

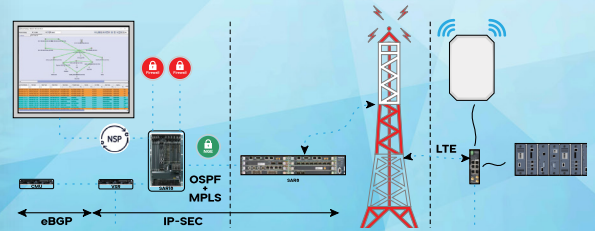
Engineer Nezar Al-Shammasi:

I owe the Bahrain Society of Engineers a lot personally, professionally and in respect of voluntary activities



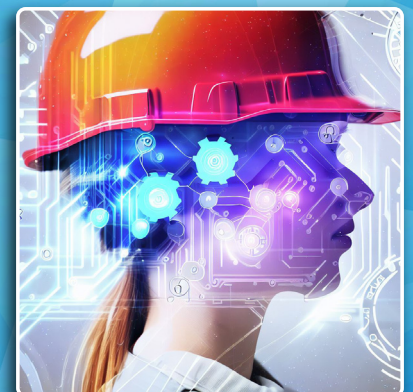
Al-Fateh Highway development project...

A strategic project that facilitates transportation and supports the economy



▶ Secondary Substation Automation in the Electricity Distribution Secondary Network

▶ Understanding Generative AI
The Art of Digital Creation





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ENGINEERS**

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Dr. Isa Qamber

In present issue of Al Mohandis magazine, which is considered one of the publications of the Bahrain Society of Engineers, and in which the society has taken it upon itself to spread engineering awareness. Spreading awareness is in a way that keeps pace with the times and the reality in which we live. This issue meets with one of the members of the society who had a role in the society's voluntary activities and served the engineering sector during his movement between the eastern, central, and western regions of the Kingdom of Saudi Arabia. He settled in Aramco in the field of maintenance and reliability. This engineer played a role in establishing the Gulf Society for Maintenance and Reliability. This engineer is Nizar Al-Shammasi. Through the meeting, the biography of this generous engineer in the field of engineering after he obtained a bachelor's degree from the University of San Jose in California, USA is documented in the pages of this issue.

The issue's character was followed by the topic of the issue's project, which highlighted Al-Fateh Highway development project. This project is one of the projects of the Ministry of Works. With a length of more than three kilometers, it includes providing several smooth accesses to the areas on which this road is located. This project also includes a tunnel for both directions, where each direction contains three lanes. It is not a secret that there are two single-lane bridges. The first for a left turn onto Prince Saud Al-Faisal Street towards Al-

Fateh suburb, and the other with two lanes for a reverse turn near the entrance to Al-Fateh Corniche. Al-Fateh Highway development project is considered as a part of the strategic plan, which includes the construction of the Manama Ring Road to provide free, non-stop movement in the Bahrain's capital. With the completion of this project, traffic movement for those coming from King Fahd Causeway towards Muharraq or the Bahrain Bay area will be free without stopping, and with a length of more than twenty kilometers.

In the present time, modern names have begun to bring together several specializations. One of these names is generative artificial intelligence. To understand this term, Dr. Raida Al-Alawi, President of the BSE, discussed this term. The field of generative artificial intelligence is the intersection of several fields, the field of deep learning inspired by human brain learning, the field of natural language processing, and the field of computer vision. This type of intelligence has evolved significantly, transformatively, from basic AI systems based on rules and fundamentals to advanced neural networks capable of creating content that resembles human-generated content. Dr. Raida discussed the types of prominent models for generative artificial intelligence. This type of intelligence was not limited to large companies, but also included emerging companies. The author also touched on many of the challenges and concerns facing generative artificial intelligence.

After that, the Chairperson of the Council for Regulating the Practice of Engineering Professions, Dr. Abdullah Yousif Talib Abdul-Ghani, addresses Issuance of the new executive regulations for the Law Regulating the Practice of Engineering Professions. The new executive regulations included making the procedures and requirements for issuing licenses in various engineering specializations and branches smooth and easy to meet the needs of the markets, as well as promoting the growth and prosperity of engineering offices, and encouraging investment in the engineering sector.

The countries in the world are always looking towards various achievements that keep pace with the current era. The Kingdom of Bahrain has launched in this year 2023 the Bahraini electronic passport under the patronage of the Minister of the Interior, HE General Shaikh Rashid bin Abdullah Al Khalifa, and the Undersecretary for Nationality, Passports and Residence at the Interior Ministry, H.E. Shaikh Hisham Bin AbdulRahman AlKhalifa. The electronic passport includes a secure electronic chip. In this project, it is addressed from several aspects and including engineering and technical aspects.

After that, Professor Dr. Walid Zubari often talks in his article about the basics for humans, which is water. Drinking water must be safe and affordable for everyone, and this is the specific condition for obtaining drinking water and sanitation. Therefore, this is the meaning that sheds light on the extent of commitment and the reality of implementation. The moment the GCC achieved a safe and stable water supply, the GCC drinking water metering system found significant financial, economic, and environmental costs.

It is known that currently the world is turning to the field of energy and its transfer, as well as its transformation into several forms through which it is beneficial to get rid of carbon emissions, which lead to pollution. To achieve clean energy, it is necessary to prepare competencies capable of critical thinking and have the necessary skills to address technical, economic, and environmental issues related to various sustainable energy systems, and this is what Dr. Mohammad bin Shams talked about in his article.

Two articles are considered initiatives of the Kingdom of Bahrain's Economic Vision 2030, the first of which relates to the initiatives of the Ministry of Electricity and Water Authority in the field of automation of the substations in the electricity distribution network. This project includes several experimental stages to achieve the expected efforts, which have led to positive and tangible results. This is achieved through qualified national cadres that the Electricity and Water Authority is proud of to ensure the smooth functioning of businesses and projects in the Kingdom of Bahrain. The second article relates to the project of renewable energy. It is working to reduce carbon emissions by approximately one-third of what is emitted in the current period. Currently, work is underway to update national plans to include the commitments announced by the Conference of the Parties (COP26) to reduce gas emissions, and to develop indicators to measure the performance and environmental impact of the initiatives and policies of the updated plan.

This was followed by highlighting future engineers through their graduation projects, designing a multi-system smart incubator for newborns with transcutaneous bilirubin measurement for the pediatric ward, the first project. The second project is a solar DC charger that features maximum power point tracking. The third project is leaking detection using a water turbine and a torque controller for a single-phase induction motor. As for the fourth project, it is a hydroponic agriculture monitoring system. The projects were concluded by the final project which is a smart trash that can work using machine learning. We do not miss the topic of the Engineer Award, which is celebrated at the Bahraini Engineer's Day ceremony in the BSE.

The Indispensable Cultural and Heritage Significance of Landmarks in The Development World is the title of article written by the PhD candidate Ms. Amal Attiya Ebrahim. She deals in her article about architecture, which is a multifaceted field that goes beyond just creating functional and visually appealing structures. She Studied the cultural context of the landmark's location, where she takes some examples, as a landmarks from Kingdom of Bahrain. These examples are Al-Khamis Mosque, the Clock Roundabout, The Pearling Path Visitor and Experience Centre.

Engineer Nezar Al-Shammasi:

- I owe Bahrain Society of Engineers a lot personally, professionally and in respect of voluntary activities.



- I was among the first batch of large college students who were sponsored to study in the United States..
- I owe it to my superiors, colleagues and those around me to become one of the world's leading maintenance and reliability experts.
- Voluntary work is the key to development and openness to society.

Interviewed and prepared for publishing by: Husain Ismail

His surrounding circumstances, such as the absence of electricity, the difficulty of transportation, and the limited family income, did not prevent him from making his way towards learning, persevering and diligently in it, to excel and obtain a scholarship from the state to study engineering in the United States of America, and to serve in the engineering sector in a number of jobs, moving between the eastern, central and western regions of the Kingdom. Saudi Arabia, and to settle in the largest oil company in the world, "Aramco," and to prove his loyalty, efficiency, and excellence until he became an international expert referred to in the field of maintenance and reliability, and to strengthen his relationship with Bahrain through communication with the Bahrain Society of Engineers, and to contribute to the establishment of the Gulf Society for Maintenance and Reliability and to chair several sessions. And the emergence of his prominent role in launching the Middle East Conference for Maintenance, Reliability and Asset Management in fruitful cooperation between the two associations to which he belongs.

In the following pages, Journey magazine reviews engineer Nizar Al Shammasi, a member of the Bahrain Society of Engineers, former president of the Gulf Society for Maintenance and Reliability, and an international expert in the field of maintenance, reliability and asset management.



Engineer Nezar Al Shammasi, President of the Gulf Society for Maintenance and Reliability at the time, reads the association's administrative report during the General Assembly meeting in the Kingdom of Bahrain in April 2014.

Hard beginnings and encouragement towards learning:

He was born in "Alqala'" district of Qatif, Saudi Arabia, on September 12, 1956, at a time when there was no electricity or water. Despite his older brother owned a new house after 5 years and they relocated in the hope of an easier and more convenient life, the electricity problem still existed! No electric power had reached the region yet, so instead, electricity was provided through generators, which barely supplied electric power for a limited number of lamps and air fans.

On the light of the foregoing, we can realize the educational environment that the student Nezar Al Shammasi lived in during his childhood and early years of study with the absence of electricity and non-availability of convenient environment that used to support learning in the Kingdom of Saudi Arabia with its vast areas. However, the passion of study, and love of learning and desire to secure a better future helped him to excel. Nezar was surrounded by his family, his father used to read and write and held a position in the municipality, while his mother was a Quran teacher and knew how

to read and write as well. His elder brother worked in Aramco and his other brother, who graduated from high school, traveled overseas to study. This motivated and encouraged him to continue and excel in his studies, especially since the names of the outstanding students used to be broadcasted on the radio and published the next day in the press, which added to his enthusiasm and love of study, looking forward to hearing his name on the air and see it in the pages of newspapers>

From Distinction to San Jose State University in California:

Having obtained his high school certificate in the year 1975, he submitted his papers to the College of Petroleum and Minerals in Dhahran. He also applied to the Ministry of Higher Education for a scholarship. After obtaining approval from the College of Petroleum and Minerals

- **«I was among the first batch of large college students who were sponsored to study in the United States»**



Engineer Nezar Al-Shammasi during his undergraduate studies at the University of San Jose in California.

first, he had to withdraw his original papers after he received a call from the Ministry confirming that he has been accepted to study in the United States of America, as part of a wide government scholarship program put forward by the Kingdom. He was among the first large batch of this program.

His beginning in Bahrain

As part of his preparations for traveling and studying in the United States of America, a group of friends suggested to him to visit Bahrain to tailor, buy and prepare travel and university study clothes due to their availability, quality, and reasonable prices. The first visit of Engineer Nezar Al Shammasi was in the summer of 1975, through one of the Gulf Air flights from Dhahran to Bahrain. He spent his days in Bahrain with some of his friend's relatives preparing for travel and taking some tours around the country.

During this short 3-day visit, Eng. Nezar Al Shammasi managed to foster close relationship with Bahrain, which became stronger later after nearly three decades. He

used to visit Bahrain officially once every 3 years to attend the meetings of the GCC Production and Maintenance Committee of GCC oil companies as a representative of Aramco. He also used to visit Bahrain either as a family visit or during the weekends. Such visits increased with the establishment of the Gulf Society for Maintenance and Reliability (GSMR) when the attempts started to establish it in the year 2008, and its formation was announced in the year 2010 where its headquarter was chosen to be in the Kingdom of Bahrain.

University days:

Returning to the university years, Nezar spent his years diligently excelling in his studies until he obtained a mechanical engineering degree in the year 1981.

Following his graduation, he worked in the Ministry of Information as a maintenance engineer. However, Nezar desired to move to the private sector, which is more extensive and open, as a result of the urban and technical development that was growing and developing in the Kingdom of Saudi Arabia at the time and the promising

opportunities that were available. Accordingly, he moved to the Saudi Basic Industries Corporation (SABIC) as a mechanical engineer in one of its first companies (SAMAD), which is known today as (Al-Bayroni). It was a new experience for him in this new giant Saudi industrial company that was inaugurated by King Fahd bin Abdulaziz Al Saud in the year he joined the company.

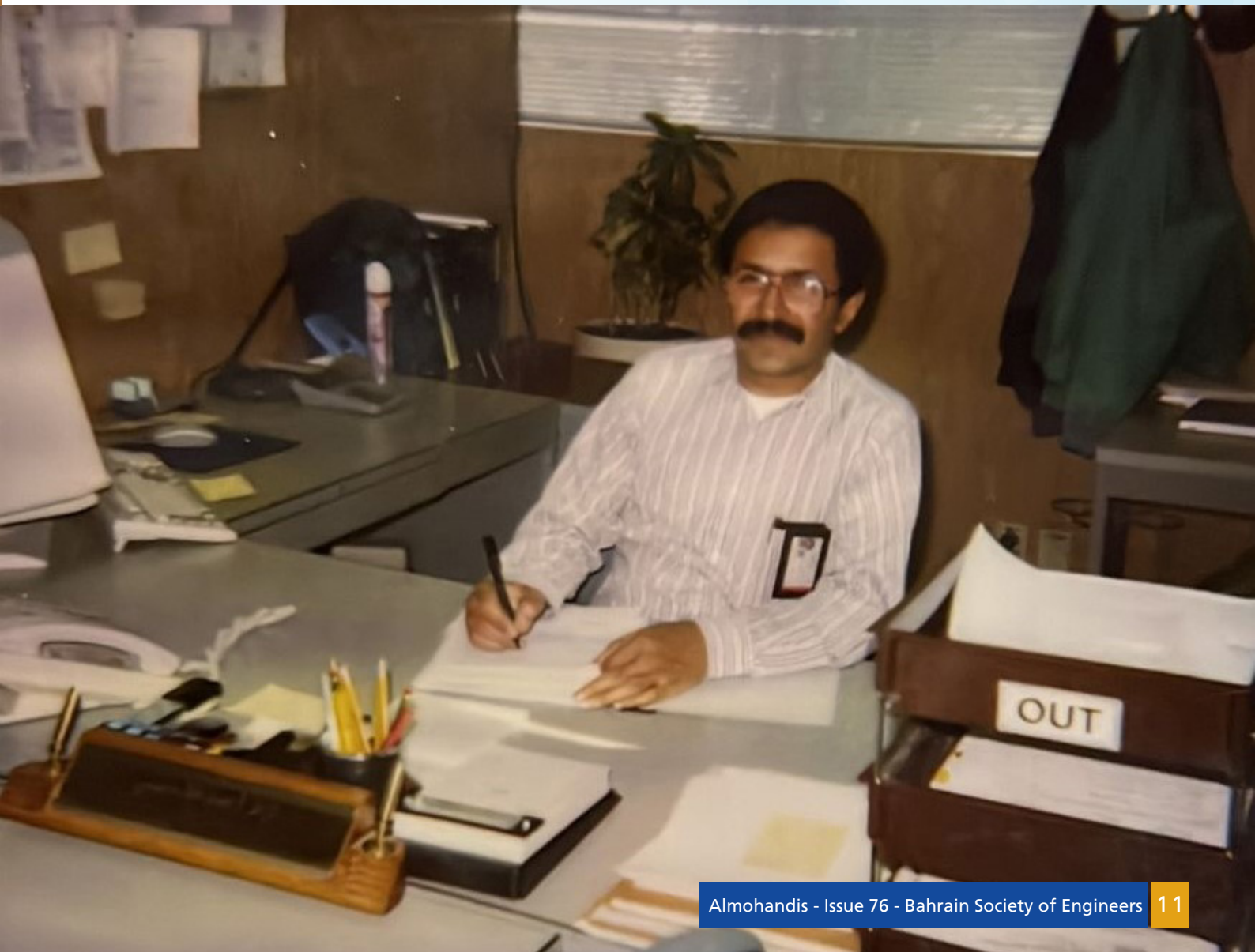
The most influential step in his career was when he moved to the Arabian American Oil Company (Aramco) on February 16, 1985 as a maintenance engineer at the gas plant in Ju'aymah (or the gas fractionation plant). He was one of the first Saudi maintenance engineers in the plant, and he worked in the gas plant for ten years. In this department, he gradually advanced from a junior maintenance engineer to a senior chief in the maintenance department of the said plant.

After merging SAMAREC Company into Aramco, he worked in Riyadh Refinery for a period of three and a half years. Although he was not happy with his job at

the beginning, it was the key to entering the field of management. He excelled in the field of maintenance engineering in the company. After his return from Riyadh, he worked in a department concerned with technical affairs in the refining and distribution sector (Down Stream). In 2001, he was chosen to work in the technical department and then the product distribution department as a maintenance officer in the eastern region. In the year 2006, he was assigned to join a central team concerned with developing maintenance performance and reliability in all Aramco's facilities and companies, and the secretary of the Maintenance Council for maintenance affairs, which included officials and representatives from all Aramco's disciplines.

In his new position, he was nominated to represent Aramco in the field of maintenance in the GCC National Oil Companies Production and Maintenance Committee. This committee used to meet every 6 months in one of the GCC countries.

Engineer Nezar Al-Shammasi during his duty at Riyadh Refinery.





