanocellulose particles with tailorable surface chemistry could be easily produced encouraging the emergence of new and more advanced applications.

Sources:

There are three common types of nanocellulose, (i) cellulose nanocrystals, (ii) cellulose microfibrils and (iii) bacterial nanocellulose. The first two are synthesized from cellulose resources by acid hydrolysis and mechanical disintegration, respectively. These methods are classified as top down approaches. The common or primary sources for cellulose are wood pulp, plant fibers such as cotton and hemp, as well as non-plant resources like marine animals such as tunicate or from algae, fungi and invertebrates. Other non-wood sources reported in literature for the extraction on nanocellulose particles include sugar beet pulp, wheat straw and soy hulls, sisal, bagasse, palm trees, ramie, potato pulp, flax and jute. The sources of the third type of nanocellulose are of bacterial origins, mainly Gluconacetobacter xylinus bacteria. These are called bacterial nanocellulose and prepared via bottom-up approach through the use of cellulose producing bacteria.

Recently, increasing interest towards new resource of cellulose from wastes produced from agricultural and industrial activities has gained the attention of many

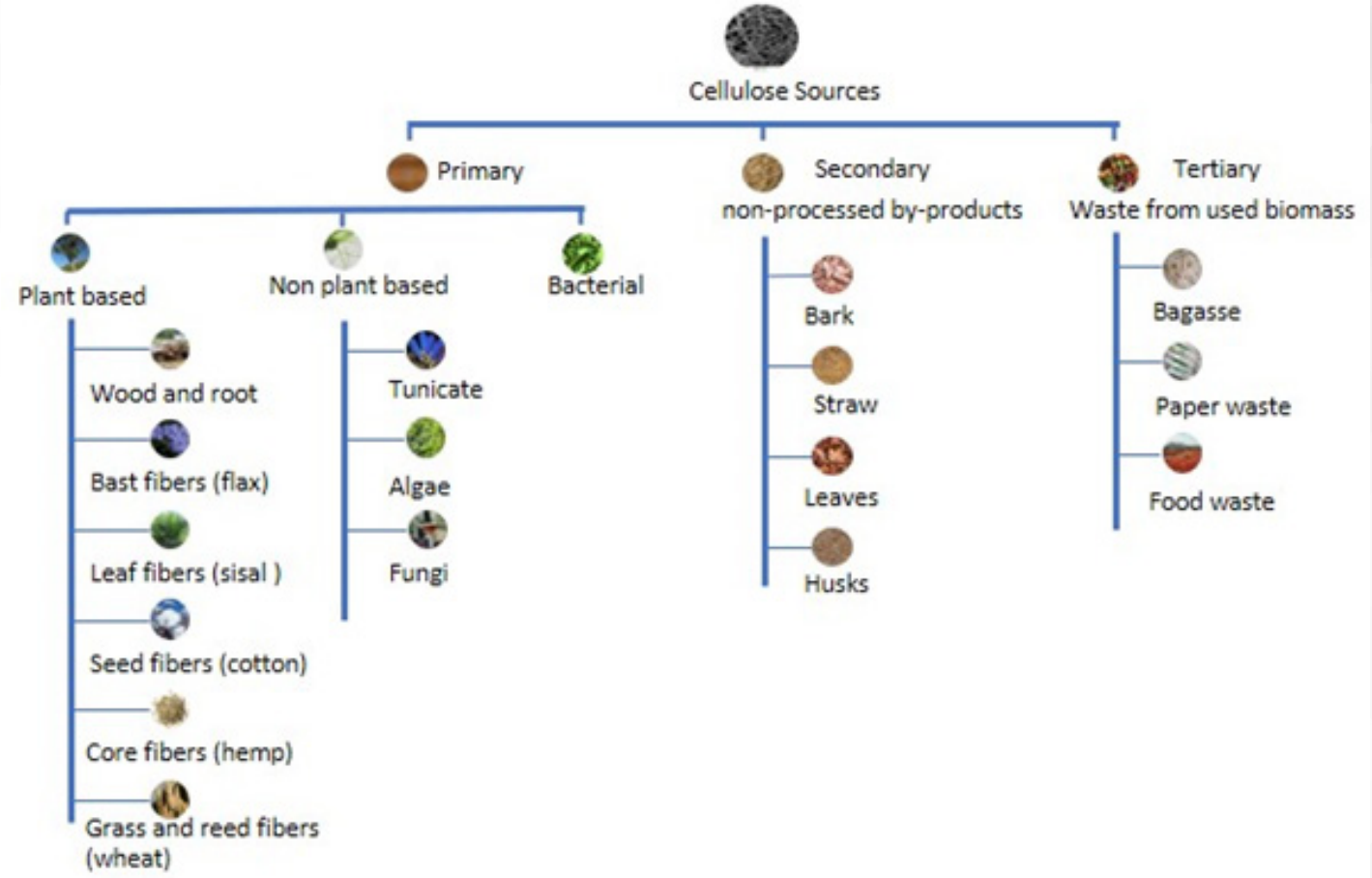

Fig. 1 Classification of the different sources of Cellulose with some examples

researchers. These may include non-processed by-products from food industry and residue from agricultural and forestry activities, or wastes from the used, cellulosic biomass such as pulp, bagasse, food residues. These could be classified as secondary and tertiary sources of cellulose. Fig.1 illustrates a general overview of the different resources for nanocellulose.

Although there is a variety of resources for the synthesis of nanocellulose particles, careful choice of the cellulosic raw material source must be considered for it the main factor affecting the nanocellulose particles' morphology and thus the aspect ratio.

Applications:

The versatility of nanocellulose as a natural material presents the potential for a wide range of diverse applications due to their inherent characteristics. These could range from common paper and packaging products, textile and automotive applications to more advanced applications such as in pharmaceutical applications, paints, cosmetics and water filtration. Fig. 2 summarizes some of their applications.

1. High volume applications:

The largest or primary uses for nanocellulose are projected to be in packaging, paper, and plastic film applications. For example, in paper industries and paperboard applications nanocellulose can be used as dry strength agent, surface strength agent or nanocoatings/ nanobarrier. For instance, nanocellulose coating can be used as a coating layer to reduce the linting and dusting related problems or to increase the surface smoothness. Moreover, cement industries have a potential for the use of nanocellulose as additives to cementitious materials for property enhancement. The addition of such nanoparticles may affect the rheological properties of cement mixtures, and the hydration process, thereby resulting in the enhancement of mechanical properties of the final product. For flexible packaging applications, nanocellulose particles can be used for plastic films coating. The superior properties of these biodegradable nanoparticles can assure lower permeability to moisture, gases, and aroma which are very important for food and biomedical packaging. For food preservation purposes, these nanoparticles can be used as edible coating to coat