Engineer Nezar Al-Shammasi speaking at the meeting of the Operation and Maintenance Committee of petroleum companies in the Gulf Cooperation Council countries, which was held in the State of Kuwait on April 23, 2008.

During the meetings of this sub-committee, an idea was emerged to establish a Gulf Conference concerned with maintenance, and thus the need to establish a branch of an international association concerned with maintenance, in order to comprehensively spread knowledge of maintenance and its importance to all professionals in the field of industry. The committee approved a proposal submitted by Eng. Nezar Al Shammai, representing Aramco to establish this entity.

Eng. Nezar is not new to voluntary works, as he started his voluntary life within the school scout troupe in the elementary and intermediate levels. During his working life, he was affiliated with some international associations or branches of international associations such as the American Society of Mechanical Engineers (ASME) and the American Vibration Institute, and others. Also he was involved in other voluntary services in the professional

field, such as conferences, for example Petrotech conference and others.

Engineer Nezar says that voluntary work has added many benefits to his personality, whether in the practical or scientific field, or in the field of building personal and professional relationships.

The surprising thing is that when Engineer Nezar Al Shammasi visited the United States of America and expressed his desire to establish a branch of the foregoing association, the idea was rejected. Therefore, the team, which included professionals in the field of maintenance and reliability from several industrial and service sectors from all the GCC countries, decided to establish a Gulf association concerned with maintenance and reliability. The team started that step in the year 2008. Following many meetings and follow-ups, the team managed to register the new society and selected the Kingdom of



Engineer Nezar Al-Shammasi during the announcement of the establishment of the International Forum for Maintenance, Reliability and Asset Management (GFMAM). The Gulf Society for Maintenance and Reliability (GSMR) was one of the five founding members of the International Forum in 2010 and one of its thirteen members currently.

Bahrain as its headquarters due to its central location between the countries of the Gulf Cooperation Council and due to the easy procedures for establishment in the Kingdom of Bahrain compared to other countries. Consequently, the society was registered on 10 February 2010.

During the same period of establishing the Gulf society, the idea of establishing a global association concerned with maintenance, reliability, and asset management emerged, to become a meeting place for all professionals in the field of maintenance and reliability in order to spread awareness on maintenance all over the world.

Presidency of two international associations in the field of maintenance:

With their endeavors to establish the Gulf Society for Maintenance and Reliability, there were procedures for

establishing a similar international association. Eng. Nezar Al Shammasi attended a number of meetings and preparations for its establishment in a number of countries. Three months later, after announcing the establishment of the Gulf Society for Maintenance and Reliability in February 2010, the establishment of the Global Forum on Maintenance & Asset Management (GFMAM) was announced. GSMR was one of the five founding members of the International Forum in 2010 and one of its thirteen members at the present time.

Eng. Nezar Al Shammasi was selected as the chairman of GSMR since its inception and for several consecutive sessions from 2010 to 2020. During the period from 2014 to 2018, he also chaired the GFMAM. During that period, he chaired two Gulf and international associations concerned with maintenance, reliability, and



His Excellency Shaikh Khalid bin Abdullah Al Khalifa, Deputy Prime Minister honors Engineer Nizar Al Shammasi among the group of honorees honored by the Bahrain Society of Engineers at its golden jubilee ceremony on March 15, 2022.

asset management. The support, encouragement and cooperation by his colleagues in the two societies helped him a lot in his mission as he said

Why such great interest in the maintenance and reliability?

Maintenance is one of the success factors for industrial enterprises, due to its importance in sustaining assets, equipment/ machines and cutting down expenses; thus achieving higher productivity and profitability for those companies as well as building a reputation based on high reliability.

The industrial companies such as Aramco, one of the largest oil companies worldwide, and the various sites it owns, countless machines and equipment at prices equivalent to the budgets of some countries, the maintenance programs represented great importance to the company, whether financially or in terms of the company's reputation which lead to building high-level maintenance programs. Thus, the companies in general, and industrial and oil companies in particular, work hard and give maintenance their entire attention to cut-down expenses, increase efficiency and productivity, and to enhance their reputation as well.



Engineer Nezar Al-Shammasi is considered the first non-American maintenance engineer in the world to obtain the Professional of the Year certificate in the field of Maintenance and Reliability (CMRP) in 2016.

Personal and professional achievements

Despite his various achievements on the professional and voluntary levels, he considers education of his children, their excellence, and obtaining decent and suitable jobs as one of the most precious and important achievements in his life. He thanks the Almighty Allah in this context, as he had no role and never imposed any pressure in determining or directing their academic inclinations. His children had desires and inclinations that were different from their father's orientations. They became acquainted with the academic specializations and professions by themselves through social media and other sources.

As for the engineer Nezar and his generation, they were more inclined to study medicine or engineering, especially civil engineering, but he obtained a scholarship in mechanical engineering. His generation used to be of limited orientation in their local community, and the study was easier for them, especially for the diligent students in high school.

As for his children's studies, Ahmed studied supply management in the United States and is currently working with Aramco. As for Reema, she graduated from New Zealand with a marketing major and works as a marketing manager for a credit card company in Saudi Arabia, Bahrain and Levant regions. Rana is an electrical engineer in Aramco, and Samar is a doctor and specialist in internal medicine, and working to be consultant in hematology.

As for the professional side, several milestones during his career can be considered important achievements that he is proud of, and the most important of which is that he did not leave Aramco until after he contributed to the establishment of a new department in the company, which is the Corporate Maintenance Services Department. This department did not exist before, or existed in the sixties in a completely different form



Student Nezar Al-Shammasi and the beginning of his volunteer work with the school scouts in the middle school.

Finally... A word of thanks and gratitude

"I feel it is my duty to thank all those I have associated and worked with throughout my career. Honestly, I was fortunate to have a team of volunteers who made all tasks easier for me, whether regarding establishing the association or organizing the conference." Nezar said.

Engineer Nezar Al Shammasi does not forget the Bahrain Society of Engineers and expressed his thanks to it through Almonhandis Magazine: "I extend my sincere

Engineer Nizar Al-Shammasi with his work colleagues during a ceremony held by Aramco on the occasion of his retirement.



thanks to Aramco's management, my superiors and my fellow employees, and their unlimited support over three decades. It was a great pleasure in my career to be associated with everyone, from technicians and ending with all levels of management all over Aramco. This has contributed to attaining several achievements on a personal, professional, and voluntary level. Indeed. For them, my name has been always associated with the field of maintenance and the related matters."

On the professional level, Eng. Nezar was the first non-American maintenance engineer in the world to obtain the CMRP Professional certificate in 2016.

Engineer Nezar recalls his first contact with the Bahraini Society of Engineers with its then president, Eng. Abdul Majeed Al-Qassab, in March 2010, when he met him to present the idea of organizing the first conference on maintenance and reliability in Decemeber of the year 2010, and his opposition to that due to lack of time, non-availability of sufficient budget and necessary preparations. Nevertheless, with serious and constructive cooperation between the two associations and the two presidents, it was possible to organize the said conference, on the same date of the same year and it registered a great success. This calls for Eng. Nezar to thank the BSE and its president at the time:

"Since we started cooperating to organize the Maintenance and Reliability Conference (Mentcon) in the year 2010, the Bahrain Society of Engineers has opened its arms and harnessed its logistical and administrative capabilities, and this has contributed to my personal development. Many thanks to the BSE, for its support to the Gulf Society for



Engineer Nezar Al Shammasi, President of the Gulf Society for Maintenance and Reliability at the time, during the signing of a memorandum of understanding with the Bahrain Society of Engineers, which was signed on behalf of the Society by its then President, Engineer Abdul Majeed Al Qassab, in 2010.



Maintenance and Reliability. I would like to express a special thanks to my brother and colleague, Eng. Abdul Majeed Al Qassab, with whom I commenced the course of this difficult event, but with the passage of days the relationship became stronger and stronger, so he was a strong supporter, an advising partner, and a loyal friend. It was a support from one brother to another, and from an association to another association. I really felt his love for voluntary activities, which contributed to serving everyone. This marvelous support and cooperation have contributed vastly in the success of the event”

Finally, the maintenance and reliability expert, Engineer Nezar Al Shammsi, stressed that there is no doubt that when a volunteer work emerges from a person in a leading position, and spending substantial time and effort defiantly will be greatly appreciated, since such time was on the account of his family and personal time. Therefore, Engineer Nezar feels obligated to express his gratitude and thanks to his family members for their understanding and tolerance of his working conditions.

Engineer Nezar Al-Shammasi delivers a speech to an international conference.

Increasing the Capacity of the Vital Highway by 61%

Al-Fateh Highway Upgrade Project (FHUP)... A Strategic Project Facilitating the Traffic



The Ministry of Works (MoW) is working now on implementing Al-Fateh Highway Upgrade Project. It is one of the important strategic projects of the Government's Program. It works to meet the current and future development requirements of the Kingdom and stimulate the economic sectors as it connects Mina Salman Interchange and the Northern Manama Causeway connecting the Bahrain Bay.

Al-Fateh Highway Upgrade Project is sort of support for the priorities and objectives of the Government Program (2023-2026) and the directions of Bahrain Economic Vision 2030, in a way that enhances comprehensive development and its various scopes, and achieves sustainable economic growth as it represents one of the infrastructure projects which comes to keep pace with the urban and investment development witnessed by the Kingdom of Bahrain.

Al-Fateh Highway is one of the vital and important Avenues in the Capital as it connects a number of important areas that are considered a destination for citizens, residents and visitors. The expansion project will contribute to increasing the traffic, making it easier to access and reduce time for road users.

In a previous issue of "Al-Mohandis Magazine", we have already reported aspects of Al-Fateh Highway Upgrade Project. In this issue, we will discuss other aspects of such major strategic projects implemented by the Ministry of Works.



Overview:

Al Fateh Highway Upgrade Project extends from Sheikh Hamad Causeway, North of Mina Salman Interchange in the South, with a length of more than three (3) kilometers. It includes providing smooth access to the two areas of Juffair and Al-Qudaibiya and the villages of Juffair, Al-Ghuraifa and Umm Al-Hassam. The main works of the project include expanding Al-Fateh Highway to four lanes in each direction together with:

- Construction of a 595-meter-long tunnel with three lanes in each direction at the intersection of Al-Fateh Highway with Awal Avenue and Bani Otbah Avenue (Al-Fateh Mosque Intersection) to move traffic along Al-Fateh Highway between the North and South freely, in addition to an intersection controlled by traffic lights at the underground level above the tunnel to provide a free U-turn in both directions and exits to Juffair and Adliya areas.
- Construction of a 367-metre-long one-way flyover with two lanes to turn left onto Prince Saud Al-Faisal Avenue towards Al-Fateh Suburb, which would provide free non-stop movement to move traffic to Al-Fateh Suburb smoothly and without any impact on the main traffic on Al-Fateh Highway.

- Provision of a 126.5-metre-long flyover with two lanes for U-turn near the entrance to Al-Fateh Corniche for northbound traffic. This Causeway mainly serves traffic flowing from Juffair via Prince Saud Al-Faisal Avenue to Al-Fateh Highway towards the South to Mina Salman, in addition to westbound traffic to Sheikh Duaij Avenue. It is worth mentioning that this Causeway is the first of its kind in Bahrain that was constructed as U-turn flyover.

The Strategic Scopes of the Project and its Impact on the National Economy:

Through its implementation of a set of strategic projects, the Ministry seeks to reach the comprehensive vision by providing safe and high-quality roads with more streamlined traffic, as the Ministry aims to construct the Bahrain North-South and West-East Ring Avenue.

Al-Fateh Highway Upgrade Project is part of this strategic plan, which includes the construction of Manama Ring Avenue, in order to provide free non-stop movement in the Capital to facilitate the smooth flow of traffic and reduce traffic congestion on the road network.

As part of the Ministry's previous projects, traffic was freed up for those coming from King Fahd Causeway, passing through Sheikh Isa Bin Salman Avenue, which will



also soon be expanded, Bahrain Map Interchange, then Umm Al-Hassam and Mina Salman Interchange to reach Al-Fateh Highway, which the Ministry is hereby working to develop to reach to Bahrain Bay area and Bahrain Financial Harbour via the Northern Manama Causeway. This will relieve pressure and congestion on King Faisal Avenue, then to Al-Farouq Intersection and Sheikh Khalifa Bin Salman Avenue to meet again with Sheikh Isa Bin Salman Avenue.

It is worth noting that with the completion of the project, traffic for those coming from King Fahd Causeway towards Muharraq or the Bahrain Bay area will be free non-stop movement, with a length of more than 20 km.

The Project supports the economic development in the Kingdom of Bahrain and attracts investments in a way that enhances the revitalization of economic sectors, given that the Highway connects Mina Salman Interchange and the Northern Manama Causeway connecting to Bahrain Bay, in addition to other tourist and vital areas whose entrances and exits located on Al-Fateh Highway as part of the project works will be developed.

In the future, Al-Fateh Highway will also witness the implementation of one of the main lines of the Bahrain Metro, which will be implemented by the Ministry of Transportation & Telecommunications.

Traffic Statistics Numbers:

- The average traffic volume used for Al-Fateh Highway before the start of the project is 87,000 vehicle per day.
- The average traffic volume is expected to reach to 138,000 vehicles per day in 2030.
- After completion of the Project, it is hoped to provide a high capacity of up to 140,000 vehicles per day serving transit traffic on Al-Fateh Highway, which means increasing the capacity by 61% of the previous situation.
- The average speed of vehicles on Al-Fateh Highway before the development works is 40 km/h. It is hoped that the average speed of vehicles will rise to 55 km/h, an increase of 38%, knowing that the maximum speed of the Avenue will be 80 km/h.
- The upgrade of Al-Fateh Highway will have a positive impact on the average time for crossing the Highway, as the average time will reach 4.1 minutes instead of the previous situation, which reached 5.8 minutes, at 29% less.

Implementation Phases:

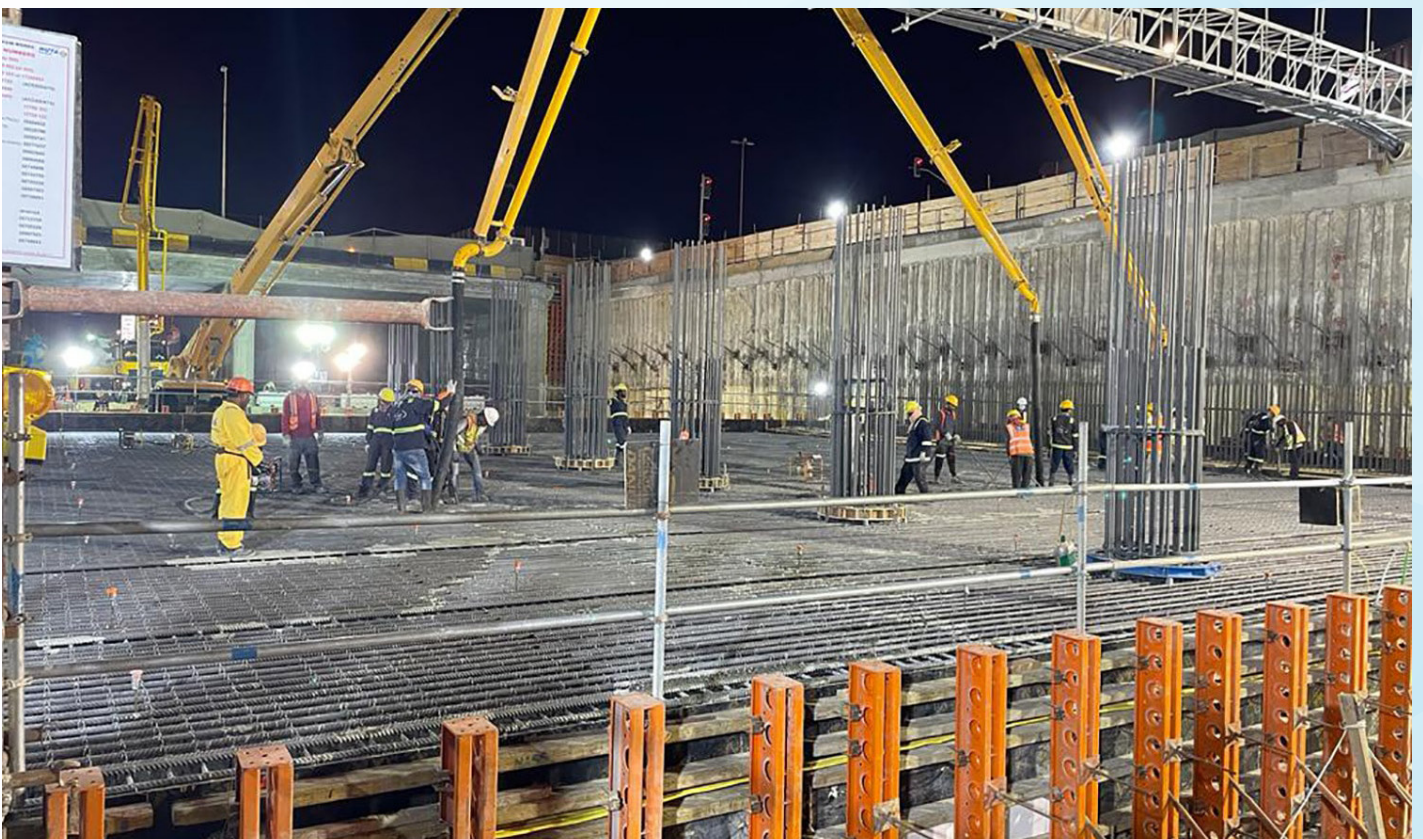
Given the importance of the Highway and the large number of underground services, some of which clash with the expansion and development of Al-Fateh Highway, it either needs protection or transfer, the Ministry divided the Project into two main phases as follows:



Preliminary Work Phase:

Since 2018, the Ministry has been working on a set of preliminary works for this Project, in order to remove the greatest amount of collision affecting the Project's main work program. The most prominent aspects of which are:
Extending Juffair Al-Ghuraifa sewerage line, which aims to replace the current sewerage line extending on Al-

Fateh Highway from the intersection of Awal Avenue and Bani Utbah Avenue (The intersection of Gulf Hotel and Al-Fateh Mosque) to the intersection of Juffair Avenue and Mahooz Avenue (Al-Dolab intersection) in order to increase the capacity and remove collisions with the road works of the main project. It has been completed in January 2022 at a cost of BD. 2.283 million, funded by Saudi Fund for Development.