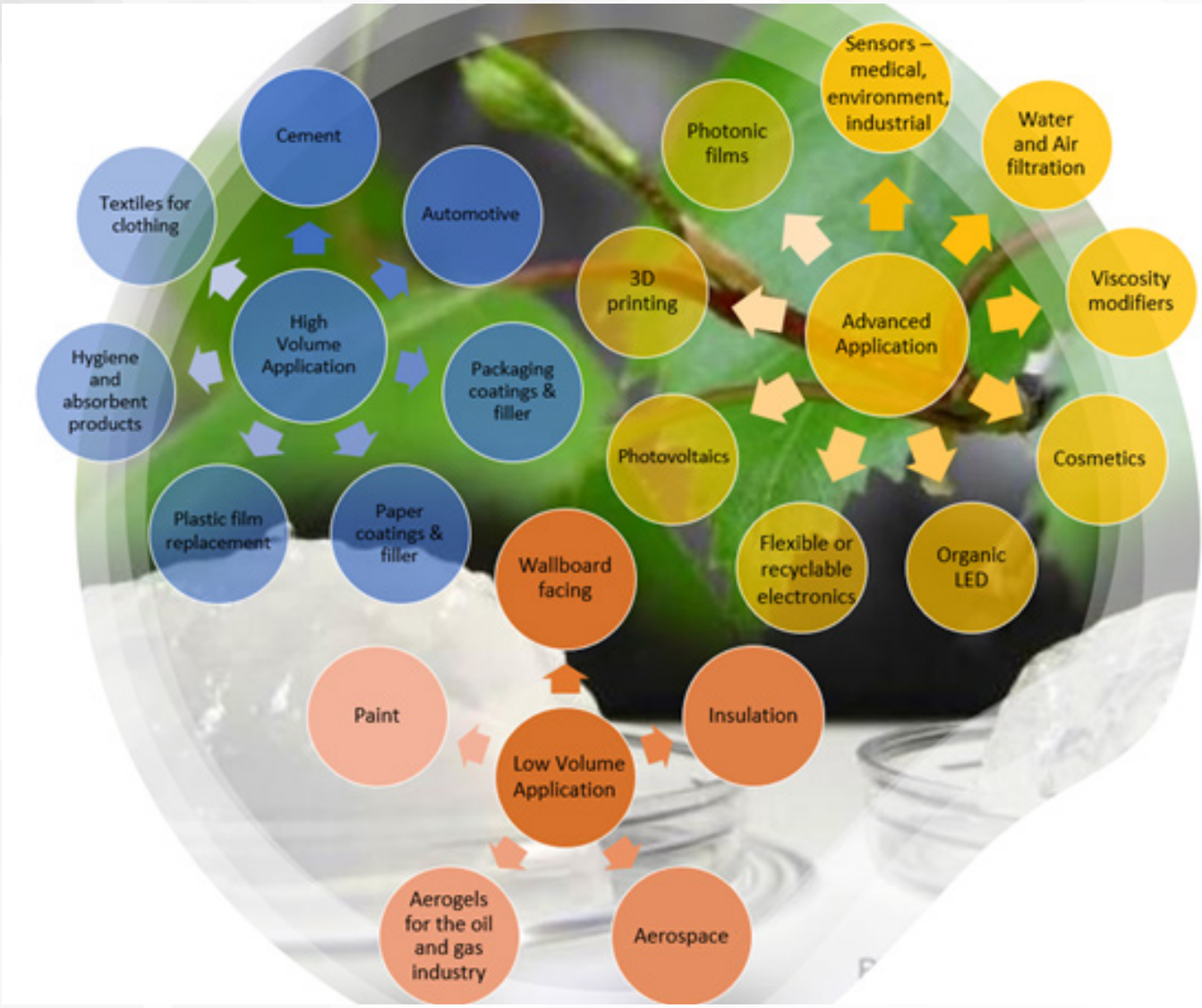

Fig. 2 Examples of some applications of nanocellulose
Such applications can be classified to high volume, low volume and advanced applications.

the epicarps of some fruits and vegetables like banana and eggplant.

Other industrial sectors with large usage for nanocellulose include textile and automobile parts followed by hygiene products. For example, polyester treated with nanocellulose particles altered the thermal property, improved absorbency and reduced water and air permeability of polyester fabric. It also enhanced the color strength of polyester fabric and improved the fastness towards soaping. Automobile applications comprise of the use of nanocellulose in areas such as the manufacturing of automotive-interiors and automotive-body components.

2. Low volume applications:

As a low volume applications, nanocellulose can be used in different areas including aerospace materials, paint additives, insulations and oil and gas industries. For example, in paint and coating, cellulose nanoparticles can be used in spray uses due to its viscosity recovery effect. Moreover, such nanoparticles can enhance the drying time, and improve the rub and scratch resistance thereby improving the durability of the painted products.

Moreover, the unique properties of nanocellulose aerogels featured in their high stability and extremely low thermal conductivities make them good candidates as thermal insulation materials for various applications. These materials are considered to be cheap and four times more efficient than glass fibers. In oil and gas industries, aerogels containing cellulose can improve isolation and heat insulation of deepwater oil and gas pipelines, reducing steel content in piping designs and the cost of installation. In addition, they can be used to absorb oil and collect spilled oil from the water surfaces.

Furthermore, nanocellulose can be used to improve the stability of oil in water emulsions.

3. Advanced and emerging applications:

In biomedical applications, bacterial nanocellulose can be used for skin care purposes such as wound dressings, acting as a barrier to wound infection or scaffold material for tissue engineering as well as replacement of blood vessels and soft tissues. In pharmaceutical fields nanocellulose can be used in drug release. In medicine, it can be also used for antimicrobial films and water absorbent pads. In addition, it found potential for certain dental applications and for detection and biosensing purposes. Whereas in cosmetic applications it can be used as an anti-wrinkle agent as part of a wide range of cosmetic products.

In oilfield applications, bacterial nanocellulose can be used to improve the rheological properties of the fracturing fluids as well as to reduce the frictional losses along the well casing. In electronic applications, these nanoparticles can be suitable for energy storage. Moreover, due to their excellent conductivity, good thermal stability and lightweight, they can be good candidate for producing flexible electronics. Furthermore, upon coating them with indium tin oxide film, nanocellulose particles can be used as organic light emitting diodes.

For environmental applications and wastewater treatment, different forms of nanocellulose can be used with membranes and filters as well as adsorbents. Moreover, metal oxide-cellulose nanocomposites can be applied for the removal of toxic metals and dyes from wastewater.

Concluding remarks and future prospective:

Nanocellulose is one of the emerging materials that found numerous potential applications in various fields. The rise in the global awareness of the concept of sustainability and the need to overcome the environmental problems had shifted the attention of many researchers towards the utilization of such eco-friendly, and renewable materials. Nanocellulose proved to be suitable candidate for many applications due to its renewability, availability, biocompatibility as well as its many unique characteristics. Applications such as packaging, cements, paper products, automotive as well as emerging advanced products such as membranes, organic light-emitting diodes, flexible electronics, and sensors can open new prospective in different fields.

Although, converting wood and other natural resources into nanocellulose could create new wealth and returns, utilizing agricultural and industrial wastes could highly contribute to solving many environmental concerns. Moreover, focusing the current research in surface modification and the nanocomposite synthesis can open the door to new and state of the art products.

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Artificial Intelligence: An Indispensable Problem-solving Tool for Chemical/ Biochemical Engineers

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University of Bahrain, Bahrain.

1. Introduction:

Artificial intelligence (AI) generally refers to a computer program's capacity to replicate independent human intelligence through thinking, judgment, and decision-making. In brief, AI enhances performances by reducing energy consumption, increasing process effectiveness, and mitigating weather-related effects [1]. Scientists can simulate and optimize processes under different situations by creating complex AI models, which promote resilience and adaptation to shifting environmental impacts [2]. This predictive capacity improves systems' efficacy and reliability, eventually leading to a more sustainable strategy.

2. Comparative view:

A comparative view of artificial intelligence (AI), Machine learning (ML), and deep learning (DL) is shown in (see Figure 1)[3]. The idea behind artificial intelligence (AI) is the development of intelligent machines. Some types of AI include Reactive Machines (no past experiences are used for making new decisions), Limited Memory (use information over some time), Theory of Mind (able to understand human emotions that affect decision-making), and Self-awareness (designed and created to be aware of themselves).

Building AI-driven applications is aided by machine learning (ML), a subset of artificial intelligence. ML can be classified as supervised (uses known and labeled data as input), unsupervised (uses unlabeled data as input), and reinforcement learning (does not require data as it learns by interacting with the environment). The most common supervised algorithms are Decision trees, Support vector machines, and Logistic regression. K-means clustering, the Apriori algorithm, and Hierarchical clustering are employed as unsupervised algorithms.

A branch of machine learning called "Deep Learning" trains models using enormous amounts of data and sophisticated algorithms. Generally, Artificial Neural Network (ANN) is considered to be a deep learning category. ANN is a mathematical model that processes information by mimicking the behavioral traits of a biological neural network (NN). Like the human nervous system, ANNs comprise different configurations of interconnected neural units or computing units. A typical ANN is made up of an input layer, an output layer, and a few hidden layers that are located in between the two layers. ANN uses a variety of variable weights to accomplish complicated nonlinear computation between neurons and active functions, including sigmoid, tanh, and ReLU functions. ANN can be more complex nonlinear models with more hidden layers, but its expression ability improves. Thus, by building and optimizing loss functions, ANN can be trained to learn intricate nonlinear correlations between inputs and outputs. The most popular ANN models include Recurrent Neural Networks (RNNs), Fuzzy Neural Networks (FNNs), Convolutional Neural Networks (CNNs), and Deep Neural Networks (DNNs).

3. Applications in chemical/biochemical engineering:

In the last few years, artificial intelligence (AI) has begun to present a new angle and promise for solving a range of chemical/biochemical engineering issues, such as data-driven modeling, the development of novel reactions, chemical property prediction, fluid dynamics,

process data analytics, process design, optimization, and operation, etc. Nonetheless, there are still significant divides between chemical engineers and AI societies, which hinder the use of AI in chemical/biochemical engineering. If these gaps are filled, the chemical/biochemical industries will have a bright future. Here are a few significant sectors where AI is having a big influence.

Optimization: Achieving maximum efficiency in chemical/biochemical processes requires adjusting several factors, which are typically difficult. Temperature, pressure, flow rates, concentration, and other parameters can all be optimized using AI algorithms that assess real-time sensor data and make necessary modifications.