Main Works Phase of the Project:

The Work Program includes:

- o Completion of the work of the U-turn flyover near the entrance of Al-Fateh Corniche and opening it for traffic in December 2022.
- o Completion of the one-way Causeway work at the intersection of Al-Fateh Highway with Sheikh Duajj and Prince Saud Al-Faisal Avenues, and opening it for traffic in April 2023.
- o Completion of most of the work of the tunnel at Al-Fateh Mosque intersection and opening it partially in July 2023 and fully in the last quarter of 2023.
- o Expansion of Al-Fateh Highway from three lanes to four lanes, paving its roads with the layers applicable in the Kingdom of Bahrain, up to the asphalt layer, developing sidewalks and installing the necessary lamp posts, traffic lights and traffic signs.
- o Excavation, paving and piling work for foundations, Causeway construction structures, and reconstruction of a rainwater drainage network equipped with a pumping station.
- o Landscaping.
- o The Project work also includes protecting the currently existing underground services or transferring them to

their new locations and providing underground channels for future use.

It is worth mentioning that the value of the main works of the Project is amounted to BD. 29,662,314.735. The total value of the Project works includes the preliminary works, main works and appointment of consultants to supervise these works in a sum of BD. 39,856,756, of which BD 34,875,000 was generously funded by Saudi Fund for Development and BD 4,981,756 funded by the Government of Bahrain's budget.

Difficulties facing Implementation:

- **Traffic Diversions:** Completing the Project in conjunction with the flow of traffic and ensuring the least impact thereon with the presence of high traffic density and the strategic and important location of the Project as it is a main artery connecting King Faisal Avenue in the North and Sheikh Isa Bin Salman Avenue in the South and contains main outlets to important areas.
- **Underground Services:** There are several main and important underground services that need to be taken with caution in dealing therewith, either due to their highest significance or danger, in addition to the high requirements for their protection or transfer thereof in the event of a collision with other services.
- **Architectural Requirements:** There are special

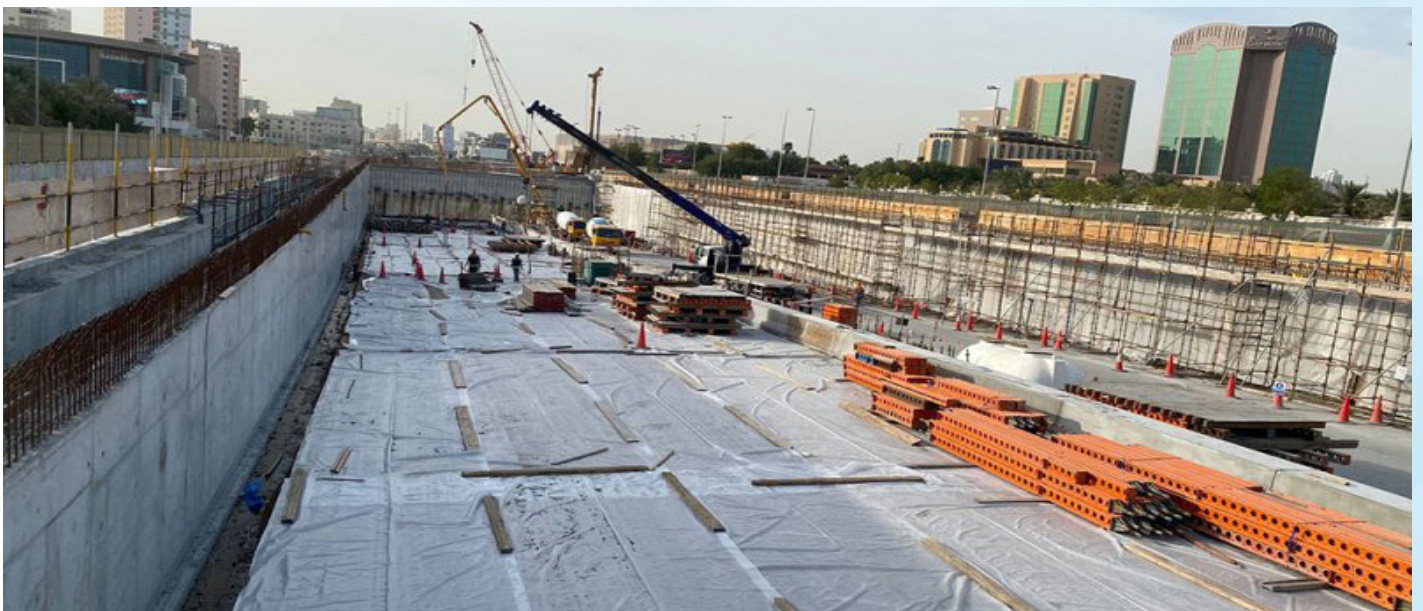


architectural requirements for the implementation of the Project in proportion to the surrounding area for both the tunnel walls and Causeways, which require time to prepare and coordinate with the concerned authorities to obtain the necessary approvals.

- Limited Area of Work: Limited area of work either due to the buildings, underground services or even traffic diversions on the road require the work team to accommodate to working in narrow areas.

The role of Bahraini Engineer in Implementing these Projects:

The Bahraini engineer is present in many different phases of the Project, where he plays key roles within one work team composed of various parties, including the Ministry, the Project Consultant, the Contractor and other supporting Parties. The fingerprints of the Bahraini engineer are clear since the inception of the Project in the planning and design phase to reach the optimal design in proportion to Project requirements, as well as in the implementation phase wherein he play more roles.



Secondary Substation Automation in the Electricity Distribution Secondary Network...



Electricity plays a vital role in modern human life, serving as the foundation for operating industries, businesses, homes, hospitals, schools, and other essential infrastructure necessary for life. In the context of sustainable development and achieving economic and social progress, the development of the electrical sector is crucial and necessary for countries worldwide. As the Kingdom of Bahrain is committed to providing an improved quality of life for both citizens and residents, it adopts this vision and works diligently to enhance its electrical capabilities and improve its performance through strategies aimed at enhancing efficiency and sustainability. The focus on developing electricity in the Kingdom of Bahrain reflects the desire to achieve sustainable development and enhance the quality of life for its citizens and residents. Through its comprehensive strategy, the Kingdom of Bahrain will be able to meet its growing electricity needs and enhance its economic and competitive capabilities on the global stage.

Based on the strategy of the Kingdom of Bahrain, the Electricity and Water Authority seeks to provide quality and reliable electricity and water supplies to achieve the sustainable development across the kingdom. Firstly, increase electricity generation capacity and improve its efficiency through diversifying energy sources and adopting modern technologies and smart systems. Secondly, enhance the distribution network and improve the quality of service provided to customers, including the application of smart grid technologies and load management improvement. Thirdly, it places great emphasis on promoting environmental sustainability by encouraging the use of renewable energy and implementing clean energy projects.

The Electricity and Water Authority continues to utilize modern technology and innovations in the electricity sector to enhance efficiency and achieve environmental sustainability. The authority strives to raise awareness of the importance of energy sustainability and encourages consumers to take measures to conserve energy and benefit from renewable energy sources. It also works on developing a solid electricity infrastructure that enables reliable and efficient service delivery for everyone.

Project Strategic Objective

The authority has begun implementing the smart city model, which involves digitizing and automating all energy production and operation processes. One of the key steps of this model is the automation of secondary substations in the electricity distribution network, as it is crucial for achieving high efficiency and effectiveness in operating the electrical network in the Kingdom of Bahrain. The importance of automation lies in the application of

modern systems and technologies that contribute to improving performance, reducing failures, and enhancing the quality of service provided to consumers with the highest reliability.

Project Goals

Automation of secondary substations enables more accurate and efficient monitoring, tracking, and control of electricity distribution operations. Automated monitoring and control systems are used to monitor the network's



status and capture important information such as voltage level, current, frequency, switch and transformer status in the substations.

Automation also enhances the capabilities of operating engineers to effectively and quickly control the electrical network. Through the use of automated control and smart monitoring systems, operators can continuously monitor quality indicators, detect faults, control distribution operations remotely, easily perform restoration and switching operations according to altering needs and conditions. These operations are executed automatically and at high speed, thereby reducing power outage durations and improving the network's responsiveness to variable demands. This contributes to raising the network's reliability, providing a stable and reliable electricity service, enhancing customers' confidence in the electrical system, and promoting their comfort and stability.

Secondary substations automation in the electricity distribution network in the Kingdom of Bahrain plays a crucial role in improving resource utilization efficiency and reducing operational costs through remote control, thereby minimizing travel and field visits. By accurately monitoring electrical flows and loads, optimal power distribution can be achieved, avoiding overload on transformers and other electrical equipment, resulting in reduced energy losses and improved system efficiency overall. Additionally, safety standards are boosted through the secure implementation of remote daily disconnection and connection programs, minimizing direct contact between technicians and high-voltage equipment.

Implementation process

The process of automating substations in the electricity distribution network in the Kingdom of Bahrain passes through several stages to ensure its successful implementation and effectiveness. This set of sequential stages is subject to continuous evaluation in order to improve the implementation process and achieve a better customer service. Below we review some of the main

stages of implementing this process:

1. Analysis and Planning:

The first stage begins with analyzing the need for substation automation and defining its main objectives and requirements, this followed by assessing the infrastructure, identifying targeted substations that will be considered within the automation project, plan the process timeline and determine the resources required to implement the project.

2. Systems Design:

This stage includes designing the system that was implemented in the substations. By specifying the equipment and devices used such as automatic switches, measurement transformers, monitoring and control systems, as well as specifying the communication interface and the software used in the system.



3. Installation and preparation:

In this stage, the specific equipment and devices in the substations were installed, integrated with the current electricity grid and communication network, and equipped as per the design. All wires and cables were connected, sensors and control devices installed, as well as the central monitoring and control system.

4. Testing and commissioning:

After installation and commissioning, comprehensive tests were carried out on the automated substation to ensure the correct functionality, integration and accuracy of the system according to the designed requirements. Sensors, control and associated software were also tested through operational (point to point testing) to check the performance and response in all substations.

5. Operation and Maintenance:

In this stage, the process of monitoring and controlling the system is running on constantly to ensure that substations are in service, the system is operational and monitor against interruptions. Furthermore, in electrical power systems, maintenance is essential to ensure the healthy operation of all equipment in the network—from generation plants to the transmission network, substations, and distribution network—so power reaches consumers safely, continuously, and efficiently. Therefore, a periodic maintenance of equipment and devices is carried out to ensure continuity of performance, efficiency and avoid any potential issues.

Project implementation stages

The pilot phase and the first phase of the project paved a

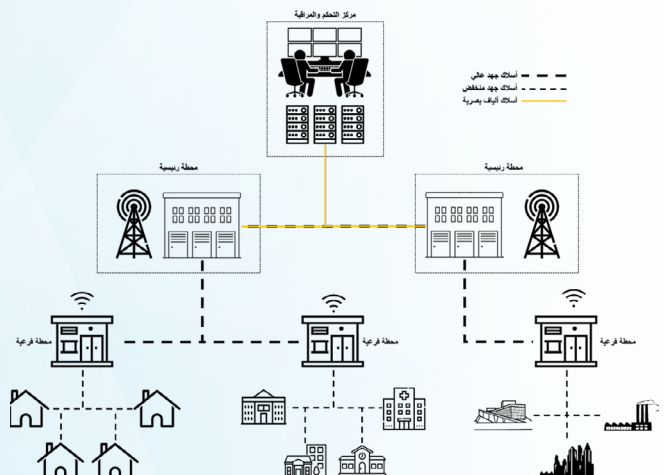
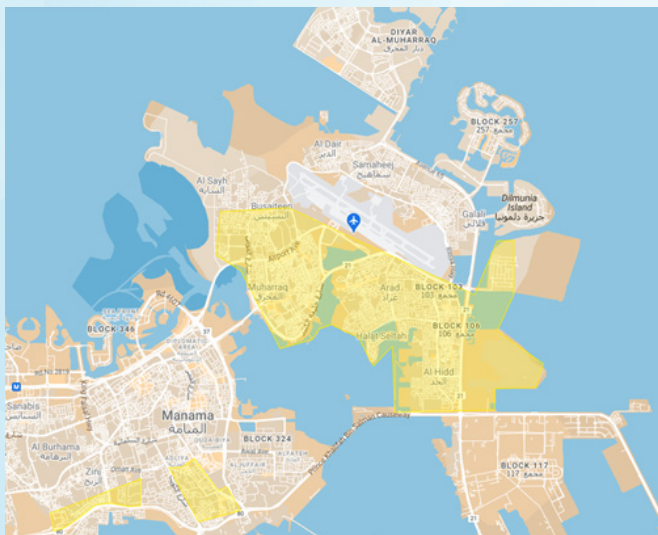
success way towards future modernization and upgrade of the electricity distribution grid for better performance and reliability. The implementation of which, can be summarized as follows:

Experimental phase:

1. Exchanging knowledge and experiences with regional countries and globally to benefit from their practices, and obtain valuable as well as buildable feedback in this field.
2. Performing studies on the latest technologies used globally in distribution automation projects.
3. Implementing separate pilot projects on selected automated substations, which were on different locations, whilst using various technologies to study their compatibility with EWA's requirements as well as Bahrain's Environment.
4. Conducting a study of the findings and results of each of the pilot projects on the selected automated substations, whilst highlighting the benefits to create an optimal model.
5. Preparing all documents required to initiate the first phase of the project.

The First Phase:

As the Kingdom of Bahrain always strives to be the leader in all fields, the dedicated team on this project worked on implementing advanced private LTE solution to modernize the grid and make it future-ready. Hence, EWA is the first in the region to establish a reliable private wireless communication network in the automation of electricity distribution, by allocate a frequency spectrum for the Electricity Distribution Directorate in coordination with



The Telecommunications Regulatory Authority in Bahrain. In the first phase of deployment, around 450 distribution substations in Muharraq area were selected to be automated, besides around 50 substations were selected to be the stepping-stone towards establishing the fiber optic network of electricity distribution network. After the successful completion of the first phase, it is expected that the project will expand to connect thousands of secondary substations and hundreds of primary substations spread across the entire Kingdom.

As part of the project implementation, all traditional Ring Main Units were replaced with automated Ring Main Units (RMU), that were equipped with sensors and motors for remote electrical switching and monitoring. This is to encompass all distribution stations into a unified automation and management platform. Afterwards, Remote Terminal Units (RTU) were installed for acquisition of real time status and control functions of switching devices such as breaker, load break switches etc. Wired and wireless network communication devices were then installed to transmit information to the main control center. Communications towers for the electricity distribution network were installed in primary locations and all signals were transmitted to the database of the main control center. Digital signals and remote control of automated substations tests were performed to ensure the correct functionality and accurate operation. Currently, the project is under constant monitoring and control, whilst regular maintenance is performed. In

addition, distribution automation is implemented in new MoH projects as well as Bahrain development projects.

Results achieved:

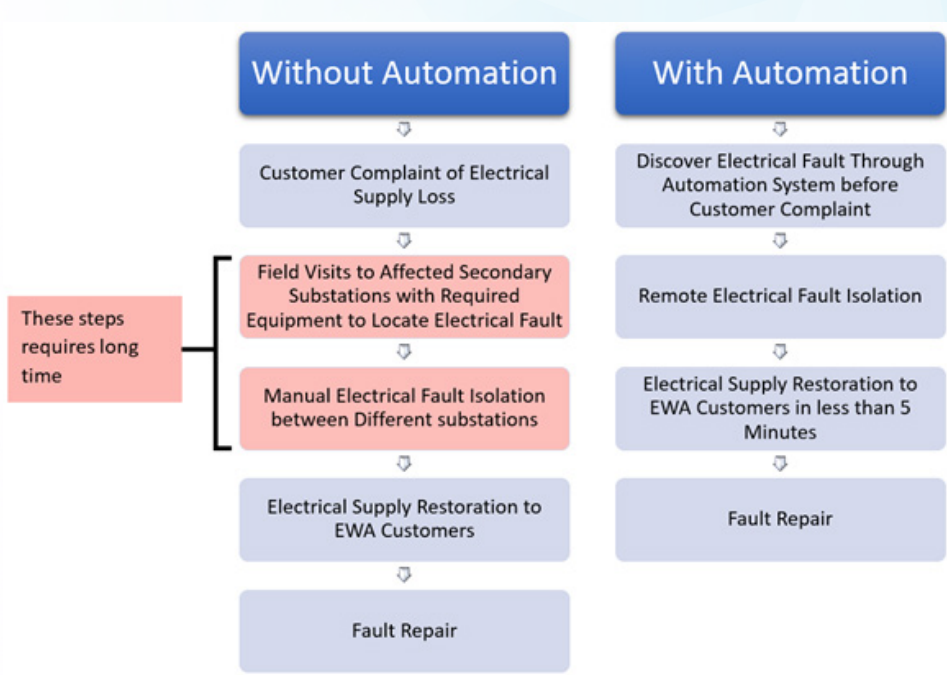
These collaborative efforts have led to positive and tangible results that positively impacted performance indicators and electricity reliability, such as:

- Improved network efficiency: improve service reliability along with minimum power supply restoration time that was reduced by 80% according to the performance indicator to less than 5 minutes.
- Balancing electrical loads: achieving electrical load balance between primary and secondary substations and thus increasing the reliability and dependability of electricity, as well as protecting electrical equipment from overloads.
- Increased safety: decreased work accidents and reduced risks resulting from human intervention.

Reduce Electrical Supply Restoration Time By 80%



To less than 5 minutes



• Enhancing control and monitoring: Obtaining real-time data and control over distribution substations in selected area where the project is implemented, as well as acting proactively in identifying electrical fault locations faster by responding on automated substations alarms and projections.

• Faster emergency response: restoring electrical power to EWA customer before a customer complaint is raised.

Difficulties and challenges

When looking to implementing

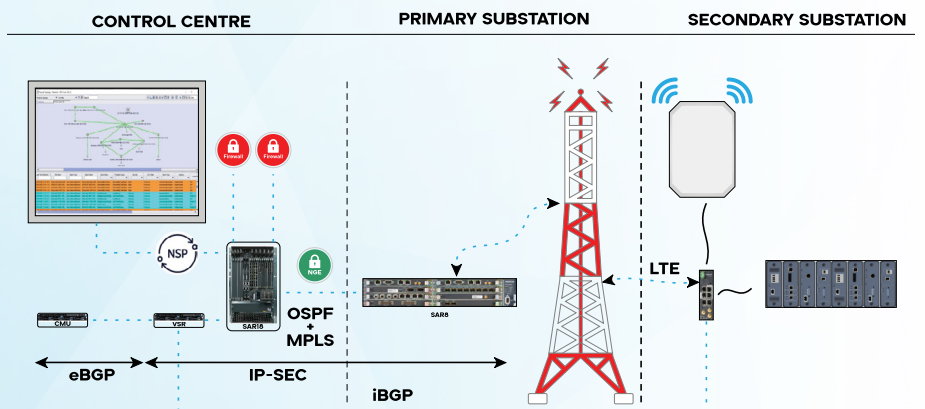


the distribution automation project in the Kingdom of Bahrain, there are potential difficulties and challenges, including:

- The delay of materials' shipping due to the Covid-19 pandemic.
- The slow manufacturing of electronic conductor chips necessary for the project, hence resulting in delay in its shipping and installation.
- The complexity of installing the fiber optic network, as there are many services occupying the infrastructure in Bahrain, which required cooperative coordination with various EWA directorates and government entities.
- Difficulty in compatibility and integration of the modernized automation systems along with existing equipment and components in network.

- Maintaining the stability of the electrical network during the process of converting to the automation system where critical measures have been taken
- Into consideration to deal with any potential impact.
- The probability of cybersecurity threats arising with the establishment of a private wireless network, where significant prevention measures and high level of security

MIDDLE EAST'S FIRST PRIVATE LTE SOLUTION FOR AUTOMATING AND DIGITIZING THE COUNTRY'S DISTRIBUTION NETWORK



was taken into consideration.

- Operating and maintaining a distribution automation grid requires a trained and qualified team to handle the implemented technologies, and this was implemented to its full extent by employing and training Bahraini cadres.

Role of the Bahraini engineer

Based on the belief and pride of the Electricity and Water Authority in its qualified national cadres, supported with the lucid vision of its management; EWA has employed and trained Bahraini engineers to be involved and take control in many of its mission critical projects, herewith, the electricity distribution automation project was also included. In this project, the Bahraini engineer played a decisive and key role in planning, designing, implementing and maintaining the distribution automation system without refereeing to external consultation bodies.

The Bahraini engineer has left remarkable fingerprint since the inception of the project in its various stages, and undertook many responsibilities such as but not limited to:

- Managing the project and its jobs as per the scope and the plan, whilst ensuring meeting EWA requirements and level of quality according to international standards.
- Financial management of the project, ensuring that the project is implemented within the specified financial scope, preparing financial cash flow and reviewing its disbursement.
- Ensuring the successful integration of various devices, electrical components, and their compatibility with the current electricity distribution grid.
- Preparing the necessary periodic reports to highlight the progress of the project and the issues arising that may hinder implementation process, whilst focusing on addressing them at an optimal period.
- Performing direct supervision on the project, to follow up its progress and ensure quality of implementation as well as work safety, which is in cooperation with technical workers who connect wires, install devices and equipment.

- Operate the integrated systems and verify their compliance with the required specifications and standards.
- Coordination with stakeholders from other government and service sectors to obtain the required approvals.
- Training other EWA employees to use new systems and update the technical and operational documents related.
- Monitoring the performance of the system and taking the necessary measures to fix any malfunctions or technical problem, which in turn ensures the continuity and efficiency of the system.
- The Bahraini engineer contributes to achieving clear enhancements in the performance of automated substations, which contributes to increasing their reliability, saving energy and improving operational efficiency.



In the presence of several engineering sector officials... Celebrating Bahraini Engineer's Day... Members of the BSE participate in a donation campaign to support our brothers in Gaza...

The BSE held a Bahraini Engineer's Day celebration at its headquarters in Juffair on the evening of Wednesday, 18th October 2023, in the presence of several officials in the country's engineering sector from both the public and private sectors, and a large number of the society's officials and members.

Since 2014, the BSE has been celebrating this occasion in honor and appreciation of the role played by the Bahraini engineer in the development of the engineering profession and raising the status of the engineering sector. In addition, to introduce the great efforts made by engineers in this sector and to enhance the comprehensive development renaissance experienced by the Kingdom of Bahrain.

Dr. Raida Al-Alawi, President of the BSE, expressed on this occasion her sincere congratulations and the members of the Board of Directors to all male and female engineers in the Kingdom of Bahrain. Stressing that the achievements witnessed by the Kingdom of Bahrain in its comprehensive development process were achieved through continuous and continuous efforts by Bahraini engineers who work hard and diligently. Contributing their knowledge and effort to building and developing our love Kingdom of Bahrain.

A wise vision and generous royal patronage for the engineering sector

Dr. Raida Al-Alawi stressed that the march of achievements and developments in the engineering sector in the Kingdom of Bahrain, and in the context of the comprehensive development renaissance, is the result of the wise vision and generous care that the engineering sector in the Kingdom of Bahrain enjoys from His Majesty King Hamad bin Isa Al Khalifa, the great King of the Kingdom of Bahrain, may God protect him. It was sponsored and closely followed by His Royal Highness Prince Salman bin Hamad Al Khalifa, the Crown Prince, and Prime Minister, may God protect him. Their continued support and interest have inspired and encouraged the adoption of strategies and policies that enhance the development of infrastructure and achieve sustainable progress, which contributes to strengthening the economy and improving the quality of life for citizens. Dr. Raida also expressed her thanks to all parties in the

private and private sectors for their permanent cooperation with the association and its various activities.

Dr. Abdulrahman Jawahery, guest of honor for the celebration

Dr. Raida Al-Alawi expressed the BSE's pride in hosting Dr. Abdul Rahman Abdul Hussein Jawahery, CEO of BAPCO Refining Company, as the guest of honor for this year's celebration, in appreciation of his outstanding efforts in supporting economic development in the Kingdom of Bahrain, whose professional career was characterized by giving, sincerity, and excellence, and he emerged as an expert national figure. It is influential in the petrochemical and energy industry at the regional and global levels.

In his speech at the celebration, Dr. Jawahery reviewed his professional career in the engineering sector and his extensive experience that extends for more than forty years, pointing out the most important stations that he went through in this journey since his joining in the year

1983 as a trainee engineer at the Gulf Petrochemical Manufacturing Company (GPIC) until he was appointed CEO of the largest industrial company in the country (BAPCO) in October 2021,

Members of the BSE stand in solidarity with Gaza:

In coordination with the national campaign organized by the Royal Humanitarian Foundation to provide

urgent humanitarian relief aid to the people of Gaza, and considering the Bahraini national campaign, "Help Gaza," the BSE held a solidarity stand during the Bahraini Engineer's Day celebration. In addition, the BSE members, during the celebration stood for a minute of silence to mourn the lives of the martyrs of Gaza. Also, participated in a donation campaign to contribute to the national campaign, in support of the brothers in Gaza.



Dr. Bashar Ahmadi

Winner of the "Best Professional Achievement" Award 2023:

"Award provides engineers with a sense of achievement, helps to promote the engineering profession"

After winning the Bahrain Society of Engineers' Award for the Best Professional Achievement category for the year 2023, (Al Mohandis) magazine surveyed Dr. Bashar Ahmadi about his opinion regarding this award, its importance, and what it means to him, so the magazine had this dialogue with him.

What does the award mean to you? And what does it mean for engineers in general?

An amazing feeling of accomplishment! It's a chance for me to recognize my hard work and dedication, and an encouragement to keep pushing forward. I am honored and humbled to be chosen out of so many great candidates. Receiving this award is a great reminder to stay motivated and keep reaching for the best. Bahrain Society of Engineers has been part of my professional career for the last 42 years, since I was a young graduate working at the ministry of Housing prior to my academic career at the Gulf Polytechnic and then at the University of Bahrain.

What is the importance of launching the award by the Bahrain Society of Engineers?

Giving awards to engineers helps to promote better engineering. It gives recognition to worthy candidates, which inspires them to continue their hard work and strive for excellence. It also helps to create a sense of competition among engineers, which encourages them to tackle complex engineering solutions, innovate new ideas and keep up with advancements in engineering technologies. Furthermore, awards provide engineers with a sense of achievement and can help them grow their professional network and open doors to new career opportunities. Lastly, giving award for engineers helps to promote the engineering profession and the importance of its role in society.

How do you find the role of the Bahrain Society of Engineers in supporting the engineering sector in the country?

Bahrain Society of Engineers play an important role in the development of the engineering sector in the Kingdom of Bahrain, as the BSE provides a platform for professionals in the sector to come together and share knowledge, ideas, and best practices. BSE also provide support to members in the form of networking opportunities, career guidance, and resources. BSE also help to promote advances in the



engineering sector by providing access to research and other forms of education. Additionally, BSE often partner with government bodies to lobby for policy changes and funding opportunities that will benefit the engineering sector. BSE also building relationships with universities, industry leaders, and international organizations.

Briefly, as an engineer, what is the most important achievement done by Dr. Bashar Ahmadi?

My personality as an Engineer/ Architect has always been an analytical problem solver who applies science and mathematics to develop solutions to technical problems. I have always tried to make things work better, faster, and more cost-effectively. I have always been dedicated, motivated, creative, and technically curious individual. As a professor at the university for 30 years, I have tried to mentor young Bahraini engineers and architects to understand the engineering theories and ability to apply them to real life and become an excellent problem solvers. During my university career, I conducted many research topics related to our country and have published many research papers and books.

My most important achievement which I'm so proud of is that I taught many successful Bahraini Engineers. My other achievement is being able to establish my real estate development company "Orchid Developers" with more than 15 large development projects in the Kingdom of Bahrain such as "Spiral Orchid Residence" a 41 story building, "Orchid Plaza" the tallest building in Juffair with 48 floors and in the process of completing for the first time a 13 story residential building with every flat having its own private large swimming pools and private garden.

Engineer Reem Ibrahim Khalfan

Winner of the "Experienced Engineer" Award 2023:

"The award is a high level of recognition at the Kingdom level for the achievements made in the field of engineering, and from the association that I consider the "House of Engineers."

As an engineer in the engineering field in the Kingdom of Bahrain, who is Eng. Reem Khalfan?

I (Eng. Reem Ebrahim Khalfan) am the current Chief of Building Maintenance Project Section in Cost Engineering Directorate at Ministry of Works, Kingdom of Bahrain. I am a highly accomplished and experienced professional with a proven track record of success. I have had more than 17 years of working experience in the field of cost engineering for construction and maintenance projects and have held a variety of leadership positions in both public and private sectors.

In addition to my current role, I am the leader of a team of engineers responsible for the development and implementation of cost management strategies which have helped in successful management of several construction and refurbishment projects with varying degree of complexities within the Kingdom of Bahrain including the new Bahrain International Exhibition Centre among other road infrastructure projects.

My administrative prowess as the current chief of my section has helped the section to be recognised as one of best among others in the directorate in adoption and implementation of best practices of project management and/or administration.

My office as the Chief of the section is considered a valuable asset to the Ministry of Work due to how my dedication, commitment and passion for my work have helped to improve the efficiency and effectiveness of delivering most government's projects.

Upon assuming of office after my appointment as my group in February 2012, I helped in coordination with my group members to close all project final accounts which have been outstanding for several before my employment with the Ministry of Works.

Here are some of my specific achievements:

- Led the team that developed and implemented a new cost management system for all government projects in the Kingdom of Bahrain.



- Improved the quality of government projects by implementing new quality control measures.
- Implementation of new project management techniques which helped to significantly reduce delivery time all government projects.
- Increased the satisfaction of government clients by providing them with better communication and coordination at tendering process.
- Development opportunities by training many new graduates as trainee staffs in the Ministry

Due to my excellent records of achievement, I was requested to help in pre contract administration of several Municipalities projects in addition to my primary projects in works affairs for more than two years. Thus, helping me to improve my tendering skills sets on waste, agricultural, harbours projects among others.

Further to the above, I am an active member of the Bahrain Society of Engineers and served as board member for three consecutive cycle (6 continuous years).

In addition, I have recently been appointed as a board member of the Council for Regulating the Practice of Engineering Professions (CRPEP) in Kingdom of Bahrain. Not only that, but I am also actively involved in organising industry conferences and have participated in arbitration/dispute resolution proceedings on many projects within Bahrain.



Understanding Generative AI

The Art of Digital Creation

Written by: Dr. Raida Al Alawi

The President of the Bahrain Society of Engineers

From the inception of personal computers to the widespread adoption of the Internet, technology has consistently reshaped our world. Today, as we stand on the edge of another transformative era, with Generative AI emerging as the next game-changer. This technology has the capability of creating entirely new content that resembles what might be created by a human such as text, images, video, codes, music, and digital art. Following the introduction of ChatGPT in November 2022, there has been a notable rise in generative AI companies and startups, each advancing with unique and innovative features. ChatGPT stands out, demonstrating the potential of AI to emulate human conversation. We're not merely witnessing a tech evolution; we're stepping into a new paradigm of interacting with artificial intelligence. In this article we will be having a simplified overview of the Generative AI technology.



Image generated by DALL-E from Text.

What is Generative Artificial Intelligence?

Generative Artificial Intelligence (GAI) is a branch of AI called Artificial Intelligence Generated Content (AIGC), which is related to the creation of digital content, such as text, images, music, and video. Generative AI can generate new data that resembles the data it has been trained on. Unlike traditional AI models that make predictions or classifications according to predetermined patterns and rules, generative models can create entirely new content by learning from a set of data without explicit instructions.

The Generative AI field is the intersection of Deep Learning, Natural Language Processing (NLP), and Computer Vision. GAI utilizes advanced machine learning techniques to produce new, high-quality data. The secret behind Generative AI is its reliance on deep learning, which are multi-layer artificial Neural Networks (NNs) inspired by the structure and function of the brain. The advanced NNs architectures allow generative models to capture complex data distributions from their training sets. Whether it's text generation in Natural Language Processing (NLP) or image creation in Computer Vision, these deep

learning-enabled models aim to learn the underlying data distributions of the input data. Once trained, they can generate new data that is statistically similar but not identical to the original dataset.

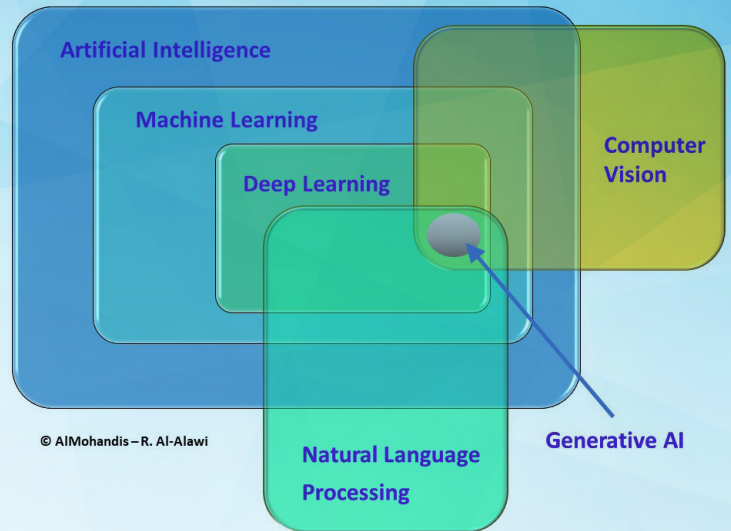


Figure 1. Intersection of Generative AI field with NLP and Computer Vision.