Maintenance: Chemical/Biochemical factories expose their machinery to harsh environments, making unplanned malfunctions costly and sometimes hazardous. AI predicts when maintenance is necessary by evaluating historical data, which helps avoid equipment failures.

Energy Efficiency and Sustainability: By evaluating past data and simulating various operational conditions, AI algorithms can find chances for energy savings.

Safety and Risk Evaluation: AI can evaluate past accident data, spot possible risks, and suggest safety precautions. AI-powered simulations can also assist engineers in creating emergency response plans and assessing the effects of various situations.

Quality Control: AI can identify deviations from the intended parameters and quickly make adjustments to ensure product quality by analyzing data from sensors and cameras. This is especially helpful in sectors where product quality is crucial, including the pharmaceutical and food processing industries.

Material discovery: AI can recommend novel materials that satisfy certain criteria by analyzing large databases of material qualities, chemical compositions, and performance characteristics. This is useful in a variety of industries, including aerospace and electronics.

Others: Numerous chemical/biochemical processes depend on catalysts, and AI can help designing novel catalysts with improved characteristics like excellent selectivity, better stability, and lower cost. AI can also aid in the design of greener chemical/biochemical processes by reducing energy usage, waste production, and greenhouse gas emissions. AI can also aid in the optimization of the supply chain. It can analyze data on raw material availability, transportation logistics, and market demand to find optimal purchase strategies, inventory management approaches, and distribution plans.

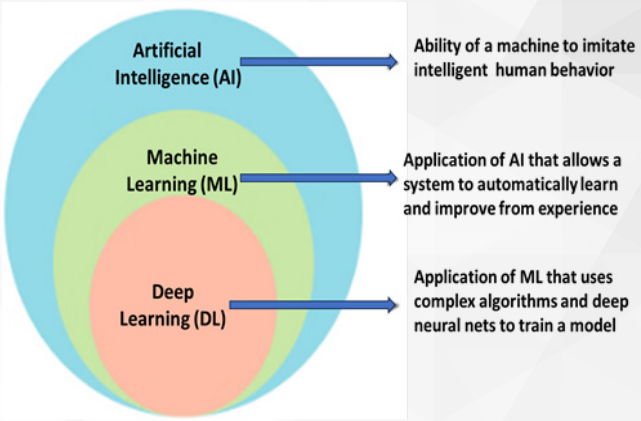

Figure 1. A comparative view of AI, ML, and DL [3].

4. Conclusion:

AI is becoming a trustworthy element in the modeling toolbox of chemical/biochemical engineers. As technology continues to advance, more innovative AI applications are necessary that may increase process efficiency, safety, and environmental sustainability. Nevertheless, AI modeling offers several advantages over conventional methods, such as speed, accuracy, and flexibility. The applications of AI with chemical/biochemical-related data are still few. Thus, developing new machine learning frameworks, big databases, benchmarks, and representations for chemical and biochemical applications is imperative. This initiative could also make implementing AI approaches in the chemical/biochemical engineering research easier.

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Site Visits as the Best Learning Experience for the Engineering Students

Dr. Hamdy Alsayed, Associate Professor, Programme Director and Acting Head of Training and Internship Unit, College of Engineering, Applied Science University.
Engineer Safa Jamal, College of Engineering, Applied Science University.

The College of Engineering at the Applied Science University believes that practical experience in a professional setting is essential to the comprehensive development of the skills, knowledge, and abilities for the students in different programmes. The College was established in 2017 and offered four Bachelor Degree Programmes in Engineering: BEng (Hons) Architectural Engineering, BEng (Hons) Civil Engineering, BEng (Hons) Mechanical Engineering and BEng (Hons) Electrical and Electronic Engineering. These programmes are awarded by London South Bank University in the UK and are recognized by the Higher Education Council in the Kingdom of Bahrain.

Importance of Learning Experience through Site Visits

Construction site visit is one of the most important activities that intends to reinforce the students learning by giving them an opportunity to gain practical experience in applying academic concepts. In addition, sites visits are essential to share with our future engineers the development and understanding of how engineering theory is put into practice. Students will develop their intellectual skills such as they are able to report on practical observation of construction sites in the industry and determine and assess real construction situations. Indeed, students will acquire and develop practical skills such that they are able to identify design processes and site management and follow health and safety instructions. Moreover, student will be able to identify aspects of environmental planning and supply chain and prepare a report on the visits.