The Journey to Generative AI

Generative AI has evolved remarkably since its inception, transforming from basic rule-based systems to sophisticated neural architectures capable of creating human-like content.

The timeline to the left traces the journey from the birth of AI to the latest GAI innovations like stable diffusion and GPT-4.

Figure 2. Generative AI Timeline

Specialized Architectures in Generative AI

Several types of neural network architectures stand out in the world of Generative AI, the following are the prominent models of generative AI.

1. Recurrent Neural Networks (RNNs) and Long Short-Term Memory (LSTM)

A Recurrent Neural Network (RNN) is a deep learning model specifically designed for processing sequential data. What sets RNNs apart from standard feedforward neural networks is their ability to maintain a memory of past inputs. This memory retention is achieved through internal loops that allow information to pass from one step in the sequence to the next. At each step, an RNN unit takes both the input from the previous step and the current data point, enabling it to model temporal dynamics and dependencies within the data. RNNs are like readers who remember the previous word while reading the next. However, conventional RNNs face challenges with long-term associations, often due to training problems where the gradient (used for updating the NN weights) becoming too small (vanishing) or too large (exploding), which can hinder the learning process of the network.

To address these challenges, Long Short-Term Memory (LSTM) networks were introduced. LSTMs are a specialized type of RNN with a more complex internal structure, featuring gates (input, forget, and output



Image generated by MidJourney from Text.

gates) that regulate the flow of information, allowing them to better capture long-term dependencies and retain important information over longer sequences. Using the reader analogy, consider LSTM as a reader having highlighters. As he goes through the text, he highlights important events or details, ensuring he retains these points even as he progresses through multiple chapters. This highlighting technique helps the reader (or LSTM) in retaining vital information across lengthy sequences, making them more effective for tasks that require understanding over extended periods.

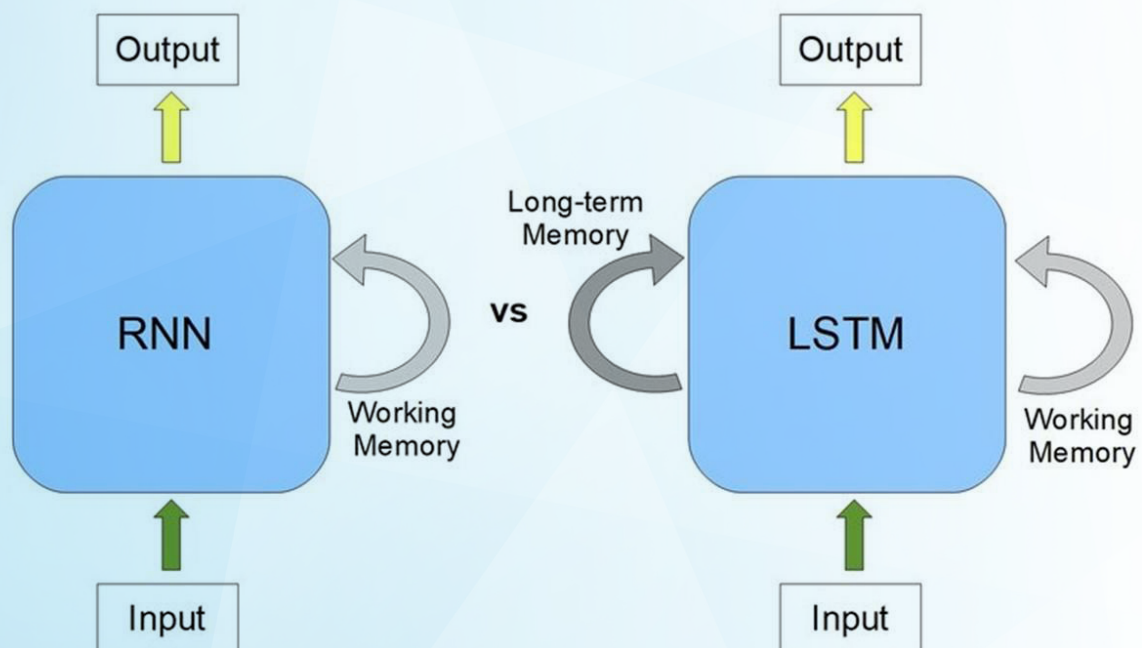


Figure 3. RNN vs LSTM

2. Variational Autoencoder (VAE)

Variational Autoencoders (VAEs) are based on neural networks consisting of two primary components: an encoder and a decoder. Both components can be constructed using different architectures of neural networks, but they're mostly built using feed-forward neural networks or convolutional neural networks (CNNs). The encoder of the VAE compresses the input vector into a compact representation known as a 'latent space.' During compression, the encoder doesn't produce a fixed point but a distribution of possible points. This distribution usually centers around a mean with some standard deviation. The decoder takes the latent space vector as an input to generate an output vector that resembles the original dataset.

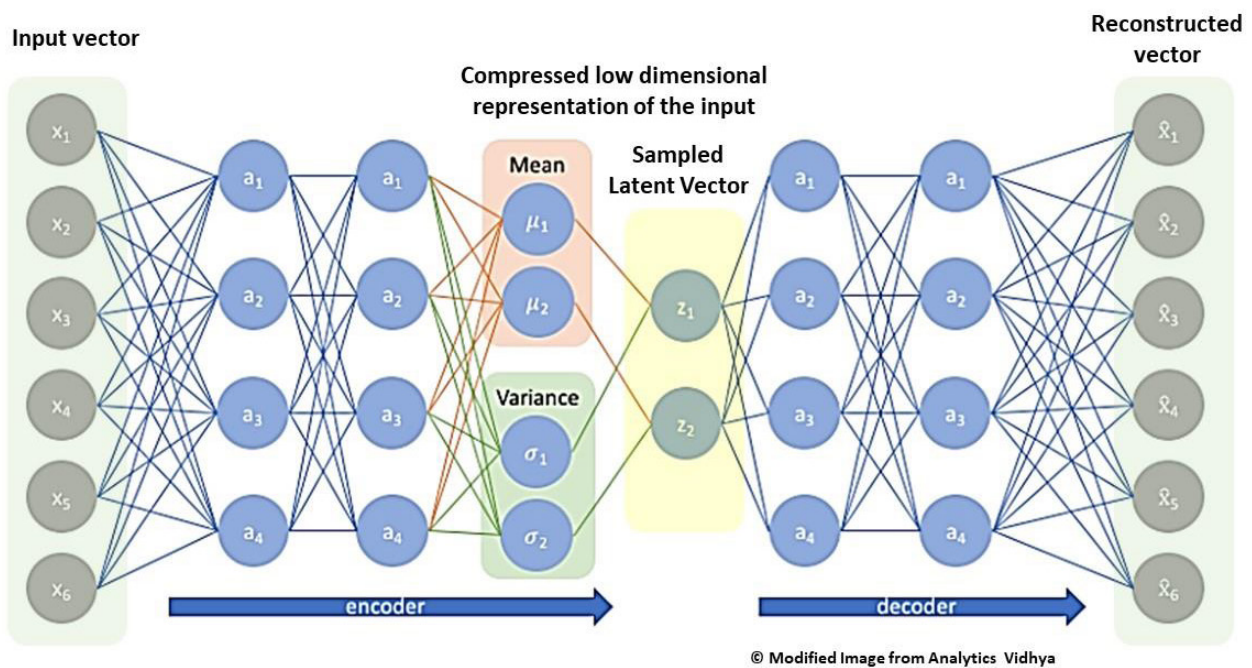


Figure 4. Architecture of VAE

Back to the readers analogy, VAEs are like readers who summarize a story into essential points (encoding) captured as keynotes (latent space). After that, they try to recreate the story using their imagination by filling in the gaps (decoding) to produce a new version of the story that is similar, but not an exact replica of the original. This unique capability of VAEs to encode and decode positions them as powerful tools for generating new content, such as news, stories, graphics or music in a specific style.

3. Generative Adversarial Networks (GANs)

Generative Adversarial Networks (GANs) are deep learning neural networks that can generate highly realistic content like pictures, music, or even text. GANs uses two neural networks, the generator and the discriminator, competing one against the other. the generator tries to create fake data samples that look real, while the discriminator tries to classify whether the samples are fake or real. There is a continuous

feedback loop between the generator and the discriminator, and after a few thousand (or million) epochs, the generator will be trained to produce new high-quality fake samples that looks real. So, together, they learn how to make things that look real and can fool people into thinking they are real.

Using the readers analogy for GANs: Imagine two readers — a junior author (Generator) and an expert reviewer (Discriminator). The Generator writes stories, aiming for them to resemble existing novels, while the Discriminator tries to distinguish these stories from real novels. As the Generator receives feedback from the Discriminator, its stories improve, making them increasingly indistinguishable from real novels.

4. Transformer-based models

Transformer-based models are a type of neural network architecture introduced in the paper "Attention Is All You Need" by Vaswani et al. in 2017. Transformer-based generative AI models are a type of deep learning neural network designed to produce sequences, such as sentences or images. At their core, they utilize layers of "self-attention" mechanisms, allowing each token (a fundamental unit of data, like a word in a sentence or a pixel in an image) to focus on other relevant tokens in the input. This self-attention mechanism captures relationships and dependencies regardless of their distance in the sequence. By stacking multiple layers of these mechanisms, the model can capture increasingly complex patterns and relationships, making it adept to tasks like language translation, text generation, and more. Many state-of-the-art Large Language Models (LLMs), including those from the GPT (Generative Pre-training Transformer) series, are based on the Transformer architecture, which is a popular choice for generative models due to its self-attention mechanism.

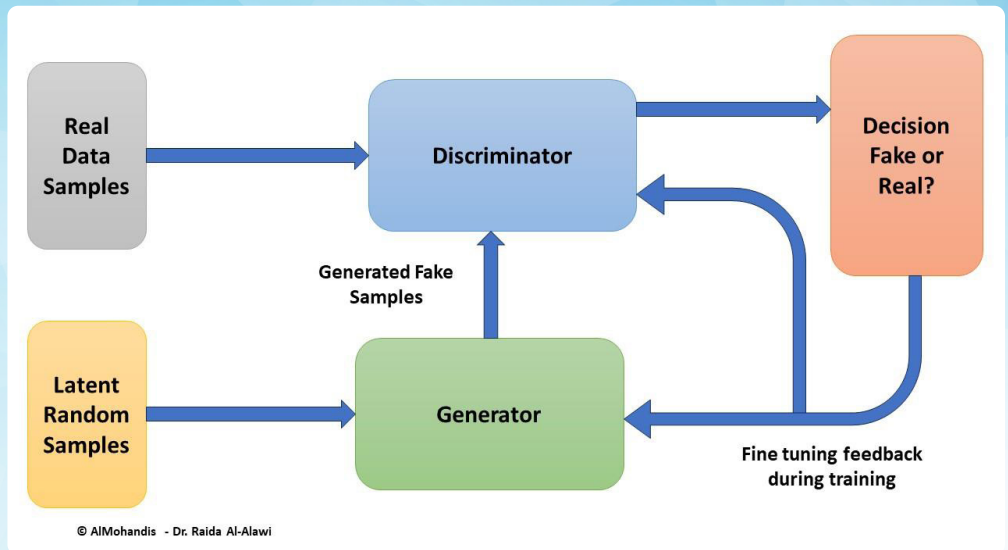


Figure 5. GAN Architecture

We can draw an analogy between Transformer-based models and a book reading club, each club member "Token" is assigned a chapter of a complex novel. Instead of focusing solely on their chapter "Self-Attention", club members collaborate to grasp the full depth of the novel, so they consult each other to understand references and deeper themes. This collaboration reflects the Transformer's self-attention mechanism, where tokens relate to others in the sequence, while the collective understanding of the club members reflects the layered approach of Transformer models in deep learning.

Who are the main tech contributors in the generative AI sector?

The generative AI industry is witnessing rapid growth and expansion. This isn't limited to just the dominant corporations in the tech world; a large number of emerging startups are making their mark into generative AI landscape. These startups, driven by innovation and ambition, are not only receiving substantial financial backing but are also leveraging cutting-edge open-

source methodologies to refine and redefine generative AI applications. Recognizing the great potential of this technology, established software giants such as SAP, Salesforce, and Autodesk are proactively incorporating generative AI functionalities into their suite of products. Nevertheless, it is essential to note that the trajectory and dynamics of the generative AI market are greatly influenced by these major players like Microsoft Corporation, Google, IBM Corporation, Meta and OpenAI are instrumental in shaping the sector's direction and evolution.

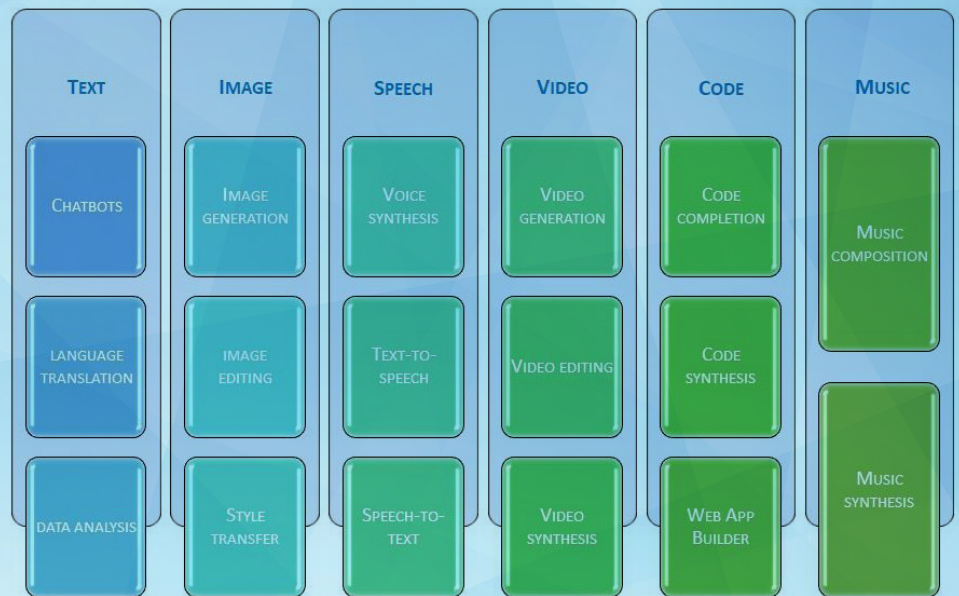
According to Gartner, the predominant stakeholders are:

- Google with its two extensive language models, namely, Palm and Bard, are being incorporated into their professional software portfolio, ensuring widespread access for countless users.
- Microsoft's collaboration with OpenAI by integrating OpenAI ChatGPT and DALL-e into its products.
- Amazon has allied with Hugging Face, a platform offering open-source LLMs, to develop cloud-based generative AI solutions via AWS.
- IBM with its many generative AI foundational models.

Generative AI Application Landscape

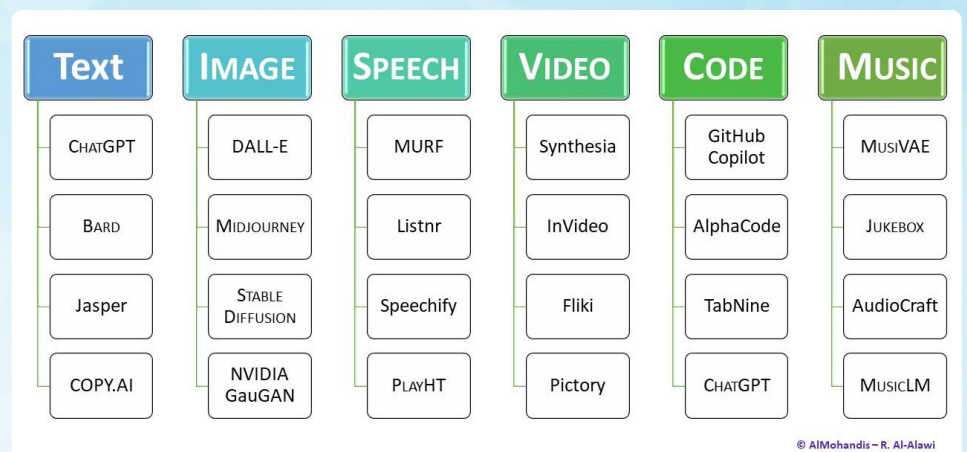
Generative AI involves a wide range of function specific use cases across various industries and domains. The following shows the type of data generated by the generative AI models and their use cases.

Today, numerous apps based on generative AI models are being developed, each designed for a specific function or task. Yet, this is just the beginning. As we move forward, we expect to see an exponential surge in the creation of innovative, task-specific apps that utilize the power of generative AI. The following diagram lists some of the most popular Apps available today.



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Figure 7. Type of data generated by the generative AI models and their use cases.



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Figure 8. Common Apps based on Generative AI.

Prompt Engineering: The Art of using Generative AI

Prompt engineering is the art and science of crafting specific and detailed questions or inputs, known as "prompts", to guide generative AI models, such as OpenAI's GPT series, in producing desired outputs. Often likened to "AI whispering" because you're essentially guiding the GAI product to give you a creative solution to your question or prompt. Prompt engineering requires a deep understanding of the AI model's capabilities and the basics of human language. The goal is to harness the AI's vast knowledge and ensure the output aligns with the user's intent. As these models gain prominence in both personal and business realms, the ability to effectively engineer prompts becomes invaluable. It's not merely about posing a question but framing it in a manner that elicits creative and refined results. For instance, one can even guide the AI to respond from a specific perspective, like asking the GAI product to reply as someone well known, such as Donald Trump. As the digital landscape increasingly integrates with generative models, mastering prompt engineering is essential, with companies now recognizing its importance and even creating roles dedicated to this skill. This expanding field ensures our interactions with AI are meaningful, purposeful, and tailored to our needs.

Creating effective prompts for generative AI models requires practice and a clear understanding of your end goal. With the following guidelines, you can optimize the quality and relevance of the generated content:

- **Clarity is Crucial:** Ensure your prompt is straightforward and devoid of ambiguity. The clearer the instruction, the more accurate the response.
- **Stay Neutral:** Avoid biases or leading questions. Aim for a neutral tone to get unbiased and objective responses.
- **Provide Context:** Offering a background or scenario can guide the AI towards more relevant answers. For example, if you're seeking a medical perspective, mention that.



An image created by generative AI of a robot camel wandering the streets of a smart city generated by Midjourney

- **Adopt a conversational tone:** Communicate as if you're chatting with a coworker, not a machine. While generative AI can handle technical terms, it's often better to keep language simple and direct to ensure the desired outcome.
- **Encourage Detailed Responses:** Frame your questions to obtain detailed answers. Avoid binary questions that might result in 'yes' or 'no' responses.
- **Specify Your Audience:** If the response is intended for a particular group, like children or experts in a field, make that clear in your prompt.
- **Set a persona:** Ask the GAI to give answers from the perspective of someone well-known, like Vladimir Putin or Oprah Winfrey — or a specific type of person like an executive manager or a customer.
- **Iterate and Adjust:** If the initial answer isn't satisfactory, refine your prompt. A slight rewording can lead to a significantly different response.
- **Use Prompt Sequencing:** For complex queries, break them down. Start with a general prompt and then use the AI's response to guide subsequent, more specific prompts.

Challenges and Concerns of Generative AI

Despite the transformative potential of Generative AI, there are several challenges and concerns, among them are the following:

- **Ethical Concerns:** The ability of generative AI to produce convincing fake contents, such as deepfake videos and images, that can be misused to spread misinformation or offend individuals. Another concern is plagiarism with their ability to generate contents that resembles human-created content, can lead potential copyright issues and concerns about originality.
- **Job Displacement:** With generative models taking over content creation and various tasks, there's a risk of job reductions, particularly within the creative sectors.
- **Bias and Fairness:** Generative models can inherit and amplify biases present in their training data., leading to unfair or discriminatory outputs.
- **Data Privacy:** To generate meaningful content, these models often require vast amounts of data, raising concerns about data privacy and misuse.
- **Quality Control:** Ensuring consistent quality in AI-generated content can be challenging. It's not always predictable how the AI will interpret a request or what kind of output it will produce.
- **Computational Costs:** Training generative models, especially large ones, can be resource intensive.
- **Safety and Security:** There are concerns about generative AI being used in cyberattacks, for example,



Image of a mosque using Van Gogh style generated by DALL-E by generating phishing content or impersonating individuals.

- **Dependency:** Over-reliance on AI for content generation might weaken human creativity and innovation in many areas.
- **Regulation and Oversight:** Current regulatory frameworks may not be adequate to address the unique challenges posed by generative AI. Developing new regulations without hindering the innovation progress presents its own set of challenges.

It is very important to address these challenges to ensure that generative AI is developed and deployed responsibly, maximizing its benefits while minimizing potential harms.



Image of a generative artificial intelligence creation inspired by the Bahrain flag - DALL-E2



Image created by generative artificial intelligence of a child witnessing the end of the world - Midjourney



The Indispensable Cultural and Heritage Significance of Landmarks in The Development World

Written by: Amal Attiya Ebrahim,
Ph.D. candidate

Introduction:

Architecture is a multifaceted field that goes beyond just creating functional and visually appealing structures. It also has the power to evoke a sense of identity by preserving culture and societal values, which becomes especially important in landmark architecture. Renowned architect and designer Norman Foster once said: "As an architect you design for the present, with an awareness of the past, for a future which is essentially unknown". As a symbol of architectural heritage, landmarks play a significant role in our history and tradition, representing the essence of a location and its people. Unfortunately, in modern times, the importance of landmarks is often disregarded, leading to the loss of cultural heritage. There are various contributing factors that have led to this situation, including urbanization, globalization, and the need to modernize. The prioritizing of economic development over cultural preservation may lead architects to abstract designs, resulting in the loss of cultural and traditional identity in these iconic structures. Culture and tradition are essential components of landmark architecture, and their preservation is crucial for maintaining cultural heritage. By placing users at the center of the design and by adopting a culturally responsive design approach, it is possible to incorporate tradition and culture into landmark architecture while preserving it for future generations.

Architectural Structure Factors / Elements:

There are various factors to consider when designing an architectural structure, such as location, history, and culture. These elements can significantly influence the design and architectural style of the space. For example, if the building is in a historic district, the design may draw inspiration from the area's historical background. In contrast, a building located in a modern and contemporary area may lean toward a more sleek and minimalist style. Furthermore, the functionality and accessibility of these landmarks also play a significant role in the design process. Ultimately, the goal of any building design is to create a functional and aesthetically pleasing space, whether the design is meant to blend in with its surroundings or stand out as a unique and independent unit.

Architectural Landmarks:

Architectural landmarks are essential for navigating and orienting oneself in Urban wayfinding. These landmarks are crucial due to their visibility, memorability, and their role as reference points; they help create a sense of

place, aid navigation, and assist individuals in creating mental maps of cities. It was proved that Landmark-based instructions lead users to their destination points faster and more efficiently. Furthermore, landmarks also serve as physical representations of cultural identity, historical and traditional significance, and societal values. They serve as a major reference point for navigation and are considered iconic structures representing the city's identity and cultural significance. Architects can incorporate influences in different ways into their landmark designs; they may directly incorporate elements easily recognizable and relatable to the surrounding context. Alternatively, they may use abstract concepts that convey a mysterious message or a modernized version of the original influence to create innovative and creative designs. When it comes to evaluating a property, architects and non-architects have different priorities. While still understanding the importance of a functional layout, architects tend to focus on design innovation and creative designs. At the same time, non-architects prioritize functionality above all else, but they still appreciate a well-designed space.

Environmental Images Creation Process & Examples:

There is an interactive process between the observer and the environment in creating environmental images. Architects study the background, culture, attributes, and spaces of non-architect users or observers when they want to convey and communicate their design intentions. By placing users at the center of the development or design process, their needs and requirements can inform new architecture aesthetically and functionally. Studying the cultural context of the landmark's location is a responsive

• **Al-Khamis Mosque** is one of the oldest Islamic mosques in Bahrain and is considered a significant historical landmark. Located in the capital city of Manama, the mosque holds great religious and cultural importance for the people of Bahrain. It is dated back to the 11th century, making it one of the oldest mosques in the Arabian Region. Al-Khamis Mosque reflects Islamic influences, featuring a traditional plan with a large central courtyard. The main hall is supported by local stone and teak wood columns carved with decorative motifs and patterns. The twin minarets are decorated with geometric patterns, and the mosque's design prominently features pointed arches as shown in Figure 1 and Figure 2.



Figure (1) Ebrahim, A. (2023). Al-Khamis Mosque [Photograph].

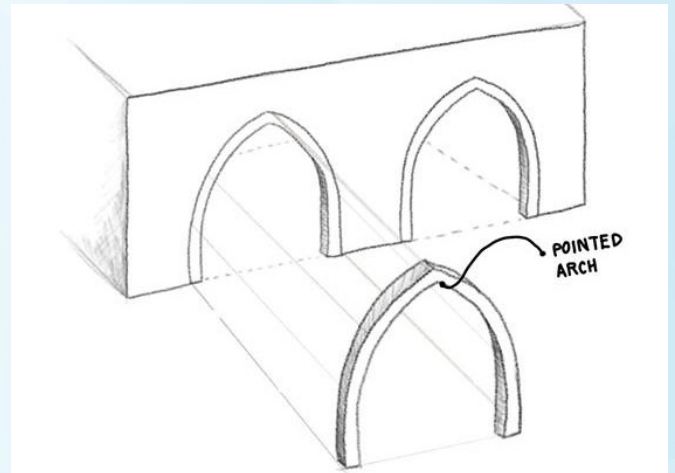


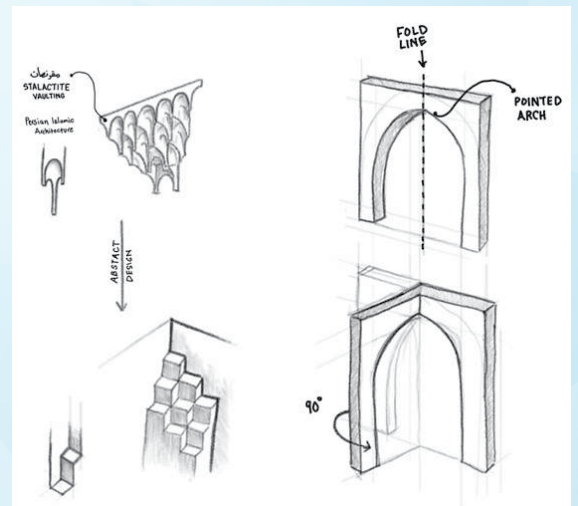
Figure (2) Ebrahim, A. (2023). Al-Khamis Mosque's Arch Design [Digital Sketch].

• **The Clock Roundabout** located in Riffa, Bahrain, is one of the most recognizable landmarks in the country. The structure was built in the 1980s, Figure 2.1 shows that the architectural design reflects many traditional elements influenced by Bahrain's culture, including the shape of the minaret and the pointed arches. Other elements, such as Stalactite Vaults 'Muqarnas', which is a form of ornamented vaulting, were added to the structure. Some of the elements in the landmark use an abstract approach. Figure 2.2 indicates the change of elements from traditional as seen in Al-Khamis Mosque to abstract in the Clock Roundabout, it also displays the extra elements added.



Figure (3) Ebrahim, A. (2023). The Clock Roundabout [Photograph].

Figure (4) Ebrahim, A. (2023). The Clock Roundabout's Abstract Design Approach [Digital Sketch].



• The Pearling Path Visitor and Experience Center

Center designed by Valerio Olgiati and built in 2019 in Muharraq, Bahrain, is part of the UNESCO Pearling Path project. Olgiati is renowned for his minimalist and geometric designs, with a philosophy centered around carefully integrating context, geometry, materiality, and spatial experience. Olgiati focuses on a harmonious balance between simplicity and complexity, creating visually striking architectural compositions responsive to their surroundings. His design of the Pearling Path is marked with concrete elements that create a new focal point in the densely populated city. The canopy, carried by thick columns, features a series of geometric openings that match the shape of the columns and wind catchers (minaret). In Figure

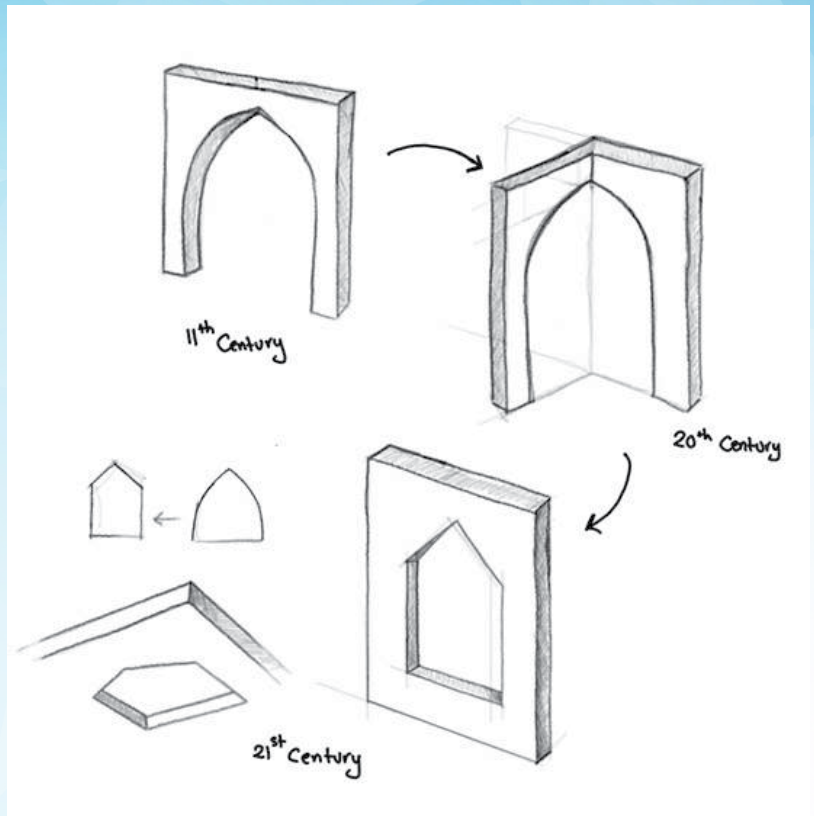


Figure (6) Ebrahim, A. (2023). Pearling Path Visitor and Experience Center's Arch Design Development [Digital Sketch].



3.1, we can observe that certain features of the country's tradition and culture are incorporated in an abstract manner, such as a minimal representation of minarets and pointed arches used as openings in the overhead horizontal plate. Figure 3.2 shows further development in the shape of arches from the 11th to the 21st century.

Figure (5) Ebrahim, A. (2023). Pearling Path Visitor and Experience Center [Photograph].

Discussion and Conclusion:

It is worth noting that while many factors may impact the experience between observers and architectural design, it is vital to question if architects prioritized innovation over functionality and cultural integration. The Arabian Gulf region's architecture and urbanism present numerous examples of lost urban identity and cultural heritage within the various built environment components. This not only misleads tourists with inaccurate cultural representation but also impacts locals by introducing foreign structures

into their neighborhoods. When the history of architecture is studied and how it has been placed in different contexts, valuable insights can be gained into the development of architectural practice. This understanding is crucial in ensuring that architectural identity is recognized as a fundamental human right for all nations.

In the contemporary world, the meaning of architectural identity has changed from reflecting context to abstract representations of distinct movements or cultures. This shift has, unfortunately, resulted in many cities around the

world featuring crowded architectural structures, which can lead to a sense of homogeneity and a loss of cultural identity. Ultimately, the goal of architectural practice should be to create spaces that are not only functional and aesthetically pleasing but also reflect the unique character of the communities they serve. By embracing this vision, tradition, and culture, a world where architecture truly reflects our shared values and aspirations can be created regardless of the design philosophy implemented.

To conclude, globalization and modernization have pushed architects toward minimalist and abstract designs in the contemporary world. While architects focus on innovative designs and functionality, cultural significance should be addressed. Aesthetics, functionality, and cultural significance are not factors to be taken lightly

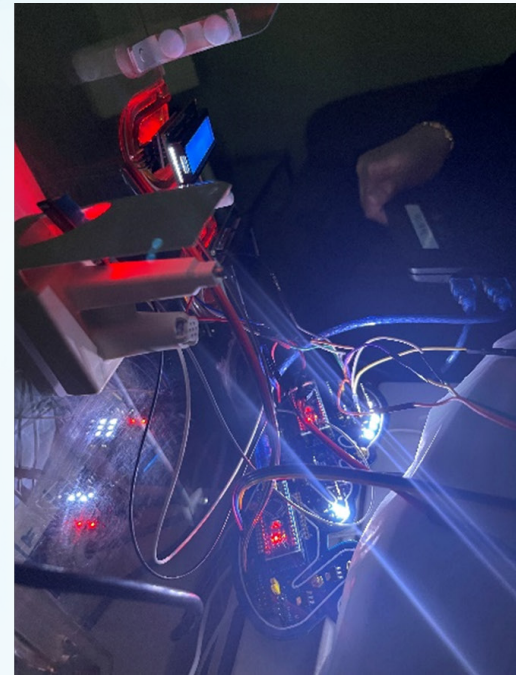
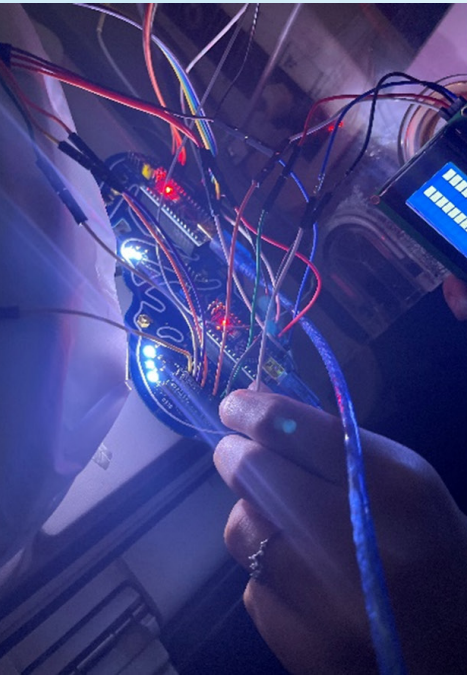
when designing landmarks. Failing to consider the cultural context can have serious consequences; landmarks can misrepresent the culture they intend to reflect or lead to confusion and a loss of historical identity. To avoid these adverse outcomes, it is crucial to prioritize understanding the backgrounds of users and observers. By taking the time to learn about the cultural context of a particular area and placing the locals and community at the center of the design, designers can ensure that their landmarks accurately reflect and represent the culture they are meant to embody with the approach of minimalization and abstraction. Ultimately, preserving historical and societal identity is possible while still maintaining functionality and innovative designs.