Site Visits to Top Ranked Projects in Bahrain

In the first semester of this academic year 2022/2023, the College of Engineering has planned and arranged several site visits for the students enrolled in the Civil and Architectural Engineering programmes to different projects in the Kingdom of Bahrain. Students have been given the opportunity to visit some projects in different stages of progress and were provided with an explanation of the design and construction cycle from inception to completion.

Communications with several construction companies have been conducted to identify firms with project site visit opportunities for students of the Civil and Architectural Engineering Programmes. Seven site visits have been scheduled to be conducted at unique and top ranked projects: AMAS North Islands Apartments, Bahrain Precast Concrete Factory, First Energy Bank Tower, Bahrain New Exhibition and Convention Center, Alnaseem Project – Phase Ii, King Hamad American Mission Hospital – A'ali, Solartecc Green Energy Factory. The university has applied and received approval from the HEC for these visits.

BPC Factory Site Visit

Students from Civil and Architectural Engineering programmes have practiced the first visit to Bahrain

Precast Concrete (BPC) Factory. BPC Group was first established in 1977 as a joint venture company between the Haji Hassan Group, Bahrain, and NTR Holding A/S (previously known as Rasmussen and Schiotz Holding A/S), Denmark. It was fully acquired by Haji Hassan Group in early 2006 to be added as a division of this conglomerate of manufacturing and trading companies. BPC is considered as the pioneer of precast concrete in the region, they have established a thriving business that has revolutionized the Gulf construction industry.

Students' Testimony

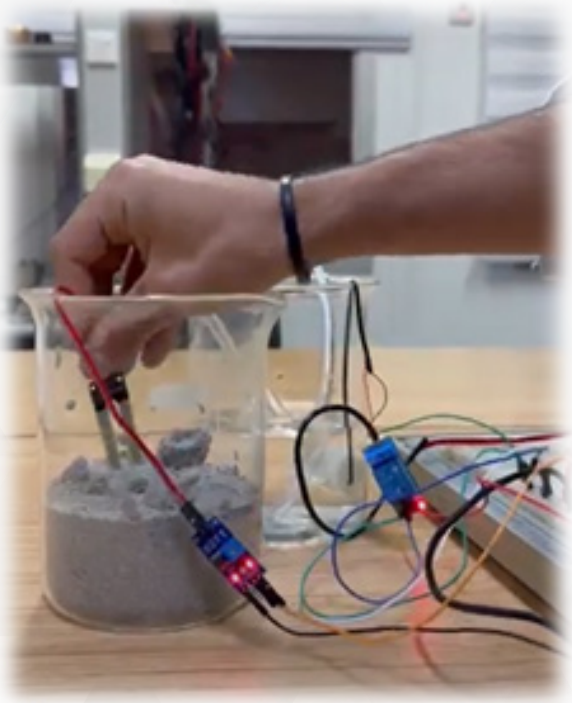
During the visit, the students have visited different departments in the factory and listening to the explanation from the company's engineers. All the students have confirmed their appreciation and satisfaction for the great opportunity and practical skills that have been offered to them by this company.

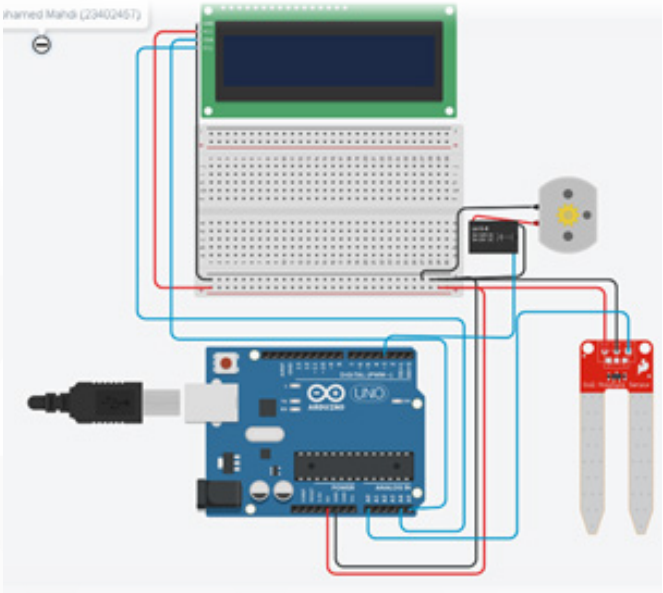
Student Noor Jasim said "I really enjoyed my time there; it was beneficial experience". Also, Jumana Altaweel informed that "the site visit was really interesting I enjoyed seeing the processes inside the factory rather than only studying the theoretical aspects". Indeed, the students acknowledged the strong practical skills and experiences in the field of Civil and Architectural Engineering. At the end of the visit Dr. Hamdy Alsayed has acknowledged the time, efforts and well organization that done by the BPC's Engineers Eng. Akram Abdulla and Eng. Sayed Alsabea.