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https://www.archdaily.com/914629/pearling-site-museum-and-entrance-valerio-olgiati?ad_source=search&ad_medium=projects_tab
- huge red concrete canopy at entrance to Bahrain's Pearling Path
<https://www.dezeen.com/2019/04/20/valerio-olgiati-canopy-pearling-path-concrete-architecture/>

Designing a Smart Multi-System Neonatal Incubator with Transcutaneous Bilirubin Measurement for a Pediatric Ward

Students: Ehsan Ali Alhawaj & Zainab Ahmed Alsaffar
Supervisor: Dr. Abdulla Rabea



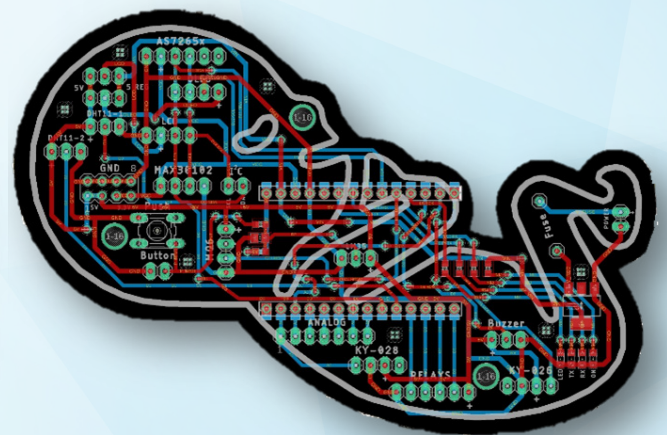
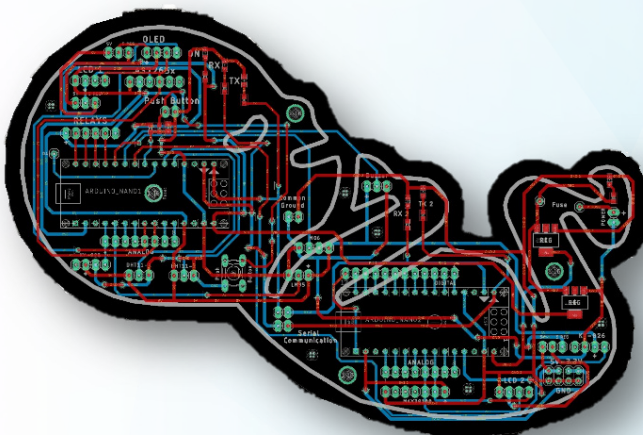
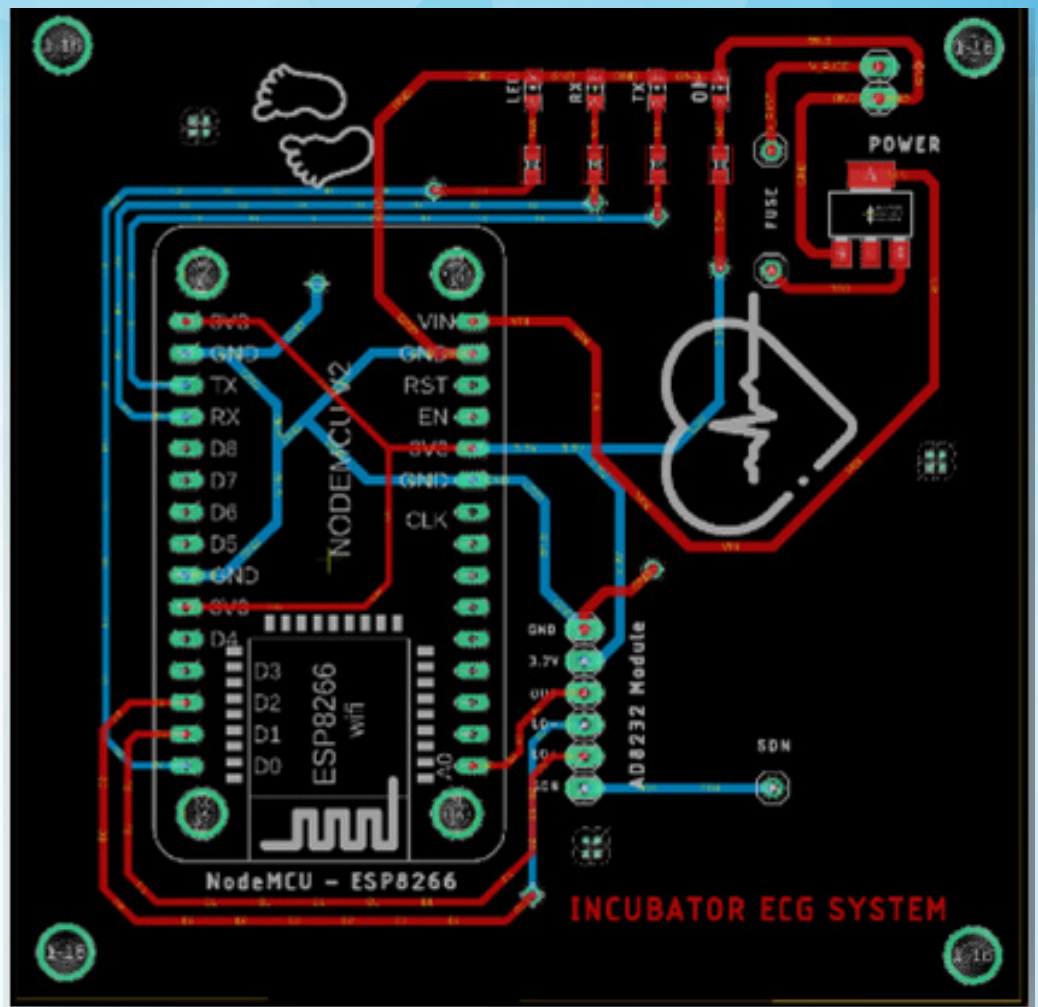
This project focuses on discussing and analyzing problems related to the pediatric department in local hospitals. It was important to focus on infant incubators to reach the best level of care by developing smart systems that will be attached to the neonate incubators with the least space and cost. The current infant incubators lack many necessary systems, and the pediatric ward suffers from current methods of measuring vital systems that consume effort and time. In addition, infants, especially premature ones, are born with very thin skin, and a diagnosis of invasive jaundice causes them to bruise and suffer pain. Newborns are exposed to infections and diseases quickly due to their weak immune systems.

The project is designed to provide incubators with

advanced and modern care systems to preserve newborn lives. Among the most prominent systems that have been designed and added to the neonate incubators, the systems are classified into four different categories: neonate care system, electrocardiography system, phototherapy system, and automatic sanitizing system. The neonatal care system consists of two versions: ZE V1 2023 and ZE V2 2023. This system will be responsible for providing the pediatrician with vital readings for the newborn. In addition, this system will be able to measure the concentration of bilirubin (non-invasively), which is responsible for causing a condition called jaundice, which is known as yellowing of the skin and eyes caused by increased levels of bilirubin in the bloodstream. The ZE V1 from

the care system will have the same functionality as the ZE V2, but the V2 will have the ability to provide the pediatric ward with a smart care system that will allow the pediatrician to monitor and provide treatment to infants remotely and physically.

The ZE family, which includes three versions: ZE V0, ZE V1, and ZE V2, was developed in order to be used in incubators to aid medical work and alleviate baby pain. These systems were founded to give pediatricians a smart multi-system customized for neonatal incubators in order to care for, monitor, and treat jaundiced babies. This project substantially benefits the pediatric ward because it demands less time and effort on their part to complete their tasks.



A Solar Driven DC Charger Characterized by a Maximum Power Point Tracker Feature

Students: Abdulaziz Abduljabbar Nadheer, Ghadeer Mohammed Ali, & Noora Ahmed Abdulrahman

Supervisor: Dr. Maamar Taleb

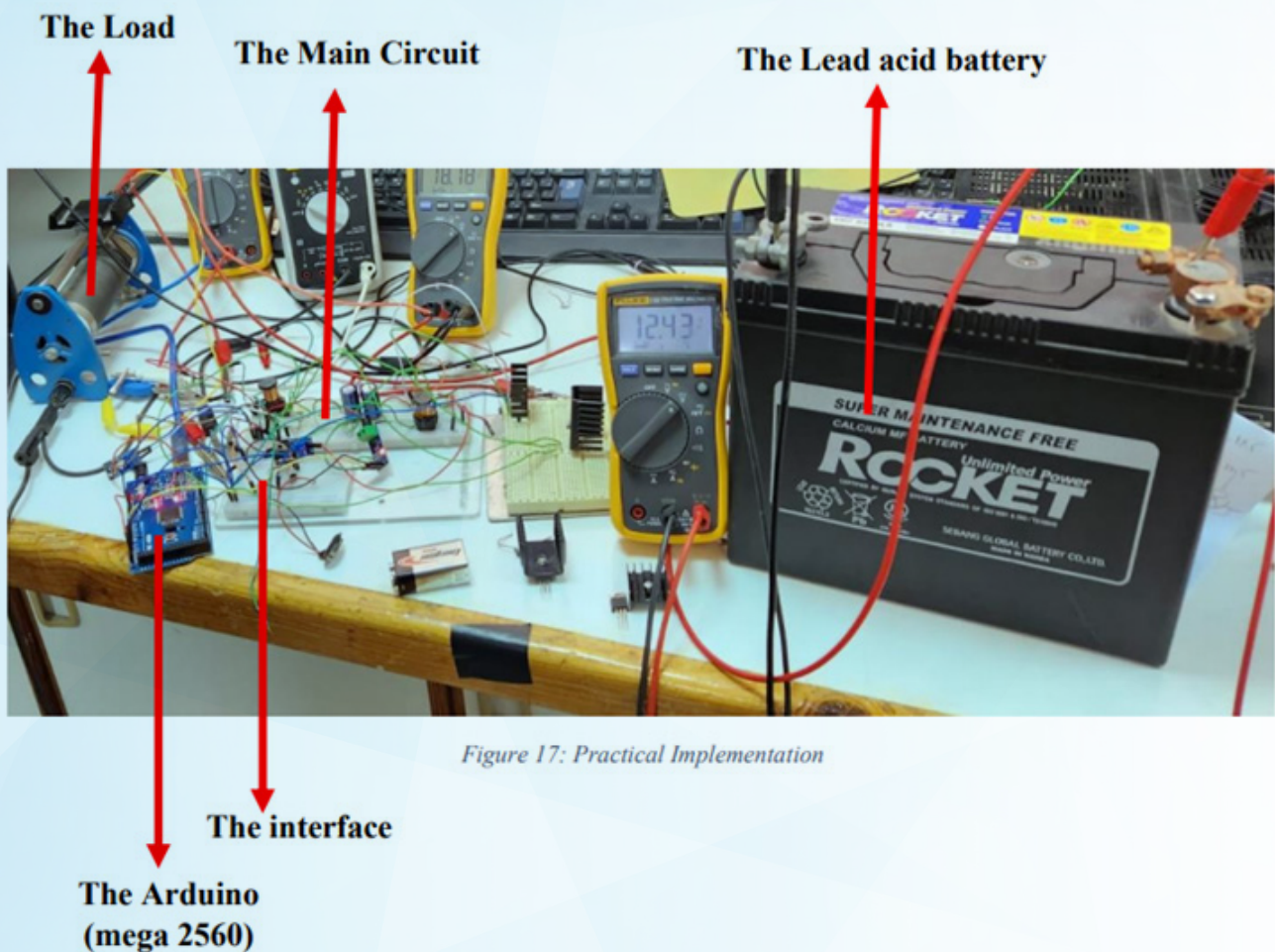


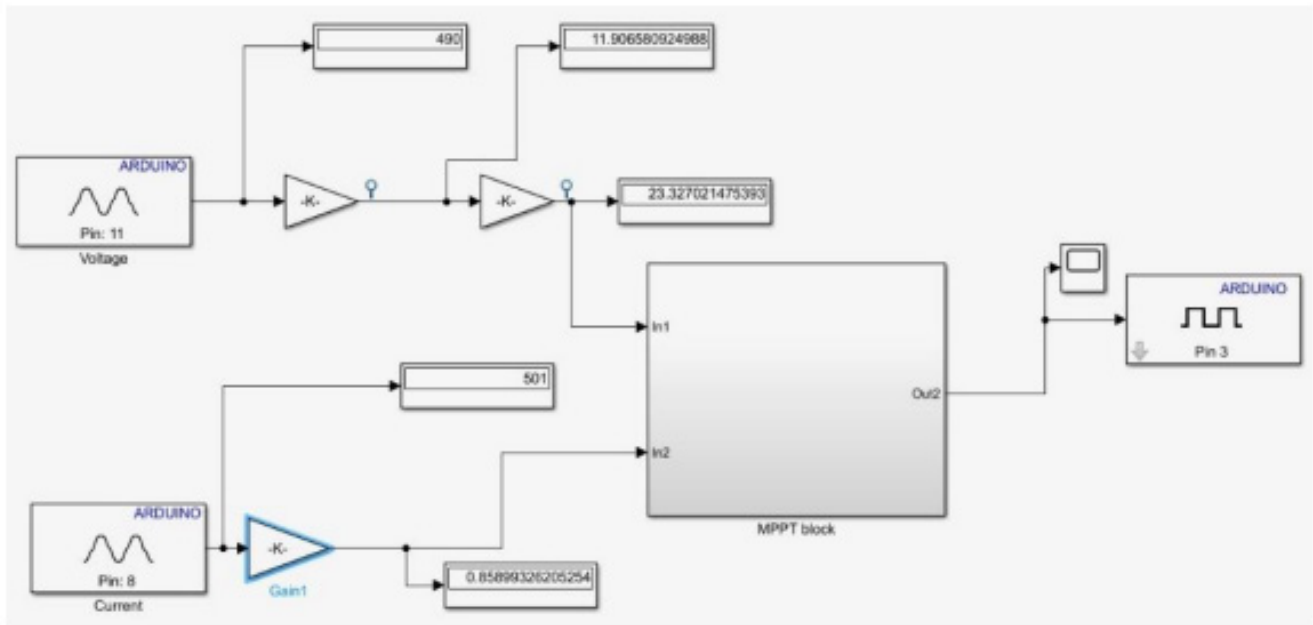
Figure 17: Practical Implementation

Global use of photovoltaic power generation systems is anticipated to rise in response to the growing need for renewable energy. The main goal of our project is to effectively charge a battery using renewable energy. Currently, coal, natural gas, oil, and other gases account for 60% of the world's electrical production. This has a negative impact on our climate, increases

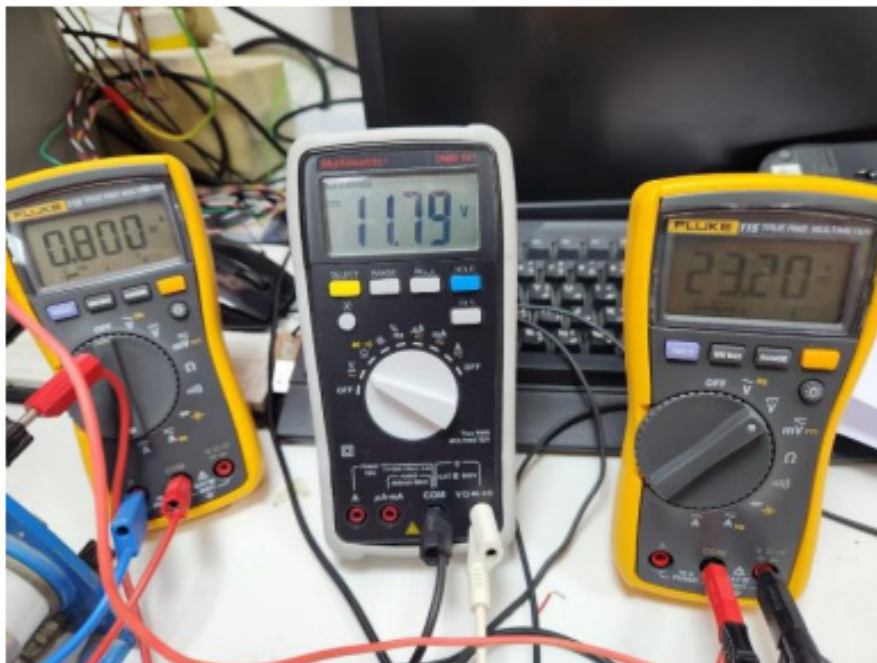
temperature and environmental pollution, and could potentially make it difficult for certain people to afford the costs of using electricity due to a sudden increase in the cost of producing electricity from these sources, among many other negative effects. This is why we adopted the choice to make it the goal of our initiative to avoid any negative effects on

the environment by producing as much clean energy from renewable sources as we can. In this project, the battery will be charged using the electrical energy produced by the solar cells.

The MPPT maximum value tracking technology regulates the optimal power transfer the solar array produces in all potential external weather circumstances and is managed by this applicable system.



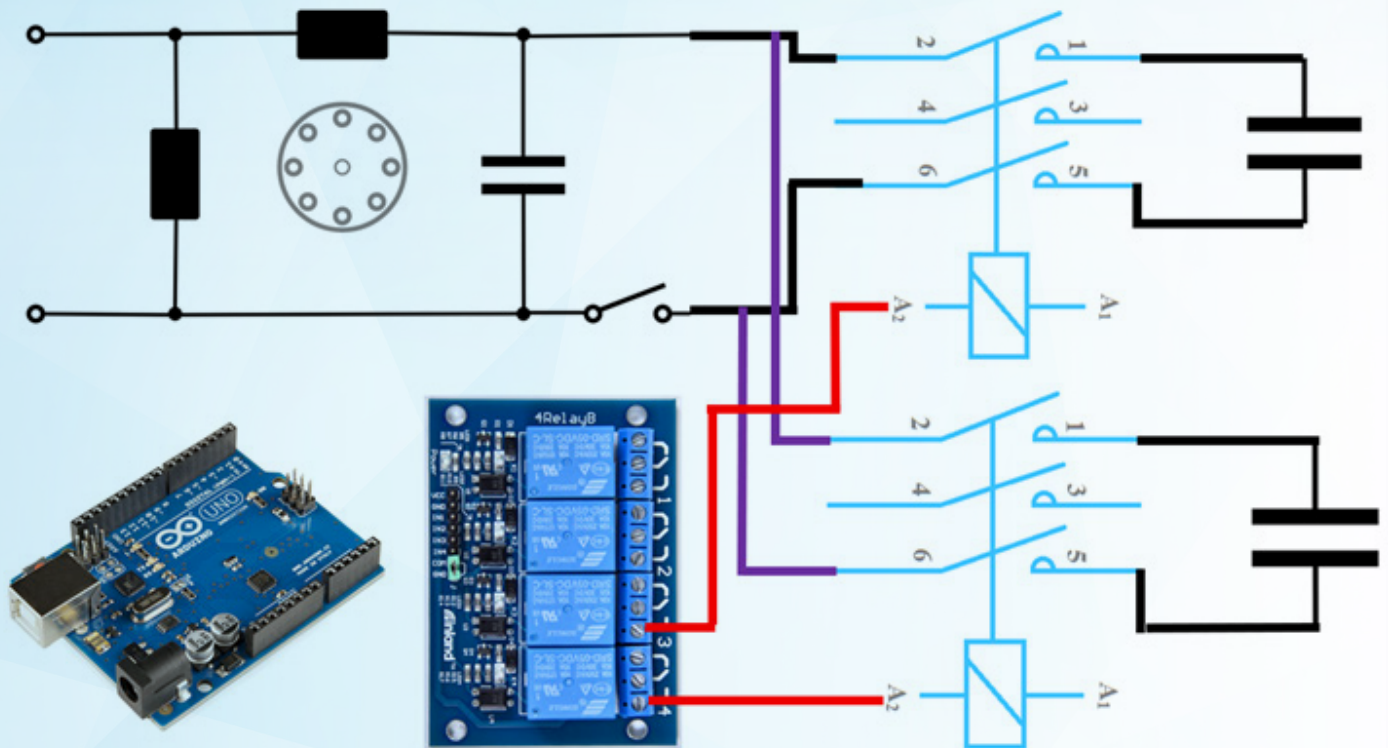
(a)



(b)

Leak Detection by using Hydro Turbines & Torque Controller for a Single -Phase Induction Motor

Students: Fahad Salah Saad Marsal, Abdulla Ebrahim Mohamed Hasan, Abdulla Awad Haroon Hamad
Supervisor: Dr. Salwa Saleh Baserrah

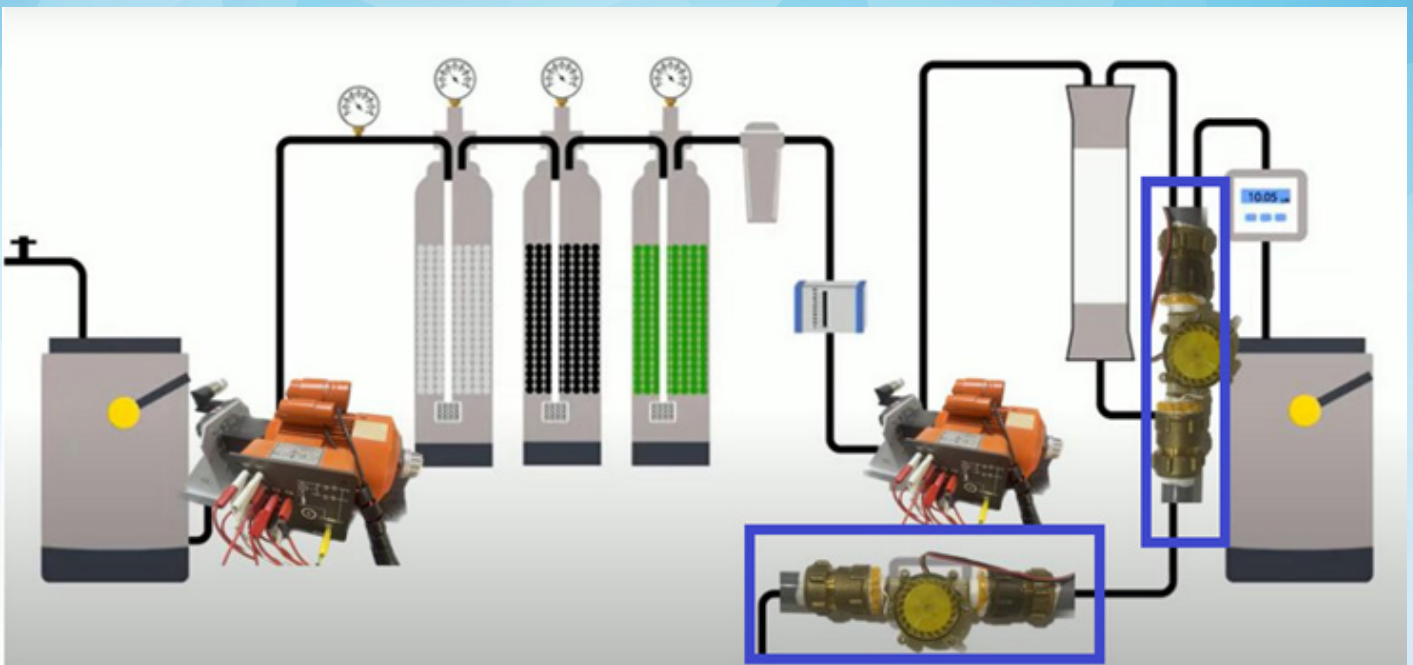


A system that adds multi-industrial applications to the educational learning features of electric machines has been developed by a group of students from the University of Bahrain's Department of Electrical and Electronics Engineering. The project's primary goal is to move the speed-torque characteristics of a single-phase induction motor up or down by adjusting the capacitor values, while also managing the starting and maximum torque of the motor. Second, using hydro turbines to develop a novel technique for detecting water leaks. Thirdly, improve the reverse osmosis system's effectiveness and reliability.

The project's work focuses on two types of loads: constant load torque loads like centrifugal pumps and

variable load torque loads like compressors. When the single-phase induction motor is run at constant load torque, it runs smoothly and without vibration. However, if the motor is linked to a fluctuating load, vibrations will increase and the operating point of torque will oscillate, causing bearing damage. These issues could be resolved by changing the speed-torque motor characteristic.

Three-phase induction motors are always the focus of universities, teachers, and literature. Unfortunately, the experiments relating to the single-phase induction motor are not well-detailed; therefore, developing a novel experiment relating to the single-phase induction motor will aid learners in understanding



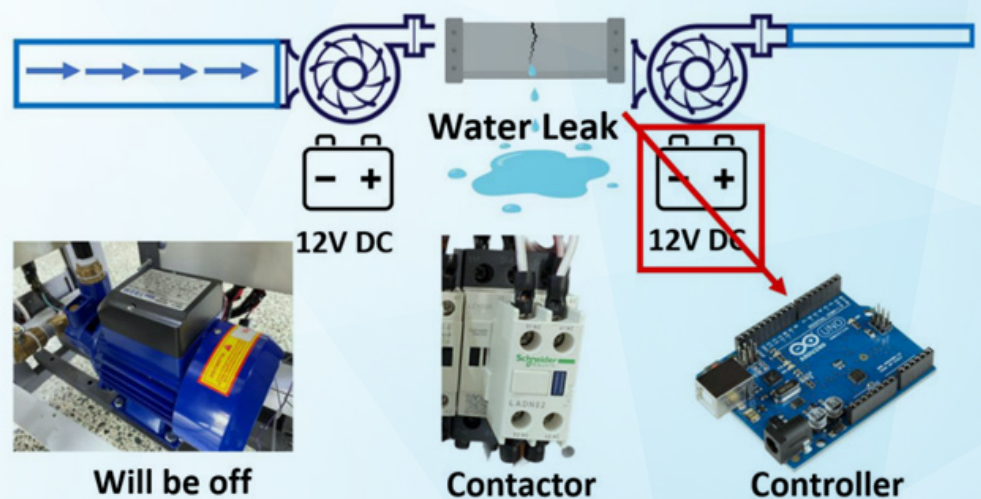
its operation. The capacitor is the most important component in a single-phase induction motor; developing a mechanism for controlling capacitance values can assist students in answering various practical concerns, such as why capacitors are required. How would the capacitance value effect torque and motor operation? All of these questions will be addressed by creating a motor torque controller for a single-phase induction motor.

Hydro turbines were constructed to generate energy from the water waste, which improved the system's efficiency. The reverse osmosis filter creates a pressure waste in most reverse osmosis systems. The filter removes the salt while leaving the potable water intact, and it sends the waste water back into the ocean where it can't do any more harm. As a result, the waste will cause the reverse osmosis system to function less effectively.

The installation of the hydro turbines may cause a water leak in the water rejection pipeline that was built to transport the water that was rejected from the reverse osmosis system. The joints in the pipes facilitate

the rapid emergence of the water leak. When there are more connections between pipes, more water will leak out and less trust can be placed in the system as a whole. Installing hydro turbines is the best solution for detecting water leaks.

The graduation project won first place for electrical engineering projects at the University of Bahrain (UOB) senior project exhibition in the second semester of the academic year 2022/2023, and it represented UOB's best electrical senior projects at the Engineering Design Expo at Kuwait University, which was held on June 22-23, 2023, under the patronage of the Prime Minister - His Highness Sheikh Ahmed Nawaf Al-Ahmad Al-Sabah.



Hydroponic Monitoring System

Students: Hanin Ahmed Ali ALKooheji, Omar Farooq Ali ALQattan, & Yusuf Jasim Ahmed ALHaji



Hydroponics is the process of growing plants without the involvement of soil. This could be done by growing the plants in sand, gravel, or more commonly in liquids. Plants grown in hydroponic systems grow faster, have better quality and stronger yields due to having direct contact to nutrients set specifically for the plant's needs. Another trait is that hydroponics could be built in a controlled environment to set the place to the perfect conditions for the plants to grow in, and so specific crops could be planted even out of season in excellent condition.

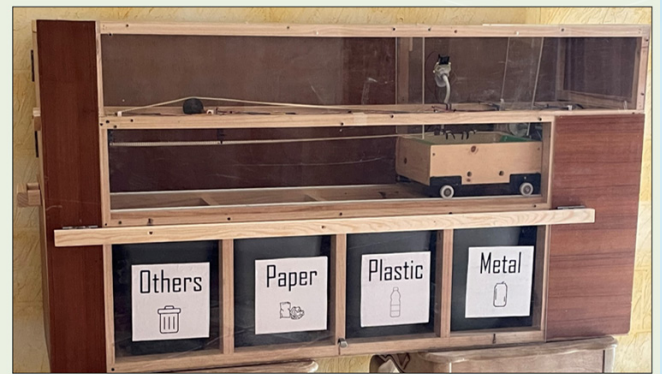
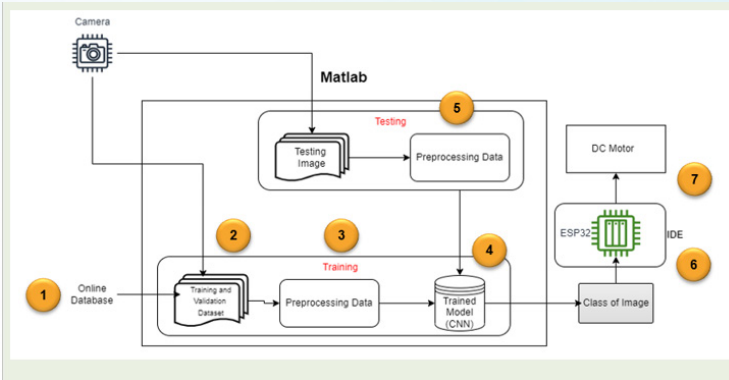


But the main issue hydroponic systems face is that they are hard to monitor and keep track of changes that could affect the plant's growth. This paper proposes an implemented design as way to monitor hydroponic systems using sensors and semi automate the environment in a way that accommodates the plant's needs according to the given information. The system would show any changes and notify the user of anything that needs to be fixed to keep the environment at an optimum state.



Machine Learning-Enabled Smart Bins

Students: Ali Abdulhadi Abdulameer Alkhayat, Hamza Jaafar Ahmed Hasan, Mahmood Mohamed Husain Alkhayat
Supervisor: Dr. Sarah Al-Shareeda



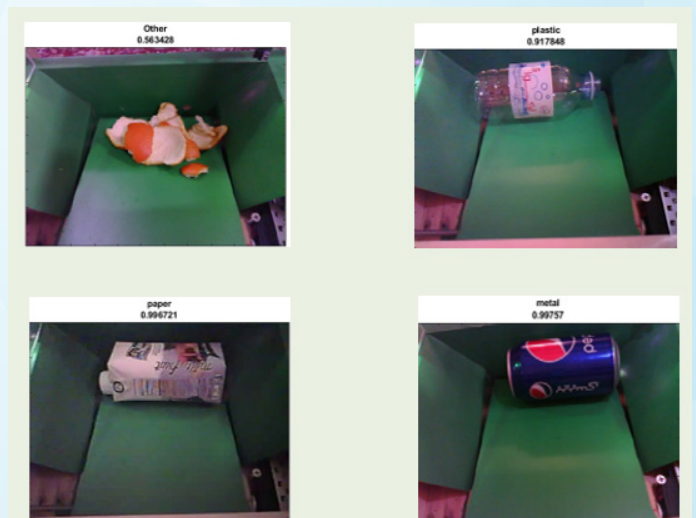
Waste is a major environmental issue that poses significant threats to the health and well-being of our planet. Proper management of waste is essential for protecting the environment and ensuring sustainable development. One aspect of waste management is waste classification, which involves categorizing different types of waste based on their composition, potential hazards, and appropriate disposal methods. Traditionally, waste classification has been carried out by humans, who visually inspect, and sort waste based on their knowledge and experience. However, this method can be time consuming, error-prone, and subjective, leading to inconsistencies and inaccuracies in waste classification.

To address these challenges, artificial intelligence (AI) can be applied to waste classification to improve accuracy, efficiency, and consistency. Our motivation for using Machine Learning in waste classification is to provide an efficient and cost-effective solution to the growing problem of improper waste management.

By reducing the need for human labor and providing more accurate and consistent sorting, we aim to improve recycling rates, reduce environmental pollution, and promote sustainable development. Our focus on developing an inexpensive method of waste classification will make this solution accessible to a wider range of communities

and organizations, ensuring that we can make a positive impact on the environment while also reducing costs.

Effective waste management practices require efficient and accurate classification of different types of waste materials. In this project, we propose a trash classification system that utilizes Convolutional Neural Networks (CNN) to accurately identify and classify metal, plastic, paper, and other waste materials. To train our CNN, we collected a database of waste material images from Kegel and ended up with 4,122 JPG images. Our system achieved an impressive accuracy validation score of 94.53% using real-time classification. The images were used to train our CNN, which was then able to accurately classify waste materials in real-time.



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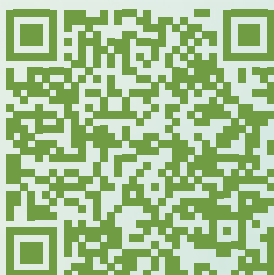


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