Sustainable Solutions

Using Automated Irrigation to Optimize Plant Health and Water Usage

Project Team: Mohamed Mahdi (student)
Supervisor: Dr. Walid El Fezzani, Electrical and Elictronic Program at the Gulf University in collaboration with University os Northampton (UK)

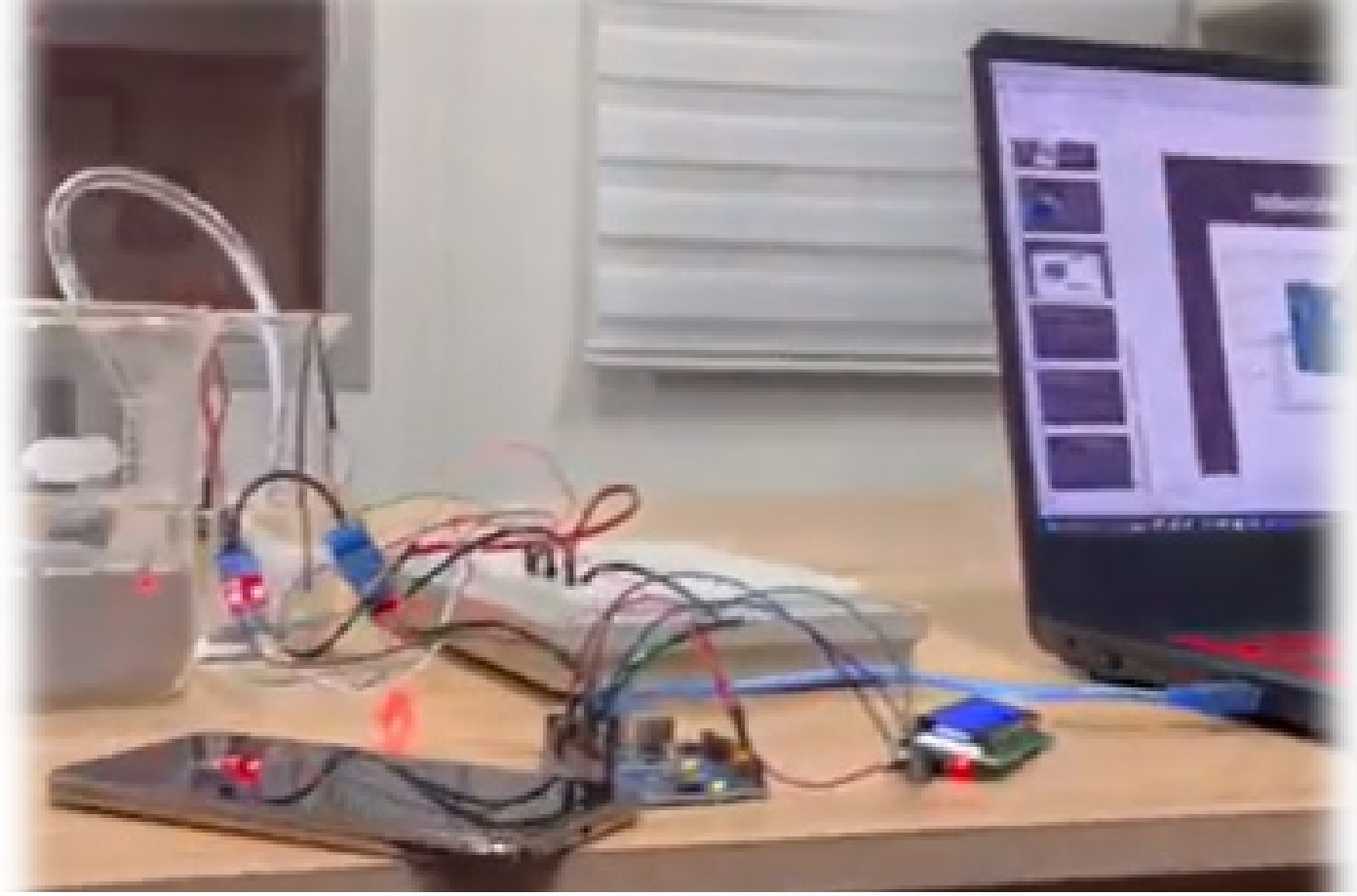




We often take for granted the simple act of watering our plants. But for Mohammed Mahdi, a student at the Gulf University in collaboration with University os Northampton (UK).

, manual watering of plants was a problem he sought to solve. Under the guidance of Dr. Walid El Fezzani, the student successfully completed a project for the CSY2015 Microprocessor Systems module that not only addressed this issue, but also showcased the potential of using technology to improve our daily tasks.

The student project is under the umbrella of Sustainability and Development Makers Center and it involves creating an advanced irrigation system that can automatically water plants based on their moisture levels. This means never forgetting to water or over-watering your plants, which results in healthier, happier plants. The key element of this system was a moisture sensor, which detects when the soil is dry and activates a water pump to nourish the plant. To bring his project to life, the student used Arduino, open-source electronics prototyping platform commonly used by hobbyists and professionals alike. The main board used was an Arduino Uno, which served as the brain of the system. It was responsible for receiving data from the humidity sensor, processing it, and sending signals to the water pump and the LCD screen. The student project was meticulously programmed using C++, the main programming language for Arduino. This language allowed him to write code that would control the various components and ensure that they worked together smoothly. The student also used the LCD screen to provide visual feedback on the status of the plants and the system, facilitating monitoring and troubleshooting. The components used in the project were relatively simple and easily accessible, making it a cost-effective solution. Besides the Arduino Uno and the humidity sensor, the student also used a relay that acts as a switch to turn the water pump on and off.



This simple and innovative use of automated irrigation technology not only makes our lives easier, but also has the added benefit of conserving water resources. One of the most impressive aspects of the student project was its scalability. The system is designed to be able to monitor and water multiple plants simultaneously. This will be especially useful for large gardens or even commercial greenhouses, where manual watering can be time-consuming and labor-intensive. The student project is a prime example of how technology can be applied to solve everyday problems and improve our lives. Under the guidance of Dr. Walid El Fezzani, he successfully demonstrated the possibility of using microprocessors to automate tasks that may seem mundane but can have a significant impact. Not only did his project earn him a high grade in his unit, but it also sparked the interest of his peers and professors.

The student project demonstrates how a simple but well-designed solution can have a profound impact. By using a moisture sensor, the system can accurately measure soil moisture levels and provide the necessary nutrition to plants. He has been a role model for other students to think outside the box and use their knowledge and skills to address real-world problems. We commend Mohamed Mahdi for his ingenuity and believe that his project has the potential to revolutionize the way we water plants in the future.

To see the presentatiom on Youtube

click or scan the QR code

A Dual Functionality Line Following & Obstacle Avoidance

Project Team: Mohamed Mohsin - Hashem Abdellatif - Qasim Yusuf
Supervisor: Dr. Walid Abushiba
Electrical and Electronic Engineering Program at the Applied Science University

Abstract

The increasing integration of fully automated robots into various facets of our world has prompted a paradigm shift in industrial processes, logistics, and everyday tasks. This project investigates into the realm of robotics, focusing on the development and innovation observed in a specific project: "A Dual-Functionality Line-Following and Obstacle-Avoidance Robot". Driven by an Arduino microcontroller, this robot represents an endeavour to enhance the adaptability and functionality of automated vehicles.

Exploring the broader landscape, the project underscores the growing significance of fully automated robots. These machines have transcended their traditional roles, evolving into indispensable industry entities. From manufacturing and logistics to healthcare and education, fully automated robots are revolutionizing how tasks are accomplished, introducing efficiency, precision, and adaptability into diverse operational environments.

The project's primary objective is to contribute to this narrative by creating a robot capable of seamlessly transitioning between line-following and obstacle-avoidance modes. This dual functionality aligns with the evolving demands of industries that require automated vehicles to navigate complex environments and respond dynamically to obstructions. This innovative approach not only meets the demands of industries requiring automated vehicles with dynamic responses but also demonstrates our commitment to pushing the boundaries of conventional robotics.

Lastly, this project not only explores a specific robotics project but also showcases the integration of fully automated robots into industries and societal functions. The dual-functionality robot project stands as a statement about the ongoing innovation in robotics, contributing to the evolution of automated systems that redefine how we interact with technology in our daily lives.